HERBERTIA

1944

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VOLUME 11

ALLIEAE EDITION

EDITED BY

HAMILTON P. TRAUB

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This volume contains a total of forty-three illustrations—twenty-five plates and eighteen [text] figures.

PREFACE

The ALLIEAE Edition, devoted primarily to the onion and its relatives as a worth while contribution to the war effort, is one of the most outstanding issues of HERBERTIA published up to the present, and this achievement is in very great measure due to the splendid cooperation of our British friends. Prof. E. J. Salisbury, C. B. E., F. R. S., Director of the Royal Botanic Gardens, Kew, authorized a talented member of his staff, Mr. H. K. Airy Shaw, B. A., F. L. S., to make the excellent translation, from the Russian into English, of Vvedensky's monumental monograph of the genus *Allium* in the Soviet Union, which is the main feature of this issue. The making of this translation was in itself also a monumental undertaking and Mr. Shaw is to be congratulated on the high quality of the finished product. The annotations by Messrs. Shaw and Stearn will serve a very useful purpose. At one stroke this work gives us descriptions of 225 *Allium* species, about 38 per cent of the estimated total of 600 species in the genus.

Mr. William T. Stearn, formerly of the Lindley Library, Royal Horticultural Society, but now in the British Army, has favored us with some valuable contributions, including an illuminating essay on the Alliums in the Old World; an article on the floristic regions of the Soviet Union, that serves as an introduction to the translation of Vvedensky's monograph; a translation of Victor de Janka's "Key to the Alliums of Europe", and a very thorough research on the "Nomenclature and Synonomy of *Allium odorum* and *A. tuberosum*". These contributions are of the very highest order and will serve as a sound basis for further progress.

In behalf of the members of the Society, the writer takes this opportunity of putting on record expressions of gratitude to Prof. Salisbury, Mr. H. K. Airy Shaw, Mr. Cotton, and others at Kew, and Mr. Stream, formerly of the Royal Horticultural Society, and now with the British Army, who have cooperated so generously. Last, but not least, a debt of gratitude is due the unofficial ambassador of good will, of whom Britain is justly proud, our good and well known friend, Major Albert Pam, O. B. E., V. M. H., F. L. S., who arranged the details of the cooperation and personally saw to it that the articles reached us in time for publication in this issue. Due to this generous cooperation, the systematics of the genus *Allium*, to which the domestic onion belongs, is at last receiving the attention it deserves.

In this connection it is of interest to note that on November 25 the University of Oxford conferred the degree of M. A., *honoris causa*, on Major Pam. The writer is certain that the members will join him in extending to Major Pam heart-felt congratulations.

The ALLIEAE EDITION of HERBERTIA is fittingly dedicated to Dr. Henry A. Jones, Principal Olericulturist at the U. S. Dept. of Agri. Bureau of Plant Industry Station, Beltsville, Maryland, the eminent American authority on the onion, who contributes a brief autobiography and an important article on onion breeding. Articles on onion propagation by Drs. Little, Jones and Clarke; on nutrient deficiency effects in the onion by Dr. Stuart and Miss Griffin, and colchicine-induced tetraploids in *Allium* by Miss Toole and Dr. Clarke, are contributed by Dr. Jones and his associates at Beltsville, Maryland. The gratitude of the Society is due to these workers for these first rate contributions. The members interested in amaryllid breeding will be particularly interested in the article on colchicine-induced tetraploidy since it clearly outlines a technique that has application to other amaryllids. It should be noted that proper caution is to be exercised in handling the poison, colchicine.

Dr. Uphof favors us with a review of "Little Known Allieae of Northwestern North America." Sgt. Harkness, the Chairman of the Allieae Committee, has arranged what is apparently the first symposium on ornamental Alliums in North America, including contributions by Mrs. Helen M. Fox, Miss Elizabeth Lawrence, Mrs. Lester Rowntree, and Messrs. F. L. Skinner and Claude A. Barr. The thanks of the Society go to Dr. Uphof and Sgt. Harkness wherever he is now serving his country in the U. S. Army.

Grateful acknowledgement is also due for various articles on other amaryllids. Dr. Du Puis and Messrs. Zeiner, Brown and James write about hybrid Amaryllis. Articles on daylilies are furnished by Professors Watkins and Saxton; Messrs. Claar, Gilmer, Shull; Miss Christenson, and Drs. Cooley and Stout. Various amaryllids are discussed by Miss Stanford, of South Africa, Miss Stewart, of Texas, and Messrs. James, Hannibal and Houdyshel.

The next issue of Herbertia, 1945, will be dedicated to Supt. R. G. Huey of the Paintsville (Kentucky) Public Schools, for his pioneer contributions toward the use of amaryllids as an educational tool. (The readers are directed to the brief notes by Supt. Huey and Mr. Nelson in the present issue.) The 1945 issue will also contain a wealth of material on hybrid *Amaryllis,* daylilies, *Narcissus,* Alliums, and other amaryllids. Many of these contributions have already been received and it is hoped that the issue can be mailed out earlier than was possible in case of the past few numbers.

Herbertia for 1946 will be the NARCISSUS EDITION, and the very active and competent Narcissus Committee promises an outstanding coverage of the *Narcissus* field for this issue. The other amaryllids, as usual, will receive due attention.

December 22, 1944. —*Hamilton P. Traub*
Salinas, California.

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ERRATA

HERBERTIA, VOL. 10, 1943

Cover; due to an error by the engraver, some copies of Vol. 10 were sent out with ''1944'' on cover; on these ''1944'' should be changed to ''1943''.
Page 49; species no. 17, for ''Gray'' read ''Grey, Hardy Bulbs''.
Page 52; 15th. line from bottom, for ''family'' read ''finally''.
Page 53, 7th. line from top, for ''1853'' read ''1753''.
Page 54; 2nd. line from top, for ''distichously or spirally'' read ''not biflabellately''.
Pages 83, 87, and 88; Fig. 94, and Plates 245 and 246, for ''*gen. nov.*'' read ''*comb. nov.*''.
Page 96, Fig. 96, for ''*ovallaris*'' read ''*obvallaries.*''
Page 101, 3rd. line from bottom, for ''*Beckhouse*'' read ''*Backhouse*''.
Page 116, 16th. line from top, for ''*Lyconis*'' read ''*Lycoris*''.
17th. line from top, for ''*Stenbergia*'' read ''*Sternbergia*''.
Page 118, 16th line from top, for ''volubil'' read ''volubile''.
Page 131, title at top, after ''DICHOGAMY AND INTERSPECIFIC'' add ''IN ALSTROEMERIA''.
Page 194, 9th. line from bottom, for ''Cpl.'' read ''Sgt.''
Page 195, 22nd. line from bottom, for ''Uphoff'' read ''Uphof''.
Page 196, 29th. line from top, for ''Thirty-eight'' read ''forty-one''; for ''18'' read ''12''; and for ''20'' read ''29''.
30th. line from top, for ''225'' read ''205''.

NOTE FOR HERBERTIA CONTRIBUTORS

Correspondence regarding articles and illustrations for HERBERTIA, the Year Book of the American Amaryllis Society, is cordially invited.

STYLE. Manuscripts must be *typewritten* and *double-spaced.* Check with special care all calculations, figures, tables, names, quotations and literature citations.

MANUSCRIPTS AND PHOTOGRAPHS. To insure against loss in the mails, authors should *retain copies* of manuscripts, and the *original negative or extra prints* of photographs, sent for publication in HERBERTIA. Photographs should have the *name and address* of the owner to whom credit should be given, and the *name and size of the subject,* written on the back.

When taking photographs of amaryllids, an effort should be made to include the whole plant—*stem,* if any, *leaves, scape* and *flowers.* Separate views of the *bulb* and *roots* are also valuable in some cases. These remarks do not apply to cut-flowers.

(Preface—Continued from page 4.)

The majority of the linotype operators at our printer's are serving in the U. S. Armed Forces and that accounts for the late appearance of this Volume of Herbertia. However, it is hoped that the members will feel that the rich harvest contained in this volume is worth waiting for.

In the meantime, our Executive Secretary, L. S. Hannibal, has resigned. The gratitude of the members is due to Mr. Hannibal for his unselfish devotion to the Society's interests during his term in office. Mr. E. Frederick Smith, Assistant Instructor in Biological Sciences at Stanford University, California, has accepted the position of Assistant Secretary, in charge of the membership roster, etc. Mr. Smith is a U. S. Navy veteran of World War I; he received his education in horticulture at Iowa State College, Ames; and he has had wide experience with plants. He was formerly employed by the Berkeley (Calif.) City Park Board; later he engaged in private nursery and landscape business; and recently, before going to Stanford University, he was employed in the U. S. Guayule Rubber Research Project in California. The Society is fortunate to secure the services of Mr. Smith.

In the meantime, also, the field of the Society has been enlarged to include all of plant life, and the name of the organization has been changed to the American Plant Life Society. Herbertia, the year book devoted to the amaryllids, as well as all the other activities concerned with the amaryllids, will be continued, and in addition, for the present, occasional numbers of Plant Life, devoted to plant life in general, will be published and sent to all members.

September 17, 1945 *Hamilton P. Traub*
Editor

NOTE TO MEMBERS AND LIBRARIANS

The Errata list for Herbertia, Volume 10, 1943, will be found on a separate sheet[page iii] at the end of this volume. When binding Volumes 6 to 10, inclusive, into one book, the sheet [page iii at the end of the present volume] should follow page ii of the title sheet for Volumes 6-10, 1939-1943 that was published at the end of Volume 10.

Dedicated to

DR. HENRY A. JONES

in recognition of

his outstanding work in

Onion Breeding

Herbert Medalist — Dr. Henry A. Jones

Plate 254

NOTES ON THE GENUS ALLIUM IN THE OLD WORLD

Its Distribution, Names, Literature, Classification and Garden-worthy Species

William T. Stearn, *England*

The genus *Allium* comprises about 500 species. Their collective range covers almost the whole northern hemisphere, from the Atlantic coasts of Europe and North Africa to the Pacific and from the western to the eastern coast of North America. Most of them are to be found in temperate mountain regions with well-marked seasons, notably in California, northwestern Persia and Central Asia, but one species of immense range and great variability (*Allium Schoenoprasum*) extends into the Arctic, and a few occur in Tropical latitudes as far south as Abyssinia and Ceylon. In America no true *Allium* grows wild south of Mexico. *Nothoscordum* and *Ipheion* (*Beauverdia*) take the place of *Allium* in South America. The range of the genus thus embraces the Old World centers of early agricultural development and plant domestication in western Asia and China but does not reach the ancient American agricultural centers in Central America and the Andes. The alliaceous plants cultivated for food—onion (*A. Cepa*), shallot (*A. ascalonicum)* Welsh Onion *(A. fistulosum)*, leek *(A. Porrum)*, kurrat (*A. Kurrat*), garlic (*A. sativum*), rocambole (*A. Scorodoprasum*), cuchay or kiu ts'ai (*A. tuberosum*) and chives (*A. Schoenoprasum*)—are all of Old World origin. The North American Indian appreciated the flavor of the Alliums he found growing wild, but he never undertook their cultivation.

All true Alliums possess, though in varying degree, the pungent oniony taste and odor which indicates the presence of oil of garlic and related volatile oils having diallyl disulphide ($C_6H_{10}S_2$) or diallyl trisulphide ($C_6H_{10}S_3$) as a constituent. Those plants of *Allium*-like form which lack this alliaceous odor, and have at the same time their perianth-segments fused at base into a short tube and their ovaries furnished (as in some true Alliums, i. e. those belonging to Sect. *Melanocrommyum*) with numerous ovules in each chamber (locules), are best excluded from *Allium* and put in the genera *Nothoscordum* and *Caloscordum.* Of the genus *Nothoscordum*, the best known member is *N. inodorum* (Bot. Mag. t. 1129; *Allium fragrans*) now naturalized as a weed in many parts of the world; otherwise it is an exclusively American group, attaining its greatest number of species in the Andean region.

Long-cultivated plants usually exist in a multitude of forms, but these rarely coincide exactly with any wild form, and the region whence their ancestors were first taken into cultivation from the wild is thus uncertain; indeed, to recognize these ancestral species is often difficult, so greatly have the cultivated forms diverged from them. Chives (*A. Schoenoprasum*) and kiu ts'ai (*A. tuberosum*) match wild forms closely, but the origin of the onion (*A. Cepa*), Welsh Onion (*A. fistulosum*), leek *(A. Porrum)* and garlic *(A. sativum)* is more obscure. Undoubtedly their cultivation began in the far remote past, long before the dawn of history. In north-eastern Persia, Afghanistan and the adjacent Pamir-Alai region of Soviet Central Asia are to be found the wild forms most resembling onion and leek. Welsh Onion, an important crop in China and Japan, has its nearest relative in *A. altaicum*, a species of southern Siberia, Mongolia and Eastern Turkistan. The leek probably originated in the eastern Mediterranean region and probably has *A. Ampeloprasum* as its remote ancestor.

The earliest records relating to the genus *Allium* naturally deal only with these economic plants and come from Egypt. In ancient Egypt, Juvenal and Pliny tell us mockingly, onion and garlic were esteemed as gods; the Egyptians took their oaths upon them. Specimens of onion, garlic and leek have been found in ancient Egyptian tombs. The Greek geographer Herodotus (5th cent. B. C.) saw an inscription in Egyptian characters on the Great Pyramid of King Cheops, which, according to his interpreter, recorded the quantity of radishes, onions and garlic eaten by the workmen who built it, and the money spent in this way was said to be 1600 talents of silver. This inscription no longer exists, but certain ancient Egyptian words in other inscriptions are interpreted as referring to onion, leek, garlic. Jewish tradition likewise testifies to the extremely ancient cultivation of these alliaceous crops in Egypt. When the Children of Israel wandered hungrily in the desert, they recalled with longing the appetizing foods of Egypt, "the fish which we did eat in Egypt for nought; the cucumbers and melons, and the onions and the garlick" (Numbers 11:5; compiled c. 900-750 B. C.). Since none of these plants are native to Egypt, their cultivation must have begun in yet more ancient times in the lands to the north-east, in Mesopotamia and beyond, whence the Egyptians first obtained them. They are thus among the oldest of plants cultivated for flavoring. Their cultivation spread through the Mediterranean lands long before the first Greek or Roman writers began to comment on the many varieties available. In ancient Rome and Athens, as in most Mediterranean lands today, garlic was a characteristic food of the poor. "Indeed", writes Bunyard, "of the many gifts that Europe owes to Asia, none, I imagine, have done more to reconcile man to a life of penury, than the vine and onion family. The laborer in Greek fields, with the traditional crust of bread, a skin of wine and a clove of garlic, could support his hard labor on those sunswept slopes. Even to-day his brother in England finds a lunch of bread and cheese a little tasteless without an onion."

Most of the European names of the onion, leek and garlic are of Latin origin. To the Romans garlic was known as *allium* or *alium*—obvious source of the modern French *ail,* Italian *aglio,* Spanish *ajo*—and this old vernacular name was adopted by Haller and Linnaeus in the eighteenth century as the scientific name of the whole genus. It is thus nowadays made to cover a multitude of plants bearing little obvious resemblance to its original owner; before the eighteenth century there existed no common name embracing them all like the scientific term *Allium* does today. The Latin name for the onion was *cepa* or *caepa* and this is the source of the modern Italian *cipollo,* Spanish *cebolla,* German *Zwibel.* Later another word *unio,* probably at first a waggish slang-name, came into use among the Romans and from this, meaning "unity", and applied also to large pearls, and aptly distinguishing the single-bulbed onion from garlic with its many cloves, are derived the modern French *oignon* and English *onion,* of which there exist no less

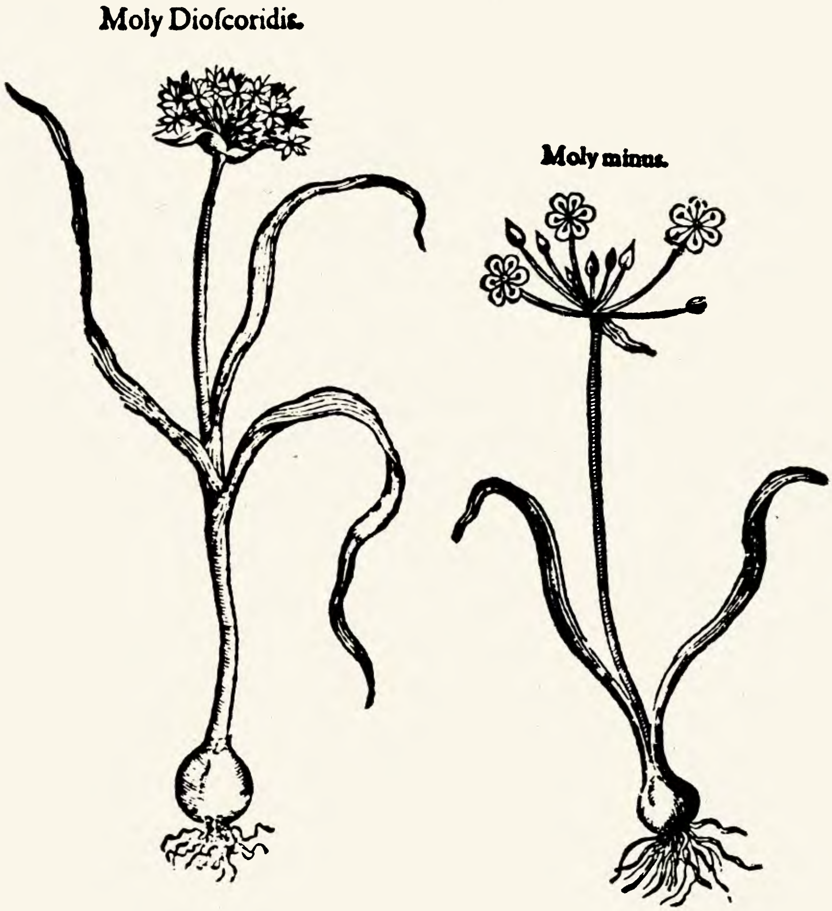

Figure 117. Left, Allium subhirsutum L., Moly Dioscoridis Clus.; right, A. Clusianum Retz., M. minus Clus. From Clusius, Rariorum Plantarum Historia (1601).

than nineteen old spellings. The leek was known as *prason* to the Greeks, *porrum* to the Romans, whence modern Italian *porro,* French *poireau,* Spanish *puerro,* but the Celtic, Germanic and Slavonic peoples had their own entirely different name, possibly meaning at first any cultivated herb, of which English leek (Anglo-Saxon *leac*), German *Lauch,* Dutch *look,* Swedish *lök,* Russian *luk* are modern variants. The English name *garlic* (Anglo-Saxon *garleac,* i. e. spear-leek) is derived from this. The Greek names for leek, garlic and onion, i. e. *prason, skorodon* or *skordon* and *krommuon,* while they have contributed little to modern vernacular names, nevertheless form the base of many modern specific and sectional names in the genus, usually in the latinized forms—*prasum,—scordum* and—*crommyum.* The name *moly* has more romantic associations than these plebeian names with their neck of kitchen and cabbage-patch. Moly, Homer tells us, was the name by which the gods called the potent herb with milk-white flowers and black root wherewith Odysseus defied the spells and drugs of Circe, and so escaped the fate of his men, changed by her to swine. One would like to think of brilliant *Allium Moly* as being this magic herb, but the name *Moly* ought never to have been applied to that yellow-flowered Iberian plant which was unknown before the seventeenth century. *Moly* should have been kept for a white-flowered species of the Homeric lands.

"Garleek, oynons and eek lekes", which Chaucer's boozy Summoner loved so well, all through the Middle Ages, as in the earlier times, helped to liven the laborer's dull food or hide its unsavory flavor, but no great increase in knowledge of the genus *Allium* came before the sixteenth century. Modern botanical nomenclature begins with Linnaeus's *Species Plantarum* of 1753, wherein 31 species of *Allium* are named, but to understand his species and apply his names correctly it is necessary to delve into the writings of his predecessors. Sooner or later the enquirer arrives back at Clusius's *Rariorum Plantarum Historia* (1601). Charles de L'ECLUSE (1526-1609), or Carolus CLUSIUS as he called himself when writing in Latin, was the leading botanist of the sixteenth century, a scholar with many accomplishments, upon whom, in his old age, the University of Leiden bestowed a professorship. Here, at Leiden, Clusius embodied into one large folio volume with woodcut illustrations, his celebrated *Rariorum Plantarum Historia,* all the material of his previous publications, the discoveries made on his travels in Hungary, Austria, Spain and elsewhere, the results of his life-long observation of plants. Clusius possessed the gift of detecting the essential specific features of plants and so triumphed over the limited scientific terminology of his day as to give recognizable accounts of more Alliums than any previous author. It is fitting that one of them (Fig. 117, right) should be named *A. Clusianum* in his honor. The others include *A. Victorialis, A. Ampeloprasum, A. controversum, A. nigrum, A. subhirsutum, A. Scorodoprasum, A. carinatum, A. flavum, A. paniculatum, A. rotundum, A. agulosum, A. montanum* and *A. Moly.* He must also have known the common onion, leek, garlic, chives, crow garlic (*A. vineale*) and ramsons (*A. ursinum*), already well illustrated in the works of Brunfels (1489-1534), Fuchs (1501-66) and Mattioli (1500-1577), but he probably considered them too common for inclusion in a volume devoted to rare plants. In the history of *Allium,* as in many other genera, Clusius's work is a landmark; it can almost be described as the starting point of our modern knowledge. Figs. 117, 118, and 120 show typical illustrations from the *Rariorum Plantarum Historia.* Linnaeus cited Clusius's *Moly Dios-*

coridis from Cadiz (Fig. 117, left) when publishing *A. subhirsutum* Linn.; Retzius's *A. Clusianum* is partly based upon Clusius's *Moly minus* (Fig. 117, right). These illustrations thus help to typify the species of later authors. Clusius placed his species under the generic headings *Victorialis, Scorodoprasum, Moly, Allium sive Moly montanum* and *Moly Narcissi foliis*. Later authors treated the onion, leek and garlic as members of different genera, *Cepa, Porrum* and *Allium*. The first to bring all the alliaceous plants under one heading, to adopt the name *Allium* for this and so to give the name its present wide application and the genus its present definition, seems to have been the Swiss anatomist, botanist, bibliographer, and poet, many-sided Albrecht von HALLER (1708-77). Haller's most important scientific work was in the field of human anatomy and physiology, but his encyclopaedic mind was as competent as that of Linnaeus in botanical matters and equally versed in botanical literature. In 1745 Haller published at Goettingen the first monograph of the Genus, *De Allii Genere naturali Libellus,* a pamphlet of 56 pages with two engraved plates; later republished, with alterations, in his *Opuscula* (1749). It examines the views of Morison, Tournefort, Magnol, Ray, Knaut, Micheli, Ruppius, Boerhaave, Rivinus, Heucher and Linnaeus upon the definition of the genus, then carefully disentangles the synonymy of the 24 species then known and describes them in considerable detail; it also states their distribution with as great accuracy as the limited collecting of the period allowed. This work is the basis of the account of *Allium* by Carl von Linné (1707-78), better known as Linnaeus, in his *Species Plantarum* (1753). Here the cumbrous descriptive phrase-names used by Linnaeus's predecessors and contemporaries are swept into synonymy and replaced by convenient binominals. Thus for Haller's *Allium foliis radicalibus subhirsutis, caulinis glabris, floribus umbellatis* Linnaeus substituted the name *Allium subhirsutum,* but in order to ascertain what he meant by this it is necessary to refer back to Haller's work and, ultimately, to that of Clusius.

An enormous amount of literature relating to *Allium* has been published since 1753. It must suffice to mention here only a few important illustrated and monographic works.

On his travels in the Orient, a region wherein Alliums abound, John Sibthorp (1758-96), the Sherardian Professor of Botany at Oxford, was accompanied by Franz Bauer (1758-1840), an Austrian, who has been considered the greatest of botanical artists, "der groeste Pflanzenmaler". Bauer drew and painted the plants in a living state as he and Sibthorp found them in Greece, the Aegean islands, Asia Minor and Cyprus. The 16 plates of *Allium* by Bauer in Sibthorp and Smith's *Flora Graeca 4*: tt. 312-327 (1823) are equalled only in beauty and accuracy by those in Redoute's *Les Liliacées* (8 vols., 1802-16).* This fine work devotes 35 plates to *Allium,* the species figured being those available in French gardens at the time. Pierre Joseph Redouté

* The dates of publication of Redoute's *Liliacées,* as established by B. B. Woodward in *Journ. of Bot.* 43:26 (1905), are as follows:—Vol. *1*: tt. 1-18 in 1802, tt.

(1761-1841), who can justly be rated Bauer's equal as a botanical artist, painted the illustrations, but the text of vols. *1-4* was written for him by A. P. de Candolle (1778-1841), *5* and *6* by François de la Roche (d. 1813), *7* and *8* by A. Raffeneau Delile (1778-1850). The plates in H. G. Ludwig Reichenbach's *Icones Florae Germaniae et Helveticae* do not reach the high quality of Redouté's and Bauer's; vol. 10 tt. 482-508 (1848) nevertheless contains an extremely useful series of illustrations of almost all the European species of *Allium.* There are also many colored plates of *Allium* scattered through Curtis's *Botanical Magazine.*

Of monographic works since Haller's, the first was *A Monograph of the Genus Allium* by George Don the younger (1798-1856), which was read to the Wernerian Natural History Society of Edinburgh in April 1826 and published in vol. *6*:1-102 of the Society's *Memoirs,* the latter being dated "1832". A separate edition, however, came out early in 1827. Don based his work on the rich Lambert herbarium, later divided and scattered, and on the plants grown in the Chelsea Physic Garden. A gardener by training, he had a keen eye for differences between individual plants and tended to regard such differences as of specific value; consequently many of the 139 species he recognized have since been reduced. The generally accepted division of the genus *Allium* into the sections *Porrum, Macrospatha, Schoenoprasum, Molium* and *Rhizirideum* was first proposed by Don. The value of his work today lies primarily in its citations of pre-Linnean literature ignored by Regel.

The *Alliorum adhuc cognitorum Monographia* by Eduard von Regel (1815-92) is the last survey of the genus *Allium* as a whole. It was published at Leningrad in 1875 as part of *Acta Horti Petropolitani,* vol. *5.* The descriptions and key are in Latin, the introduction and notes in German. In working through the collections sent home from Turkistan by the explorers Alexis and Olga Fedtschenko, Regel came upon species after species which did not fit any of the descriptions in C. S. Kunth's *Enumeratio Plantarum 4*:379-450, 684-691 (1843), a compilation which brings together information from a great variety of works, and ultimately he found himself obliged to monograph the entire genus. In this he included *Nothoscordum, Caloscordum* and *Nectaroscordum* as well as species of *Triteleia, Muilla* and *Bloomeria,* making 263

19-24 in 1802 or 1803, tt. 25-48 in 1803, tt. 49-60 in 1804; Vol. *2:* tt. 61-102 in 1804, tt. 103-120 in 1805; vol. *3:* tt. 121-138 in 1805, tt. 139-162 in 1806, tt. 163-180 in 1807; vol. *4*: tt. 181-204 in 1807, tt. 205-240 in 1808; vol. *5*: tt. 241-276 in 1809, tt. 277-300 in 1810; vol. *6*: tt. 301-348 in 1811, tt. 349-360 in 1812; vol. *7*: tt. 361-402 in 1812, tt. 403-420 in 1813; vol. *8*: tt. 421-444 in 1814, tt. 445-468 in 1815, tt. 469-486 in 1816. The *Allium* plates are *A. album,* t. 300; *Ampeloprasum,* t. 385; *arenarium,* t. 379; *bisulcum,* t. 286; *brachystemon,* t. 374; *carinatum,* t. 368; *carolinianum,* t. 101; *cernuum,* t. 345; *Chamaemoly,* t. 325; *ciliare,* t. 311; *denudatum,* t. 357; *flavum,* t. 119; *foliosum,* t. 214; *fragrans,* t. 68; *globosum,* t. 179; *longispathum,* t. 316; *lusitanicum,* t. 27; *Moly,* t. 97; *moschatum,* t. 100; *mutabile,* t. 240; *nigrum,* t. 102; *nutans,* t. 233; *obliquum,* t. 363; *obtusiflorum,* t. 118; *pallens,* t. 272; *paniculatum,* t. 252; *roseum,* t. 213; *scorzonerifolium,* t. 99; *sphaerocephalon,* t. 391; *striatum,* t. 50; *subhirsutum,* t. 305; *sulcatum,* t. 482; *tataricum,* t. 98; *triquetrum,* t. 319; *ursinum,* t. 303; *Victorialis,* t. 265.

species in all. Later, in 1887, Regel published a supplementary work, *Allii Species Asiae Centralis* (*Acta Horti Petrop. 10*: 278-362) illustrated with drawings that are neither accurate nor artistic.

Figure 118. Left, Allium carinatum L., Allium s. Moly montanum II Clus.; right, A. Scorodoprasum L., A. s. M. montanum I Clus. From Clusius, Rariorum Plantarum Historia *(1601).*

In 1882 the Genevese botanist Edmond Boissier (1810-85) published in his *Flora Orientalis 5:* 229-285, an account of the species occurring in the territory from Greece and Egypt eastward to the boundaries of India. This includes 141 species as well as many varieties, some of which are now given specific rank.

These two works made unnecessary a survey of the genus by the Kew botanist John Gilbert Baker (1834-1920) who was then engaged on a revision of the petaloid monocotyledons. Baker did, however, write the text accompanying many plates of *Allium* in the *Botanical Magazine.*

Of recent publications the most important is A. Vvedensky's account of *Allium* in the Soviet Union, forming part of Komarov, *Flora URSS 4* (1935), which not only provides detailed and accurate descriptions in Russian of 225 species, but fits into a systematic framework and points out the distinguishing features of the many species discovered in the Caucasus and Russian Central Asia since the comprehensive works of Regel and Boissier. No less than 40 of these had been described previously by Vvedensky himself, mostly in periodicals not readily accessible.

Up to the present well nigh 1100 specific names have been proposed in the genus *Allium* and have to be accounted for by the next monographer, but about 600 of them may prove to be synonyms. Thus reduced, *Allium* will, nevertheless, remain a vast almost unwieldy genus. To understand it, related species must be grouped together and this is no easy task. Difficulty arises from the features which give the genus its fascination—the great diversity of structure which its species display, their many different combinations of characters. No organ remains constant in form throughout the genus and all must be considered in building a natural classification. Much attention has been given to the outward from and the outer coverings of the bulb but very little to its internal structure, which varies immensely from group to group. The vernation of the leaves and the characters of the capsules, seeds and seedlings also offer promising fields of enquiry.

The first to appreciate the great morphological variation of the group and to attempt "to divide it into Genera from the various Structure of the Bulb, Leaves, Bractes, Petals, Filaments, Stigmata, Fruits and Seeds" seems to have been Richard Anthony Salisbury (1761-1829). He was an extremely acute observer, whose whole life was devoted to the study of plants. During his life-time he published nothing of consequence on the genus, but 37 years after his death J. E. Gray printed a fragment of his manuscript "*Genera Plantarum*" dealing with petaloid monocotyledons. Here the "*Order Cepaceae*", as Salisbury termed the group, is divided into 18 carefully characterized "legitimate Genera, differing often materially not only in Leaves and Flowers, but in their Fruits and Seeds, which latter Haller and Linné neglected to examine". Every line reveals how closely he had studied these plants in a living state. He confesses, however, that he found "the smell of *Cepaceae* * * * frequently so intolerable that after dissecting about half the species in our collections, I abandoned the rest". Such features as the form of the nectary and the number of ovules in each chamber of the ovary did not escape him. His "Genera" accordingly represent fairly natural groups worthy of sectional rank, and in the interval between his death in 1829 and the publication in 1866 of his *Genera of Plants, a Fragment containing Part of Liriogamae,* many of them were published as sections of the genus *Allium* by other authors and some have been recently described as new sections by F. Hermann. C. S. Rafinesque (1783-1840) likewise considered that "several ancient Genera, Onion, Leek and Garlick, were blended by L[innaeus] without just cause" and he too attempted a "generic reform" by splitting *Allium* into 13 new genera, scrappily defined and by no means so well-founded and homogeneous in content as Salisbury's. Indeed the contrast between Salisbury's precise and scholarly *Genera,* many times rewritten but to the author's mind never perfect enough for publication, and Rafinesque's muddled *Flora Telluriana (1-3,* 1837; *4,* 1838; not 1836; cf. Barnhart in *Torreya 7,* 177:1907), with its hundreds of imperfectly studied and ill-defined "generic groups", is well exemplified in their treatment of the genus *Allium.*

George Don in 1827 divided the genus into eleven "divisions" (each with a description and a Roman number) and these he subdivided into "sections" (each with a description and an Arabic number). The eleven divisions he grouped under seven apparently subgeneric names—*Porrum* (comprising Divisions I-II), *Schoenoprasum* (Div. III), *Macrospatha* (Div. IV-VI), *Rhizirideum* (Div. VII), *Molium* (Div. VIII-IX), *Anguinum* (Div. X) and *Ornithogalodeum* (Div. XI)—which, however, lack descriptions, so that their essential characters have to be deduced from those common to the divisions comprised in each. The names *Porrum, Macrospatha* and *Molium* all cover more than one division and are in a sense *nomina nuda;* their nomenclatural standing is debatable. Don's classification proved an important contribution to a system of the genus and was adopted with little change by Roemer and Schultes in 1830, by Kunth in 1843, by Regel in 1875 and by Engler in 1888.

In the year that Don's monograph first appeared the Belgian politician Barthelémy Charles Dumortier (1797-1878) published at Tourney a *Florula Belgica* in which he attempted to divide the genera of the Belgian flora into natural sections. His section *Alliotypus,* with the filaments of the alternate stamens broadened and tricuspidate and comprising *A. Porrum, A. sativum, A. Scorodoprasum, A. sphaerocephalon, A. vineale* and *A. Ascalonicum,* corresponds to Don's group *Porrum* and the name *Alliotypus* appears to be the correct title. Dumortier's other section *Schoenoprasum,* with undivided stamens, is less natural; it includes *A. Schoenoprasum, A. oleraceum, A. flavum, A. carinatum, A. Moly* and *A. ursinum,* species of very unlike character representing four distinct sections.

In December 1836, Stephen Endlicher (1804-49) proposed in his *Genera Plantarum* the division of the genus *Allium* into four sections:—(a) *Moly* corresponding to Don's *Molium;* (b) *Ophioscorodon* (Wallr.) based on *A. ursinum;* (c) *Codonoprasum* (Reichenb.) corresponding to Don's *Macrospatha;* (d) *Schoenoprasum* (Kunth) corresponding to Don's *Porrum,* Dumortire's *Alliotypus.*

Another classification was put forward in 1848 by Philip Barker Webb (1793-1854) in his *Phytographia Canariensis.* He separated the species with more than two ovules in each chamber of the ovary from those with only two ovules, naming the first *Melanocrommyum* (from the Greek words for black and onion, in allusion to the type species, *A. nigrum),* the second *Crommyum.* Boissier in 1882 accepted these as primary divisions of the genus and then subdivided the section *Crommyum* into the subsections *Porrum, Rhizirideum* and *Haplostemon,* the last being further divided into series *Schoenoprasum, Brachyspatha, Codonoprasa* and *Molia.*

In 1939 F. Hermann published a short review of the sections and subdivisions of *Allium* in Europe, directing attention to the valuable taxonomic characters presented by the nectaries and by the leaf-vernation. Most of Hermann's new sections correspond to genera described by Salisbury, while some of them are identical with sections already well-established in the literature and for which new names such as *Melamprason, Rhynchoprason, Nikeprason* and *Arktoprason* are superfluous.

None of the classifications yet proposed, however, is adequate for the satisfactory disposition of the vast number of species now known. All are to some degree artificial, being based upon too limited a range of characters and hence incapable of giving a true picture of the complex inter-relationships necessarily existing in so large a genus. The writer cannot at present supply the new classification that is so manifestly needed but would suggest that the following sections* may be provisionally recognized:—

Melanocrommyum Webb et Benth. (1848); syn. sect. *Melamprason* F. Hermann (1939), genus *Panstenum* Raf. (1837), genus *Canidia* Salisb. (1866); type-species, *A. nigrum* (Bot. Mag. t. 1148), sect. *Kaloprasum* C. Koch (1849)†.

Moly Endl. (1836), syn. sect. *Molium* G. Don ex Koch (1837), sect. *Rhodoprason* F. Hermann (1939), sect. *Crommyum* subsect. *Haplostemon, Molia* Boiss. (1882), genus *Iulus* Salisb. (1866), genus *Molium* (G. Don) Fourr. (1869); type-species, *A. neapolitanum* (Bot. Mag. t. 3531) or *A. roseum* (Bot. Mag. t. 978).

Briseis (Salisb.) Stearn, sect. nov. (1946); syn., genus *Briseis* Salisb. (1866)*; type-species, *A. triquetrum* (Bot. Mag. t. 869).

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* For the original publication of these, see Dumortier, Fl. Belg. 140 (1827); Endlicher, Gen. Pl. 146(1836); Koch, Synop. Fl. Germ. 714(1837); Rafinesque, Fl. Tellur. 2. 17(1837); Kunth, Enum Pl. 380(1843); Webb et Berthelot, Hist. Nat. Iles Canaries, Bot. *3.* 347(1848); Salisbury, Gen. Pl. 88(1866); Boissier, Fl. Orient. *5.* 229(1882); Maximowicz in Bull. Acad. Sci. St. Petersb. *31.* 109(1887); Prokhanov in Bull. Appl. Bot. (Leningrad) *24.* ii. 176(1931); F. Hermann in Fedde, Repert. Sp. Nov. *46.* 57(1939).

† Sect. *Kaloprasum* C. Koch in Linnaea *22.* 235 (1849) is based on *A. caspium (Bot. Mag.* t. 4598) which diverges from other species of sect. *Melanocrommyum* in its rather more campanulate perianth and its much longer stamens and style.

* "*Briseis.* Petala disco basis coalita, recurva, oblonga, interiora angustiora post anthesin conniventia et scariosa. Filamenta supra basin petalorum 2 seriebus inserta, subulata. Pericarpium turbinatum. Stylus 3-fidus. Stigmata 3, hemisphaerica. Semina arillata * * * Nomen poeticum ob fructos cernuos * * * *Briseis* differs from every other Genus here, in its extremely narrow filaments inserted in

MICROSCORDUM Maxim. (1887); type-species, *A. monanthum.*

CHAMAEPRASON F. Hermann (1939); syn., genus *Saturnia* Maratti (1772); type-species, *A. Chamaemoly* (Bot. Mag. t. 1203).

XANTHOPRASON F. Hermann (1939); syn., genus *Molyza* Salisb. (1866); type-species, *A. Moly* (Bot. Mag. t. 499).

OPHIOSCCRODON (Wallr.) Endl. (1836); syn., sect. *Arktoprason* F. Hermann (1939); genus *Ophioscorodon* Wallroth (1822), genus *Hylogeton* Salisb. (1866); type-species, *A. ursinum.*

CEPA (Moench) Prokhanov (1931); syn., genus *Cepa* Moench (1794) p. p., amend. Salisb. (1866), genus *Kepa* Raf. (1837) p. p.; type-species, *A. Cepa.*

PHYLLODOLON (Salisb.) Prokhanov (1931); syn., genus *Phyllodolon* Salisb. (1866); type-species, *A. fistulosum* (Bot. Mag. t. 1230).

HAEMOPRASON F. Hermann (1939); syn., sect. *Schoenoprason* Regel (1875) p. p. maj., sect. *Crommyum* subsect. *Haplostemon* § *Brachyspatha* Boiss. (1882); type-species, *A. melanantherum.*

CODONOPRASUM (Rchb.) Endl. (1836); syn. sect. *Macrospatha* G. Don ex Kunth (1843), sect. *Rhynschoprason* F. Hermann (1939), sect. *Crommyum* subsect. *Haplostemon* § *Codonoprasa* Boiss. (1882), genus *Codonoprasum* Reichenbach (1828), genus *Raphione* Salisb. (1866); type-species, *A. oleraceum.*

RHIZIRIDEUM G. Don ex Koch (1837); syn. genus *Endotis* Raf. (1837), genus *Xylorhiza* Salisb. (1866), genus *Butomissa* Salisb. (1866), genus *Rhizirideum* (G. Don) Fourr. (1869); type-species, *A. senescens.* Here may belong the genera *Gynodon* Raf. (1837) and *Calliprena* Salisb. (1866), both based on *A. cernuum* (Bot. Mag. t. 1324), and the genera *Stelmesus* Raf. (1837) and *Hexonychia* Salisb. (1866), both based on *A. stellatum* (Bot. Mag. t. 1506).

ANGUINUM G. Don ex Koch (1837); syn. sect. *Nikeprason* F. Hermann (1939), genus *Loncostemon* Raf. 1837), genus *Berenice* Salisb. (1866), genus *Anguinum* (G. Don) Fourr. (1869); type-species, *A. Victorialis* (Bot. Mag. t. 1222).

ALLIOTYPUS Dumortier (1827); syn. sect. *Schoenoprasum* (Kunth) Endl. (1836) non Dumortier (1827), sect. *Porrum* G. Don ex Koch (1837), genus *Schoenoprasum* Kunth (1815), genera *Getuonis, Plexistena* and *Stemodoxis* Raf. (1837), genus *Porrum* Salisb. (1866); type-species, *A. Porrum* or *A. sativum.*

NOTHOSCORDUM Kunth (1843), CALOSCORDUM Herbert (1844) and NECTAROSCORDUM Lindley (1836) are considered separate genera.

If the definition of the sections is difficult, far more so is that of the species. No herbarium adequately represents the whole genus and in any event herbarium specimens need to be supplemented by living plants, for they often lack bulb, leaves, spathe or capsule, all of which may be necessary in order to place a species in its proper group and to

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two series, and arillated Seeds; its Leaves are so sharply keeled as to appear triangular like those of *Carex*, and its Peduncle which is triangular soon bends down to the ground from the weight of its fruits" (Salisb. Gen. Pl. 92-94. 1866). Briseis was the favorite slave of Achilles; her seizure by Agamemnon led to the quarrel between Achilles and Agamemnon which is the theme of the first part of the Iliad.

identify it with certainty. The identification of incomplete *Allium* specimens, as of garden plants whose provenance has been forgotten, is no easy task under present conditions.

This lack of certainty is much to be regretted, for the genus offers many decorative plants to the keen gardener and many interesting problems to workers in plant-anatomy, physiology and cytology, to all of whom correct nomenclature is important. Chouard's work on the bulbs, seedlings, etc., of *Scilla (Ann. Sci. Nat. Bot.,* 10e sér. *13.* 131-323. 1931) suggests the desirability of similar work on *Allium.* Levan's cytological researches (*Hereditas 13.* (1929) et seq.) have contributed to an understanding of the relationship between various species and of the variation in certain groups; most of these he examined proved to be diploid, but a number of polyploids (morphologically not greatly different from the corresponding diploids) also exist and possible correlations of geographical distribution and cytological characters need study. The fruit-biology of the genus, briefly sketched by Sernander in his monograph on the dispersal of seeds and fruits by ants (*Kungl. Svenska Vet. Akad. Handl.* 41, no. 7, pp. 260-264. 1906), presents other problems.

The gardener values plants for their use and appearance rather than their biological peculiarities. The culinary importance of onion, leek, shallot and chives hardly needs mention, but many other species can likewise be eaten. Although some are unpalatable, none are known to be poisonous. Explorers in North America, China, Tibet, Turkistan, Afghanistan, Siberia and North Africa mention a great variety of species as being gathered in a wild state and eaten by native peoples. Ramsons (*A. ursinum*) was more esteemed in former times in Europe than it is at present, but makes a good substitute for garlic. The little bulbils of *A. paradoxum,* a weed in some gardens, can be added to salads. Chinese chives, cuchay or kiu ts'ai (*A. tuberosum*), which in Europe and America is grown only for ornament, in the Far East is much esteemed as a salad-plant. From August to October its clumps of profuse grassy leaves are overtopped by angled stems a foot or so high bearing starry white flowers in umbels 1½ inches or so across. These flowers have a pleasant hawthorn-like scent. To salads they impart a honeyed sweetness as well as a garlic pungency, while the leaves can be used like those of chives.

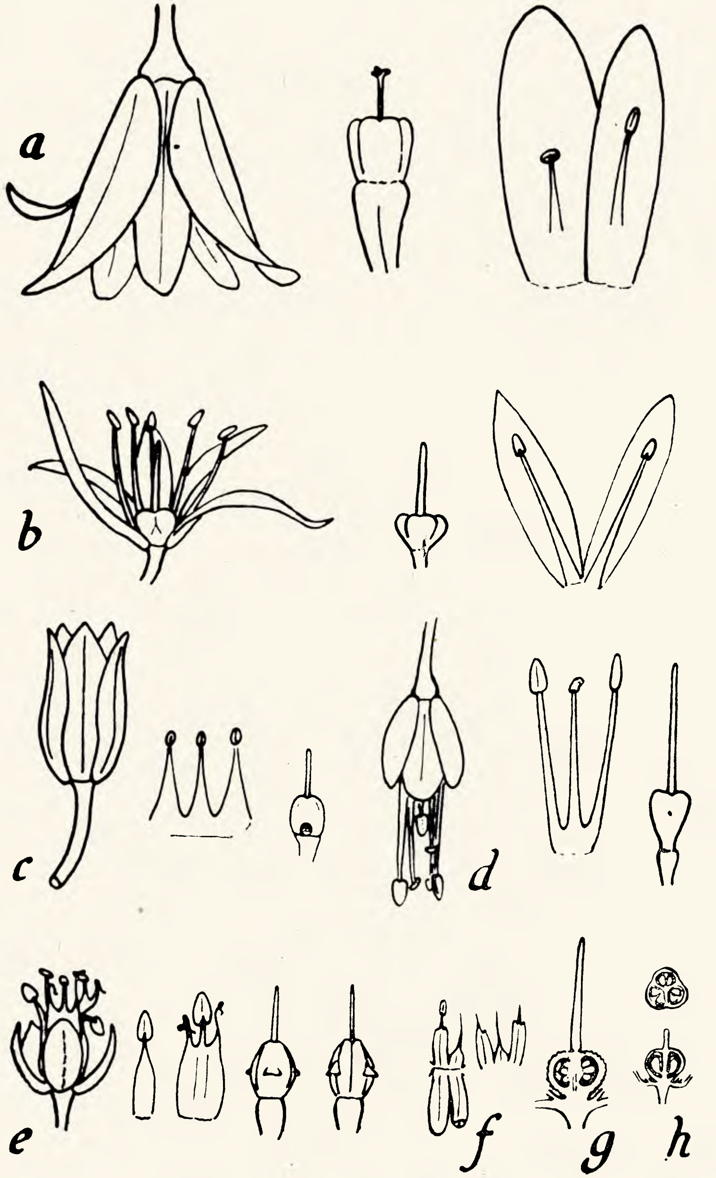
Coming to Alliums of decorative value, "of the whole Family, there are a great many which I must leave", as three centuries ago Parkinson was obliged to do, and like him, "I will only select out a few for this our Garden, whose flowers for the beauty of stateliness, form or colour, are fit to be entertained, and take place therein, every one according to his worth, and are accepted of by the lovers of these delights", adding words of warning about some others. The cultivation of Alliums offers no difficulty. In nature most species grow in well-drained rocky places, amid sparse vegetation, on sunny exposed slopes, and in the garden a light soil and a sunny position suit them best. Those of low stature obviously ask for homes in the rock garden. *A. paradoxum, A. triquetrum, A. ursinum* and *A. Victorialis* are exceptional in being often woodland plants in nature and therefore thriving well under shady conditions in the garden. *A. paradoxum* has no particular merit. Its three-sided stem, about 6 to 12 inches high, ends in a cluster of bulbils, out of which one fairly large white cup-shaped flower rises on a slender curved pedicel. These bulbils provide an all too efficient means of increase. It is a native of the Caucasus and north Persia but has become naturalized in parts of Europe. Strangely enough, it was first described as a species of *Scilla*! Its stigma is trilobed, a feature not common in the genus *Allium* and one which connects it with *A. triquetrum* (*Bot. Mag.* t. 869). This is a handsome plant of very easy cultivation; in fact it needs no cultivation—only to be left alone. Above its clumps of grassy leaves, on three-sided stems 9 to 12 inches high, droop one-sided umbels of large white bell-shaped flowers (Plate 255-a), each segment marked down the outside with a conspicuous green stripe. After flowering the perianth dries around the swelling capsule and the stem becomes limp, bending over and resting upon the ground by the time the seeds are ripe. Ants find the aril, with which the seeds are provided, very appetizing and carry them about the garden. *A. triquetrum* has a fairly wide range in the western Mediterranean region and is eaten in North Africa. Regel united with it *A. pendulinum,* a less robust species of southern Italy and Corsica. This has more slender leaves and stems; the umbel is not markedly one-sided as in *A. triquetrum,* the pedicels curving instead in all directions; the perianth opens widely, saucer-fashion, at anthesis, instead of being permanently bell-shaped; the perianth-segments are narrowly elliptic, rather than narrowly oblong, and smaller (about 1 cm. or less against 1.5 cm. or more in *A. triquetrum*). It has been in cultivation but, lacking the robust nature of *A. triquetrum,* it has died out and needs re-introduction. *A. triquetrum,* on the other hand, has become naturalized in southern England.

The peculiarity of seed-dispersal by ants noted for *A. triquetrum* has also been observed in *A. ursinum.* Here again the three-sided stem becomes limp after flowering, ultimately lying flat upon the ground and bringing its globular seeds within easy reach of ants; there is no aril but, according to Sernander, the seed-coat is impregnated with oil. What connection this species has with bears is now uncertain; the German name *Baerenlauch* probably originated as a translation of the Latin name *allium ursinum,* which goes back to the first century A. D., being mentioned by Pliny, to a time, that is, when wild bears were much commoner in Europe than they are now. Its English name is *wild garlic* or *ramsons* (Old English *hramsa*), an interesting and ancient word cognate with Russian *cheremsha* and Greek *crommyum* and obviously the same as Swedish *ramslök* and Dutch and German *rams.* In late spring *A. ursinum* carpets many an English wood with its broad, lanceolate or narrowly ovate leaves and often tricks the inexperienced into thinking they have found Lily-of-the-Valley (*Convallaria*). Its strong odor quickly proclaims its identity. The bulb is long and slender, with a truncate top where the leaf-stalk has fallen off, and is formed from the base of a single leaf. The leaves are a fresh green above, and a glaucescent green below, but the "lower" side is morphologically the upper side, for by a twist in the petiole the leaf has been turned upside down, a phenomenon well-known in *Alstroemeria* but not in *Allium*. The starry white flowers (Plate 255-b) are produced in great abundance. Like *A. triquetrum* it needs no cultivation, merely to be left alone and allowed to colonize some dark unconsidered spot. It is the only member of the section *Ophioscorodon*.

A. Victorialis (*Bot. Mag.* t. 1222) is an interesting but hardly ornamental species of wide distribution. In Siberia, under the name *cheremsha*, it is gathered and stored as a preventive of scurvy; like *A. ursinum* it has a strong garlic flavor. The leaves are broad, firm-textured, dark green, several times folded, not rolled, when young; their sheaths are purple; netted fibrous tunics envelop the oblong bulbs, which are mounted on a rhizome. The flowers are yellowish and very small, with long protruding stamens. The herbalist's name *Victorialis* commemorates the medieval superstition of German miners in Bohemia, who called it *Siegwurz* ("victory-root") and believed that it warded off evil spirits liable to attack them underground. This reputation it shares with the herb Moly, which protected Odysseus against the designs of Circe, and with garlic, which was reputed to keep off vampires; those who dislike garlic find themselves in bad company.

A. Moly (*Bot. Mag.* t. 499) has no connection with the Moly of Homer but is a broad-leaved handsome plant with large, bright yellow, glossy, saucer-shaped flowers on stems about a foot high. It increases rapidly. When Regel published his monograph in 1875, all he could say about the provenance of this species was that it grew in southern Europe. Now it is known from southwestern France [dep. Aude; cf. Timbal-Lagrave in *Bull. Soc. Bot. France 17*. 211 (1880); Petit in *Bull. Soc. Sci. Aude 7* (1896)], Spain and Portugal. *A. stramineum* Boiss. et Reut., non Regel, is the only related species and has narrower leaves and pale flowers. *A. Moly* var. *bulbilliferum* carries bulbils in the umbel and is not so ornamental as the type. *A. Moly* is the type-species of section *Xanthoprason*.

The *Molium* garlics centre on *A. neapolitanum*. They have small more or less globose bulbs, linear leaves parting from the stem at or slightly above the ground-level, and fairly large white or pink saucer-shaped flowers; there are two ovules (not more) in each chamber of the ovary (Plate 255-h). *A. neapolitanum* has large white flowers and is an attractive species much used for forcing and pot-cultivation. The leaves are hairless but have a minutely toothed edge; the stem is three-angled. These characters separate it from a group of other Mediterranean species with round stems and hairy-edged leaves, *A. subhirsutum*, *A. Clusianum*, *A. ciliatum* (*Bot. Mag.* t. 774), *A. trifoliatum*, *A. Blomfieldianum*, *A. Chamaemoly* (*Bot. Mag.* t. 1203), the last-named being a minute species with four narrow leaves resting on the ground and a few small white flowers nestling at their centre. It was long ago placed in a genus *Saturnia* distinct from *Allium* and is not closely allied to these other species. They should be given a well-drained, sheltered and sunny



Floral details of **Allium.** a, **A. triquetrum** (sect. Briseis); b, **A. ursinum** (sect. Ophioscorodon); c. **A. Schoenoprasum** (sect. Rhizirideum or Schoenoprasum), d, **A. pulchellum,** Tubergen's var. (sect. Codonoprasum or Macrospatha); e, **A. Porrum** (sect. Alliotypus or Porrum); f, **A. cardiostemon** (sect. Melanocrommyum), after Nabelek; g. **A. albopilosum,** ovary in section (sect. Melanocrommyum); h, **A. Blomfieldianum,** ovary in section (sect. **Moly** or **Molium).** All X2.5.

Plate 255

Plate 256 *Distribution of Allium Babingtonii*

place in the rock-garden. *A. roseum* is a taller, foot-high species, with a round stem but glabrous leaves. The type has numerous deep pink flowers and is a diploid (2n=16, according to Messeri). More common in gardens is a variety with fewer flowers but numerous bulbils in the ovary, var. *bulbilliferum* (*Bot. Mag.* t. 978), and this, according to Messeri, is a tetraploid (2n=48).

Comparatively few of the numerous Alliums of Central Asia are now in cultivation, although many were introduced last century by Regel's explorer son Albert and were figured in *Gartenflora*. *A. karataviense* (*Bot. Mag.* t. 6451) is, however, well established. This species has broad, smooth, glaucous, reddish-margined leaves up to a foot long, 3 inches wide, and a large umbel, 3 or 4 inches in diameter, of pale pink flowers with reflexing segments, on a short stem about 6 inches high. Its most noteworthy features are its ornamental leaves and its large deeply indented capsules. It takes its name from the Kara Tau in northwestern Turkistan. *A. albopilosum* (*Bot. Mag.* t. 7982) is a much more striking species. The leaves are broad, numerous and hairy. The

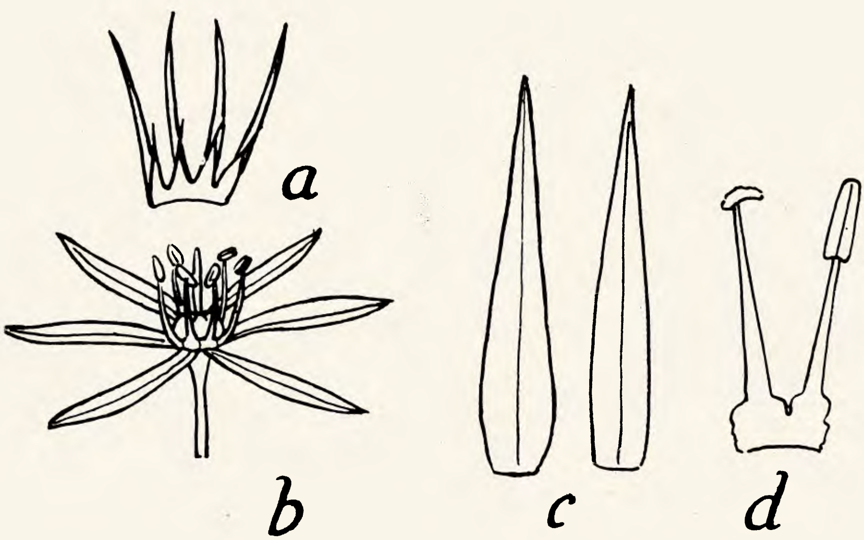


Figure 119. a, Allium Christophi (after Regel); b, A. albopilosum (after Bot. Mag.); c, perianth-segments, d, stamens (original).

flower-stem, usually more than a foot high, ends in an umbel, about 5 inches across, of very large starry flowers with long, glossy, lilac, narrowly lanceolate pointed segments (Fig. 119-b & c) which do not reflex but become stiff and woody after flowering. It is a native of the Turkmen mountains separating northeastern Persia from Transcaspia. This is also the type-region of *A. Christophi* (Figure 119-a) and Vvedensky unites the two, *A. Christophi* Trautv. (1884) having priority over *A. albopilosum* C. H. Wright (1903). There is nothing in the original descriptions against this identification, but the filaments of *A. Christophi* as figured, probably incorrectly, in *Acta Horti Petrop. 10* t. 7 (1889) do not agree with those of *A. albopilosum* as known from living material. (Figure 119-d). Confirmation of Vvedensky's conclusion is desirable.

In most Alliums there are only two ovules in each chamber (loculus) of the ovary. Around the Mediterranean, and particularly in the mountains and hills from Palestine and Syria eastward to the Caucasus and the Pamir-Alai region of Central Asia, grow a number of species with from three to ten ovules in each loculus (Plate 255 f & g); their leaves are fairly broad and part from the stem about ground-level. In habit they resemble the *Molium* Alliums. This group forms the section *Melanocrommyum. A. albopilosum* belongs to it, but the type-species is *A. nigrum* (*Bot. Mag.* t. 1148; *A. multibulbosum*), a robust plant with linear-lanceolate leaves up to 2½ inches wide and with stems 2 to 3 feet high carrying a many-flowered umbel about 3 inches across of large whitish or pink flowers; the perianth-segments are elliptic and the anthers yellow. *A. Cyrilli* is closely related but may be distinguished by its linear perianth-segments and purplish anthers. Both flower in June and seem to be fairly widespread in the Mediterranean region. *A. atropurpureum* (*A. nigrum* var. *atropurpureum*) has the general habit but is easily recognized by its extraordinarily dark reddish-purple, almost black, flowers; it is a native of Hungary and the Balkan Peninsula.

A. stipitatum is another tall species, the stem rising to about 3 feet and bearing a globose umbel, about 3 inches across, of small thin-textured pale lilac flowers with linear segments; pull these off and the papillose ovary will be seen to be narrowed at the base into a short stalk or stipe. The leaves, about four to a bulb, up to 13 inches long and 2 inches or so wide, are large, bluish-grey, strap-shaped and pubescent along the margin, and also on both sides towards the base, with short white hairs. *A. stipitatum* usually passes in gardens as *A. Rosenbachianum*, which, however, is a glabrous species. *A. giganteum* (*Bot. Mag.* tt. 6707, 6828) resembles *A. stipitatum* in habit but its leaves are glabrous and its lilac perianth-segments are elliptic. Too tall for the rock-garden, these species are excellent for growing in clumps in the herbaceous border.

Of species suitable for the rock-garden *A. oreophilum*, of which *A. Ostrowskianum (Bot. Mag.* t. 7756) is no more than a light-colored form, is as beautiful as any. It is a dwarf plant, with the stem about 4 to 8 inches high, carrying a flat umbel, 1½ to 2 inches across, of rather large wide-open triangular flowers. It possesses a remarkable distribution, being found in the northern Caucasus and also in the mountains of Central Asia. Like most species, all it needs is a sunny position in light well-drained soil.

Such a position suits admirably *A. flavum (Bot. Mag.* t. 1330), a graceful slender species with bluish stem and bluish smooth almost cylindrical but solid leaves; its small cup-shaped flowers are a soft yellow, with conspicuously protruding yellow anthers, on loose curving pedicels. It grows about 9 inches high. *A. flavum* is a characteristic species of the section *Macrospatha* or *Codonoprasum,* in which the spathe is divided into two somewhat unequal valves, each with a long tail-like appendage. *A. carinatum* (Fig. 118, left), belonging to the same group, must be mentioned with a warning. Its reddish-purple flowers are all too few, and the bulbils which replace them are all too numerous, to justify its introduction. These bulbils ensure that it springs up where it isn't wanted. *A. pulchellum* is, on the contrary, of great garden merit. It can be regarded as a variety of *A. carinatum* without bulbils; actually, being a diploid, it is probably the species from which the triploid *A. carinatum* arose. There are two plants in cultivation under the name *A. pulchellum,* both with flat slightly ribbed leaves and reddish flowers with long protruding stamens, in a loose many-flowered bulbil-free umbel. Reference to the original description of *A. pulchellum* by George Don shows that his plant grew about a foot high, had dark anthers with yellowish pollen and produced seeds. These characters are shown by one of our cultivated plants. It grows about 1-1½ feet high and has deep red-purple flowers from July to August; it produces abundant seeds and the fruiting pedicels stand erect. This plant can accordingly be regarded as typical *A. pulchellum.* The other plant, which is even more attractive but less common in gardens, grows about 1½-2 feet high and has clear lilac (violet-rose) flowers (Plate 255-d) from August to September, rather later than the other plant; its anthers are yellow. It is either sterile or seeds rarely, and its bulbs increase rather slowly. This plant appears to have no official name; for the present it may be called "*A. pulchellum* van Tubergen's variety". The name *A. pulchellum* may possibly be superceded by an earlier name, either *A. cirrosum* Vandelli or *A. coloratum* Sprengel, if the precise application of these is ever established. For garden purposes *A. flavum* and the *A. pulchellum* forms are the best of the *Macrospatha* or *Codonoprasum* group. The other members of the group include many graceful plants, like *A. stamineum* and the perplexingly variable *A. paniculatum,* but beware of those which, like *A. oleraceum,* carry bulbils in the umbel.

Section *Porrum* or *Alliotypus* has more value in the kitchen—than in the flower-garden. Leek and garlic are its best-known members. It is easily recognized by the great difference in form between the outer and inner stamens. Whereas the outer three filaments are slender and subulate, the alternating inner three are broad and flattened, with the somewhat oblong basal part terminating in three appendages or cusps, of which the middle one carrying the anther is usually rather short while the two anther-less side cusps are often long and thread-like (Plate 255-e). The flowers in this section are usually rather small and ovoid or cup-shaped with erect segments often scabrid on the outside; they are crowded into dense heads. *A. sphaerocephalon* is probably the best for garden ornament. It grows about 1½ to 2½ feet high, has slender leaves sheathing the wiry stem for much of its height, and carries a dense rounded head of deep purple-red flowers in July and August. It has a wide distribution in Europe. *A. descendens* is an allied species of south-eastern Europe. In Spain there occurs another close relative, *A. melananthum,* with purple-black flowers. *A. Babingtonii (A. Ampeloprasum* var. *Babingtonii*) may sometimes be met with in botanic gardens. It is best described as a perennial leek, with robust stems 4 to 6 feet high, having a few pale reddish flowers intermixed with numerous large bulbils. The distribution of *A. Babingtonii* is puzzling (Plate 256). It was first noticed in Cornwall, growing in or near old orchards, where it may have been a relict of former cultivation, and has since been recorded from Dorset in southern England, as well as from the counties Clare, Galway, Mayo and Donegal in western Ireland where it is now considered indigenous. It appears to be unknown outside the British Isles and decidedly Atlantic "oceanic" in range. Apart from its "architectural form" it has no garden value. The serpent garlic *(A. controversum*) belongs to the same group and has been recommended to the connoisseur of oddity for its complete and wayward irrelevance. Its "beak-shaped flower-heads writhe upwards in elaborate curves and coils, imitating a flamingo at its toilet and sometimes tying themselves in knots" and, as Jason Hill further remarks, "it is quite in character that this studied performance is a prelude to nothing in particular and that the flower-head, when at last it appears, discloses only a few onion flowers and a bunch of bulbils." This contortionist grows about 2 feet high. It is an old garden plant, being figured by Clusius in 1601 (Fig. 120) under the name *Scorodoprasum secundum; A. Ophioscordum,* if not identical, is at least very similar. The notorious crow garlic *(A. vineale*), most pestilential weed in the genus, also belongs to section *Porrum.* It produces bulbils in such abundance that its flowers are not so often seen. These bulbils may remain dormant in the soil for several years and its extirpation, once it has become established, is often extremely difficult.

A. caeruleum and *A. caesium* are blue-flowered species having the lanky, drum-stick habit of *A. sphaerocephalon* and are often grown in gardens. Their wiry stems, 1½ to 2 feet high, end in dense globose heads about 1½ inches across. To distinguish them, dissect a flower and look at the stamens. In *A. caeruleum* (*Bot. Reg. 26.* t. 51; *A. azureum*) all the stamens are simple and undivided; in *A. caesium* the inner three filaments are much broader towards the base than the outer three and and have two tooth-like appendages. Both species are widely distributed in the steppes and deserts of Central Asia, and a warm, dry place in the rock-garden suits them well.

These are not the only blue-flowered Alliums. In the mountains extending from Sikkim eastward to central and north China occurs a group of low-growing species with blue flowers and narrow, clustered, rhizomatous bulbs. *A. cyaneum* (*Bot. Mag.* t. 9483) from north China has clusters of little cup-shaped purplish-blue or pale heliotrope flowers, with long protruding stamens, on stems about 6 inches high, and makes close tufts of thread-like leaves. The others have broader, linear leaves and their stamens are shorter than the perianth. In *A. kansuense* (*Bot.*

Mag. t. 7290) and *A. sikkimense* (*Bot. Mag.* t. 8858) the leaves are almost basal and the flowers are about 9 mm. long. In *A. Beesianum* (*Bot. Mag.* t. 9331) the leaves sheathe the foot-high stem for a third or more of its length and the pendulous China-blue flowers are about 14 mm. long.

Scorodopraſum II.

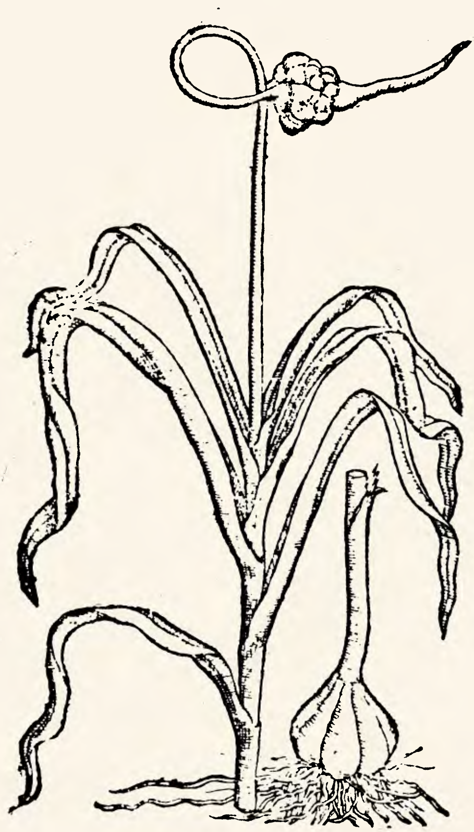


Figure 120. Allium controversum Schrader Scorodoprasum secundum Clus. From Clusius Rariorum Plantarum Historia (1601).

China yields many other beautiful species of *Allium* belonging to the same section as these "blue-bell garlics". *A. Mairei* (*A. yunnanense*), about 4 to 8 inches in height, by its narrow almost thread-like leaves recalls *A. cyaneum,* but its small narrowly bell-shaped flowers stand almost erect and are pale pink or white dotted with pink. It blooms in August and September. *A. amabile* (*Bot. Mag.* t. 9257), which is probably not specifically distinct from *A. pyrrhorrhizum,* resembles *A. Mairei* closely but possesses flowers of rich magenta-crimson. *A. Farreri* is rather more robust. It was long known in English gardens as "*A.* sp. Tibet," a designation which became converted into *A. tibeticum.* There exists, however, an *A. tibeticum* described by Rendle in 1906, a blue-flowered plant related to *A. sikkimense* and unconnected with this reddish-purple one, which could not be identified with any of the species known from India and China. Luckily one enthusiast, the late Reginald Cory, grew it as "Farrer 165" and comparison with a specimen in the Edinburgh herbarium under the same number proved that it had indeed been introduced by Reginald Farrer (1880-1920) from the neighborhood of Siku, Kansu, in northwestern China. It is an attractive species, with grassy leaves or sprawling angled stems 6 to 12 inches or so high, carrying a loose umbel of tubular-campanulate purplish flowers about 8 mm. long. The stamens are fused into a tube around the ovary and the pedicels are rough with minute teeth. By these features it is easily recognized. The narrow bulbs are closely clustered and joined by a short rhizome.

Section *Rhizirideum* is typified by the *A. senescens* group. (Plate 255-c). It consists of plants with fairly stout, woody, Iris-like rhizomes, whence Don's name *Rhizirideum* and Salisbury's *Xylorhiza;* the leaves are basal, more or less erect, flat, *Narcissus*-like, often glaucous and twisted, and out between them rise two-edged stems carrying many-flowered hemispherical heads of pink or purplish, more rarely white or yellowish flowers. To recognize the group is easy; to distinguish the species is another matter. *A. nutans* (*Bot. Mag.* t. 1143) is the most robust. It often grows as much as 2 feet high. The inner stamens are twice as broad as the outer three and have normally a tooth on each side at base. *A. senescens* is dwarfer; the inner stamens are scarcely broader than the outer and lack basal teeth. The leaves are smooth and rounded beneath, with no prominent mid-rib. A multitude of different-looking plants, all answering to this general description, may be found in gardens. They differ among themselves in height, in the width, twistedness and color of their leaves, and in shade of flower-color, but they defy classification into well-defined varieties, so much have they intermingled under cultivation. The identification of wild material is less difficult. To this group belong the names *A. baicalense, A. fallax, A. glaucum, A. serotinum, A. spirale* and *A. spurium.* Its geographical area falls into two parts:—the Asiatic, which extends from the Tarbagatai region of the U. S. S. R. to Manchuria, i. e. probably not west of 80° E; and the European, which extends from Portugal, Spain and Sicily to the Volga-Don region of the U. S. S. R., i. e. probably not east of 40°E. The European form (*A. montanum* F. W. Schmidt) has much narrower leaves than the robust Siberian form figured by Gmelin (Fl. Sib. *1.* t. 11:1747) which is usually regarded as the type of *A. senescens.* The gap of 40 degrees of longitude which separates them is a further argument for considering them specifically distinct. In nature *A. montanum* grows under dry conditions, on stony well-drained slopes, as I have observed in the type-region, Bohemia. The related *A. angulosum,* which may be distinguished by the prominent mid-rib on the underside of the leaf, prefers moist conditions—I have seen it in quite damp meadows in the Rhineland—and is rarely cultivated.

The *A. senescens* group lacks richness of color but this is not a defect showed by all the *Rhizirideum* Alliums, certainly not by *A. narcissiflorum* (*Bot. Mag.* t. 6182; *A. pedemontanum, A. grandiflorum*). This species is among the most beautiful of the genus and was Reginald Farrer's favorite. In his *English Rock Garden* he described it with his characteristic enthusiasm. "In places more august" than those chosen by *A. Schoenoprasum* var. *Hegetschweileri* "dwells *A. narcissiflorum,* in the steep earth-pans and stony screes high up in the most awesome shelves of the limestone Alps of Piedmont * * * Here it runs underground, forming a huge ramifying mass of rootstocks below in the unnegotiable stony hard earth, and the surface of that barren place is covered with a waving green jungle of upstanding strap-shaped leaves, up among which come shooting, in August, springy stems of 8 or 10 inches, each hanging out a loose head of some six or eight flowers, very large and lovely indeed, great pendent bells of glowing vinous red". It is quite easy to cultivate on a ledge of the rock-garden. *A. insubricum,* from the Alps of Lombardy, is a closely allied plant.

Chinese chives or kiu ts'ai (*A. tuberosum*) has already been mentioned as a salad-plant of Chinese and Japanese kitchen-gardens. It is often called *A. odorum,* the flowers being pleasantly scented unless bruised. The true *A. odorum* (*Bot. Mag.* t. 1142), for which the correct name is *A. ramosum,* blooms earlier (from June to July instead of from August to October) than *A. tuberosum* and has larger almost bell-shaped flowers, with the stamens about half as long (not almost as long) as the segments. Out of flower the two may be distinguished by their leaves, solid in *A. tuberosum,* hollow towards the base in *A. ramosum.*

Nectaroscordum siculum (*Bot Reg. 22.* t. 1912; *A. siculum*) may with almost equal propriety be included in the genus *Allium* or excluded from it as the type of an allied genus. It grows about 3 feet high and has comparatively large, thick-textured, bell-shaped flowers colored dull green, purplish pink and buff, on curved pedicels which become erect as the capsules mature, the perianth-segments then becoming dry and cartilaginous. The tip of the pedicel is swollen into a broad disc, in which the ovary is, as it were, sunk, its broad shallowly conical top rising little above the point of insertion of the perianth-segments. There are numerous ovules in each chamber of the ovary. It is a graceful species but not one to be handled; it gives out when bruised a most powerful nauseating vile stench reminiscent of a bad drain or a gas-escape. *N. siculum* is a native of Sicily, Sardinia, Corsica, Italy and Provence. An allied form with whitish flowers, *N. bulgaricum* (*A. bulgaricum*), occurs in the Balkan Peninsula.

There are many other Alliums worthy of cultivation besides those mentioned above. They are only a selection of Old World species and include by no means all that may be encountered in botanical gardens or that have been introduced into cultivation and subsequently lost, leaving their portraits in Curtis's *Botanical Magazine* and Regel's *Gartenflora*. The American species are less numerous but no less interesting; to discuss them here would occupy too much space. The *Allieae* include no flamboyant beauties; those, however, who like their flowers small and delicate —"the taste of all gardeners", observes Miss Sackville-West, "as their discrimination increases, dwindles toward the microscopic"—will find the group one of almost inexhaustible interest.

HERBERT MEDALIST, 1944

In recognition of his outstanding contributions in the field of onion breeding, the William Herbert Medal for 1944 has been awarded to Dr. Henry A. Jones, Principal Olericulturist, Bureau of Plant Industry, Agricultural Research Administration, United States Department of Agriculture. An excellent portrait of Dr. Jones is presented in Plate 254.

HERBERTIA, VOLUME 11 (1944)

The demand for this volume of Herbertia, the most outstanding up to the present, and published in a limited edition, will not diminish in the future. Members are requested to preserve their copies with the greatest care so that copies may later be available for library, and other special needs.

HENRY ALBERT JONES

An Autobiography[1]

When I was a small boy my father rented a 40-acre market garden near Ottawa, Illinois, and grew small fruits and vegetables, mostly onion sets and asparagus, to be sold on the local markets or shipped to Chicago. I attended school in Ottawa then, but not very regularly because I spent a good deal of my time cutting and packing asparagus; picking berries, beans, peas; and sorting onion sets. We harvested onion sets in late summer or early fall, stored them throughout the winter, and sold them to the Chicago wholesalers the following spring. My big fall and winter job was removing sprouted and rotted onions from the shallow storage trays. This seems somewhat significant now, but I am sure that as a young boy, sorting onions until my fingers were numb and my feet cold, I had no desire at all to become an onion fancier.

In December, 1901, when I was 12 years old, my family moved to Seward, Nebraska. There we grew nearly all the locally important vegetable crops in a small market garden along the Blue River and sold them to the Seward markets. My father died in 1905. During the next 4 years I stayed with mother while she operated the market garden. I found it very fascinating to grow an assortment of vegetables, but huckstering from door to door did not interest me at all. In two of those four years disastrous July floods destroyed all our crops. These reverses were probably blessings in disguise to me, because they rather encouraged me to continue my education, which had been greatly neglected up to that time.

In the fall of 1909 I entered the School of Agriculture at Lincoln, Nebraska, and was graduated in the spring of 1912. That same fall I matriculated at the University of Nebraska's College of Agriculture and in March 1916 completed the required course of study with majors in botany and plant pathology. In June of that year I was married to Louise Frances White, and in the following October I began graduate study for a doctorate at the University of Chicago, with a major in plant physiology. I completed this work in August 1918.

My first job after graduation—another onion undertaking—was a temporary one with the United States Department of Agriculture's Bureau of Markets studying onion storage in the Connecticut Valley of Massachusetts. An opening in the Department of Horticulture at the University of West Virginia in Morgantown tempted me, and I began work there in January 1919. In June 1920 we moved to the University of Maryland in College Park, where my time was occupied in teaching and research in vegetable crops. In the summer of 1922 I was invited to take charge of the Division of Truck Crops, University of California, at Davis, and I started work there the following October. I spent 14 years in California, and they were most interesting years filled with rich experiences.

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1 Born Deer Park, Illinois, May 6, 1889; B. S. A., University of Nebraska, 1916; Ph. D., University of Chicago, 1918.

I left California, with my wife and four children, in 1936 to take charge of the United States Department of Agriculture's potato and onion investigations, with headquarters at the Plant Industry Station near Beltsville, Maryland. Though we were all reluctant to leave California, I felt that the Beltsville Research Center was destined to become one of the world's outstanding agricultural research centers, and I welcomed the opportunity to cast in my lot with this rapidly developing institution. My years at this Station also have been rich in experiences and associations, and my work on the development of hybrid onions—begun in California and continued here—has certainly been a most fascinating and satisfying undertaking. I am indeed glad that those numb fingers and cold feet in boyhood did not forever keep me away from onions.

AMARYLLID NOTES FROM SOUTH AFRICA

K. C. Stanford, *South Africa*

The writer has heard from Mr. Frank McCoy about the "Giant White" *Agapanthus* (described elsewhere in this issue). The writer does not know how it happened as hers look near alike, but of course these were not grown from seeds. However, the writer now has some that were purchased as special hybrids that are "lightly" shaded blue or pink, but it must be said that this is very "lightly". Their blossoms are big and appreciably distinct and for that reason the writer is going to save seeds when they flower again.

The writer has a huge lot of *Agapanthus pendulus* grown from seeds furnished by the National Botanical Gardens at Kirstenbosch. They are very mixed and it will take years to sort them out. The true form is a "Navy Blue" on a five foot scape. There is also the dwarf, dark coloured mountain variety which is very attractive, but is apt to grow tall as the type under garden conditions.

The writer is working up a collection of *Alstroemeria* species. They do well here when given shade and ample water. Our rich acid soil is near ideal for their culture, and since they flower later than most of our bulbous plants they are in demand as a cut flower.

The publication of a book on South African flowers has been announced. The author knows quite a bit about them and he is an excellent photographer. It is to be sold for Red Cross funds. The present writer has also started on a similar book, but it will take a year or more to complete it.

AMARYLLID MUSINGS

W. M. James, *California*

For the first time in three years I was able to leave Ojai for a few days this summer. A short visit with Dr. Traub was very enjoyable. It was a pleasure to meet Mr. Hannibal for the first time. He is very energetic and is growing many varieties of Amaryllids. It was between seasons and most of his plants were dormant, but I enjoyed "comparing notes" with him. At Mr. Brown's near Gilroy, I saw a few good off-season blooms of white amaryllis. These flowers, and a collection of colored transparencies, indicate that he has a very fine strain. Mr. Brown spent several years in Rhodesia and is very interesting to visit and talk with.

Figure 121. Lycoris aurea. Photo by W. M. James.

The *Worsleya procera* (Plate 257) bloomed very nicely at Las Positas Nursery again this year. Some of the plants which bloomed this season were marked as having bloomed last season also. There is quite a variation in color and size of flower. Some are bluer than others. The plants look vigorous and healthy and apparently like their position in partial shade in a slightly raised bed composed solely of decomposed granite. Seedlings are proving difficult, although the seed germinates readily.

The nerines at El Rancho Rinconada did very well this year especially those with summer foliage.

Nerine Masoniorum and *N. filifolia* flower stems were about as thick as grass. (Plate 257a). Apparently they like the warm summers we have here. *Nerine Hera* is doing much better than it did at Santa Barbara (Plates 258).

I am beginning to think that the secret of success with Alstromerias in Southern California is to keep them from starting too early in the fall. The warm summers seem to ripen the tubers so thoroughly that it takes very little water to start foliage growing in September. I have never seen these early stems produce flowers—only those which start after colder weather and which make most of their growth in the spring. It is so warm in the fall that the only way I know of to keep them from starting is to withhold all water. This will not be easy on smaller places, but if a corner can be given them and kept completely dry from ripening time in the late spring until about November, good results are quite certain.

A bulb of *Lycoris aurea* belonging to Dr. Traub bloomed this fall (Figure 121). This plant is not new at all in Southern California, but it is so seldom seen that it is almost a curiosity. In Santa Barbara it is very short lived, possibly because of the cool summers. I hope it will do better in the warmer climate of Ojai.

Temperature is apparently quite a factor in seed setting on the white hybrids of *Brunsvigia rosea*. At Las Positas Nursery I had difficulty in getting seed even with careful hand pollination. At El Rancho Rinconada many of the white flowers and almost all of the pink forms set seed without any hand pollination. Bumble bees were probably responsible for the pollination. These seedlings take three to five years to bloom and those at Las Positas Nursery so far have not had a high percentage of whites—mostly a wide variation from very dark pink to near white. Next year I hope to have time to start a thorough test of the correlation between seed and flower color, as outlined by Mr. E. O. Orpet on pages 124-126 in Vol. 10 of Herbertia. Pink forms are in such supply that there is no use in growing seedlings of that color if it can be avoided.

Worsleya procera in bloom at Las Positas Nursery, Santa Barbara, Plate 257
Calif., 1944. Photo by W. M. James.

Plate 257a

Nerine filifolia
Photo by W. M. James

Nerine Hera
Photo by W. M. James

Plate 258

As I write this, war conditions both in Europe and the Pacific look more favorable, indicating that the time is not too far distant when some of our boys will be coming home and that we can again resume some of the activities which have had to be curtailed or postponed for a time.

CAIN'S "FOUNDATIONS OF PLANT GEOGRAPHY"[1]

Hamilton P. Traub, *California*

This is undoubtedly the first important book in this field and is indispensable to the modern worker in plant systematics.

In order to orient the reader, "in a field that seems naturally to be diverse and ramifying", the author presents, in Part I, a brief outline of thirteen previously proposed principles of plant geography, primarily from the works of Good and Mason. In the remaining portion of the book, according to the author, "Some of principles will not receive more than incidental consideration . . . . This is especially true of those that belong more in the province of physiological plant geography. Others, those having primarily chronological significance, will be dealt with in some detail. Some of the principles of Good and Mason are reworded and elaborated and additional ones are added as the subject is developed." This is the modest claim of the author. The reader will note, after he has finished reading the book that Prof. Cain has actually accomplished much more than that for he has given us a comprehensive viewpoint of the science of plant geography that had a rather vague meaning to many workers in plant science. In subjecting a large number of research papers, in the field under consideration, to keen critical review it has been possible for him to outline a sound basis for plant geography.

Parts II to V, inclusive, of the book are devoted to paleoecology, areography, evolution and plant geography, and the significance of polyploidy in plant geography.

One of the outstanding qualities of the book consists of the rigid insistence on the scientific method of approach. In referring to the sciences of geobotany, plant geography, plant ecology and plant sociology, the author remarks, "What is most needed in these fields is a complete return to inductive reasoning, with assumptions reduced to a minimum and hypotheses based upon demonstrable facts and proposed only when necessary."

With reference to the selection of the material included in the book, each specialist will undoubtedly notice, what seems to him, important omissions. This, however, is a vast field, and Prof. Cain is to be congratulated for making his treatise as comprehensive as it is in this first edition of a work that will be essential for an indefinite period.

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[1] Cain, Foundations of Plant Georgraphy, Harper & Brothers, 49 East 33rd. St., New York. 1944. $5.00

1. REGIONAL ACTIVITY AND EXHIBITIONS

AMARYLLIDS AS AN EDUCATIONAL TOOL

R. G. Huey, *Superintendent*
Paintsville (Kentucky) Public Schools

An appreciation of the beautiful in nature should and can be the heritage of every child. Upon this philosophy rest the attempts made in the Paintsville Public Schools to interest its pupils in the study and cultivation of amaryllids.

The ability to recognize and enjoy a beautiful plant or flower is a priceless possession. Neither adversity nor misfortune can take it away. Once acquired, it is a permanent part of life. It is a personal retreat where one may momentarily withdraw from the routine problems and cares of every day toil to relax in peace and refreshing enjoyment.

Our interest in amaryllids began with a very fine clone of Hybrid *Amaryllis* received some years ago along with a shipment of dahlias from India. To this was added additional stock from some of the best American and English sources. The Botany Department became interested and began to make some crosses and to propagate. Seedlings from some of these first crosses have flowered during the present year. As the study continued and the interest grew, other amaryllids have been added to the collection, which now includes various forms of *Crinum, Clivia, Lycoris, Nerine, Vallota, Brunsvigia, Haemanthus, Zephyranthes, Stenomesson, Amarcrinum, Sprekelia,* and *Habranthus.* We hope to add others as rapidly as possible.

The cultivation, care, breeding and propagating is carried on by the students in the Botany Department under the guidance of instructors and affords valuable practical experience in the class room. Out of the work and study of the various amaryllids has come a greatly increased interest in the geography of the native lands of these plants, and, as a result of the geographical study, a better understanding of the people of these countries. Considerable correspondence has been carried on with students in other lands. Former students in this school, now in the armed services, are writing from the various lands where they are now located and telling of the various amaryllids they have run across.

The school is becoming amaryllid conscious. Each of the thirty home rooms grows and flowers in its windows during the school year one or more forms. Many of the pupils are growing them in their homes. We believe they will become better and happier men and women from having done so.

AMARYLLIDS IN THE SAN FRANCISCO PUBLIC SCHOOLS

[The following letter from Mr. Harry E. Nelson is of interest in connection with the amaryllid projects in our public schools.—*Ed.*]

VICTORY GARDEN ADVISORY COUNCIL

an activity of the

SAN FRANCISCO CIVILIAN WAR COUNCIL

San Francisco Junior College,
Ocean and Phelan Avenues,
San Francisco 12
October 24, 1944

Dear Mr. Traub:

Your letter of October 18th. is at hand and in reply Mr. Silva and I wish to say that we feel that we have little to write about at this time.

Last spring a Victory Gardening program was started in the elementary and junior high school through the auspices of the Civilian War Council. It proved very helpful and did a great deal of good, especially in the way of therapy. It was continued through the summer and we recognized it again this fall. Some of the schools are having such good results that they wish to make gardening a regular portion of their curriculum.

The Board of Education has decided to take two of the school programs under its wing if we will keep the teachers supplied with information, and if we will make regular calls to supervise the program. This is a great satisfaction because I feel that we will probably keep a certain type of youngster in school longer if he has a gardening activity to keep him busy. Then, too, there is a possibility that we will get some of these youngsters after a period of time in my floriculture classes. At any rate I have a great deal of enthusiasm for the program and feel very happy that they will give us the opportunity of trying it on the students.

Mr. Silva and I became very much interested in the amaryllids a few months ago and were trying to reach some decision as to what genera we should work with. We were agreed that the Amaryllis family offered great possibilities and we both liked the species with which we were familiar. Mr. Silva is interested in the Nerines, and my chief interest is in the Bomareas.

We felt that we could do a great deal of good work during our spare time if we had something of the sort to work with and so we took a trip up to see Mr. Hannibal. He overwhelmed us with a tremendous collection of rare as well as the more common kinds. We brought them home and we then reviewed the whole situation.

[AMARYLLIDS; SAN FRANCISCO SCHOOLS, continued on page 274.]

2. DESCRIPTION, CLASSIFICATION AND PHYLOGENY

THE FLORISTIC REGIONS OF THE U. S. S. R. WITH REFERENCE TO THE GENUS ALLIUM

William T. Stearn

1. *Geographical Divisions adopted in the "Flora URSS"*

The Union of Soviet Socialist Republics inherits the original East European homeland of the Russian people and the vast Asiatic empire which they conquered and colonized in the Tsarist times. This area of more than 8,170,000 square miles opens to the west upon the Black Sea, the Baltic Sea and the White Sea, to the east upon the Pacific Ocean. Between the Arctic Ocean, which bounds the Union in the north, and the long chains of high mountains which lie along most of its southern frontier, there stretch wide zones of tundra with permanently frozen subsoil, of coniferous, mixed and deciduous forest, of marsh, steppe and desert. Russia's soils range from the peat of the tundra, the grey soil of the forest and the very fertile black soil of the southwestern plains to the barren red and yellow sands of the deserts and the rocky screes of the mountains. The Union includes cold dry regions and hot dry regions and regions of heavy rainfall, arctic regions and subtropical regions, and it thus offers to plants a great variety of climatic and edaphic conditions. During the Ice-Ages much of its Tertiary vegetation must have been swept away, for even though, at the maximum extension of the ice, probably less than half of the whole area was covered by ice-sheets, these tended to surround the central ice-free land with belts of high barometric pressure and to subject this area to a very severe continental climate. The Union borders on regions both in the southeast and southwest where rich floras survived, and from these the ice-devastated areas were recolonized. In their new homes, particularly in the mountains of Central Asia (the Pamir-Alai and Tien Shan regions), the colonist populations broke up into a number of new species. The flora of the Soviet Union is accordingly a rich and varied one, including many endemics, i. e. species which do not extend beyond its borders. Ledebour's *Flora Rossica*, published between 1841 and 1853, enumerates nearly 6,600 species of flowering plants and vascular cryptogams, among them 65 species of *Allium*, but in his day the Khanates of Bukhara, Khive and Khokand in Central Asia were still unconquered; Western Turkistan, floristically the richest part of the Soviet Union, had not been added to the Russian Empire. The flora of the Union is now estimated to consist of between 15,000 and 20,000 species, among them 225 species of *Allium*.

For the purpose of the *Flora URSS*, edited by V. L. Komarov for the Academy of Science of the U. S. S. R. (Leningrad, 1934 *et seq.*), which aims at classifying and describing all the flowering plants and vascular cryptogams of the Soviet Union and at stating concisely their distribution, the territory of the Union has been divided into seven parts (chasti) :—the *Arctic* part, extending from Kela Peninsula in Lapland to the Bering Strait; the *European* part, extending south of the Arctic to the Black Sea, the Caucasus and the Caspian Sea; the *Caucasus; Western Siberia*, including the Soviet Altai; *Eastern Siberia;* the *Far Eastern* part from the foot of the Kamchatka Peninsula south to Vladivostok; *Central Asia*, corresponding to the Russian (or western) Turkistan of the Tsarist Empire.

These seven parts (chasti) are again divided, making forty-nine regions (rayony) in all. This is not an excessive number for so vast a territory, and some of them, notably the Siberian regions, might usefully have been split into much smaller areas. Only a few of these floristic divisions coincide in name and boundaries with past or present administrative areas. They are not mapped in any atlas or defined in any accessible work. Their approximate boundaries can, however, be deduced from occasional statements in the text of the *Flora URSS* and the sketch-map in vol. *1* facing p. xvi (1934) which is, unfortunately, on a very small scale, without much detail. It is to be hoped that in the final volume of the *Flora* this will be supplemented by a number of more detailed maps on a larger scale. The *Flora* summarizes the distribution of plants in terms of the abbreviated regional names used on this map. Hence without the map its statements of distribution are meaningless. Plate 259 is a copy of this map on a yet smaller scale, with Arabic numbers substituted for the abbreviated names of the original; indications of the courses of rivers and the boundaries of republics have been reluctantly omitted. The numbers are those under which the regions are listed in the *Flora URSS 1*. 13 (1934) where an explanation is given of the abbreviations employed on the map and in the text. The numbers themselves do not appear elsewhere in the *Flora*, but they have been added to the translation of Vvedensky's account of *Allium* in the Soviet Union *(Herbertia 11*:65-218. 1944).

The floristic regions of the Soviet Union are based on major topographic features such as the courses and basins of rivers and groups of mountains. They take most of their names from such rivers and mountains, thus resembling the Departments of France. The rivers include the Amu Darya, Anadyr, Angara, Bureya, Dnieper, Don, Dvina, Trtysh, Kama, Kolyina, Lena, Ob, Pechora, Syr Darya, Tobel, Ussuri, Volga, Yenisei and Zeya. The mountain regions include the Caucasus, Pamir, Alai, Tien Shan, Altai and Tarbagatai. Lakes Balkhash, Ilmen and Ladoga, the Black, Aral and Caspian Seas and the deserts Kyzyl Kum and Kara Kum have given names to others, and in a few instances existing regional names have been retained, notably for sea-girt areas, like the Crimea, Kamchatka, Novaya Zembla and Sakhalin.

In List No. 1, are listed the "parts" and "regions" recognized in the *Flora URSS*. Each region is preceded by the number under which it is shown on Plate 259 and listed in the *Flora URSS 1*. 13 (1934) ; then follows the Cyrillic abbreviation used in the text of the *Flora* and a transliteration of the full Russian name.

LIST NO. 1

A. The "parts" and "regions" recognized in the *Flora URSS*. Each region is preceded by the number under which it is shown on Plate 259 and listed in the *Flora URSS 1*. 13 (1934) ; then follows the Cyrillic abbreviation used in the text of the *Flora* and the transliteration of the full Russian name.

I. ARCTIC (АРКТ.; Arktika)

1. Arctic Europe (Аркт Евр.; Arktichesky poyas Evr. chasti S. S. S. R.)
2. Novaya Zemlya (Н. Зем.; Novo-Zemel'sky rayon)
3. Arctic Siberia (Аркт. Сиб.; Arktichesky poyas Sibiri)
4. Chukotsk (чук.; Chukotsky rayon)
5. Anadyr (Анад.; Anadyrsky)

II. EUROPE (ЕВРОП. Ч.; Evropeyskaya chast')

6. Karelian Lapland (Кар.-Лапл.; Karelo-Laplandsky rayon)
7. Dvina-Pechora (Дв.-Печ.; Dvinsko-Pechersky)
8. Ladoga-Ilmen (Лад.-Ильм.; Ladoga-Il'mensky)
9. Upper Volga (Верх.-Волж.; Verkhne-Volzhsky)
10. Volga-Kama (Волж.-Кам.; Volzhsky-Kamsky)
11. Upper Dnieper (Верх.-Днепр.; Verkhne-Dneprovsky)
12. Middle Dnieper (Сред.-Днепр.; Sredne-Dneprovsky)
13. Volga-Don (Волж.-Дон.; Volzhske-Donskoy)
14. Transvolga (Заволж.; Zavolzhsky)
15. Bessarabia (Бесс.; Bessarabsky)
16. Black Sea (Причерн.; Prichernomorsky)
17. Crimea (Крым; Krym)
18. Lower Don (Ниж.-Дон.; Nizhne-Donskoy)
19. Lower Volga (Ниж.-Волж.; Nizhne-Volzhsky)

19a. Ural [Урал; Ural (khrebet)]

III. CAUCASUS (КАВКАЗ; Kavkaz)

20. Ciscaucasia (Предкавк.; Predkavkazsky rayon)
21. Dagestan (Даг.; Dagestansky)
22. West Transcaucasia (Зап.-Закавк.; Zapadno-Zakavazsky)
23. East Transcaucasia (Вост. Закавк.; Vostochno-Zakavkazsky)
24. South Transcaucasia (Юж.-Закавк,; Yuzhno-Zakavkazsky)
25. Talysh (Тал; Talyshsky)

IV. WESTERN SIBERIA (ЗАП. СИБИРЬ; Zapadnaya Sibir')

26. Ob[1] (Обск.; Obsky rayon)
27. Upper Tobol (Верх.-Тоб.; Verkhne-Tobol'sky)

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[1]The Ob region extends from the eastern slope of the Urals to the Yenisei river but does not include the eastern tributaries of the Yenisei, i.e., the lower Tunguska and the Middle Tunguska, which are in the Yenisei region.

28. Irtysh (Ирт.; Irtyshsky)
29. Altai[2] (Алт.; Altaysky)

V. EASTERN SIBERIA (ВОСТ. СИБИРЬ; Vostochnaya Sibir')

30. Yenisei (Енис.; Yeniseysky rayon)
31. Lena-Kolyma (Лен.-Кол.; Leno-Kolymsky)
32. Angara-Sayan (Анг.-Саян.; Angaro-Sayansky)
33. Dauria (Даур.; Daursky)

VI. FAR EAST (ДАЛЬН. ВОСТОК; Dal'ny Vostok)

34. Kamchatka (Камч.; Kamchatka)
35. Okhotsk (Охот.; Okhotsky rayon)
36. Zeya-Bureya (Зее-Бур.; Zee-Bureinsky)
37. Udsk (Удск.; Udskoy)
38. Ussuri (Уссур.; Ussuriysky)
39. Sakhalin (Сах.; Sakhalin)

VII. CENTRAL ASIA (СР. АЗИЯ; Srednyaya Aziya)

40. Aral-Caspia (Арало-Касп.; Aralo-Kaspiysky rayon)
41. Balkhash (Прибалх.; Pribalkhashsky)
42. Dzungaro-Tarbagatai (Дж.-Тар.; Jungaro-Tarbagataysky)
43. Kyzyl Kum[3] (Кыз.-Кум.; Kyzyl-Kumsky)
44. Kara Kum (Кара-Кум.; Kara-Kumsky)
45. Mountain Turkmenia (Горн. Туркм.; Gorno-Turkmensky)
46. Amu Darya Foothills[4] (Аму-Дар.; Amu-Dar'insky podgorny)
47. Syr Darya Foothills (Сыр-Дар.; Syr-Dar'insky podgorny)
48. Pamir-Altai (Пам.-Ал.; Pamiro-Alaysky)
49. Tien Shan (Тянь-Шан.; Tyan'-Shansky)

B. For indicating the general distribution of species which range beyond the Soviet Union, the following areas are employed:—

I. Arctic (Аркт.), i. e. Spitzbergen, Greenland.
II. Scandinavia (Сканд.), i. e. Norway, Denmark, Sweden, Finland,

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[2]TheAltai region is listed under Western Siberia in the text of the *Flora URSS* but is shown as part of Eastern Siberia on the map in the *Flora URSS*.

[3]Alternately Kizil Kum (Kizil, red).

[4]"Piedmont, the beginning of the mountain slope' is possibly a better rendering for подгорье (podgor'ye) than 'foothills', though less convenient; the region lies mostly between 200 and 500 meters.

Estonia and Latvia.

III. Central Europe (Ср. Евр.), i. e. Germany, Lithuania, Poland, Czechoslovakia, Hungary, Austria, Switzerland.

IV. Atlantic Europe (Атл. Евр.), i. e. Holland, Belgium, the British Isles, France, Portugal.

V. Mediterranean (Средиз.), i. e. (1) Spain, Italy, Algeria, Tunisia, Tripolitania; (2) Cyrenaica, Egypt, Palestine, Syria.

VI. Balkan Peninsula and Asia Minor (Балк.-Малоаз.)

VII. Turkish Armenia and Kurdistan (Арм.-Курд.)

VIII. Iran (Иран), i. e. (Persia and Afghanistan)

IX. India and the Himalaya (Инд.-Гим.)

X. Eastern or Chinese Turkistan (Дж.-Кашг.), i. e. Kuldja district, Dzungaria and Kashgaria.

XI. Mongolia (Монг.)

XII. Japan and China (Японо-Кит.), i. e. northern China, Manchuria, Korea, Japan, with southern Sakhalin (Karafuto) and Kurile Islands.

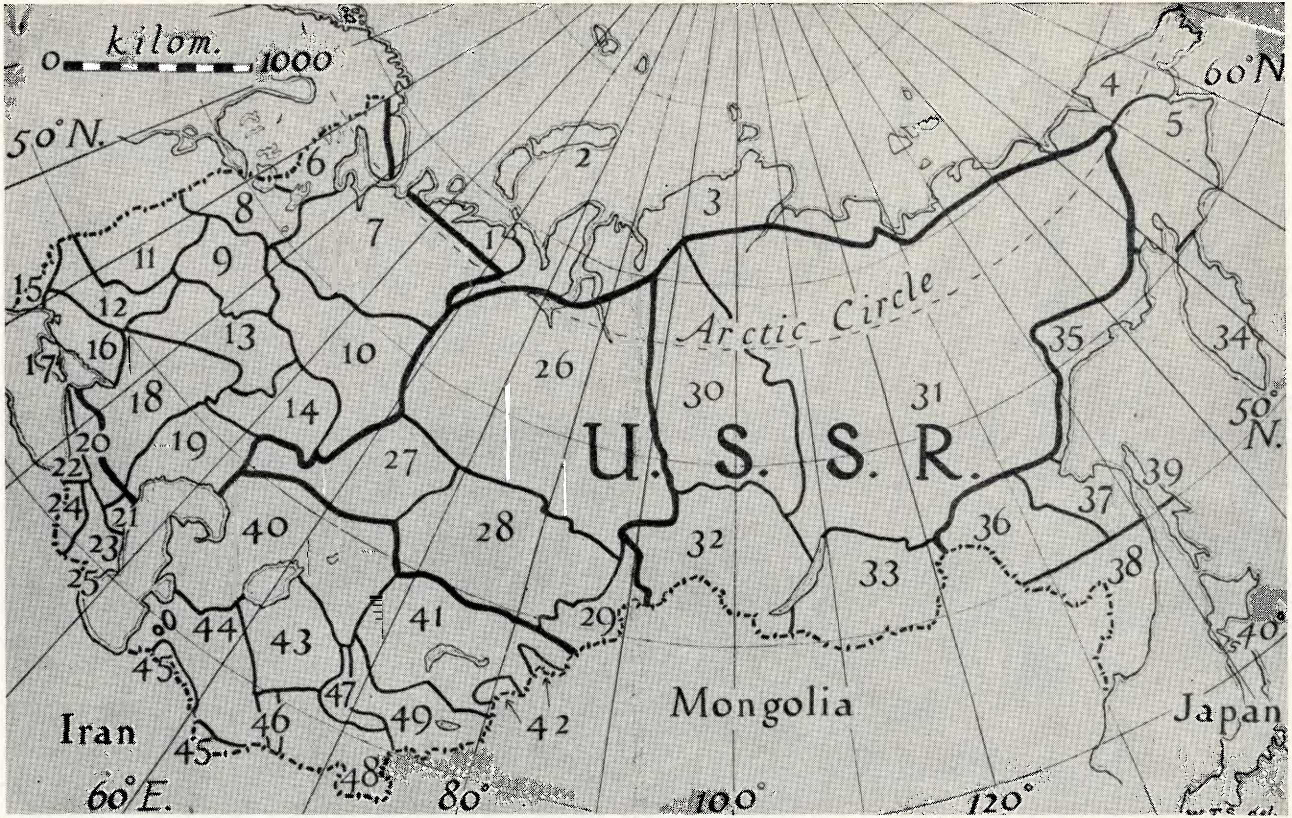
XIII. Alaskan (or Eastern) coast of Bering Sea (Беринг.)

XIV. North America (Сев. Ам.), i. e. Canada and U. S. A.

XV. Tibet (Тиб.)

2. *Distribution of Allium in U. S. S. R.*

Two hundred and twenty odd species of Allium are described by A. I. Vvedensky in the *Flora URSS 4*. 112-280 (1935) as native of the Soviet Union. The policy of the *Flora URSS* is to recognize as independent species all populations possessing constant inherent features by which they can be distinguished from other populations, no matter how closely related these populations are (Komarov, 1934). The species adopted in the *Flora URSS* thus correspond to the subspecies, varieties and geographical races of many authors. For statistical comparison of areas this policy should be kept in mind, because an area from which a large number of small units has been described appears to be floristically richer than a similar area from which a smaller number of more broadly defined units has been described, although the flora may be the same in both. When, however, areas have been studied on the same lines, comparison of the number of species in each can be made. Provided the areas are not too heterogeneous, i. e. are defined so as not to include too great a variety of geographical conditions, such comparison may throw light on past migrations and the influence of regional conditions upon species-building as well as indicate the areas most likely to yield plants worthy of cultivation. The floristic regions adopted in the *Flora URSS* are intended to enclose topographically uniform areas, lowland regions being separated from mountain areas, etc., and as Vvedensky's work covers them all by grouping his species under these regions the general distribution of *Allium* within the Soviet Union becomes clear (Plate 260).



Map 1. Floristic Regions of U. S. S. R. adopted in Flora URSS; for names see corresponding numbers in List No. 1 in the text.

Plate 259

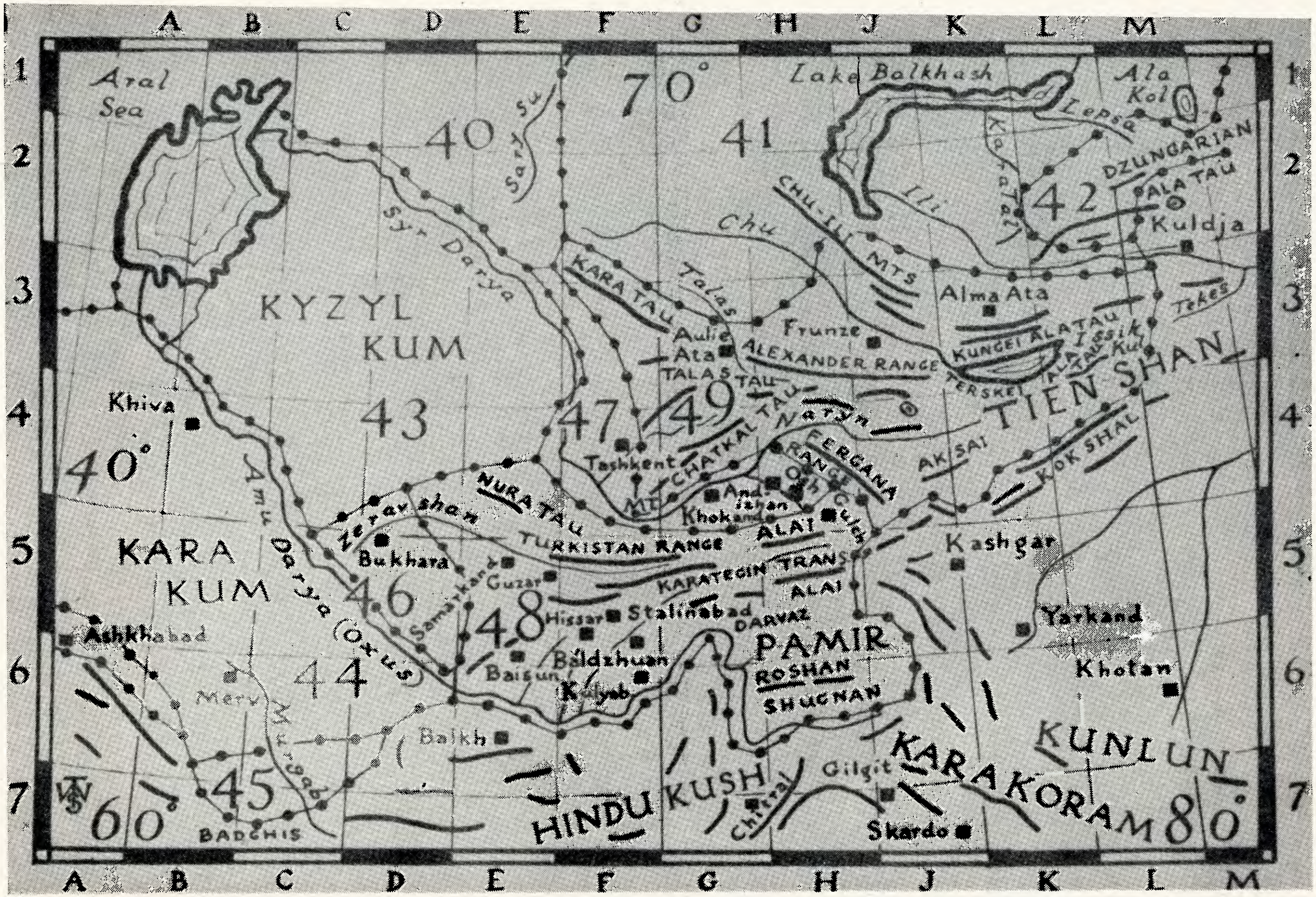
Map. 2. Distribution of Allium in U. S. S. R; the figures state the number of species recorded from each region up to 1935.

Plate 260

Of the major parts of the Soviet Union, the most interesting to the student of *Allium* and the most promising to the gardener seeking new bulbous plants is undoubtedly CENTRAL ASIA (Plate 261). This stretches from the Kirgiz Steppe (north of the Aral Sea and Lake Balkhash) to the Soviet frontier with Persia and Afghanistan; the Caspian Sea and the Ural River bound it in the west and the Soviet frontier with Chinese Turkistan bounds it in the east. The whole area occupies about 1,417,000 square miles. For the most part it is a land of harsh climate, suffering great variation in temperature, daily as well as seasonally, and becoming very cold during the winter; the air of the lowlands is dry and precipitation slight, while violent parching winds often sweep over the deserts and steppes. Snow lies on the high mountains and their glaciers are among the world's longest. Here, in the mountainous Tien Shan and Pamir-Alai regions, the genus *Allium,* like the genus *Tulipa,* attains its greatest number and diversity of species. It is represented by about 145 species of which 81 are endemic, but there is a great contrast between the poverty of the lowland regions and the wealth of the mountains. The low-lying Amu Darya, Syr Darya, Kyzyl Kum and Kara Kum regions (Plate 261, nos. 43, 44, 46, 47) contain only 4 to 9 species each, the most widespread being *A. Borszczowii, A. filidens* and *A. caspium.* The Aral-Caspian and Balkhash steppe-regions (nos. 40, 41) have 17 or 18 species. The whole lowland area, despite its wide expanse, musters only 30 or so species. Mountain Turkmenia (no. 45) on the other hand has 33 species, while the Tien Shan and Pamir-Alai regions (nos. 48, 49) have 105 species between them, of which 61 are endemic; 26 are confined to the Pamir-Alai, 22 to the Tien Shan; 32 species are common to the two regions and of these 13 are not found elsewhere. The number of endemic species is thus remarkably high. There are 19 non-endemic species occurring in both Pamir-Alai and Tien Shan, 11 non-endemics occurring in Pamir-Alai (but not in Tien Shan) and 14 non-endemics occurring in Tien Shan (but not in Pamir-Alai). The ranges of these non-endemic species vary greatly; many are confined to Central Asia, but some occur also in Persia and others in Chinese Turkistan, from which areas the mountains of Central Asia must have been recolonized on the retreat of the ice. The differences between the Alliums of the Pamir-Alai and the Tien Shan are probably due in part to the one region receiving most of its original species from the west, the other receiving most from the east.

The *Aral-Caspian* region (no. 40) consists of the western part of the Kazakh Republic. It is a steppe region, not rising much above 500 meters. Seventeen species are recorded, none endemic. The adjacent *Balkhash* region (no. 41) comprises the steppes around Lake Balkhash and corresponds roughly to the eastern lowland part of the Kazakh Republic. Eighteen species of *Allium* are recorded, none endemic; 8 of these grow also in the Aral-Caspian region.

The *Dzungaro-Tarbagatai* region (no. 42) consists of the mountains of the Dzungarian Ala Tau and the Tarbagatai which stand between the



Map 3. Floristic Regions of Central Asia; 40, Aral-Caspia; 41, Balkhash; 42, Dzungara-Tarbagatai; 43, Kyzyl Kum; 44, Kara Kum; 45, Mountain Turkmenia; 46, Amu Darya Foothills; 47, Syr Darya Foothills; 48, Pamir-Alai; 49, Tien Shan. (—.—.—.—. approximate boundary of regions; M. T., Mogol Tau).

Plate 261.

lowlands of the Balkhash region and Dzungaria. These mountains connect the Altai region with the Tien Shan. Thirty species of *Allium* are recorded from Dzungaro-Tarbagatai, one, *A. robustum,* being apparently endemic; 18 of these occur also in the Tien Shan, of which it is floristically a northern extension and from which it is separated by the valley of the river Ili.

The *Kyzyl* or *Kizil Kum* (no. 43) is a lowland desert region lying between the Syr Darya and Amu Darya rivers. Six species of *Allium* are recorded, none endemic.

The *Kara Kum* (no. 44) is a similar lowland region lying south of the Amu Darya and corresponding to the lowland part of the Turkmen Republic. To the south, where the waters of the Murgab river lose themselves in the sand, is the fertile oasis of Merv, traditional site of the Garden of Eden. None of the 5 species of *Allium* recorded are endemic; *A. giganteum,* said to have been introduced by E. O'Donovan from Merv but more probably coming from the mountains between Merv and Meshed in Persia, occurs also in the Pamir-Alai region and in Afghanistan.

Mountain Turkmenia (no. 45) forms the Soviet frontier region with Persia and northwest Afghanistan and is floristically a northern extension of Khurasan. Thirty-four species of *Allium* are recorded from this mountain region, among them *A. Christophi (A. albopilosum),* 5 being probably endemic.

The *Amu Darya* foothill region (no. 46) comprises the lowlands north of the middle course of Amu Darya; it includes the city of Bukhara but not the western mountains of the Pamir-Alai region which formed part of the old Moslem Khanate of Khiva and which are often referred to as "Buchara" or "Bokhara" in botanical literature. It is part of the Uzbek Republic. Four species of *Allium* are recorded, none endemic.

The *Syr Darya* foothills region (no. 47) consists of the lowlands between the Kara Tau and the Syr Darya and also those on either side of the river up into the Fergana basin. Only 9 species of *Allium,* none endemic, are recorded from this sheltered and fertile region, which in Tsarist times formed part of the Khanate of Khokand.

To describe in a few words the intricate mountain systems which make up the *Tien Shan* and Pamir-Alai regions (nos. 48, 49) is impossible. Access to these mountains is provided by eight main rivers and their tributaries. As one ascends their valleys, the fertile irrigated lowlands give place to forests and these to treeless meadows and regions of perpetual ice and snow. The Tien Shan may be visualized as extending westward from its highest point, Khan Tengri (7200 meters) in three long irregular ridges, with lesser mountains north and south of them. Its principal river, the Naryn, flows westward into the Fergana basin, which separates the Tien Shan from the Pamir-Alai region. Most of the rivers of the Pamir-Alai flow southward into the Amu-Darya river, which constitutes its southern boundary.

The *Pamir-Alai* region (no. 48) is for the most part a bleak treeless land of very high mountains, with inhospitable plateaus, vast glaciers and innumerable wide high-level valleys scantily clad with grassy vegetation and scrub. The soils are poor, rocky and well-drained; the winter season is long and severe. Most of the area lies well above 1000 meters and its highest peaks reach 7127 and 7495 meters. It belongs mostly to the Tajik Republic. From this wild region, scenically one of the grandest in the world, 69 species of *Allium* are recorded, 26 of them endemic; the future will see these figures increased, for many species are limited in range and many valleys difficult of access remain to be intensively explored.

The *Tien Shan* region (no. 49) is of similar character and comprises the mountains north and east of the Fergana basin. The Kara Tau is in the Kazakh Republic, but most of the region belongs to the Kirgiz Republic. The Tien Shan proper (Chinese *t'ien,* heavenly *shan* mountain) is in Chinese Turkistan. Sixty-eight species of *Allium* are recorded from the Tien Shan region of the Soviet Union, 22 being endemic.

When in the 4th century B. C. the Greeks under Alexander penetrated into the western deserts and fertile foothill regions of Central Asia, into Margiana, Sogdiana and Bactria, the country was then inhabited by Iranian-speaking people and so continued for the next five centuries. Later Arabs from the southwest, Turks and Mongols from the northeast and Russians from the northwest swept over it, conquering and destroying, then settling and colonizing. These movements of peoples have left their mark upon its geographical names. Iranian, Arabic, Russian, Chinese and Mongolian names have to be faced by the botanist tracing the distribution of *Allium* in Central Asia, but the predominant names are of Turki origin. All over the map occur such Turki words as *ak* (white), *kara* (black), *kul* (lake), *kum* (sand), *sary* (yellow), *su* (water) and *tau* (mountain). In mountainous country, plants, animals and men tend to colonize in the same manner by penetrating up the valleys. Into the Pamir-Alai region the tributaries of the Amu Darya provide the easiest and often the only means of access, and this river emerges into the lowlands nearest to Persia. Thus it is not surprising that Iranian speech persists most in this region of Central Asia, in Tajikstan and Afghanistan, and that its *Allium* flora reveals traces of emigration from Persian areas of refuge. The Tien Shan region shows in its flora as in its place-names a greater affinity with Eastern (or Chinese) Turkistan. Thus the parallel migrations of plants and men in this difficult country might possibly be revealed by mapping in detail the distribution of species in genera like *Allium* and comparing this with the distribution of languages and dialects in the same regions.

In striking contrast to Central Asia, the *Arctic* possesses only one species, *A. Schoenoprasum,* and this occurs even on Novaya Zemlya (no. 2), although it does not reach Spitsbergen. It has, however, the widest range of all Alliums and its Arctic stations form only the fringe of a much greater area outside the Arctic.

No high mountains diversify the *European* part of the U. S. S. R. Within this land of plains and not very high plateaus, 36 species are native, but only one, *A. Marschallianum,* is endemic; this Crimean plant is not well distinguished from the widespread *A. saxatile* and may possibly occur in the Caucasus. Almost all the others are species of wide range. Their numbers decrease from south to north, the *Crimea* (no. 17) possessing 18 species, the southern and middle regions (nos. 10-16, 18-19) 15 to 10 species, the northern regions (nos. 6-9) only 4 to 2 species, namely *A. Schoenoprasum, A. angulosum, A. oleraceum* and *A. Waldsteini* (cf. Plates 259 and 260). Although the Crimea is small in area, a range of mountains lies along its southern coast and its Allium-flora is almost identical with that of Ciscaucasia.

Western Siberia (excluding the mountainous Altai region, no. 29), *Eastern Siberia* (excluding the mountainous Angara-Sayan region, no. 32) and the *Far East* are even poorer in species of *Allium* than European Russia, since they are largely areas of frozen or partly frozen soil covered with tundra and forest. Western Siberia without the Altai possesses 21 species; with the Altai it has 36 species. Eastern Siberia without Angara-Sayan possesses 17 species, with Angara-Sayan 25 species. The Altai, with 27 species, and Angara-Sayan, with 21 species, adjoin one another; both lie on the southern border of the Soviet Union and are regions of mountainous character, offering a greater variety of habitats than the forested northern lowlands, they possess 18 species in common. The most widespread of the Siberian and Far Eastern species are *A. Victorialis,* a broad-leaved forest garlic, *A. strictum* and *A Schoenoprasum,* all of which occur also in Central Europe. The only endemic species are *A. Maacki* of the Ussuri region (no. 38) and *A. pumilum* of the Altai (no. 29).

The *Caucasus,* a very mountainous area, has 48 species of *Allium,* 21 being endemic. On account of its general topographic character, southern position (roughly 38 degrees to 45 degrees N.) and area, the Caucasus resembles the Pamir-Altai and Tien Shan regions more than other parts of the Soviet Union and approaches them in its number of *Allium* species. The plants themselves are mostly different; indeed *A. Schoenoprasum, A. oreophilum, A. scabriscapum* and *A. caspium* seem to be the only species they have in common. Eight species are recorded for *Talysh* (no. 25), 14 for *West Transcaucasia* (no. 22), 20 for *Dagestan* (no. 21), 21 for *Ciscaucasia* (no. 20), 28 for *South Transcaucasia* (no. 24) and 31 for *East Transcaucasia* (no. 23).

There is thus a marked increase in the number of species from the north to the south of the Soviet Union and from the lowlands to the high mountains.

The lowland species of *Allium* are mostly well-defined and widely distributed; the areas they inhabit tend to be of uniform character over wide expanses and to offer few barriers to the spread of plants. *Allium Victorialis* and *A. ursinum* are broad-leaved species adapted for growth in forests. *A. paradoxum* and *A. (Nectaroscordum) Dioscoridis* are also woodland plants. The others prefer open country with scanty vegetation, for they cannot compete with lush vigorous herbage; their bulbs enable them to rest during a long cold dry season and to start quickly into growth when the warm wet season comes again. It is probable that, as in *A. vineale,* the bulbils of some species can remain dormant in the soil for several years and escape uncongenial seasons. Hence, in such regions as the mountains of Persia and Central Asia, they find conditions particularly favourable for their survival and growth, although not so favourable for wide colonization. These mountain regions possess a greater variety of species than the lowlands, but the species themselves, unlike the lowland species, are often of very limited range and are closely related to one another. This is well illustrated by the *A. inderiense* group. In Regel's monograph of 1875, this group, under the misapplied name "*A. tataricum*", is regarded as being all one species, widespread in the deserts and steppes of southern Russia and southwest Siberia, the valleys of Turkistan and north Persia, and possessed of great variability. Vvedensky (1935) has analyzed this into eleven species. The best known, *A. inderiense* (named from the Inder Lake near the Ural River) is a lowland plant with a wide range from the Lower Volga region (no. 19), north of the Caspian Sea, to the Balkhash region (no. 41). The others are mountain plants with more restricted ranges which tend to overlap but are not identical and thus appear to extend from different centers. Their collective range is from north Persia and north Afghanistan over the Pamir-Alai region (no. 48) to the Tien Shan region (no. 49). They differ among themselves principally in the width of the leaves, the density of the umbel, the relative length of the pedicels to the flowers, and the depth of the flower-colour. Much of the territory occupied by these not very well differentiated species was probably heavily glaciated during the Ice Ages. They thus appear to be young species derived from lowland populations which colonized the valleys running into the mountains from the west on the retreat of the ice and the ensuing change in the lowland climate. Isolated among the mountains such populations acquired features differentiating them from other populations, chiefly of a quantitative nature with a different mean to their range of variation; later spreading brought about the present occasional overlapping of ranges and may also in some districts have led to a mingling of characters. As the genus *Allium* has today its greatest concentrations of species in mountain areas productive of differentiation in this way, it would appear to be a genus in which species-building has proceeded fairly rapidly since the Ice Ages, but the wide range of the genus as a whole and its great morphological diversity indicate clearly that major well-differentiated types arose long before then.

To such pre-glacial types a revised grouping of the species into sections and subsections (cf. Hermann, 1939) may provide a guide. Regel admitted only six sections (*Porrum, Schoenoprasum, Rhizirideum, Macrospatha, Molium;* and *Nectaroscordum,* which can well be considered a distinct genus). Vvedensky adopts nine (*Anguinum, Ophioscorodon, Rhizirideum, Phyllodolon, Cepa, Haplostemon, Porrum, Molium; Coloscordum,* and *Nectaroscordum).* His classification is admittedly provisional and the sections *Rhizirideum, Haplostemon* and *Molium* might usefully be further divided; the others seem natural groups. Section *Anguinum* (syn. *Nikeprason*) is represented in U. S. S. R. by only one species, *A. Victorialis* (Plate 262), of wide range (from Portugal to Kamchatka) but displaying within that range such regional variation as to lead to its division by Prokhanov (1931) into four minor species; *A. Victorialis* proper of Europe (and the Caucasus?), *A. microdictyon* of the Ural mountains, central Siberia and Mongolia, *A. ochotense* of Kamchatka and Sakhalin, and *A. latissimum* (*A. Victorialis* subsp. *platyphyllum* Hultén) of Kamchatka, the Ussuri region, Japan, Korea and northeast China, this last being probably tetraploid. In Europe *A. Victorialis* is a fairly uniform species, the only representative of its section. In China—not only does *A. Victorialis* show an almost protean variation; it possesses allies in *A. Listera* (Chihli), *A. funchiaefolium* (Hupeh) and *A. ovalifolium* (Yünnan) as well as in *A. caput-medusae* of upper Burma (Plate 262). Section *Anguinum* is thus essentially an East Asiatic group; it extends along the Himalaya and into Siberia but avoids Central Asia*.

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* The following is a provisional synopsis of the *Anguinum* Alliums; it does not include the imperfectly characterized *A. ochotense* Prokh. (1931) and *A. cannaefolium* H. Lév. (1914), both of which come under *A. Victorialis* sensu lato, and like *A. latissimum* and *A. microdictyon* are apparently worthy of no more than sub-specific rank.

A. Leaf-blade narrowly to broadly elliptic (i. e. broadest about the middle and narrowing to both ends), the base wedge-shaped or rounded, not cordate, the tip acute, rarely acuminate.

- B. Blade tapering into petiole, narrowly elliptic to elliptic (2-6 times as long as broad) . . . . *A. Victorialis* L. (1753) sensu lato
  - C. Bulb-envelopes well-developed, to about 8 cm. high; leaf-blades 3-4, about 2-4 times as long as broad, up to 7 cm. broad.
    - D. Sheaths purple. Europe. . . . . . . *A. Victorialis* L. sensu stricto
    - DD. Sheaths green. Far East . . . . . . *A. latissimum* Prokh. (1931)
  - CC. Bulb-envelopes reduced, to about 3 cm. high. Leaf-blades usu. 2, about 4-6 times as long as broad, narrower (up to about 3 cm. broad). Sheaths purple. Siberia, Mongolia. . . . *A. Microdictyon* Prokh. (1931)
- BB. Blade rounded at base, broadly elliptic (about 1½ times as long as broad), up to 9.5 cm. broad. N. E. China. . . . . *A. Listera* Stearn (1934)

AA. Leaf-blade lanceolate to broadly ovate (i. e. broadest below the middle), the base cordate or subcordate, the tip acuminate.

- E. Pedicels ascending. Perianth-segments white or yellowish, 3-4 mm. long. Stamens about 6-7 mm. long.
  - F. Blade ovate to broadly ovate, large (13-18 mm. long, 7.5-11.5 cm. broad), one to a stem, the base deeply cordate, the basal sinus about 1.3 cm. or less deep, the margin smooth; petiole 7.5-15 cm. long. Pedicels 10-25 mm. long. Central China . . . . . . *A. funchiaefolium* Hand.—Mazz. (1920)
  - FF. Blade lanceolate to narrowly ovate, smaller (7.5-13 cm. long, 3-5.5 cm. broad), two to a stem, the base shallowly cordate, the basal sinus 7 mm. or less deep, the margins ciliated with minute papillae (visible under lens); petiole 4-5.5 cm. long. Pedicels 4-13 mm. long.
    W. China. . . . . . *A. ovalifolium* Hand.—Mazz. (1920)
- EE. Pedicels drooping. Perianth-segments purplish red, about 1.2 cm. long. Stamens about 1.8 cm. long. Blade narrowly ovate to ovate (11-12 cm. long, 5-8.5 cm. broad), two to a stem, the base shallowly cordate, the margin smooth; petiole 6-10 cm. long. Pedicels 1-2 cm. long. Upper Burma. . . . *A. Caput-Medusae* Airy-Shaw (1931)

Section *Ophioscorodon* (Syn. *Arktoprason)* is another broad-leaved section of woodland habitat, but the range of its one species, *A. ursinum,* bears no resemblance to that of *A. Victorialis;* it is widespread and abundant in northern Europe, avoids the Mediterranean lands and reaches its eastern limit in the Volga-Don region (n. 13).

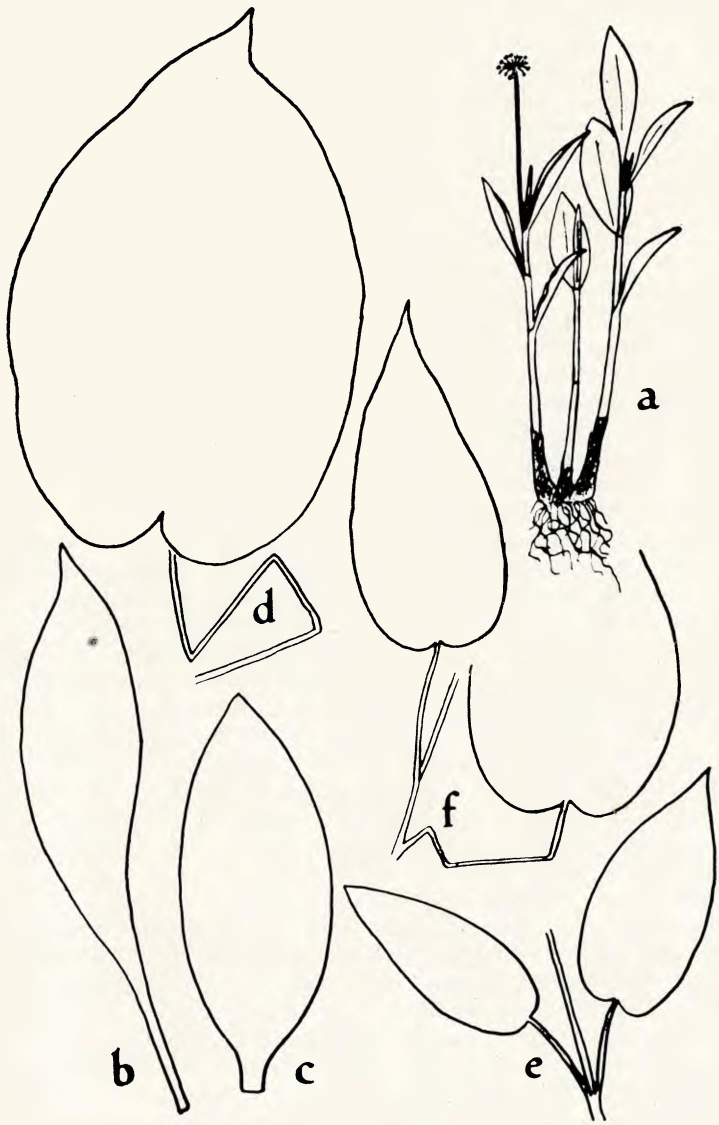
Vvedensky fuses sect. *Molium* (syn. *Rhodoprason*), with two ovules in each chamber of the ovary, and sect. *Melanocrommyum* (syn. *Melamprason),* with numerous ovules, presumably on account of several species in Central Asia possessing up to 7 or 8 ovules in the whole ovary. Sect. *Melanocrommyum* probably represents a primitive state of the genus. Many of its species are robust large-flowered herbs with fairly broad, strap-shaped, basal leaves and simple stamens. Its general range covers the Mediterranean region and extends into Western Siberia, but the greatest concentrations of species are in Western Asia and Central Asia. Section *Molium* is essentially a Mediterranean group and has by no means so great a range in Asia; it is represented by only a few species in the U. S. S. R. *A. monanthum* of the Ussuri region, placed by Vvedensky in *Molium,* is probably best regarded as constituting a distinct section *Microscordum.*

Sections *Phyllodolon* and *Cepa* are quite distinct from one another in distribution as in morphology. *Phyllodolon* is a group of south-east Siberia and Mongolia and has contributed *A. fistulosum* to Far Eastern kitchen gardens. *Cepa* is a group of Central Asia, with Afghanistan and Persia, and gave the world the common onion, *A. Cepa.* Sect. *Porrum*, taking its name from the Leek, *A. Porrum,* is likewise a natural group; it represents the extreme development of the tendency in the genus for the inner three stamens to be broader than the outer three and of different form. The plants are mostly small-flowered and many are of small growth with narrow leaves sheathing the stem for much of its height. They represent an advanced state of development. This section is widespread in Europe, North Africa and Western Asia, but does not reach Siberia; it has seven species in the Pamir-Alai region but only two in the Tien-Shan.

The section *Haplostemon*, as accepted by Vvedensky, is a very heterogeneous group, part of which, namely *Macrosphatha* (syn. *Codonoprasum, Rhynchoprason),* seems to deserve separation. This is a European and west Asiatic group, not extending east of Mountain Turkmenia, whereas the most of other species are confined to Central Asia.

The section *Rhizirideum* has the widest distribution of any group, even if the well nigh ubiquitous *A. Schoenoprasum* be left out of consideration. Its greatest concentrations of species are in Eastern and Central Asia. It is a very heterogeneous group.

Although large numbers of species are confined to Central Asia, no section of the genus is endemic here. Central Asia tends to be the boundary of the ranges of sections having their centers elsewhere. Thus its importance as the region wherein *Allium* is now most richly represented is evidently the result of species-formation since the retreat of the ice; it is a meeting place for plants, as for men, of populations from the east and the west, and to this and to the favourable con-



Leaf-form in Allium sect. Anguinum. ..A. victorialis, European form, cult., (a) habit, (b) upper leaf, (c) lower leaf; A. funckiaefolium (Henry 5590 F), (d); A. ovalifolium (Hand.—Mozz. 7045) (e); A. Caput-Medusae (Ward 3416) (f).

Plate 262

ditions it has offered for their further evolution is to be attributed the remarkable diversity of its species.

3. Index of the Places in Central Asia

It is often difficult to find on maps the places named in Eduard von Regel's *Allii Species Asiae Centralis* (Acta Horti Petrop. 10: 281-366. 1887) and other literature on the Alliums of the Pamir-Alai and Tien Shan regions, or even to ascertain the approximate positions of such places. Plate 261 shows at a glance the floristic importance of Central Asia; many beautiful and interesting plants have been introduced from there in the past and many await introduction or reintroduction into American and British gardens. Difficulties arise from the lack of adequate readily accessible maps, the diversity of forms which Turki, Iranian, Arabic and Russian names assume when romanized according to different systems, the use of the same name for different places and of different names for the same place. The Russian names Wernoje and Verni and the Tartar name Alma Ata, for example, refer to the same place; Aksu *(ak* white, *su* river) is the name of several rivers, and so on. Regel's German origin naturally led him to write these place-names in a German manner, using letters with German phonetic values. Hence in attempting to find the places he lists it is well to remember this fact. For the convenience of the reader, phonetic equivalents in the German, Polish, Russian and English languages are given in Table I.

(German *Tschu*, for example, corresponds to English *Chu;* German *Serawschan* to English *Zeravshan,* and so on. The type-locality of *Allium gulczense* (Russian Гульча) may be rendered *Gulcha, Gultscha* or *Gulcza;* the last is in Polish transliteration, which has often been adopted by Russian authors for the romanization of Russian and Central Asian personal and geographical names.)

Fortunately for the enquiring botanist, in 1881 Regel's explorer son Albert, whose collections enriched European gardens and herbaria

TABLE I

Phonetic equivalents in the German, Polish, Russian and English languages.

German	Polish	Russian	English
ch		х	kh
d			t
dsch		дж	dz, dzh or j
j			y
k			c, k or q
	rz	ж	zh
s		з	z
sch	sz	ш	sh, zh
schtsch	szcz	щ	shch
tsch	cz	ч	ch
v		ф	f
w		в	v
z		ч	ts

with so many new plants from Central Asia, published an *Index Locorum Natalium* (Acta Horti. Petrop. 7:ii. 667-677) together with a detailed map of the Tien Shan region on which his routes and those of Fedtschenko, Kaulbart, Kuropatkin, Oster-Sacken, Przewalski and Sewerzow are marked. From this list the following list is mainly derived. It gives the appropriate position of almost all the Central Asiatic places mentioned in the first seven volumes of the Acta Horti Petrop. and also of many places mentioned in later literature, but it is not complete. War conditions have made it impossible to trace all the places named as habitats of *Allium.* Many names have been left in the German orthography adopted by Regel, since some of them are undoubtedly corrupt and to supply correct English equivalents demands access to good modern official maps and a knowledge of Turki, Arabic, Persian, Mongolian and Chinese which the present compiler does not possess. The list is a guide to the localities where Alliums and other plants have been collected in the past and whence, it is hoped, they will be collected again in the future; it is not an attempt to standardize the spelling of place-names.

Plate 261 shows the approximate boundaries (marked -.-.-.-.-) of the floristic regions of Central Asia as indicated by statements in the text of the *Flora URSS.* It is to be hoped a more accurate and detailed official map will later supersede this sketch-map. The positions of places named below may be found by means of the grid. For further precision, imagine each quadrangle divided into four smaller quadrangles, each representing one degree of latitude by one of longitude; the top left is represented in the grid-references below by the letter *a,* the top right by *b*, the bottom left by *c,* the bottom right by *d,* Hence Tashkent, having grid-reference 4Fb, is located in the top right division of quadrangle 4F.

The following abbreviations are employed: (E) = English rendering; E. = East; (G) = German rendering; Mt(s) = mountain(s); N. = North; R. = river; S. = South; W. = West.

4. Select Bibliography

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THE GENUS ALLIUM IN THE USSR

A. I. Vvedensky

(Translated from V. L. Komarov, *Flora URSS* IV (1935) 112-280, by H. K. Airy Shaw, B. A., F. L. S., Royal Botanic Gardens, Kew, England.)

[The scope, format and policy of the *Flora URSS* was decided at a conference of Soviet plant-geographers and taxonomists in 1931 and Professor V. L. Komarov was made general editor. It is only by team-work that the flora of so great an area as the Soviet Union can be written within a reasonable time and the writing up of different groups was accordingly enthrusted to botanists who seemed best qualified to deal with them. Volume IV (1935) is the work of no less than fourteen botanists. The account of *Allium* by A. I. Vvedensky in this volume (pp. 112-280) is the most important contribution to our understanding of the genus which has been published in the present Century. Vvedensky's interest in *Allium* goes back many years. He has published more than forty new species, and, as botanist at the University of Central Asia in Tashkent, which stands on the fringe of the mountains wherein the genus attains its greatest diversity and number of species, he has had opportunities of observing many of them in the living state, while his studies of specimens in the rich Leningrad Herbarium, containing all Regel's type-material as well as authentic specimens of many species described by other botanists, have given opportunities for that critical interpretation of the older literature which is so necessary in a flora employing such narrowly defined units as the *Flora URSS* does. This account of *Allium* provides detailed descriptions of more species than any work since Regel's *Alliorum adhuc cognitorum Monographia* of 1875. It fits into a systematic framework a large number of little-known species discovered since then, indicates their distinguishing features and distribution and makes readily accessible much hitherto scattered information about them, at the same time improving the commonly accepted classification of the genus. It is thus of high value to students of *Allium* outside as well as inside the Soviet Union. The original work is in Russian.

Certain differences which will be noted between this translation and the original require explanation.

1. *Bibliography.* All errors, inaccuracies or omissions in citations, whether of author, title, volume, date or page, which it has been possible to detect, have been corrected. The majority are due to Mr. W. T. Stearn; the more important are commented upon in footnotes, over the initials W. T. S., but minor corrections have been incorporated without comment. These footnotes, and all major additions in the text, are enclosed in square brackets [ ]. All footnotes not enclosed in square brackets form part of the original account.

2. *Geography.* With very few exceptions, the spelling of place-names has been brought into accordance with the recommendations of the Permanent Committee on Geographical Names, Royal Geographical Society. Hyphens have accordingly been omitted throughout, except in certain names of Persian origin, and in compound names derived from two distinct place-names (e. g. Pamir-Alai, Chu-Ili, etc.).

3. *Specific epithets.* In many cases of specific epithets derived from names of persons or places, Vvedensky has adopted a spelling differing —sometimes considerably—from the original. In all such cases, the original spellings (for which I am indebted to Mr. Stearn) have been restored, even when Vvedensky's spelling is easier or otherwise preferable for English-speaking people, since the International Rules of Botanical Nomenclature permit the original to be altered only in cases of "unintentional typographic or orthographic error."

In a few instances, where the original spelling of accepted specific epithets, derived wholly or partially from Latin or Greek, is faulty and may charitably be attributed to such "unintentional . . . error," minor corrections have been made (e. g. '*hymenorhizum*' to *hymenorrhizum;* '*firmotunicatum*' to *firmo-tunicatum;* '*pseudoseravschanicum*' to *pseudo-seravschanicum;* etc.).

4. *Russian authors' names.* A uniform system of transliteration has been adopted throughout, with the object of making such names more intelligible to English-speaking botanists. The spelling here adopted differs from that employed in the *Flora URSS* in the following cases:— Albov (present translation) = Alboff (*Fl. URSS*); Bordzilovsky = Bordzilowsky; Fedchenko = Fedtschenko; Ilyin = Iljin; Kirilov = Kirilow; Maximovich = Maximowicz; Mishchenko = Mis[z]czenko; Shishkin = Schischkin; Turchaninov = Turczaninow.

5. *Misprints, etc.* In the descriptions, attention is called to a few slips, printer's errors, obscure passages, etc., either by means of footnotes marked "Translator's note", or by the word "[sic]" in the body of the description.

6. *Miscellaneous.* Each word of the titles in the bibliographical references begins with a capital letter. Semi-colons in the Russian descriptions have been largely replaced by full-stops, with of course a capital for the word following. In the distributional paragraph under each species, a key-number has been prefixed to each phytogeographical province, referring to the corresponding number on Mr. Stearn's sketch-map.

Other minor discrepancies do not call for special comment.

—*H. K. A. S.*]

[This account does not include the following species described since 1935:—*A. sypsodictyum* Vvedensky in Schreder, Fl. Uzbekist. I (1941) 453,543, t. 66; *A. kasteki* Popov in Bull. Soc. Nat. Mosc., Bio. n. s. XLVII (1938) 85; *A. Kurssanovii* Popov, l. c. (1938) 85; *A. Leonidis* Grossheim in Trud. Bot. Inst. Akad. Nauk S.S.S.R., Azerb. Fil., Baku II (1936) 246; *A. majus* Vvedensky, l. c. (1941) 462, 543; *A. rhodanthum* Vvedensky, l. c. (1941) 463, 543. —*W. T. S.*]

Genus ALLIUM L.

Linné, Gen. Pl. ed. 5 (1754) 143; Ledeb. Fl. Ross. IV (1852[1]) 161; Boiss. Fl. Or. V (1882[2]) 229.

Perianth of free or ± united segments, with 1 — 7 nerves, usually persistent and changed or unchanged after flowering. Stamens 6, ± connate and adnate to the perianth. Anthers dorsifixed. Ovary trilocular or unilocular, with 6 or many ovules. Style attached to the base of the ovary, persistent. Seeds angular or rounded.

Perennial (under cultivation sometimes biennial) bulbous herbs, or with almost undeveloped bulbs, with a pungent smell and taste of onion (or garlic); inflorescence umbellate, enclosed when young in a spathe.

On account of their gustatory and aromatic qualities certain species of *Allium* were long ago introduced into cultivation, but in many localities the population also use wild species for food. There are records of the employment of *A. paradoxum, A. sabulosum, A. monadelphum, A. Schoenoprasum, A. saxatile,* etc., but particularly extensive use is made of *A. Victorialis* and *A. ursinum,* which the population do not distinguish, uniting them under the general term *cheremsha,* and of the wild *A. altaicum, A. Oschanini, A. pskemense* and *A. longicuspis,* which are closely related to cultivated forms. Undoubtedly these do not exhaust the list of possible edible species.

It appears, however, that the majority of species of the section *Molium* are not suitable as food, but many of them can be utilised as decorative plants, and the most effective of them (*A. giganteum, A. Christophi*) are eagerly sought after by foreign nursery firms. *A. coeruleum* is also greatly in demand.

The garlic odour and taste of *Allia* is due to the oil of garlic (0.005—0.009 per cent of the whole plant, according to Wehmer) which is found in all the tissues and of which the principal part, the disulphide $C_6 H_{12} S_2$, contains much sulphur.

In pastures *Allia* are not always desirable, even if they form a normal admixture in the usual grass fodder, since many of them communicate an unpleasant flavour to the milk of animals eating them.

The genus *Allium* as hitherto accepted, including also the account for the Flora U S S R, forms a very unnatural collective group, with extremely artificial division into sections. The great number of species (upwards of 400 in the whole world) and the lack of very many of them

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[1] [Vvedensky cites Ledebour, Fl. Ross. IV. 161-190 as published in 1853. The first part of Fl. Ross. IV, i. e. pp. 1-240, was published in 1852, probably April (cf. Stearn in Journ. Arnold Arb. XXII (1941), 227), and this date has accordingly been adopted in the translation. —*W. T. S.*]

[2] [Vvedensky cites Boissier, Fl. Orient. V. pp. 229-285 as published in 1884. The first part of Fl. Orient. V., i. e. pp. 1-428, was published in July 1882 and this date has accordingly been adopted in the translation. —*W. T. S.*]

in the herbaria at my disposal, and also the small extent to which the *Allium* flora of China and Farther Asia—those powerful centres of *Allium*-evolution—has been studied, have compelled me to refrain from introducing any radical changes in the *Allium*-system of Don and Regel[3,4,5] as accepted at the present day. I make an exception only for a small number of extremely isolated species, the taxonomy of which has recently been elaborated in detail by Prokhanov.[6]

Not only the want of species, but also the lack of many characteristic features in the species that are represented in herbaria, form an obstacle to work on the taxonomy of the *Allia.* When *Allia* are collected, they must be carefully dug up, in order not to disturb the integrity of the tuft [mat, turf], if the species concerned forms one, and in order not to lose the outer envelopes of the bulb, and bulblets, if the latter are present. It is also extremely important, before drying the plant, to make a sketch of a transverse section of the leaf in two places—above the base and above the middle. Very important characters are yielded by the spathe in the unexpanded state: hence it is desirable to have represented in collections specimens both in the flowering state and also with the still unexpanded spathe.

With well-collected material, the determination of *Allia* usually presents no difficulty.

1. Perianth-segments with 3—7 nerves. Pedicels discoidally expanded beneath the flower. Innermost (upper) leaf vaginiform, embracing the scape[7] for some way up. (Sect. *Nectaroscordum*) ____________________________________ 2

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[3] Don, A Monograph on the Genus Allium. Mem. Werner. Nat. Hist. Soc. VI. (1827) 1-102.

Regel, Alliorum adhuc cognitorum Monographia. Acta Horti Petrop. III, 2 (1875) 1-266.

[4] [Vvedensky cites George Don's Monograph sometimes as '1832', sometimes as '1826'. It was published early in 1827 (cf. Stearn in Journ. of Bot. LXXIV (1936) 322) and this date has accordingly been adopted in the translation. —*W. T. S.*]

[5] [The reference "Regel, Fl. Turk." in the following pages is to E. Regel, Flora Turkestanskaya: Primulaceae, Liliaceae (1876), which forms the botanical part of A. P. Fedtschenko's work on his travels in Turkistan:— Puteshest. Turkest. III, Bot. 1 (Izvest. Imp. Obschest. Lyubit. Estest., Antrop. i Etnogr. XXI 2). This is the work to which Regel refers in his All. Mon. 45, footnote (1875) and may be regarded as an illustrated supplement to the monograph: it has 22 plates, not of high quality. —*W. T. S.*]

[6] Prokhanov. The cultivated Alliums of China and Japan. Bull. Appl. Bot. Leningrad (Tr. Prikl. Bot. Gen. & Selekt.) XXIV, 2 (1931) 123-188.

[7] [Lit. "stem", and so throughout. —Translator's note.]

\+ Perianth-segments with 1 nerve. All leaves with a lamina or only the outer (lower) ones vaginiform ---------------- 3

2\. Disc *c*. 5 mm. wide. Perianth-segments persistent ----------
228. *A. Dioscoridis* Sibth. et Sm.

\+ Disc *c*. 3 mm. wide. Perianth-segments caducous --------
227. *A. tripedale* Trautv.

3\. Leaves with a lanceolate, oblong or broadly elliptic lamina, gradually or ± abruptly narrowed into the petiole. Seeds spherical or almost spherical. Capsule spherico-triquetrous with broadly obcordate valves ------------------------- 4

\+ Leaves filiform, semicylindric, cylindric, linear, loriform, or lanceolate, to broadly elliptic, never narrowed into the petiole. Seeds angular ------------------------------------- 5

4\. Bulb attached to a rhizome, with reticulate envelopes. Scape clothed with leaf-sheaths for 1/3—½. Perianth-segments 4—5 mm. long (Sect. *Anguinum*) ----------1. *A. Victorialis* L.

\+ Bulb not attached to a rhizome. Bulb-envelopes splitting into parallel fibres. Scape clothed with leaf-sheaths at the base. Perianth-segments *c*. 9—12 mm. long (Sect. *Ophioscordon*)
2. *A. ursinum* L.

5\. Robust plants with a stout (7—20 mm.) scape and fistular leaves. Bulb-envelopes (in wild plants) red-brown, thinly coriaceous, entire. Flowers white or yellowish, in a spherical, more rarely hemispherical, many-flowered, dense umbel 6

\+ Scape usually less than 7 mm. thick, but if plants robust with a thicker scape, then leaves broad, flat, not fistular -- 13[8]

6\. Perianth stellate, white, with segments 4—6 mm. long. Pedicels with bracteoles at the base (Sect. *Cepa*) ----------- 9

\+ Perianth campanulate, yellowish, with segments 6—8 mm. long. Pedicels without bracteoles. (Sect. *Phyllodolon*) -- 7

7\. Comparatively small plant, 20—25 cm. high. Scape 7—10 mm. thick. Leaves 5—7 mm. wide --86. *A. microbulbum* Prokh.

\+ Larger plants, 30—70 cm. high and more, with thicker scape and leaves --------------------------------------- 8

8\. Pedicels thick, slightly shorter than or (the central ones) 1½ times as long as the perianth. Umbel almost capitate ----
87. *A. altaicum* Pall.

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[8] [The original has "12", which is evidently an error: see 11th dichotomy, 2nd alternative. —Translator's note.]

+ Pedicels slender, 2—3 times as long as the perianth. Umbel more lax. Cultivated plant .... 88. *A. fistulosum* L.

9. Scape not inflated or slantingly inflated. Leaves 2—3. Filaments ± coalescent with one another above their adnation to the perianth 10

+ Scape with a ± distinct inflation below the middle. Leaves 4—9. Filaments free above their adnation to the perianth. 11

10. Scape solid, 20—50 cm. high. Leaves 3—10 mm. wide. Perianth-segments 4—5 cm. long ....89. *A. galanthum* Kar. et Kir.

+ Scape hollow, 40—80 cm. high. Leaves 20—30 mm. wide. Perianth-segments 6 mm. long. ......90. *A. pskemense* B. Fedch.

11. Leaves flattened, canaliculate, congregated at the base of the scape, recurved ....91. *A. Vavilovi* M. Pop. et Vved.

+ Leaves cylindric, straight 12

12. Scape slender above the inflation. Wild plant .... 92. *A. Oschanini* O. Fedch.

+ Scape fairly thick above the inflation. Cultivated plant .. 93. *A. Cepa* L.

13. Bulbs cylindric, conical, oblong or more rarely oblong-ovoid or ovoid, solitary or aggregated, always attached to a rhizome. (Sect. *Rhizirideum*) 14

+ Bulbs spherical or ovoid or more rarely oblong-ovoid, devoid of a rhizome 96

14. Filaments 1/4—¾ as long as the perianth-segments, adnate half-way to the perianth and connate for 2/3—¾ 15

+ Filaments shorter or longer than the perianth, connate for the same distance as they are adnate to the perianth 17

15. Leaves 0.5—1 mm. wide, semicylindric, canaliculate. Perianth-segments rose-violet, 5—6 mm. long. Filaments 1/4—1/3 shorter than the perianth-segments .... 79. *A. Weschniakowi* Regel

+ Leaves 2—15 mm. wide. Perianth-segments 7—15 mm. long, shining, yellow, or later becoming reddish or dark-purple. Filaments 1/4—½ as long as the perianth-segments 16

16. Leaves (2)—3, broadly linear, canaliculate, 5—15 mm. wide, not fistular ....80. *A. Semenovi* Regel

+ Leaves 1—2—(3), cylindric, fistular, 2—7 mm. wide. ...... 81. *A monadelphum* Less.

17. Leaves 1—2, fistular. Segments of the campanulate perianth rose or rose-violet, generally shining. Bulb-envelopes without noticeable nerves, crustaceo-coriaceous or almost papyraceous, breaking up. Spathe almost without a beak ----- 18

\+ Leaves (2)—3—9, non-fistular, or fistular and then either the spathe with a long beak or the leaves canaliculate-triquetrous -- 21

18. Filaments 1/3—½ as long as the perianth. Pedicels 1/3—½ as long as[9] the perianth, more rarely equalling it ------ 82. *A. Schoenoprasum* L.

\+ Filaments slightly longer than, equalling, or up to 1/3 shorter than, the perianth-segments. Pedicels (1½)—2—3 times as long as the perianth-segments --------------------- 19

19. Perianth-segments 7—12 mm. long. Style strongly exserted from the perianth ------83. *A. Ledebourianum* Roem. et Schult.

\+ Perianth-segments 5—6—(7) mm. long. Style slightly exserted from the perianth ------------------------------ 20

20. Bulb-envelopes greyish, almost papyraceous. Filaments of inner stamens gradually narrowed from the base, 1½ times as broad as the outer ones at the base ----------------- 84. *A. Maximowiczi* Regel

\+ Bulb-envelopes cinnamomeous or violet-cinnamomeous, crustaceo-coriaceous. Filaments subulate from a scarcely expanded base, almost equal -------85. *A. oliganthum* Kar. et Kir.

21. Leaves canaliculate-triquetrous or sharply carinate, 2—5 mm. wide. Filaments 1½ times as long as the perianth-segments. Segments of the hemispherical perianth elliptic, obtuse, rose-purple or dirty-rose, darker on the back, 4—5.5 mm. long -- 22

\+ Leaves flat or semicylindric, without a keel, or with one, and then the filaments shorter than the perianth-segments ---- 23

22. Leaves (2)—3—(4), canaliculate-triquetrous, sometimes fistular at the base. Bulbs oblong-ovoid, with cracking, indistinctly reticulate-fibrous envelopes, surrounding the base of the stem. Perianth-segments rose-purple, 4.5—5.5 mm. long 3. *A. sacculiferum* Maxim.

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[9] ["1—2 times shorter than" (i. e. 'equalling to ½ as long as') in the original. The correction here made is based upon the description in Fl. URSS. IV. 193. —Translator's note.]

\+ Leaves 4—7, canaliculate, sharply carinate. Bulb ovoid, with coriaceous entire envelopes. Perianth-segments dirty-rose, darker on the back, 4—4.5 mm. long --4. *A. Komarovianum* Vved.

23. Bulb-envelopes papyraceous, membranous or coriaecous, cracking or split into fibres, sometimes obscurely reticulate-fibrous (and then spathe without a beak, and roots numerous, almost cord-like), but never becoming reticulate -------- 24

\+ Bulb-envelopes reticulate-fibrous, or obscurely reticulate-fibrous and then the spathe with a ± long beak ---------- 59

24. Fliaments connate, and adnate to the perianth, half-way, almost 1/3 shorter than the perianth. Umbel fasciculate, few-flowered, lax ------------------------59. *A. setifolium* Schrenk

\+ Filaments connate, and adnate to the perianth, at the base or for 1/4 -- 25

25. Bulbs ovoid-conical or almost cylindric, with coriaceous, numerous, compact, entire envelopes. Spathe either with a ± long, sometimes very long, beak, several times exceeding the base of the spathe, or without a beak, and then the plant small, with a slender stem 10—15 cm. high, with purple flowers. Filaments longer than the perianth or (*A. Alexandrae*) shorter than it -------------------------------- 26

\+ Spathe without a beak, or with a short beak and then the filaments shorter than the perianth ---------------------- 39

26. Filaments slightly shorter than the perianth, the inner ones widened for ¾ and then abruptly narrowed, sometimes almost dentate, 3 times as broad as the subulate outer ones
73. A. *Alexandrae* Vved.

\+ Filaments slightly longer than or up to twice as long as the perianth-segments, subulate almost from the base, equal or the inner ones up to 1½ times broader --------------- 27

27. Filaments slightly longer than the perianth. Perianth almost stellate, rose-purple. Umbel few-flowered, lax ----------
60. *A. subtilissimum* Ledeb.

\+ Filaments (1¼ or) 1½—2 times as long as the perianth-segments. Perianth ovoid-campanulate or campanulate ------ 28

28. Umbel fasciculate-hemispherical, few-flowered, lax, with cernuous flowers. Perianth-segments *c.* 3mm. long, pale-yellow, becoming rosy. Pedicels (1½)—2 times as long as the perianth ---------------------------62. *A. tytthanthum* Vved.

\+ Umbel spherical or hemispherical, dense, many-flowered, or few-flowered and then the pedicels shorter or only slightly longer than the perianth and the flowers rose or purple -- 29

29. Perianth-segments 5—6 mm. long, obtuse, the outer ones emarginate, the inner 1/6 longer. Pedicels slightly shorter or slightly longer than the perianth. Stem 10—25 cm. high 66. *A. tianschanicum* Rupr.

\+ Perianth-segments 3—5 mm. long, acute or obtuse with a short apiculus, the inner slightly longer than the outer. -------- 30

30. Pedicels shorter than, equalling, or very rarely up to 1½ times as long as, the perianth. Spathe with a comparatively short beak, usually shorter than the base of the spathe, more rarely twice exceeding it, or altogether without a beak. Flowers rose or purple ---------------------------------- 31

\+ Pedicels 1½—3—(4) times as long as the perianth. Spathe with a long beak, usually several times exceeding the base of the spathe, or with a comparatively short beak and then the flowers yellow -------------------------------------- 34

31. Spathe without a beak. Perianth-segments purple. Leaves flat, smooth ----------------------------61. *A. jucundum* Vved.

\+ Spathe with a beak. Perianth-segments rose. Leaves semicylindric, canaliculate ---------------------------------- 32

32. Filaments of the inner stamens 1½ times as broad as the outer ones, bidentate at the base ------------63. *A. kokanicum* Regel

\+ Filaments equal, subulate -------------------------------- 33

33. Leaves almost filiform, 0.25—0.5—(1) mm. wide, smooth or more rarely finely scabrid. Filaments usually feebly coloured ----------------------------------64. *A. filifolium* Regel

\+ Leaves 0.5—1 mm. wide, ciliate-scabrid on the margin. Filaments usually purple ------------------65. *A. caricoides* Regel

34. Flowers pale-yellow. Perianth-segments subobtuse or obtuse with a short apiculus, 4—5 mm. long. ----------------- 35

\+ Flowers white, rose or rose-purple, or pale-yellowish-green turning rose and then the perianth-segments 3—4 mm. long. Perianth-segments acute -------------------------------- 36

35. Leaves 0.5—1 mm. wide. Bulb-envelopes greyish or brownish, coriaceous, almost papyraceous --68. *A. petraeum* Kar. et Kir.

\+ Leaves 1—2.5 mm. wide. Bulb-envelopes thinly coriaceous, brown, often shining --------------67. *A. condensatum* Turcz.

36. Perianth-segments 3—4 mm. long, pale-yellowish-greenish, turning rose ------------------------69. *A. talassicum* Regel

\+ Perianth-segments 4—5 mm. long, white, rose or rose-purple 37

37. Perianth-segments rose-purple ....72. *A. globosum* M. Bieb.

\+ Perianth-segments white or rose 38

38. Perianth-segments rose; anthers usually violet ....
71. *A. saxatile* M. Bieb.

\+ Perianth-segments white; anthers usually yellow ....
70. *A. Marschallianum* Vved.

39. Rhizome with runners; bulb scarcely developed. Umbel with numerous, large, 6—7 mm. long, cernuous flowers. Filaments ¼—1/3 shorter than the perianth-segments, the inner ones almost 3 times as broad as the outer ....
52. *A. caespitosum* Sievers

\+ Rhizome without runners. Filaments of the inner stamens, not more than twice as broad as the outer ones, or broader and then the filaments longer than the perianth 40

40. Filaments ¼—1/3 shorter than the perianth-segments, expanded and entire at the base. Perianth-segments 3.5—4.5 mm. long, obtuse or truncate, obcuneate 41

\+ Filaments equalling, or up to twice as long as, the perianth-segments, or shorter than them; in the latter case these segments 5—6—(7) mm. long, and either acute or, if obtuse, the filaments bidentate 2/3—¾ of the way up 42

41. Umbel hemispherical, few-flowered, with cernuous flowers; pedicels almost equal, 1½—2—(3) times as long as the perianth. Scape 5—25 cm. high. Perianth hemispherical; inner segments obcuneate, the outer ones almost orbicular-elliptic.
50. *A. tenuissimum* L.

\+ Umbel fasciculate or fasciculate-hemispherical, usually many-flowered. Pedicels unequal, 3—7 times as long as the perianth. Scape 20—40 cm. high. Perianth broadly campanulate; inner perianth-segments obcuneate or linear-obcuneate, the outer ones broadly elliptic or oblong-elliptic ....
51. *A. anisopodium* Ledeb.

42. Compact-caespitose plants, not tall, 10—25 cm. high, with numerous almost cord-like roots. Bulbs feebly developed, *c.* 0.5 cm. thick, with envelopes split into parallel laciniae or into obscurely reticulate fibres 43

\+ Plants more robust, 30—100 cm. high, forming tufts or not forming them, or small caespitose plants, but never with numerous almost cord-like roots 45

43. Bulb-envelopes split into almost reticulate fibres. Filaments of the inner stamens expanded, and more often bidentate, at the base ---------------------- 47. *A. polyrrhizum* Turcz.

\+ Bulb-envelopes split into parallel laciniae. Filaments of the inner stamens bidentate 2/3—¾ of the way up ---------- 44

44. Umbel hemispherical or spherical, dense. Pedicels equalling, or 1½ times as long as, the perianth. Filaments slightly shorter than the perianth-segments. Leaves 1—1.5 mm. wide ------------------------------ 48. *A. bidentatum* Fisch.

\+ Umbel hemispherical, lax, with almost pendulous flowers. Pedicels (1½)—2 times as long as the perianth. Filaments equalling the perianth-segments. Leaves *c.* 0.5 mm. wide -- 49. *A. bellulum* Prokh.

45. Bulb-envelopes coriaceous ------------------------------ 46

\+ Bulb-envelopes membranous, or almost coriaceous and then the leaves semicylindric, canaliculate, congregated at the base of the stem ------------------------------------ 50

46. Filaments slightly longer than the perianth-segments. Perianth-segments linear-oblong, obtuse, rosy with a strong purple nerve, 4 mm. long. Umbel dense, capitate. Bulb 0.75—1 cm. thick, 2—3 cm. long, attached singly to an ascending rhizome, which is covered with the remains of the bulbs of past years -------------------- 58. *A. glaciale* Vved.

\+ Filaments 1½—2 times as long as the perianth-segments. Bulbs 1—3 cm. thick, crowded a few together, or solitary and then the flowers greenish-yellow ---------------------- 47

47. Perianth-segments greenish-yellow. Leaves 6—9, broadly linear, 5—20 mm. wide, gradually narrowed towards the apex. Bulb solitary ----------------------- 53. *A. obliquum* L.

\+ Perianth-segments rose. Leaves with almost parallel margins. Bulbs ± crowded --------------------------------- 48

48. Bulb-envelopes not shining, entire. Filaments of the inner stamens twice as broad at the base as the outer ones. Leaves broadly linear, generally falcately recurved -------------- 55. *A. polyphyllum* Kar. et Kir.

\+ Bulb-envelopes shining, cracking. Filaments almost equal at the base. Leaves narrow-linear, straight --------------- 49

49. Pedicels 1/3 shorter than or equalling the perianth. Perianth-segments pale-rosy-lilac with a darker strong nerve ------ 57. *A. kaschianum* Regel

+ Pedicels 1½—2—(3) times as long as the perianth. Perianth-segments bright rose, with an inconspicuous nerve -------- 56. *A. hymenorrhizum* Ledeb.

50. Perianth-segments linear-lanceolate or lanceolate, 6—8 mm. long, rose. Leaves broadly linear, flat ---------------- 54. *A. platyspathum* Schrenk

+ Perianth-segments 3—6 mm. long, oblong, elliptic or ovate - 51

51. Leaves smooth, linear, flat or carinate. Flowers rose or rose-violet. Loosely caespitose plants, or bulbs attached singly to a rhizome -- 52

+ Leaves scabrid, semicylindric, often almost filiform, or flattish and smooth and then the flowers white. Plants generally densely caespitose ----------------------------------- 54

52. Filaments slightly or ¼ shorter than the perianth-segments. Perianth-segments acute. Leaves carinate --37. *A. angulosum* L.

+ Filaments slightly longer than or up to twice as long as the perianth-segments. Perianth-segments obtuse. Leaves flat 53

53. Filaments 1½—2 times as long as the perianth-segments, the inner ones twice as broad, and usually bidentate, at the base --45. *A. nutans* L.

+ Filaments slightly longer than or 1½ times as long as the perianth-segments, the inner ones 1½ times as broad, and entire, at the base --------------------------44. *A. senescens* L.

54. Perianth-segments rose-violet or purple ------------------ 55

+ Perianth-segments white or yellow, sometimes with a rosy tinge -- 57

55. Perianth-segments purple. Pedicels slightly shorter or slightly longer than the perianth. Leaves 2—4. --------------- 43. *A. tytthocephalum* Roem. et. Schult.

+ Perianth-segments rose-violet. Pedicels 2—3 times as long as the perianth. Leaves 5—8 ------------------------ 56

56. Style not exserted from the perianth. Perianth-segments broadly elliptic or ovate, almost entire ----42. *A. rubens* Schrad.

+ Style exserted from the perianth. Perianth-segments oblong or more rarely oblong-ovate, the inner ones ± crenulate -- 41. *A. prostratum* Trev.

57. Leaves filiform, 0.5—0.75 mm. wide. Perianth-segments yellowish, 3—4 mm. long, oblong-lanceolate or oblong. Pedi-

cels 2—3—(4) times as long as the perianth ------------ 39. *A. flavescens* Bess.

+ Leaves 0.75—2—(4) mm. wide. Perianth-segments white or yellow, sometimes with a rosy tinge, 4—5 mm. long, oblong, ovate or broadly elliptic. Pedicels 1½—2 times as long as the perianth -- 58

58. Perianth-segments white, flattish. Filaments equalling or scarcely longer than the perianth ------38. *A. albidum* Fisch.

+ Perianth-segments yellow. Leaves semicylindric. Filaments slightly longer than or 1½ times as long as the perianth-segments --------------------------40. *A. Stellerianum* Willd.

59. Segments of the almost spherical perianth greenish-whitish, sometimes dirty-purple on the back, 4—5 mm. long, obtuse. Style exserted from the perianth. Filaments 1½—2 times as long as the perianth-segments. Umbel spherical, many-flowered, dense. Leaves flat, broadly linear, 3—15 mm. wide. (C. Asia) ------------------------------------ 60

+ Perianth-segments rose, rose-violet, dirty-violet, yellow or yellowish or white and then the style and filaments not exserted from the perianth ------------------------------ 61

60. Filaments entire, equal. Scape leafy up to half-way ------ 5. *A. Drobovi* Vved.

+ Filaments of the inner stamens bidentate at the base, almost twice as broad as the outer ones. Scape clothed with leaf-sheaths at the base or for 1/3 --------6. *A. oreoscordum* Vved.

61. Bulb-envelopes indistinctly reticulate-fibrous or coarsely reticulate-fibrous, or (the outermost ones) almost reticulate and then the spathe with a long beak. Filaments entire -- 62

+ Bulb-envelopes clearly reticulate, or coarsely and obscure reticulate and then the filaments of the inner stamens with teeth at the base ------------------------------------ 67

62. Umbel capitate. Pedicels half as long as, more rarely slightly shorter than, the perianth, without bracteoles at the base. Leaves ± falcately recurved. Small plant *c.* 10 cm. high. 46. *A. pumilum* Vved.

+ Umbel fasciculate or hemispherical. Pedicels usually equalling or 1½—2 times as long as the perianth, with bracteoles at the base -- 63

63. Filaments 1/3 shorter than the perianth-segments. Perianth campanulate -- 64

\+ Filaments slightly longer than or 1½ times as long as the perianth-segments. Perianth hemispherical 65

64\. Filaments of the inner stamens gradually narrowed from the base to the apex, 3 times as broad as the outer ones .... 74. *A. teretifolium* Regel

\+ Filaments abruptly subulate from a triangular base which in the inner ones is twice as broad ......75. *A. Korolkowi* Regel

65\. Leaves flat, canaliculate, 4—5 mm. wide. Perianth-segments acute ....78. *A. daghestanicum* Grossh.

\+ Leaves 0.5—2 mm. wide. Perianth-segments obtuse or with a short apiculus 66

66\. Leaves 0.5—1 mm. wide. Perianth-segments 4—5 mm. long. Pedicels 1½—2 times as long as the perianth .... 77. *A. gunibicum* Mishch.

\+ Leaves 1—2 mm. wide. Perianth-segments 5—6 mm. long. Pedicels equalling or 1½ times as long as the perianth .... 76. *A. Albovianum* Vved.

67\. Filaments connate and adnate to the perianth at the extreme base 68

\+ Filaments connate and adnate to the perianth for 1/4—½, or for only1/5—1/6 and then the perianth narrowly campanulate, (5)—7—10 mm. long 83

68\. Scape scabrid; sheaths often shaggy 69

\+ Scape smooth, sheaths smooth 70

69\. Perianth-segments yellow, oblong, obtuse, 4—6 mm. long .... 21. *A. scabriscapum* Boiss. et Kotschy

\+ Perianth-segments reddish-violet, oblong-lanceolate, acute, more rarely obtuse, generally 7 mm. long .... 22. *A. trachyscordum* Vved.

70\. Perianth-segments 2—3 mm. long. Umbel brittle, few-flowered, lax. Pedicels with numerous bracteoles at the base. Small plant, *c.* 15 cm. high ....20. *A. oreodictyum* Vved.

\+ Perianth-segments (3.5)—4—7 mm. long. Umbel not brittle, dense or rather lax. Pedicels with numerous bracteoles .. 71

71\. Perianth-segments greenish-yellowish or almost white, sometimes with a reddish tinge on the back. Filaments yellow . 72

\+ Flowers rose or rosy-lilac 73

72. Leaves flat, with almost parallel margins. Perianth-segments greenish-yellow .... 10. *A. flavidum* Ledeb.

\+ Leaves semicylindric, canaliculate, fistular, narrowed towards the apex. Perianth-segments almost white ....
9. *A. leucocephalum* Turcz.

73. Leaves semicylindric, (0.5)—1—2 mm. wide 74

\+ Leaves flat, (1)—2—5 mm. wide 75

74. Umbel hemispherical, ± few-flowered, rather lax. Leaves congregated at the base of the scape. Filaments slightly longer than the perianth .... 7. *A. Fischeri* Regel

\+ Umbel generally spherical, dense, many-flowered. Scape clothed for 1/3 with distant leaf-sheaths. Filaments 1½ times or almost twice as long as the perianth ....
8. *A. clathratum* Ledeb.

75. Filaments slightly shorter than or up to 1½ times as long as the perianth-segments, the inner ones entire or toothed at the base; base almost as long as broad; perianth-segments with a strong nerve 76

\+ Filaments 1.5—2 times as long as the perianth-segments 79

76. Perianth-segments pale-rose with a purple nerve. Leaves 4—6, strongly crowded at the base of the stem, smooth. Style strongly exserted from the perianth ....
19. *A. oreoprasoides* Vved.

\+ Perianth-segments rose or rose-purple. Leaves 2—4, scabrid on the margin. Scape clothed for 1/3 with distant leaf-sheaths or sheaths ± crowded at the base and then the flowers especially strongly coloured 77

77. Style 5—6 mm. long, strongly exserted from the perianth; stigma scarcely thickened; pedicels slightly shorter than or equalling the perianth .... 16. *A. amphibolum* Ledeb.

\+ Style 2.5—3.5 mm. long, exserted from the perianth; pedicels equalling or 1½—2 times as long as the perianth 78

78. Perianth-segments rose, darker on the back, oblong-lanceolate or oblong-linear; stigma scarcely thickened ....
15. *A. bogdoicola* Regel

\+ Perianth-segments rose, elliptic or oblong-elliptic; stigma almost capitate .... 14. *A. strictum* Schrad.

79. Pedicels scarcely more than half as long as, or slightly longer than, the perianth. Perianth-segments generally pale-rose, 5—7 mm. long 80

\+ Pedicels 1.5—2—3 times as long as the perianth. Perianth-segments rose, 3.5—4—(5) mm. long, or light-rosy-lilac and then not more than 4 mm long ____________________________ 81

80\. Perianth-segments (5)—6—7 mm. long, lanceolate or oblong-lanceolate. Bulb-envelopes clearly reticulate ____________ 17. *A. Szovitsi* Regel

\+ Perianth-segments 5 mm. long, oblong or ovate. Bulb-envelopes coarsely and obscurely reticulate __18. *A. brachyodon* Boiss.

81\. Perianth-segments rose with an inconspicuous nerve. Base of the inner filaments longer than broad ______13. *A. lineare* L.

\+ Perianth-segments with a strong nerve. Base of the inner filaments as long as, or shorter than, broad ____________ 82

82\. Bulbs narrowly cylindro-concial. Perianth-segments 3.5—4 mm. long, light-rosy-lilac ____________12. *A. splendens* Willd.

\+ Bulbs ovoid-oblong. Perianth-segments 4—5 mm. long, rose 11. *A. Maackii* Prokh.

83\. Leaves as well as sheaths (especially the lower sheaths) hairy.

Small plant 5—15 cm. high __________23. *A. gusaricum* Regel

\+ Plant glabrous, generally more robust __________________ 84

84\. Perianth almost stellate or hemispherical; leaves congregated at the base of the scape ______________________________ 85

\+ Perianth campanulate or narrowly campanulate; leaves ± distant ____ 86

85\. Filaments of the inner stamens twice as broad at the base as the outer ones; bulb-envelopes strongly reticulate ________ 35. *A. oreoprasum* Schrenk

\+ Filaments almost equal; bulb-envelopes thin and comparatively obscurely reticulate ______________________36. *A. odorum* L.

86\. Ovary provided with teeth at the apex forming a corona surrounding the base of the style ________________________ 87

\+ Ovary without a corona of teeth at the apex ______________ 88

87\. Perianth-segments dirty-violet, unequal, the outer ones linear-lanceolate or lanceolate, ¼ longer than the lanceolate or oblong-lanceolate inner ones. Pedicels unequal, half as long as, or slightly (in fruit twice) longer than, the perianth __ 33. *A. stephanophorum* Vved.

\+ Perianth-segments bright deep-rose, almost equal, the outer ones oblong, the inner lanceolate. Pedicels almost equal, half as long as the perianth-segments ____34. *A. tenuicaule* Regel

88. Filaments equalling or slightly longer than the perianth-segments. Style (especially in fruit) exserted from the perianth -- 89

\+ Filaments ½—2/3 as long as the perianth. Style, even in fruit, not exserted from the perianth ------------------ 90

89. Umbel hemispherical or almost spherical, more rarely fasciculate-hemispherical. Pedicels equalling or 1½ times (to twice) as long as the perianth. Anthers yellow ----------
31. *A. dolichostylum* Vved.

\+ Umbel fasciculate or fasciculate-hemispherical, more rarely hemispherical. Pedicels ½ as long as, equalling, or (in fruit) 1½ times as long as, the perianth-segments. Anthers violet --------------------------------32. *A. inderiense* Fisch.

90. Perianth-segments yellowish --------------28. *A. lutescens* Vved.
\+ Perianth-segments dirty-violet, rose-violet or violet, without a yellow tinge --- 91

91. Perianth-segments dirty-violet or cinnamomeous-violet, darker on the back -- 92

\+ Perianth-segments pale-rose, rose, light-violet or violet, with a darker nerve -- 93

92. Leaves 2—3, narrowly linear, often almost filiform, 0.5—1 mm. wide, canaliculate ------------24. *A. inconspicuum* Vved.

\+ Leaves 4—5, linear, 2.5—10 mm. wide, flat, falcately recurved -------------------------25. *A. drepanophyllum* Vved.

93. Umbel spherical or hemispherical, very rarely fasciculate-hemispherical, lax. Pedicels ascending, 4—6 times as long as the perianth, or only (2)—3—4 times as long and then the perianth 5—7 mm. long ----------------------------- 94

\+ Umbel fasciculate or hemispherical, dense. Pedicels ½ as long as, equalling or more rarely 2—3 times as long as, the perianth. Perianth-segments 7—14 mm. long -------- 95

94. Leaves canaliculate, fistular, 1—3 mm. wide. Perianth-segments purple-violet, 7—9 mm. long. Pedicels 4—6 times as long as the perianth ------------29. *A. longiradiatum* Vved.

\+ Leaves flat, not fistular, falcately recurved, (1)—3—4 mm. wide. Perianth-segments generally pale-violet, 5—7 mm. long. Pedicels (2)—3—4 times as long as the perianth.
30. *A. dolichomischum* Vved.

95. Leaves flat, 3—5—(10) mm. wide, falcately recurved. Anthers usually violet ---------- 26. *A. xiphopetalum* Aitch. et Baker

\+ Leaves canaliculate, 1—3mm. wide. Anthers yellow ------ 27. *A. Barszczewskii* Lipsky

96. Filaments of the inner stamens trifid at 1/3—4/5 of their height, with filiform lateral teeth exceeding in the majority of species the middle antheriferous one, in the minority shorter. Scape clothed with leaf-sheaths ± high up in the aëriel part. (Sect. *Porrum*) ------------------------ 97

\+ Filaments entire or the inner ones bidentate; teeth never exexceeding the anther, short, or ± long but then situated at the base of the filament ------------------------------ 130

97. Small, generally stocky plants, 10—30 cm. high; leaves exceeding the umbel (C. Asia) ------------------------------ 98

\+ Taller, slender plants, 30—70 (-100) cm. high, more rarely (generally stunted specimens) 15—30 cm.; leaves considerably shorter than the scape ------------------------------ 101

98. Outer bulb-envelopes papyraceous or almost coriaceous, without nerves. Bulblets absent, or almost smooth ------------ 99

\+ Outer bulb-envelopes reticulate or with reticulate venation. Bulblets with reticulate venation ---------------------- 100

99. Middle tooth of the inner stamens 1/3 as long as the base and ½—2/3 as long as the laterals; bulblets absent; perianth-segments 6—7 mm. long -------- 144. *A. Lehmannianum* Merckl.

\+ Middle tooth of the inner stamens equalling or 1/3 shorter than the base and slightly longer than or up to 1½ times as long as the laterals. Bulblets dull, yellow, with a keel on the back. Perianth-segments 4—(6) mm. long ----------- 143. *A. ferganicum* Vved.

100. Middle tooth of the inner stamen ¼—1/3 as long as the base. Scapes usually 2—(5) from one bulb —145. *A. Borzczowi* Regel

\+ Middle tooth of the inner stamens 1½—2 times as long as the base. Scape solitary ----------------- 146. *A. brevidens* Vved.

101. Outer bulb-envelopes reticulate or reticulate-nerved. Bulblets, if present, always yellowish, large --------------- 102

\+ Outer bulb-envelopes papyraceous or coriaceous, cracking, or sometimes bast-like at the apex with indistinct reticulation. Bulblets, if present, black-brown or black-violet, or yellow and then small ------------------------------------- 107

102. Bulblets with reticulate venation, densely studded with crystalline tubercles ------------------148. *A. crystallinum* Vved.

+ Bulblets, if present, smooth or with reticulate venation, never with crystalline tubercles ---------------------------------- 103

103. Bulb-envelopes reticulate or with reticulate venation, surrounding the scape for a comparatively short distance; bulblets always smooth (C. Asia) ---------------------------- 104

+ Bulb-envelopes numerous, very reticulate, surrounding the scape for some distance up. Bulblets absent, or with reticulate venation -- 105

104. Perianth-segments rose-violet, 5—6 mm. long, linear-lanceolate, acute. Middle tooth of the inner stamens equalling the base and the lateral teeth ----147. *A. turcomanicum* Regel

+ Perianth-segments greenish (in the herbarium often rosy), 4—5 mm. long, oblong or oblong-obovate. Middle tooth of the inner stamens ½ as long as the base and 2/7—2/3 as long as the laterals ---------------------149. *A. filidens* Regel

105. Leaves not fistular, linear, canaliculate, congregated at the base of the scape. Perianth-segments whitish, scabrid, 5—6 mm. long. Style not exserted from the perianth --------
150. *A. dictyoscordum* Vved.

+ Leaves fistular, narrowing towards the apex. Perianth-segments 3—5 mm. long, dull-green, white-edged on the margin, dark-purple or brown-green, smooth --------------------- 106

106. Leaves 6—11 mm. wide. Perianth-segments dull-green, white-edged on the margin. Filaments glabrous, more rarely sparsely ciliate --------------------------151. *A. viride* Grossh.

+ Leaves 3—5 mm. wide. Perianth-segments dark-purple or brown-green. Filaments slightly ciliate ----------------
152. *A. dictyoprasum* C. A. Mey.

107. Segments of the tubular-campanulate perianth 7—9 mm. long ------------------------------------154. *A. Aucheri* Boiss.

+ Perianth-segments 4—5 mm. long ---------------------- 108

108. Leaves fistular. Style exserted from the perianth ---------- 109

+ Leaves not fistular, linear, canaliculate ------------------ 115

109. Umbel generally with bulbils ----------------153. *A. vineale* L.

+ Umbel without bulbils ------------------------------------ 110

110. Perianth narrowly campanulate, whitish or with a blotch on the segments. Filaments of the inner stamens broader than the perianth-segments at the base ------------------- 111

+ Perianth oblong-ovoid or ovoid, generally vinaceous-red or purple. Filaments of the inner stamens equalling the perianth-segments at the base ---------------------------- 112

111. Perianth 4 mm. long, whitish, without blotches on the segments. Filaments ciliate ----------------156. *A. affine* Ledeb.

+ Perianth 2.5 mm. long, whitish, with a small blotch on the segments. Filaments glabrous ------------155. *A. guttatum* Stev.

112. Bulb-envelopes coriaceous, hard. Bulblets yellowish-brown, finely tuberculate. Leaves cylindric. Perianth 3.5 mm. long, vinaceous-red, with the outer segments scabrid on the keel -- 157. *A. firmo-tunicatum* Fom.

+ Bulb-envelopes papyraceous or coriaceous. Bulblets yellowish and smooth, or yellowish-brown or brown and matt, owing to the prominent nerves, and then the leaves semicylindric, canaliculate. Perianth *c.* 4mm. long, rose or more often dark purple, very rarely whitish --------------------- 113

113. Bulblets yellowish-brown or more often brown, numerous. Middle tooth of the inner filaments 1/3—½ as long as the base. Pedicels smooth --------------160. *A. Regelianum* Beck.

+ Bulblets yellowish, few. Middle tooth of the inner filaments ½—2/3 as long as the base. Pedicels scabrid beneath the flower -- 114

114. Perianth-segments scabrid. Leaves usually smooth. Bracteoles few ---------------------------159. *A. sphaerocephlon* L.

+ Perinath-segments smooth. Leaves usually scabrid. Bracteoles numerous -------------------158. *A. fusco-violaceum* Fom.

115. Umbel with bulbils ------------------------------------- 116

+ Umbel without bulbils ----------------------------------- 118

116. Perianth-segments 5 mm. long, scabrid. Leaves scarcely exceeding the middle of the scape ------161. *A. Scorodoprasum* L.

+ Perianth-segments 3 mm. long, smooth. Leaves considerably exceeding the middle of the scape ---------------------- 117

117. Filaments at the end of flowering up to 1½ times as long as the perianth-segments; wild plant ----162. *A. longicuspis* Regel

+ Filaments shorter than the perianth-segments; cultivated plant ------------------------------------163. *A. sativum* L.

118. Bulblets and envelopes of the new bulb black-brown, black-violet or brown-purple ---------------------------------- 119

\+ Bulblets and envelopes of the new bulb yellowish ----------- 125

119. Perianth spherical-campanulate. Filaments equalling or more rarely slightly shorter than the perianth-segments. Capsule equalling the perianth ------------------------------------ 120

\+ Perianth campanulate, ovoid-campanulate or ovoid-pyramidal. Filaments ¼ or 1/3 shorter than the perianth-segments 122

120. Perianth-segments light-rose --166. *A. gracilescens* Somm. et Lev.

\+ Perianth-segments whitish, sometimes ± purple on the back, or dark-purple --- 121

121. Perianth-segments whitish, sometimes ± purple on the back 164. *A. Fominianum* Mishch.

\+ Perianth-segments dark-purple --------165. *A. ponticum* Mishch.

122. Segments of the campanulate perianth lanceolate, acute, rose-coloured ------------------------------167. *A. erubescens* C. Koch

\+ Perianth-segments broader, oblong, ovate or elliptic, at least the inner ones obtuse or subobtuse ---------------------- 123

123. Segments of the broadly canpanulate perianth obtuse, the outer ones dark-purple, the inner elliptic, usually almost white with a purple nerve ----------------168. *A. rotundum* L.

\+ Segments of the ovoid-campanulate or ovoid-pyramidal perianth ± uniformly coloured, the inner ones oblong-ovate -- 123

124. Perianth-segments rose-violet. Umbel usually almost capitate 169. *A. jajlae* Vved.

\+ Perianth-segments dark-purple-violet --170. *A. Waldsteini* G. Don

125. Scape 15—30 cm. high. Filaments slightly shorter than the perianth-segments. Perianth-segments almost white, 5 mm. long, acute, strongly scabrid. Style not exserted from the perianth ------------------------171. *A. talyschense* Mishch.

\+ Scape 50—120 cm. high; filaments scarcely longer than or up to twice as long as the perianth; style exserted from the perianth 126

126. Filaments $1\frac{1}{4}$ times or up to twice as long as the perianth-segments; perianth-segments 3—4 mm. long 127

\+ Filaments scarcely longer than the perianth; segments 5 mm. long 129

127. Middle tooth of the inner filaments equalling the base and scarcely longer than the laterals; perianth-segments lanceolate or oblong-lanceolate, acute, rose-coloured .... 172. *A. pseudo-ampeloprasum* Mishch.

\+ Middle tooth $\frac{1}{2}$—2/3 as long as the base and the lateral teeth; perianth-segments elliptic, oblong-ovate or ovate, obtuse or subacute, white, dirty-green or dark-purple-violet 128

128. Perianth-segments white ....128. *A. leucanthum* C. Koch

\+ Perianth-segments dark-purple-violet, more rarely dirty-green ....173. *A. atro-violaceum* Boiss.

129. Perennial wild plant; scape ascending laterally from the bulb 175. *A. Ampeloprasum* L.

\+ Biennial cultivated plant; scape issuing from the centre of the bulb ....176. *A. Porrum* L.

130. Scape [*sphalm.* "style"] clothed with leaf-sheaths ± high up in the aërial part. Leaves filiform, semicylindric, or cylindric, more rarely flat; fistular or not fistular. (Sect. *Haplostemon*) 131

\+ Scape clothed with leaf-sheaths in the underground part; more rarely the sheaths clothe the scapes in the aërial part and then the leaves are loriform. Leaves never fistular, linear, linear-lanceolate, loriform, oblong to elliptic 179

131 Umbel fasciculate or fasciculate-hemispherical, as it were two-tiered, owing to the, at the time of flowering, cernuous or pendulous flowers and erect fruiting pedicels. Spathe tearing into two long-acuminate portions, the longer of which is generally considerably longer than the umbel (cf. *A. karsianum*), and the beak of which equals, or more often several times exceeds, the base of the spathe. Bulb-envelopes papyraceous or almost coriaceous, never reticulate or reticulate-fibrous 132

\+ Umbel fasciculate, hemispherical, sometimes almost capitate, with flowers not cernuous or pendulous, or pendulous and then the bulb-envelopes reticulate or reticulate-fibrous. Spathe coming away entire, with a short or long beak; or tearing, with a short beak, or sometimes with a long beak up to 3 times exceeding the base of the spathe (cf. *A. delicatulum*) 143

132. Flowers pearly-white; capsule slightly longer than the perianth .... 110. *A. convallarioides* Grossh.

+ Flowers coloured; capsule slightly shorter than or almost equalling the perianth 133

133. Perianth-segments dull owing to the detersible "bloom". Filaments $1\frac{1}{2}$—2 times as long as the perianth-segments. Ovary oblong on a short stipe 134

+ Perianth-segments without "bloom," shining or not shining 135

134. Flowers yellowish with a ± intense rose tinge, dirtyish. Umbel without bulbils .... 102. *A. pulchellum* G. Don

+ Flowers rose. Umbel with bulbils .... 103. *A. carinatum* L.

135. Perianth-segments 3—4 mm. long. Filaments $1\frac{1}{4}$ or $1\frac{1}{2}$ times (to twice) as long as the perianth-segments 136

+ Perianth-segments 5—8 mm. long. Filaments slightly shorter or scarcely longer than the perianth-segments 138

136. Perianth-segments whitish-greenish with a violet blotch .... 100. *A. kossoricum* Fom.

+ Perianth-segments yellow or rose 137

137. Perianth-segments yellow, more rarely with a violet tinge. Outer bulb-envelopes almost coriaceous, with distinct parallel nerves; envelopes of the new bulb with distinct parallel nerves .... 101. *A. pseudo-flavum* Vved.

+ Perianth-segments rose without any trace of yellow tint. Outer bulb-envelopes papyraceous, almost without nerves; envelopes of the new bulb without noticeable nerves .... 99. *A. stamineum* Boiss.

138. Umbel with bulbils .... 104. *A. oleraceum* L.

+ Umbel without bulbils 139

139. Pedicels almost equal, slightly shorter than or 2—(3) times as long as the perianth 140

+ Pedicels very unequal, the longest not less than 3 times as long as the shortest, (1)—2—9 times as long as the perianth 141

140. Perianth-segments pale-rose, almost white with a purple nerve, not shining, 5—6 mm. long. Filaments equalling the perianth or slightly longer than it ---------- 109. *A. rupestre* Stev.

+ Perianth-segments rose or more often deep-rose with a purple nerve, shining, (6)—7—8 mm. long. Filaments slightly or ¼ shorter than the perianth-segments ------------------ 108. *A. Kunthianum* Vved.

141. Perianth-segments pale-rose, almost white, obtuse, with a rounded apex, (6)—7—8 mm. long ---- 107. *A. karsianum* Fom.

+ Perianth-segments rose, sometimes deep-rose or dirty-rose, obtuse with a truncate or almost truncate apex, 5—6 mm. long -- 142

142. Perianth-segments shining, bright-rose or deep-rose, at any rate at the time of flowering ----------- 105. *A. paniculatum* L.

+ Perianth-segments, even at the time of flowering, insignificant, dirty-rose, dull ------------ 106. *A. lenkoranicum* Mishch.

143. Outer bulb-envelopes reticulate, reticulate-fibrous or with reticulate venation, or coriaceous and indistinctly reticulate-nerved, or almost papyraceous with almost parallel nerves, but in any case with conspicuously prominent closely arranged nerves and the bulblets then with evident nerves -- 144

+ Outer bulb-envelopes papyraceous or coriaceous, without conspicuous nerves, or with distant clearly parallel nerves and the bulblets then foveolate. Bulblets, if present, always without nerves -- 159

144. Filaments connate and adnate to the perianth at the base -- 145

+ Filaments connate and adnate to the perianth for 1/3—½, or for ¼ and then the spathe coming away entire, caducous -- 150

145. Leaves cylindric, fistular, spirally (almost helicoidally) twisted. Bulblets few -------------- 122. *A. ophiophyllum* Vved.

+ Leaves filiform, canaliculate, never spirally coiled. Bulblets absent -- 146

146. Inner perianth-segments ± deeply incised in the apical portion, the outer ones entire -------------- 98. *A. lacerum* Freyn

+ All the perianth-segments entire ---------------------------- 147

147. Bulb-envelopes reticulate; lower sheaths ± pilose -------- 97. *A. callidictyum* C. A. Mey.

+ Bulb-envelopes coriaceous, cracking or (in some) ± reticulate-fibrous; leaves glabrous, smooth -------------------- 148

148. Spathe at the base forming a tube surrounding the base of the umbel. Ovary almost spherical. Bulb-envelopes coriaceous, cracking, with almost reticulate nerves .... 94. *A. Margaritae* B. Fedch.

+ Spathe lacerate to the base. Ovary truncate-conical or pyriform. Envelopes almost coriaceous, cracking, ± reticulate-fibrous 149

149. Pedicels very unequal, (2)—3—6—(10) times as long as the perianth. Perianth-segments 4—5—(7) mm. long; leaves withering towards flowering-time ......95. *A. inaequale* Janka

+ Pedicels almost equal, equalling or 2—(3) times as long as the perianth. Perianth-segments (5)—6—7 mm. long; leaves lasting almost until fruiting-time .... 96. *A. moschatum* L.

150. Perianth-segments light-flesh-pink, the inner ones with a fovea at the base, up to 1/3 shorter than the outer ones .... 121. *A. Griffithianum* Boiss.

+ Perianth-segments white, rose or deep-rose, the inner ones without a fovea at the base. Perianth umbilcate at the base. (*A. rubellum* s. 1.) 151

151. Spathe coming away entire, caducous 152

+ Spathe becoming torn to the base, persistent 157

152. Segments of the broadly campanulate perianth 3—5—(6) mm. long. Filaments slightly or up to 1/3 shorter than the perianth-segments. Capsule slightly shorter than the perianth . 153

+ Segments of the campanulate or narrowly campanulate perianth (4)—5—7 mm. long. Filaments 1/3—2/3 as long as the perianth-segments. Capsule ½—2/3 as long as the perianth 155

153. Outer bulb-envelopes coriaceous, often reticulate-fibrous. Bulbs with reticulate venation. Spathe with a beak usually exceeding the base of the spathe. Perianth-segments 4—5—(6) mm. long ....122. *A. fibrosum* Regel

+ Outer bulb-envelopes coriaceous, with almost reticulate venation. Bulblets generally winged, with slender nerves. Perianth-segments 3—4—(5) mm. long 154

154. Perianth-segments deep-rose, linear-oblong, obtuse .... 113. *A. syntamanthum* C. Koch

+ Perianth-segments rose, oblong or oblong-lanceolate, attenuate, acute or subotuse ....114. *A. rubellum* M. Bieb., s. s.

155. Outer bulb-envelopes greyish, almost papyraceous, with almost parallel nerves. Bulblets whitish, with slender nerves ---------------------------117. *A. Jacquemontii* Kunth

+ Outer bulb-envelopes brown, coriaceous, with almost reticulate nerves, and sometimes bast-like. Bulblets yellowish or brownish -- 156

156. Bulblets few, with slender nerves. Filaments of the inner stamens equalling the perianth-segments at the base -------- 115. *A. albanum* Grossh.

+ Bulblets usually numerous, with thick reticulate nerves, often with distinct cells between the nerves. Filaments of the inner stamens usually slightly broader at the base than the perianth-segments ------116. *A. scabrellum* Boiss. et Buhse

157. Perianth-segments rose, [the outer ones] $1\frac{1}{4}$ or more often $1\frac{1}{2}$ times as long as the inner ------118. *A. anisotepalum* Vved.

+ Perianth-segments white, equal, or the outer ones slightly longer than the inner ------------------------------------- 158

158. Segments of the broadly campanulate perianth oblong or rarely oblong-lanceolate, generally shortly acuminate, the outer ones generally slightly shorter than the inner ------------ 119. *A. minutum* Vved.

+ Segments of the campanulate perianth oblong-lanceolate or lanceolate, very attenuate, equal ------120. *A. parvulum* Vved.

159. Perianth purple, 8—10 mm. long. Leaf solitary. Whole plant scabrid ------------------------135. *A. kujukense* Vved.

+ Perianth 3—7 mm. long. Leaves 2—4. Plants (at any rate the scapes) smooth, or, if the scape is scabrid, the filaments of the inner stamens bidentate -------------------------- 160

160. Outer bulb-envelopes coriaceous, foveolate, or with cristate outgrowths, or striate owing to the impressed distant nerves, or sometimes smooth, but the bulblets always tuberculate-foveolate --- 161

+ Outer bulb-envelopes papyraceous, smooth. Bulblets absent or smooth -- 166

161. Filaments of the inner stamens triangular, 3 times as broad at the base as the outer ones. Perianth-segments (5)—6—7 mm. long ---------------------- 136. *A. eremoprasum* Vved.

+ Filaments subulate, equal. Perianth-segments *c.* 3 mm. long 162

162. Outer perianth-segments scabrid 163

+ Perianth-segments smooth 164

163. Perianth-segments greenish, obtuse. Bulb-envelopes striate owing to the impressed distant nerves. Scape thick, as it were slantingly inflated ....141. *A. sabulosum* Stev.

+ Perianth-segments cinnamomeous, in the herbarium with a violet tinge, acute. Scape slender ....138. *A. confragosum* Vved.

164. Outer bulb-envelopes without cristate outgrowths, foveolate, blackish or brownish. Plant stocky, generally with a thickish scape 10—20 cm. high ....139. *A. scrobiculatum* Vved.

+ Outer bulb-envelopes, at least in young (sterile) examples, with longitudinal crests, light-brownish. Scape (15)—20—60 cm. high, slender 165

165. Perianth-segments light lilac, obtuse .... 140. *A. transvestiens* Vved.

+ Perianth-segments whitish with a dirty-purple nerve, acute 137. *A. Popovii* Vved.

166. Filaments of the inner stamens 2—3 times as broad as the outer ones at the base 167

+ Filaments equal at the base, or the inner ones up to 1½ times broader, generally without teeth 174

167. Perianth-segments *c.* 3 mm. long, obtuse, rose-coloured, not shining; leaves flat from the base, narrowed towards the apex, 2—10 mm. wide. Robust plant (40)—70—100 cm. high, with a bulb 1.5—3 cm. thick .... 142. *A. turkestanicum* Regel

+ Perianth-segments 4—8 mm. long. Scape not above 40 cm. in height, or if more, flowers azure or dark-blue-azure 168

168. Uppermost sheath inflated at the apex. Flowers shining, rose-coloured, in a dense almost capitate umbel. Pedicels ½ as long as, equalling, or (in fruit) up to 1½ times as long as, the perianth. Filaments of the inner stamens bidentate .. 134. *A. schoenoprasoides* Regel

+ Sheaths not inflated. Pedicels not less than twice as long as the perianth, or, if equal or 1½ times as long, then the filaments edentate 169

169. Perianth-segments azure or dark-blue-azure, or blue-violet, or white when alive and light-violet in the herbarium 170

+ Perianth-segments rose with a purple nerve. Small plants, not above 20 cm. high -- 172

170. Perianth-segments in the living state white, in the herbarium light-violet, 5—6 mm. long. Slender plant, 10—20 cm. high, with a lax umbel with ascending outer pedicels ---------- 131. *A. elegans* Drob.

+ Perianth-segments azure, dark-blue-azure or blue-violet. Coarser plants, (15)—30—80 cm. high, with a dense umbel 171

171. Leaves semicylindric, canaliculate. Perianth campanulate. Filaments of the inner stamens ± bidentate at 2/3 of their height ----------------------------------130. *A. caesium* Schrenk

+ Leaves triquetrous, canaliculate. Perianth broadly campanulate. Filaments of the inner stamens without teeth or bidentate below the middle ----------------129. *A. caeruleum* Pall.

172. Perianth-segments 4—5 mm. long. Filaments of the inner stamens bidentate --------------------133. *A. oreophiloides* Regel

+ Perianth-segments 6—7 mm. long. Filaments without teeth 173

173. Pedicels 2—3 times as long as the perianth, with bracteoles at the base. Spathe caducous --------------123. *A. inops* Vved.

+ Pedicels equalling or 1½ times as long as the perianth. Spathe persistent -------------------132. *A. kopetdagense* Vved.

174. Pedicels 3—5 times as long as the perianth. Umbel few-flowered, lax. Filaments slightly or up to 1/3 shorter than the perianth. Spathe several times shorter than the umbel, very shortly acuminate --------------111. *A. kirindicum* Bornm.

+ Pedicels slightly shorter than or 1½—2 times as long as the perianth, or up to 4 times as long as the perianth and then the umbel dense, spherical, and either the filaments longer than the perianth or the spathe with a long beak -------- 175

175. Filaments up to 1½ times as long as the perianth-segments, more rarely equalling them and then the spathe shortly acuminate -- 176

+ Filaments ¼ shorter than the perianth-segments, or equalling them and then the spathe with a long beak at least half as long as the base of the spathe ---------------------------- 177

176. Perianth-segments rose-coloured, shining, 3—4 mm. long, lanceolate or oblong-lanceolate. Umbel always without bulblets --127. *A. Pallasi* Murr.

\+ Perianth-segments deep-rose, (4)—5 mm. long, comparatively dull, oblong or oblong-lanceolate. Umbel usually with bulblets, more rarely without them ---------------- 128. *A. macrostemon* Bunge

177\. Sheaths densely short-hairy. Perianth-segments 6—7 mm. long. Style not exserted from the perianth ------------ 124. *A. lasiophyllum* Vved.

\+ Sheaths glabrous, smooth or more rarely scabrid. Style scarcely exserted from the perianth ------------------ 178

178\. Pedicels usually 2—3 times as long as the perianth. Perianth-segments whitish or rosy ----125. *A. delicatulum* Sievers

\+ Pedicels slightly shorter than or equalling the perianth. Perianth-segments rose-violet ----------126. *A. glomeratum* Prokh.

179\. Pedicels with large bracteoles at the base. Filaments adnate to the perianth half-way. (Sect. *Caloscordum*) ---------- 226. *A. neriniflorum* Baker

\+ Pedicels without bracteoles at the base (Sect. *Molium*) ---- 180

180\. Perianth-segments soon reflexed, withering after flowering, ± twisted -- 181

\+ Perianth-segments usually not withering after flowering, not twisted, usually pointing upwards --------------------- 207

181\. Ovary with 7—10 ovules. Umbel lax. Pedicels 3 or many times as long as the perianth. Perianth-segments 4—5 mm. long. Small plants with scape 10—20 cm. high ---------- 182

\+ Ovary with many ovules ---------------------------- 186

182\. Leaves divided to the base into filiform segments, forming a false whorl ------------------------185. *A. verticillatum* Regel

\+ Leaves entire -- 183

183\. Spathe with a long herbaceous beak. Bulb-envelopes coriaceous ------------------------------------186. *A. aroides* Vved.

\+ Spathe shortly acuminate. Bulb-envelopes papyraceous -- 184

184\. Scape thick, 5—8 mm. thick. Pedicels thick, clavately thickened beneath the flower. Perianth-segments 5 mm. long -- 182. *A. helicophyllum* Vved.

\+ Scape slender, *c.* 1.5 mm. thick. Pedicels slender, not thickened beneath the flower. Perianth-segments 4 mm. long 185

185\. Leaves straight, pilose beneath in the lower half together with the upper part of the sheaths ----------184. *A. Eugenii* Vved.

+ Leaves twisted [*sphalm.* 'crowded'], glabrous ------------ 183. *A. Sergii* Vved.

186. Plants stocky, 10—25 cm. high, with a thick scape buried halfway or more in the ground. Leaves considerably exceeding the umbel -- 187

+ Plants generally taller, with the scape buried in the ground at the base. Leaves shorter than the scape -------------- 188

187. Leaves linear-lanceolate or narrowly lanceolate, 1—2 cm. wide ---------------------------194. *A. brachyscapum* Vved.

+ Leaves lanceolate or more often oblong or almost elliptic, (3)—5—12 cm. wide --------------195. *A. karataviense* Regel

188. Ovary with 6 cornicles. Filaments clearly united into a ring above their point of adnation to the perianth ---------- 189

+ Ovary without cornicles --------------------------------- 190

189. Perianth-segments gradually narrowed from the base to the apex, deep-rose-violet. Umbel rather lax ---------------- 214. *A. sarawschanicum* Regel

+ Perianth-segments narrowed from the middle to the apex, light-rose-violet. Umbel more compressed, dense -------- 215. *A. pseudo-seravschanicum* M. Pop. et Vved.

190. Perianth-segments white with a green nerve, 11 mm. long, filiform-linear, gradually narrowed from the base to the apex. Robust plant, 90—150 cm. high ---------------- 208. *A. gulczense* B. Fedch.

+ Perianth-segments rose, rose-violet, violet or vinaceous-red, or white and then 4 mm. long ------------------------------ 191

191. Perianth-segments rose-violet, delicate, with an inconspicuous nerve, 5—7 mm. long. Filaments of the inner stamens generally with teeth at the base --------198. *A. Fetisowi* Regel

+ Perianth-segments with a conspicuous nerve -------------- 192

192. Leaves, and sometimes also the scape, pubescent ---------- 193

+ Glabrous plants -- 195

193. Robust plant 60—150 cm. high. Perianth-segments lilac, 9 mm. long --------------------------207. *A. stipitatum* Regel

+ Scape 15—70 cm. high. Perianth-segments 4—6 mm. long - 194

194. Perianth-segments 6 mm. long, light-violet. Pubescence long-pilose ---------------------------------206. *A. alaicum* Vved.

+ Perianth-segments 4 mm. long, white. Pubescence short, scabrous ---------------- ------199. *A. dasyphyllum* Vved.

195. Perianth-segments 3—5 mm. long 196

+ Perianth-segments 6—12 mm. long 202

196. Perianth-segments dark-purple or vinaceous-red 197

+ Perianth-segments pale-rose or rose-violet 199

197. Perianth-segments 5 mm. long, dark-purple ....
201. *A. robustum* Kar. et Kir.

+ Perianth-segments 3—4 mm. long, vinaceous-red 198

198. Filaments scarcely shorter than the perianth-segments, the inner ones obtusely bidentate above the middle ....
197. *A. cardiostemon* Fisch. et Mey.

+ Filaments entire, slightly longer than the perianth-segments
196. *A. Mariae* Bordz.

199. Filaments almost equal at the base 200

+ Filaments of the inner stamens twice as broad at the base as the outer ones 201

200. Small plant 20—30 cm. high. Leaves 1—2 mm. wide ......
200. *A. insufficiens* Vved.

+ Fairly robust plant 35—85 cm. high. Leaves 5—20 mm. wide ....204. *A. Suworowi* Regel

201. Perianth-segments linear ....203. *A. Sewerzowi* Regel

+ Perianth-segments narrowly elliptic. ...202. *A. decipiens* Vved.

202. Leaves broadly lanceolate or oblong, 4—8 cm. wide. Scape 30—50 cm. high. Perianth-segments 6 mm. long ....
213. *A. Komarovii* Lipsky

+ Leaves linear-lanceolate or loriform. Plants more robust, 70—150 cm. high, or comparatively small (20—40 cm.) and then the perianth-segments 8—12 mm. long 203

203. Perianth-segments white-rose ....205. *A. grande* Lipsky

+ Perianth-segments light or dark-violet 204

204. Scape 20—70 cm. high, ribbed owing to the strongly projecting nerves 205

+ Scape 80—150 cm. high, with feebly prominent nerves 206

205. Perianth-segments dark-violet, gradually narrowed from the base to the apex, acute ....212. *A. Rosenbachianum* Regel

+ Perianth-segments deep-rose-violet, with almost parallel margins, obtuse ....211. *A. taeniopetalum* M. Pop. et Vved.

206. Scape above ground clothed with leaf-sheaths. Leaves glaucous, 6—8. Anthers violet. Filaments free above their point of adnation to the perianth ---------------------- 209. *A. aflatunense* B. Fedch.

+ Scape above ground not clothed with leaf-sheaths. Leaves ± green, 4—6. Anthers yellow. Filaments ± united above their adnation to the perianth --------210. *A. altissimum* Regel

207. Perianth-segments after flowering rigid, sometimes almost spinose, owing to the thickening of the nerve ------------ 208

+ Nerve of the perianth-segments not thickening after flowering. Perianth-segments not spinose -------------------- 214

208. Scape buried in the ground half-way or almost up to the umbel. Leaves 1—3 ------------------------------------ 209

+ Scape buried in the ground only at the base. Leaves 2—7 -- 212

209. Perianth-segments 5—6 mm. long. Scape buried in the ground almost up to the umbel. Leaf 1 --------------- 209. *A. monophyllum* Vved.

+ Perianth-segments 7—13 mm. long. Scape buried in the ground half-way. Leaves (1)—2—3 ------------------- 210

210. Leaves linear-lanceolate, 0.5—1 cm. wide. Perianth-segments white with a violet nerve. Filaments 1/3—½ as long as the perianth-segments --------188. *A. Derderianum* Regel

+ Leaves linear to elliptic, 2—6 cm. wide. Perianth-segments rose with a darker nerve. Filaments slightly shorter than or ½ as long as the perianth-segments ------------------ 211

211. Filaments slightly or 1/3 shorter than the perianth-segments 189. *A. Alexeianum* Regel

+ Filaments ½ as long as the perianth-segments ------------ 190. *A. Akaka* Gmel.

212. Perianth-segments 5—9 mm. long, lilac with a reddish nerve. Leaves glabrous ------------------191. *A. materculae* Bordz.

+ Perianth-segments 10—18 mm. long, rose-violet or purple-violet -- 213

213. Leaves 1—2—(4), linear-lanceolate, recurved, stiffly ciliate, glabrous, or scabrid beneath. Scape comparatively slender, not more than 4—(5) mm. thick ------193. *A. Bodeanum* Regel

+ Leaves 3—7, almost loriform, erect, with stiff patent hairs beneath and on the margin, more rarely almost glabrous. Scape thick, 5—15 mm. thick --------192. *A. Christophi* Trautv.

214. Pedicels clavately thickened beneath the flower (especially in fruit), usually very unequal, forming as it were two spheres in the umbel. Umbel very lax, with fertile and sterile flowers ---------------------- 219. *A. Schubertii* Zucc.

+ Pedicels never clavately thickened beneath the flower ---- 215

215. Ovary with 6 ovules ------------------------------------ 216

+ Ovary with numerous ovules ---------------------------- 220

216. Ovary 1—2—(3)—flowered; perianth-segments rose, 4—5 mm. long ------------------------ 177. *A. monanthum* Maxim.

+ Umbel usually with a large number of flowers; perianth-segments 8—12 mm. long ------------------------------ 217

217. Flower white, sometimes with a rosy tinge; leaves shorter or slightly longer than the scape; scape buried in the ground at the base; umbel sometimes with bulbils -------------- 218

+ Flowers rose-purple or dirty-purple; leaves considerably exceeding the umbel; scape buried in the ground for ½—¾ - 219

218. Scape triquetrous. Leaf solitary, 0.5—2.5 cm. wide ------ 178. *A. paradoxum* (M. Bied.) G. Don

+ Scape terete. Leaves 2—3, 3—7 mm. wide -------------- 179. *A. Candolleanum* Albov

219. Segments of the broadly campanulate perianth bright rose-purple, oval -------------------- 180. *A. oreophilum* C. A. Mey.

+ Segments of the campanulate perianth dirty-purple, strongly coloured at the apex, oblong-linear or oblanceolate ------ 181. *A. gypsaceum* M. Pop. et Vved.

220. Filaments 2/5—½ as long as the perianth-segments, connate and adnate to the perianth for ½—2/3, sometimes united up to half-way in the free part. Perianth narrowly campanulate -- 221

+ Filaments slightly shorter than, or up to 1½—2 times as long as, the perianth-segments, connate and adnate to the perianth at the base. Perianth stellate or campanulate -- 225

221. Perianth-segments not withering after flowering, erect ---- 225. *A. iliense* Regel

+ Perianth-segments withering after flowering ------------ 222

222. Filaments united up to half-way above their point of adnation to the perianth; umbel lax 223

+ Filaments almost free above their adnation to the perianth; umbel dense 224

223. Umbels usually 2—3—(4) on one scape, arranged one above the other, more rarely umbel solitary ....224. *A. Regeli* Trautv.

+ Umbel always 1 ....223. *A. cupuliferum* Regel

224. Flowers rosy-violet ....222. *A. Winklerianum* Regel

+ Flowers white ....221. *A. darwasicum* Regel

225. Perianth campanulate. Stocky plant with a scape 10—30 cm. high ....220. *A. caspium* (Pall.) M. Bieb.

+ Perianth stellate. Scape 50—150 cm. high 226

226. Pedicels at the base immersed in the thickened spongy apex of the scape. Perianth-segments almost coriaceous after flowering. Filaments slightly shorter than the perianth-segments ....218. *A. Trautvetterianum* Regel

+ Pedicels not immersed at the base. Perianth-segments thin after flowering. Filaments slightly longer than or up to 1½ times as long as the perianth-segments 227

227. Perianth-segments elliptic, 5 mm. long, obtuse. Filaments almost 1½ times as long as the perianth-segments .... 217. *A. giganteum* Regel

+ Perianth-segments linear-lanceolate, 6—8 mm. long. Filaments slightly longer than the perianth-segments .... 216. *A. elatum* Regel

Section 1. ANGUINUM G. Don, Mon. (1827) 96. —Bulb attached to a rhizome. Leaf-sheaths clothing the scape high up in the aerial part. Spathe persistent. Perianth-segments with one nerve. Filaments entire. Capsule 3-seeded. Seeds globose. [Sp. 1.]

1. A. Victorialis *Linné,* Sp. Pl. (1753) 295; Ledeb. Fl. Ross. IV (1852) 184; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2(1854) 127; Boiss. Fl. Or. V (1882) 245; Schmalh. Fl. II (1897) 492; Kryl. Fl. Zap. [Western] Sib. III (1929) 629; Kom. Opred. Rast. Dalnevost. Kraya [Key Pl. Far Eastern Region] I (1931) 365. —*A. microdictyum* Prokhanov in Tr. Prikl. Bot. [Bull. Appl. Bot., Leningrad] XXIV, 2 (1930) 174. —*A. ochotense* Prokhanov, l. c. —*A. latissimum* Prokhanov l. c. —Ic. Kom., l. c., tab. 112, fig. 1. —Exs.: Billot, Fl. Gall. et German. exs. no. 2543.

Bulbs 1-few together, attached to an oblique rhizome, cylindro-conical, 1-1.5-(2) cm. thick, with light brown or greyish-brown reticulate envelopes. Scape 30-70 cm. high, clothed for 1/3 to ½ with smooth, often violet-tinted leaf-sheaths. Leaves 2-3, smooth, with a lanceolate, oblong or broadly elliptic, acute or obtuse lamina, (2)—3—6—(10 cm. wide, gradually narrowed into the petiole, which is ¼—½ as long as the lamina. Spathe slightly or 1/3 shorter than the umbel, persistent, obtuse or almost without a beak. Umbel spherical or more rarely hemispherical, many-flowered, fairly dense, cernuous before flowering; pedicels equal, 2—3 times as long as the perianth, without bracteoles at the base. Segments of the almost stellate perianth whitish-greenish with an inconspicuous nerve, 4—5 mm. long, elliptic, obtuse, the outer ones somewhat narrower and shorter. Filaments almost 1½ times as long as the perianth, adnate at the extreme base to the perianth, entire, gradually narrowed from the extreme base, narrowly triangular, the inner ones 1½ times as broad. Ovary on a short stipe; style exserted from the perianth. Capsule spherico-triquetrous, with broadly obcordate valves; seeds spherical. VI—VII.

In woods, on woodland fringes, in meadows. —EUROPEAN PART: 10 Volga—Kama (E. part); CAUCASUS: 20 Ciscauc., 21 Dag., 23 E. Transcauc.; W. SIBERIA; 26 Ob. (S. part), 27 Upper Tob. (N. part), 29 Alt.; E. SIBERIA: 30 Yenisei (S. part), 32 Ang.—Sayan, 33 Dauria; FAR EAST: 34 Kamch., 35 Okhotsk, 36 Zeya-Bur., 37 Udsk, 38 Ussuri, 39 Sakh. General distr.: Eur., Atl. Eur., W. Medit., Balkans —Asia Minor, India-Himal., Mongolia, Japan-China, N. Amer. Described from the mountains of Central Europe.

Note: Recently (Prokhanov, l. c.) an attempt has been made to distinguish elementary units within *A. Victorialis*, —an attempt which, unfortunately, has taken no account at all of *A. Victorialis* in the old sense.

A. microdictyum (Urals, Siberia, Mongolia), according to Prokhanov, should differ from *A. Victorialis* (Europe, Caucasus) and from *A. latissimum* (Ussuri region, Japan, northern Korea, north China: Chihli) in the less, and irregularly, reticulate envelopes of the bulb, with more slender nerves, in the narrower, often paired leaves, in the often violet-tinted leaf-sheaths, and in the yellowish flowers.

A. latissimum should differ from *A. Victorialis* in the habitat (the former being a woodland plant, the latter an alpine) and broader leaves. The leaves in *A. latissimum* are obovate-oblong, usually 3, the sheaths usually not coloured, the flowers white.

A. ochotense (Kamchatka, Sakhalin) should differ from *A. microdictyum* in the longer rhizome, darker and broader leaves, and flowers often reddish. The differences between this species and *A. Victorialis* and *A. latissimum* are not indicated.

ECONOMIC IMPORTANCE. The *cheremsha* (or *kolba*) is readily used for food in the raw or sour state. It possesses anti-scorbutic properties. In many localities in Siberia very considerable stocks of *cheremsha,* in the salted state, are laid by for the winter.

Section 2. OPHIOSCORODON (*Wallroth*) *Endlicher, Gen. Pl.* (1836) 147.[10] —*Ophioscordon* Wallroth, Sched. Crit. (1822) 129. — Bulb without a rhizome. Leaf-sheaths subterranean. Spathe deciduous. Perianth-segments with one nerve. Filaments entire. Capsule 3-seeded, seeds globose. [Sp. 2.]

2. A. URSINUM *Linné,* Sp. Pl. (1753) 300; Ledeb. Fl. Ross. IV (1852) 186; Boiss. Fl. Or. V (1882) 275; Schmalh. Fl. II (1897) 490. —*A. latifolium* Gilib. Exerc. Phyt. (1792) 470. —Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1109. —Exs.: HFR no. 2046 a et b.

Bulb elongate, about 1 cm. thick, with envelopes split into parallel fibres. Scape triquetrous, 15—40 cm. tall, clothed at the base with leaf-sheaths. Leaves 2, somewhat shorter than the scape, with a lanceolate or oblong, acute lamina, ± gradually narrowed into the petiole, 3—5 cm. wide, equalling, or half as long as, the petiole. Spathe equalling the umbel, acuminate, deciduous. Umbel fasciculate or hemispherical, comparatively few-flowered, dense; pedicels equal, 1.5—2 times as long as the perianth, scabrid or smooth, without bracteoles at the base. Segments of the almost stellate perianth white, with an inconspicuous nerve, 9—12 mm. long, linear-lanceolate, obtuse or subacute. Filaments half as long as the perianth, adnate to it at the base, subulate. Style shorter than the perianth. Capsule spherical, triquetrous, with broadly obcordate valves; seeds almost spherical. V—VI.

In shady woods. —EUROPEAN PART: 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga—Don (W. part); CAUCASUS: 20 Ciscauc. 22 W., 23 E. and 24 S. Transcauc. Gen. distr.: Scand., C. Eur., Atl. Eur., W. Medit., Balkans—Asia Min. Described from the island of Gotland.[11]

ECONOMIC IMPORTANCE. Readily used for food in the raw state.

Section 3. RHIZIRIDIUM *G. Don,* Mon. (1827) 55. —Bulbs attached to a rhizome, generally narrow, cylindric-conical or ovoid-conical, sometimes undeveloped, more rarely ovoid or oblong, more often crowded. Scape clothed ± high up in the aerial part with leaf-sheaths. Perianth-segments with one nerve. Filaments entire or with teeth; teeth short or long, but never exceeding the anther. Seeds angular. [Spp. 3—85.]

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[10] ["*Ophioscordon* (Wallr.) (Vved., comb. nov." in the original, but Endlicher anticipated Vvedensky by almost a hundred years in according Wallroth's genus *Ophioscordum* sectional rank. —*W. T. S.*]

[11] [This statement is misleading as it stands. The name *Allium ursinum* goes back to Roman times, being used by Pliny the younger (1st cent. A. D.), and when Linnaeus gave it modern scientific validity by publication in his Species Plantarum he did not describe the plant as a new species from Gotland but referred back to earlier publications by Fuchs, Camerarius, G. Bauhin, Haller, Gmelin and Royen, as well as to his own Hort. Cliff., Gotlandska Resa, and Fl. Suec., thus establishing it as a species of northern Europe in general with no definite type-locality: —"Habitat in Europae septentrionalioris nemorosis." —*W. T. S.*]

3. A. SACCULIFERUM *Maximovich in* Mém. Acad. Pétersb. Sav. Étrang. IX (1859) 281; Kom. Opred. Rast. Dalnevost. Kraya I (1931) 366. —Exs.: Karo, Pl. Amur. et Zeaëns. no. 181.

Bulbs 1—(2) together, attached to a short vertical rhizome, oblong-ovoid, 0.75—1—(1.5) cm. thick, with black-brown, splitting, indistinctly reticulate-fibrose envelopes, surrounding the base of the scape. Scape (30)—40—60 cm. high, clothed for ¼-1/3 with smooth leaf-sheaths. Leaves (2)—3—(4), canaliculate-triquetrous, sometimes fistular at the base, smooth, 2—3—(4) mm. wide, shorter than the scape. Spathe with a beak sometimes ½ as long as the basal part of the spathe, slightly or 1/3 shorter than the umbel, persistent. Umbel usually spherical, ± many-flowered, rather dense; pedicels equal, 2—3—(4) times as long as the perianth, with bracteoles at the base. Segments of the hemispherical perianth rose-purple, with a darker nerve, 4.5—5.5 mm. long, elliptic, obtuse, the outer ones cymbiform, somewhat shorter than the inner. Filaments 1½ times as long as the perianth, connate at the base and adnate to the perianth, entire, almost equal at the base, subulate. Style strongly exserted from the perianth. Capsule almost equalling the perianth. VIII—IX.

In damp meadows. —FAR EAST: 36 Zeya-Bur., 38 Ussuri. Gen. distr.: Japan-China. Described from the middle course of the Amur. Type at Leningrad.

4. A. KOMAROVIANUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 119.

Bulb solitary (?), attached to a short vertical rhizome, ovoid, 1—1.5—(2) cm. thick, with black-brown, almost coriaceous, entire outer envelopes, scarcely embracing the base of the scape. Scape 25—60 cm. high, clothed for ½ or almost ½ with smooth leaf-sheaths. Leaves 4—7, linear, canaliculate, strongly keeled, smooth, 2—5 mm. wide, equalling or slightly shorter than the scape. Spathe with a beak sometimes ½ as long as the basal part of the spathe, approximately equalling the umbel, persistent. Umbel spherical, dense, usually many-flowered; pedicels equal, 1½—2 times as long as the perianth, with bracteoles at the base. Segments of the hemispherical perianth dirty-rose-coloured, more deeply coloured on the back, 4—4.5 mm. long, elliptic, obtuse, the outer ones cymbiform, somewhat shorter than the inner. Filaments 1½ times as long as the perianth, connate at the base and adnate to the perianth, entire, almost equal at the base, subulate. Style strongly exserted from the perianth. Capsule slightly exserted from the perianth. IX.

On dry slopes. —FAR EAST: 38 Ussuri. Gen. distr.: Japan-China (Manchuria). Described from Fadeyevka on the Suifun. Type at Leningrad.

5. A. DROBOVI *Vvedensky* in Trans. Sci. Soc. Turk. I (1923) 125.

Bulbs 1—2 together, attached to an ascending rhizome, narrowly conical, almost cylindric, 0.75—1.5 cm. thick, with coriaceous, brownish, splitting, ± reticulate (especially along the margins) envelopes. Scape robust, 50—100 cm. high, clothed for almost ½ or slightly more than ½ with smooth leaf-sheaths. Leaves 5—9, green, broadly linear, 4—15 mm. wide, flat, smooth, considerably shorter than the scape. Spathe shortly acuminate, almost equalling the umbel, persistent. Umbel spherical, many-flowered, dense; pedicels unequal, the outer ones ⅓ shorter, 2—5 times longer than the perianth, with bracteoles at the base. Segments of the almost spherical perianth greenish-whitish, the outer ones sometimes dirty purple on the back, with a greenish nerve, 4—5 mm. long, broadly oblong, obtuse, the outer ones cymbiform, scarcely shorter than the inner. Filaments almost twice as long as the perianth-segments, connate at the base and adnate to the perianth, entire, subulate from a somewhat expanded base, equal. Style exserted from the perianth. Capsule slightly longer than the perianth. VI-VII.

On stony and rubbly slopes. —C. ASIA: 49 Tien Shan (Kara Tau, S. W. spurs of the Talas Ala Tau). Endemic. Described from the Kara Tau mountains. Type at Tashkent.

6. A. OREOSCORDUM *Vvedensky* in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 95.

Bulbs 1—(2?) together, attached to an ascending rhizome, narrowly conical about 1 cm. thick, with cinnamomeous or brownish reticulate envelopes. Scape 25—50 cm. high, clothed at the base or for 1/3 with ± approximate, smooth leaf-sheaths. Leaves 5—7, linear, 3—6 mm. wide, flat, rigid, scabrid on the margin, considerably shorter than the scape. Spathe shortly acuminate, equalling the umbel, persistent; umbel spherical, many-flowered, dense; pedicels almost equal, the inner ones somewhat longer, (1½)—2—3 times as long as the inflorescence, with bracteoles at the base. Segments of the almost spherical perianth greenish-whitish, greenish or dirty purple on the back, about 4 mm. long, broadly elliptic, obtuse, the outer ones cymbiform, scarcely shorter than the inner. Filaments 1½ times as long as the perianth-segments, connate at the base and adnate to the perianth, the outer ones subulate from a slightly expanded base, the inner almost twice as wide, subulate from an almost quadrate, often bidentate base. Style exserted from the perianth. Capsule equalling the perianth. V—VII.

On stony and rubbly slopes. —ASIA: 49 Tien Shan (Chatkal range Uzankhmat mountains). Endemic. Descr. from Ungar Tyube mountains. Type at Leningrad.

7. A. FISCHERI Regel[12] in A. H. P. III, 2 (1875) 161; Kryl. Fl. Zap. Sib. III. (1929) 624.

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12 [For this species a new name appears necessary: —*Allium Eduardi* Stearn, nom. nov.; syn. *A. Fischeri* Regel (1875) non Besser in Roemer et Schultes, Syst. VII (1830) 1081. This new name is proposed in honour of Eduard August von Regel (1815-92), whose "Alliorum adhuc cognitorum Monographia" (1875) has so long been the standard work on the genus *Allium*. —*W. T. S.*]

Bulbs attached, a few together, to a rhizome, forming a ± dense tuft, cylindric-conical, 1.5—1 cm. thick, 5—8 cm. long, with rufous-brown reticulate envelopes. Scape 15—30 cm. high, clothed at the base with approximate, smooth leaf-sheaths. Leaves 2—3, semi-cylindric, about 1 mm. wide, canaliculate, smooth, usually shorter than the scape. Spathe with a long beak 3 times longer than the basal part of the spathe, slightly shorter or slightly longer than the umbel, persistent. Umbel usually hemispherical, ± few-flowered, rather lax; pedicels equal, (1½)—2—3 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth deep-rosy-violet with a darker nerve, about 5 mm. long, acute or obtuse with a short reflexed apiculus, oblong-elliptic or lanceolate, the outer ones somewhat shorter. Filaments somewhat longer than the perianth-segments, connate at the base and adnate to the perianth, the outer ones subulate, the inner bidentate at the base, 1½ times as wide as the outer. Style somewhat exserted from the perianth. Capsule 2/3 as long as the perianth. VIII.

On rocks and in stony places.—W. SIBERIA: 29 Altai (rarely). Gen. distr.: Mongolia, Dzung.-Kashg. Descr. from the Altai. Type at Leningrad.

8. A. CLATHRATUM *Ledebour,* Fl. Alt. II (1830) 18; id. Fl. Ross. IV (1852) 178; Kryl. Fl. Zap. Sib. III (1929) 627.—Ic.: Ledeb. Ic. Pl. Fl. Ross. IV (1833) t. 356[13].

Bulbs 1—2 together, attached to an ascending rhizome, cylindric-conical, 0.75—1 cm. thick, 5—10 cm. long, with brown coarsely reticulate envelopes. Scape 20—50 cm. high, terete, smooth, ribbed, clothed for 1/3 with smooth distant leaf-sheaths. Leaves 3, semi-cylindric, canaliculate, (0.5)—1—2 mm. wide, smooth, somewhat shorter than or equalling the scape. Spathe shortly acuminate, 1/3 shorter than the umbel, persistent. Umbel hemispherical or more often spherical, many-flowered, ± dense; pedicels equal, 1½—2—(3) times as long as the perianth, with numerous bracteoles at the base. Segments of the narrowly campanulate perianth rose or pale-rose with a purple nerve, 4—5 mm. long, linear or linear lanceolate, obtuse or subacute, the outer ones somewhat shorter than the inner. Filaments 1½ times or almost twice as long as the perianth, connate at the base and adnate to the perianth, the outer ones subulate, the inner twice as broad at the base, subulate from a bidentate base, more rarely entire; base longer than broad. Style strongly exserted from the perianth. Capsule slightly shorter than the perianth, with broadly elliptic valves. VII.

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[13] The group of species related to *A. lineare* (8-18) is one of the most involved groups of onions. The majority of the species included here are generally appended either to *A. lineare* or to *A. strictum,* or are even united under the one name *A. lineare.* Taxonomy and nomenclature in this group are especially difficult east of the Altai, and cannot be regarded as final.

On steppes and rubbly and stony slopes. —W. SIBERIA: 26 Ob (S. E. part), 29 Altai; E. SIBERIA: 32 Ang. —Sayan (W. part). Gen. distr.: Mongolia. Descr. from R. Charysh. Type at Leningrad.

9. A. LEUCOCEPHALUM *Turchaninov* in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 123. —*A. flavo-virens* Regel in A. H. P. X. (1887) 344, t. 8, f. 1.

Bulbs 1—2 together, attached to an ascending rhizome, cylindro-conical, 0.75—1 cm. thick, 5—8 cm. long, with brown reticulate envelopes. Scape 30—60 cm. high, terete, smooth, slightly ribbed, clothed for 1/3 with smooth leaf-sheaths. Leaves 2—3, semi-cylindric, canaliculate, fistular, 1—5 mm. wide, gradually narrowed to the apex, smooth, considerably shorter than the scape. Spathe with a beak sometimes exceeding the base of the spathe, somewhat shorter than the umbel, persistent. Umbel spherical, many-flowered, very dense, capitate; pedicels almost equal, slightly shorter or slightly longer than the perianth, with bracteoles at the base. Segments of the campanulate perianth almost white with an inconspicuous greenish or violet nerve, shining, 5—6 mm. long, oblong-elliptic, obtuse, the outer ones almost ¼ shorter. Filaments 1½ times or almost twice as long as the perianth-segments, connate at the extreme base and adnate to the perianth, yellow, the outer ones subulate, the inner twice as broad at the base, subulate from a bidentate base; base longer than broad; teeth usually equalling the base, often bifurcate. Style strongly exserted from the perianth, stigma scarcely thickened. Capsule somewhat shorter than the perianth, with broadly elliptic valves. VIII.

On steppe slopes. —E. SIBERIA: 33 Dauria. Gen. distr.: Mongolia, Kansu. Descr. from R. Dzhida. Type at Leningrad.

10. A. FLAVIDUM *Ledebour*, Fl. Alt. II (1830) 7; id. Fl. Ross. IV (1852) 179, excl. syn. Turch.; Kryl. Fl. Zap. Sib. III (1929) 628. —Ic.: Ledeb. Ic. Pl. Fl. Ross. IV (1833) 362.

Bulbs 1—2 together, attached to an ascending rhizome, cylindro-conical, 0.5—1 cm. thick, 2—4 cm. long, with brown reticulate envelopes. Scape (20)—25—50 cm. high, terete, smooth, ribbed, clothed for almost ½ with smooth leaf-sheaths. Leaves 2—4, linear, (2)—3—5—(7) mm. wide, with almost parallel margins, obtuse, often somewhat flexuous, flat, scabrid on the margin, considerably shorter than the scape. Spathe scarcely acuminate, somewhat shorter than the umbel, persistent. Umbel spherical, more rarely hemispherical, many-flowered, dense, almost capitate; pedicels almost equal to, or 1.5—(2) times longer than, the perianth, with bracteoles at the base. Segments of the campanulate perianth greenish-pale-yellow, sometimes with a reddish tinge on the back, shining, with an inconspicuous nerve, 5—6 mm. long, oblong-elliptic, obtuse, the outer ones almost ¼ shorter than the inner. Filaments 1¼ or 1½ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, yellow, the outer ones subulate, the inner twice as broad at the base, subulate from a bidentate base; base longer than broad; teeth usually equalling the base, sometimes bifurcate. Style strongly exserted from the perianth, stigma scarcely thickened. Capsule somewhat shorter than the perianth, with broadly elliptic valves. VII.

In woodland, or more rarely alpine, meadows, sometimes on stony slopes. —W. SIBERIA: 29 Alt.; C. ASIA: Dzung.—Tarb. (Tarbagatai). Gen. distr.: Mongolian Altai. Descr. from R. Byelaya [White] Uba. Type at Leningrad.

11. A. Maackii *(Maximovich) Prokhanov ex Komarov,* Opred. Rast. Dalnevost. Kraya I (1931) 366. —*A. lineare* var. *Maackii* Maxim. in Mém. Acad. Petersb. Sav. Étrang. IX (1859) 282.

Bulbs 1—2 together, attached to a short rhizome, ovoid-oblong, 1—1.5 cm. thick, 2—5 cm. long, with brown, reticulate, coriaceous, almost entire, sometimes prolonged outer envelopes. Scape (10)—20—50 cm. high, terete, smooth, ± ribbed, clothed for ¼—1/3 with smooth leaf-sheaths. Leaves 2—3, narrowly linear, 1—2—(3) mm. wide, somewhat narrowed towards the base, flat, smooth or scabrid on the margin, shorter than the scape. Spathe shortly acuminate, slightly or 1/3 shorter than the umbel, persistent. Umbel hemispherical or spherical, many-flowered, ± dense; pedicels equal, 1½—2 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a conspicuous purple nerve, 4—5 mm. long, oblong-elliptic or oblong, obtuse or subobtuse, the outer ones slightly shorter. Filaments 1½—2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as wide at the base, subulate from a bidentate base; base almost as long as broad. Style strongly exserted from the perianth. Capsule somewhat shorter than the perianth. VI—VII.

In rocky and stony places. —FAR EAST: 38 Ussuri. Endemic (?). Descr. from R. Amur: Sargu. Type at Leningrad.

12. A. splendens *Willdenow ex Roemer et Schultes,* Syst. VII, 2 (1830) 1023; Ledeb. Fl. Ross. IV (1852) 179, (excl. pl. Kamtsch.). —*A. lineare* auct. fl. Sib. orient. —Exs.: H F R no. 1242, sub *A. lineari.*

Bulbs 1—2 together, attached to a short ascending rhizome, narrowly cylindric-conical, 0.5—0.75 cm. thick, 3—7 cm. long, with brown reticulate envelopes. Scape 25—50 cm. high, slender, terete, smooth, slightly ribbed, clothed for 1/3—½ with smooth leaf-sheaths. Leaves 3—4, linear, 1—4 mm. wide, slightly narrowed towards the base, flat, scabrid on the margin, shorter than the scape, spathe shortly acuminate, somewhat shorter than the umbel, persistent. Umbel hemispherical, many-flowered, ± dense; pedicels slender, equal, 1½—2 times as long as the perianth, with numerous bracts at the base. Segments of the campanulate perianth usually bright rosy-lilac with a strong purple nerve, 3.5—4 mm. long, oblong-elliptic or oblong, obtuse, the outer ones somewhat shorter. Filaments 1½ times or almost twice as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad at the base, subulate from a bi-tri-quadri-dentate base; base usually shorter than broad. Style strongly exserted from the perianth. Capsule somewhat shorter than the perianth-segments. VII—VIII.

In light woodland, bushy places, meadows, stony slopes. —E. SIBERIA: 31 Lena Kolyma (S. part), 32 Ang.—Sayàn, 33 Dauria; FAR EAST: 36 Zeya-Bur., 37 Udsk, 38 Ussuri, 39 Sakh. Gen. distr.: Mong., Japan-China. Descr. from Siberia.

13. A. LINEARE *Linné,* Sp. Pl. (1753) 295; Ledeb. Fl. Ross. IV (1852) 178, pro max. parte; Schmalh. Fl. II (1897) 492; Kryl. Fl. Zap. Sib. III (1929) 625, excl. var. *strictum.* —Ic.: Regel, Fl. Turk.[14] (1876) t. 13, f. 1—5.

Bulbs 1—2 together, attached to an ascending rhizome, cylindric-conical, 0.5—1 cm. thick, 3—4—(6) cm. long, with brown reticulate envelopes. Scape (20)—30—60 cm. high, terete, smooth, slightly ribbed, clothed for 1/3—½ with distant smooth leaf-sheaths. Leaves 3—4, narrowly linear, 1—3 mm. wide, flat, smooth or hispid on the margin, shorter than the scape. Spathe shortly acuminate, slightly or 1/3 shorter than the umbel, persistent. Umbel spherical or hemispherical, many-flowered, comparatively lax; pedicels slender, equal, (1½)—2—3 times as long as the perianth, with numerous bracteoles at the base. Segments of the campanulate perianth rose-coloured with an inconspicuous nerve, 3.5—4—(5) mm. long, oblong-elliptic or oblong, obtuse, often with a short reflexed apiculus, the outer somewhat shorter. Filaments usually 1½—2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad at the base, subulate from a bidentate base; base longer than broad, teeth sometimes forked. Style strongly exserted from the perianth, stigma scarcely thickened. Capsule with broadly elliptic valves, equalling or slightly exceeding the perianth. VI—VII.

On steppes and meadows, more rarely in bare places. —EUROPEAN PART: 10 Volga—Kama (S. E. part), 13 Volga—Don (E. part), 14 Transvolga, 18 Lower Don, 19 Lower Volga; W. SIBERIA: 27 Upper Tob., 28 Irt., 29 Alt. (rarely); C. ASIA: 40 Aral—Casp., 41 Balkhash, 42 Dzung—Tarb. Gen. distr.: N. W. Mongolia. Described from Siberia.

14. A. STRICTUM *Schrader,* Hort. Goett. (1809) 7, t. 1; Ledeb. Fl. Ross. IV (1852) 178, excl. pl. Cauc.; Schmalh. Fl. II (1897) 492. —*A. volhynicum* Besser, Catal. Hort. Crem. Suppl. III (1814) 2. —*A. Schrenki* Regel in A. H. P. III (1875) 172. —*A. lineare* var. *strictum* Krylov, Fl. Zap. Sib. III (1929) 626. —Ic.: Fl. S. E. III (1929) fig. 179. —Exs.: Pl. Finl. exs. no. 572.

Bulbs 1—2 together, attached to an ascending rhizome, almost cylindric, 0.75—1.5 cm. thick, 6—8—(10) cm. long, with brown reticulate

14 [See footnote 5, above. —*W. T. S.*]

envelopes. Scape 40—60 cm. high, terete, smooth, ribbed, clothed for 1/3 with distant smooth leaf-sheaths. Leaves 3—4, linear, 3—5 mm. wide, flattish, rigid, scabrid on the margin, narrowed towards the apex, shorter than the scape. Spathe shortly acuminate, somewhat shorter than the umbel, persistent. Umbel hemispherical or more rarely spherical, ± many-flowered, dense; pedicels comparatively thick, almost equal, 1½—2—(3) times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured, with a strong purple nerve, 4—5 mm. long, elliptic or oblong-elliptic, obtuse, the outer somewhat shorter. Filaments usually somewhat longer than the perianth, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad at the base, usually shortly bidentate at the base, more rarely with long teeth or entire. Style exserted from the perianth; stigma almost capitate. Capsule somewhat shorter than the perianth. VI—VII.

Principally in bare places and on rocks. —EUROPEAN PART: 7 Dvina—Pechora, 10 Volga—Kama (E. part), 13 Volga—Don. (E. part), 14 Transvolga; W. SIBERIA: 26 Ob (S. part), 27 Upper Tob., 28 Irt., 29 Alt.; E. SIBERIA: 31 Lena—Kol., 32 Ang—Sayan, 33 Dauria; FAR EAST: 34 Kamch., 35 Okhotsk, 36 Zeya—Bur., 39 Sakh.; C. ASIA: 41 Balkhash, 42 Dzung.—Tarb., 49 Tien Shan (Tur Aigyr). Gen. distr.: C. Eur., Scand., Mongolia. Descr. from Siberia.

15. BOGDOICOLA *Regel* in A. H. P. VI (1880) 530.

Bulbs attached singly to an ascending rhizome, cylindric, 0.75—1 cm. thick, (4)—6—8 cm. long, with brown reticulate envelopes. Scape 20—40 cm. high, terete, smooth, slightly ribbed, clothed for 1/3, more rarely up to ½ or at the base, with smooth sometimes reddish leaf-sheaths. Leaves 3, linear, 2—4 mm. wide, flat, scabrid on the margin, with almost parallel margins, rather rigid, almost erect, obtuse, distinctly shorter than the scape. Spathe shortly acuminate, equalling, or scarcely shorter than, the umbel, persistent. Umbel spherical, many-flowered, dense, almost capitate; pedicels almost equal, equalling, or twice as long as, the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured, darker on the back with a strong purple nerve, 4—5 mm. long, oblong-linear or oblong-lanceolate, obtuse, the outer ones somewhat shorter than the inner. Filaments somewhat shorter or scarcely longer than the perianth-segments, connate at the base and adnate to the perianth, rose-coloured, the outer ones subulate, the inner 3 times as broad at the base, bidentate or entire at the base. Style exserted from the perianth; stigma scarcely thickened. Capsule scarcely shorter than the perianth, with broadly elliptic valves. VII.

In alpine meadows. —C. ASIA: 42 Dzung. —Tarb. Gen. distr.: Dzung. —Kashg. Described from the Bogdo Mats. Type at Leningrad.

Note. Very close to *A. amphibolum,* and requires further study.

16. A. AMPHIBOLUM *Ledebour,* Fl. Alt. II (1830) 5; id. Fl. Ross. VI (1852) 179; Kryl. Fl. Zap. Sib. III (1929) 624. —Ic.: Ledeb. Ic. Pl. Fl. Ross. VI (1833) tab. 357.

Bulbs 1—2 together, attached to an ascending rhizome, cylindro-conical, 1—1.5 cm. thick, (4)—6—8 cm. long, with brown reticulate envelopes. Scape 10—25 cm. high, terete, smooth, slightly ribbed, clothed at the base or for 1/3 with smooth, ± approximate, sometimes reddish sheaths. Leaves 2—4, linear, 2—5 mm. wide, flat, scabrid on the margin, somewhat narrowed towards the base and apex, usually somewhat flexuous, scabrid on the margin, obtuse, somewhat shorter than, or equalling, the scape. Spathe shortly acuminate, approximately equalling the umbel, persistent. Umbel spherical or hemispherical, dense, capitate; pedicels equal, somewhat shorter than or equalling the perianth, with bracteoles at the base. Segments of the campanulate perianth rose or rose-purple with a darker nerve, shining, 5—6 mm. long, oblong-lanceolate, or lanceolate, sub-obtuse, the outer somewhat shorter than the inner. Filaments slightly or 1½ times longer than the perianth-segments, connate at the base and adnate to the perianth, deep-rose, the outer ones subulate, the inner 1—2-toothed at the base. Style strongly exserted from the perianth; stigma scarcely thickened. Capsule somewhat shorter than the perianth, with broadly elliptic valves. VI—VII.

On stony and rubbly slopes in the alpine zone. —W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang—Sayan (S. E. part). Gen. distr.: Mongolia. Descr. from R. Charysh and from the neighborhood of Riddersk. Type at Leningrad.

17. A. Szovitsi *Regel* in A. H. P. III, 2 (1875) 171, quoad pl. Cauc.—*A. strictum* Ledebour, Fl. Ross. IV (1852) 178, quoad pl. Cauc. —*A. strictum* var. *anodon* Boissier, Fl. Or. V (1882) 247. —*A. pseudostrictum* Albov in Tr. Tifl. Bot. Sada [Bull. Tifl. Bot. Gard.] I (1895) 238.

Bulbs 1—2 together, attached to an ascending rhizome, cylindro-conical, 1—1.5 cm. thick, 3—10 cm. long, with brown reticulate envelopes. Scape 15—30 cm. high, terete, smooth, slightly furrowed, clothed for ¼ with smooth sometimes reddish leaf-sheaths. Leaves 2—3, linear, 2—4 mm. wide, flat, scabrid on the margin, obtuse, scarcely narrowed towards the base, shorter or somewhat longer than the scape. Spathe shortly acuminate, equally or somewhat shorter than the umbel, persistent. Umbel hemispherical or almost spherical, dense, almost capitate; pedicels equal, almost half as long as or somewhat longer than the perianth, thick, with a few bracteoles at the base. Segments of the campanulate perianth rose-coloured or almost white with a strong purple nerve, (5)—6—7 mm. long, lanceolate or oblong-lanceolate, obtuse or subacute, the outer ones somewhat shorter than the inner. Filaments 1½ times or almost twice as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as wide, subulate from a bidentate base or sometimes entire; base distinctly longer than broad. Style strongly exserted from the perianth, stigma almost capitate. Capsule somewhat shorter than the perianth. VII—VIII.

In mountain meadows and on stony slopes. —CAUCASUS: 20 Ciscauc., 21 Dag., 22 W., 23 E. and 24 S. Transcauc. Gen. distr.: Arm. —Krud. Descr. from the Karabagh: Kins Mts. Type at Leningrad.

18. A. BRACHYODON *Boissier,* Diagn. Pl. Or. I, 7 (1846) 117. —*A. strictum* var. *brachyodon* [(Boissier) Regel in A. H. P. III, 2 (1875) 116;] Boiss. Fl. Or. V (1882) 247. —Ic.: Fl. Turkm. II (1932) 275.

Bulbs 2—3 together, attached to an ascending rhizome, cylindric, 1—1.5 cm. thick, 5—10 cm. long, with grey-brown, coriaceous, splitting, coarsely reticulate envelopes. Scape 10—20 cm. high, terete, smooth, slightly furrowed, clothed at the base with smooth approximate leaf-sheaths. Leaves 3—4, linear, 2—3 mm. wide, flat, scabrid on the margin, equalling the scape. Spathe shortly acuminate, equalling the umbel, persistent. Umbel spherical or hemispherical, few-flowered, dense; pedicels equal, somewhat shorter than the perianth, with a few bracteoles at the base. Segments of the broadly campanulate perianth whitish, rosy on the back, with a dark purple nerve, about 5 mm. long, obtuse, the outer ones oblong, somewhat shorter than the ovate inner ones. Filaments 1½ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as wide at the base, subulate from a bidentate base; base longer than broad; teeth often themselves toothed. Style exserted from the perianth, stigma almost capitate. Capsule equalling the perianth, with rounded valves. VII.

In stony places. —C. ASIA: 45 Mountain Turkm. (Chapan Dag). Gen. distr.: Iran. Descr. from Kuh Dayen Mts. Cotype at Leningrad.

19. A. OREOPRASOIDES *Vvedensky* in Trans. Sci. Soc. Turk. II (1925) 29, t. 1.

Bulbs crowded, a few together, attached to an ascending rhizome, cylindro-conical, 0.5—1 cm. thick, with rufous-brown reticulate envelopes. Scape 20—30 cm. high, furrowed, clothed at the base with smooth approximate leaf-sheaths. Leaves 4—6, linear, 2—3 mm. wide, flat, smooth, narrowed towards the apex, somewhat flexuous, more than half as long as the scape. Spathe with a beak sometimes equalling the basal part of the spathe, ½—2/3 as long as the umbel, persistent. Umbel hemispherical or spherical, many-flowered, dense; pedicels equal, 2—3 times as long as the perianth, with bracteoles at the base. Segments of the campanulate-ovoid perianth pale rose with a purple nerve, 4—5 mm. long, almost equal, oblong-elliptic, subacute, the outer ones cymbiform. Filaments one-quarter longer than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate from a somewhat expanded base, the inner ones 1½ times as broad. Style strongly exserted from the perianth. Capsule equalling the perianth. V.

On rubbly slopes. —C. ASIA: 49 Tien Shan (Kara Tau). Endemic. Descr. from Okuz Bulak. Type at Tashkent.

20 A. OREODICTYUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 119.

Bulbs ovoid-conical, 0.75—1 cm. thick, 3—4 cm. long, attached, a few together, to a short rhizome, with brown reticulate envelopes. Scape 5—15 cm. high, slender, furrowed, smooth, clothed for ¼ or at the base with smooth leaf-sheaths. Leaves 2, filiform, 0.5—1 mm. wide, semi-cylindric, canaliculate, smooth, apparently equalling the scape. Spathe with a beak sometimes equalling half the base of the spathe, half as long as the umbel, persistent. Umbel brittle, hemispherical or almost spherical, comparatively few-flowered, lax; pedicels[15] equal, 1½—2—3 times as long as the perianth, with numerous bracteoles at the base. Segments of the broadly campanulate, almost spherical perianth rosy, with a strong dirty-green nerve, 2—3.5 mm. long, obtuse or with a short apiculus, the inner ones elliptic or oblong-elliptic, the outer ovate or oblong, slightly concave. Filaments slightly or 1½ times longer than the perianth, connate at the base and adnate to the perianth, subulate from a triangular, sometimes bluntly toothed base, which is twice as broad in the inner ones. Style scarcely exserted from the perianth. Capsule spherical, scarcely shorter than the perianth. VII.

Rubbly slopes. —C. ASIA: 48 Pam.—Al. (Mogian Darya: Sor Sai, Kshtut). Endemic. Descr. from Sor Sai. Type at Leningrad.

21. A. SCABRISCAPUM *Boissier et Kotschy* in Boiss. Diagn. Pl. Or. I, 13 (1853) 31; Boiss. Fl. Or. V (1882) 246.—Exs.: Herb. Fl. As. Med. no. 339.

Bulbs crowded, a few together, attached to a short ascending rhizome, cylindro-conical, about 1 cm. thick, with brownish reticulate envelopes. Scape 25-50 cm. high, erect, furrowed, scabrid, more rarely almost smooth, clothed at the base with smooth or scabrid or almost shaggy leaf-sheaths. Leaves 4-6, linear, 2-4 mm. wide, flat, scabrid or sometimes pilose, distinctly shorter than the scape. Spathe shortly acuminate, 1/3-2/3 as long as the umbel, persistent. Umbel hemispherical or more often spherical, many-flowered, rather lax, brittle; pedicels equal, 3-4 times as long as the perianth, with numerous bracteoles at the base. Segments of the broadly campanulate almost hemispherical perianth yellow, brownish in the herbarium, especially on the back, 4-6 mm. long, almost equal, oblong, obtuse. Filaments equalling, or 2/3 as long as, the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate from a triangular base, the inner ones twice as broad. Style exserted from the perianth. Capsule somewhat shorter than the perianth. V-VI.

On rubbly slopes in the lower mountain zone.—CAUCASUS: 24 S. Transcauc. (Nakhichevan); C. ASIA: 45 Mountain Turkm., 49 Tien-Shan (Kara-Tau, Tashkent Ala Tau). Gen. Distr.: Iran. Descr. from Mt. Elbrus. Cotype at Leningrad.

Note. The western Tien-Shan plant differs in its more strongly developed pubescence, approaching in this respect *A. trachyscordum,* which also grows in the western Tien-Shan.

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[15] [*Sphalm.* "bracteoles" in the original. —Translator's note.]

22. A. TRACHYSCORDUM *Vvedensky* in Herb. Fl. As. Med. (1925) no. 65 [in Bull. Univ. Asie Centr. *IX* (1925)].

Bulbs crowded, a few together, attached to an ascending rhizome, cylindro-conical, with brown reticulate envelopes. Scape 25-30 cm. high, erect, furrowed, very scabrid, almost pilose, clothed at the base or for ¼ with shaggy leaf-sheaths. Leaves 3-4, linear, 1.5-3 mm. wide, flat, usually hairy, more rarely only so on the margin, distinctly shorter than the scape. Spathe shortly acuminate, ⅓-½ as long as the umbel, persistent, externally scabrid. Umbel hemispherical, more rarely spherical, many-flowered, lax; pedicels equal, 2-4 times as long as the perianth, with numerous bracteoles at the base. Segments of the broadly campanulate perianth reddish-violet, cinnamomeous in the herbarium, usually 7 mm., more rarely 5-6 mm. long, almost equal, oblong-lanceolate, acute, very rarely obtuse. Filaments somewhat shorter than the perianth, connate at the extreme base and adnate to the perianth, entire, subulate from a somewhat expanded base, the inner somewhat broader. Style somewhat exserted from the perianth. Capsule 2/3 as long as the perianth. VI-VII.

On outcrops of particoloured rocks and on stony slopes.—C. ASIA: 49 Tien Shan (Kara Tau, Alexander Range, Chu-Ili Mts.). Endemic. Descr. from Alexander Range: Uch Bulak. Type at Tashkent.

2. A. GUSARICUM *Regel* in A.H.P. X (1887) 349, tab. 3, fig. 3.

Bulbs crowded, a few together, attached to a short ascending rhizome, cylindric-conical, about 0.5 cm. thick, with brownish reticulate envelope. Scape 5-15 cm. high, slender, furrowed, smooth, clothed at the base with scabrid or pilose leaf-sheaths. Leaves 3-4, narrowly linear, 0.5-1.5 mm. wide, apparently flat, pilose, distinctly shorter than the scape. Spathe shortly acuminate, 1/2-2/3 as long as the umbel, persistent. Umbel fasciculate or hemispherical, few-flowered, lax; pedicels equal, 1½-2 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth, in the herbarium, violet with a cinnamomeous tinge, 7-8 mm. long, almost equal, linear-lanceolate, attenuate, acute. Filaments 2/3 as long as the perianth-segments, connate, entire, the outer ones triangular-subulate, the inner twice as broad, narrowly triangular. Style not exserted from the perianth. Capsule ½ as long as the perianth. VI-VII.

On stony slopes.—C. ASIA: 48 Pam.-Al. (Zeravshan valley). Endemic. Described without indication of native country. Type at Leningrad: Zeravshan valley: Guzar-Kshtut.

24. A. INCONSPICUUM *Vvedensky* in Not. Syst. Herb. Horti. Bot. Petrop. V (1924) 93.—*A. tataricum* auct. fl. As. Med., p.p.

Bulbs 1-4 together, attached to an oblique rhizome, oblong-ovoid, 0.5-0.75-(1.5) cm. thick, 1-1.5-(3) cm. long, with brown reticulate envelopes. Scape 15-30 cm. high, slender, clothed at the base with smooth or more rarely scabrid leaf-sheaths. Leaves 1-2, narrowly linear, often almost filiform, 0.5-1 mm. wide, canaliculate, smooth or more rarely scabrid on the margin and nerve, somewhat shorter than the scape. Spathe shortly acuminate, 1/3-1/2 as long as the umbel, persistent. Umbel fasciculate, few-flowered, rather lax; pedicels almost equal, half as long as, equal to, or longer than the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth pale dirty-violet, cinnamomeous-violet on the back, 8-11 mm. long, almost equal, linear-lanceolate or oblong-lanceolate, attenuate, acute. Filaments scarcely more than half as long as the perianth-segments, connate, and adnate to the perianth, for 1/3, entire, the outer ones triangular-subulate, the inner narrowly subulate, twice as broad as the outer; anthers violet. Style not exserted from the perianth. Capsule half as long as the perianth, with almost circular emarginate valves devoid of cartilagineous teeth. IV-V.

On foothills, principally on outcrops of particoloured rocks.—C. ASIA: 48 Pam.-Al. (Nura Tau, low mountains along left bank of Zeravshan), 49 Tien Shan (W. Tien Shan). Endemic. Descr. from the station of Ziadin and the Tashkent-Chimkent particoloured [? rock, ? soil] region. Type at Leningrad.

Note. In the Kara Tau mountains examples are sometimes met with which, in flower colour (judging from the herbarium), approach the race of *A. Barszczewskii* that prevails there.

25. A. DREPANOPHYLLUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 120.

Bulbs 1-3 together, attached to an oblique rhizome, (0.5)-0.75-1.5 cm. thick, (1.5)-3-6 cm. long, with brown reticulate envelopes. Scape 15-45 cm. high, clothed at the base with scabrid or smooth leaf-sheaths. Leaves 4-5, linear, 2.5-10 mm. wide, flat, falcately curved, obtuse, smooth or scabrid on the margin, shorter than the scape. Spathe shortly acuminate, slightly or 1/2-(2/3) shorter than the umbel, persistent. Umbel fasciculate or fasciculate-spherical, comparatively few-flowered, rather lax; pedicels unequal, 1½-2, in fruit 3 times as long as the perianth, with a few bracteoles at the base. Segments of the narrowly campanulate perianth cinnamomeous-violet, more deeply coloured on the back, 8-10 mm. long, equal, linear-lanceolate, attenuate, acute. Filaments half as long as the perianth-segments, and connate, entire; the outer ones triangular-subulate, the inner twice as broad, triangular; anthers violet or yellow. Style exserted from the perianth. Capsule half as long as the perianth, with almost circular emarginate valves devoid of cartilagineous teeth. V.

In the lower mountain zone, principally on outcrops of particoloured rocks.—C. ASIA: 48 Pam.-Al. (S. W. part). Endemic. Descr. from the Baisun region: Khodzha Ipak. Type at Leningrad.

Note. A. drepanophyllum represents, together with *A. inconspicuum,* a very aberrant form with broad falcate leaves, in this respect approaching *A. xiphopetalum.* Its relation to *A. inconspicuum,* as accepted here, requires further study.

26. A. XIPHOPETALUM *Aitchison et Baker* in Trans. Linn. Soc. ser. 2, Bot. III, 1 (1888) 118, t. 48. —*A. tataricum* Boiss. Fl. Or. V (1882) 246, quoad pl. Kotschyanam.

Bulbs 1-3 together, attached to an oblique rhizome, narrowly conical or ovoid-conical, 0.75-1 cm. thick, 3-4 cm. long, with light-brown finely reticulate envelopes. Scape (20)-30-40 cm. high, clothed at the base or for ⅓ with smooth leaf-sheaths. Leaves 3-4, linear, 3-5-(10) mm. wide, flat, falcate, obtuse, smooth, or scabrid on the margin, scarcely more than ½ as long as the scape. Spathe shortly acuminate, somewhat shorter than the umbel, persistent. Umbel fasciculate or hemispherical, few-flowered, dense; pedicels almost equal, half as long as, equalling, or (in fruit) twice as long as, the perianth, with a few bracteoles at the base. Segments of the campanulate perianth rosy-violet with a darker nerve, 9-12 mm. long, attenuate, subacute, the outer ones oblong-lanceolate, somewhat longer than the inner lanceolate ones. Filaments 2/3-3/4 as long as the perianth-segments, connate and adnate to the perianth half-way, entire, the outer ones triangular-subulate, the inner ones twice as broad, triangular; anthers generally violet. Style not exserted from the perianth. Capsule half as long as the perianth, with almost circular emarginate valves devoid of cartilagineous teeth. IV-V.

On stony slopes.—C. ASIA: 45 Mountain Turkm., 48 Pam.-Al. (Pistali Tau, Sulyukta). Gen. distr.: Iran. Descr. from the Parapamisus. Cotype at Leningrad.

27. A. Barszczewskii *Lipsky* in A.H.P. XVIII (1900) 114.—*A. tataricum* auct. fl. As. Med., p. p.—Ic.: Regel, Fl. Turk. (1876) t. 14, f. 1-5.

Bulbs (1)-2—few together, attached to an oblique rhizome, elongate-conical or ovoid-conical, 0.75-1.5 cm. thick, 3-5 cm. long, with brown reticulate envelopes. Scape 20-60 cm. high, clothed for ⅓ with smooth or (the lower ones) scabrid leaf-sheaths. Leaves 3-5, linear, 1-3 mm. wide, canaliculate, smooth, or scabrid on the margin, shorter than the scape. Spathe shortly acuminate, (⅓)-½ as long as the umbel, persistent. Umbel fasciculate or fasciculate-hemispherical, usually many-flowered, mostly dense; pedicels unequal, somewhat shorter than, equal to, or 2-(3) times as long as, the perianth, generally without bracteoles at the base. Segments of the campanulate perianth white, pale-rose, rose or rosy-violet, 7-14 mm. long, equal, more rarely the outer ones ¼ shorter, linear-lanceolate, lanceolate or oblong-lanceolate, attenuate, acute. Filaments 1/2-2/3 as long as the perianth-segments, connate and adnate to the perianth for 1/3-1/2 entire, the outer ones triangular-subulate, the inner triangular, 2-3 times as wide as the outer; anthers yellow. Style not exserted from the perianth; capsule 1/2-2/3 as long as the perianth, with valves devoid of cartilagineous teeth. V-VIII.

On stony, more rarely on earth slopes, from the lower to the upper mountain zone.—C. ASIA: 48 Pam.-Al., 49 Tien Shan. Endemic. Descr. from Karategin: Sary Kuh-i-Kalon pass. Type at Leningrad.

28. A. lutescens *Vvedensky* in Herb. Fl. As. Med. (1935) no. 610.

Bulbs 1-2 together, attached to an oblique rhizome, elongate-conical or ovoid-conical, 0.75-1 cm. thick, 2-5 cm. long, with brown reticulate envelopes. Scape 20-35 cm. high, clothed for ⅓ or almost ½ with smooth leaf-sheaths. Leaves 3-5, linear, 1-2.5 mm. wide, canaliculate, smooth, approximately equalling the scape. Spathe shortly acuminate, 1/2-2/3 as long as the umbel, persistent. Umbel fasciculate or fasciculate-hemispherical, ± many-flowered, dense; pedicels almost equal, somewhat shorter than or 1½-(2) times as long as the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth pale-yellow, 8-12 mm. long, almost equal, linear-lanceolate, very attenuate, acute. Filaments ½ as long as the perianth-segments, connate and adnate to the perianth for ½, entire, the outer ones triangular-subulate, the inner ones twice as broad, triangular; anthers yellow. Style not exserted from the perianth. Capsule half as long as the perianth, with almost circular emarginate valves devoid of cartilagineous teeth. V.

On rubbly and stony slopes.—C. ASIA: 49 Tien Shan. Endemic. Descr. from R. Mashat. Type at Tashkent.

Note. Known from a very restricted area in the north-western foothills of the Talas Ala Tau, where it has been gathered by many collectors.

29. A. LONGIRADIATUM *(Regel) Vvedensky* in Opred. Rast. Okrest. Tashk. [Key Pl. Neighb. Tashk.] I (1923) 67. *A. tataricum* var. *longiradiatum* Regel in A. H. P. III, 2 (1875) 180.—Ic.: Regel, Fl. Turk. (1876) t. 14, f. 6.—Exs.: Herb. Fl. As. Med. no. 60.

Bulbs 1-2-(4) together, attached to an oblique rhizome, ovoid-conical or elongate-conical, 0.75-1.5 cm. thick, 2-5-(7) cm. long, with brown reticulate envelopes. Scape 25-50 cm. high, clothed for 1/3 with smooth or (the lower, often) scabrid sheaths. Leaves 4-5, linear, 1-3 mm. wide, canaliculate, fistular, smooth or scabrid, often shorter than the scape. Spathe shortly acuminate, ⅛-¼ as long as the umbel, persistent. Umbel spherical, more rarely hemispherical, many-flowered, lax; pedicels almost equal, 4-6 times as long as the perianth, with bracteoles at the base, the outer ones usually ascending. Segments of the narrowly campanulate perianth purple-violet, 7-9 mm. long, almost equal, linear-lanceolate, attenuate, acute. Filaments ½ as long as the perianth-segments, connate and adnate to the perianth for ½, entire, the outer ones triangular-subulate, the inner 3 times as broad, triangular. Style not exserted from the perianth; ovary without a corona [cf. no. 33, *A. stephanophorum*]. Capsule half as long as the perianth. V.

On foothills, principally on outcrops of particoloured rocks.—C. ASIA: 49 Tien Shan (Tashkent Ala Tau). Endemic. Descr. from neighbourhood of Tashkent. Type at Tashkent.

30. A. DOLICHOMISCHUM *Vvedensky* in Herb. Fl. As. Med. (1935) no. 606.

Bulbs 1-2-(3) together, attached to an oblique rhizome, oblong-ovoid or conic-ovoid, (0.5)-0.75-1 cm. thick, 1.5-3 cm. long, with brown finely reticulate envelopes. Scape (10)-20-90 cm. high, clothed for ¼-⅓ with smooth leaf-sheaths. Leaves 4-5, linear, (1)-3-4 mm. wide, flat, twisted, falcately curved, smooth, shorter than the scape. Spathe shortly acuminate, ¼-1/3-(½) as long as the umbel [*sphalm* "perianth"], persistent. Umbel hemispherical, generally many-flowered, lax; pedicels almost equal, (2)-3-4 times as long as the perianth, with bracteoles at the base. Segments of the narrowly campanulate perianth generally pale-violet with a dark-violet nerve, more rarely dark-violet, 5-7 mm. long, equal, linear-lanceolate or lanceolate, attenuate, acute, the outer ones somewhat broader. Filaments 2/3 as long as the perianth-segments, connate and adnate to the perianth for ⅓, entire, the outer ones triangular-subulate, the inner twice as broad, narrowly triangular; anthers yellow or violet. Style not exserted from the perianth; ovary without a corona. Capsule 2/3 as long as the perianth. V-VI. (Tab. XI. fig. 1a).

In the intermediate mountain zone, on outcrops of particoloured rocks (always?).—C. ASIA: 48 Pam.—Al. (W. part of Hissar range, Mt. Chulbair). Endemic. Descr. from Mt. Chulbair: Sina. Type at Tashkent.

31. A. DOLICHOSTYLUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 120.

Bulbs 1-3 together, attached to a short rhizome, elongate-conical or ovoid-conical, 0.5-1.5 cm. thick, 1.5-4 cm. long, with brown reticulate envelopes. Scape 30-70 cm. high, clothed for ¼-1/3 with smooth, more rarely scabrid leaf-sheaths. Leaves 4-5, linear, 1.5-4 cm. wide, canaliculate, generally scabrid on the margin, shorter than the scape. Spathe shortly acuminate, ½-2/3 as long as the umbel, persistent. Umbel usually hemispherical, more rarely fasciculate-hemispherical or almost spherical, many-flowered, dense; pedicels almost equalling, equalling, or 1.5(2) times as long as, the perianth, with a few bracteoles at the base. Segments of the narrowly campanulate perianth rose-coloured with a darker nerve, (5)-7-9 mm. long, equal, attenuate, acute, the inner ones lanceolate or linear-lanceolate, the outer oblong-lanceolate or lanceolate. Filaments equalling, or scarcely longer than, the perianth-segments, connate and adnate to the perianth for 1/6, entire, the outer ones triangular-subulate, the inner narrowly triangular, 1½ times as broad as the outer; anthers usually yellow. Style exserted from the perianth. Capsule ½ as long as the perianth, with almost circular emarginate valves devoid of cartilagineous teeth. VI-VII.

Stony and rubbly slopes of the intermediate mountain zone.—C. ASIA: 48 Pam.—Al. (Alai range), 49 Tien Shan. Endemic. Descr. from Sary Chilek. Type at Leningrad.

NOTE. In the Chatkal range there have repeatedly been collected small-flowered (5-6 mm.) examples, requiring further study.

32. A. INDERIENSE *Fischer ex Bunge* in Goebel, Reise . . . II (1838) 311.—*A. tataricum* Ledebour, Fl. Ross. IV (1852) 185; Boiss. Fl. Or. V (1882) 246, quoad pl. Lehmannianam.—*A. diaphanum* Janka, Linnaea XXX (1860) 605.—*A. Beckerianum* Regel, Ind. Sem. Horti Petrop. (1860) 30.—Ic.: Fl. Yugo-Vostoka [South-East] III (1929) fig. 180.

Bulbs 1-4 together, attached to an oblique rhizome, ovoid-conical, 0.75-1.5 cm. thick, 1-3-(4) cm. long, with brown reticulate envelopes. Scape 20-40 cm. high, clothed at the base or for ¼ with smooth leaf-sheaths. Leaves 3-5, linear, 1-3 mm. wide, canaliculate, generally scabrid on the margin, shorter than the scape. Spathe with a short beak, half as long as the umbel, persistent. Umbel fasciculate or fasciculate-hemispherical, more rarely hemispherical, comparatively few-flowered, dense; pedicels almost equal, half as long as, equal to, or (in fruit) 1½ times as long as, the perianth, with a few bracteoles at the base. Segments of the campanulate perianth rosy-violet with a darker nerve, 7-10 mm. long, equal, attenuate, acute, the outer ones oblong-lanceolate, the inner lanceolate. Filaments equalling the perianth-segments, connate and adnate to the perianth for 1/5, entire, the outer ones triangular-subulate, the inner 1½ times as broad, narrowly triangular; anthers violet. Style exserted from the perianth. Capsule half as long as the perianth, with almost circular emarginate valves devoid of cartilagineous teeth. V-VI.

Salt-marshy steppes.—EUROPEAN PART: 19 Lower Volga; W. SIBERIA: 27 Upper Tob. (S. E. part); C. ASIA: 40 Aral-Casp., 41 Balkhash. Endemic. Descr. from Lake Inder. Type at Leningrad.

33. A. STEPHANOPHORUM *Vvedensky* in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 94.—*A. tataricum* auct. fl. As. Med., p. p.

Bulbs 1-4 together, attached to an oblique or ascending rhizome, elongate-conical or oblong-ovoid, 0.5-1.5 cm. thick, 2-5 cm. long, with rufous-brown reticulate envelopes. Scape 15-50 cm. high, clothed at the base with smooth or (especially the lower) scabrid leaf-sheaths. Leaves 3-5, narrowly linear, 0.5-2.5 mm. wide, slightly canaliculate, often recurved, generally scabrid on the margin. Spathe shortly acuminate, ½-2/3 as long as the umbel, persistent. Umbel fasciculate or almost hemispherical, comparatively few-flowered, ± dense; pedicels unequal, half as long as or slightly longer than (in fruit twice as long as) the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth dirty-violet or rosy-violet (?) with a darker nerve, attenuate, subacute or subobtuse, the outer ones (6)—8-12 mm. long, linear-lanceolate or lanceolate, ¼ longer than the inner lanceolate or oblong-lanceolate ones. Filaments half as long as the perianth-segments, connate and adnate to the perianth for ½, entire, the outer ones triangular-subulate, the inner almost 3 times as broad, triangular; anthers yellow. Style not exserted from the perianth; ovary with cartilagineous teeth at the apex, forming a corona surrounding the base of the style. Capsule half as long as the perianth. V.

On clayey and rubbly slopes in the lower mountain zone.—C. ASIA: 48 Pam.—Al. (Turkestan range, Nura Tau, low mountain region of Baisun, Shurab), 49 Tien Shan (Mogol Tau). Endemic. Descr. from Turkestan range. Type at Leningrad.

Note. In the Kyzyl Kum (Ak Tau, Changhildy), plants have been collected, very close to *A. stephanophorum,* but differing in their equal perianth-segments; they require further study.

34. A. TENUICAULE *Regel* in A. H. P. X (1887) 348, t. 4, f. 4.—*A. tataricum* auct. fl. As. Med., p. p.

Bulbs 2-6 together, attached to a rhizome, ovoid-conical, 0.5-0.75 cm. thick, 1-2 cm. long, with brown reticulate envelopes. Scape 10-20-(30) cm. high, slender, clothed for ¼-⅓ with smooth or scabrid leaf-sheaths. Leaves 2-3, almost filiform, convolute, scabrid on the margin. Spathe shortly acuminate, somewhat shorter than the umbel, persistent. Umbel fasciculate or almost hemispherical, generally few-flowered, dense; pedicels almost equal, half as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth deep-rose, 7-8 mm. long, almost equal, acute, the outer ones oblong, 1½ times as broad as the inner lanceolate ones; Filaments 2/3 as long as the perianth-segments, connate and adnate to the perianth for ½, entire, the outer ones triangular-subulate, the inner twice as broad, triangular; anthers yellow. Style not exserted from the perianth; ovary at the apex with cartilagineous teeth, forming a corona surrounding the base of the style. Capsule 2/3 as long as the perianth. VI-VII.

Rubbly and stony slopes in the alpine zone.—C. ASIA: 48 Pam.Al. (Zeravshan valley, Chulbair and Kuh-i-Tang mts.). Endemic. Descr. from Zeravshan valley. Type at Leningrad.

35. A. OREOPRASUM *Schrenk* in Bull. Scient. Acad. Pétersb. X (1842) 354; Ledeb. Fl. Ross. IV (1852) 185.—Ic.; Regel, Fl. Turk. (1876) t. 14, f. 7-9.

Bulbs crowded, a few together, attached to a horizontal rhizome, cylindro-conical, 1-1.5 cm. thick, with rufous-brown reticulate envelopes. Scape 20-40 cm. high, slightly ribbed, almost ancipitous above. Leaves 3-5, narrowly linear, 1-4 mm. wide, ± canaliculate, scabrid on the margin or smooth, congregated at the base of the stem, somewhat shorter than the scape. Spathe shortly acuminate, 1/2-2/3 as long as the umbel, persistent. Umbel fasciculate or fasciculate-hemispherical, ± few-flowered; pedicels equal, 1½-2-(3) times as long as the perianth, with bracteoles at the base. Segments of the hemispherical perianth rosy with a strong dirty-purple nerve, 5-7 mm. long, almost equal, broadly elliptic, with acute reflexed apiculi. Filaments ½-2/3 as long as the perianth-segments, connate and adnate to the perianth for ⅓, entire, subulate from a triangular base, the inner ones twice as broad, almost broadly triangular. Style not exserted from the perianth. Capsule somewhat shorter than the perianth. V-VII.

On rocks and stony slopes. —C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), 48 Pam.-Al. (Alai range, Pamir), 49 Tien Shan (C. Tien Shan, Alexander range, Talas Ala Tau). Gen. distr.: Dzung.-Kashg., Tibet. Descr. from Kul Asu. Type at Leningrad.

NOTE. The localities Kara Tau *(Mayev)* and Guberlin Mts. *(Regel)* are very doubtful.

36. A. ODORUM Linné[16] Mant. (1767) 62; Ledeb. Fl. Ross. IV (1852) 185; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 127; Krylov, Fl. Zap. Sib. III (1929) 630; Kom. Opred. Rast. Delnevost. Kraya I (1931) 365.—*A. tataricum* Linné fil. Suppl. (1781) 196.-Ic.: Redouté, Lil. II (1804) t. 98.—Exs.: H F R, no. 1241.

Bulbs 1-3 together, rarely more, attached to a horizontal rhizome, narrowly cylindric-conical, scarcely distinguishable, with rufous-brown reticulate envelopes. Scape (15)-30-50 cm. high, slightly ribbed. Leaves 2-3, narrowly linear, (1.5)-2-4 mm. wide, congregated at the base of the stem, somewhat shorter than the stem. Spathe shortly acuminate, ½-2/3[17] as long as the umbel, persistent. Umbel fasciculate or fasciculate-hemispherical, ± many-flowered, dense; pedicels equal, 2-3 times as long as the perianth, with bracteoles at the base. Segments of the almost stellate perianth white with a greenish nerve, 6-9 mm. long, almost equal, lanceolate or elliptic, obtuse or subacute. Filaments 2/3 as long as the perianth-segments, connate and adnate to the perianth for ¼, entire, subulate from a somewhat expanded base, almost equal. Style not exserted from the perianth. Capsule about 5 mm. long. VII-VIII.

In meadows and salt-marshy places, and on slopes; rarely as a weed. Cultivated in the Far Eastern Region.—W. SIBERIA: 28 Irt. (E. part), 29 Alt.; E. SIBERIA: 31 Lena-Kolyma, 32 Ang.-Sayan, 33 Dauria; FAR EAST: 36 Zeya-Bur., 38 Ussuri; C. ASIA (introduced): 48 Pam.-Al. (Roshan), 49 Tien Shan (Alexander range). Gen. distr.: India-Himal., Japan-China, Tibet. Descr. from C. Europe.

NOTE. Prokhanov (Bull. Appl. Bot. XXIV, 2 (1930) 175) segregates the cultivated plant as a separate species under the name *A. Chinense* Don, distinguishing it by its flat keeled leaves and white flowers. I have observed precisely the same characteristics (judging from the herbarium) in the wild *A. odorum.*

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[16] ["*A. odorum*" of authors covers at least two distinct species:—

1) *A. RAMOSUM Linné,* Sp. Pl. I (1753) 296. —*A. odorum Linné,* Mantissa (1767) 62. —*A. tataricum* Linné fil., Suppl. Pl. (1781) 196. —Illust.: —Redouté, Lilic. II (1804) t. 98; Bot. Mag. XXVIII (1808) t. 1142.

Leaves slightly fistulose. Perianth somewhat campanulate; segments white with a purplish nerve, 6-10 mm. long, lanceolate—oblong. Filaments half as long as the perianth-segments, reddish. Capsule with valves broadest below the middle, clasped by the withered perianth-segments. VI-VII. W. & E. Siberia.

2) *A. TUBEROSUM Rottler ex Sprengel,* Syst. II (1825) 38. —*A. tuberosum* Roxburgh. Hort. Beng. (1814) 24, nomen nudum; Roxburgh, Fl. Indica, 2nd ed. II (1832) 141. —*A. uliginosum* G. Don, Mon. Allium (1827) 60. —*A. Roxburghii* Kunth, Enum. Pl. IV (1843) 454. —"*A. chinense*" Prokhanov in Bull. Appl. Bot. Leningrad, XXIV, 2 (1931) 164, 176, 181, non G. Don. —Illust.: —Iinuma, Somoku Dzus. 3rd ed. VI (1910) t. 42; Bull. App. Bot. l. c.

Leaves not fistulose. Perianth stellate; segments white with a faint brownish or greenish nerve, 4-7 mm. long, narrowly ovate. Filaments four-fifths the length of the perianth segments, white. Capsule with valves broadest above the middle, the withered perianth-segments reflexed from it. VIII-X. Far East; much cultivated as a salad plant. —*W. T. S.*]

[17] ["½—2 times shorter" in the original, presumably sphalm. for "1½—2 times shorter", *i. e.* "½—2/3 as long." —Translator's note.]

37. A. ANGULOSUM *Linné,* Sp. Pl. (1753) 299; Ledeb. Fl. Ross. IV (1852) 180; Kryl. Fl. Zap. Sib. III (1929) 619.—*A. acutangulum* Schrader, Cat. Sem. Hort. Goett. (1808); Schmalh. Fl. II (1897) 494.—*A. laxum* G. Don, Mon. (1827) 63.—Ic.: Syreishch. Ill. Fl. Mosc. Gov. I (1906) 236.—Exs.: Kerner, Fl. exsicc. Austro-Hung. no. 3481.

Bulbs 1-2-(3) together, attached to a horizontal or ascending rhizome, narrowly conical, 0.5-0.75 cm. thick, with greyish, membranous, almost entire envelopes. Scape 25-50 cm. high, angular, slender. Leaves 5-6, congregated at the base of the scape, ± carinate, narrowly linear, 2-4 mm. wide, obtuse, smooth, erect, more than half as long as the scape. Spathe shortly acuminate, half as long as the umbel, persistent. Umbel fasciculate-hemispherical or more often hemispherical, many-flowered, ± dense; pedicels equal, 2-3 times as long as the perianth, with a few bracteoles at the base. Segments of the broadly campanulate perianth rosy-violet, with an inconspicuous nerve, 6-(7) mm. long, acute, oblong, almost equal. Filaments slightly or 1/4 shorter than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate from a somewhat expanded base, the inner ones somewhat broader. Style not exserted from the perianth. Capsule scarcely more than 2/3 as long as the perianth. VI-VIII.

In meadows.—EUROPEAN PART: 6 Karelian Lapl., 7 Dvina-Pechora, 8, Ladoga—Ilmen, 9 Upper Volga, 10 Volga—Kama, 11 Upper Dnepr, 13 Volga-Don, 14 Transvolga, 16 Black Sea, 18 Lower Don, 19 Lower Volga; W. SIBERIA: 26 Ob, 27 Upper Tob., 28 Irt., 29 Alt.; E. SIBERIA: 32 Ang.-Sayan (W. part). Gen. distr.: C. Eur. Descr. from Siberia.

38. A. ALBIDUM *Fischer ex Besser,* Enum. Pl. Volhyn. (1822) 55; Ledeb. Fl. Ross. IV (1852) 181, quoad pl. Cauc.; Schmalh. Fl. II (1897) 494.—*A. angulosum* var. *caucasicum* Regel in A. H. P. III, 2 (1875) 145. —Ic.: Reichb. Ic. Pl. Crit. (1827) f. 592.

Bulbs 2-4 together, attached to a horizontal rhizome, conical, 0.75-1 cm. thick, with greyish, membranous, ± entire envelopes. Scape 20-30 cm. high, ± angular, ribbed. Leaves 6, narrowly linear, 1-2-(4) mm. wide, flattish, canaliculate, apparently somewhat fleshy, obtuse, generally smooth, approximately half as long as the scape. Spathe shortly acuminate, 2/3 as long as the umbel, persistent. Umbel hemispherical or almost spherical, many-flowered, dense; pedicels equal, slightly or usually 1½-2 times longer than the perianth, without bracteoles. Segments of the hemispherical almost stellate perianth white, sometimes with a reddish tinge, with an inconspicuous nerve, 4-5 mm. long, obtuse, oblong or oblong-elliptic, entire, the outer ones cymbiform, 1/4 shorter than the inner. Filaments equalling or scarcely exceeding the perianth-segments, connate at the extreme base and adnate to the perianth, entire or sometimes the inner ones bidentate, the outer triangular-subulate, the inner narrowly triangular, 1½ times as broad as the outer. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VII.

In rocky places.—EUROPEAN PART: 17 Crimea; CAUCASUS: 20 Ciscauc., 21 Dag., 23 E. & 24 S. Transcauc. Gen. distr.: Arm.-Kurd. Descr. from Caucasus.

39. A. FLAVESCENS *Besser* Enum. Pl. Volhyn. (1822) 56; Schmalh. Fl. II (1897) 494.—*A. albidum* Ledebour Fl. Ross. IV (1852) 181, p.p; Krylov, Fl. Zap. Sib. III (1929) 621.—Exs.: H F R no. 1496, sub *A. albido.*

Bulbs crowded, a few together, attached to a horizontal rhizome, conical, 0.5-0.75 cm. thick, with blackish, almost coriaceous, ± entire envelopes. Scape 10-30 cm. high, slender, erect, often flexuous, slightly ribbed. Leaves 6-8, filiform, semicylindric, canaliculate, 0.5-0.75 mm. wide, scabrid on the margin, slightly shorter than or half as long as the scape. Spathe half as long as the umbel, shortly acuminate, persistent, umbel fasciculate-hemispherical or hemispherical, many-flowered, dense; pedicels equal, 2-3-(4) times as long as the perianth, without bracteoles at the base. Segments of the hemispherical perianth yellowish with an inconspicuous nerve, 3-4 mm. long, oblong-lanceolate or oblong, almost entire, the stiff[18] outer ones slightly or ¼ shorter than the inner, cymbiform. Filaments equalling or somewhat exceeding the perianth segments, connate at the extreme base and adnate to the perianth, entire, subulate, the inner ones almost 1½ times as broad. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VI-VII. (Tab. X, fig. 1 a).

On steppes and slopes.—EUROPEAN PART: 10 Volga-Kama (S. part), 12 Middle Dnepr, 13 Volga-Don, 14 Transvolga, 16 Black Sea, 18 Lower Don; W. SIBERIA: 27 Upper Tob., 28 Irt. Endemic (?). Descr. from S. Russia.

40. A. STELLERIANUM *Willdenow,* Sp. Pl. II (1799) 82; Ledeb. Fl. Ross. IV (1852) 181, quoad var. *a.*

Bulbs crowded, a few together, and attached to a horizontal rhizome, narrowly conical, 0.5-1 cm. thick, with brownish or blackish, membranous or almost coriaceous, ± entire envelopes. Scape 10-30 cm. high, slender, erect, slightly ribbed. Leaves 4-6, congregated at the base of the scape, semi-cylindric, canaliculate, 0.75-1.5 mm. wide, scabrid on the margin, somewhat shorter than the scape. Spathe 2/3 as long as the umbel, shortly acuminate, persistent. Umbel spherical, more rarely hemispherical, ± few-flowered, dense, often almost capitate; pedicels equal, slightly or 1½-(2) times longer than the perianth, without bracteoles at the base. Segments of the hemispherical perianth yellow, sometimes with a rosy tinge, with an inconspicuous nerve, (4)-5 mm. long, broadly elliptic or ovate, obtuse, entire, the outer ones cymbiform, somewhat shorter than

18 [There is probably a printer's error here: the passage should almost certainly read: "segments . . . oblong, almost entire, *obtuse,* the outer ones slightly or ¼ shorter . . . " —*Translator's note.*]

the inner. Filaments slightly or 1½ times longer than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, the inner almost 1½ times as broad. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VII-VIII.

On slopes.—W. SIBERIA: 29 Alt. (?); E. SIBERIA: 32 Ang.-Sayan. Gen. distr.: Mongolia. Descr. from the Yenisei.

41. A. PROSTRATUM *Treviranus,* Ind. Sem. Hort. Wratislaw. (1821); id. All. (1822) 16; Ledeb. Fl. Ross. IV (1852) 182; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 125.—Ic.: Trev. in Acta Acad. Leop.-Carol. XII, 1 (1826) t. 11.

Bulbs 2 (?) together, attached to a horizontal rhizome, cylindric, 0.5-0.75 cm. thick, with brownish almost coriaceous, ± entire envelopes. Scape slender, weak, ascending, slightly ribbed, 10-25 cm. high. Leaves 5-8, congregated at the base of the scape, semicylindric, canaliculate, 0.75-1.5 mm. wide, scabrid on the margin, somewhat shorter than the scape. Spathe ⅓-½ as long as the umbel, shortly acuminate, persistent. Umbel hemispherical or almost spherical, few-flowered, ± lax; pedicels equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the almost spherical perianth rosy-violet with an inconspicuous nerve, about 5 mm. long, oblong or more rarely oblong-ovate, obtuse, the inner ones ± crenate, somewhat longer than the cymbiform outer ones. Filaments equalling or more rarely scarcely exceeding the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, the inner ones 1½ times as broad. Style exserted from the perianth. Capsule equalling the perianth. VII.

In stony places.—E. SIBERIA: 31 Lena-Kolyma, 32 Ang.-Sayan (E. part), 33 Dauria. Gen. distr.: Mongolia. Descr. from Pribaikal Siberia.

NOTE. The plant from the Lena-Kolyma region deserves further study—it has often strongly exserted stamens; the flowers, apparently (to judge from the herbarium), sometimes have a yellowish tinge.

42. A. RUBENS *Schrader ex Willdenow,* Enum. Pl. Hort. Berol. I (1809) 360.—*A. Stellerianum* Ledebour Fl. Ross. IV (1852) 181, quoad var. *b;* Kryl. Fl. Zap. Sib. III (1929) 620.—Ic.; Ledeb. Ic. Pl. Fl. Ross. IV (1833) t. 384.

Bulbs crowded a few together, attached to a horizontal rhizome, narrowly conical, 0.5-1 mm.[19] thick, with brownish, almost coriaceous, ± entire envelopes. Scape 10-25 cm. high, slender, erect, slightly ribbed. Leaves 5-6, congregated at the base of the scape, semicylindric, canaliculate, 1-1.5-(2) mm. wide, ± scabrid on the margin, approximately equalling the scape. Spathe shortly acuminate, ½-2/3 as long as the umbel, persistent. Umbel hemispherical or spherical, ± few-flowered, lax; pedicels equal, 2-(3) times as long as the perianth, without bracteoles at the base. Segments of the broadly campanulate almost hemis-

[19] [Presumably *sphalm.* for "cm." —Translator's note.]

pherical perianth rosy-violet with an inconspicuous nerve, (4)-5 mm. long, broadly elliptic or elliptic, obtuse, almost entire, the outer ones somewhat shorter, cymbiform. Filaments equalling or scarcely exceeding the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, almost equal. Style not exserted from the perianth. Capsule somewhat shorter than the perianth. VI-VIII.

On rocks and stony slopes.—EUROPEAN PART: 10 Volga-Kama (S. Ural); W. SIBERIA: 26 Ob (S. E. part), 27 Upper ob., 28 Irt., 29 Alt.; E. SIBERIA: 32 Ang.-Sayan (W. part); C. ASIA: 42 Dzung.-Tarb. Gen. distr.: Mongolia. Descr. without indication of native country.

43. A. TYTTHOCEPHALUM Roemer et Schultes, Syst. VII, 2 (1830) 1133.—*A. senescens* var. *brevipedicellatum* Regel in A.H.P. III, 2 (1875) 140; Kryl. Fl. Zap. Sib. III (1929) 618.[20]

Bulbs 1-2 together, attached to a horizontal or ascending rhizome, narrowly conical, almost cylindric, 0.5-0.75 cm. thick, with blackish, membranous, ± entire envelopes. Scape 15-25 cm. high, ribbed, ancipitous in the upper half. Leaves 2-4, congregated at the base of the scape, apparently semicylindric, canaliculate, 1-2 mm. wide, scabrid on the margin, somewhat shorter than the scape. Spathe shortly acuminate, 2/3 as long as the umbel, persistent. Umbel hemispherical, few-flowered, dense; pedicels equal, slightly shorter or slightly longer than the perianth, without bracteoles. Segments of the broadly campanulate perianth purple with an inconspicuous nerve, 5-6 mm. long, ovate or broadly elliptic, obtuse, the outer ones cymbiform, ¼ shorter than the inner. Filaments purple, somewhat longer than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, almost equal. Style exserted from the perianth. Capsule 2/3 as long as the perianth. VIII. (Tab. X, fig. 2 a).

Rubbly slopes in the alpine region.—W. SIBERIA: 29 Alt. (Lake Balyktykol, R. Saaskandy); E. SIBERIA: 32 Ang.-Sayan (Sayany (?), R. Khatigol). Endemic. Descr. from Siberia.

44. A. SENESCENS *Linné,* Sp. Pl. (1753) 299; Ledeb. Fl. Ross. IV (1852) 180; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 124; Kryl. Fl. Zap. Sib. III (1929) 617; Kom. Opred. Rast. Dalnevost. Kraya, I (1931) 365.—*A. montanum* Schmidt, Fl. Boem. VI (1794) 28.—*A. baicalense* Willdenow, Enum. Hort. Berol. I (1809) 360.—*A. spirale* Willdenow, ibid. Suppl. (1813) 17.—*A. glaucum* Schrader, Cat. Hort. Goett. (1814).—*A. Andersonii* G. Don, Mon. (1827) 59.—*A. spurium* G. Don, l.c.—*A. fallax* Roemer et Schultes, Syst. VII, 2 (1830) 1072; Schmalh. Fl. II (1897) 494.—*A. angulosum* var. *minus* Ledebour Fl.

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[20] [To the synonymy of *A. tytthocephalum* must be added: —*A. Salesovi* Regel in A. H. P. III. 2 (1875) 140, in obs. sub *A. senescente brevipedicellato;* Simpson in Journ. Linn. Soc. Bot. XLI (1913) 446, pro sp. M. P. Price's material collected on Kizil Taiga, Lower Kemchik river, N. W. Mongolia, on which Simpson's description is based, agrees with Vvedensky's description. The umbel is about 1.5 cm. across, with the flowers almost sessile. The species thus occurs outside the Soviet Union in adjacent Mongolia. —*W. T. S.*]

Ross. IV (1852) 180.—Ic.: Gmelin, Fl. Sib. I (1747) t. 11, f.2.—Exs.: H F R no. 1342; Karo, Pl. Amur. et Zeaens. no. 179.

Bulbs (1)-2-3 together, attached to a horizontal rhizome, conical, 1-1.5-(2) cm. thick, with blackish, membranous, ± entire envelopes. Scape (20)-30-60 cm. high, ancipitous or even narrowly winged in the upper part. Leaves 5-8, congregated at the base of the scape, flat, linear, obtuse, ± glaucous, the outer ones (2)-3-6-(10) mm. wide, smooth, erect or falcate or twisted in a sloping spiral, half as long as the scape or slightly longer than it. Spathe shortly acuminate, (⅓)-½ as long as the umbel, persistent. Umbel hemispherical or more rarely spherical, dense, many-flowered; pedicels equal, 2-3-(4) times longer than the perianth with a few bracteoles at the base or without them. Segments of the hemispherical perianth rose or deep-rose or rosy-violet with an inconspicuous nerve, (4)-5-(6) mm. long, obtuse, oblong-lanceolate to ovate, the inner ones slightly or ¼ longer than the outer cymbiform ones. Filaments connate at the extreme base and adnate to the perianth, slightly or 1½ times longer than the perianth, entire, subulate, the inner ones 2½ times as broad. Style exserted from the perianth. Capsule equalling the perianth with obcordate valves. V-VII.

In stony and sandy places, and in meadows.—EUROPEAN PART: 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don (E. part) (?); CAUCASUS (??); W. SIBERIA: 29 Alt.; E. SIBERIA: 31 Lena-Kolyma (S. part), 32 Ang.-Sayan, 33 Dauria; FAR EAST: 36 Zeya-Bur., 38 Ussuri; C. ASIA: 42 Dzung-Tarb. (Tarbagatai). Gen. distr.: W. Eur., Mongolia, Manchuria. Descr. from Siberia and Sicily.

NOTE. It falls into four races: the European, known as *A. montanum* (=*A. fallax*) with narrow, (2)-3-(4) mm., erect leaves, with an ancipitous (not winged) scape, and usually with oblong-lanceolate, slightly attenuate inner perianth-segments; the Altai-Sayan, more stocky, with short leaves, usually half as long as the scape, and generally ovate rosy-violet perianth-segments; the Transbaikal, which is the typical one (*A. senescens* s.s. = *A. baicalense*), more robust, with broad, 5-10 mm. wide, falcately curved, short leaves, often with scapes narrowly winged upwards, usually with oblong-lanceolate perianth-segments; and the Far Eastern, to which apparently the names *A. spirale* and *A. glaucum* are referable, with long leaves, approximately equalling the scape and coiled into a sloping spiral, with scape usually narrowly winged above and with ovate perianth-segments.

The indistinct morphological outlines of these races, and especially the presence of a long and involved synonymy (due to brief descriptions which, in the majority of cases, lack any indication of the exact provenance of the species described), make it impossible for me to treat them as independent units.

45. A. NUTANS *Linné,* Sp. Pl. (1753) 299; Ledeb. Fl. Ross. IV (1852) 180; Kryl. Fl. Zap. Sib. III (1929) 616.—Ic.: Bot. Mag. XXVIII (1808) t. 1143.

Bulbs 1-2 together attached to a horizontal or somewhat ascending, thick rhizome, conical, 1.5-2 cm. thick, with blackish, membranous, ± entire envelopes. Scapes (20)-30-60 cm. high, thick, with 2 usually winged ribs in the upper part. Leaves 6-8, congregated at the base of the scape, flat, glaucous, obtuse, ± falcate, smooth, the outer ones (5)-8-15 mm. wide, half as long as the scape. Spathe shortly acuminate, 2/3 as long as the umbel, persistent. Umbel spherical, more rarely almost spherical,[21] many-flowered, dense, almost capitate, cernuous before flowering; pedicels equal, 1½-2 times as long as the perianth, with bracteoles at the base. Segments of the hemispherical perianth rose or rosy-violet with an inconspicuous nerve, (4)-5-(6) mm. long, obtuse, oblong-ovate, the inner ones somewhat longer than the cymbiform outer ones. Filaments connate at the extreme base and adnate to the perianth, 1½ times or almost twice as long as the perianth-segments, subulate, the inner ones generally bidentate at the base, twice as broad as the outer. Style exserted from the perianth. Capsule equalling the perianth. VI-VII.

On steppes, meadows and stony slopes.—W. SIBERIA: 26 Ob (S. E. part), 27 Upper Tob., 28 Irt., 29 Alt.; E. SIBERIA: 32 Ang.-Sayan (W. part); C. ASIA: 42 Dzung—Tarb. (Saur.). Endemic. Described from Siberia.

46. A. PUMILUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 121.

Bulbs 1-3 together, attached to a horizontal rhizome, mostly conical, about 0.5 cm. thick, 2-3 cm. long, with greyish, coarsely reticulate, fibrous envelopes. Scape about 10 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 2-3, narrowly linear, 1-2 mm. wide, flat, or slightly canaliculate at the base, ± falcately recurved, smooth, shorter than the scape. Spathe acuminate, equalling the umbel, persistent. Umbel few-flowered, capitate; pedicels half as long as, more rarely slightly shorter than, the perianth, without bracteoles at the base. Segments of the broadly campanulate perianth rose-coloured, about 4 mm. long, oblong-elliptic, obtuse, the outer ones somewhat shorter. Filaments approximately equalling the perianth-segments, connate at the base and adnate to the perianth, entire, triangular-subulate, almost equal. Style not exserted from the perianth. VII.

Dry slopes.—W. SIBERIA: 29 Alt. (Collected once by B. K. Shishkin on the Ukok plateau in 1931). Type at Leningrad.

47. A. POLYRRHIZUM *Turchaninov ex Regel* in A. H. P. III, 2 (1875) 162.

Roots numerous, almost cord-like. Bulbs crowded, a few together, attached to a horizontal rhizome, forming together with the sterile ones a dense tuft, almost cylindric, c. 0.5 cm. thick, with blackish-brown envelopes split into almost reticulate fibres. Scape 10-20 cm. high, slender, erect, slightly ribbed. Leaves 2-3, filiform, 0.5-0.75 mm. wide, semi-cylindric, canaliculate, scabrid on the margin, congregated at the base

21 ["Almost hemispherical" is perhaps meant here. —Translator's note.]

of the scape, more than half as long as the scape. Spathe half as long as the umbel, shortly acuminate, persistent. Umbel fasciculate or more often hemispherical, ± few-flowered, dense; pedicels equal, equalling or 1½ times (to twice) as long as the perianth, without bracteoles at the base. Segments of the broadly campanulate perianth rose-coloured with an inconspicuous nerve, 4-5 mm. long, obtuse, oblong-elliptic, the outer ones somewhat shorter than the inner. Filaments equalling or somewhat longer than the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate from a somewhat expanded base, the inner twice as broad, with teeth above the base, more rarely almost entire. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VIII. (Tab. X, fig. 3 a).

In salt-marshy places.—E. SIBERIA: 33 Dauria; C. ASIA: 42 Dzung.-Tarb. (Tarbagatai). Gen. distr.: Mongolia. Described from the R. Argun. Type at Leningrad.

NOTE. In the Tarbagatai (Tasbeit Kuduk—Ters Airyk) was collected the var. *Prezewalskii* Regel in A. H. P. III, 2 (1875) 163, et [*ut* var. *"Przewalskianum"*] X (1887) 339, t. 4, f. 1. This variety is distinguished by its larger flowers (6 mm.), umbels of greater size, filaments of the inner stamens expanded [widened] almost half-way, and more abundant rufescent or rufous envelopes of the bulbs; it requires further study.

48. A. BIDENTATUM *Fischer ex Prokhanov* in Mater. Izuch. [Study] Mong. . . . 2 (1929) 83, in adn., et in Bull. Jard. Bot. Princ. U R S S XXIX (1930) 564, fig. 5.—*A. tenuissimum* Turchaninov in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 126, excl. syn.—*A. omiostema* Airy-Shaw in Notes Bot. Gard. Edinb. XVI (1931) 144.—Ic.: Prokhanov, l. c.; [Airy-Shaw in Hook. Ic. Plant. XXXII (1933) t. 3181].—Exs.: Karo, Pl. Daur. no. 120, sub *A. tenuissimo.*

Roots numerous, almost cord-like. Bulbs crowded a few together and attached to a horizontal rhizome, forming with the sterile ones a fairly dense tuft, almost cylindric, *c.* 0.5 cm. thick, with brownish almost coriaceous envelopes split into parallel laciniae. Scape 10-25 cm. high, slender, erect, ribbed. Leaves 3, congregated at the base of the scape, semicylindric, canaliculate, 1-1.5 mm. thick, scabrid on the margin, somewhat shorter than the scape. Spathe half as long as the umbel, shortly acuminate, persistent. Umbel hemispherical, more rarely almost spherical, few-flowered, dense; pedicels equal, equalling or 1½ times as long as the perianth, without bracteoles at the base. Segments of the broadly campanulate perianth deep-rose with an inconspicuous nerve, 5-6 mm. long, the inner ones oblong-elliptic, almost linear-oblong, obtuse, almost truncate, the outer ones ¼ shorter than the inner, oblong-ovate, obtuse. Filaments somewhat shorter than the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad, bidentate at 2/3-3/4 of their height. Style not exserted from the perianth. Capsule 2/3 as long as the perianth. VI-VIII.

Rubbly and stony slopes.—E. SIBERIA: 32 Ang.-Sayan, 33 Dauria; FAR EAST: 38 Ussuri (introduced); C. ASIA: 42 Dzung.-Tarb. (Tarbagatai). Gen. distr.: Mongolia. Descr. from Transbaikalia. Type at Leningrad.

49. A. BELLULUM *Prokhanov* in Bull. Gard. Bot. Princ. U R S S XXIX (1930) 568, t. 6.

Roots numerous, almost cord-like. Bulbs crowded a few together, attached to a horizontal rhizome, forming with the sterile ones a fairly dense tuft, almost cylindric, c. 0.5 cm. thick, with brownish envelopes split into parallel laciniae. Scape 7-20 cm. high, slender, erect, ribbed. Leaves 2, filiform, congregated at the base of the scape, *c.* 0.5 mm. wide, semicylindric, canaliculate, scabrid on the margin, somewhat shorter than the scape. Spathe 1/3 as long as the umbel, shortly acuminate, persistent. Umbel hemispherical, few-flowered, lax, with almost pendulous flowers; pedicels equal, (1½)-2 times as long as the perianth, slender, without bracteoles. Segments of the broadly campanulate perianth deep-rose, 3.5-4.5 mm. long, obtuse, ovate, the outer ones somewhat shorter than the inner. Filaments equalling the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad, bidentate two-thirds of the way up. Style not exserted from the perianth. Capsule somewhat shorter than the perianth. VII.

On stony steppes.—W. SIBERIA: 29 Alt. (valley of the R. Bukhtarma). Gen. distr.: Mongolia. Descr. from valley of the R. Turgen. Type at Leningrad.

NOTE. Very close to *A. bidentatum,* and requires further study.

50. A. TENUISSIMUM *Linné* Sp. Pl. (1753) 301; Ledeb. Fl. Ross. IV (1852) 183; Kryl. Fl. Zap. Sib. III (1929) 623.—Ic.: Ledeb. Ic. Pl. Fl. Ross. IV (1833) t. 358.—Exs.: H F R no. 1389.

Bulbs attached a few together to a horizontal rhizome, narrowly cylindric-conical, almost undifferentiated, with blackish or brownish, almost membranous, slightly split, almost entire envelopes. Scape 5-25 cm. high, slender, erect, terete, ribbed. Leaves 2-3, filiform, 0.5-1 mm. wide, semicylindric, canaliculate, smooth or scabrid, somewhat shorter than or equalling the scape. Spathe shortly acuminate, 1/3-1/2 as long as the umbel, persistent. Umbel hemispherical, few-flowered, lax, with cernuous flowers; pedicels almost equal, 1½-2-(3) times as long as the perianth, without bracteoles. Segments of the hemispherical perianth whitish or rosy, *c.* 4 mm. long, truncate or very obtuse, the inner ones obcuneiform, the outer somewhat shorter than the inner, almost round-elliptic. Filaments almost 1/3 shorter than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate from an expanded base, the inner ones twice as broad, almost triangular. Style not exserted from the perianth. Capsule somewhat shorter than the perianth. VI-VII.

On rocks, and stony and rubbly slopes.—W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang.-Sayan. Endemic (?). Descr. from Siberia.

51. A. ANISOPODIUM *Ledebour,* Fl. Ross. IV (1852) 183; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 126; Kryl. Fl. Zap. Sib. III (1929) 622; Kom. Opred. Rast. Dalnevost. Kraya, I (1931) 366.[22]—Ic.: Komarov, l. c. t. 112, f. II.

Bulbs attached a few together to a horizontal or ascending rhizome, narrowly cylindro-conical, almost undifferentiated, with blackish-brown or brownish envelopes, ± split, sometimes almost into fibres. Scape 20-40 cm. high, slender, erect, terete. Leaves 2-3, semicylindric, canaliculate, *c.* 1 mm. wide, smooth, somewhat shorter than the scape. Spathe shortly acuminate, 1/3-1/2 as long as the umbel, persistent. Umbel fasciculate or fasciculate-spherical, ± many-flowered, lax; pedicels unequal, 3-7 times as long as the perianth, without bracteoles, the outer ones somewhat ascending. Segments of the broadly campanulate perianth rosy with an inconspicuous nerve, 3.5-4.5 mm. long, obtuse or truncate, the inner ones obcuneiform or inversely linear-cuneiform, the outer ones oblong-elliptic or broadly elliptic, somewhat shorter than the inner. Filaments 2/3 as long as the perianth, connate at the extreme base and adnate to the perianth, entire, subulate from an expanded base, the inner ones twice as broad, almost triangular. Style scarcely exserted from the perianth. Capsule somewhat shorter than the perianth. VI-VII.

On dry slopes and sands.—W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang.-Sayan, 33 Dauria; FAR EAST: 36 Zeya-Bur., 38 Ussuri; C. ASIA: 41 Balkhash (N. E. part). Gen. distr.: Mongolia, Japan-China. Descr. from Transbaikalia. Type at Leningrad.

52. A. CAESPITOSUM *Sievers ex Bongard et Meyer* in Bull. Scient. Acad. Pétersb. VIII (1841) 341; Ledeb. Fl. Ross. IV (1852) 183; Kryl. Fl. Zap. Sib. III (1929) 622.—Ic.: Bongard et Meyer in Mém. Acad. Pétersb. VI, sér. IV, 228 (1845) t. 16.

Forming lax tufts, owing to its long runners, which are up to 10 cm. long. Bulbs almost undifferentiated, but distinguished by their bright greyish-brownish, membranous, split envelopes, the inner ones white. Scape 15-20 cm. high, terete. Leaves 4-6, congregated at the base of the scape, semicylindric, canaliculate, *c.* 1 mm. wide, smooth, shorter than the scape. Spathe ½ as long as the umbel, shortly acuminate, persistent. Umbel hemispherical, few-flowered, ± lax, with cernuous flowers; pedicels almost equalling, or 1½ times as long as, the perianth, without bracteoles. Segments of the broadly campanulate, almost hemispherical perianth whitish, sometimes with a rosy tinge, 6-7 mm. long, obtuse, the inner ones broadly elliptic, somewhat longer than the outer ovate ones. Filaments 1/4-1/3 shorter than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, the outer ones

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[22] [To the synonymy of this species can be added *A. tenuissimum* var. *anisopodium* (Ledeb.) Regel in A. H. P. III, 2 (1875) 157. For notes on the *A. tenuissimum* group, see Airy-Shaw in Notes Roy. Bot. Gard. Edinburgh, XVI (1931) 144-6. —*W. T. S.*]

subulate, the inner almost 3 times as broad, subulate from a triangular base, almost narrowly triangular. Style not exserted from the perianth. Capsule somewhat shorter than the perianth. VI-VIII.

On sands.—C. ASIA: 41 Balkhash (Irtysh, Kurtu). Gen. distr.: Dzung-Kashg. (?). Descr. from the Picket [Piketny] fishing station on the Irtysh.[23] Type at Leningrad.

53. A. OBLIQUUM *Linné,* Sp. Pl. (1753) 296; Ledeb. Fl. Ross. IV (1852) 173; Schmalh. Fl. II (1897) 492; Kryl. Fl. Zap. Sib. III (1929) 614.—Ic.: Redouté, Lil. VII (1812) t. 364.—Exs.: Schultz, Herb. Norm. nov. ser. no. 2390.

Bulb solitary, attached to a vertical rhizome, oblong-ovoid, 2-3 cm. thick, with coriaceous reddish-brown envelopes. Scape robust, 60-100-(150) cm. high, clothed up to half-way with smooth leaf-sheaths. Leaves 6-9, linear, 5-20 mm. wide, gradually narrowed towards the apex, flat, subobtuse, smooth on the margin, considerably shorter than the scape. Spathe shortly acuminate, somewhat shorter than the umbel. Umbel spherical, dense, many-flowered; pedicels almost equal, 2-3 times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth greenish-yellow, 4-5 mm. long, ovate, subacute or obtuse, the outer ones somewhat shorter than the inner, cymbiform. Filaments 1½ times as long as the perianth-segments, connate at the base and adnate to the perianth, entire, subulate, almost equal. Style strongly exserted from the perianth. Capsule equalling the perianth. IV-VII.

In meadows and on woodland slopes.—EUROPEAN PART: 14 Transvolga, 18 Lower Don (?);[24] W. SIBERIA: 26 Ob (S. E. part), 27 Upper Tob., 29 Alt.; E. SIBERIA: 32 Ang.-Sayan (W. part); C. ASIA: 42 Dzung.-Tarb., 49 Tien Shan (Fergana range). Gen. distr.: C. Eur., Dzhung.-Kashg. Descr. from Siberia.

54. A. PLATYSPATHUM *Schrenk,* Enum. Pl. Nov. I (1841) 7; Ledeb. Fl. Ross. IV (1852) 184; Kryl. Fl. Zap. Sib. III (1929) 614.—*A. amblyophyllum* Karelin et Kirilov in Bull. Soc. Nat. Mosc. XV (1842) 510.—*A. alataviense* Regel in Bull. Soc. Nat. Mosc. XLI, 1 (1868) 448.—Ic.: Regel, Fl. Turk. (1876) t. 12, f. 4-6.

Bulbs 1-(2-3) together, attached to a vertical rhizome, almost cylindric, 1-2 cm. thick, with membranous white inner and black-brown

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[23][Bongard and Meyer give the type-locality of *A. caespitosum* as "ad fl. Irtysch infra excubias Piketnaja-Rybalka dictas." Ledebour also cites it as occurring "in Sibiriae altaicae deserto soongorokirghisico (Sievers)" and Regel as occurring "in Dschungariae orientalis arenosis ad lacum Saissan-nor (Sievers)". All refer to the region of the Zaysan Nor Lake. The name *A. caespitosum* Sievers seems to have been first published in Pallas, Nord. Beytr. VII (1796) 304. —*W. T. S.*]

[24] Novocherkassk, *Pabo* —requires confirmation.

papyraceous outer envelopes. Scape 10-70 cm. high, clothed at the base or up to half-way with smooth leaf-sheaths. Leaves 2-6, linear, 3-17 mm. wide, flat, obtuse, smooth, or more rarely scabrid on the margin, equalling or somewhat longer than the scape. Spathe shortly acuminate, sometimes coloured, somewhat shorter than the umbel, persistent. Umbel hemispherical or spherical, many-flowered, dense; pedicels equal, equalling or 1½ times as long as the perianth, without bracteoles at the base. Segments of the broadly campanulate perianth rosy with an inconspicuous nerve, shining, 6-8 mm. long, almost equal, lanceolate or linear-lanceolate, subobtuse or subacute. Filaments somewhat shorter than, or up to 1½ times as long as, the perianth-segments, connate at the extreme base and adnate to the perianth, equal, entire, subulate from a somewhat expanded base. Style strongly exserted from the perianth. Capsule 2/3 as long as the perianth. VI-VII.

In the alpine and subalpine mountain zones.—W. SIBERIA: 29 Alt.; C. ASIA: 42 Dzung.-Tarb., 48 Pam.-Al. (Pamir, Alai and Transalai ranges), 49 Tien Shan (C. Tien Shan, Alexander range, Talas Ala Tau). Gen. distr.: Dzung.-Kashg. Descr. from the Dzhilkaragai Alps. Type at Leningrad.

55. A. POLYPHYLLUM *Karelin et Kirilov* in Bull. Soc. Nat. Mosc. XV (1842) 509; Ledeb. Fl. Ross. IV (1852 174.—Ic.: Regel, Fl. Turk. (1876) t. 12, f. 1-3.—Exs.: Herb. Fl. As. Med. no. 338.

Bulbs 1-2 together, attached to a vertical or obliquely ascending rhizome, broadly cylindric-conical, 1.5-2.5 cm. thick, with brown, coriaceous, entire, non-shining envelopes. Scape robust, 20-60 cm. high, clothed for ¼-½ with smooth leaf-sheaths. Leaves 5-7, broadly linear, 3.5-15 mm. wide, flat, obtuse, generally falcately recurved, almost smooth on the margin, shorter than the scape. Spathe shortly acuminate, equalling the umbel, sometimes coloured. Umbel spherical, more rarely hemispherical, dense, many-flowered; pedicels equal, equalling or up to twice as long as the perianth, without bracteoles at the base. Segments of the ovoid-campanulate perianth rosy with an inconspicuous nerve, 5-8 mm. long, obtuse, the outer ones oblong or oblong-ovate, slightly or 1/4 shorter than the obovate or oblong-obovate inner ones. Filaments 1½-2 times as long as the perianth-segments, connate at the base and adnate to the perianth, entire, subulate from an expanded base, the inner ones twice as broad. Style strongly exserted from the perianth. Capsule almost 1/3 shorter than the perianth. VII-VIII.

On rubbly and stony slopes in the subalpine and alpine mountain zones.—C. ASIA: 42 Dzung.-Tarb., 48 Pam.-Al., 49 Tien Shan. Gen. distr.: Dzung.-Kashg. Described from the Dzungarian Ala Tau, from the R. Sarkhan. Type at Leningrad.

56. A. HYMENORRHIZUM *Ledebour*, Fl. Alt. II (1830) 12; Ledeb. Fl. Ross. IV (1852) 184; Boiss. Fl. Or. V (1882) 248; Kryl. Fl. Zap. Sib. III (1929) 615.—*A. macrorhizum* Boissier, Diagn. Pl. Or. I, 13 (1853) 32.—Ic.: Ledeb. Ic. Pl. Fl. Ross. IV (1833) tab. 359.—Exs.: Herb. Fl. As. Med. no. 58.

Bulbs 1—few together, attached to a rhizome, forming a fairly dense tuft, cylindro-conical, (1)-1.5-2 cm. thick, with numerous, coriaceous, brown, splitting envelopes. Scape 30-90 cm. high, clothed almost halfway with smooth distant sheaths. Leaves 4-6, linear, 2-5 mm. wide, flattish, generally erect, smooth, somewhat shorter than the scape. Spathe shortly acuminate, somewhat shorter than or equalling the umbel, persistent. Umbel spherical or more rarely hemispherical, many-flowered, dense; pedicels equal, 1½-2-(3) times as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth rosy with an inconspicuous nerve, 4-6 mm. long, subobtuse or subacute, the outer ones lanceolate or oblong-lanceolate, somewhat shorter than the oblong or oblong-elliptic inner ones. Filaments 1½-2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, almost equal. Style strongly exserted from the perianth. Capsule equalling the perianth. VII-VIII.

In meadows.—W. SIBERIA: 27 Upper Tob. (Iryndyk), 29 Alt.; C. ASIA: 42 Dzung.-Tarb., 48 Pam.-Al., 49 Tien Shan. Gen. distr.: Iran, Dzung.-Kashg. Descr. from the rivers Koksu and Uba in the Altai. Type at Leningrad.

57. A. KASCHIANUM *Regel* in A. H. P. X (1887) 338, t. 3, f. 2.

Bulbs 1-few together, attached to a rhizome, forming a rather lax tuft, almost cylindric, 1-1.5 cm. thick, with coriaceous, dark brown envelopes, splitting into narrow sections. Scape 15-40 cm. high, clothed for ⅓-½ with smooth leaf-sheaths. Leaves 4-5, narrowly linear, 1-3 mm. wide, flattish, scabrid on the margin, slightly shorter or slightly longer than the scape. Spathe shortly acuminate, equalling the umbel, persistent. Umbel spherical or hemispherical, comparatively few-flowered, dense, almost capitate; pedicels equal, 2/3 as long as or equalling the perianth, without bracteoles at the base. Segments of the campanulate perianth pale rosy-lilac with a strong darker nerve, *c.* 5 mm. long, subobtuse, the outer ones oblong-lanceolate, somewhat shorter than the oblong-elliptic inner ones. Filaments 1½ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, almost equal. Style strongly exserted from the perianth. Capsule equalling the perianth. VII-IX.

On meadow-steppe slopes of mountains.—C. ASIA: 49 Tien Shan (C. Tien Shan, rarely). Gen. distr.: Dzung.-Kashg. Descr. from the rivers Kash and Kegen. Type at Leningrad.

58. A. GLACIALE *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 121.

Bulb solitary, attached to an ascending rhizome covered with the remains of bulbs of former years, conical, 0.75-1 cm. thick, 2-3 cm. long, with yellowish-brownish, coriaceous envelopes, which are entire or sometimes split into fibres. Scape 20-30 cm. high, thickish, terete, smooth, scarcely ribbed, clothed for ⅓ or almost ½ with smooth distant leaf-sheaths. Leaves 3-4, linear, 2-3 mm. wide, flat, smooth on the margin or finely scabrid, apparently shorter than the scape. Spathe shortly acuminate, equalling the umbel or somewhat longer than it, persistent.

Umbel spherical, many-flowered, dense, capitate; pedicels equal, equalling or somewhat longer than the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a strong purple nerve, *c.* 4 mm. long, linear-oblong, very obtuse, the outer ones somewhat shorter than the inner. Filaments somewhat longer than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, the inner ones somewhat broader. Style exserted from the perianth. VII.

C. ASIA: 48 Pam.-Al. Found once by Drobov in the Turkestan Range on a stony southern slope towards the Zeravshan glacier. Endemic. Type at Tashkent.

59. A. SETIFOLIUM *Schrenk,* Enum. Pl. Nov. I (1841) 6; Ledeb. Fl. Ross. IV, (1852) 172.—Ic.: Regel, Fl. Turk. (1876) t. 11, f. 1-3.

Bulbs usually numerous, attached to a rhizome, forming a dense tuft, elongate, ovoid, more often almost cylindric, 0.5-0.75 cm. thick, 2-3 cm. long, with coriaceous, yellowish-brownish, entire envelopes splitting above. Scape slender, 5-10 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 2, capillary, smooth, almost equalling the scape. Spathe acuminate, small, several times shorter than the umbel, persistent. Umbel fasciculate, few-flowered, lax; pedicels almost equal, equalling or twice as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a darker nerve, 6-7 mm. long, almost equal, linear-lanceolate, subobtuse. Filaments 2/3 as long as the perianth-segments, connate, and adnate to the perianth, almost halfway, entire, subulate from a somewhat expanded base, almost equal. Style not exserted from the perianth. Capsule ⅓ shorter than the perianth. VI-VII.

In stony country in foothills.—C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), 49 Tien Shan (Trans-Ilian Ala Tau, Chu-Ili Mts.). Gen. distr.: Dzung.-Kashg. Descr. from Labasa. Type at Leningrad.

60. A. SUBTILISSIMUM *Ledebour,* Fl. Alt. II (1830) 22; id. Fl. Ross. IV (1852) 173; Kryl. Fl. Zap. Sib. III (1929) 612.—Ic.: Ledebour, Ic. Pl. Fl. Ross. IV (1833) t. 360.

Bulbs elongate-conical, 0.75-1 cm. thick, packed into an easily disintegrating tuft, with almost coriaceous greyish-brown envelopes. Scape 5-20 cm. high, slender, erect. Leaves 3-4, filiform, *c.* 0.5 mm. wide, semicylindric, canaliculate, scabrid on the margin, slightly shorter or slightly longer than the scape. Spathe small, half as long as the umbel, with a beak equalling the base of the spathe, persistent. Umbel fasciculate or hemispherical, few-flowered, very lax; pedicels equal, 2-3 times as long as the perianth, with bracteoles at the base, the outer ones ascending. Segments of the almost stellate perianth rosy-purple with a darker nerve, *c.* 4 mm. long, elliptic, obtuse, equal, the outer ones concave. Filaments purple, somewhat longer than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, equal. Style longer than the perianth. Capsule scarcely shorter than the perianth. VII-VIII.

In salt-marshes and on stony slopes.—W. SIBERIA: 28 Irt.; C. ASIA: 41 Balkash, 42 Dzung-Tarb. Gen. distr.: Mongolia. Descr. from the R. Irtysh. Type at Leningrad.

NOTE. The indications for the Urals and Pamir-Alai are erroneous.

61. A. JUCUNDUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 122.

Bulbs apparently attached, a few together, to a short rhizome, cylindric-conical, 0.5-1 cm. thick, with brown, almost coriaceous, ± entire envelopes. Scape 10-15 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 2-3, narrowly linear, 1-1.5 mm. wide, smooth, almost equalling the scape. Spathe persistent, somewhat shorter than the umbel, uncoloured, without a beak. Umbel hemispherical, few-flowered, lax; pedicels equal, equalling or somewhat longer than the perianth, without or with a few bracteoles at the base. Segments of the campanulate perianth purple with a darker nerve, c. 5 mm. long, oblong, subobtuse, almost equal. Filaments 1¼ or 1½ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, purple, subulate, entire, equal. Style exserted from the perianth. VII.

On rocks.—C. ASIA: 49 Tien Shan (C. Tien Shan). Endemic. Descr. from Ulakhol. Type at Leningrad.

NOTE. To a certain extent related to the high-mountain species of the *A. globosum*, s.l., group, but differs from all of them in the beakless spathe and flat leaves. Related, but perhaps more distantly, to *A. Pevtzovi* Prokh., which differs from it in the long filaments and general flower-structure of the *A. globosum* group.

62. A. TYTTHANTHUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 122.

Bulbs attached a few together to a short rhizome, ovoid-conical or elongate-conical, *c.* 1 cm. thick, with brown, coriaceous, entire envelopes. Scape 10-15 cm. high, clothed at the base or almost half-way with smooth leaf-sheaths. Leaves 3-4, filiform, 0.5-1 mm. wide, canaliculate, hispid, apparently somewhat shorter than the scape. Spathe persistent, scarcely more than half as long as the umbel, with a short beak sometimes equalling half the base of the spathe. Umbel fasciculate-spherical, few-flowered, lax; pedicels equal, (1½)-2 times as long as the perianth, slender, with cernuous flowers, with bracteoles at the base. Segments of the hemispherical perianth pale-yellowish, becoming rosy, *c.* 3 mm. long, elliptic, obtuse, the inner ones with a short apiculus, somewhat longer than the outer. Filaments 1½ times as long as the perianth, connate at the extreme base and adnate to the perianth, subulate, entire, equal. Style exserted from the perianth. VII.

On rocks and stony slopes in the intermediate mountain zone.—C. ASIA: 48 Pam.-Al. (Chulbair Mts.). Endemic. Descr. from the Chulbair Mts.: Khodzaha Barku. Type at Tashkent.

NOTE. Collected at two very closely situated points in the Chulbair mountains. Differs from all species of the *A. globosum*, s.l., group, in the lax umbel with pendulous flowers.

63. A. KOKANICUM *Regel* in A. H. P. III, 2 (1875) 104.—Ic.: Regel, Fl. Turk. (1876) t. 10, f. 4-6.

Bulbs attached, a few together, to a short rhizome, cylindric-conical, 0.75-1.5 cm. thick, with brown, coriaceous, ± entire envelopes. Scape 5-20-(40) cm. high, clothed at the base with smooth leaf-sheaths. Leaves 2-4, filiform, canaliculate, 0.5-1 mm. wide, ciliate-scabrid. Spathe persistent, equalling or more rarely somewhat longer than the umbel, with a beak equalling or twice as long as the base of the spathe. Umbel hemispherical or spherical, usually few-flowered, dense; pedicels equal, shorter than or equalling the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, 4-5 mm. long, subacute, almost equal. Filaments 1¼ or 1½ times as long as the perianth, connate at the extreme base and adnate to the perianth, ± purple, the outer ones subulate, the inner 1½ times as broad, bidentate at the base. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VII-VIII.

On stony and rocky slopes in the upper mountain zone.—C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), 48 Pam.-Al. (Alai range), 49 Tien Shan (Alexander range, Fergana range). Endemic (?). Descr. from the Alai range. Type at Leningrad.

NOTE. A species with a curious distribution; related to *A. caricoides,* from which it differs in the toothed filaments of the inner stamens.

64. A. FILIFOLIUM *Regel,* A. H. P. X (1887) 352, t. 6, f. 3.

Bulbs attached, a few together, to a short rhizome, elongate-conical or almost cylindric, 0.5-1 cm. thick, with brown, coriaceous, ± entire envelopes. Scape 10-20 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 2-3, filiform or almost capillary, 0.25-0.5-(1) mm. wide, canaliculate, smooth, or finely scabrid on the margin, somewhat shorter than the scape. Spathe persistent, somewhat longer than the umbel, with a beak shorter than the base of the spathe or equalling it, generally coloured. Umbel hemispherical, more rarely spherical, few-flowered, dense; pedicels equal, half as long as, equalling, or rarely 1½ times as long as, the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, (4)-5 mm. long, oblong, subacute, almost equal. Filaments 1½ times or almost twice as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, equal, subulate, generally slightly coloured. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VII-VIII.

Rubbly and stony slopes in the upper mountain zone.—C. ASIA: 48 Pam.-Al., 49 Tien Shan. Endemic. Descr. from the Talas Ala Tau: Bish Tash. Type at Leningrad.

Note. In the Talas Ala Tau and the Alexander range is found the typical *A. filifolium* with smooth almost capillary leaves; in the remaining part of the area (Tashkent Ala Tau, Pamir-Alai) specimens frequently occur with broader, scabrid leaves, in this respect approaching *A. caricoides* Regel.

Further collections are needed of the high-mountain, Central Asiatic onions of the *A. globosum,* s. l., group, since there is often incomplete material from the most interesting parts of their areas.

65. A. CARICOIDES *Regel* in A. H. P. VI (1880) 532.—*A. Hoeltzeri* Regel, A. H. P. VIII (1884) 657 et in Gartenfl. (1884) 291, t. 1169.—Ic.: Regel in A. H. P. X (1887) t. 6, f. 2 [et in Gartenfl. l. c.].

Bulbs attached, a few together, to a short rhizome, cylindric-conical, 0.5-1 cm. thick, with brown, coriaceous, ± entire envelopes. Scape 5-20 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 3-4, filiform, 0.5-1 mm. wide, canaliculate, ciliate-scabrid on the margin, generally longer than the scape. Spathe persistent, slightly shorter or slightly longer than the umbel, with a beak slightly shorter or slightly longer than the base of the spathe, coloured. [Umbel . . . ?]; pedicels equal, half as long as or equalling the perianth, with bracteoles at the base. Segments of the campanulate perianth pale-rose with a purple nerve, 4.5 mm. long, oblong, acute, almost equal. Filaments 1½ times as long as the perianth, connate at the extreme base and adnate to the perianth, entire, equal, subulate, ± purple. Style exserted from the perianth. Capsule somewhat shorter than it. VI-IX.

Rubbly slopes of the intermediate and upper mountain zones.—C. ASIA: 49 Tien Shan (C. Tien Shan). Endemic (?). Descr. from the Trans-Ilian Ala Tau: Malaya [Little] Almatinka. Type at Leningrad.

Note. Known from a few points in the Central Tien Shan, and requires further study. It is practically intermediate between *A. filifolium* Regel and *A. tianschanicum* Rupr.

66. A. TIANSCHANICUM *Ruprecht* in Mém. Acad. Pétersb. sér. 7, XIV, 4 (1869) 33.—*A. hymenorhizum* var. *thianschanicum* Regel in A. H. P. III, 2 (1875) 132.—*A. macrorhizon* Regel in A. H. P. III, 2 (1875) 154. —*A. globosum* var. *albidum* Regel in A. H. P. X (1887) 352.—Ic.: Regel, Fl. Turk. (1876) t. 13, f. 12-14.

Bulbs attached, a few together, to a short rhizome, cylindro-conical or almost cylindric, (0.75)—1-2 cm. thick, (5)—10-15 cm. long, with brown, coriaceous, ± splitting envelopes. Scape 15-25 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 3-4, narrowly linear, 1-1.5 mm. wide, canaliculate, ciliate-scabrid, generally shorter than the scape. Spathe persistent, somewhat longer than the umbel, with a beak approximately equalling the base of the spathe. Umbel hemispherical or almost spherical, ± many-flowered, dense; pedicels equal, slightly shorter or slightly longer than the perianth, with bracteoles at the base. Segments of the almost spherical perianth yellowish, (?or) whitish,[25] becoming reddish, 5-6 mm. long, ovate, obtuse, the outer ones sometimes emarginate, one-sixth shorter than the inner. Filaments 1¼ or 1½ times as long as the perianth-segments, connate at the extreme base and

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[25] ["Yellowish-white" is perhaps intended. —Translator's note.]

adnate to the perianth, subulate, entire, equal. Style exserted from the perianth. Capsule scarcely shorter than the perianth. VII-IX.

On stony and rocky slopes in the intermediate mountain zone.—C. ASIA: 48 Pam.-Al. (Alai range, Pamir), 49 Tien Shan (C. Tien Shan). Gen. distr.: Dzung.-Kashg. Descr. from Dzhaman Daban. Type at Leningrad.

Note. Judging from the herbarium, the Pamir-Alai and certain Tien Shan specimens have a yellowish tinge to the flowers. I myself have collected this species in the Terskei Ala Tau without the yellow tint in the flowers.

67. A. CONDENSATUM *Turchaninov* in Bull. Soc. Nat. Mosc. XXVII, 2 (1855) 121.—Kom. Opred. Rast. Dalnevost. Kraya I (1931) 365.—*A. Steveni* var. *e* Ledeb. Fl. Ross. IV (1852) 177.

Bulbs 1-(2) together, attached to a short rhizome, cylindro-conical, 1-2 cm. thick, with brown, often shining, thinly coriaceous, ± entire envelopes. Scape 30-80 cm. high, clothed at the base or for one quarter with smooth leaf-sheaths. Leaves 4-7, semicylindric, canaliculate, fistular, 1-2.5 mm. wide, smooth, shorter than the scape. Spathe persistent, approximately equalling the umbel, with a beak sometimes equalling the base of the spathe. Umbel spherical or almost spherical, dense, many-flowered; pedicels equal, (1½)-2-3-(4) times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth pale-yellow with a greenish nerve, 4-5 mm. long, ovate, subobtuse, the outer ones somewhat shorter than the inner. Filaments 1½ times as long as the perianth, connate at the extreme base and adnate to the perianth, entire, subulate, equal. Style exserted from the perianth. Capsule slightly shorter than the perianth. VII-IX.

On accumulations of gravel and on rocks. —E. SIBERIA: 33 Dauria; FAR EAST: 36 Zeya-Bur., 38 Ussuri. Gen. distr.: Mongolia, Japan-China. Descr. from Dauria. Type at Leningrad.

68. A. PETRAEUM *Karelin et Kirilov* in Bull. Soc. Nat. Mosc. XV (1842) 512.—*A. Steveni* var. *d* Ledeb. Fl. Ross. IV (1852) 177.

Bulbs attached, 1-3 together, to a short rhizome, elongate-conical or almost cylindric, 0.75-1-1.5 cm. thick, with greyish (the inner often violet), coriaceous, almost papyraceous, splitting envelopes. Scape (20)-30-50 cm. high, clothed for ¼-⅓ with scabrid or smooth leaf-sheaths. Leaves 4-5, filiform, 0.5-1 mm. wide, canaliculate, generally smooth, somewhat shorter than the scape. Spathe persistent, 2-4 times longer than the umbel, with a beak several times exceeding the base of the spathe. Umbel spherical, dense, many-flowered; pedicels equal, 1½ times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth pale-yellow, with a greenish or more rarely dirty-green nerve, *c.* 4 mm. long, oblong-ovate, obtuse with a short apiculus, the outer ones somewhat shorter than the inner. Filaments 1½-2 times as long as the perianth, connate at the extreme base and adnate to the perianth, entire, subulate, equal. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VII.

Stony slopes in the foothills.—C. ASIA: 41 Balkhash, 42 Dzung.-Tarb., 49 Tien Shan (Chu-Ili Mts.). Endemic. Descr. from the Dzungarian Ala Tau: Lepsa. Type at Leningrad.

69. A. TALASSICUM *Regel* in A. H. P. V (1878) 628.

Bulbs attached, 1-3 together, to a short rhizome, cylindric-conical, 0.75-1.5 mm. thick, with brown, coriaceous, almost entire envelopes. Scape (15)-30-75 cm. high, clothed for ⅓ or nearly ½ with smooth leaf-sheaths. Leaves 3-7, narrowly linear or filiform, 0.5-1.5-(2) mm. wide, canaliculate, smooth, or scabrid on the margin. Spathe persistent, 1½-3 times as long as the umbel, with a beak 1½-5 times exceeding the base of the spathe. Umbel spherical or hemispherical, generally many-flowered, dense; pedicels equal, (1.5)-2-3 times as long as the perianth, with bracteoles at the base. Segments of the ovoid perianth pale-yellowish, greenish, turning rose, oblong-lanceolate, acute, 3-4 mm. long, the outer ones somewhat shorter than the inner. Filaments 1½ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, equal. Style exserted from the perianth. Capsule somewhat longer than the perianth. VII-VIII. (Tab. XI fig. 2a).

On rocky and stony slopes in the intermediate mountain zone.—C. ASIA: 49 Tien Shan. Endemic. Descr. from Talas: Karachoku. Type at Leningrad.

70. A. MARSCHALLIANUM[26] *Vvedensky*, nom. nov.—*A. saxatile* Marschall-Bieberstein, Fl. Taur.—Cauc. I (1808) 264, Suppl. (1819) 260, non M. B. 1798 et auct. fl. Taur.—*A. Steveni* var. *g* Ledeb. Fl. Ross. IV (1852) 177.—*A. globosum* var. *ochroleucum* Boissier, Fl. Or. V (1882) 248, quoad pl. taur.—*A. globosum* var. *saxatile* Schmalhausen, Fl. II (1897) 493, p. p —Ic.: M. Bieb. Cent. Pl. Rar. (1810) t. 29.

Bulbs attached, a few together, to a short rhizome, elongate-conical, 0.75-1.5 cm. thick, with brown, coriaceous, splitting envelopes. Scape 10-35 cm. high, clothed at the base or for ¼ with smooth leaf-sheaths. Leaves 3-4, filiform, 0.5-1 mm. wide, canaliculate, smooth or scabrid, equalling or somewhat shorter than the scape. Spathe persistent, 1½-3 times as long as the umbel, with a beak several times as long as the base of the spathe. Umbel spherical or hemispherical, dense, generally many-flowered; pedicels equal, equalling or twice as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth white or scarcely rosy, scarcely yellowish in the herbarium, 4-5 mm. long, oblong-ovate, acute, the outer ones somewhat shorter than the inner. Filaments 1½-2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, equal; anthers generally yellow. Style exserted from the perianth. Capsule scarcely shorter than the perianth. VII-VIII.

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[26] [Spelled *A. Marschalianum* by Vvedensky on p. 184 but *A. Marschallianum* on p. x. —W. T. S.]

On rocks, in stony localities and on mountain slopes.—EUROPEAN PART: 17 Crimea. Endemic (?). Descr. from the Crimea. Type at Leningrad.

NOTE. Very close to *A. saxatile* M. B., with which Bieberstein himself at first united it. Treating it as a distinct species, as has come to be done at the present time (cf., e. g., Wulff, Fl. Krym. 3, 34), I have been obliged to give it a new name, although I have no great faith in the differences of this species either from *A. saxatile* M. B. or from *A. szurulense* Lerchenf., if the latter indeed in its turn is distinct from *A. saxatile.*

71. A. SAXATILE *Marschall-Bieberstein,* Tabl. Prov. Casp. (1798) 114.—*A. savranicum* Besser, Cat. Hort. Crem. Suppl. (1818) (n. v.)—*A. caucasicum* Marschall-Bieberstein, Fl. Taur.-Cauc. Suppl. (1819) 258. —*A. Steveni* var. *b* Ledeb. Fl. Ross. IV (1852) 177.—*A. globosum* Boiss. Fl. Or. I (1884) 247, p. p.—*A. Ruprechtii* Boissier, Fl. Or. V (1882) 264 (?).—*A. globosum* var. *saxatile* Schmalhausen, Fl. II (1897) 493, p. p.—*A. globosum* f. *dilute-roseum* Kryl. Fl. Zap. Sib. III (1929) 632.—Exs.: Pl. Or. exs. no. 130, sub *A. globoso.*

Bulbs attached, a few together, to a short rhizome, ovoid-conical or elongate-conical, 0.75-1 cm. thick, with brown, coriaceous, splitting envelopes. Scape 20-50 cm. high, clothed at the base or for ¼-(⅓) with smooth or scabrid leaf-sheaths. Leaves 5-7, filiform, 0.5-1 mm. wide, canaliculate, smooth or scabrid, shorter than the scape. Spathe persistent, 1½-3 times as long as the umbel, with a beak generally several times exceeding the base of the spathe. Umbel hemispherical or spherical, generally many-flowered, dense; pedicels equal, equalling or more often 1½-2 times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth pale-rose, deeper on the back, 4-5-(6) mm. long, oblong, acute, the outer ones somewhat shorter than the inner. Filaments 1½-2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, equal, subulate; anthers usually violet. Style exserted from the perianth. Capsule scarcely shorter than the perianth. VII-VIII.

On rocks, in stony places, on sands and steppes.—EUROPEAN PART: 12 Middle Dnepr, 16 Black Sea, 17 Crimea, 18 Lower Don (W. part); CAUCASUS: 20 Ciscauc., 21 Dag., 22 W. and 23 E. Transcauc.; C. ASIA: 41 Balkhash (N. E. part), 42 Dzung.-Tarb. Gen. distr.: C. Europe, Dzung.-Kashg. Descr. from E. Transcauc.: Kurt Bulak.

Note. The difference in the habitats of the Ukrainian (sands and steppes) and Caucasian (rocks and stony slopes) plants, and also the great discontinuity of the Dzungaro-Tarbagatai locality, lead one to suppose that one is here dealing with distinct races, but it has not been possible to decide this point from herbarium material alone. The high-mountain Caucasian form with larger flowers also requires further study.

72. A. GLOBOSUM *Marschall-Bieberstein ex Redouté,* Lil. III (1807) t. 179; Boiss. Fl. Or. V. (1884) 247, p. p.; Schmalh. Fl. II (1897) 493,

p. p.; Kryl. Fl. Zap. Sib. III (1929) 631.—*A. caucaseum*[27] Ker-Gawler, Bot. Mag. XXVIII (1808) in adn. ad tab. 1143 (?).—*A. Steveni* var. *a* Ledeb. Fl. Ross. IV (1852) 176.—*A. Gmelinianum* Mishchenko ex Grossheim, Fl. Cauc. I (1928) 269.—Exs.: H F R no. 536.

Bulbs attached, usually a few together, to a short rhizome, ovoid-cylindric or elongate-conical, 0.75-1.5 cm. thick, with brown, coriaceous, splitting sheaths. Scape 20-60 cm. high, clothed for $\frac{1}{4}$-$\frac{1}{3}$ with smooth leaf-sheaths. Leaves 5-6, subulate, 0.5 mm. wide, canaliculate, smooth or more rarely scabrid, shorter than the scape. Spathe persistent, usually 2-3-(4) times as long as the umbel, with a long beak usually several times exceeding the base of the spathe. Umbel usually spherical, more rarely hemispherical, dense; pedicels equal, $1\frac{1}{2}$-2 times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth deep-rose, almost purple, with a darker nerve, 4-4.5 mm. long, oblong-ovate, acute, the outer ones scarcely shorter than the inner. Filaments $1\frac{1}{2}$-2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, equal; anthers violet. Style exserted from the perianth. Capsule equalling the perianth. VI-VIII.

On stony slopes, on chalk and limestone, and in salt-marshes.—EUROPEAN PART: 10 Volga-Kama, 13 Volga-Don, 14 Transvolga, 17 Crimea (?), 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc.; W. SIBERIA: 27 Upper Tob., 28 Irt.; C. ASIA: 41 Balkhash (N. E. part). Endemic. Descr. from the Caucasus.

73. A. Alexandrae *Vvedensky* in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 95.

Bulbs attached, a few together, to an oblique rhizome, elongated-ovoid or almost cylindric, 0.75-1.5 cm. thick, 2-6 cm. long, with coriaceous entire envelopes, lacerate, and bearing parallel venation, only at the top. Scape (10)-20-30 cm. high, clothed up to half-way with smooth or scabrid leaf-sheaths. Leaves 4-5, filiform, *c.* 0.5 mm. wide, semi-cylindric, canaliculate, striate, smooth or scabrid, usually shorter than the scape. Spathe small, with a long beak sometimes 3 times exceeding the umbel, persistent. Umbel hemispherical, few-flowered, dense; pedicels almost equal, half as long as, equalling, or (in fruit) twice as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, 4-5 mm. long, obtuse, the inner ones oblong-elliptic, somewhat longer and distinctly broader than the oblong-lanceolate outer ones. Filaments scarcely shorter than the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{4}$, the outer ones oblong-subulate, the inner 3 times as broad, at $\frac{3}{4}$ of the way

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[27] [Spelled *A. caucasicum* by Vvedensky. The name *A. caucaseum* was publisted by Ker-Gawler in 1808 as a new name for the plant with deep rose flowers and purplish anthers figured in Bot. Mag. t. 973 (1806) as "*A. paniculatum.*" *W. T. S.*]

up suddenly narrowed, sometimes almost dentate. Style not exserted from the perianth. Capsule somewhat shorter than the perianth. VII-VIII.

On steppe slopes.—C. ASIA: 49 Tien Shan (C. Tien Shan). Endemic. Descr. from a few localities in the Central Tien Shan. Type at Leningrad.

74. A. TERETIFOLIUM *Regel* in A. H. P. V (1878) 629.—*A. Grimmii* Regel in Trautv., Regel, Maxim. et Winkl. Dec. Pl. Nov. (1882) 10.

Bulbs attached, 2 to a few together, to a short rhizome, elongated-ovoid, 1-1.5 cm. thick, with brown or rufescent-brown, coriaceous, reticulate-nerved (the outer reticulate-fibrous) envelopes, surrounding the base of the scape. Scape 15-50 cm. high, clothed for ¼ or ½ with smooth leaf-sheaths. Leaves 3-4, filiform, *c.* 0.5 mm. wide, canaliculate, striate, smooth, shorter than the scape. Spathe with a beak 1½ times exceeding the base of the spathe, equalling the umbel or somewhat shorter than it, persistent. Umbel fasciculate or more often fasciculate-hemispherical, generally many-flowered; pedicels ± unequal, equalling or more often 1½-2 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, 6-9 mm. long, almost equal, lanceolate, subacute. Filaments 2/3 as long as the perianth-segments, connate, and adnate to the perianth, for 1/5, usually entire, the outer ones triangular-subulate, the inner three times as broad at the base, triangular. Style not exserted from the perianth. Capsule half as long as the perianth. VII-VIII.

Rubbly slopes.—C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), Tien Shan (Ketmen). Gen. distr.: Dzung.-Kashg. Descr. from the Dzungarian Ala Tau: Altyn Imel.

75. A. KOROLKOWI *Regel* in A. H. P. III, 2 (1875) 158.—*A. oliganthum* var. *elongatum* Karelin et Kirilov in Bull. Soc. Nat. Mosc. XV (1842) 511.—*A. moschatum* var. *dubium* et var. *brevipedunculatum* Regel, A. H. P. VI (1880) 522, 523.—*A. oliganthum* auct. fl. As. Med.—Ic.: Regel, Fl. Turk. (1876) t. 13-15.

Bulbs attached, 2 to a few together, to a short rhizome, oblong-ovoid, 0.75-1-(1.5) cm. thick, with coriaceous, brown, often shining, densely-, often almost reticulately-nerved envelopes, embracing the base of the scape and there slightly reticulate-fibrous. Scape slender, 10-20-(45) cm. high, clothed at the base or for 1/3 with smooth leaf-sheaths. Leaves 2-4, filiform, *c.* 0.5 mm. wide, striate, canaliculate, smooth or more rarely scabrid, distinctly shorter than the scape. Spathe with a short beak, sometimes equalling half the base of the spathe, somewhat shorter than the umbel, persistent.[28] Umbel fasciculate or hemispherical, usually few-flowered; pedicels ± unequal, somewhat shorter than,

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[28] [Owing to errors in punctuation, the original of this passage reads as follows: "spathe . . . shorter than the umbel; persistent umbel fasciculate. . . ." —Translator's note.]

equalling, or twice as long as, the perianth, with bracteoles at the base. Segments of the campanulate perianth almost white, in the herbarium rosy with a purple nerve, 5-8 mm. long, almost equal, lanceolate or oblong-lanceolate, subacute or sometimes shortly acuminate. Filaments 2/3 as long as the perianth-segments, connate, and adnate to the perianth, for 1/4, generally entire, abruptly subulate from a triangular base which in the inner ones almost twice as broad. Style not exserted from the perianth. Capsule half as long as the perianth. VII-VIII.

On dry steppe slopes.—C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), 48 Pam.-Al. (Irkeshtam), 49 Tien Shan (C. Tien Shan). Gen. distr.: Dzung.-Kashg. Descr. from the mountains between the Little Naryn and Ulan. Type at Leningrad.

76. A. ALBOVIANUM *Vvedensky,* nom. nov.—*A. gracile* Albov in Tr. Tifl. Bot. Sada I (1895) 239, non Ait. (1789).

Bulbs attached, 2-3 together, to a rhizome, narrowly conical, *c.* 0.75 cm. thick, with brownish, coriaceous, fibrously splitting, indistinctly reticulate-fibrous envelopes. Scape 20-30 cm. high, ribbed, clothed at the base with ± approximate smooth leaf-sheaths. Leaves 3-5, narrowly linear, *c.* 2 mm. wide, thickish, canaliculate, smooth or very finely scabrid on the margin, somewhat shorter than the scape. Spathe with a short beak, somewhat shorter than the umbel, persistent. Umbel hemispherical, ± few-flowered, dense; pedicels equal, approximately equalling the perianth. [Segments of the . . . perianth] deep-rose with an inconspicuous nerve, 5-6 mm. long, elliptic, obtuse, the outer ones somewhat shorter than the inner. Filaments deep-rose, 1½ times as long as the perianth, connate at the extreme base and adnate to the perianth, entire, subulate, equal. Style scarcely exserted from the perianth. VII.

Alpine pastures.—CAUCASUS: 22 W. Transcauc. Endemic. Descr. from Mt. Dzhvari.

77. A. GUNIBICUM *Mishchenko ex Grossheim,* Fl. Kavk. I (1928) 208.

Bulbs attached, a few together, to a short rhizome, ovoid-conical or elongate-conical, 0.5-0.75 cm. thick, (1)-2-7 cm. long, with brown, coriaceous, splitting, obscurely reticulate-fibrous envelopes. Scape 10-20 cm. high, slender, clothed at the base with smooth approximate leaf-sheaths. Leaves 3-4, semicylindric, canaliculate, smooth, 0.5-1 mm. wide, approximately equalling the scape. Spathe with a long beak, equalling or slightly shorter than the base of the spathe, somewhat shorter than the umbel, persistent. Umbel fasciculate-hemispherical, or hemispherical, few-flowered, lax; pedicels equal, 1½-2 times as long as the perianth, with a few bracteoles at the base. Segments of the hemispherical perianth rose-purple, c. 5 mm. long, elliptic, obtuse. Filaments rose, 1½ times as long as the perianth-segments, connate at the base and adnate to the perianth, entire, subulate, equal. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VIII.

On rocks and stony slopes, 1300-2000 m.—CAUCASUS: 21 Dag. Endemic. Descr. from Gunib. Type at Leningrad.

NOTE. Near the village of Gimra [? Himra], on limestone, at an altitude of about 700 m., an onion was collected by A. Poretsky which comes very near to this species, but differs in its smaller (*c.* 4 mm.) narrower, apiculate perianth-segments.

A. gunibicum is very close to *A. Albovianum,* and their differences are not altogether clear to me, since I only know the latter species from cultivated specimens.

78. A. DAGHESTANICUM *Grossheim,* Fl. Kavk. I (1928) 208.

Bulbs ovoid-lanceolate, attached to a rhizome, with grey slightly reticulate-fibrous envelopes. [Scape . . . ?] Leaves shorter than the scape, thick, flat, canaliculate, 4-5 mm. wide. Spathe shorter than the pedicels, with a subulate tip. Umbel few-flowered, lax; pedicels unequal, 4-6 times as long as the flowers. Perianth-segments rose-coloured, 5-7 mm. long, acute, ovate-lanceolate, the outer ones lanceolate. Filaments 1½ times as long as the perianth-segments; anthers dark. Style somewhat longer than the ovary.

High-mountain zone.—CAUCASUS: 21 Dag. Endemic. Type at Tiflis.

79. A. WESCHNIAKOWI *Regel* in A. H. P. VI (1880) 531.—Ic.: Regel in A. H. P. X (1887) t. 8, f. 3.

Roots numerous, almost cord-like. Bulbs crowded a few together, attached to a horizontal rhizome, scarcely differentiated, with greyish-brownish, membranous, ± entire envelopes. Scape 10-15 cm. high, slender, erect, ribbed. Leaves 2-3, subulate,[29] 0.5-1 mm. wide, semicylindric, canaliculate, smooth, somewhat shorter than the scape. Spathe shortly acuminate, ⅓-½ as long as the umbel, persistent; umbel fasciculate, few-flowered, fairly lax; pedicels equal, 1½-2 times as long as the perianth, without bracteoles. Segments of the campanulate perianth rosy-violet with a strong dirty-violet nerve, 5-6 mm. long, oblong-elliptic, obtuse, the outer ones somewhat shorter than the inner. Filaments ¼-1/3 shorter than the perianth-segments, adnate half-way to the perianth and connate for almost ¾, the outer ones subulate above the level of concrescence, the inner narrowly triangular. Style not exserted from the perianth. Capsule scarcely more than half as long as the perianth. VI-VII.

On gravelly and rubbly and stony slopes in the alpine region.—C. ASIA: 49 Tien Shan (C. Tien Shan). Gen. distr.: Dzung.-Kashg. Descr. from the R. Kegen. Type at Leningrad.

80. A. SEMENOVI *Regel* in Bull. Soc. Nat. Mosc. XLI, 1 (1868) 449. —Ic.: Regel, Fl. Turk. (1876) t. 8, 4-5.

Bulbs attached, 1 to a few together, to a rhizome, cylindric, scarcely differentiated, 0.75-1 cm. thick, with brownish, almost reticulate-fibrous envelopes. Scape thickish, 10-40 cm. high, clothed half-way or almost half-way with smooth approximate leaf-sheaths. Leaves (2)-3, broadly linear, 5-15 mm. wide, gradually narrowed towards the apex, not fistular,

[29] [Probably a slip for "filiform". —Translator's note.]

canaliculate, smooth, somewhat longer than the scape. Spathe shortly acuminate, approximately equalling the umbel, generally coloured, persistent. Umbel spherical-ovoid, ± few-flowered, dense, capitate; pedicels unequal, the outer ones several times shorter than the inner, somewhat shorter than or equalling the perianth, without bracteoles at the base. Segments of the campanulate perianth yellow, becoming reddish later, 10-15 mm. long, unequal, the outer ones 1½ times as long, lanceolate or oblong-lanceolate, attenuate, acute, ± denticulate. Filaments 1/4-1/3 as long as the outer perianth-segments, adnate half-way to the perianth and connate for ¾, triangular-subulate above the level of concrescence, the inner ones twice as broad, generally bidentate. Style not exserted from the perianth, with 3 stigmata, sometimes divided almost to the base. Capsule scarcely more than 1/3 as long as the perianth. VI-VII.

In alpine meadows.—C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), 49 Tien Shan. Gen. distr.: Dzung-Kashg. Descr. from a few points in the Central Tien Shan. Type at Leningrad.

81. A. MONADELPHUM[30] *Lessing ex Kunth,* Enum. IV (1843) 393; Ledeb. Fl. Ross. IV, (1852) 168; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 120.—*A. atrosanguineum* Schrenk, Bull. Acad. Pétersb. X (1842) 355; Ledeb. Fl. Ross. IV (1852) 168.—*A. atrosanguineum* Karelin et Kirilov in Bull. Soc. Nat. Mosc. XV (1852) 508.—*A. Fedtschenkoanum* Regel in A. H. P. III, 2 (1875) 82.—*A. Kaufmanni* Regel in A. H. P. III, 2 (1875) 84.—Ic.: Regel, Fl. Turk. (1876) t. 8, f. 1-3.

Bulbs solitary or crowded, attached to a rhizome, cylindric, scarcely perceptible, 0.5-1 cm. thick, with brownish, ± fibrous, bast-like envelopes. Scape thickish, 10-60-(100) cm. high, clothed for 1/5-½ with smooth leaf-sheaths. Leaves 1-2-(3), cylindric, fistular, 2-7 mm. wide, smooth, somewhat shorter or somewhat longer than the scape. Spathe shortly acuminate, equalling or somewhat shorter than the umbel, generally coloured, persistent. Umbel spherical-ovate, few-flowered, dense, often capitate; pedicels unequal, the inner ones longer than the outer, ⅓-½ as long as, equalling, or (the inner in fruit) twice as long as, the perianth, without bracteoles at the base. Segments of the campanulate perianth shining, yellow or later reddening or dark-purple, 7-14 mm. long, equal or the outer ones 1½ times as long, lanceolate, oblong-lanceolate or oblong, often attenuate, obtuse or acute, entire or ± denticulate. Filaments ⅓-½ as long as the perianth-segments, adnate to the perianth almost half-way and connate for 2/3-¾, triangular-subulate above the level of concrescence, the inner ones 1½ times as wide, sometimes bidentate. Style not exserted from the perianth, with 3 stigmata, sometimes divided for 2/3. Capsule half as long as the perianth. VI-VII.

In stony and earthy localities in the subalpine and alpine mountain zones.—W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang.-Sayan, 33 Dauria;

[30] [According to the synonymy here given, the correct name for this species should be *A. atro-sanguineum* Schrenk (or Kar. et Kir.), 1842. The dates of publication of the papers by Schrenk and by Karelin and Kirilov need investigation. —Translator's note.]

C. ASIA: 42 Dzung. —Tarb., 48 Pam.-Al., 49 Tien Shan. Gen. distr.: India-Himal. Dzung.-Kashg., Mongolia. Descr. from W. Sayan: Sabin Daban. Type at Leningrad.

NOTE. *A. monadelphum* s. l. constitutes a very complex, exceedingly polymorphic cycle. For its successful analysis into elementary units it is especially necessary to have observations in the field, particularly on the colour of the flowers and on the degree of caespitoseness.

82. A. SCHOENOPRASUM *Linné,* Sp. Pl. (1753) 301; Ledeb. Fl. Ross. IV (1852) 166, excl. syn. *A. oliganthum* Kar. et Kir.; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 119; Boiss. Fl. Or. V (1882) 250; Schmalh. Fl. II (1897) 493; Kryl. Fl. Zap. Sib. III (1929) 606; Kom. Opred. Rast. Dalnevost. Kraya I (1931) 366.—*A. sibiricum* Linné, Mant. II (1771) 562.—*A. Raddeanum* Regel in A. H. P. III, 2 (1875) 155.—Ic.: Syreishch. Ill. Fl. Mosc. Gov. I (1906) 235.—Exs.: H F R no. 85.

Bulbs attached, one to a few together, to a short rhizome, oblong-ovoid or ovoid-conical, 0.75-1 cm. thick, with brown, papyraceous, almost coriaceous, sometimes slightly parallel-fibrous envelopes. Scape thickish, 10-60 cm. high, smooth or more rarely scabrid, clothed for ⅓-½ with smooth or more rarely scabrid leaf-sheaths. Leaves 1-2, cylindric or semicylindric at the base, 2-6 mm. wide, fistular, smooth or more rarely scabrid, generally shorter than the scape. Spathe shortly acuminate, equalling or somewhat shorter than the umbel, often coloured, persistent. Umbel fasciculate-spherical or almost spherical, dense, almost capitate; pedicels unequal, the inner ones longer, ⅓-½ as long as the perianth-segments, more rarely equalling them, without bracteoles at the base. Segments of the narrowly campanulate perianth shining, pale-rose to rose-violet, with a darker nerve, 7-17 mm. long, linear-lanceolate, lanceolate or oblong, ± attenuate, acute or subobtuse, often with reflexed apiculi. Filaments ⅓-½ as long as the perianth-segments, connate and adnate to the perianth for ¼-⅓, entire, attenuate from a triangular base which is 1½ times as broad in the inner ones. Style not exserted from the perianth. Capsule ⅓-½ as long as the perianth. V-VIII.

In meadows, in river-valleys, more rarely on stony slopes.—ARCTIC: 1 Arct. Eur., 2 Nov. Zeml., 3 Arct. Sib., 4 Chukotsk, 5 Anadyr; EUROPEAN PART: 6 Karelian Lapl., 7 Dvina-Pechora, 8 Ladoga-Ilmen, 9 Upper Volga, 10 Volga-Kama, 11 Upper Dnepr, 12 Middle Dnepr (rarely), 13 Volga-Don, 16 Black Sea (rarely), 18 Lower Don (rarely); CAUCASUS: 20 Ciscauc., 21 Dag., 22 W., 23 S. and 24 E. Transcauc.; W. SIBERIA: 26 Ob, 28 Irt., 29 Alt.; E. SIBERIA: 30 Yenisei, 31 Lena-Kolyma, 32 Ang.-Sayan, 33 Dauria; FAR EAST: 34 Kamch., 35 Okhotsk, 37 Udsk, 38 Ussuri; C. ASIA: 42 Dzung.-Tarb., 49 Tien Shan (C. Tien Shan). Gen. distr.: Scand., C. Eur., W. Medit., Balkans-Asia Min., Iran, India-Himal., Dzung-Kashg., Mongolia, Japan-China, Beringia, N. Amer. Descr. from Siberia and Oland.

NOTE. *A. Schoenoprasum,* as accepted here, represents a very polymorphic cycle.[31] Especially deserving of interest for further study is the central Asiatic (strongly scabrid) race. Scabridity of scape and leaves sometimes appears also in the Caucasian *A. Schoenoprasum;* this has led certain writers on the Caucasian flora to identify such plants with *A. scabrellum* Boiss. et Buhse, which is quite erroneous.

ECONOMIC IMPORTANCE. Chives is sometimes cultivated in the western zone of the European part of the USSR for a tender pot-herb. In Siberia it is stored up salted for the winter.

83. A. LEDEBOURIANUM *Roemer et Schultes,* Syst. VII (1830) 1029; Ledeb. Fl. Ross. IV (1852) 168; Kryl. Fl. Zap. Sib. III (1929) 607.—*A. uliginosum* Ledeb. Ic. Pl. Fl. Ross. I (1829) 20, t. 83 [non G. Don (1827).—Ic.: Ledeb. Ic. l. c.].

Bulbs attached, 2-few together, to a rhizome, cylindric or elongate-ovoid, 0.75-1 cm. thick, with greyish-brown, crustaceo-coriaceous, disintegrating envelopes. Scape thickish, 40-80 cm. high, smooth, clothed half-way with smooth leaf-sheaths. Leaves 1-2, semicylindric (?), fistular, 5-10 mm. wide, smooth, shorter than the scape. Spathe shortly acuminate, ½-2/3 as long as the umbel, persistent. Umbel fasciculate-spherical or almost spherical, many-flowered, dense; pedicels almost equal, 1½-3 times as long as the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth shining, rosy-violet, with a darker nerve, 7-12 mm. long, oblong-lanceolate or lanceolate, acute. Filaments slightly or ⅓ shorter than the perianth-segments, connate at the base and adnate to the perianth, entire, the outer ones triangular-subulate, the inner 1½ times as broad at the base, very narrowly triangular. Style strongly exserted from the perianth. Capsule half as long as the perianth. VI-VII.

In meadows and river-valleys.—W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang.-Sayan, 33 Dauria; FAR EAST: 36 Zeya-Bur., 37 Udsk. Gen. distr.: Mongolia. Descr. from the Byelaya [White] Uba and Koksun rivers. Type at Leningrad.

NOTE. The var. *intermedium* described by Krylov (Fl. Alt. VI (1912) 1379) is apparently a hybrid between *A. Ledebourianum* and *A. Schoenoprasum.*

84. A. MAXIMOWICZI *Regel* in A. H. P. III, 2 (1875) 153; Kom. Opr. Rast. Dalnevost. Kraya I (1931) 366.

Bulbs attached, a few together, to a rhizome, cylindro-conical, 0.75-1 cm. thick, with greyish, almost papyraceous, disintegrating envelopes.

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[31] [The polymorphism of *Allium Schoenoprasum* is dealt with at length by A. Levan, Zytologische Studien an Allium Schoenoprasum (Akademische Abhandlung, Lund; 1935).

Allium Raddeanum from Munko Sardik, Irkutsk region, west of Lake Baikal (E. Angaro-Sayan, no. 32) is a robust Siberian form 40-60cm. high, with umbels 3-4 cm. across and flowers to 15 mm. long, apparently very similar to the tetraploid "Gigasform" introduced by Turesson from the shore of Lake Teletsker, Oiraten region (W. Angaro-Sayan, no. 32) and figured by Levan (loc. cit. figs 5, 6). —*W. T. S.*]

Scape 15-60 cm. high, clothed at the base or for ⅓ with smooth, sometimes violet-tinted leaf-sheaths. Leaves 1-(2), cylindric (?), fistular, 1-5 mm. wide, smooth, somewhat shorter than the scape. Spathe shortly acuminate, somewhat shorter than the umbel, persistent. Umbel hemispherical or spherical, many-flowered, dense; pedicels almost equal, (1½)-2-(3) times as long as the perianth, without bracts at the base. Segments of the campanulate perianth shining, rose-coloured, with a darker nerve, 5-6-(7) mm. long, oblong-lanceolate, acute. Filaments slightly shorter or scarcely longer than the perianth-segments, connate at the base and adnate to the perianth, entire, the outer ones subulate from a somewhat expanded base, the inner almost 1½ times as broad at the base, gradually narrowed from the base. Style somewhat exserted from the perianth. Capsule 2/3 as long as the perianth. VI-VII. (Tab. XI, fig. 3, 3a).

In meadows and river-valleys.—E. SIBERIA: 33 Dauria; FAR EAST: 35 Okhotsk, 36 Zeya-Bur., 37 Udsk, 38 Ussuri, 39 Sakh. Gen. distr.: Japan-China. Descr. from the Amur and Ussuri region. Type at Leningrad.

NOTE. Very close to *A. Ledebourianum,* and requires further study, since the differences between them are not altogether clear.

85. A. OLIGANTHUM *Karelin et Kirilov* in Bull. Soc. Nat.Mosc. XIV (1841) 856.—*A. stenophyllum* Schrenk in Bull. Phys.-Math. Acad. Pétersb. III (1845) 210; Ledeb. Fl. Ross. IV (1852) 172; Kryl. Fl. Zap. Sib. III (1929) 613.—Ic.: Regel, Fl. Turk. (1876) t. 9, f. 4-6.

Bulbs attached, a few together, to a short rhizome, elongate-ovate, *c.* 1 cm. thick, with crustaceo-coricaeous, cinnamomeous or violet-cinnamomeous, disintegrating envelopes surrounding the base of the stem and there ± parallel-fibrous. Scape 15-35 cm. high, clothed for ⅓ or almost ½ with smooth leaf-sheaths. Leaves 1-2, semi-cylindric, fistular (?), canaliculate, 1-2 mm. wide, shorter than the scape. Spathe shortly acuminate, ½-2/3 as long as the umbel, persistent. Umbel fasciculate-hemispherical or spherical, ± many-flowered, comparatively lax; pedicels almost equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth rose-coloured with a darker nerve, 5-6 mm. long, oblong, acute. Filaments somewhat shorter than the perianth-segments, connate at the base and adnate to the perianth, entire, almost equal, subulate from a scarcely expanded base. Style somewhat exerted from the perianth. Capsule 2/3 as long as it. VI-VII.

In salt-marshy meadows.—W. SIBERIA: 28 Irt.; C. ASIA: 41 Balkhash (N. part). Descr. from the region between the rivers Ayaguz and Donsyk. Type at Leningrad.

Section 4. PHYLLODOLON *(Salisbury) Prokhanov* in Bull. Appl. Bot., Leningrad (Tr. Prikl. Bot., Gen. i Selek.) XXIV (1930) 178.—*Phyllodolon* Salisbury, Gen. Pl. Fragm. (1866) 90.—Bulbs (in the wild species) attached to a rhizome, elongate, ± crowded. Scape robust, hollow, clothed ± high up in the aerial part with leaf-sheaths. Leaves fistular. Pedicels without bracteoles. Perianth campanulate; perianth-segments with one nerve. Filaments entire. Capsule ovoid-trigonous, with scarcely perceptible foveae; seeds angular. [Spp. 86-88.]

86. A. MICROBULBUM *Prokhanov* in Bull. Appl. Bot., Leningrad, XXIV, 2 (1930) 180.

Bulbs attached, 1-3 together, to a short rhizome, ovoid-conical, 0.75-1.5 cm. thick, with red-brown, thinly coriaceous, entire envelopes. Scape 20-25 cm. high, 0.75-1.5 cm. thick below the middle, gradually tapering upwards, clothed at the base with smooth leaf-sheaths. Leaves 2-3, cylindric, fistular, 5-7 mm. thick, gradually narrowed towards the apex, slightly shorter than or ½ as long as the scape. Spathe shortly acuminate, equalling the umbel, persistent. Umbel spherical or almost spherical, many-flowered, dense, capitate; pedicels thick, unequal, the central ones somewhat longer, slightly shorter than or (the central ones) up to twice as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth yellowish, shining, 6-7 mm. long, acute, the inner ones oblong-elliptic, somewhat longer than the oblong-lanceolate outer ones. Filaments twice as long as the perianth-segments, connate at the base and adnate to the perianth, entire, almost equal, subulate from a triangular base. Style strongly exserted from the perianth. Capsule scarcely more than half as long as the perianth.

E. SIBERIA: 33 Dauria (known from 3 localities). According to Prokhanov it is a cultivated plant. Descr. from R. Shavka. Type at Leningrad.

87. A. ALTAICUM *Pallas,* Reise . . . II (1773) 737, t. R.—*A. fistulosum* Ledebour, Fl. Ross. IV (1852) 169; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 120; Kryl. Fl. Zap. Sib. III (1929) 609.—Ic.: [Pallas, l. c.;] Prokhanov in Bull. Appl. Bot., Leningrad (Tr. Prikl. Bot.) XXIV, 2 (1930) 132.

Bulbs attached, 1—few together, to an oblique rhizome, oblong-ovoid, 2-4 cm. thick, with reddish-brown, thinly coriaceous, entire envelopes. Scape robust, 30-70-(100) cm. high, thick, 1-3 cm. thick below the middle, gradually tapering towards the apex, clothed for ⅓-½ with smooth leaf-sheaths. Leaves 2-4, cylindric, fistular, 8-20 mm. wide, gradually narrowed towards the apex, short, ⅓-½ as long as the scape. Spathe shortly acuminate, approximately equalling the umbel. Umbel spherical, many-flowered, dense, capitate; pedicels thick, almost equal, slightly shorter than or 1½ times as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth yellowish, shining, 6-8 mm. long, acuminate, the inner ones elliptic, the outer oblong-lanceolate, somewhat shorter than the inner. Filaments almost twice as long as the perianth, connate at the base and adnate to the perianth, entire, almost equal, subulate from a triangular base. Style exserted from the perianth. Capsule 2/3 as long as the perianth. VII-VIII.

On rocks and in stony places.—W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang.-Sayan, 33 Dauria; C. ASIA: 42 Dzung.-Tarb. Gen. distr.: Dzung.-Kashg., Mongolia. Descr. from the Altai.

(88.) A. FISTULOSUM *Linné,* Sp. Pl. (1753) 301; Schmalh. Fl. II (1897) 489.—Ic.: Prokhanov in Bull. Appl. Bot., Leningrad (Tr. Prikl. Bot.) XXIV, 2 (1930) 133.

Bulbs oblong, sometimes almost undeveloped. Scape up to 1 m. high, thick, fistular, gradually inflated. Leaves fistular. Umbel spherical, many-flowered; pedicels slender, 2-3 times as long as the perianth. Perianth campanulate; perianth-segments yellowish, oblong, acute. Filaments 2-3 times as long as the perianth, entire.—Cultivated plant.

ECONOMIC IMPORTANCE. Abundantly cultivated in the Far East and in Siberia; to the west, beyond Bashkiria, it does not extend as a large-scale crop-plant. In the Far East, the Chinese use the whitened [? bleached] base of the stem ("Japanese leek"). In Europe, in more recent times, owing to the earlier development of the greenstuff, it has been employed in place of the green turnip onion ("winter onion").

Section 5. CEPA *Prokhanov* in Bull. Appl. Bot., Leningrad, XXIV (1930) 180.—Bulbs (in the wild species) attached to a rhizome, ± crowded, often well developed, conical to ovoid. Scape robust, clothed ± high up in the aerial part with leaf-sheaths. Leaves fistular. Pedicels with bracteoles. Perianth stellate; perianth-segments with one nerve. Filaments entire or the inner ones shortly bidentate at the base. Capsule depressed-spherical, provided with wide sacculae (nectaries) at the base. [Spp. 89-93.]

89. A. GALANTHUM *Karelin et Kirilov* in Bull. Soc. Nat. Mosc. XV (1842) 508; Ledeb. Fl. Ross. IV (1852) 169; Kryl. Fl. Zap. Sib. III (1929) 608.—*A. pseudo-cepa* Schrenk in Bull. Acad. Pétersb. X (1842) 355.—Ic.: Regel, Fl. Turk. (1876) t. 8, f. 6-8.

Bulbs attached, a few together, to a rhizome, conic-cylindric, 1.5-2.5 cm. thick, with red-brown, thinly coriaceous, entire envelopes. Scape robust, 20-50 cm. high, solid, gradually narrowed to the apex, clothed at the base with smooth leaf-sheaths. Leaves 2-(3), cylindric, gradually narrowed to the apex, fistular, erect, 3-10 mm. wide, ½-2/3 as long as the scape. Spathe ½-2/3 as long as the umbel. Umbel hemispherical or more often spherical, many-flowered, ± dense; pedicels equal, 2-3 times as long as the perianth, with a few bracteoles at the base. Segments of the stellate perianth white with an inconspicuous nerve, 4-5 mm. long, equal, oblong, obtuse. Filaments scarcely longer than the perianth, adnate to the perianth at the base, subulate from expanded bases which are united into a ring, entire. Style shorter than the capsule. Capsule somewhat longer than the perianth. VII.

Rubbly and stony slopes.—W. SIBERIA: 28 Irt., 29 Alt.; C. ASIA: 41 Balkhash, 42 Dzung.-Tarb., 49 Tien Shan. Gen. distr.: Dzung.-Kashg. Descr. from R. Lepsa. Type at Leningrad.

NOTE. The plant from the Central Tien Shan requires further study.

90. A. PSKEMENSE *B. Fedchenko* in Bull. Jard. Bot. Pétersb. V (1905) 43.—Exs.: Herb. Fl. As. Med. no. 417, a et b.

Bulbs attached, a few together, to a rhizome, elongate-ovoid, 4-6 cm. thick, with red-brown, thinly coriaceous, entire envelopes. Scape robust, 40-80 cm. high, hollow, shallowly inflated below the middle, clothed at the base with smooth leaf-sheaths. Leaves 3, cylindric, narrowed to the apex, fistular, erect, 2-3 cm. thick, half as long as the scape. Spathe approximately equalling the umbel. Umbel spherical, dense, many-flowered; pedicels equal, 3-4 times as long as the perianth, with bracteoles at the base. Segments of the stellate perianth white with an inconspicuous nerve, *c.* 6 mm. long, equal, oblong, obtuse. Filaments somewhat longer than the perianth-segments, connate at the base and adnate to the perianth, slightly united above into a ring, the outer ones subulate, the inner subulate from a bidentate base, which is almost 3 times as broad as in the outer ones and[32] distinctly broader than in the outer ones and distinctly broader than the base of the perianth-segments. Style shorter than the capsule. Capsule spherico-triquetrous. VIII.

In crevices of rocks and in stony places.—C. ASIA: 49 Tien Shan (Tashkent Ala Tau, Chatkal range). Endemic. Descr. from Pskem. Type at Leningrad.

91. A. Vavilovi *M. Popov et Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 122.

Bulbs attached, 1-2 together, to a rhizome, ovoid-oblong, 2.5-4 cm. thick, with red-brown, coriaceous, entire envelopes. Scape robust, 70-90 cm. high, hollow, inflated ¼-⅓ of the way up, clothed at the base with approximate smooth leaf-sheaths. Leaves 7-9, flattened, canaliculate, fistular, glaucous, almost biseriate, recurved, 7-15 mm. wide, several times shorter than the scape. Spathe with a short beak, approximately equalling the umbel. Umbel spherical, dense, many-flowered; pedicels equal, 3-4 times as long as the perianth, with bracteoles at the base. Segments of the stellate perianth white with a green nerve, about 4 mm. long, linear-oblong, obtuse, equal. Filaments equalling the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad as the outer at the base and somewhat broader than the perianth-segments, subulate from a broadly ovate, obtusely bidentate base; anthers greenish-yellow. Style shorter than the capsule. Capsule almost spherical, *c.* 4 mm. in diameter. VI.

In crevices of rocks and on stony slopes.—C. ASIA: 45 Mountain Turkm. Gen. distr.: N. Iran. Descr. from Kopet Dag: Hermab. Type at Tashkent.

92. A. Oschanini *O. Fedchenko* in Progress. Sadov. [Horticulture] i Ogorod. [Market-gardening] III (1906) 332, cum tab.—*A. Cepa* var. *sylvestre* Regel in A. H. P. X (1887) 314.—[Ic.: O. Fedchenko, l. c.] —Exs.: Herb. Fl. As. Med. no. 334.

Bulbs attached, 1-3 together, to a rhizome, ovoid, 2.5-4 cm. thick, with red-brown, coriaceous, entire envelopes. Scape robust, 45-100 cm. high, hollow, inflated below the middle, clothed at the base with ± distant smooth leaf-sheaths. Leaves 4-5, cylindric, narrowed towards the apex,

[32] [Evidently some error here. The words "ones and" should probably be omitted. —Translator's note.]

fistular, glaucescent, erect, 4-15-(40) mm. wide, ⅓ as long as the scape. Spathe approximately equalling the umbel. Umbel spherical, dense, many-flowered; pedicels equal, 3-4 times as long as the perianth, with bracteoles at the base. Segments of the stellate perianth white with a green nerve, 4-5 mm. long, equal, linear-oblong or oblong-lanceolate, obtuse. Filaments 1¼ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad as the outer at the base and somewhat wider than the perianth-segments, subulate from a broadly ovate, obtusely bidentate base. Style shorter than the capsule. Capsule spherico-triquetrous, *c.* 5 mm. in diameter. VI.

In crevices of rocks and on stony slopes.—C. ASIA: 48 Pam.-Al., 49 Tien Shan (Mogol Tau). Endemic. Descr. without indication of native country (probably from the Alai range).[33]

(93.) A. CEPA *Linné,* Sp. Pl. (1753) 300; Schmalh. Fl. II (1897) 489.—Ic.: Syreishch. Ill. Fl. Mosc. Gov. I (1906) 236.

Bulb oblong or depressed-spherical, with yellow-brown, reddish or white envelopes. Scape up to 1 m. high, thick, inflated below the middle, fistular. Leaves fistular. Umbel spherical, dense, many-flowered; pedicels several times longer than the perianth. Perianth stellate, whitish-greenish, with oblong obtuse segments. Filaments longer than the perianth, the inner ones obtusely bidentate at the base. Cultivated plant.

ECONOMIC IMPORTANCE. Cultivated throughout the Union for the bulbs, which are stored up, and as a pot-herb. Large-scale cultures are found in the central zone of the European part of the USSR; there is also a considerable culture in Transcaucasia and Central Asia; it is rare in Siberia and the Far East, where it has only recently penetrated. In the north it is only grown for the greenstuff.

Sect. 6. HAPLOSTEMON [(Boissier) Halácsy, Consp. Fl. Graecae III (1904) 240, 250.—Sect. *Crommyum* subsect. *Haplostemon*] *Boissier,* Fl. Or. V (1882) 230, [249].—Bulb solitary, spherical, ovoid or oblong-ovoid, without a rhizome. Scape clothed with leaf-sheaths ± high up in the aerial part. Perianth-segments with one nerve. Filaments entire or shortly bidentate. Seeds angular. [Spp. 94-142.]

94. A. MARGARITAE *B. Fedchenko* in Bull. Jard. Bot. Princ. XVIII, 1 (1918) 14.—*A. moschatum* auct. Fl. As. Med.—Exs.: Herb. Fl. As. Med. no. 61.

Bulb ovoid, 1-1.5 cm. thick, the outer envelopes brown or grey-brown, coriaceous, splitting, with prominent almost reticulate nerves. Scape 10-20 cm. high, clothed half-way with smooth leaf-sheaths. Leaves 3-4, filiform, apparently semicylindric, canaliculate, smooth, equalling the scape. Spathe ⅓-½ as long as the umbel, with a beak half as long as the base of the spathe, not becoming torn to the base, forming a small tube

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33 [*A. Cepa* var. *sylvestre* Regel (1887) was collected by Albert Regel in the mountains to the northwest of the Iskander Kul lake, south of the Zeravshan river. —*W. T. S.*]

surrounding the base of the umbel. Umbel capsuliferous, fasciculate, few-flowered, lax; pedicels unequal, 2-4-(5) times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth almost white, with a strong, dirty-purple nerve, 5-6 mm. long, equal, lanceolate, acute. Filaments 2/3 as long as the perianth, connate at the base and adnate to the perianth, subulate from a triangular base, the inner ones twice as broad; anthers yellow. Style not exserted from the perianth; ovary almost spherical, papillose [lit. "scabrid"]. Valves of the capsule almost circular, scarcely emarginate, *c.* 3 mm. long. VI-VII.

On outcrops of particoloured rocks.—C. ASIA: 41 Balkhash, 49 Tien Shan. Endemic. Descr. from the valley of the R. Chu: Uspenskoye. Type at Leningrad.

NOTE. It is very probable that, with more detailed study, this species, together with the four following, will have to be transferred to the section *Rhiziridium.*

95. A. INAEQUALE *Janka* in Linnaea, XXX (1860) 603.—*A. moschatum* auct., p. p.—Ic.: Fl. Yugo-Vost. I (1927) 367.

Bulb ovoid, 1-2 mm. thick; outer envelopes brown or grey-brown, almost coriaceous, splitting and ± reticulate-fibrous, especially at the apex which embraces the base of the scape. Scape 10-25 cm. high, clothed for 1/3 or almost ½ with smooth leaf-sheaths. Leaves 3-4-(5), filiform, apparently semicylindric, canaliculate, smooth or more rarely scabrid, apparently shorter than the scape, withering towards flowering-time. Spathe 1/3-1/2 as long as the umbel, with a beak equalling the base of the spathe, torn down to the base. Umbel capsuliferous, fasciculate, few-flowered, lax; pedicels usually very unequal, (2)-3-6-(10) times as long as the perianth, with a few bracteoles at the base. Segments of the campanulate perianth pale-rose with a purple nerve, 4-5-(7) mm. long, equal, oblong-lanceolate, obtuse. Filaments ¼ shorter than the perianth-segments, connate at the base and adnate to the perianth, the inner ones narrowly triangular, twice as broad as the triangular-subulate inner ones; anthers violet. Style not exserted from the perianth, usually *c.* 1.5 mm. long; ovary truncate-conical, scabrid. Valves of the capsule circular, scarcely emarginate, *c.* 3 mm. long. VI-VIII.

On steppe slopes, limestone, chalk, sand.—EUROPEAN PART: 13 Volga-Don (S. W. part), 16 Black Sea, 17 Crimea (Balaklava), 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc. (Stavropol), 21 Dag.[34] (?); C. ASIA: 40 Aral-Casp. Endemic. Descr. from Krasnoarmeisk.

NOTE. Typical *A. inaequale* occurs beyond the Volga; but to the west, over the south of the European part of the U S S R, a form is prevalent, transitional in character to *A. moschatum,* but coming nearest to *A. inaequale.* These forms require further detailed study.

96. A. MOSCHATUM *Linné,* Sp. Pl. (1762) 427; Ledeb. Fl. Ross. IV (1852) 172, p. p.; Boiss. Fl. Or. V (1882) 265; Schmalh. Fl. II (1897)

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[34] Akhty, *Becker* — requires confirmation.

490, p. p.—Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1091.—Exs.: Fl. Hung. exs. no. 697.

Bulb oblong-ovoid, 1-1.5 cm. thick; outer envelopes grey-brown, almost coriaceous, splitting, with reticulate nerves at the apex, which ± surrounds the base of the stem, reticulate-fibrous or reticulate. Scape 10-25 cm. high, clothed for 1/3-1/2 with smooth leaf-sheaths. Leaves (4)-5-6, filiform, canaliculate, ± convolute, ciliate-scabrid on the margin, approximately equalling the scape, lasting almost up to the time of fruiting. Spathe generally somewhat shorter than the umbel, with a beak generally exceeding the base of the spathe, torn down to the base. Umbel capsuliferous, fasciculate or more often hemispherical, ± few-flowered; pedicels almost equal, equalling or 2-(3) times as long as the perianth, with a few bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, (5)-6-7 mm. long, almost equal, lanceolate, obtuse. Filaments almost 1/3 shorter than the perianth-segments, connate at the base and adnate to the perianth, triangular-subulate, the inner ones 1½ times as broad as the outer at the base; anthers violet. Style not exserted from the perianth, generally *c.* 3 mm. long; ovary pyriform, papillose [lit. ''scabrid'']. Valves of the capsule *c.* 3 mm. long, almost circular, with a short narrowly emarginate apiculus at the apex. VII-VIII.

On rocks and dry slopes.—EUROPEAN PART: 12 Middle Dnepr (W. part), 17 Crimea; CAUCASUS: 20 Ciscauc., 22 W., 23 E. and 24 S. Transcauc. Gen. distr.: C. Eur., W. Medit., Balkans-Asia Min. Descr. from France and Spain.

97. A. CALLIDICTYON *C. A. Meyer ex Kunth*, Enum. IV (1843) 413; Ledeb. Fl. Ross. IV (1852) 173; Boiss. Fl. Or. V (1882) 266.

Bulb oblong-ovoid, 1-1.5 cm. thick; outer envelopes rufescent, reticulate. Scape 10-20 cm. high, clothed for 1/3 or almost ½ with ± hairy lower and smooth upper leaf-sheaths. Leaves 3-4, filiform, convolute, scabrid or smooth on the margin, shorter than the scape. Spathe half as long as the umbel, with a beak almost equalling the base of the spathe, torn down to the base. Umbel capsuliferous, fasciculate, few-flowered, lax; pedicels unequal, 1/5-1/3 as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth whitish with a dirty-green nerve, 6-7 mm. long, equal, oblong-lanceolate, the outer ones subacute, the inner obtuse. Filaments ¼ shorter than the perianth-segments, connate and adnate to the perianth for ¼, the inner ones triangular, twice as broad as the narrowly triangular outer ones; anthers yellow. Style not exserted from the perianth; ovary elongate-truncate-conical, smooth. VI.

In dry stony places.—Indicated for 23 E. and 24 S. Transcauc. I have seen no specimens thence. Gen. distr.: Asia Min., Iran. Descr. from N. Iran. Cotype at Leningrad.

98. A. LACERUM *Freyn* in Oesterr. Bot. Zeitschr. XLII (1892) 373 et herb. *A. laceratum* Freyn in Oesterr. Bot. Zeitschr. XLI (1891) 60, non Boiss. et Noë (1859).—*A. incisum* Fomin in Monit. Jard. Bot. Tiflis

14 (1909) 52—*A. araxanum* Fomin ex Grossheim, Fl. Kavk. I (1928) 211.—*A. fimbriatum* Shishkin in Izv. Tom. Gos. Un. [Inf. Tomsk State Univ. ?] 80 (1929) 432.

Bulb oblong-ovoid, *c.* 1 cm. thick; outer envelopes brownish, reticulate, sometimes prolonged and embracing the base of the stem. Scape 5-40 cm. high, slender, clothed half-way with ± hairy leaf-sheaths. Leaves 3-5, semicylindric, canaliculate, apparently fistular, 0.5-1.5 mm. wide, scabrid-hirsute on the margin. Spathe somewhat shorter than, or half as long as, the umbel, with a beak half as long as the base of the spathe, not becoming torn to the base, forming a short tube surrounding the base of the umbel. Umbel capsuliferous, fasciculate, few-flowered, lax; pedicels unequal, 1½-3-(5) times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth pale-rose, almost white, in the herbarium sometimes yellowish, 6-7 mm. long, equal, the outer ones ovate or oblong-ovate, acute or subacute, with ± reflexed apiculi, entire, the inner ones oblong-elliptic, obtuse, ± deeply dissected along the margin in the upper part. Filaments 1/2-2/3 as long as the perianth-segments, connate at the base and adnate to the perianth, the inner ones triangular, twice as broad as the narrowly triangular outer ones. Style not exserted from the perianth. VII.

In rocky places.—CAUCASUS: 24 S. Transcauc. Gen. distr.: Asia Min., N. Iran. Descr. from Asia Minor: Amasia. Cotype at Leningrad.

99. A. STAMINEUM *Boissier,* Diagn. Pl. Or. II, 4 (1859) 119; Boiss. Fl. Or. V (1882) 256.—*A. kossoricum* var. *araraticum* Mishchenko ex Grossheim, Fl. Kavk. I (1928) 212, et in herb.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes greyish or blackish, papyraceous, almost without nerves; envelopes of the new [lit. "replacing"] bulb without noticeable nerves. Scape 20-30 cm. high, clothed for (1/3)-1/2-2/3 with smooth leaf-sheaths. Leaves 2-(4), semicylindric, *c.* 1 mm. wide, smooth, straite, longer than the scape.[35] Umbel capsuliferous, fasciculate or more often fasciculate-hemispherical, usually many-flowered; pedicels unequal, 2-5-(9) times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a dirty-purple nerve, 4 mm. long, elliptic-oblong, obtuse with a rounded apex, the outer ones cymbiform, somewhat shorter than the outer. Filaments 1¼ or more rarely 1½ times as long as the perianth-segments, more rarely [36] connate and adnate to the perianth for 1/5, subulate, purple; anthers yellow. Ovary almost sessile, spherical, scabrid; style strongly exserted from the perianth. Valves of the capsule circular, shallowly emarginate, *c.* 3.5 mm. long. VI-VII.

Mountain steppes.—CAUCASUS: 24 S. Transcauc. Gen. distr.: E. Medit., Balkans.-Asia Min., Arm.-Kurd., Iran. Descr. from Asia Minor: Caria.

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35 "Umbel" in the original. —Translator's note.

36 ["More rarely" should perhaps be omitted (? printer's error). —Translator's note.]

100. A. KOSSORICUM *Fomin* in Monit. Jard. Bot. Tiflis 14 (1909) 50.

Bulb ovoid, *c.* 1 cm. thick; outer envelopes blackish, torn into parallel fibres. Scape c. 20 cm. high, clothed for 1/3 with smooth leaf-sheaths. Leaves 3, cylindric-filiform, smooth. Spathe somewhat shorter than the umbel. Umbel capsuliferous, few-flowered, fasciculate-hemispherical; pedicels unequal, 2-5 times as long as the perianth. Segments of the ovoid-campanulate perianth whitish-greenish with a small violet blotch, with a green nerve, 3-3.5 mm. long, elliptic-oblong, obtuse, with the apex rounded or provided with a small reflexed apiculus, the outer ones cymbiform, somewhat shorter than the inner. Filaments 1½-2 times as long as the perianth-segments, connate and adnate to the perianth for 1/5, subulate, violet-coloured; anthers yellow. Ovary almost sessile, spherical, scabrid; style considerably exserted from the perianth. VI.

On dry stony slopes.—CAUCASUS: 24 S. Transcauc. Gen. distr.: Arm.-Kurd. Descr. from Olta, near the village of Kosor. Type at Tiflis.

NOTE. Cited by Grossheim (Fl. Kavk. I, 212) from various places in Transcaucasia, but I have not seen the material determined by him. It is described, in the original description, as having bulb-envelopes torn into parallel fibres; I have seen no bulbs from the type locality. All the green-flowered material of the *A. stamineum* (s. l.) group, with bulbs preserved, that I have at my disposal, has the outer bulb-envelopes without nerves or with feebly developed nerves.

A. stamineum, A. kossoricum and *A. pseudo-flavum,* together with other related Allia from Asia Minor, require further study; for their separation it will be essential to call in other characters besides the colour of the flowers, on which their separation is here chiefly based.

101. A. PSEUDO-FLAVUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 123.—*A. flavum* auct., quoad pl. Transcauc. et Pers., p. p.

Bulb ovoid, 0.75-1 cm. thick; outer envelopes greyish or brownish, almost coriaceous, with distinct parallel nerves; envelopes of the new bulb with longitudinal nerves. Scape (10)-15-25 cm. high, clothed for 1/3 or more rarely ½ with scabrid, more rarely smooth leaf-sheaths. Leaves 4, filiform, *c.* 0.5 mm. wide, semicylindric, striate, scabrid or smooth on the margin, apparently shorter than the scape.[37] Spathe 1½-3 times as long as the umbel. Umbel capsuliferous, few-flowered, fasciculate or more rarely fasciculate-hemispherical; pedicels unequal, 1½-3-(5) times as long as the perianth, with bracteoles at the base. Segments of the ellipsoid-campanulate perianth yellow, more rarely with a rosy tinge, 4 mm. long, elliptic-oblong, obtuse, with the apex rounded or more often provided with a small reflexed apiculus, the outer ones cymbiform, scarcely shorter than the inner. Filaments 1¼ or more

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[37] "Umbel" in the original. —Translator's note.

often $1\frac{1}{2}$ times as long as the perianth-segments, connate and adnate to the perianth for 1/5, subulate, yellow; anthers yellow. Ovary almost sessile, spherical, papillose [lit. "scabrid"]; style considerably exserted from the perianth. Valves of the capsule circular, shallowly emarginate, 3.5 mm. long. VI-VII. (Tab. XII, fig. 1 a-c).

On dry slopes.—CAUCASUS: 23 E. & 24 S. Transcauc., 25 Talysh. Gen. distr.: N. Iran. Descr. from Nor Bayazet near the village of Subbotan. Type at Leningrad.

NOTE. Certain plants from E. Transcaucasia and Talysh have a rosy tinge to the perianth.

102. A. PULCHELLUM *G. Don.* Mon. (1827) 46, excl. syn. *A. paniculatum* et *A. Sequierianum.*—*A. flavum* var. *pulchellum* Ledebour Fl. Ross. IV (1852) 175, p. p.—*A. carinatum* var. *capsuliferum* Ledebour, l. c.—*A. flavum* var. *tauricum* Besser ex Reichenbach, Pl. Crit. VI (1828) f. 776.—*A. Paczoskianum* Tuzson in Bot. Közlem. XII (1913) 190, t. 5, f. 1.—*A. flavum* auct., quoad pl. Ross. Europ. et Cauc., p. p.—Ic.: Reichb. l. c., Tuzs. l. c.

Bulb ovoid, 0.75-1-(1.5) cm. thick; outer envelopes greyish or brownish, papyraceous, almost without nerves. Scape (20)-30-50 cm. high, clothed half-way with smooth leaf-sheaths. Leaves 3-4, semicylindric, 0.5-1 mm. wide, smooth, striate, apparently usually shorter than the scape. Spathe 2-4-(5) times as long as the umbel. Umbel capsuliferous, fasciculate or fasciculate-hemispherical, generally many-flowered; pedicels very unequal, 2-10 times as long as the perianth. Segments of the ellipsoid-campanulate perianth yellowish with a ± intense rosy tinge,[38] with a "bloom," matt [lustreless], (4)-5 mm. long, elliptic-oblong, obtuse, with a rounded apex, the outer ones cymbiform, somewhat shorter and broader than the inner. Filaments $1\frac{1}{2}$-(2) times as long as the perianth-segments, connate and adnate to the perianth for 1/5, subulate, generally violet; anthers bright-violet, pollen yellow. Style considerably exserted from the perianth; ovary on a distinct stipe, oblong, smooth. Valves of the capsule broadly obcordate, almost circular, 4-5 mm. long. VI-VII.

On dry slopes.—EUROPEAN PART: 12 Middle Dnepr, 13 Volga-Don, 16 Black Sea, 17 Crimea, 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc., 22 W. and 23 E. Transcauc. Gen. distr.: Balkans-Asia Min. Descr. from Russia.

NOTE. The true *A. flavum* L. does not extend within the bounds of the U S S R, and all records of it, apart from certain Transcaucasian ones, refer to the present species. *A. flavum* is yellow with a complete absence of anthocyanin tints.

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38 [Vvedensky's description of the perianth of *A. pulchellum* as "yellowish with a more or less intense rosy tinge" seems to be taken from dried specimens. In a living state the perianth is a deep red-purple. Don cites Redouté, Liliac. V. t. 252 (1809), under the name "*A. paniculatum,*" as representing his species. —*W. T. S.*]

103. A. CARINATUM *Linné,* Sp. Pl. (1753) 297; Ledeb. Fl. Ross. IV (1852) 174, excl. var. *capsuliferum;* Boiss. Fl. Or. V (1882) 255; Schmalh. Fl. II (1897) 488.—Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1057.—Exs.: Kerner, Fl. Hung. exs. no. 3483.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes blackish or brownish, almost papyraceous, with slender parallel nerves. Scape 25-45 cm. high, clothed half-way with scabrid or smooth leaf-sheaths. Leaves 3-(4), narrowly linear, 1-2 mm. wide, ± convolute, striate, scabrid or smooth, apparently equalling the scape. Spathe 3 times as long as the umbel. Umbel with bulbils, fasciculate or more often fasciculate-spherical, lax, few-flowered; pedicels almost equal, 2-4 times as long as the perianth. Segments of the ovoid-campanulate perianth rose-coloured with a darker nerve, with a "bloom," matt, 5-6 mm. long, almost equal, elliptic-oblong, obtuse. Filaments 1½ times as long as the perianth-segments, connate and adnate to the perianth for 1/5, subulate, purple; anthers bright-violet, pollen yellow. Style considerably exserted from the perianth; ovary oblong, on a short stipe, smooth. VI-VIII.

Cited for many localities in the western part of former European Russia, the majority of which do not come within the bounds of the U S S R, but in herbaria it is usually *A. oleraceum* L. which is represented under this name. I have not seen *A. carinatum* from within the bounds of the U S S R.

104. A. OLERACEUM *Linné,* Sp. Pl. (1753) 299; Ledeb. Fl. Ross. IV (1852) 174; Schmalh. Fl. II (1897) 488; Kryl. Fl. Zap. Sib. III (1929) 631.—*A. scabrum* Gilib. Exerc. Phyt. II (1792) 469.—Ic.: Syreishch. Ill. Fl. Mosc. Gov. I (1906) 238.

Bulb ovoid, *c.* 1 cm. thick; outer envelopes brownish or greyish, with slender parallel nerves. Scape 25-50 cm. high, clothed for 1/3-1/2 with smooth, more rarely scabrid leaf-sheaths. Leaves 3-4, narrowly linear, 1-2 mm. wide, ± convolute, smooth or scabrid, shorter than the scape. Spathe 2-3 times as long as the umbel. Umbel with bulbils, fasciculate or fasciculate-hemispherical, lax, few-flowered, very rarely with bulbils alone without flowers; pedicels unequal, 2-4-(6) times as long as the perianth, generally flexuous. Segments of the narrowly-campanulate perianth greenish or more rarely rosy, 6-7 mm. long, equal, linear-oblong, obtuse, with the apex rounded, often provided with a very small apiculus. Filaments equalling the perianth-segments, connate and adnate to the perianth for 1/5, subulate; anthers yellow. Style exserted from the perianth, almost ½ shorter than the capsule. Valves of the capsule obcordate, *c.* 6 mm. long. VI-VII.

Over meadows, steppes, and slopes, and in thickets; sometimes as a weed.—EUROPEAN PART: 8 Ladoga-Ilmen, 9 Upper Volga, 10 Volga-Kama, 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don, 14 Transvolga, 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc. Gen. distr.: W. Eur. Descr. from Sweden and Germany.

105. A. PANICULATUM *Linné,* Syst. Nat. ed. 10, II (1759) 978; Boiss. Fl. Or. V (1882) 259, p. p.; Schmalh. Fl. II (1897) 489, excl. var.

rupestri.—*A praescissum* Reichenbach, Pl. Crit. V. (1827) 17, f. 618.—*A. paniculatum* var. *legitimum* Ledebour, Fl. Ross. IV (1852) 176.—*A. fuscum* auct. fl. Ross.—Ic.: Reichb. l. c.—Exs.: H F R no. 535.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes greyish, papyraceous, with scarcely noticeable, slender, parallel nerves. Scape (20)-30-50 cm. high, clothed for 2/3 with smooth leaf-sheaths. Leaves 3-4, narrowly linear, 1-2 mm. wide, ± convolute, striate, smooth or scabrid, apparently (at least the upper ones) longer than the scape. Spathe (1½)-2-4 times as long as the umbel. Umbel capsuliferous, fasciculate or more rarely fasciculate-hemispherical, lax, generally branched, ± many-flowered; pedicels very unequal, 2-9 times as long as the perianth, with bracteoles at the base. Segments of the narrowly campanulate perianth rose-coloured, sometimes deep-rose, with a darker nerve, shining, more intensely coloured at the apex, 5-6 mm. long, equal, linear-oblong, obtuse, truncate. Filaments scarcely shorter than the perianth-segments, connate and adnate to the perianth for ¼, subulate; anthers yellow. Style scarcely exserted from the perianth, 2/5 as long as the capsule. Valves of the capsule obcordate, *c.* 5 mm. long. VII-VIII.

On steppes, in sandy places, on slopes.—EUROPEAN PART: 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don, 14 Transvolga, 16 Black Sea, 17 Crimea, 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc.; W. SIBERIA: 27 Upper Tob., 28 Irt.; C. ASIA: 45 Mountain Turkm. Gen. distr.: S. Eur., Asia Min. (?). In the work of Linnaeus cited, the locality is not indicated; in later editions southern Europe is given.

NOTE. The Kopet Dag plant merits further study: in its dirty-rose, inconspicuous flowers it approaches *A. lenkoranicum,* but differs from it in the coarser envelopes of the bulbs and more slender leaves. Apart from that, it grows in entirely different conditions. The Kopet Dag plant is an inhabitant of dry mountain slopes.

106. A. LENKORANICUM *Mishchenko ex Grossheim,* Fl. Kavk. I (1928) 214.

Bulb ovoid, 1-2 cm. thick; outer envelopes greyish-brownish, thinly papyraceous. Scape 20-50 cm. high, clothed for 1/2-2/3 with smooth leaf-sheaths. Leaves 4-5, filiform, 1-2 mm. wide, convolute, apparently flat, withering before flowering-time. Spathe 6 times as long as the umbel. Umbel fasciculate, lax, comparatively few-flowered; pedicels unequal, 2-6 times as long as the inflorescence, with a few bracteoles at the base. Segments of the narrowly campanulate perianth dirty-lilac-rose, with a dirty-purple nerve, dull, 5-6 mm. long, linear-oblong, obtuse, with a rounded-truncate apex, sometimes provided with a little apiculus. Filaments scarcely shorter than or equalling the perianth-segments, connate, and adnate to the perianth, for 1/5, subulate; anthers yellow. Style exserted from the perianth, half as long as the capsule. Valves of the capsule broadly obovate, *c.* 4 mm. long. VIII.

On slopes in the forest zone.—CAUCASUS: 25 Talysh. Endemic. Descr. from Lenkoran.

107. A. KARSIANUM *Fomin* in Monit. Jard. Bot. Tiflis, 14 (1909) 51.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes greyish, papyraceous, almost without noticeable nerves. Scape 20-40 cm. high, clothed for 2/3-3/4 with smooth leaf-sheaths. Leaves 3-4, narrowly linear, 1-1.5 mm. wide, ± convolute, striate, smooth or scabrid, longer than the scape. Spathe 2-3 times as long as the umbel. Umbel fasciculate or more often fasciculate-hemispherical, mostly dense and many-flowered; pedicels unequal, equalling or 2-5 times as long as the perianth, with a few bracteoles at the base. Segments of the narrowly campanulate perianth pale-rose, almost white, with a purple nerve, shining, (6)-7-8 mm. long, linear-oblong, obtuse with a rounded apex. Filaments 1/4 shorter than the perianth-segments, connate, and adnate to the perianth, for 1/5, subulate; anthers yellow (?). Style not exserted from the perianth, 1/2 as long as the capsule. Valves of the capsule obcordate, *c.* 5 mm. long. VII.

On stony slopes and rocks.—CAUCASUS: 23 E. and 24 S. Transcauc. Endemic. Descr. from Olta: Kyrkh Kilis-Khas Kei. Type at Tiflis.

NOTE. A species very close to *A. Kunthianum* Vved. and requiring verification from fresh material. In herbaria it is commonly found under the name *A. paniculatum,* a species which, however, does not occur in Transcaucasia. From the latter it is distinguished very much better than from *A. Kunthianum.*

108. A. KUNTHIANUM *Vvedensky,* nom. nov.—*A. lepidum* Kunth, Enum. IV (1843) 408, p. p., quoad pl. Hohenack., non Ledeb. (1833); Boiss. Fl. Or. V (1882) 263.—*A. paniculatum* var. *macilentum* Ledebour, Fl. Ross. IV (1852) 176, p. p.

Bulb (usually paired) ovoid, 0.75-1 cm. thick; outer envelopes blackish, papyraceous, without noticeable nerves. Scape (5)-10-30 cm. high, clothed for 1/2-2/3 with smooth leaf-sheaths. Leaves 2-(4), apparently semicylindric, *c.* 1 mm. wide, striate, smooth, or scabrid on the margin, longer than the scape. Spathe 1½-2 times as long as the umbel. Umbel capsuliferous, fasciculate-hemispherical, ± few-flowered; pedicels almost equal, somewhat shorter than or 2-(3) times as long as the perianth, with a few bracteoles at the base. Segments of the narrowly campanulate perianth rose-coloured, mostly deep-rose, with a purple nerve, shining, (6)-7-8 mm. long, equal, linear-oblong, subobtuse with ± reflexed apiculi. Filaments slightly or 1/4 shorter than the perianth-segments, connate, and adnate to the perianth, for 1/5, subulate; anthers yellow. Style not exserted from the perianth, 1/2 as long as the capsule. Valves of the capsule obcordate, *c.* 5 mm. long. VII-IX. (Tab. XII, fig. 2 a, b).

On high-mountain meadows and rocks.—CAUCASUS: 20 Ciscauc., 21 Dag., 22 W., 23 E. and 24 S. Transcauc. Endemic. Descr. from the neighbourhood of Shushi.

NOTE. To this species, apparently, belongs the plant cited by Albov (Tr. Tifl. Bot. Sada, I (1895) 240) as *A. subquinqueflorum* Boiss. I have seen neither Albov's specimens nor any other examples of *A.*

subquinqueflorum, a species which, according to Albov, deserves further study. According to Boissier, *A. subquinqueflorum* has smaller (5 mm.) whitish flowers.

109. A. RUPESTRE *Steven* in Mém. Soc. Nat. Mosc. III (1812) 260.—*A. paniculatum* var. *macilentum* Ledebour, Fl. Ross. IV (1852) 176, p. p.—*A. paniculatum* var. *pallens* Boissier, Fl. Or. V (1882) 260, p. p.—*A. paniculatum* var. *rupestre* Regel in A. H. P. III, 2 (1875) 192; Schmalh. Fl. II (1897) 489.—*A. charaulicum* Fomin in Monit. Jard. Bot. Tiflis, 14 (1909) 54 (?).—Ic.: Reichb. Pl. Crit. V (1827), f. 616, 617.—Exs.: Pl. Or. exs. no. 57.

Bulb ovoid, *c.* 1 cm. thick; outer envelopes papyraceous, with very slender parallel nerves; bulblets whitish, with slender parallel nerves, small, generally absent. Scape 25-40 cm. high, clothed halfway with scabrid, very rarely smooth leaf-sheaths. Leaves (2)-3, filiform-linear, 0.5-1 mm. wide, ± convolute, striate, generally scabrid, considerably shorter than the scape. Umbel capsuliferous, fasciculate or fasciculate-hemispherical, more rarely almost spherical, usually few-flowered; pedicels almost equal, slightly shorter than or 1½-2 times as long as the perianth, with bracteoles at the base. Segments of the narrowly campanulate perianth pale-rose, almost white, with a purple nerve, not shining, 5-6 mm. long, almost equal, oblong-elliptic, obtuse, the apex rounded or more often provided with a very short apiculus. Filaments equalling or scarcely longer than the perianth-segments, connate, and adnate to the perianth, for 1/5, subulate; anthers violet. Style exserted from the perianth, 1/5 as long as the capsule. Valves of the capsule obcordate, almost circular, 5mm. long. VIII-X.

On stony and sandy slopes and rocks.—EUROPEAN PART: 17 Crimea; CAUCASUS: 21 Dag., 22 W. & 23 E. Transcauc. Gen. distr.: Asia Min. Descr. from Mtskhet.

NOTE. *A. charaulicum* (loc. class. Artvin: Kharaul) is described as having filaments 1½ times as long as the perianth-segments and pedicels 4 times exceeding the perianth. An authentic specimen, preserved at Leningrad, shows filaments equalling the perianth-segments and pedicels equalling the perianth or only 1½ times as long. The question needs further investigation.

110. A. CONVALLARIOIDES *Grossheim* in Grossheim et Shishkin, Pl. Orient. Exs. (1924) no. 107.—*A. pallens* Vvedensky in Fl. Turkm. I (1932) 263.—Exs.: Pl. Orient. l. c.

Bulb ovoid, *c.* 1 cm. thick; outer envelopes greyish, papyraceous, almost without noticeable nerves. Bulblets yellowish, with very slender parallel nerves, generally absent. Scape 40-60 cm. high, clothed for almost ½ with smooth leaf-sheaths. Leaves 4-5, narrowly linear, 1-1.5 mm. wide, canaliculate, striate, smooth, apparently shorter than the scape. Spathe 1½-2 (?) times as long as the umbel. Umbel capsuliferous, fasciculate-ovoid or fasciculate-spherical, dense, many-flowered; pedicels unequal, 2-5 times longer than the perianth, with bracteoles at the base. Segments of the campanulate perianth white, 4-5 mm. long, broadly linear-oblong, obtuse, truncate, the inner ones somewhat longer; filaments scarcely longer than the perianth-segments, connate, and adnate to the perianth, for 1/5, subulate; anthers yellow. Style exserted from the perianth, ¼ as long as the capsule. Capsule somewhat longer than the perianth, with almost circular scarcely emarginate valves. VI-VII.

In slightly saline localities.—CAUCASUS: 23 E. & 24 S. Transcauc.; C. ASIA: 45 Mountain Turkm. Endemic (?). Descr. from Erivan: Dzhervish. Type at Baku.

111. A. KIRINDICUM *Bornmüller* in Bot. Centralbl. XXXIII, 2 (1915) 209.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes papyraceous, greyish, with slender, distant, parallel nerves; bulblets none. Scape 15-25 cm. high, clothed with (1)-2-(5) sheaths (the lower ones scabrid, the upper often smooth), of which the uppermost more often exceeds the base of the umbel and simulates a spathe, more rarely reaching only to the middle of the scape. Leaves filiform, canaliculate, scabrid, not exceeding the umbel, the uppermost one abbreviated. Spathe persistent, several times shorter than the umbel, very shortly acuminate. Umbel fasciculate or fasciculate-hemispherical, few-flowered, lax; pedicels very slender, almost equal, 3-5 times as long as the perianth, with bracteoles at the base. Segments of the tubular-campanulate perianth white or very light-rose with a strong dirty-purple nerve, 4-5 mm. long, almost equal, oblong-lanceolate, subobtuse, the inner ones somewhat broader. Filaments slightly or up to 1/3 shorter than the perianth-segments, connate, and adnate to the perianth, for 1/3, entire, triangular-subulate, almost equal. Style not exserted from the perianth. Capsule (immature) 1/3 shorter than the perianth. VIII.

C. ASIA: 45 Mountain Turkm. Found once on consolidated screes on Mt. Dushak. Gen. distr.: Iran. Descr. from Nehavend.

112.[39] A. FIBROSUM *Regel* in A. H. P. X (1887) 322, t. 7, f. 2.—*A. Korolkowi* var. *albidum* O. Kuntze in A. H. P. X (1887) 243.—*A. leucosphaerum* Aitchison et Baker in Trans. Linn. Soc. Ser. 2, Bot. III (1888) 117.—Ic.: Regel, l. c.—Exs.: Herb. Fl. As. Med. no. 177.

Bulb ovoid, 0.75-1 cm. thick; outer envelopes brown, almost coriaceous, splitting, with reticulate venation; bulblets numerous, large, with reticulate nerves, yellowish. Scape (more often 2 from one bulb) (15)-25-60 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 4-6, semicylindric, 0.5-2 mm. wide, canaliculate, fistular, smooth

[39] The group of *A. rubellum* s. l. (112-120) represents a very intricate, polymorphic, eastern Mediterranean, xerophilous complex, still far from adequately studied. Herewith is presented an attempt to distinguish within it elementary units, many of which were at one time described as independent species, but later came to be regarded as synonyms of *A. rubellum* M. B. These units are not sharply defined, and show transitions in all the characters of which it was possible to make use in the herbarium.

or more rarely scabrid, shorter than the scape. Spathe with a long beak usually exceeding the base of the spathe, coming away entire, early caducous. Umbel capsuliferous, hemispherical or almost spherical, more rarely fasciculate, dense, many-flowered; pedicels almost equal, (1½)-3-5 times as long as the perianth, without bracts. Perianth broadly campanulate, umbilicate at the base, segments white, rose or deep-rose, with a strong green or purple nerve, 4-5-(6) mm. long, equal, elliptic or oblong-elliptic, obtuse with a short, small apiculous, the inner ones somewhat broader than the outer. Filaments ½-¾ as long as the perianth-segments, connate, and adnate to the perianth, for 1/4-1/3, entire, the inner ones triangular, twice as broad as the narrowly triangular outer ones. Style not exserted from the perianth. Capsule somewhat shorter than the perianth. IV-V.

In sandy deserts and in foothills on particoloured rocks.—C. ASIA: 44 Kara Kum, 45 Mountain Turkm. Gen. distr.: N. Afghanistan. Descr. from Chikishlyar. Type at Leningrad.

113. A. SYNTAMANTHUM *C. Koch* in Linnaea, XXII (1849) 238.— *A. rubellum* var. *parviflorum* Ledebour Fl. Ross. IV (1853) 171, p. p.; Boiss. Fl. Or. V (1882) 253, p. p.

Bulb ovoid, *c.* 1 cm. thick; outer envelopes brown, coriaceous, splitting, with strong almost reticulate nerves; bulblets few, large, winged, elongate, yellowish, with slender nerves. Scape 15-30 cm. high, clothed for 1/4-1/3 with smooth approximate leaf-sheaths. Leaves 3.4, semicylindric, canaliculate, apparently fistular, smooth, *c.* 1 mm. wide, apparently shorter than the scape. Spathe coming away entire, early caducous, ± rose-coloured. Umbel capsuliferous, hemispherical or almost spherical, dense, ± few-flowered; pedicels almost equal, slightly or more often 2-(3) times longer than the perianth, without bracteoles. Segments of the broadly campanulate, umbilicate-based perianth deep-rose with a purple nerve, 3-4 mm. long, linear-oblong, obtuse, the outer ones up to 1½ times broader and scarcely shorter than the inner. Filaments somewhat shorter than the perianth-segments, connate, and adnate to the perianth, for ¼, entire, the outer ones narrowly triangular, the inner triangular, 1½ times as broad as the outer and equalling the perianth-segments at the base. Style not exserted from the perianth. Capsule scarcely shorter than the perianth. V-VI.

On stony slopes.—CAUCASUS: 24 S. Transcauc. Endemic. Descr. from the Erivan district. Type at Berlin.

114. A. RUBELLUM *Marschall-Bieberstein,* Fl. Taur.-Cauc. I (1808) 264; III (1819) 260.—*A. rubellum* var. *parviflorum* Ledebour, Fl. Ross. IV (1852) 171, p. p.; Boiss. Fl. Or. V (1882) 253, p. p.

Bulb ovoid, *c.* 1 cm. thick; outer envelopes brown, coriaceous, splitting, with strong almost reticulate nerves; bulblets few, large, winged, yellowish, with slender nerves. Scape (sometimes 2 from one bulb) 15-40 cm. high, clothed at the base or for ¼ with approximate smooth leaf-sheaths. Leaves 3-4, semicylindric, canaliculate, fistular, smooth, or more rarely scabrid on the margin, 1-2 mm. wide, usually shorter than the scape. Spathe somewhat shorter than the umbel, with a beak somewhat shorter than the base of the spathe, coming away entire, early caducous. Umbel capsuliferous, hemispherical or almost spherical, dense, many-flowered; pedicels almost equal, 2-3 times as long as the perianth, without bracteoles. Segments of the broadly campanulate, umbilicate-based perianth rose with a purple nerve, 3-4-(5) mm. long, oblong or more often oblong-lanceolate, attenuate, acute or subobtuse, the outer ones somewhat broader and shorter than the inner. Filaments ¼ or 1/3 shorter than the perianth-segments, connate, and adnate to the perianth, for ¼, entire, the outer ones narrowly triangular, the inner triangular, 1½ times as broad as the outer and equalling the perianth-segments at the base. Style not exserted from the perianth. Capsule somewhat shorter than the perianth. V.

On dry slopes.—CAUCASUS: 23 E. Transcauc., 25 Talysh (?). Gen. distr.: N. Iran (?). Descr. from Georgia.

NOTE. Typical *A. rubellum* s.s. is found in the western part of E. Transcaucasia and does not reach Gandzha. Here, and also farther to the south-east along the right bank of the Kura, *A. rubellum* is not always distinguishable from *A. albanum*. I therefore refer the Talysh and certain North Persian material to the present species with a query.

115. A. ALBANUM *Grossheim,* Fl. Kavk. I (1928) 211.—*A. rubellum* var. *grandiflorum* Ledebour, Fl. Ross. IV (1852) 171; Boiss. Fl. Or. V (1882) 253, p. p.—*A. rubellum* Schmalhausen, Fl. II (1897) 490.—Ic.: Regel, Fl. Turk. (1876) t. 10, f. 7-9.

Bulb ovoid, *c.* 1 cm. thick; outer envelopes coriaceous, brown, splitting, with strong almost reticulate nerves; bulblets few, generally small, yellowish, very rarely brownish, sometimes winged, with slender nerves. Scape (often 2 from one bulb) 10-30 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 4-5-(6), semicylindric, canaliculate, fistular, smooth, or more rarely scabrid on the margin, 1-2-(3) mm. wide, usually shorter than the scape. Spathe somewhat shorter than the umbel, with a beak equalling the base of the spathe, coming away entire, early caducous, sometimes rose-coloured. Umbel capsuliferous, hemispherical or more rarely spherical, dense, many-flowered; pedicels almost equal, 2-3-(4) times longer than the inflorescence, without bracteoles. Segments of the campanulate, umbilicate-based perianth rose with a purple nerve, (4)-5-6 mm. long, oblong-lanceolate, attenuate, acute or subacute, the outer ones somewhat broader and shorter than the inner. Filaments ½-2/3 as long as the perianth-segments, connate, and adnate to the perianth, for ¼, entire, the outer ones narrowly triangular, the inner triangular, 1½ times as broad as the outer and equalling the perianth-segments at the base. Style not exserted from the perianth. Capsule (½)-2/3 as long as the perianth. V-VI.

On dry slopes, in semi-desert and on dry mountain steppes.—EUROPEAN PART: 19 Lower Volga (Bogdo); CAUCASUS: 21 Dag., 23 E. Transcauc. (to the east of Gandzha); C. ASIA: 40 Aral-Casp.

(Manghyshlak, Kara Bugaz), 45 Mountain Turkm. Gen. distr.: N. Persia. Descr. from various localities in E. Transcaucasia.

NOTE. The plants from Apsheron deserve further study, since they are usually stocky, with leaves exceeding the scape, while at the same time approaching *A. scabrellum* in certain characters (e. g. nervation of bulblets, colour of flowers). The reference of the Kopet Dag mountain-steppe plants to this species also requires confirmation.

Among the Kopet Dag representatives of the *A. rubellum* (s. l.) group, an onion with small white flowers, obtained by many collectors from Gaudan, still remains obscure.

116. A. SCABRELLUM *Boissier et Buhse* in Nouv. Mém. Soc. Nat. Mosc. XXII (1860) 215; Boiss. Fl. Or. V (1882) 251.—*A. rubellum* ssp. *scabrellum* Vvedensky in Herb. Fl. As. Med. (1926) no. 180.—Exs.: HFR no. 1190, sub *A. Tschulpias;* Herb. Fl. As. Med., l. c.

Bulb ovoid, (1)-2 cm. thick; outer envelopes ± coriaceous, brown, splitting, with reticulate nerves, sometimes bast-like; bulblets generally numerous, small, yellowish, unwinged, often with distinct cells between the nerves. Scape 25-50 cm. high, clothed for ⅓ with smooth, or more rarely scabrid, ± distant leaf-sheaths. Leaves 3-4, semicylindric, canaliculate, fistular, scabrid on the nerves, more rarely smooth, 2-3 mm. wide, shorter than the scape. Spathe somewhat shorter than the umbel, with a beak approximately equalling the base of the spathe, coming away entire, falling early, often rose-coloured. Umbel capsuliferous, fasciculate-hemispherical, more rarely almost spherical, dense, many-flowered; pedicels almost equal, 2-3 times as long as the perianth, without bracts. Segments of the narrowly campanulate, umbilicate-based perianth generally pale-rose with an inconspicuous purple nerve, shining in the herbarium, (5)-6-7 mm. long, almost equal, lanceolate or oblong-lanceolate, usually strongly attenuate, acute or subacute, the outer ones somewhat broader than the inner. Filaments ⅓-½ as long as the perianth-segments, connate, and adnate to the perianth, for ¼-⅓, entire, the outer ones narrowly triangular, the inner generally broadly triangular, twice as broad as the outer and usually slightly broader than the base of the perianth-segments. Style not exserted from the perianth. Capsule half as long as the perianth. V-VI. (Tab. XIII, fig. 1 a-c).

Generally as a weed in oases.—C. ASIA: 45 Mountain Turkm., 47 Syr Dar., 48 Pam.-Al. Gen. distr.: Iran. Descr. from Yezd. Type at Leningrad.

117. A. JACQUEMONTII *Kunth,* Enum. IV (1843) 399.[40]

Bulb ovoid, 0.5-1 cm. thick; outer envelopes greyish, almost papyraceous, with almost parallel nerves; bulblets few, whitish, unwinged, with

[40] [*A. Jacquemontii* Kunth (1843), which Regel regarded as synonymous with *A. rubellum* M. Bieb., should not be confused with *A. Jacquemonti* Regel in A. H. P. III 2 (1875) 162, which is a plant with elongate-cylindric bulbs, reticulate-fibrous bulb envelopes and slightly exserted stamens of which the inner filaments are slightly toothed at base. This last plant is so closely allied to *A. Eduardi* Stearn (*A. Fischeri* Regel, non Besser) that no new name is proposed for it at present. —*W. T. S.*]

slender nerves. Scape 15-35 cm. high, clothed for ¼-⅓ with smooth ± distant leaf-sheaths. Leaves 2-(3), semicylindric, canaliculate, fistular, smooth or more rarely scabrid, 1-2 mm. wide, shorter than the scape. Spathe coming away entire, early caducous. Umbel capsuliferous, hemispherical, dense, ± many-flowered; pedicels almost equal, equalling or 1½ times (to twice) as long as the perianth, without bracteoles. Segments of the campanulate, umbilicate-based perianth rose-coloured, with a strong dirty-purple nerve, 5-(6) mm. long, almost equal, somewhat attenuate, oblong-lanceolate, acute, the outer ones somewhat broader than the inner. Filaments almost ⅓ shorter than the perianth, connate, and adnate to the perianth, for ⅓, entire, the outer ones narrowly triangular, the inner broadly triangular, twice as broad as the outer and somewhat broader than the perianth-segments at the base. [Ovary . . .? Style . . .? Capsule . . .?] V.

Stony slopes in the lower mountain zone.—C. ASIA: 48 Pam.-Al. (Shugnan). Gen. distr.: N. W. India. Descr. from India. Type at Paris.

NOTE. I refer the Shugnan material to this species with some doubt, as I have had no Indian plants for comparison.

118. A. ANISOTEPALUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 123.

Bulb ovoid, 0.5-0.75-(1) cm. thick; outer envelopes grey-brown or brown, coriaceous, splitting, with indistinct almost reticulate nerves; bulblets few, unwinged, small, whitish, with slender nerves. Scape 10-25-(40) cm. high, covered for ⅓ with smooth ± distant leaf-sheaths. Leaves 2-3-(4), filiform, apparently semicylindric, canaliculate, smooth, or more rarely scabrid on the margin, 0.5-1.5 mm. wide, usually shorter than the scape. Spathe usually ⅓ shorter than the umbel, with a short beak ⅓-½ as long as the base of the spathe, sometimes rose-coloured, generally persistent, torn down to the base. Umbel capsuliferous, fasciculate-hemispherical or hemispherical, dense, ± many-flowered; pedicels almost equal, equalling or 1½-2 times as long as the perianth, without bracteoles. Segments of the campanulate, intruse-based perianth rose-coloured with a dirty-purple nerve, unequal, the outer ones (4)-5-(6) mm. long, very attenuate, acute, oblong or oblong-lanceolate, more rarely lanceolate, 1¼ or more often 1½ times as long as the inner, which are acute, oblong or oblong-elliptic, and up to 1½ times broader than they. Filaments 1/6-1/5 as long as the outer perianth-segments, connate, and adnate to the perianth, for ⅓-½, the outer ones narrowly triangular, the inner broadly triangular, 2-(3) times as broad as the outer and approximately equalling the perianth-segments at the base. Style not exserted from the perianth. Capsule half as long as the perianth.[40a] (Tab. XIII, fig. 2, a-c).

Rubbly and earthly slopes in the montane steppe zone.—C. ASIA: 48 Pam.-Al. (Alai range), 49 Tien Shan (Fergana range). Endemic. Descr. from the Fergana range: Arslanbob. Type at Leningrad.

[40a] [Flowering period omitted. —Note by translator.]

119. A. MINUTUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 124.

Bulb ovoid, 0.5-0.75 cm. thick; outer envelopes almost coriaceous, black-brown, ± splitting, with almost reticulate nerves; bulblets few, unwinged, small, whitish, with slender nerves. Scape 10-20 cm. high, slender, clothed for ¼ with smooth ± distant leaf-sheaths. Leaves 2-3, filiform, *c.* 0.5 mm. wide, apparently semicylindric, canaliculate, smooth, shorter than the scape. Spathe ⅓ shorter than the umbel, very shortly acuminate, persistent, torn down to the base. Umbel capsuliferous, fasciculate-hemispherical, or hemispherical, dense, ± few-flowered; pedicels almost equal, equalling or 1½ times (to twice) as long as the perianth, without bracteoles. Segments of the broadly campanulate, intruse-based perianth white, with a dirty-green nerve, 3-4-(5) mm. long, oblong, very rarely oblong-lanceolate, usually shortly acuminate, acute, the outer ones generally somewhat longer and broader than the inner. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for ⅓, entire, the outer ones triangular, the inner broadly triangular, almost twice as broad as the outer and equalling the perianth-segments at the base. Style not exserted from the perianth. Capsule ⅓ shorter than the latter. V-VII.

Rubbly and particoloured (? always) mountain slopes.—C. ASIA: 48 Pam.-Al. (Fergana range). Endemic. Descr. from the Kok Su valley. Type at Leningrad.

120. A. PARVULUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 124.

Bulb ovoid, 0.5-0.75 cm. thick; outer envelopes almost coriaceous, black-brown, ± splitting, with almost reticulate nerves; bulblets few, unwinged, small, whitish, with slender nerves. Scape (sometimes 2 from one bulb) 10-20 cm. high, slender, clothed for ¼ with smooth ± distant leaf-sheaths. Leaves 3-4, filiform, *c.* 0.5 mm. wide, apparently semicylindric, canaliculate, smooth, shorter than the scape. Spathe ½-(2/3) as long as the umbel, with a short beak ¼-⅓ as long as the base of the spathe, generally persistent, torn down to the base. Umbel capsuliferous, fasciculate-hemispherical or hemispherical, dense, ± many-flowered; pedicels almost equal, (1½)-2-3 times as long as the perianth, without bracteoles. Segments of the campanulate, intruse-based perianth white with a dirty-green nerve, 4-(5) mm. long, equal, oblong-lanceolate or lanceolate, very attenuate, acute, often with reflexed apiculi. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for ⅓, entire, the outer ones narrowly triangular, the inner broadly triangular, twice as broad as the outer and somewhat broader (at the base) than the perianth-segments. Style not exserted from the perianth. Capsule ½ as long as the latter. V.

Rubbly (apparently particoloured) slopes of the lower mountain zone.—C. ASIA: 49 Tien Shan (Alexander range, Trans-Ilian Ala Tau). Endemic. Descr. from Auliё Ata: Tek Turmas. Type at Leningrad.

121. A. Griffithianum *Boissier,* Diagn. Pl. II, 4 (1859) 117.—*A. Tschulpias* Regel in A. H. P. III, 2 (1875) 107.—*A. Kuschakewiczi* Regel, l. c. (1875) 117.—*A. tenue* Regel, l. c. (1875) 206, non G. Don.—*A. Bahri* Regel in A. H. P. X (1887) 326, t. 1, f. 2.—Ic.: Regel, Fl. Turk. (1876) t. 10, f. 10-12; ibid. t. 11, f. 12-13.—Exs.: Herb. Fl. As. Med. no. 66, sub *A. Tschulpias.*

Bulb ovoid, 1-2 cm. thick; outer envelopes almost coriaceous, splitting, with reticulate nerves; bulblets few, large, yellowish, with reticulate venation. Scape 10-30-(50) cm. high, clothed at the base or for ⅓ with smooth or more rarely slightly scabrid leaf-sheaths. Leaves 2-3, semicylindric, canaliculate, fistular, 1-2 mm. wide, usually scabrid on the margin, generally shorter than the scape. Spathe somewhat shorter than the umbel, with a short beak, coming away entire, quickly caducous; umbel capsuliferous or very rarely with bulbils, hemispherical, dense, ± many-flowered; pedicels ± unequal, shorter than, or usually equalling or up to twice as long as, the perianth, without bracteoles. Segments of the campanulate perianth light-flesh-pink with a darker nerve, oblong-lanceolate or lanceolate, subobtuse or obtuse, unequal, the outer ones 7-8 mm. long, ¼-⅓ longer and somewhat broader than the inner, which are provided at the base with a fovea. Filaments ⅓ as long as the outer perianth-segments, connate, and adnate to the perianth, for ½-2/3, entire, the inner triangular, twice as broad as the narrowly triangular outer ones. Style not exserted from the perianth. Capsule ½ as long as the latter. IV-V.

Soft soils of foothill deserts and of the lower mountain zone.—C. ASIA: 47 Syr Dar., 48 Pam.-Al. (does not reach the Fergana valley). Gen. distr.: Afghanistan. Descr. from the Kabul region. Type at Geneva.

122. A. ophiophyllum *Vvedensky* in Herb. Fl. As. Med. (1928) no. 336.—Exs.: l. c.

Bulb ovoid, *c.* 1 cm. thick; outer envelopes cinnamomeous, almost coriaceous, with obscurely reticulate nerves, ± torn into laciniae at the apex and base; bulblets few, straw-yellow with parallel nerves. Scape 15-40 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 3-4, cylindric, fistular, 1-1.5 mm. wide, glaucous, spirally, often almost helicoidally, coiled, smooth or slightly scabrid. Spathe persistent, ⅓ shorter than the umbel, with a very short beak. Umbel capsuliferous, fasciculate or hemispherical, generally few-flowered, ± dense; pedicels almost equal, (1)-1½-2 times as long as the perianth, without bracteoles. Segments of the campanulate perianth light-violet with a darker nerve, shining when withering, bluish, (6)-7 mm. long, obtuse, the inner ones linear-oblong, somewhat longer than the lanceolate outer ones. Filaments equalling or scarcely shorter than the perianth-segments, connate and adnate to the perianth at the base, entire, violet, the outer ones triangular-subulate, the inner narrowly triangular, somewhat broader than the outer. Style scarcely exserted from the perianth. Capsule half as long as the latter. IV-V.

Outcrops of particoloured rocks.—C. ASIA: 46 Amu Dar., 47 Pam.-Al. Endemic. Descr. from Khaudak Tau. Type at Tashkent.

123. A. INOPS *Vvedensky* in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 91.

Bulb conspicuous, *c.* 1 cm. thick; outer envelopes cinnamomeous or greyish, almost papyraceous, without nerves. Scape 8-17 cm. high, clothed for ⅓ with smooth leaf-sheaths. Leaves 2-3, apparently semi-cylindric, filiform, *c.* 0.5 mm. wide, smooth, somewhat shorter than or equalling the scape. Spathe early caducous, thinly membranous. Umbel capsuliferous, fasciculate, later almost spherical, few-flowered, lax; pedicels equal, 2-3 times as long as the perianth, with bracteoles at the base. Segments of the narrowly campanulate perianth rosecoloured with a purple nerve, 6-7 mm. long, equal, lanceolate, acute or subacute. Filaments connate, and adnate to the perianth, for ¼, the inner subulate from a triangular base, ¼ shorter than the perianth-segments, 1½ times as long and 2-3 times as broad as the subulate outer ones; anthers yellow. Style not exserted from the perianth, ⅓ as long as the capsule, the latter half as long as the perianth, with almost circular, scarcely emarginate valves. V.

On outcrops of saline [saliferous, halophorous] rocks.—C. ASIA: 49 Tien Shan. Endemic. Descr. from the neighborhood of Aulië Ata: Dair Mulla. Type at Leningrad.

124. A. LASIOPHYLLUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 125.

Bulb ovoid, 5-8 mm. thick; outer envelopes grey, papyraceous, without noticeable nerves, prolonged, surrounding the base of the scape; bulblets none. Scape (very rarely 2 from one bulb) 10-20 cm. high, clothed for ½ with densely short-hairy leaf-sheaths. Leaves 2-4, filiform, 0.5-1 mm. wide, apparently flat, canaliculate, glabrous or ± densely pubescent, shorter than the scape. Spathe scarcely more than ⅓ as long as the umbel, with a beak less than half as long as the base of the spathe, persistent. Umbel capsuliferous, fasciculate, ± few-flowered; pedicels almost equal, equalling or 1½ times as long as the perianth, with bracteoles at the base. Segments of the narrowly campanulate perianth rosecoloured with a darker nerve, 6-7 mm. long, equal, linear-lanceolate, acute, the outer ones scarcely broader. Filaments ¼ shorter than the perianth-segments, connate and adnate to the perianth at the base, entire, the inner triangular-subulate, 1½ times as broad at the base as the almost subulate outer ones. Style not exserted from the perianth. Capsule (almost ripe) scarcely more than half as long as the perianth. VI.

C. ASIA: 49 Tien Shan (Tekes). Endemic. Type at Leningrad.

125. A. DELICATULUM *Sievers ex Roemer et Schultes,* Syst. VII (1830) 1133; Ledeb. Fl. Ross. IV (1852) 171; Schmalh. Fl. II (1897) 490; Kryl. Fl. Zap. Sib. III (1929) 610.—*A. Willdenowii* Kunth, Enum. IV (1843) 453; Ledeb. Fl. Ross. IV (1852) 190.—*A viridulum* auct.—Ic.: Regel, Fl. Turk. (1876) t. 9, f. 7-9.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes grey or almost black, papyraceous, without noticeable nerves; bulblets solitary, almost smooth, commonly absent. Scape 15-45 cm. high, clothed for ⅓-½ with smooth leaf-sheaths. Leaves 2-3, filiform, 0.5-1.5 mm. wide, apparently semi-cylindric, canaliculate, smooth or very rarely scabrid, shorter than the scape. Spathe ½-2/3 as long as the umbel, with a beak equalling or 3 times exceeding the base of the spathe, persistent. Umbel capsuliferous, fasciculate or more often fasciculate-hemispherical, more rarely almost spherical, dense, many-flowered; pedicels almost equal, slightly or commonly 2-3-(4) times longer than the perianth, with numerous rather large bracteoles at the base. Segments of the campanulate perianth whitish or rose with a strong violet-purple nerve, (3)-4-6 mm. long, equal, subobtuse or subacute, lanceolate or oblong, the inner ones somewhat broader. Filaments equalling or ¼ shorter than the perianth-segments, connate, and adnate to the perianth, for 1/5, entire, triangular-subulate, the inner ones 1½ times as broad as the outer at the base. Style scarcely exserted from the perianth. Capsule somewhat shorter than the perianth. VI-VII.

In salt-marshes, in wormwood [*Artemisia*] deserts, more rarely on chalk formations.—EUROPEAN PART: 14 Transvolga (S. part), 19 Lower Volga; W. SIBERIA: 27 Upper Tob., 28 Irt.; C. ASIA: 40 Aral-Casp., 41 Balkhash. Gen. distr.: Dzung.-Kashg. Descr. from the "Krigiz desert."

126. A. GLOMERATUM *Prokhanov* in Bull. Jard. Bot. Princ. URSS, XXIX (1930) 560, fig. II.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes grey, papyraceous, with slender parallel nerves, prolonged, surrounding the base of the scape, bulblets none. Scape often ± flexuous, 10-20 cm. high, clothed for ½ with smooth leaf-sheaths. Leaves 2-3, narrowly linear, 0.5-1.5 mm. wide, apparently flat, canaliculate, smooth, or scabrid on the margin, slightly shorter or slightly longer than the scape. Spathe persistent, almost equalling the umbel, with a beak slightly shorter than or half as long as the base of the spathe. Umbel capsuliferous, hemispherical, dense, few-flowered; pedicels almost equal, slightly shorter than or equalling the perianth, with narrow bracteoles at the base. Segments of the campanulate perianth rosy-violet with a darker nerve, (4)-5 mm. long, lanceolate, acute, the outer ones scarcely broader. Filaments equalling or scarcely shorter than the perianth-segments, connate and adnate to the perianth at the base, entire, subulate, almost equal; anthers violet. Style scarcely exserted from the perianth. Capsule 2/3 as long as the perianth. VII-VIII.

Argillaceous and stony slopes.—C. ASIA: 49 Tien Shan (C. Tien Shan). Gen. distr.: Dzung.-Kashg. Descr. from Kashgaria: Kok Muinak Pass. Type at Leningrad.

127. A. PALLASI *Murray,* Comment. Goetting. VI (1775) 32, t. 3; Ledeb. Fl. Ross. IV (1852) 170; Kryl. Fl. Zap. Sib. III (1929) 612.—*A. tenue* G. Don, Mon. (1827) 34.—*A. lepidum* Ledebour, Ic. Pl. Fl. Ross. IV (1833) 17.—*A. caricifolium* Karelin et Kirilov in Bull. Soc. Nat. Mosc.

XIV (1841) 854.—*A. semiretschenskianum* Regel in A. H. P. V (1878) 630.—*A. Alberti* Regel in A. H. P. V (1878) 632.—Ic.: Ledeb. Ic. Pl. Fl. Ross. IV (1833), t. 355.—Exs.: H. F. A. M. no. 337.

Bulb ovoid, 1-2 cm. thick; outer envelopes grey, papyraceous, without nerves, or almost coriaceous, brownish, with parallel nerves; bulblets none. Scape (sometimes 2 from one bulb) (10)-20-65 cm. high, clothed for ⅓ or almost ½ with smooth leaf-sheaths. Leaves (2)-3-4, filiform or narrowly linear, 0.5-1.5-(2.5) mm. wide, smooth, or scabrid on the margin, shorter than the scape. Spathe persistent, slightly shorter than or ⅓-½ as long as the umbel, shortly acuminate. Umbel capsuliferous, hemispherical or more often spherical, many-flowered, rather lax; pedicels almost equal, (1½)-2-3-(4) times as long as the perianth, with a few bracteoles or more often without them. Segments of the broadly campanulate, sometimes almost stellate perianth rose-coloured with a purple nerve, shining, 3-4 mm. long, equal, lanceolate or oblong-lanceolate, obtuse or subacute. Filaments equalling or up to 1½ times as long as the perianth-segments, connate and adnate to the perianth at the base, subulate from a triangular base, the inner ones 1½ times as broad at the base, sometimes obtusely bidentate at the base. Style slightly exserted from the perianth. Capsule equalling or 2/3 as long as the latter. V-VI.

In salt-marshes, on carbonate [? of calcium] slopes, on outcrops of parti-coloured rocks and on stony and rubbly slopes in the alpine and subalpine zones.—W. SIBERIA: 28 Irt., 29 Alt.; C. Asia: 40 Aral-Casp. (Mai Tyube), 41 Balkhash, 42 Dzung.-Tarb., 48 Pam.-Al., 49 Tien Shan. Gen. distr.: Dzung.-Kashg. Descr. from Siberia.

NOTE. The mountain plants have the outer bulb-envelopes papyraceous, without nerves; in plants from the plains they are generally almost coriaceous, with distinct parallel nerves. More detailed investigation of this phenomenon is needed.

128. A. MACROSTEMON *Bunge* [Enum. Pl. China Bor. (1833) 65, reimpr. in] Mém. Sav. Étr. Acad. Pétersb. II (1835) 139[41]; Kom. et Alis. Opred. Rast. Dalnevost. Kraya, I (1931) 365.—*A. uratense* Franchet in Nouv. Arch. Mus. Hist. Nat. VII (1884) 114.

Bulb almost spherical, 1-2 cm. thick; outer envelopes blackish, papyraceous, without noticeable nerves; bulblets none. Scape (40)-60-90 cm. high, covered for ¼-⅓ with smooth leaf-sheaths. Leaves 3-4, linear, 2-3 mm. wide, not fistular, canaliculate, smooth, considerably shorter than the scape. Spathe persistent, half as long as the umbel, with a beak half as long as or almost equalling the base of the spathe. Umbel with bulbils (sometimes almost without flowers), more rarely without bulbils (var. *uratense* Airy-Shaw in Notes Bot. Gard. Edinb. XVI (1931) 136), hemispherical or spherical, ± many-flowered, dense; pedicels almost equal, (2)-3-4 times as long as the perianth, with numerous bracteoles at the base. Segments of the broadly campanulate, almost hemispherical

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41 [The separate edition of Bunge's paper was published in March 1833 before its appearance in the Mémoires of the Petrograd Academy in 1835; cf. Stearn in Journ. of Bot. LXXIX (1941) 63. —*W. T. S.*]

perianth deep rose with a darker nerve, (4)-5 mm. long, almost equal, oblong or oblong-lanceolate, subacute. Filaments 1/4 longer than the perianth-segments, connate and adnate to the perianth at the base, entire, gradually becoming subulate from an expanded base, the inner ones 1½ times as broad as the outer. Style exserted from the perianth. VI-VII.

In meadows and plough-lands.—FAR EAST: 38 Ussuri. Gen. distr.: Japan-China. Descr. from Pekin.

129. A. CAERULEUM *Pallas,* Reise. . . II (1773) 727, t. R; Ledeb. Fl. Ross. IV (1852) 170; Kryl. Fl. Zap. Sib. III (1929) 611.—*A. coerulescens* G. Don, Mon. (1827) 34.—*A. azureum* Ledebour, Fl. Alt. II (1830) 13.—*A. viviparum* Karelin et Kirilov in Bull. Soc. Nat. Mosc. XIV (1841) 852; Kryl. Fl. Zap. Sib. III (1929) 611.—Ic.: Ledeb. Ic. Pl. Fl. Ross. II (1830) t. 136.—Exs.: Herb. Fl. As. Med. no. 335.

Bulb almost spherical, 1-2 cm. thick; outer envelopes papyraceous, grey, without noticeable nerves; bulblets gray-violet or violet, without nerves, usually absent. Scape (rarely 2 from one bulb) 25-85 cm. high, clothed for 1/3 with smooth or scabrid leaf-sheaths. Leaves (2)-3-4, triquetrous, canaliculate, (1)-2-4 mm. wide, smooth or more rarely scabrid, shorter than the scape; spathe ½-2/3 as long as the umbel, acuminate, persistent. Umbel capsuliferous or with bulbils (var. *bulbilliferum* Ledebour, Fl. Ross. IV (1853) 170), hemispherical or spherical, dense, many-flowered; pedicels equal, 2-5 times as long as the perianth, with bracteoles at the base. Segments of the broadly campanulate perianth sky-blue with a darker nerve, 4-5 mm. long, equal, subobtuse, the outer ones oblong-lanceolate, the inner lanceolate. Filaments equalling or slightly longer than the perianth-segments, connate and adnate to the perianth at the base, subulate from a triangular base, the inner ones twice as broad as the outer at the base, sometimes bidentate below the middle. Style exserted from the perianth. Capsule slightly shorter than the perianth. VI-VII.

In salt-marshes and salt-marshy meadows, and in mountains in the steppe zone.—EUROPEAN PART: 19 Lower Volga; W. SIBERIA: 27 Upper Tob. (Naurzum), 28 Irt. (S. part), 29 Alt.; C. ASIA: 40 Aral—Casp., 41 Balkhash, 42 Dzung.-Tarb., 49 Tien Shan (except the Tashkent Ala Tau), 48 Pam.-Al. (Alai range, Mogian). Gen. distr.: Dzung.-Kashg. Descr. from the neighborhood of Semipalatinsk: Berezovka.

NOTE. When growing together, *A. caeruleum* and *A. caesium* sometimes form hybrids with each other; such are known, for example, from Kulan Utmes (Irt.).

130. A. CAESIUM *Schrenk* in Bull. Phys.-Math. Acad. Pétersb. II (1844) 113; Ledeb. Fl. Ross. IV (1852) 166.—*A. urceolatum* Regel in A. H. P. II (1873) 406.—*A. Renardi* Regel in A. H. P. VI (1880) 521.—Ic.: Regel, Fl. Turk. (1876) t. 9, f. 10-12.—Exs.: Herb. Fl. As. Med. no. 56; HFR no. 2789.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes almost coriaceous, grey, without noticeable nerves; bulblets greyish-brownish or violet, with indistinct longitudinal nerves. Scape 15-65 cm. high, clothed for 1/4 or sometimes ½ with scabrid, more rarely smooth, leaf-sheaths. Leaves 2-3, semicylindric, canaliculate, 1-3 mm. wide, fistular (? always), scabrid, more rarely almost smooth, slightly longer or slightly shorter than the stem. Spathe ½ as long as the umbel, acuminate, persistent. Umbel usually capsuliferous, more rarely with bulbils, very rarely with bulbils only, without flowers, generally hemispherical or spherical, many-flowered, dense; pedicels equal, 2-3-(5) times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth dark azure blue with a darker nerve, more rarely white, 4-6 mm. long, equal, oblong or oblong-lanceolate, subobtuse, the inner ones somewhat broader. Filaments slightly or ¼ shorter than the perianth-segments, connate and adnate to the perianth at the base, the outer ones subulate from a triangular base, the inner twice as broad at the base, widened for 2/3, obtusely bidentate. Style slightly exserted from the perianth. Capsule 2/3 as long as the latter. V-VI.

In the steppe zone in salt-marshes, in semi-desert; in the southern part in foothills and mountains up to 2000 m.—W. SIBERIA: 28 Irt. (S. part); C. ASIA: 40 Aral-Casp., 41 Balkhash, 42 Dzung.-Tarb., 47 Syr Dar., 48 Pam.-Al. (Alai and Turkestan ranges), 49 Tien Shan. Gen. distr.: Dzung.-Kashg. Descr. from Karaganda. Type at Leningrad.

NOTE. The plants from the Alai range, and part of those from the Fergana range, have, judging from the herbarium, generally darker flowers with a distinct violet tinge; they are narrower and longer, generally 6 mm. long. Such plants were noted by Drobov (in herb. Acad. et Univ. As. Med.) as *A. Litvinovii,* and were evidently proposed for publication in the Herb. Fl. Ross. under this name. These plants from Fergana, and also the white-flowered plants sometimes occurring in great quantities in one locality (e.g. the Chu-Ili Mts., Chimgan), require further study. *A. Renardi* was described by Regel as having white flowers.

131. A. ELEGANS *Drobov* in Sched. ad H F R (1917) no. 2790.

Bulb ovoid, 0.75-1 cm. thick; outer envelopes coriaceous, greyish or brownish, splitting, without noticeable nerves; bulblets few, brownish or violet, smooth. Scape 10-20 cm. high, clothed ¼-⅓ with smooth leaf-sheaths. Leaves 2, filiform, 0.5-1 mm. wide, canaliculate, smooth, slightly shorter than or equalling the scape. Spathe very small, several times shorter than the umbel, acuminate, persistent. Umbel capsuliferous, fasciculate or more often hemispherical or almost spherical, ± many-flowered, lax; pedicels almost equal, (3)-4-6 times as long as the perianth, the outer ones ascending, with bracteoles at the base. Segments of the campanulate perianth in the living state white, in the herbarium light-violet with a darker nerve, 5-6 mm. long, almost equal, lanceolate, subobtuse. Filaments 2/3 as long as the perianth, connate, and adnate to the perianth, for ¼, entire, triangular-subulate, the inner twice as broad as the outer at the base. Style not exserted from the perianth. Capsule ½ as long as the perianth. V-VI. (Tab. XIII, fig. 4 a, b).

Clayey-rubbly slopes.—C. ASIA: 48 Pam.-Al. (Alai range, Sary Tau). Endemic. Descr. from the Alai range: R. Shakhimardan, village of Pulgan. Type at Leningrad.

132. A. KOPETDAGENSE *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 125.

Bulb ovoid, 0.5-0.75 cm. [sphalm. "mm."] wide; outer envelopes papyraceous, grey, with scarcely noticeable parallel nerves; bulblets none. Scape 5-12 cm. high, clothed for ½-3/4 with smooth leaf-sheaths. Leaves 3, filiform, semicylindric, canaliculate, smooth, considerably exceeding the umbel. Spathe persistent, ⅓ as long as the umbel, without a beak. Umbel capsuliferous, hemispherical or more rarely almost spherical, lax, few-flowered; pedicels almost equal, equalling or 1½ times as long as the perianth, without bracteoles. Segments of the campanulate perianth rose-coloured with a purple nerve, 6-7 mm. long, narrowly lanceolate, acute, equal. Filaments ⅓ shorter than the perianth-segments, connate, and adnate to the perianth, for ⅓, entire, the outer ones triangular-subulate, the inner triangular, almost 3 times as broad as the outer and 1½ times as broad as the perianth-segments at the base. Style not exserted from the perianth. Capsule scarcely more than ½ as long as the perianth, with broadly obcordate valves. VI.

Rubbly slopes.—C. ASIA: 45 Mountain Turkm. Endemic. Descr. from Prokhaladnoye. Type at Leningrad.

133. A. OREOPHILOIDES *Regel* in A. H. P. III, 2 (1875) 114.—Ic.: Regel, Fl. Turk. (1876) t. 11, f. 4-6.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes papyraceous, grey, with scarcely noticeable parallel nerves; bulblets none. Scape 3-10 cm. high, smooth or ± (sometimes very strongly) scabrid, clothed for ¼-½ with smooth or ± scabrid leaf-sheaths. Leaves 2, filiform, *c.* 0.75 mm. wide, apparently semicylindric, canaliculate, ± scabrid, or almost smooth, longer than the scape. Spathe persistent acuminate, 1/3-1/2 as long as the umbel. Umbel capsuliferous, hemispherical or almost spherical, ± few-flowered, generally dense; pedicels almost equal, 2-3 times as long as the inflorescence, with a few bracteoles at the base. Segments of the broadly campanulate perianth pale-rose with a strong purple nerve, 4-5 mm. long, equal, acute, the inner ones oblong-ovate, somewhat broader than the oblong outer ones. Filaments 1/3 shorter than the perianth-segments, connate, and adnate to the perianth, for ¼, the outer ones triangular-subulate, the inner twice as broad at the base, widened almost to the apex, bidentate. Style not exserted from the perianth. Capsule scarcely more than ½ as long as the perianth. VII-VIII.

On moraines and rocks in the alpine zone.—C. ASIA: 48 Pam.-Al., 49 Tien Shan (valleys of the rivers Susamyr, W. Karakol, Talas). Endemic. Descr. from the Shchurovsky glacier. Type at Leningrad.

NOTE. The Tien Shan plants are more attenuate and generally more strongly pubescent, but there is too little material to enable one to settle the problem of their taxonomic status.

134. A. SCHOENOPRASOIDES *Regel* in A. H. P. V (1878) 630.—*A. sairamense* Regel in A. H. P. VI (1880) 520.—*A. Kesselringi* Regel in A. H. P. VIII (1883) 272.—Ic.: Regel in A. H. P. X (1887) t. 1, f. 3—Exs.: Herb. Fl. As. Med. no. 340.

Bulb broadly ovoid, almost spherical, 1-1.5 cm. [sphalm. "mm."] thick; outer envelopes papyraceous, blackish, very thin, without nerves; bulblets none. Scape (10)-15-40 cm. high, clothed for 1/3, or more often for ½ or slightly more, with smooth leaf-sheaths; upper sheaths inflated in the upper part. Leaves 2-(3), narrowly linear, (1)-2-3 mm. wide, flat, canaliculate, smooth, or more rarely scabrid on the margin, usually somewhat shorter than the scape. Spathe slightly shorter than or equalling the umbel, shortly acuminate, early caducous. Umbel capsuliferous, hemispherical or more often spherical, ± many-flowered, dense, sometimes almost capitate; pedicels almost equal, equalling or ½ as long as the perianth, later 1½ times as long, without or with a few bracteoles. Segments of the narrowly campanulate perianth rose-coloured, with an inconspicuous darker nerve, shining, (4)-6-7-(8) mm. long, almost equal, oblong-lanceolate, subacute or subobtuse, entire, the outer ones somewhat broader than the inner. Filaments 1/2-2/3 as long as the perianth-segments, connate, and adnate to the perianth, for 1/3, the outer ones subulate from a narrowly triangular base, the inner twice as broad as the outer, widened for 2/3 of their height, ± bidentate. Style not exserted from the perianth. Capsule ½ as long as the perianth. VII-VIII.

Stony slopes in the alpine and subalpine zones.—C. ASIA: 42 Dzung.-Tarb., 49 Tien Shan (principally Central), Pam.-Al. (Alai range, Bakhan). Gen. distr.: Dzung.-Kashg. Descr. from the neighbourhood of Alma Ata.

135. A. KUJUKENSE *Vvedensky* in Trans. Sci. Soc. Turk. I (1923) 124.

Bulb ovoid, 0.75-1 cm. thick; outer envelopes papyraceous, grey, somewhat prolonged at the apex; bulblets few, whitish, foveolate, sometimes absent. Scape 7-20 cm. high, clothed with strongly scabrid leaf-sheaths (and buried in the ground) for half its length. Leaves solitary, cylindric, 1-2 mm. wide, fistular, strongly scabrid, usually considerably exceeding the umbel. Spathe persistent, ½ as long as the umbel, without a beak. Umbel capsuliferous, fasciculate-hemispherical or more rarely almost spherical, lax, ± few-flowered; pedicels almost equal, equalling or up to twice as long as the perianth. Segments of the narrowly campanulate perianth purple, with a darker nerve, 8-10 mm. long, equal, acute, the outer ones lanceolate, the inner oblong-lanceolate, denticulate at the apex. Filaments ½ as long as the perianth-segments, connate, and adnate to the perianth, for 1/3, entire, the outer ones triangular-subulate, the inner triangular, 3 times as broad as the outer; style not exserted from the perianth. Capsule scarcely more than 1/3 as long as the perianth. V-VI. (Tab. XIII, fig. 3 a-c).

Rubbly and clayey slopes of the lower mountain zone.—C. ASIA: 49 Tien Shan (Kara Tau). Endemic. Descr. from the Kuyuk Mts. Type at Tashkent.

136. A. EREMOPRASUM *Vvedensky* in Not. Syst. Herb. Horti. Bot. Petrop. V (1924) 92.—Exs.: Herb. Fl. As. Med. no. 176.

Bulb ovoid, *c.* 1 cm. thick; outer envelopes papyraceous, greyish, ± foveolate and wrinkled; bulblets foveolate. Scape (10)-15-25 cm. high, clothed half-way with smooth leaf-sheaths; leaves 2, filiform, apparently semicylindric, canaliculate, smooth, withering towards flowering time. Spathe persistent, 1/10-1/5 as long as the umbel, acuminate. Umbel capsuliferous, fasciculate, few-flowered, lax; pedicels unequal, 3-7 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth dirty-rose with a dirty-purple nerve, (5)-6-7 mm. long, acute, the outer ones lanceolate, entire, the inner oblong-lanceolate, denticulate, with a small sacculus at the base, 1½ times as broad as and scarcely longer than the outer. Filaments 1/3 shorter than the perianth-segments, connate, and adnate to the perianth, half-way, entire, the outer ones narrowly triangular, the inner broadly triangular, almost 3 times as broad as the outer. Style not exserted from the perianth. Capsule scarcely more than ½ as long as the perianth. V-VI.

Stony slopes of the lower mountain zone.—C. ASIA: 48 Pam. Al. (known from one spot: the Zera Bulak heights). Endemic. Descr. from the Zera Bulak heights. Type at Tashkent.

137. A. POPOVII *Vvedensky* in Trans. Sci. Soc. Turk. I (1923) 124. —Exs.: Herb. Fl. As. Med. no. 63.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes generally light-brown, coriaceous, with longitudinal projecting crests, splitting at the apex and base; bulblets light-brownish, cristate-foveolate. Scape (15)-20-40 cm. high, slender, clothed half-way or slightly higher with smooth leaf-sheaths. Leaves 3-4, filiform, canaliculate, fistular, *c.* 0.5 mm. wide, smooth, or scabrid on the margin, approximately equalling the scape. Spathe 1/4-1/3 as long as the umbel, acuminate, generally persistent. Umbel capsuliferous, spherical or almost spherical, ± few-flowered, lax; pedicels equal, 3-6 times as long as the perianth, with numerous bracteoles at the base; segments of the almost spherical perianth whitish with a dirty-purple nerve, smooth, *c.* 3 mm. long, almost equal, oblong, acute, the outer ones cymbiform, somewhat narrower than the inner. Filaments somewhat longer than the perianth-segments, connate and adnate to the perianth at the base, entire, equal, subulate. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VI.

Outcrops of particoloured rocks, rubbly slopes, ''takyrs''.—C. ASIA: 47 Syr Dar. (Dzhety Sai, Kurkat, S. W. foothills of Mogol Tau), 48 Pam.-Al. (between Kabadian and Dzheli Kul). Endemic. Descr. from Dzhety Sai. Type at Tashkent.

NOTE. Apart from those enumerated, there are also the following localities: 47 Syr-Dar. (Mt. Mansur Ata, between the stations of Chanak and Montai Tash) and 48 Pam.-Al. Zera Bulak heights). Fresh material is needed from these spots, since the existing material is incomplete and does not permit of certainty regarding the correctness of the identification.

138. A. CONFRAGOSUM *Vvedensky* in Sched. ad Herb. Fl. As. Med. (1935) no. 619.—Exs.: Herb. Fl. As. Med. no. 341, sub *A. scrobiculato*.

Bulb ovoid, 1-1.5 cm. thick, the outer envelopes coriaceous, greyish-brownish or blackish, foveolate, splitting at the base; bulblets black-brown, tuberculate-foveolate. Scape 15-30 cm. high, slender, clothed for 1/3 or almost 1/2 with smooth leaf-sheaths. Leaves 3-4, filiform, *c.* 0.5 mm. wide, semicylindric, canaliculate, smooth, or scabrid on the margin, equalling or more often somewhat shorter than the scape. Spathe 1/3-½ as long as the umbel, long-acuminate, generally persistent. Umbel capsuliferous, hemispherical or more often spherical, many-flowered, dense; pedicels almost equal, 2-4 times as long as the perianth, with numerous bracteoles at the base. Segments of the almost spherical perianth cinnamomeous, in the herbarium with a violet tinge, especially at the tips of the perianth-segments, *c.* 3 mm. long, equal, oblong-ovate, acute, the outer ones cymbiform, scabrid. Filaments 1½ times as long as the perianth-segments, connate at the base and adnate to the perianth, entire, equal, subulate. Style exserted from the perianth. Capsule (almost ripe) somewhat shorter than the perianth. V-VI.

On rocks and on rubbly slopes.—C. ASIA: 49 Tien Shan. Known from a few points on the Mogol Tau Mts. Endemic. Descr. from the mountain of Spa. Type at Tashkent.

139. A. SCROBICULATUM *Vvedensky* in Trans. Sci. Soc. Turk. I (1923) 123.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes blackish or brownish, coriaceous, foveolate, splitting at the base; bulblets apparently few, brown, foveolate. Scape 10-20 cm. high, generally thickish, clothed for 1/3 or almost ½ with smooth leaf-sheaths. Leaves 3-4, filiform, *c.* 0.5 mm. wide, semicylindric, canaliculate, smooth, apparently equalling the scape. Spathe ¼ as long as the umbel, long-acuminate, generally persistent. Umbel capsuliferous, hemispherical or spherical, ± few-flowered, rather lax; pedicels equal, 4-6 times as long as the perianth, the outer ones often ascending, with numerous bracteoles at the base. Segments of the almost spherical perianth rose-violet with a dirty-purple nerve, 3-3.5 mm. long, almost equal, smooth, subacute, the outer ones cymbiform, oblong, somewhat narrower than the oblong-ovate inner ones. Filaments 1½ times as broad as the perianth-segments, connate and adnate to the perianth at the base, entire, equal, subulate. Style exserted from the perianth. Capsule almost 1/3 shorter than the perianth. V.

Outcrops of particoloured rocks, rubbly slopes, salt-marshes.—C. ASIA: Tien-Shan (Trans-Kara Tau plain, Chu-Ili Mts.). Endemic. Descr. from Lake Ak Kul. Type at Tashkent.

140. A. TRANSVESTIENS *Vvedensky* in Herb. Fl. As. Med. (1935) no. 619.

Bulb oblong-ovoid, 1-1.5 cm. thick; outer envelopes light-brownish, coriaceous, slightly foveolate-rugulose, sometimes smooth, the young (sterile) bulbs more foveolate, with longitudinal crests; bulblets numerous, light-brown, tuberculate-foveolate. Scape 30-60 cm. high, slender, clothed for 1/5-1/4 with smooth leaf-sheaths. Leaves 3, semicylindric, canaliculate, fistular, 1.5-2 mm. wide, smooth, apparently considerably shorter than the scape, withering towards flowering-time. Spathe 1/3 shorter than the umbel, acuminate, persistent. Umbel capsuliferous, spherical, dense, many-flowered; pedicels equal, 2-3 times as long as the perianth, with numerous bracteoles at the base. Segments of the almost spherical perianth pale-lilac with a darker nerve, *c.* 3 mm. long, smooth, obtuse, the outer ones cymbiform, elliptic-oblong, the inner oblong-ovate. Filaments 1½ times as long as the perianth-segments, connate and adnate to the perianth at the base, entire, equal, subulate. Style exserted from the perianth. VI. (Tab. XII, fig. 3 a-d).

Outcrops of particoloured rocks.—C. ASIA: 45 Mountain Turkm. Known from two places in the neighbourhood of the Kara Kal Mts. Endemic. Type at Tashkent.

141. A. SABULOSUM *Steven ex Bunge* in Goebel, Reise . . . II (1838) 311; Ledeb. Fl. Ross. IV (1852) 170; Boiss. Fl. Or. V (1882) 251, p. p., exclus. specim. Bunge.; Schmalh. Fl. II (1897) 489.—Ic.: Regel, Fl. Turk. (1876) t. 9, f. 1-3.

Bulb oblong-ovoid, 1½-2 cm. thick; outer envelopes coriaceous, light-brown, with immersed, distant, parallel nerves, owing to which the envelopes appear corrugated [lit. "goffered"], often lacerate along the nerves; bulblets light-brown, irregularly tuberculate-foveolate. Scape 20-60 cm. high, thick, as it were shallowly [lit. "slantingly"] inflated, clothed for ¼ with smooth leaf-sheaths. Leaves 3-4, semicylindric, canaliculate, fistular, 1-2 mm. wide, smooth or more rarely scabrid, shorter than the scape. Spathe almost equalling the umbel, acuminate, caducous. Umbel capsuliferous, hemispherical or more often spherical, many-flowered, ± dense; pedicels equal, 3-5 times as long as the perianth, with numerous bracteoles at the base. Segments of the hemispherical perianth greenish or whitish, with a green nerve in fruit, transversely wrinkled, *c.* 3 mm. long, equal, elliptic, the outer ones scabrid, cymbiform, obtuse, the inner ones emarginate. Filaments somewhat longer than the perianth-segments, connate, and adnate to the perianth, at the extreme base, entire, equal, linear-subulate. Style exserted from the perianth. Capsule *c.* 3 mm. long, with circular scarcely emarginate valves. V-VI.

Sandy deserts.—EUROPEAN PART: 19 Lower Volga; C. ASIA: 40 Aral-Casp., 41 Balkhash, 43 Kyzyl-Kum, 45 Mountain Turkm. (Kushkin region). Gen. Distr.: Dzung.-Kashg. Descr. from the northern shore of the Caspian Sea.

NOTE. *A. sabulosum* varies somewhat in the bulb-envelopes:—sometimes strongly fibrous envelopes occur, but the great bulk of the herbarium material lacks envelopes altogether, hence it is impossible to make any definite statement about such examples.

142. A. TURKESTANICUM *Regel* in A. H. P. III, 2 (1875) 197.—*A. nothum* Vvedensky in Opred. Rast. Okr. Tashk. I (1923) 66.—Exs.: Herb. Fl. As. Med. no. 343.—Ic.: Regel, Fl. Turk. (1876) t. 15, f. 6-8.

Bulb almost spherical, 1.5-3 cm. thick; outer envelopes papyraceous, grey, without noticeable nerves; bulblets none. Scape (40)-70-100 cm. high, clothed for $\frac{1}{4}$ with smooth or very rarely scabrid leaf-sheaths. Leaves 4-6, linear, gradually narrowed from the base to the apex, 2-10 mm. wide, flat, scabrid on the margin, considerably shorter than the scape, very quickly withering. Spathe persistent, equalling the umbel, with a long beak equalling the base of the spathe. Umbel capsuliferous, spherical, dense, many-flowered; pedicels almost equal, (2)-3-4 times as long as the perianth, with bracteoles at the base. Segments of the broadly campanulate perianth rose-coloured, with an inconspicuous darker nerve, *c.* 3 mm. long, almost equal, obtuse, the outer ones ovate, cymbiform, the inner elliptic, narrowed towards the base. Filaments slightly longer than, or up to $1\frac{1}{2}$ times as long as the perianth-segments, connate and adnate to the perianth at the base, the outer ones subulate from a triangular base, the inner subulate from a broadly ovate obtusely bidentate base, twice as broad as the outer at the base and slightly broader than the perianth-segments. Style strongly exserted from the perianth. VI-VII.

Principally on outcrops of particoloured rocks.—C. ASIA: 40 Aral-Casp. (lower course of R. Sary Su), 41 Balkhash (Balkhash), 49 Tien Shan (sporadically in the foothills from Alm Ata to Mogol Tau), 45 Mountain Turkm. (Sulyuklyu). Endemic. Descr. from Mogol Tau. Type at Leningrad.

Sect. 7. PORRUM *G. Don,* Mon. (1827) 4.—Bulb solitary, spherical or ovoid, devoid of a rhizome. Scape clothed ± high up in the aerial part with leaf-sheaths. Segments of the perianth with one nerve. Filaments of the inner stamens trifid, with filiform lateral teeth, usually exceeding the central antheriferous one. Seeds angular. [Spp. 143-225.]

143. A. FERGANICUM *Vvedensky* in Not. Syst. Herb. Horti. Petrop. V (1924) 90.—*A. Lehmannianum* var. *kokanicum* Regel in A. H. P. X (1887) 304.

Bulb ovoid, 0.5-1 cm. thick; outer envelopes papyraceous, greyish; envelopes of the new bulb yellowish; bulblets few, large, dull, yellow, with a keel on the back. Scape 10-20 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 2-4, filiform, smooth, *c.* 1 mm. wide, apparently longer than the scape. Spathe 1/2-2/3 as long as the umbel, with a short beak, early caducous. Umbel capsuliferous, hemispherical or more often spherical, many-flowered, dense; pedicels almost equal, $1\frac{1}{2}$-3 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, almost equal, 4-6 mm. long, acute, oblong-lanceolate. Filaments somewhat shorter than the perianth-segments, connate and adnate to the perianth at the base, not ciliate, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion equalling or 1/3 shorter than the oblong-triangular base and slightly longer than or $1\frac{1}{2}$ times as long as the lateral portions. Style not exserted from the perianth. Valves of the capsule almost spherical, *c.* 4 mm. long. V.

Desert foothills.—C. ASIA: 48 Pam.-Al. Endemic. Descr. from the foothills of the Alai and Turkestan ranges. Type at Leningrad.

144. A. Lehmannianum *Mercklin* in Mém. Acad. Pétersb. VII (1851) 509; Boiss. Fl. Or. V (1882) 234, excl. var. *Bungei* Boiss.—Ic.: Regel, Fl. Turk. t. 6, f. 8-10.

Bulb ovoid, *c.* 0.75 cm. wide; outer envelopes papyraceous, greyish- or reddish-cinnamomeous, envelopes of the new bulb yellow; bulblets none. Scape 5-7 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 2-3, filiform, smooth, *c.* 1 mm. wide, exceeding the umbel. Spathe early caducous, half as long as the umbel, shortly acuminate. Umbel capsuliferous, hemispherical, more rarely spherical, comparatively few-flowered; pedicels with a few bracteoles at the base, almost equal, 1½-2-(3) times as long as the perianth. Segments of the campanulate perianth rose-coloured, with a strong purple nerve, smooth, equal, 6-7 mm. long, lanceolate or oblong, acute, the inner somewhat broader. Filaments slightly or 1/3 shorter than the perianth-segments, connate, and adnate to the perianth, for ¼, not ciliate, the outer ones triangular-lanceolate, the inner scarcely broader than the perianth-segments at the base, trifid, with the middle portion 1/3 as long as the oblong-triangular base and 1/2-2/3 as long as the laterals. Style not exserted from the perianth. Valves of the capsule circular, *c.* 4 mm. long, emarginate. V-VI.

Argillaceous deserts.—C. ASIA: 40 Aral-Casp., 43 Kyzl-Kum. Endemic. Descr. from the Aral desert. Type at Leningrad.

145. A. Borszczowi *Regel* in A. H. P. III, 2 (1875) 74.—Ic.: Regel, Fl. Turk. (1876) t. 6, f. 11-14.

Bulb oblong-ovoid, 1-1.5 cm. thick; outer envelopes reticulate-fibrous, brown; envelopes of the new bulb yellowish; bulblets few, large, elongate, yellow, reticulate-striate. Scapes 10-30 cm. high, generally 2-3 from one bulb, more rarely solitary or up to 5, recurved-ascending on emergence from the sheaths, more rarely almost erect, clothed for ¼-½ with glabrous approximate leaf-sheaths. Leaves 3-5, apparently fistular, narrowly linear, glabrous, 1-2 mm. wide, usually longer than the scapes. Spathe acuminate, twice to several times shorter than the umbel. Umbel capsuliferous, spherical, more rarely fasciculate, generally many-flowered, lax; pedicels with bracteoles at the base, unequal, 2-5 times as long as the perianth. Segments of the campanulate-hemispherical perianth rose-coloured with a darker nerve, almost equal, 5-6 mm. long, smooth, oblong-lanceolate or lanceolate, acute or obtuse. Filaments slightly or ¼ shorter than the perianth-segments, connate and adnate to the perianth at the base, eciliate, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion ¼-⅓ as long as the triangular base and slightly longer than or ⅓ as long as the laterals. Style not exserted from the perianth. Valves of the capsule almost circular, *c.* 4 mm. long, generally with 2 cartilagineous teeth at the apex, forming (in the ovary stage) a corona surrounding the base of the style. IV-VI.

On sands and more rarely on outcrops of particoloured rocks.—C. ASIA: 40 Aral-Casp., 43 Kyzye Kum, 44 Kara Kum, 45 Mountain Turkm., 46 Amu Dar., 47 Syr Dar. Endemic. Descr. from the Syr Darya valley. Type at Leningrad.

NOTE. The plants from the southern part of Central Asia, with short lateral teeth to the inner filaments and frequent absence of the corona on the ovary, approach (if they are not identical with) the north Persian *A. Boissieri* Regel. The question requires further investigation.

146. A. BREVIDENS *Vvedensky* in Not. Syst. Herb. Horti. Petrop. V (1924) 89.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes reticulate, brown, envelopes of the new bulb yellow, with reticulate nerves. Scape 20-30 cm. high, clothed half-way with scabrid or (the upper) smooth leaf-sheaths. Leaves 2-3, fistular, semicylindric, canaliculate, scabrid, 1-3 mm. wide, somewhat exceeding the umbel. Spathe early caducous, somewhat shorter than the umbel, with a beak 1½ times exceeding the base of the spathe. Umbel capsuliferous, spherical or more rarely hemispherical, generally many-flowered, dense; pedicels with bracteoles at the base, 3-8 times as long as the perianth, unequal, the inner ones up to twice as long. Segments of the ovoid perianth whitish with a strong dirty-purple nerve, 3-4 mm. long, acute, smooth, the outer ones carinate, oblong, the inner elliptic. Filaments somewhat longer than the perianth, connate and adnate to the perianth at the base, eciliate, the outer ones subulate from a triangular base, the inner equalling the perianth-segments at the base, trifid, with the middle portion 1½-2 times as long as the laterals and as the oblong-triangular base. Style strongly exserted from the perianth. Valves of the capsule circular, *c.* 3.5 mm. long. V-VII. (Tab. XIV, fig. 2 a-d).

Outcrops of particoloured rocks.—C. ASIA: 48 Pam.-Al. Descr. from Karatag and Rink. Type at Leningrad.

147. A. TURCOMANICUM *Regel* in A. H. P. X (1887) 305, t. 1, f. 4.—Ic.: 1. c.

Bulbs solitary or more often aggregated 2-3 together, ovoid, 1-1.5 cm. thick; outer envelopes reticulate, rufescent-brown or brown; envelopes of the new bulb yellowish, with reticulate venation; bulblets few, large, elongate, yellow, smooth, shining. Scape 30-100 cm. high, clothed for ⅓-½ with smooth leaf-sheaths. Leaves [sphalm. "fruits"] 4-5, fistular, semicylindric (?), smooth, 2-6 mm. wide, considerably shorter than the scape. Spathe early caducous. Umbel capsuliferous, spherical, many-flowered, ± dense; pedicels with bracteoles at the base, 3-5 times as long as the perianth, unequal, the inner ones 1½ times as long. Segments of the ovoid perianth rose-violet, 5-6 mm. long, almost equal, acute, linear-lanceolate or lanceolate, smooth, the outer ones carinate. Filaments scarcely longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones subulate from a broadly triangular base, the inner scarcely broader than the perianth-segments at the base, trifid, with the middle portion approximately equalling the laterals and the oblong-triangular base. Style scarcely exserted from the perianth. Valves of the capsule almost circular, transversely wrinkled, *c.* 3.5 mm. long. IV-V.

Clayey and sandy soils.—C. ASIA: 44 Kara Kum, 45 Mountain Turkm., 48 Pam.-Al. Endemic. Descr. from the region between Kalaburun and Abdulla Khan, near Murgab, south of Merv. Type at Leningrad.

148. A. CRYSTALLINUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 126.

Bulb ovoid, *c.* 2 cm. thick; outer envelopes almost coriaceous, reticulate, grey-brown; envelopes of the new bulb yellow, reticulate; bulblets few, large, yellow, with reticulate venation, densely studded with crystalline tubercles. Scape 60 cm. high, clothed for ⅓ with smooth leaf-sheaths. Leaves 2, fistular, cylindric, smooth, 3-5 mm. wide, shorter than the scape. Spathe early caducous, somewhat longer than the umbel, with a beak approximately equalling the base of the spathe. Umbel capsuliferous, many-flowered; pedicels 2-3 times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth whitish with a reddish nerve, smooth, acute, 5 mm. long, the outer ones carinate, oblong-lanceolate, somewhat shorter than the linear-oblanceolate inner ones. Filaments somewhat shorter than the perianth-segments, connate and adnate to the perianth at the base, slightly ciliate at the base, the outer ones triangular-subulate, the inner somewhat broader than the perianth-segments at the base, trifid, with the middle portion half as long as the laterals and the oblong-triangular base. Style not exserted from the perianth. V.

Juniper thickets.—C. ASIA: 48 Pam.-Al. Endemic. Collected once by Lepeshkin in a juniper thicket on the Ketmenchapta range near Aulata. Type at Tashkent.

149. A. FILIDENS *Regel* in A. H. P. III, 2 (1875) 174.—Akrakense Regel in A. H. P. III, 2 (1875) 176.—*A. Ugami* Vvedensky in Trans. Sci. Soc. Turk. I (1923) 123.—*A. margaritaceum* auct. Fl. As. Med.—Ic.: Regel, Fl. Turk. (1876) t. 15, 11-13.

Bulb ovoid, 1-2 cm. thick; outer envelopes brown, reticulate-fibrous, surrounding the base of the scape; envelopes of the new bulb yellowish; bulblets few, yellowish or dark-brown, large, elongate, smooth, shining. Scape 20-60 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 3-4, fistular, semicylindric, canaliculate, smooth or slightly scabrid, 1-3 mm. wide, considerably shorter than the scape. Spathe caducous, equalling or 1½ times as long as the umbel, with a beak approximately equalling the base of the spathe. Umbel capsuliferous, spherical or hemispherical, many-flowered, dense; pedicels with bracteoles at the base, almost equal, 2-5 times as long as the perianth. Segments of the ovoid-campanulate perianth greenish-azure (in the dried state often rosy) with a strong green nerve, almost equal, 4-5 mm. long, smooth, the outer ones carinate, oblong, subobtuse, the inner oblong-obvate or inversely oblong[42], obtuse, with a little apiculus. Filaments equalling the perianth-segments or slightly shorter than it, connate and adnate to the perianth at the base, ciliate at the base, the outer ones triangular-subulate, the inner 1½ times as broad as the perianth-segments at the base, trifid, with the middle portion half as long as the ovate-triangular base and 2/7-2/3 as long as the laterals. Style not exserted from the perianth. Valves of the capsule circular, *c.* 4 mm. long, emarginate. V.-VI.

Rubbly slopes of the lower mountain zone, especially particoloured beds.—C. ASIA: 40 Aral-Casp. (Sary Su), 43 Kyzyl-Kum, 46 Amu Dar., 47 Syr Dar., 48 Pam.-Al., 49 Tien Shan. Descr. from the Mogol Tau. Type at Leningrad.

150. A. DICTYOSCORDUM *Vvedensky* in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 90.

Bulb ovoid, 2-2.5 cm. thick; outer envelopes reticulate, brown, surrounding the base of the stem high up, envelopes of the new bulb yellowish; bulblets none. Scape (sometimes 2 from one bulb) 50-70 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 4-6, edentate, linear, canaliculate, strongly scabrid on the margin, 3 mm. wide, considerably shorter than the scape. Spathe somewhat longer than the umbel, with a beak equalling the base of the spathe. Umbel capsuliferous, spherical, more rarely hemispherical, dense, generally many-flowered; pedicels with bracteoles at the base, 1½-3 times as long as the flowers, almost equal. Segments of the ovoid-campanulate perianth whitish with a green nerve, almost equal, 5-6 mm. long, linear-oblong, obtuse or subobtuse, the outer ones carinate, scabrid. Filaments almost equalling the perianth-segments, connate and adnate to the perianth at the base, eciliate, the outer ones triangular-subulate, the inner almost twice as broad as the perianth-segments at the base, trifid, with the middle portion half as long as the ovate-triangular base and half as long as the laterals. Style not exserted from the perianth. Valves of the capsule almost circular, *c.* 5 mm. long, scarcely emarginate. V-VI.

Saline clays in the lower mountain zone.—C. ASIA: 45 Mountain Turkm. Endemic. Descr. from Hermab. Type at Leningrad.

151. A. VIRIDE *Grossheim*, Fl. Kavk. I (1928) 201.

Envelopes of the bulb reticulate-fibrous, attenuate into a long neck 2-3 times as long as the bulb itself. Scape 70-150 cm. high, with a glaucous ''bloom.'' Leaves hollow, cylindric, rapidly narrowing towards the apex, 6-11 mm. wide, up to 40 cm. long. Spathe early caducous. Umbel capsuliferous, oval-spherical, dense, 3.5-4 cm. in diameter; pedicels extremely unequal, 3-5 times as long as the perianth. Segments of the oblong-oval perianth dull-green, narrowly white-edged on the margin, very obtuse, smooth, 3-5 mm. long. Filaments longer than the perianth-segments, glabrous, more rarely sparsely ciliate, the outer ones shorter than the inner, without teeth or with 1-2 short teeth at the sides, the inner with 3 equal teeth.

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42 [Possibly a slip for "inversely ovate", i. e. "obovate". —Note by translator.]

CAUCASUS: 25 Talysh. Endemic.
Note. I have seen no specimen of this species.

152. A. DICTYOPRASUM *C. A. Meyer ex Kunth,* Enum. IV (1843) 390; Ledeb. Fl. Ross. IV (1852) 166; Boiss. Fl. Or. V. (1882) 243.

Bulb ovoid, 2-2.5 cm. thick; outer envelopes brown, reticulate, surrounding the scape high up; envelopes of the new bulb yellowish; bulblets few, large, yellow, elongate, reticulate-nerved, commonly absent. Scape 60-100 cm. high, clothed for 1/3 with smooth leaf-sheaths. Leaves 3-4, fistular, cylindric, narrowing towards the apex, smooth, 3-5 mm. wide, considerably shorter than the scape. Spathe approximately equalling the umbel, with a short beak. Umbel capsuliferous, spherical, dense, many-flowered; pedicels with bracteoles at the base, 2-3 times as long as the perianth, unequal, the inner ones twice as long as the outer. Segments of the oblong-ovoid perianth dark-purple or brown-green, with a darker nerve, smooth, *c.* 3 mm. long, unequal, the outer ones cymbiform, broadly elliptic, very obtuse, considerably shorter than the ovate emarginate inner ones. Filaments 1½ times as long as the perianth-segments, connate and adnate to the perianth at the base, slightly ciliate at the base, the outer ones triangular-subulate, the inner narrower than the perianth-segments at the base, trifid, with the middle portion slightly shorter than the linear-triangular base and slightly longer than or half as long as the laterals. Style strongly exserted from the perianth. Valves of the capsule almost circular, 3.5 mm. long, scarcely emarginate at the apex. VI-VII. (Tab. XIV, fig. 1a).

In dry stony places.—CAUCASUS: 24 S. Transcauc. Endemic. Descr. from Armenia. Cotype at Leningrad.

153. A. VINEALE *Linné,* Sp. Pl. (1753) 299; Ledeb. Fl. Ross. IV (1852) 163; Boiss. Fl. Or. V. (1882) 235; Schmalh. Fl. II (1897) 486.—Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1075.—Exs.: Pl. Finl. exs. no. 573.

Bulb ovoid, 1.5-2 cm. thick; outer envelopes grey-brown, papyraceous, ± lacerate; envelopes of the new bulb yellowish, shining, smooth. Scape 40-80 cm. high, clothed for 1/3 or ½ with smooth sheaths. Leaves 3-4, fistular, semi-cylindric, canaliculate, smooth, 2-4 mm. wide, considerably shorter than the scape. Spathe approximately equalling the umbel, with a long beak, quickly caducous. Umbel with bulbils, more rarely without them, few- or many-flowered, sometimes entirely without flowers; pedicels several times as long as the perianth, almost equal, with bracteoles at the base. Segments of the ovoid perianth rose or purple with a darker nerve, 3-4.5 mm. long, obtuse, smooth, the outer ones oblong, carinate, somewhat broader than the oblanceolate inner ones. Filaments slightly or 1½ times longer than the perianth-segments, connate at the base and adnate to the perianth, slightly ciliate at the base, the outer ones subulate, the inner somewhat broader than the perianth-segments at the base, trifid, with the middle portion slightly or 1/3 shorter than the laterals, and slightly shorter than the linear-triangular base or equalling it. Style strongly exserted from the perianth. Valves of the capsule elliptic, *c.* 4 mm. long, narrowly and shallowly emarginate. VII-VIII.

In mountain meadows; in the European part as a weed.—EUROPEAN PART: 12 Middle Dnepr, 17 Crimea; CAUCASUS: 23 E. and 24 S. Transcauc. Gen. distr.: W. Eur., Asia Min., N. Amer. (introduced). Descr. from Germany.

154. A. Aucheri *Boissier,* Diagn. Pl. Or. 1, 7 (1846) 116; Boiss. Fl. Or. V (1882) 237.—*A. brevipes* Ledebour, Fl. Ross. IV (1852) 165.—*A. ledschanense* Conrath et Freyn in Bull. Herb. Boiss. IV (1896) 190.

Bulb ovoid, *c.* 1 cm. thick; outer envelopes dark-grey, almost coriaceous, splitting; envelopes of the new bulb yellowish; bulblets none. Scape 40-70 cm. high, clothed half-way or slightly higher with smooth or slightly scabrid leaf-sheaths. Leaves 2-(4), fistular, apparently semicylindric, canaliculate, smooth or slightly scabrid, *c.* 3 mm. wide, short, falling far short of the umbel. Spathe often purple-coloured, ½-2/3 as long as the umbel, without a beak, acuminate. Umbel capsuliferous, spherical, more rarely hemispherical, more often many-flowered, dense, almost capitate; pedicels without bracteoles, unequal, the outer ones half as long as the perianth, more rarely equalling or up to 1½ times as long as it, the inner equalling or twice as long as the perianth. Segments of the tubular-campanulate perianth equal, 7-9 mm. long, purple-rose (becoming lilac in the dry state), with a dirty-purple nerve, oblong-lanceolate, very acute, smooth, or sometimes denticulate on the nerve. Filaments half as long as the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion ¼ as long as the ovate-triangular base and ⅓-½ as long as the laterals. Style not exserted from the perianth. Valves of the capsule elliptic, *c.* 6 mm. long, slightly emarginate at the apex. VI-VII. (Tab. XIV, fig. 3 a, b).

In subalpine meadows.—CAUCASUS: 23 E. and 24 S. Transcauc. Gen. distr.: Asia Min., N. Persia. Descr. from Armenia and Gilan.

Note. Judging by the very detailed description of *A. ledschanense,* this species differs from *A. Aucheri* only in the non-fistular leaves. Taking into consideration how difficult it sometimes is to make out this character from dried material, I think that an error has arisen here, and that it is impossible to separate these species.

155. A. guttatum *Steven* in Mén. Soc. Nat. Mosc. XVIII (1809) 173, tab. 2, f. 1; Ledeb. Fl. Ross. IV (1852) 165.—*A. margaritaceum* var. *guttatum* J. Gay in Ann. Sci. Nat. sér. 3, VIII (1847) 223; Boiss. Fl. Or. V (1882) 240; Schmalh. Fl. II (1897) 487.—Ic.: Stev. 1. c.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes grey or brownish, papyraceous, with slender parallel nerves, sometimes torn into fibres above; envelopes of the new bulb whitish; bulblets solitary (?), large, smooth, greyish. Scape 30-60 cm. high, slender, clothed for ⅓-½ with smooth leaf-sheaths. Leaves 3-4, fistular, semicylindric, canaliculate, scabrid, 1.5-3 mm. wide, considerably shorter than the scape. Spathe approximately equalling the umbel, early caducous, with a long beak twice as long as the base of the spathe. Umbel capsuliferous, dense, many-flowered, spherical, more rarely hemispherical; pedicels several times as long as the perianth, unequal, the central ones twice as long as the outer, very slender, thickened beneath the flower, the outer ones with long membranous bracteoles at the base, almost equalling the pedicels and surrounding the base of the umbel. Segments of the narrowly campanulate perianth *c.* 2.5 mm. long, whitish, with an inconspicuous dirty-greenish nerve and with a dark-violet, in the dry state brownish-greenish, blotch in the middle, smooth, obtuse, the outer ones slightly carinate, inversely oblong [*sic!*], the inner inversely oblong-linear [*sic!*], slightly narrower and slightly broader than the outer. Filaments ¼ longer than the perianth-segments, connate at the base and adnate to the perianth, glabrous, the outer ones subulate, the inner broader than the perianth-segments at the base, trifid, with the middle portion ½-2/3 as long as the filiform laterals and equaling or ⅓ shorter than the linear-triangular base. Style somewhat exserted from the perianth. Valves of the capsule broadly elliptic, narrowly emarginate, *c.* 3 mm. long. VI-VII.

On steppes, sands and hills.—EUROPEAN PART: 16 Black Sea, 17 Crimea; CAUCASUS: 23 E. Transcauc. (?). Gen. Distr.: Balkans-Asia Min. Descr. from the lower Dnestr. Cotype at Leningrad.

Note. Indicated for E. Transcaucasia in Wilhelms' collections. I have not seen these specimens, and on the whole consider the occurrence of this onion in Transcaucasia to be extremely doubtful.

156. A. AFFINE *Ledebour*, Fl. Ross. IV (1852) 166.—*A. margaritaceum* var. *affine* Regel in A. H. P. III, 2 (1875) 50; Boiss. Fl. Or. V (1882) 240.—*A. margaritaceum* var. *scabrum* Regel, l. c.—*A. Mishtshenkoanum* Grossheim in Grossheim et Shinshkin, Sched. Herb. Pl. Or. Exsicc. Fasc. I-VIII (1924) no. 4.—Exs.: Pl. Or. exs. no. 352.

Bulb ovoid, 1-2 cm. thick; outer envelopes grey, papyraceous; envelopes of the new bulb yellowish; bulblets solitary (?), large, smooth, yellowish. Scape (20)-30-80 cm. high, clothed up to half-way with scabrid, more rarely smooth leaf-sheaths. Leaves 3-5, fistular, semicylindric, canaliculate, scabrid, 2-4 mm. wide, considerably shorter than the scape. Spathe half as long as the umbel, early caducous, with a long beak 3-4 times exceeding the base of the spathe. Umbel capsuliferous, dense, many-flowered, spherical, very rarely hemispherical; pedicels 3-4 times as long as the perianth, generally unequal, the central ones twice as long as the outer, very slender, thickened beneath the flower, the outer ones with long, often capillary, membranous bracteoles at the base, sometimes equalling the pedicels, surrounding the base of the umbel. Segments of the narrowly campanulate perianth *c.* 4 mm. long, whitish, with a strong green nerve, smooth, obtuse, the outer ones carinate, oblong, the inner oblong-linear, somewhat narrower and longer than the outer. Filaments ¼-⅓ longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the inner ones broader than the perianth-segments at the base, trifid, with the middle portion half as long as the filiform laterals and scarcely shorter than the linear-triangular base. Style exserted from the perianth. Valves of the capsule elliptic or obovate, narrowly emarginate, *c.* 5 mm. long. VI-VIII.

On dry slopes.—CAUCASUS: 21 Dag. 23 E. and 24 S. Transcauc., 25 Talysh. Gen. distr.: Iran. Descr. from Georgia. Type at Leningrad.

157. A. FIRMO-TUNICATUM *Fomin.* in Monit. Jard. Tifl. 14 (1909) 48.

Bulb ovoid-spherical; envelopes coriaceous, hard, ± splitting above into parallel laciniae; bulblets yellowish-brown, finely tuberculate. Scape up to 60 cm. high, clothed half-way with leaf-sheaths. Leaves fistular, cylindric, striate, scabrid, shorter than the scape. Spathe with a long beak, early caducous. Umbel hemispherical or sometimes almost spherical; pedicels vinous-red, unequal, the inner ones twice as long, 4-5 times as long as the perianth, with bracteoles at the base. Segments of the triquetrous-campanulate perianth vinous-red with a crimson tinge, connivent, oval-oblong, obtuse, 3.5 mm.[43] long, the outer ones strongly carinate, scabrid on the margin, strongly coloured. Filaments longer than the perianth-segments, widened at the base, the outer ones entire, the inner trifid, with the middle portion ⅓ shorter than the laterals. Style exserted from the perianth. VI.

In dry places.—CAUCASUS: 23 E. Transcauc. Endemic (?). Descr. from the Mil. Steppe.

Note. I have seen no specimen of this species.

158. A. FUSCO-VIOLACEUM *Fomin* in Monit. Jard. Bot. Tifl. 14 (1909) 50.—Exs.: Pl. Or. exs. no. 56.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes papyraceous, grey; envelopes of the new bulb yellowish; bulblets solitary (?), large, yellowish, smooth, shining. Scape 30-70 cm. high, clothed for ⅓ with smooth leaf-sheaths. Leaves 3-4, fistular, semicylindric, canaliculate, usually scabrid on the margin, 2-3 mm. wide, considerably shorter than the scape. Spathe half as long as the umbel, with a short beak. Umbel capsuliferous, spherical or even hemispherical, many-flowered, dense; pedicels almost equal or the inner ones up to half as long again, 2-3 times as long as the perianth, with bracteoles at the base. Segments of the oblong-ovoid perianth *c.* 4 mm. long, dark- or more rarely light-purple, with a darker nerve, oblong, almost equal, smooth, the outer ones obtuse, carinate. Filaments somewhat longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate, the outer one subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion almost equalling the laterals,[44] and half as long as the

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[43] [Sphalm. "3-5 mm." in original, but cf. key, 112th. dichotomy. —*H. K. A. S. & W. T. S.*]

[44] [In the original description of *A. fuscoviolaceum* the middle anther-bearing upper portion of the inner filaments is described as often twice as long as, or about as long as, the two lateral portions. The type was collected on the mountain Askyar Dag near Sarykamysh in the Kars region. —*W. T. S.*]

narrowly linear-triangular base. Style exserted from the perianth. Valves of the capsule broadly elliptic, *c.* 4 mm. long, shallowly emarginate. VII-VIII.

On dry slopes.—CAUCASUS: 20 Ciscauc., 21 Dag., 23 E. and 24 S. Transcauc. Gen. distr.: Iran. Descr. from Sary Kamysh. Type at Tiflis.

159. A. SPHAEROCEPHALON [45] *Linné,* Sp. Pl. (1753) 297; Ledeb. Fl. Ross. IV (1852) 165, excl. spec. Transcauc.; Boiss. Fl. Or. V (1882) 236; Schmalh. Fl. II (1897) 486.—*A. descendens* auct. Fl. Ross.—Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1080.—Exs.: Fl. Hung. exs. no. 793.

Bulb ovoid, 0.75-2 cm. thick; outer envelopes coriaceous, brown, entire, splitting; envelopes of the new bulb yellowish; bulblets few or wanting (?), elongate, yellowish, shining, smooth. Scape 30-80 cm. high, clothed for 1/3 with smooth leaf-sheaths. Leaves 3-5, fistular, semicylindric, canaliculate, smooth, rarely scabrid on the margin, 2-4 mm. wide, considerably shorter than the scape. Spathe half as long as the umbel, with an apiculus. Umbel capsuliferous, spherical or oblong, more rarely fasciculate-hemispherical, many-flowered, dense; pedicels unequal, the central ones generally up to twice as long as the outer, equalling or twice to many times as long as the perianth, the outer ones with bracteoles at the base. Segments of the oblong-ovoid perianth *c.* 4 mm. long, rose or purple with a darker nerve, very rarely whitish, oblong, the outer ones carinate, ± scabrid, subacute, slightly shorter and narrower than the obtuse inner ones. Filaments slightly or 1/4 longer than the perianth-segments, connate and adnate to the perianth at the base, ± ciliate at the base, the outer ones subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion almost equalling the latter and (1/2)-2/3 as long as the linear base. Style strongly exserted from the perianth. Valves of the capsule elliptic, *c.* 4 mm. long, scarcely emarginate, with cartilagineous teeth. VI-VII.

On steppes, hills, slopes,—EUROPEAN PART: 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don, 16 Black Sea, 17 Crimea, 18 Lower Don, 19 Lower Volga (?); CAUCASUS: 20 Ciscauc. Gen. Distr.: S. and C. Eur., Asia Min. (?), N. Afr. (?). Descr. from Italy.

Note. A. descendens L. differs, apart from other characters, in the leaves being carinate below. The study of living material will settle finally the question of the occurrence of this species in the U S S R. To the *A. descendens* form-cycle belongs also the form noted by Mishchenko as *A. artvinense.*

160. A. REGELIANUM *Becker* ex Ilyin in Fl. Yugo-Vost. III (1929) 355 et 356, fig. 178.—*A. descendens* var. *tenuifolium* Mishchenko ex Grossheim, Fl. Kavk. I (1928) 252.—Ic.: Fl. Yugo-Vost., l. c.

Bulb ovoid, 0.75-1 cm. thick; outer envelopes almost coriaceous, greyish-brownish, entire, splitting; envelopes of the new bulb yellowish-

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[45] [Spelled A. SPHAEROCEPHALUM by Vvedensky and most authors but A. SPHAEROCEPHALON by Linnaeus. —*W. T. S.*]

brownish; bulblets numerous, small, semi-ovoid, yellowish-brownish or more often brown, matt owing to the projecting nerves. Scape 30-60 cm. high, clothed for ⅓ with smooth leaf-sheaths. Leaves 3-4, fistular, semicylindric, canaliculate, smooth, 2 mm. wide, considerably shorter than the scape. Spathe caducous, considerably shorter than the umbel. Umbel capsuliferous, fasciculate-oblong, dense, many-flowered; pedicels unequal, the outer ones almost equalling the perianth, with bracteoles at the base, the inner 4 times as long, without bracteoles. Segments of the ovoid perianth almost equal, *c.* 4 mm. long, purple, with a darker nerve, obtuse, smooth, the outer ones carinate, oblong or oblong-lanceolate or lanceolate. Filaments equalling or slightly longer than the perianth, connate and adnate to the perianth at the base, almost glabrous, the outer ones subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion slightly shorter than the laterals and ⅓-½ as long as the linear-triangular base. Style strongly exserted from the perianth. Valves of the capsule elliptic, *c.* 3 mm. long, scarcely emarginate, with cartilagineous teeth. VIII.

In salt-marshes.—EUROPEAN PART: 16 Black Sea, 18 Lower Don, 19 Lower Volga; CAUCASUS: 21 Dag.[46] Endemic. Descr. from Krasnoarmeisk. Type at Leningrad.

161. A. Scorodoprasum *Linné,* Sp. Pl. (1753) 297, excl. var. B; Ledeb. Fl. Ross. IV (1852) 163; Boiss. Fl. Or. V (1882) 232; Schmalh. Fl. II (1897) 486.—Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1073.—Exs.: Hayek, Fl. Stir. exs.

Bulb ovoid, 1-2 cm. thick; outer envelopes cinnamomeous, almost coriaceous, breaking up; envelopes of the new bulb dark violet; bulblets small, numerous, smooth, dark-violet. Scape 40-80 cm. high, clothed for ⅓ with smooth leaf-sheaths. Leaves 3-5, linear, not fistular, gradually narrowed to the apex, scabrid on the margin and central nerve, very short, scarcely exceeding the middle of the scape, 4-10 mm. wide. Spathe longer than the umbel, early caducous, with a beak up to twice as long as the base of the spathe. Umbel with violet bulbils, ± many-flowered, very rarely without flowers; pedicels twice as long as the perianth, equal, with bracteoles at the base. Segments of the ovoid-campanulate perianth *c.* 5 mm. long, purple with a darker nerve, acute, scabrid, the outer ones oblong, carinate, somewhat narrower than the oblong-ovate inner ones. Filaments slightly shorter than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones subulate, the inner scarcely broader than the perianth-segments at the base, trifid, with the middle portion half as long as the laterals and ⅓ as long as the oblong-triangular base. Style not exserted from the perianth. VI-VII.

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[46] Derbent, *Becker* — requires confirmation.

In meadows, amongst bushes.—EUROPEAN PART: 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don, 16 Black Sea, 17 Crimea; CAUCASUS: 20 Ciscauc. (Kislovodsk, Akinfiev). Gen. distr.: W. Eur., Asia Min. Descr. from Europe.

162. A. LONGICUSPIS *Regel* in A. H. P. III, 2 (1875) 45.—*A. sativum* auct. fl. As. Med.—Ic.: Regel, Fl. Turk. (1876) t. 6, f. 1-3.

Bulb ovoid, 1-2 cm. thick; new bulbs 2-4; outer envelopes grey-brown, papyraceous, almost coriaceous; envelopes of the new bulbs greyish-rosy; bulblets none. Scape 40-100 cm. high, clothed half-way with smooth leaf-sheaths. Leaves 4-7, not fistular, broadly linear, smooth, or scabrid on the margin and on the mid-nerve below, 5-10 mm. wide, considerably shorter than the scape. Spathe 3-4 times as long as the umbel, with a long, strong beak, up to 4 times as long as the base of the spathe, caducous. Umbel with large (5-10 mm.) violet bulbils, intermingled with numerous membranous bracteoles exceeding the bulbils, many-flowered, ovoid, ± dense; pedicels filiform, several times as long as the flower, unequal, the inner up to 3 times[47] as long. Segments of the ovoid perianth rose-coloured, sometimes deep-rose, shining, smooth, equal, *c.* 3 mm. long, acute, the inner ones ovate, the outer oblong. Filaments at first shorter than the perianth-segments, afterwards up to 1½ times as long as them, connate and adnate to the perianth at the base, eciliate, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, 3-(5)-fid, with the middle portion almost twice as long as the oblong base and ⅓-½ as long as the laterals, which are sometimes provided with teeth. Style strongly exserted from the perianth. VII-VIII.

In shade at the bottom of gorges.—C. ASIA: 45 Mountain Turkm., 48 Pam.-Al., 49 Tien Shan. Endemic. Descr. from Taka. Type at Leningrad.

Note. A. longicuspis is the wild race of *A. sativum* L. (garlic), differing in the excerted anthers. In *A. longicuspis,* as in many onions possessing bulbils in the umbel, the flowers apparently do not always develop, and then the anthers are not exserted from the perianth. Observations on this species in cultivation are desirable.

In the plants from Mountain Turkmenia the stamens are somewhat less exserted from the perianth, but I have had too little material thence with well-developed flowers to be able to say whether this is generally characteristic of them.

(163). A. SATIVUM *Linné,* Sp. Pl. (1753) 296; Schmalh. Fl. II (1897) 486.—Ic.: Syreishch. Ill. Fl. Mosc. Gov. I (1906) 237.

Bulb ovoid, consisting of several (6-10) small bulblets. Scape up to 1 m. high, before flowering often coiled into a ring in the upper part. Leaves flat, linear. Spathe with a long beak. Umbel with numerous bulbils. Perianth whitish. Filaments shorter than the perianth, the

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[47] ["Up to 5 times as long" may be intended: Regel describes the pedicels as 12-15 mm. long, the perianth-segments 3 mm. long. —*W. T. S.*]

inner ones trifid with long lateral teeth. Cultivated plant. Propagated by offsets, since it practically never sets seed.

ECONOMIC IMPORTANCE. Grown in the European part of the U S S R, in the Caucasus and in the Far East, for the sake of the bulbs, which are stored up. It is used as a medicinal plant for arterio-sclerosis. Besides oil of garlic, it contains the glucoside allin.

164. A. FOMINIANUM *Mishchenko ex Grosshein et Shishkin,* Sched. Herb. Pl. Or. Exsicc. (1924) no. 80.—*A. Fominii* Mishchenko in herb.—*A. ampeloprasoides* Grossheim in Grossheim et Shishkin, l. c. (1924) no. 31.—Exs.: Pl. Or. exs. no. 80.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes almost coriaceous, brown, with indistinct parallel nerves, splitting, envelopes of the new bulb dark-purple-violet; bulblets few, often wanting, brown, matt, with slender nerves. Scape 20-60 cm. high, clothed for 1/4 with smooth leaf-sheaths. Leaves (2)-3-4, not fistular, linear, canaliculate, scabrid on the margin or more rarely smooth, 2-3 mm. wide, considerably shorter than the scape. Spathe quickly caducous. Umbel capsuliferous, spherical or more rarely hemispherical, many-flowered; pedicels almost equal, 1 1/2-2 times as long as the perianth, with bracteoles at the base. Segments of the globose-campanulate perianth whitish, sometimes ± purple on the back, with a green or purple nerve, *c.* 4 mm. long, obtuse, scabrid, the outer ones oblong, carinate, ± denticulate on the keel, 1/3 narrower and scarcely shorter than the ovate inner ones. Filaments equalling the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones linear-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion 1/4-1/3 as long as the ovate-triangular base and half as long as the laterals. Style scarcely exserted from the perianth. Valves of the capsule almost circular, *c.* 4 mm. long. V-VII.

On rocks and stony slopes.—CAUCASUS: 23 E. Transcauc. Endemic. Descr. from Tiflis. Type at Baku.

NOTE. Exceedingly close to *A. ponticum,* and is, judging from the labels, a pale-flowered, more northern ecological race, characteristic of rocks and stony slopes. These species need to be distinguished in the field, since the characters given by Grossheim (Fl. Kavk. l. c.), for the separation of *A. Fomini, A. ampeloprasoides* and *A. ponticum,* have no existence in actuality.

165. A. PONTICUM *Mishchenko ex Grossheim,* Fl. Kavk. I (1928) 206.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes almost coriaceous, splitting, envelopes of the new bulb dark-purple or reddish-brown; bulblets wanting (?). Scape 20-70 cm. high, clothed for 1/4 with smooth leaf-sheaths. Leaves 3-4, not fistular, linear, canaliculate, smooth, or more rarely scabrid on the margin, 2-5 mm. wide, considerably shorter than the scape. Spathe quickly caducous. Umbel capsuliferous, spherical or more rarely hemispherical, many-flowered; pedicels almost equal, 2-3 times as long as the perianth, with bracteoles at the base. Segments of the globose-campanulate perianth dark-purple, *c.* 4 mm. long, obtuse, scabrid, the outer ones oblong, carinate, ⅓ narrower than the broadly ovate outer ones. Filaments equalling or slightly shorter than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones linear-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion ⅓ as long as the ovate-triangular base and half as long as the laterals. Style scarcely exserted from the perianth. Valves of the capsule almost circular, *c.* 4 mm. long. V-VII.

On dry slopes.—CAUCASUS: 22 E. and 23 W. Transcauc. Descr. from Transcaucasia. Type at Leningrad.

166. A. GRACILESCENS *Sommier et Levier* in A. H. P. XIII (1893) 51.

Bulb *c.* 1 cm. thick; outer envelopes greyish-brownish, almost coriaceous, splitting; envelopes of the new bulb reddish-brown, bulblets . . . Scape *c.* 50 cm. high, clothed for ⅓ with smooth leaf-sheaths. Leaves 3, not fistular, linear, apparently canaliculate, smooth, or slightly scabrid on the margin, 3-4 mm. wide, considerably shorter than the scape. Spathe early caducous. Umbel capsuliferous, hemispherical, lax; pedicels almost equal, 3-3½ times as long as the perianth, with bracteoles at the base. Segments of the globose-campanulate perianth light-rose, 4-5 mm. long, obtuse, scabrid, the outer ones oblong, carinate, ⅓ narrower than the ovate inner ones. Filaments scarcely shorter than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones linear-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion ⅓ as long as the ovate-triangular base and 2/5-½ as long as the laterals. Style not exserted from the perianth. VI.

CAUCASUS: 22 W. Transcauc. Endemic. Descr. from Adzharia: Keda. Type at Florence.

A species exceedingly close to *A. Fominianum* and *A. ponticum;* it is possible that one of these names will have to give place to the name *A. gracilescens,* which has priority. Besides the type, which I have been able to see, there are no other specimens in herbaria.

Sommier and Levier describe their species as having light-rose flowers, and do not lump it with *A. ponticum,* since the last of their collections (Chula), which has preserved its dark-purple hue to the present day, is referred by them to *A. rotundum.* The type of *A. gracilescens* has faded so much that it is quite impossible to say what colour its flowers were: hence I am unable to identify it with *A. ponticum,* to which it is nearer both in its lax umbel and western provenance. But owing to these latter facts I cannot unite *A. gracilescens* with *A. Fominianum* either.

All this compels me to keep all these three species, for the present, distinct, and to direct the attention of workers on the Caucasian flora to the foregoing remarks. Cf. also my note on *A. Fominianum.*

167. A. ERUBESCENS *C. Koch* in Linnaea XXII (1849) 242.—*A. rudbaricum* Boissier et Buhse in Nouv. Mém. Soc. Nat. Mosc. XII (1860) 215; Boiss. Fl. Or. V (1882) 240.—*A. rotundum* ssp. *gramineum* Mishchenko in herb.—Exs.; Pl. Or. exs. no. 32.

Bulb ovoid, (0.5)-1-1.5 cm. thick; outer envelopes brown or grey-brown, coriaceous, splitting, split into fibres in the upper part; envelopes of the new bulb purple-cinnamomeous; bulblets few, small, brown, almost smooth. Scape 20-40 cm. high, clothed for ⅓-½ with smooth leaf-sheaths. Leaves 3-4, not fistular, linear, canaliculate, smooth, or scabrid on the margin, 2-5 mm. wide, considerably shorter than the scape. Spathe early caducous, equalling the umbel, with a beak almost equalling, or half as long as, the base of the spathe. Umbel capsuliferous, spherical or more rarely hemispherical, dense, generally many-flowered; pedicels with bracteoles at the base, unequal, the outer ones 1½ times as long as the perianth, more rarely shorter than it, the inner up to 3 times as long as the perianth. Segments of the campanulate perianth rose with a purple nerve, 5-7 mm. long, acute, scabrid, the outer ones lanceolate, sometimes slightly longer than the oblong inner ones, carinate, ± denticulate on the keel, sometimes slightly reflexed at the apex. Filaments ¼ or ⅓ shorter than the perianth-segments, connate and adnate to the perianth at the base, slightly ciliate at the base, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion ¼-⅓ as long as the linear-triangular base and ⅓-½ as long as the laterals. Style not exserted from the perianth. Valves of the capsule broadly oval, *c.* 5 mm. long. VI-VII.

In meadows and amongst bushes.—EUROPEAN PART: 17 Crimea (rarely); CAUCASUS: 20 Ciscauc., 21 Dag., 23 E. Transcauc., 25 Talysh. Gen. distr.: N. Persia. Descr. from Dagestan: Kuba. Type at Berlin.

168. A. ROTUNDUM *Linné,* Sp. Pl. (1762) 423; Ledeb. Fl. Ross. IV (1852) 164, p. p.; Boiss. Fl. Or. V (1882) 233; Schmalh. Fl. II (1897) 487, p. p.—*A. cilicicum* Boissier, Diagn. Pl. Or. I, 7 (1846) 115; Boiss. Fl. Or. V (1882) 242.—*A. rotundum* ssp. *scoro*[*do*]*prasoides* Mishchenko in herb.

Bulb ovoid, 0.75-2 cm. thick; outer envelopes brown or black-brown, coriaceous, splitting, in the upper part ± split into fibres; envelopes of the new bulb black-brown; bulblets ± numerous, small, brown, almost smooth. Scape 20-50 cm. high, clothed for ⅓ with smooth leaf-sheaths. Leaves 3-5, not fistular, linear, canaliculate, scabrid or smooth on the margin, 2-5-(7) mm. wide, considerably shorter than the scape. Spathe early caducous, somewhat longer than the umbel, with a beak approximately equalling the base of the spathe. Umbel capsuliferous, spherical, more rarely hemispherical, dense, more often compressed or almost capitate; pedicels with bracteoles at the base, unequal, the outer ones equalling the perianth, more rarely twice as long as it, the inner ones twice, more rarely 5 times as long as the perianth. Segments of the broadly campanulate perianth *c.* 5 mm. long, almost equal, scabrid, the outer ones dark purple with a darker nerve, carinate, ± denticulate on the keel, oblong, obtuse or subobtuse, the inner lighter, more often almost white, with a purple nerve, elliptic, very obtuse. Filaments ¼ shorter than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion $\frac{1}{4}$-$\frac{1}{3}$ as long as the oblong-triangular base and 2/5 as long as the laterals. Style not exserted from the perianth. VI-VII.

EUROPEAN PART: 16 Black Sea, 17 Crimea; CAUCASUS: 20 Ciscauc., 22 W., 23 E., & 24 S. Transcauc., 25 Talysh. Gen. distr.: C. and S. Eur. Asia Min., N. Iran. Descr. from southern Europe.

An attempt—to some extent forced—has here been made to distinguish species within *A. rotundum* s. l. I separate these species principally on the colour and form of the perianth-segments. I have been unable to make use of other characters, extremely important for the taxonomy of *Allia* (bulb-envelopes, bulblets), owing to the material in the great majority of cases being badly collected. A very material factor also has been the almost complete lack of ecological data on the labels of the Crimean—Caucasian material.

It is extremely probable that *A. rotundum* s. l. in the Crimea and Caucasus forms a series of local races, the study of which can only be successful (as always) when specially collected material is available.

169. A. JAJLAE *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 126. —*A. rotundum* ssp. *melleum* Mishchenko in herb.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes grey-brown, almost coriaceous, splitting into fibres in the upper part, envelopes of the new bulb black-brown; bulblets few, small, brown, almost smooth. Scape 20-40 cm. high, clothed for $\frac{1}{3}$-$\frac{1}{2}$ with smooth leaf-sheaths. Leaves 3-5, not fistular, linear-canaliculate, scabrid on the margin, 3-5 mm. wide, considerably shorter than the scape. Spathe early caducous, half as long as the umbel, with a beak somewhat exceeding the base of the spathe. Umbel capsuliferous, spherical, dense, more often almost capitate; pedicels with bracteoles at the base, unequal, the outer ones almost equalling the perianth or slightly longer than it, the inner up to 3 times as long, segments of the ovoid-campanulate perianth rose-violet with a darker nerve, almost equal, *c.* 5 mm. long, scabrid, the outer ones carinate, denticulate on the keel, oblong, subacute or subobtuse, the inner oblong-ovate, obtuse or subobtuse. Filaments $\frac{1}{4}$ or almost $\frac{1}{3}$ shorter than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion $\frac{1}{4}$-$\frac{1}{3}$ as long as the oblong-triangular base and 2/5 as long as the laterals. Style not exserted from the perianth. Valves of the capsule broadly elliptic, *c.* 3 mm. long, scarcely emarginate. VI-VII.

On mountains.—EUROPEAN PART: 17 Crimea; CAUCASUS: 23 E. and 24 S. Transcauc. Gen. distr.: Asia Min. Descr. from the Crimea: the Nikita Yaila. Type at Leningrad.

NOTE. I distinguished this species, in the *A. rotundum* (s. l.) group, chiefly by the compressed, often almost capitate umbel of rose-coloured flowers; it would be possibly more correct to regard the whole Crimean-Caucasian rose-coloured material of this cycle as a distinct species, irrespective of the density of the umbel.

170. A. Waldsteini *G. Don,* Mon. (1827) 17.—*A. rotundum* Ledebour, Fl. Ross. IV (1852) 164, p. p.; Schmalh. Fl. II. (1897) 487, p. p. —*A. paterfamilias* Boissier Diagn. Pl. Or. II, 4 (1859) 114 (?).—[Ic.: Waldstein et Kitaibel, Pl. Rar. Hung. (1801) t. 82.]

Bulb ovoid, 1-2 cm. thick; outer envelopes brown, coriaceous, splitting; envelopes of the new bulb dark purple; bulblets numerous, small, black-purple. Scape (30)-40-70 cm. high, clothed for 1/3 or almost ½ with smooth leaf-sheaths. Leaves 4-5, not fistular, linear, canaliculate, smooth, or scabrid on the margin, 3-7-(10) mm. wide, considerably shorter than the scape. Spathe early caducous, somewhat longer than the umbel, with a beak equalling the base of the spathe or 1½ times as long. Fruiting umbel spherical or more rarely hemispherical, dense, many-flowered; pedicels with bracteoles at the base, unequal, the outer ones 1½-2, the inner 3-5 times as long as the perianth, more rarely (in impoverished specimens) the outer ones equalling the flowers, the inner twice as long. Segments of the ovoid-pyramidal perianth dark-purple-violet with a darker nerve, (4)-5 mm. long, almost equal, scabrid, the outer ones carinate, denticulate on the keel, oblong, acute, the inner oblong-ovate, subacute or subobtuse or apiculate. Filaments ¼ or almost 1/3 shorter than the perianth-segments, connate and adnate to the perianth at the base, ciliate, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion 1/4-1/3 as long as the oblong-triangular base and half as long as the laterals. Style not exserted from the perianth. Valves of the capsule almost circular, *c.* 4 mm. long, scarcely emarginate. VI-VII.

In meadows, on slopes, more often as a weed.—EUROPEAN PART: 9 Upper Volga, 10 Volga-Kama, 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don, 14 Transvolga, 16 Black Sea, 17 Crimea, 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc., 21 Dag., 22 W., 23 E. and 24 S. Transcauc. Gen. distr.: C. and S (?) Eur. Descr. from Hungary.

171. A. talyschense *Mishchenko* ex Grossheim, Fl. Kavk. I (1928) 204.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes light-brown, almost coriaceous, split into fibres, especially at the apex; envelopes of the new bulb yellowish; bulblets few, small, yellowish, shining, almost smooth. Scape 15-30 cm. high, clothed for 1/3 with smooth leaf-sheaths. Leaves 3-4, not fistular, linear, canaliculate, scabrid, *c.* 3 mm. wide, considerably shorter than the scape. Spathe caducous, somewhat shorter than the umbel, with a beak approximately 1/3 as long as the base. Umbel capsuliferous, spherical or more rarely hemispherical, dense, many-flowered; pedicels almost equal, 1½-2 times as long as the perianth, with bracteoles at the base. Segments of the broadly campanulate perianth almost white, with a strong dirty-purple nerve, almost equal, 5 mm. long, acute, very scabrid, the outer ones carinate, denticulate on the keel, oblong-lanceolate, the inner oblong-ovate. Filaments somewhat shorter than the perianth-segments, connate and adnate to the perianth at the base, slightly ciliate at the base, the outer ones triangular-lanceolate, the inner equalling the perianth-segments at the base, trifid, with the middle portion scarcely more than 1/3 as long as the ovate-triangular base and half as long as the laterals. Style not exserted from the perianth. Valves of the capsule almost circular, *c.* 4 mm. long. VI.

In dry rocky places.—CAUCASUS: 25 Talysh. Endemic.

172. A. PSEUDO-AMPELOPRASUM *Mishchenko ex Grossheim,* Fl. Kavk. I. (1928) 204 et in herb.!

Bulb ovoid, *c.* 2 cm. thick; outer envelopes . . .; envelopes of the new bulb yellowish; bulblets numerous, elongate, yellowish, shining, smooth. Scape 50-60 cm. high, clothed for 1/3 with smooth leaf-sheaths. Leaves 5, not fistular, linear, canaliculate, smooth, 6-7 mm. wide. Spathe early caducous. Umbel capsuliferous, spherical, dense, many-flowered; pedicels unequal, the inner almost twice as long as the outer, many times longer than the perianth, with few bracts at the base. Segments of the ovoid perianth rosy, with a dirty-purple nerve, 3.5 mm. long, acute, scabrid, the outer ones lanceolate, longer than the oblong-lanceolate outer ones. Filaments almost twice as long as the perianth-segments, connate and adnate to the perianth at the base, slightly ciliate at the base, the outer ones triangular-subulate, the inner trifid, scarcely broader than the perianth-segments at the base, with the middle portion equalling the oblong-triangular base and scarcely longer than the laterals. Style strongly exserted from the perianth. Valves of the capsule broadly elliptic, scarcely emarginate, *c.* 4 mm. long. VI-VII.

On dry clay slopes.—CAUCASUS: 23 E. Transcauc. Endemic. Descr. from Shorbulag, near Erivan. Type at Leningrad.

173. A. ATRO-VIOLACEUM *Boissier,* Diagn. Pl. Or. I, 7 (1846) 112; Boiss. Fl. Or. (1882) 240.—*A. Ampeloprasum* var. *atroviolaceum* Regel in A. H. P. III, 2 (1875) 54; Schmalh. Fl. II (1897) 488.—*A. atroviolaceum* var. *caucasicum* Sommier et Levier in A. H. P. XVI (1900) 427.—*A. Ampeloprasum auct.*—Exs.: H F R no. 1191; Herb. Fl. As. Med. no. 332.

Bulb ovoid-globose, 1½-2½ cm. thick; outer envelopes greyish-brownish, bast-like, obscurely reticulate, surrounding the base of the stem for some distance; envelopes of the new bulb yellowish; bulblets numerous, yellow-brown or yellowish, dull. Scape 60-100 cm. high, clothed for ¼-½ with smooth leaf-sheaths. Leaves 4-5, broadly linear, 2-10 mm. wide, not fistular, scabrid on the margin and keel, narrowed towards the apex, shorter than the scape. Spathe quickly caducous, with a long beak several times exceeding the base of the spathe. Umbel capsuliferous, spherical, many-flowered, dense; pedicels unequal, the inner ones twice as long, 3-6 times as long as the perianth, the outer ones with bracteoles at the base. Segments of the ovoid-campanulate perianth dark-purple-violet, more rarely dirty-greenish, almost equal, 3-4 mm. long, shining, obtuse, the outer ones carinate, ± scabrid, oblong-ovate, the inner ovate. Filaments 1/4-1/3 longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones entire, triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion ⅓ or almost ½ shorter than the laterals. Style exserted from the perianth. Capsule somewhat longer than the perianth. VI-VIII.

In dry places, on rocks, in crops.—EUROPEAN PART: 17 Crimea; CAUCASUS: 20 Ciscauc., 21 Dag., 22 W., 23 E. and 24 S. Transcauc.; C. ASIA: 45 Mountain Turkm., 47 Syr Dar. Gen. distr.: Iran. Descr. from the neighbourhood of the mountains of Shiraz. Cotype at Leningrad.

174. A. LEUCANTHUM *C. Koch* in Linnaea XXII (1849) 240.—*A. Ampeloprasum* var. *leucanthum* Ledebour, Fl. Ross. IV (1852) 164; Boiss. Fl. Or. V (1882) 232.—*A. firmotunicatum* var. *album* Grossheim in Grossheim et Shishkin, Sched. Herb. Pl. Or. Exsicc. Fasc. I-VIII (1924) no. 5.—Exs.: l. c.

Bulb ovoid-spherical, 2-3 cm. thick; outer envelopes greyish-brownish, bast-like; envelopes of the new bulb yellowish; bulblets numerous, yellowish, dull. Scape 50-120 cm. high, clothed for 1/4-1/3 with smooth leaf-sheaths. Leaves 4-7, broadly linear, not fistular, carinate, 3-9 mm. wide, scabrid, considerably shorter than the scape. Spathe early caducous. Umbel capsuliferous, almost spherical, dense, many-flowered; pedicels unequal, the inner ones twice as long, 2-8 times as long as the perianth, the outer ones with bracteoles at the base, the inner without bracteoles. Segments of the ovoid-campanulate perianth white with a green nerve, 3-3.5 mm. long, obtuse or subacute, the inner ones elliptic, the outer carinate, scabrid, oblong-ovate. Filaments ¼ longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate, the outer ones entire, triangular-subulate, the inner somewhat broader than the perianth-segments at the base, trifid, with the middle portion 1/3-1/2 shorter than the laterals and 1/3-1/2 shorter than the ovate-triangular base. Style exserted from the perianth. Capsule slightly longer than the perianth. VI-VII.

In dry places and in crops.—CAUCASUS: 23 E. and 24 S. Transcauc. Endemic (?). Descr. from the Shirvan steppe. Type at Berlin.

NOTE. Very close to *A. atro-violaceum* and deserves further study.

175. A. AMPELOPRASUM *Linné,* Sp. Pl. (1753) 294; Boiss. Fl. Or. V (1882) 232, excl. var. *b*.—Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1072.—Exs.: Soc. Etude Fl. Fr.-Helv. no. 1546.

Bulb ovoid-spherical, 2-4 cm. thick; outer envelopes almost papyraceous, slightly fibrous, envelopes of the new bulb yellowish; bulblets numerous, yellowish, finely striate under a lens, ± dull. Spathe 50-80 cm. high, clothed for 1/3 with smooth leaf-sheaths. Leaves 6-9, broadly linear, not fistular, 5-10 mm. wide, carinate, smooth, or scabrid on the margin, considerably shorter than the scape. Spathe early caducous. Umbel capsuliferous, spherical, many-flowered, rather lax; pedicels unequal, the central ones twice as long, 4-8 times as long as the perianth, with bracteoles at the base. Segments of the broadly ovoid-campanulate perianth rosy, *c.* 5 mm. long, oblong, subacute, scabrid, the outer ones carinate. Filaments scarcely longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones entire, triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion half as long as the laterals and the oblong-triangular base. Style exserted from the perianth. Capsule scarcely shorter than the perianth. VI.

A weed.—C. ASIA: 48 Pam.—Al. (foot of Kuh-i-Tang, S. side). Gen. distr.: Atl. Eur., C. Eur., W. Medit., Balkans-Asia Min., Iran. Descr. from the Orient and England.

(176.) A. PORRUM *Linné* Sp. Pl. (1753) 294.—*A. Ampeloprasum* var. *Porrum* Regel in A. H. P. III, 2 (1875) 54; Schmalh. Fl. II (1897) 488.—Ic.: Syreishch. Ill. Fl. Mosc. Gov. I (1906) 237.

Annual. Bulb without or with a few bulblets. Scape arising from the middle of the bulb. Leaves linear-lanceolate. Spathe with a long beak. Umbel large, spherical. Perianth whitish or more rarely rosy, with slightly scabrid segments. Filaments scarcely longer than the perianth, the inner ones trifid with the middle portion half as long as the base. Cultivated plant.

ECONOMIC IMPORTANCE. Grown principally in the European part of the U S S R, for the sake of the whitened bases of the stems, in market-gardens chiefly in the neighbourhood of large towns.

177. A. MONANTHUM *Maximovich* in Bull. Acad. Pétersb. XXXI (1887) 109.—Ic.: Kom. Opred. Rast. Dalnevost. Kraya I (1931) 365, t. 112, f. 3.

Bulb spherical, 0.5-1 cm. thick, with greyish-brownish, almost papyraceous envelopes. Scape 5-15 cm. high, 1/2-2/3 as long as the leaves, slender, weak, surrounded at the base with membranous sheaths together with leaves. Leaves 1-2, linear, 2-4-8 mm. wide, gradually narrowed towards the base and apex, subacute. Spathe thinly membranous, sometimes coloured, acuminate, somewhat shorter than the umbel. Umbel 1-2-(3)-flowered; pedicels shorter than or equalling the perianth, slightly thickened and expanded beneath the flower. Segments of the broadly campanulate perianth rose-coloured, 4-5 mm. [long], oblong, subobtuse; filaments ¼ shorter than the perianth-segments, connate, and adnate to the perianth, for 1/3, triangular-subulate. Style not exserted from the perianth, stigma trilobed. Ovules 6. IV-V.

Grassy mountain slopes, and in woods.—FAR EAST: 38 Ussuri.—Gen. distr.: Japan-China. Descr. from R. Sidemya. Type at Leningrad.

178. A. PARADOXUM *(Marschall-Bickerstein) G. Don,* Mon. (1827) 72; Ledeb. Fl. Ross. IV (1852) 186: Boiss. Fl. Or. V (1882) 257; Schmalh. Fl. II (1897) 481.—*Scilla paradoxa* Marschall-Bickerstein, Fl. Taur.-Cauc. III (1819) 267.—Exs.: Herb. Fl. Cauc. no. 163.

Bulb spherical, *c.* 1 cm. thick, with grey-black, papyraceous envelopes. Scape sharply triquetrous, 20-30 cm. high, clothed at the base with leafless sheaths besides the leaf. Leaf solitary, linear, 0.5-1-2.5 cm. wide, carinate, gradually narrowed from the middle towards the base, subacute. Spathe acuminate, approximately 2/3 as long as the umbel. Umbel 2-5-10-flowered, often with bulbils; pedicels 1½-2 times as long as the perianth, with nodding flowers. Segments of the broadly campanulate perianth *c.* 10 mm. long, almost equal, oblong, acute. Filaments 1/3 as long as the perianth, connate, and adnate to the perianth, for ¼, triangular-subulate, almost equal. Style not exserted from the perianth, with a trilobed stigma; ovules 6. Capsule ½ as long as the perianth. V.

In shady woods.—CAUCASUS: 20 Dag., 23 E. Transcauc., 25 Talysh; C. ASIA: 45 Mountain Turkm. (W. Kopet Dag). Gen. distr.: N. Persia. Descr. from Georgia. Type at Leningrad.

179. A. CANDOLLEANUM *Albov* in Tr. Tifl. Bot. Sada I (1895) 240.

Bulb almost spherical, 0.75-1.5 cm. wide, with grey papyraceous envelopes. Scape terete, slender, 20-30 cm. high. Leaves 2-3, narrowly linear, 3-7 mm. wide, gradually narrowed towards the base and apex, almost smooth on the margin, acute, somewhat shorter than the scape. Spathe 2/3 or scarcely more than ½ as long as the umbel, acuminate. Umbel with or without bulbils, fasciculate, few-flowered; pedicels unequal, slightly shorter than or 1½ times as long as the perianth, without bracteoles, with almost cernuous flowers. Segments of the broadly campanulate almost hemispherical perianth white with a rosy tinge, 10-12 mm. long, obtuse, the outer ones elliptic, the inner oblanceolate-elliptic. Filaments scarcely more than ½ as long as the perianth, connate and adnate to the perianth at the base, triangular-subulate, the inner ones 1½ times as broad. Style not exserted from the perianth; ovules 6. VI. (Tab. XV, fig. 2a).

Subalpine and alpine meadows.—CAUCASUS: 22 W. Transcauc. Endemic. Descr. from Mt. Kutysh.

180. A. OREOPHILUM *C. A. Meyer,* Verz. Cauc. (1831) 37; Ledeb. Fl. Ross. IV (1852) 188.—*A. platystemon* Karelin et Kirilov in Bull. Soc. Nat. Mosc. XV (1842) 514.—*A. Ostrowskianum* Regel in A. H. P. VII (1881) 545.—*A. oreophilum* var. *Ostrowskianum* Regel in A. H. P. X (1887) 356.—Ic.: Regel in Gartenfl. (1873) t. 775, f. 1-3; [ibid. (1882) t. 1089; Bot. Mag. CXXVII (1901) t. 7756].—Exs.: Herb. Fl. As. Med. no. 62.

Bulb ovoid-spherical, 1-1.5-(2) cm. thick, with grey papyraceous envelopes: Scape 5-20 cm. high, clothed for ½-¾ with leaf-sheaths which are hidden beneath the ground. Leaves 2, linear, 2-8 mm. wide, scabrid on the margin, considerably longer than the umbel. Spathe ½-2/3 as long as the umbel, shortly acuminate. Umbel fasciculate or more often hemispherical or spherical, ± few-flowered, rather lax; pedicels almost equal, half as long as, equalling, or more often slightly longer than, the perianth, without bracteoles at the base. Segments of the broadly campanulate perianth rosy-purple with a darker nerve, 8-11 mm. long, oval, obtuse or more often acute. Filaments ⅓-½ as long as the perianth-segments, connate, and adnate to the perianth, half-way, the outer ones triangular-lanceolate, the inner broadly triangular. Style not exserted from the perianth, with an almost trilobed stigma; ovules 6. Capsule *c.* 4 mm. diam. VII-VIII.

Rubbly slopes in the upper mountain zone.—CAUCASUS: 21 Dag.; C. ASIA: 42 Dzung.-Tarb., 48 Pam.-Al., 49 Tien Shan. Endemic. Descr. from Dagestan; Tufan Dag. Type at Leningrad.

181. A. GYPSACEUM *M. Popov et Vvedensky* in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 92.

Bulb ovoid-spherical, 1-1.5 cm. thick, with greyish papyraceous envelopes. Scape 7-20 cm. high, clothed up to half-way with leaf-sheaths which are hidden beneath the ground. Leaves 2-3, linear, 2-5 mm. wide, scabrid on the margin, considerably longer than the scape. Spathe slightly shorter or scarcely more than ½ as long as the umbel. Umbel fasciculate-hemispherical, hemispherical or more rarely spherical, ± few-flowered, dense; pedicels equal, equalling or 1½-2 times as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth dirty-purple, with a purple nerve, more strongly coloured towards the apex, 10-11 mm. long, the outer ones oblong-linear, acute, slightly longer and broader than the oblanceolate, denticulate, subobtuse inner ones. Filaments half as long as the perianth, connate, and adnate to the perianth, up to half-way, scarcely coalescent above this, the outer ones lanceolate-subulate, the inner slightly broader, triangular. Ovary sessile, smooth, with 6 ovules. V-VI. (Tab. XVI, fig. 1a).

Chiefly on outcrops of particoloured rocks.—C. Asia: 48 Pam.-Al. (sporadically in the S. part). Endemic. Descr. from the Kuh-i-Tang Mts.: Khodzha-i-Fil. Type at Tashkent.

182. A. HELICOPHYLLUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 127.

Bulb almost spherical, 1.5-2 cm. thick, with papyraceous blackish envelopes. Scape stocky, thick, 5-8 mm. thick, 10-20 cm. high. Leaves 5-6, linear, *c.* 3 mm. wide, glaucous, glabrous, scabrid on the margin, spirally coiled in the upper third, shorter than the umbel. Spathe ¼ as long as the umbel, acuminate. Umbel fasciculate-hemispherical or hemispherical, many-flowered, lax; pedicels unequal, the central ones up to twice as long, many times longer than the perianth (up to 9 cm. long), thick, thickened beneath the flower. Segments of the stellate perianth pale-rose-violet with a strong green or dirty-green nerve, linear-oblong, subobtuse, 5 mm. long, reflexed after flowering, ± revolute. Filaments slightly shorter than the perianth-segments, adnate to the perianth at the extreme base, slightly coalescent with each other above this, subulate from a triangular base, which in the inner ones is 1½ times as broad. Ovary sessile, scabrid, with 6-7 ovules. Capsule spherical, *c.* 5 mm. diam. V-VI.

Rubbly slopes, outcrops of particoloured rocks. C. ASIA: 45 Mountain Turkm. (Kara Kala, Prokhladnoye, Sulyuklyu). Endemic. Descr. from the neighbourhood of Kara Kala. Type at Tashkent.

183. A. SERGII *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 127.

Bulb ovoid, 0.75-1 cm. thick, with grey papyraceous envelopes, covering 1-2 large, yellowish-cinnamomeous, almost smooth, dull bulblets. Scape 10-12 cm. high, slender, clothed for ⅓-½ with a leaf-sheath hidden beneath the ground. Leaves usually solitary, very rarely 2, narrowly linear, (1)-2-3-(4) mm. wide, canaliculate, glaucous, twisted like a corkscrew, smooth, or scabrid on the margin, glabrous, equalling the umbel. Spathe shortly acuminate, ⅓-½ as long as the umbel. Umbel generally hemispherical, more rarely fasciculate, few-flowered, lax; pedicels 3-4 times as long as the perianth, without bracteoles at the base, the outer ones slightly ascending. Segments of the stellate perianth pale-rose with a purple nerve, 4 mm. long, lanceolate, obtuse, later reflexed and twisted. Filaments scarcely shorter than the perianth, connate and adnate to the perianth at the base, equal, subulate from a triangular base. Ovary sessile, papillose [lit. "scabrid"], with 7-9 ovules. V.

Rubbly slopes.—C. ASIA: 49 Tien Shan (Kara Tau). Endemic. Descr. from Uch Uzen. Type at Moscow.

184. A. EUGENII *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 127.

Bulb ovoid, 1-1.5 cm. thick, with grey papyraceous envelopes. Scape clothed almost half-way with 2 sheaths, one of which is leafless. Leaf solitary, linear, 2-7 mm. wide, considerably longer than the umbel, covered in the lower half, beneath, as also the aerial part of the sheath, with reflexed hairs, above and in the anticous half glabrous. Spathe practically without a beak, several times shorter than the umbel. Umbel hemispherical or almost spherical, comparatively few-flowered, lax; pedicels many times longer than the umbel, ascending, without bracteoles at the base. Segments of the stellate perianth rose-coloured with a strong purple nerve, 4 mm. long, linear-oblong, obtuse, later reflexed and twisted. Filaments ¼ shorter than the perianth-segments, adnate to the perianth at the base, slightly coalescent with each other above this, subulate from a broadly triangular base which is slightly broader in the inner ones. Ovary almost sessile, scabrid, with 6-7 ovules. Capsule almost spherical, *c.* 3 mm. in diameter.

Rubbly slopes, at an altitude of 1500-1700 m.—C. ASIA: 45 Mountain Turkm. (Gt. Balkhany). Endemic. Descr. from the Gt. Balkhany Mts.: Kosha Kudzhuk. Type at Leningrad.

185. A. VERTICILLATUM *(Regel)* Regel in A. H. P. VI (1880) 518.—*A. Pallasi* var. *verticillatum* Regel in A. H. P. III (1875) 102.—Exs.: Herb. Fl. As. Med. no. 315.

Bulb ovoid, 0.75-1.5 cm. thick, with greyish papyraceous envelopes. Scape 10-20 cm. high, clothed for ¼ with 1 or 2 approximate leaf-sheaths. Leaves shorter than the scape, divided to the sheath into 3-9 filiform, striate, scabrid lobes, simulating a verticil. Spathe with a short beak, slightly shorter than or equalling the umbel. Umbel almost spherical or hemispherical, comparatively many-flowered, lax; pedicels unequal, the central ones sometimes twice as long, 3-7 times as long as the perianth, the outer ones ascending, without bracteoles at the base. Segments of the stellate perianth rosy with a purple nerve, *c.* 4 mm. long, oblong-lanceolate, obtuse, later reflexed and twisted. Filaments somewhat longer than the perianth-segments, adnate to the perianth at the base, united above into a ring, subulate from a triangular base. Ovary almost sessile, scabrid, with 8-10 ovules. Capsules spherical, *c.* 3 mm. in diameter. V-VI. (Tab. XV, fig. 4 a-b).

On earthy and rubble slopes in the foothills and lower mountain zone.—C. ASIA: 48 Pam.-Al. (W. part), 49 Tien Shan (W. and S. W. part). Endemic. Descr. from the Kara Tau Mts. Type at Leningrad.

186. A. ARIODES *M. Popov et Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 128.

Bulb ovoid, 1-2 cm. thick, with greyish-brownish, coriaceous, splitting envelopes, covering a solitary, large, shining, yellowish bulblet. Scape *c.* 20 cm. high, shorter than the leaves. Leaves 2, linear, 0.5-1 cm. wide, scabrid on the margin and on the nerves beneath, withering towards flowering-time. Spathe slightly shorter than or equalling the umbel, with a long herbaceous (especially when young) beak. Umbel hemispherical or spherical, comparatively few-flowered, lax; pedicels almost equal, 3-5 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth greenish (in the herbarium rosy) with a dirty-purple or dirty-green nerve, *c.* 4 mm. long, linear-oblong, obtuse, later reflexed and twisted. Filaments scarcely shorter than the perianth-segments, adnate to the perianth at the base, united above into a ring, subulate from a triangular base which in the inner ones is twice as broad. Ovary almost sessile, with 6-7 ovules. V.

On stony and earthy slopes in the lower mountain zone.—C. ASIA: 48 Pam.-Al. (sporadically in the western part). Endemic. Descr. from the Zeravshan range: Maidan Ata. Type at Tashkent.

NOTE. Well distinguished from species related to *A. verticillatum* by its coriaceous bulb-envelopes, and by the spathe with a long herbaceous beak, recalling in the young state the unopened spathe of Aroids.

187. A. MONOPHYLLUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 128.

Bulb spherical, 1-1.5 cm. thick, with greyish papyraceous envelopes. Scape buried in the ground almost up to the umbel, 5-10 cm. long, considerably shorter than the leaf. Leaf solitary, linear-lanceolate, 3-11 mm. wide, acute, scabrid on the margin. Spathe slightly or ⅓ shorter than the umbel, shortly acuminate. Umbel hemispherical, ± few-flowered; pedicels equal, slightly or 1½-(2) times as long as the perianth. without bracteoles at the base. Segments of the almost stellate perianth dirty-violet or rose-violet, with a darker nerve, 5-6 mm. long, linear, subobtuse, erect after flowering. Filaments ⅓ shorter than the perianth-segments, connate and adnate to the perianth at the base, the outer ones subulate. Capsule (unripe) ⅓ shorter than the perianth. VII. (Tab. XV, fig. 3 a).

Stony places on the summits of the central Kopet Dag.—C. ASIA: 45 Mountain Turkm. Gen. distr.: N. Iran—Khurasan. Descr. from Iondare. Type at Leningrad.

188. A. Derderianum *Regel* in A. H. P. III, 2 (1875) 242.—*A. haemanthoides* var. *lanceolatum* Boissier, Fl. Or. V (1882) 276.

Bulb almost spherical, 1-1.5 cm. thick, with greyish papyraceous envelopes. Scape thickish, 5-10 cm. high, shorter than the leaves, buried half-way in the ground. Leaves 2, linear-lanceolate, 5-10 mm. wide, scabrid on the margin. Spathe half as long as the umbel, shortly acuminate. Umbel hemispherical or spherical, many-flowered; pedicels almost equal, 1½ (in fruit 2½) times as long as the perianth. Segments of the almost stellate perianth white with a violet nerve, 8-13 mm. long, linear, acute, erect and rigid after flowering. Filaments ⅓-½ as long as the perianth-segments, connate and adnate to the perianth at the base, triangular-subulate. Capsule half as long as the perianth. V.

On dry slopes.—CAUCASUS: 24 S. Transcauc. (?). Gen. distr.: Iran. Descr. from N. Iran. Type at Leningrad.

NOTE. Cited for S. Transcaucasia, but I have seen no specimens thence.

189. A. Alexeianum *Regel* in A. H. P. III, 2 (1875) 244.—Ic.: Regel, Fl. Turk. (1875) t. 16, f. 4-6.

Bulbs almost spherical, 1.5-2 cm. thick, with blackish papyraceous envelopes. Scape thick, 10-20 cm. high, shorter than the leaves, buried half-way in the ground. Leaves (1)-2-3, lanceolate, oblong or elliptic, 2-5 cm. wide. Spathe ⅓-½ as long as the umbel, shortly acuminate. Umbel hemispherical or more rarely spherical, many-flowered; pedicels unequal, (2)-3-5 times as long as the perianth, without bracteoles at the base. Segments of the almost stellate perianth rose with a purple nerve, 7-8 mm. long, linear-lanceolate, acute, erect and rigid after flowering. Filaments slightly or about ⅓ shorter than the perianth-segments, connate and adnate to the perianth at the base, the outer ones subulate, the inner 1½ times as broad, triangular-subulate. Capsule scarcely more than ½ as long as the perianth. V-VII.

Rubbly and stony slopes of the middle and upper mountain zones.—C. ASIA: 48 Pam.-Al. Endemic. Descr. from the Zeravshan valley. Type at Leningrad.

190. A. Akaka *Gmelin ex Roemer et Schulter,* Syst. VII (1830) 1132; Ledeb. Fl. Ross. IV (1852) 187; Boiss. Fl. Or. V (1882) 275.—*A. latifolium* Jaubert et Spach, Ill. Pl. Or. II (1844)[48] t. 103.

Bulb spherical, 1.5-2.5 cm. thick, with blackish papyraceous envelopes. Scape thick, 5-15 cm. high, shorter than the leaves, buried half-way in the ground. Leaves (1)-2, oblong or elliptic, scabrid on the margin, 2-6 cm. wide. Spathe ⅓-½ as long as the umbel, shortly acuminate. Umbel fasciculate-hemispherical or hemispherical, many-flowered; pedicels equal, slightly or 1½ times (in fruit 2-3 times) longer than the perianth. Segments of the almost stellate perianth linear, 7-8 mm. long, subacute, rosy with a darker nerve, erect and rigid after flowering. Fila-

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[48] [For dates of publication of Jaubert et Spach, Illust. Pl. Orient. (5 vols., 1842-57), see Stearn in Journ. Soc. Bibl. Nat. Hist. I (1939) 255-259. —*W. T. S.*]

ments half as long as the perianth-segments, connate and adnate to the perianth at the base, triangular-subulate. Capsule half as long as the perianth. V-VI.

In dry stony places.—CAUCASUS: 23 E. and 24 S. Transcauc. Gen. distr.: Arm.-Kurd., Iran. Descr. from Gilan.

191. A. MATERCULAE *Bordzilovsky* in Zap. Kiev. Obshch. Yest. [Mem. Kiev Soc. Nat.] XXV, 1 (1915) 73.

Bulb almost spherical, 1-2 cm. thick, with grey or blackish papyraceous envelopes. Stem thick, 10-30 cm. high, shorter or longer (?) than the leaves, buried in the ground at the base. Leaves 2-4, glaucous, linear-loriform, 1-2 cm. wide, scabrid on the margin. Spathe half as long as the umbel, shortly acuminate. Umbel fasciculate, many-flowered; pedicels unequal, 2-8 times as long as the perianth. [Perianth-segments] lilac-coloured with a reddish nerve, 5-9 mm. long, linear, subacute, erect and rigid after flowering. Filaments somewhat shorter than the perianth, connate and adnate to the perianth at the base, triangular-subulate. Capsule scarcely more than half as long as the perianth. IV-V.

In dry places.—CAUCASUS: 24 S. Transcauc. Endemic. Descr. from Nakhichevan. Type at Kiev.

192. A. CHRISTOPHI *Trautvetter* in A. H. P. IX (1884) 268.—*A. albopilosum* C. H. Wright in Gard. Chron. XXXIV (1903) 34.—Ic.: Regel in A. H. P. X (1887) t. 7, f. 1; [Bot. Mag. CXXXI (1904) t. 7982].

Bulb spherical, *c.* 2 cm. thick, with grey papyraceous envelopes. Scape thick, 5-15 mm. thick, 15-40 cm. high, buried in the ground at the base, approximately equalling the leaves. Leaves 3-7, loriform, 5-25 mm. wide, glaucescent, erect, with stiff spreading hairs beneath and especially on the margin, very rarely almost glabrous. Spathe (¼)-⅓-½ as long as the umbel, shortly acuminate. Umbel fasciculate-hemispherical, more rarely spherical, many-flowered, lax; pedicels almost equal, 3-5-several times longer than the perianth-segments, without bracteoles at the base. Segments of the almost stellate perianth purple-violet or rose-violet, 10-15-(18) mm. long, linear-triangular, very acute, erect and rigid after flowering. Filaments half as long as the perianth, connate and adnate to the perianth at the extreme base, equal, abruptly linear-subulate from an expanded base. Capsule *c.* 5 mm. in diameter. V-VI.

Gentle mountain slopes, principally in the lower zone.—C. ASIA: 45 Mountain Turkm. Endemic. Descr. from the neighbourhood of Ashkhabad. Type at Leningrad.

193. A. BODEANUM *Regel* in A. H. P. III, 2 (1875) 238.—*A. Walteri* Regel in A. H. P. X (1887) 357, t. 7, f. 3.

Bulb spherical, 1-2 cm. thick, with blackish papyraceous envelopes. Scape comparatively slender (not more than 5 mm. thick), 10-20 cm. high, buried in the ground at the base, shorter than the leaves. Leaves 1-2-(4), linear-lanceolate, 1-2 cm. wide, recurved, glabrous, scabrid on the margin and sometimes beneath. Spathe half as long as the umbel, shortly acuminate. Umbel fasciculate or hemispherical, many-flowered, lax; pedicels equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the almost stellate perianth rose-violet, 10-14 mm. long, linear-triangular, acute, erect after flowering. Filaments almost ⅓ shorter than the perianth-segments, connate and adnate to the perianth at the extreme base, equal, ± abruptly linear-subulate from an expanded base. [Ovary . . .? Style . . .? Capsule . . .?] V.

Rubbly and stony slopes of the steppe zone.—C. ASIA: 45 Mount. Turkm. Gen. distr.: Iran. Descr. from Persia. Type at Leningrad.

NOTE. Very close to *A. Christophi* and deserving further study. An *Allium* very close to both species, collected by Chernyakovsky (Seamasur), to which reference is made in the Flora of Turkmenistan (II (1932) 290), still remains obscure.

194. A. BRACHYSCAPUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 129.—Ic.: Fl. Turkm. II (1932) fig. 104.

Bulb spherical, 1.5-2 cm. thick, with grey papyraceous envelopes. Scape *c.* 10 cm. high, stocky, buried in the ground half-way or almost to the umbel. Leaves (1)-2, linear-lanceolate or narrowly lanceolate, 1-2 cm. wide, scabrid on the margin, considerably longer than the umbel. Spathe scarcely more than half as long as the umbel, without a beak. Umbel hemispherical, many-flowered, dense; pedicels almost equal, (2)-3-5 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth rose-violet with a darker or greenish nerve, 5-6 mm. long, lanceolate, the outer ones subacute, the inner obtuse, later reflexed and twisted. Filaments slightly longer than or 1½ times as long as the perianth-segments, connate, mutually free above, linear-subulate, the inner ones somewhat broader. Ovary on a short stipe, papillose [lit. "Scabrid"]. V.

Rubbly slopes.—C. ASIA: Mountain Turkm. (Sulyuklyu). Endemic. Descr. from Sulyuklu. Type at Tashkent.

195. A. KARATAVIENSE *Regel* in A. H. P. III, 2 (1875) 243.—Ic.: Regel, Fl. Turk. (1876) t. 16, f. 1.-3; [Bot. Mag. (1879) t. 6451].—Exs.: Herb. Fl. As. Med. no. 59.

Bulb spherical, 2-6 cm. thick, with blackish or grayish papyraceous envelopes. Scape stocky, 10-25 cm. high, sometimes buried in the ground almost half-way, shorter than the leaves. Leaves generally 2, more rarely 1 or 3, lanceolate or more often oblong or almost elliptic, 3-15 cm. wide, smooth on the margin. Spathe slightly or ⅓ shorter than the umbel, shortly acuminate. Umbel spherical, many-flowered, dense; pedicels equal, 3-4 times as long as the inflorescence, without bracteoles at the base. Segments of the stellate perianth light-rose-violet with a darker nerve, 5-7 mm. long, linear, obtuse, later reflexed and twisted. Filaments slightly longer than the perianth-segments, adnate to the perianth at the base, coalescent with each other above, subulate from a triangular base which in the inner ones is 1½ times as broad. Ovary on a stipe, papillose [lit. "scabrid"]. Capsule obcordate, *c.* 8 mm. diam. IV-V.

On mobile limestone screes in the lower mountain zone.—C. ASIA: 48 Pam.—Al. (Alai range), 49 Tien Shan (W. Tien Shan). Endemic. Descr. from the Kara Tau Mts.: Bugun. Type at Leningrad.

196. A. Mariae *E. Bordzilovsky* in Zap. Kiev. Obshch. Yest. XXV, 1 (1915) 71.

Bulb ovoid, 1.5-2 cm. high. Scape terete, smooth, 15-35 cm. high, surrounded at the base or up to ⅓ with leaf-sheaths. Leaves 2-3, narrowly linear, 2.5-8 mm. wide, canaliculate, glaucous, scabrid on the margin and often on the nerves beneath, approximately equalling the scape. Spathe acuminate, equalling the umbel or slightly shorter than it. Umbel fasciculate or almost hemispherical; pedicels 2-5 times as long as the perianth, without bracteoles at the base. Segments of the perianth wine-red with a brownish nerve, 3-4 mm. long, linear-oblong, subobtuse or subacute, later reflexed. Filaments slightly longer than the perianth-segments, connate and adnate to the perianth at the base, gradually narrowed from the base to the apex; anthers black-vinaceous. Ovary sessile, smooth; style slightly longer than the stamens. Capsule spherical-ovoid or ovoid. V.

On dry slopes.—CAUCASUS: 24 S. Transcauc. Endemic. Descr. from Nakhichevan: Chinabad. Type at Kiev.

197. A. cardiostemon *Fischer* in Ind. Sem. Horti Petrop. VI (1840) 43; Ledeb. Fl. Ross. IV (1852) 188; Boiss. Fl. Or. V (1882) 282.

Bulb ovoid, 0.5-1-2 cm. thick, with blackish papyraceous envelopes. Scape 20-40-(60) cm. high, smooth, clothed at the base with leaf-sheaths. Leaves 2-3, linear-lanceolate or linear, 2-8 mm. wide, ± scabrid on the margin, shorter (usually considerably) than the scape. Spathe shortly acuminate, slightly or ⅓ shorter than the umbel. Umbel fasciculate-hemispherical or almost spherical, many-flowered, dense; pedicels equal, 3-4 times as long as the perianth, without bracteoles. Segments of the stellate perianth dark wine-red, *c.* 3 mm. long, linear, obtuse, later reflexed and twisted. Filaments scarcely shorter than the perianth-segments, connate and adnate to the perianth at the extreme base, the outer ones subulate, the inner considerably broader, obtusely bidentate above the middle. Ovary sessile, smooth. Capsule ovoid or almost spherical, 3-4 mm. long. VI-VII.

On dry slopes.—CAUCASUS: 23 E. and 24 S. Transcauc. Gen. distr.: Iran. Descr. from Nakhichevan: Koshadara. Type at Leningrad.

198. A. Fetisowi *Regel* in A. H. P. V (1878) 631.—*A. simile* Regel in A. H. P. X (1887) 359.—*A. tschimganicum* B. Fedchenko, Rast. [Veg.] Turk. (1915) 237, p. p.—Ic.: Regel, Gartenfl. (1879) t. 971, fig. a-f.

Bulb spherical, 1-1.5 cm. thick, with black papyraceous envelopes. Scape 40-65 cm. high, ribbed owing to the prominent nerves. Leaves 1-2, loriform, 2-15 mm.[49] wide, smooth or obscurely scabrid on the margin, considerably shorter than the scape; spathe half as long as the umbel, shortly acuminate. Umbel spherical or hemispherical, many-

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[49] ["12-15 m." in the original: presumably mm., not cm., is meant. —Translator's note.]

flowered, dense; pedicels almost equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth rose-violet, delicate, with an inconspicuous nerve, 5-7 mm. long, linear, obtuse or subobtuse, later reflexed and twisted. Filaments 1/4 shorter than the perianth-segments, connate and adnate to the perianth at the base, mutually free above, the outer ones subulate from the base, the inner subulate from an almost quadrate 2-4-toothed or more rarely triangular edentate base. Ovary on a short stipes, papillose [lit. "scabrid"]. Capsule ovoid or spherical, *c.* 4 mm. in diameter. V-VI.

In soft soils.—C. ASIA: 48 Pam.-Al. (Alai range), 49 Tien Shan. Endemic. Descr. from Ama Ata.

NOTE. I have been able to compare living examples of *A. Fetisowi* from Ugam *(A. simile)* and from the neighbourhood of Alma Ata *(A. Fetisowi* s. s.). The Alma Ata plant differs in its slightly smaller flowers, in the considerably narrower perianth-segments, which have a somewhat different tint (they are rose and distinctly purple at the base; in the Ugam plant the perianth-segments are rose-violet), in the rounder ovary and in the darker filaments. Generally speaking the Ugam examples are coarser and larger in all parts, but I have had too little material to be able to treat the characters mentioned as constant.

199. A. DASYPHYLLUM *Vvedensky* in Herb. Fl. As. Med. (1925) no. 57.

Bulb ovoid or spherical-ovoid, 0.75-1.5 cm. thick, with blackish papyraceous envelopes. Scape 15-25-(35) cm. high, ribbed owing to the prominent nerves, scabrid with short hairs. Leaf solitary, linear, 2-3-(5) mm. wide, scabrid with short hairs, distinctly shorter than the scape. Spathe slightly or 1/3 shorter than the umbel, shortly acuminate. Umbel fasciculate-hemispherical or hemispherical, ± many-flowered, dense; pedicels equal, 1½-2 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth white, with a strong green nerve, 4 mm. long, linear-lanceolate, acute, later reflexed and twisted. Filaments scarcely longer than the perianth-segments, adnate to the perianth at the base, coalescent into a ring above, the outer ones subulate, the inner 3 times as broad at the base, subulate from an almost quadrate almost bidentate base. Ovary on a short stipes, papillose [lit. "scabrid"]. Capsule almost spherical, 4-5 mm. long. VII.

On stony slopes in the upper mountain zone.—C. ASIA: 49 Tien Shan (known only from the *locus classicus:* Alexander range: Uch Bulak). Type at Tashkent.

200. A. INSUFFICIENS *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 129.

Bulb almost spherical, 0.75-1.25 cm. thick, with blackish papyraceous envelopes. Scape slender, smooth, 20-30 cm. high. Leaves 3-6, narrowly linear, 1-2 mm. wide, ciliate-scabrid on the margin, considerably shorter than (apparently half as long as) the scape. Spathe shortly acuminate, slightly shorter than the umbel. Umbel fasciculate-spherical or hemispherical, fairly multiflorous, dense; pedicels equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth apparently rose-violet with a darker nerve, 4-5 mm. long, linear, obtuse, later reflexed and twisted. Filaments approximately equalling the perianth-segments, adnate to the perianth at the extreme base, mutually free above, abruptly subulate from a broadly triangular base, almost equal. Ovary sessile, smooth. Capsule almost spherical, *c.* 3.5 mm. in diameter. IV-V.

On argillaceous, slightly saline soils. C. ASIA: 48 Pam.-Al. (Kurgan Tyube, Tash Bulak, Sarsaryak). Endemic. Descr. from the neighbourhood of Kurgan Tyube. Type at Leningrad.

201. A. ROBUSTUM *Karelin et Kirilov* in Bull. Soc. Nat. Mosc. XIV (1841) 853.—*A. robustum* var. *alpestre* Karelin et Kirilov in Bull. Soc. Nat. Mosc. XV (1842) 513.

Bulb almost spherical, 1-2 cm. thick, with blackish papyraceous envelopes. Scape 40-60 cm. high, with feebly projecting nerves. Leaves 2-4, linear, 2-10 mm. wide, smooth on the margin, considerably shorter than the scape. Spathe shortly acuminate, slightly or 1/3 shorter than the umbel. Umbel hemispherical or almost spherical, many-flowered, dense; pedicels equal, 1½-2-(3) times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth dark-purple with a darker nerve, *c.* 5 mm. long, linear-lanceolate, obtuse, later reflexed and twisted. Filaments equalling the perianth-segments, adnate to the perianth at the base, coalescent into a ring above, subulate from a triangular base which in the inner ones is almost twice as broad. Ovary almost sessile, papillose [lit. "scabrid"]. Capsule ovoid-spherical, *c.* 4 mm. in diameter. V-VI.

On dry slopes.—C. ASIA: 42 Dzung.-Tarb. Endemic. Descr. from the Tarbagatai: Chegarak Asu. Type at Leningrad.

202. A. DECIPIENS *Fischer ex Roemer et Schultes* Syst. VII (1830) 1117; Boiss. Fl. Or. V (1882) 282; Schmalh. Fl. II (1897) 491; Kryl. Fl. Zap. Sib. III (1929) 632.—*A. tulipifolium* Ledebour Ic Pl. Fl. Ross. II (1830), 13, t. 137; Ledeb. Fl. Ross. IV (1852) 187.—*A. viridulum* Ledebour, Fl. Alt. II (1830) 20, pro max. parte, quoad specimina authentica.—*A. Roborowskianum* Regel in A. H. P. X (1887) 359, t. 7, f. 4.—*A. atropurpureum* auct.

Bulb spherical-ovoid or spherical, 0.75-1.5-2 cm. thick, with blackish papyraceous envelopes. Scape 20-50-(70) cm. high, smooth. Leaves 2-4-(6), linear or linear-lanceolate, (2)-5-20-(30) mm. wide, smooth or scabrid on the margin, considerably shorter than the scape. Spathe shortly acuminate, 1/3-1/2 as long as the umbel. Umbel fasciculate-hemispherical, hemispherical or almost spherical, many-flowered, rather lax; pedicels equal, 2-6 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth pale-rosy-violet or violet (?) with a violet nerve, *c.* 5 mm. long, narrowly elliptic, obtuse, later reflexed and twisting. Filaments equalling the perianth-segments, adnate to the perianth at the base, slightly coalescent above, subulate from a triangular base which in the inner ones is twice as broad. Ovary almost sessile, papillose [lit. "scabrid"]. Capsule ovoid, *c.* 5 mm. in diameter. V-VI.

On stony slopes, bare places, salt-marshes, sands.—EUROPEAN PART: 13 Volga-Don, 14 Transvolga, 16 Black Sea, 17 Crimea, 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc.; W. SIBERIA: 27 Upper Tob., 28 Irt., 29 Alt.; C. ASIA: 40 Aral-Casp., 41 Balkhash. Gen. distr.: Dzung-Kashg. Descr. from the region between the Dnepr and the Crimea.

203. A. Sewerzowi *Regel* in Bull. Soc. Nat. Mosc. XLI, 1 (1867) 453.—*A. tschimganicum* B. Fedchenko, Rast. Turk. (1915) 237, p. p.—Exs.: Herb. Fl. As. Med. no. 342.

Bulb spherical, 1-2 cm. thick, with greyish papyraceous envelopes. Scape 35-85 cm. high, striate owing to the prominent nerves. Leaves (1)-2-3, linear or linear-lanceolate, 5-20 mm. wide, scabrid on the margin, considerably shorter than the scape. Spathe half as long as the umbel, shortly acuminate. Umbel hemispherical or more rarely spherical, many-flowered, ± dense; pedicels almost equal, 1½-2 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth rose-coloured with a violet nerve, *c.* 4 mm. long, linear, subobtuse, later reflexed and twisted. Filaments slightly shorter than or equalling the perianth-segments, adnate to the perianth at the base, mutually almost free above, subulate from a triangular base which in the inner ones is 2-3 times as broad. Ovary on a short stipe, papillose [lit. "scabrid"]. Capsule almost spherical or ovoid, *c.* 4 mm. wide. VI.

On rubbly slopes.—C. ASIA: 49 Tien Shan (W. Tien Shan). Endemic. Descr. from the Kara Tau Mts.: Boroldai. Type at Leningrad.

204. Suworowi *Regel*,[50] Gartenfl. (1881) 356, t. 1062, f. 4-5.—Ic.: Regel, Fl. Turk. (1876) t. 17, f. 5-7; [Bot. Mag. CXIV (1888) t. 6994.]—Exs.: Herb. Fl. As. Med. no. 181, sub. *A. Severtzovii.*

Bulb spherical, 2-3 cm. in diameter, with almost coricaeous, greyish, splitting envelopes, surrounding the base of the stem. Scape 30-100 cm. high, with feebly projecting nerves. Leaves 2-6, loriform, 5-20 mm. wide, scabrid on the margin, glaucescent, considerably shorter than the scape. Spathe shortly acuminate, ⅓ shorter than the umbel. Umbel hemispherical or spherical, many-flowered, dense; pedicels equal, 2-5 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth rose-violet with a darker nerve, *c.* 4 mm. long, linear, obtuse, later reflexed and twisted. Filaments slightly shorter or slightly longer than the perianth-segments, adnate to the perianth at the base,

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50 [The resemblance between this species and *A. Sewerzowi* is so close that Lipsky united them (cf. A. H. P. XVIII (1900) 139), overlooking differences in the form of the stamens and the surface of the ovary, as well as in ecological preferences to which Vvedensky later called attention when restoring *A. Suworowi* to specific rank (cf. Sched. Herb. Fl. Asiae Med. no. 181; Bull. Univ. Asie Centr. XII (1926) Suppl. 6). Vvedensky takes the type locality of *A. Suworowi* to be the Dalverzin steppe near Uralskaya south of Tashkent. —*W. T. S.*]

mutually free above, subulate from a somewhat expanded base, almost equal. Ovary almost sessile, smooth. Capsule broadly ovoid, *c.* 5 mm. in diameter. V.

On soft soils in foothills, chiefly as a weed in oases.—C. ASIA: 45 Mountain Turkm. (Kushkin region), 47 Syr Dar., 48 Pam.—Al., 49 Tien Shan. Gen. distr.: Iran (?).[51] Descr. from the Dalverzin steppe.

205. A. GRANDE *Lipsky* in A. H. P. XIII (1894) 343.—*A. decipiens* var. *latissimum* Lipsky in Zap. Kiev. Obshch. Yest. XII, 2 (1892) 363; Schmalh. Fl. II (1897) 491.

Bulb ovoid-spherical, 2.5 cm. wide. Scape 70 cm. high (and more), with feebly projecting nerves. Leaves 2-4, loriform, 3-5 cm. wide, smooth on the margin, considerably shorter than the scape. Spathe slightly shorter than, or scarcely more than half as long as, the umbel, shortly acuminate. Umbel almost spherical, many-flowered, dense; pedicels almost equal, 3-4 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth white-rose, with an inconspicuous nerve, lanceolate, acute, 6-7 mm. long, reflexed after flowering. Filaments scarcely shorter than the perianth-segments, adnate to the perianth at the base, mutually free above, subulate from a triangular base which in the inner ones is 1½ times as broad. Ovary on a short stipe, smooth. V.

In damp places among bushes.—CAUCASUS: 21 Dag. Endemic. Descr. from Makhach Kal. Type at Leningrad.

206. A. ALAICUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 130.

Bulb ovoid-spherical, 1-1.5 cm. thick, with blackish-grey, papyraceous, somewhat splitting envelopes. Scape 30-70 cm. high, ribbed owing to the prominent nerves, glabrous or with long deflexed hairs. Leaves 1-2, linear-lanceolate or linear, 5-17 mm. wide, acute, 1/3-1/2 as long as the scape, with long reflexed hairs on both surfaces, sometimes almost shaggy, more rarely almost glabrous. Spathe shortly acuminate, 2/5-½ as long as the umbel. Umbel fasciculate-hemispherical, more rarely spherical, many-flowered, ± lax; pedicels equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth apparently light-violet with a darker nerve, 6mm. long, linear, subobtuse, later reflexed and twisted. Filaments approximately equalling the perianth-segments, adnate to the perianth at the extreme base, mutually free, abruptly subulate from a short expanded base, which is 1½ times as broad in the inner ones. Ovary on a short stipe, papillose [lit. "scabrid"]. Capsule ovoid-spherical, *c.* 4 mm. in diameter. V-VI. (Tab. XV, fig. 1a).

On rubbly soils.—C. ASIA: 48 Pam.-Al. (Gulcha, Araban, Lyangar). Endemic. Descr. from Gulcha. Type at Leningrad.

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[51] [A specimen referred to *A. Suworowi* Regel, collected in North Iraq ("Kurdistaniae Turicae distr. Serizor") near Erbil, east of Mosul, is illustrated in Nábělek, Iter Turcico-Persicum IV (1929) fig. 7 and t.l, in Publ. Fac. Sci. Univ. Masaryk, 105 (1929). —*W. T. S.*]

207. A. STIPITATUM *Regel* in Gartenfl. (1881) 355, t. 1062, f. 1-3.

Bulb depressed-spherical, 3-6 cm. thick, with blackish almost papyraceous envelopes, covering a single, large, smooth bulblet. Scape 60-150 cm. high, smooth. Leaves 4-6, loriform, 2-4 cm. wide, smooth on the margin, hairy beneath, more rarely almost glabrous. [Umbel . . . ?]; pedicels almost equal, 3-6 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth lilac with a conspicuous nerve, 9 mm. long, gradually narrowed from the base, acute, later reflexed and twisted. Filaments equalling the perianth-segments, adnate to the perianth at the base, coalescent into a ring above, ± gradually subulate from a triangular base, which in the inner ones is twice as broad. Ovary on a short stipe, papillose [lit. "scabrid"]. Capsule depressed-globose, *c.* 5 mm. in diameter. V-VI.

On gentle slopes in the intermediate mountain zone.—C. ASIA: 48 Pam.-Al. Endemic.[52] Descr. from the Zeravshan valley. Type at Leningrad.

208. A. GULCZENSE *B. Fedchenko* [in Journ. Bot. Soc. Nat. St. Petersb. (1906) 194, reimpr. in Fedde, Rep. Sp. Nov. IV (1907) 320, et] in A.H.P. XXVIII (1908) 68.

Bulb ovoid-spherical, 3-5 cm. thick, with blackish papyraceous envelopes. Stem robust, 90-150 cm. high, smooth. Leaves 5-6, loriform, 4-8 cm. wide, smooth on the margin, considerably shorter than the stem. Spathe shortly acuminate, ⅓ shorter than the umbel. Umbel spherical, many-flowered, dense; pedicels unequal, the inner ones 1½ times the longer, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth white with a green nerve, 11 mm. long, filiform-linear, gradually narrowed from the base to the apex, later reflexed and twisted. Filaments slightly shorter than the perianth-segments, adnate to the perianth at the base, mutually almost free, the outer ones subulate, the inner 1½ times as broad, subulate from an almost quadrate bidentate base. Ovary sessile, papillose [lit. "scabrid"]. Capsule spherical, *c.* 6 mm. in diameter. V-VI.

On dry slopes in the intermediate mountain zone. C. ASIA: 48 Pam.-Al. (Alai range), 49 Tien Shan (Fergana range). Endemic. Descr. from the Alai range: Gulcha. Type at Leningrad.

209. A. AFLATUNENSE *B. Fedchenko* in Bull. Herb. Boiss. IV (1904) 917, cum tabula.

Bulb ovoid, 2-6 cm. thick, with greyish papyraceous envelopes. Scape robust, 80-150 cm. high, with feebly projecting nerves, surrounded by leaf-sheaths at the base both below and above the ground. Leaves

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52 [If *A. hirtifolium* Boissier (1882) proves conspecific with *A. stipitatum* Regel (1881), as seems probably—Lipsky united them in 1900 (A. H. P. XVIII. 138)—then *A. stipitatum* is not an endemic of the Pamir-Alai region but occurs also in Western Persia, in the Bakhtiari country (described by J. V. Harrison in Geogr. Journ. LXXX (1932) 193-210) between Isfahan and Dizful, as well as in the Elwend mountains near Hamadan further north. —*W. T. S.*]

6-8, loriform, the outer ones 2-10 cm. wide, glaucous, smooth on the margin, considerably shorter than the scape. Spathe slightly shorter than the umbel, shortly acuminate. Umbel almost spherical, dense, many-flowered; pedicels almost equal, 2-4 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth light-violet with a darker nerve, 7-8 mm. long, linear-lanceolate, acute, later reflexed and twisted. Filaments slightly longer than the perianth-segments, adnate to the perianth at the base, mutually free above, the outer ones subulate, the inner subulate from an almost quadrate base which is 1½ times or almost twice as broad; anthers violet. Ovary on a stipe, papillose [lit. "scabrid"]. Capsule broadly ovoid, almost spherical, *c.* 5 mm. in diameter. V.

In the upper and intermediate mountain zones.—C. ASIA: 49 Tien Shan (C. Tien Shan). Endemic. Descr. from Aflatun. Type at Leningrad.

210. A. ALTISSIMUM Regel in A.H.P. VIII (1884) 666, t. 21, f. k-m. —*A. jesdianum* Vvedensky in Fl. Turkm. II (1932) 282 [non Boiss. et Buhse].[52a]

Bulb spherical, 3 cm. thick, with greyish papyraceous envelopes. Scape 80-150 cm. high, with feebly projecting nerves. Leaves 4-6, linear-lanceolate, almost loriform, 2-4 cm. wide, ± green, almost smooth on the margin, considerably shorter than the scape. Spathe half as long as the umbel, shortly acuminate. Umbel spherical, many-flowered, dense; pedicels unequal, the central up to 1½ times as long, 4-6 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth violet, with a darker nerve, 6-7-(8) mm. long, linear-lanceolate, obtuse, later reflexed and twisted. Filaments equalling or slightly shorter than the perianth-segments, adnate to the perianth at the base, mutually ± coalescent above, subulate from a triangular base which in the inner ones is twice as broad; anthers yellow. Ovary on a short stipe, papillose [lit. "scabrid"]. Capsule obovoid, *c.* 5 mm. in diameter. IV.

In gorges.—C. ASIA: 45 Mountain Turkm., 48 Pam.-Al. Endemic. Descr. from Baldzhuan. Type at Leningrad.

Note. I have been unable to find, from herbarium material, any essential differences between the Kopet Dag and Pamir-Alai plants; on the other hand all this material that I have examined differs from the type in the narrower and slightly shorter perianth-segments. A comparison of the Fergana and Kopet Dag plants in the living state is necessary.

From *A. jesdianum* Boiss. et Buhse our plants differ in the perianth-segments having parallel margins and in the feeble ribbing of the stem.

211. A. TAENIOPETALUM *M. Popov et Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 130.

[52a] [To the synonymy of *A. altissimum* can be added *A. jesdianum* var. *latipetalum* Lipsky in A. H. P. XVIII (1900) 145. —*W. T. S.*]

Bulb almost spherical, 1-2 cm. thick. Scape 20-40 cm. high, ribbed owing to the prominent nerves. Leaves 2-3, almost loriform, 1-2 cm. wide, smooth on the margin, considerably shorter than the scape. Spathe half as long as the umbel, shortly acuminate. Umbel fasciculate-hemispherical or spherical, ± many-flowered; lax; pedicels unequal, the inner ones 1½ times as long, 2-4 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth deep rose-violet, with a greenish nerve, 8-12 mm. long, linear, with almost parallel margins, obtuse, later reflexed and twisted. Filaments ⅓ shorter than the perianth-segments, adnate to the perianth at the base, coalescent into a ring above, subulate from a triangular base, the inner ones slightly broader, anthers violet. Ovary almost sessile, scabrid. Capsule ovoid or almost spherical, *c.* 5 mm. in diameter. V.

In the shade of rocks.—C. ASIA: 48 Pam.-Al. (Turkestan range). Descr. from Zera Bulak heights. Type at Leningrad.

Note. Very close to *A. Rosenbachianum* Regel, from which, however, it is easily distinguished by the parallel margins of the perianth-segments and the shorter filaments.

212. A. Rosenbachianum *Regel* in A.H.P. VIII (1884) 664, t. 21, f. c.-i.

Bulb spherical, 1.5-2.5 cm. thick, with blackish papyraceous envelopes. Scape 50-70 cm. high, ribbed owing to the prominent nerves. Leaves 2-3, linear-lanceolate or broadly linear, (0.5)-1-5 cm. wide, almost smooth on the margin, considerably shorter than the scape. Spathe shortly acuminate, 1/2-2/3 as long as the umbel. Umbel spherical, many-flowered, lax; pedicels unequal, the central ones up to 1½ times as long, 3-9 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth dark-violet with a darker nerve, narrowly linear, gradually narrowed from the base, acute, 7-10 mm. long, later reflexed and twisted. Filaments equalling the perianth-segments, adnate to the perianth at the base, coalescent into a ring above, subulate from a triangular base, the inner ones twice as broad; anthers violet. Ovary on a short stipe, scabrid. Capsule depressed-spherical, *c.* 5 mm. in diameter. V.

On islands of earth in the intermediate mountain zone, in the shade of rocks and trees.—C. ASIA: 48 Pam.-Al. (S. W. part). Endemic. Descr. from Baldzhuan: Kyzyl Su. Type at Leningrad.

213. A. Komarovi *Lipsky* in A.H.P. XVIII (1900) 129.

Bulb spherical, 2-4 cm. wide. Scape 30-50 cm. high, almost without prominent nerves. Leaves 1-2, broadly lanceolate or oblong, 4-8 cm. wide, smooth on the margin, subacute, considerably shorter than the scape. Spathe shortly acuminate, ⅓ shorter than the umbel. Umbel hemispherical, many-flowered, dense; pedicels equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth dark-lilac with a darker nerve, linear-lanceolate, *c.* 6 mm. long, subobtuse, later reflexed and twisted. Filaments slightly longer than the perianth, adnate to the perianth at the base, coalescent into a ring above, ± gradually subulate from a triangular base, which in the inner ones is twice as broad. Ovary on a short stipe. Capsule almost spherical, *c.* 6 mm. in diameter. V-VI.

Screes in the upper mountain zone.—C. ASIA: 48 Pam.-Al. Endemic. Descr. from Iskander Kul. Type at Leningrad.

214. A. SARAWSCHANICUM *Regel* in A.H.P. III, 2 (1875) 244.—Ic.: Regel, Fl. Turk. (1876) t. 17, f. 1-4.

Bulb spherical, (1)-1.5-2 cm. in diameter, with grey papyraceous envelopes sometimes concealing a single large bulblet. Scape 25-50 cm. high, ribbed owing to the prominent nerves. Leaves 1-2, linear-lanceolate, 1-4 cm. wide, scabrid or smooth on the margin, shorter than the scape. Spathe shortly acuminate, ⅓-½ as long as the umbel. Umbel spherical or almost spherical, many-flowered, rather lax; pedicels unequal, the central ones slightly longer than the perianth, without bracteoles at the base. Segments of the stellate perianth deep rose-violet, with a darker nerve, 6-7 mm. long, linear, gradually narrowed from the base [? sic!], acute, later reflexed and twisted. Filaments slightly shorter than the perianth, subulate, adnate to the perianth at the base, coalescent into a ring above, provided with small teeth in the spaces between the filaments. Ovary on a short stipes, smooth, with 6 cornicles. Capsule almost spherical, *c.* 4 mm. in diameter. V.

In shady places in the intermediate mountain zone.—C. ASIA: 48 Pam.-Al. Endemic. Descr. from Zeravshan. Type at Leningrad.

215. A. PSEUDO-SERAVSCHANICUM *M. Popov et Vvedensky* in Sched. ad Herb. Fl. As. Med. (1935) no. 621.

Bulb spherical, 1-2 cm. thick, with blackish papyraceous envelopes. Scape (20)-30-50-(70) cm. high, ribbed owing to the prominent nerves. Leaves 1-2, linear-lanceolate, 1-4 mm. wide, scabrid on the margin, considerably shorter than the scape. Spathe slightly or ⅓ shorter than the umbel, shortly acuminate. Umbel spherical or almost spherical, many-flowered, dense; pedicels unequal, the central ones slightly longer, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth light-rose-violet, with a darker nerve, 6-8 mm. long, linear, gradually narrowed from the middle, acute, later reflexed and twisted. Filaments slightly shorter than the perianth-segments, subulate, adnate to the perianth at the base, coalescent above into an entire-margined ring. Ovary on a short stipes, smooth, with 6 cornicles. Capsule almost spherical, *c.* 4 mm. in diameter. V-VI.

In shady places.—C. ASIA: 45 Mountain Turkm. Endemic. Descr. from Syunt. Type at Leningrad.

Note. Very close to *A. sarawschanicum* Regel, but distinguished by its lighter flowers and more compressed umbel. Requires further study.

216. A. ELATUM *Regel* in A.H.P. VIII (1884) 665, t. 20, f.g.k.—*A. isphairamicum* B. Fedchenko [in Journ. Bot. Soc. Nat. St. Petersb. (1906) 194, reimpr. in Fedde, Report Sp. Nov. IV (1907) 320, et] in A.H.P. XXVIII (1908) 67.

Bulb ovoid-spherical, 2-6 cm. thick, with blackish papyraceous envelopes. Scape 60-100 cm. high, ribbed owing to the ± prominent nerves. Leaves 2-14, oblanceolate, 2-7 cm. wide, smooth on the margin. Spathe ⅓ shorter than the umbel. Umbel spherical, many-flowered, dense; pedicels equal, 3-8 times as long as the perianth, without bracteoles. Segments of the stellate perianth bright violet, with an inconspicuous darker nerve, 6-8 mm. long, linear-lanceolate, subacute or obtuse, unchanged after flowering. Filaments slightly longer than the perianth-segments, connate and adnate to the perianth at the base, subulate from a triangular base which in the inner ones is 1½ times as broad. Ovary sessile, papillose [lit. "scabrid"]. VI-VII.

On stony slopes in the upper mountain zone.—C. ASIA: 48 Pam.-Al. Endemic. Descr. from Baldzhuan.

217. A. GIGANTEUM *Regel* in Gartenfl. (1883) 97, t. 1113.—*A. procerum* Trautvetter in A.H.P. IX (1884) 274.—[Ic. Gartenfl. l. c.; A.H.P. VIII (1883) 663, t. 20, fig. h, 21, fig. m; Bot. Mag. CXI (1885) t. 6828].

Bulb ovoid, 4-6 cm. thick, with fairly numerous, grey-brown, coriaceous, splitting envelopes. Scape robust, 80-150 cm. high, with feebly projecting nerves. Leaves loriform, glaucous, 5-10 cm. wide, smooth, ⅓-½ as long as the scape. Spathe ½ as long as the umbel, with a short beak. Umbel spherical, many-flowered, dense; pedicels almost equal, 5 to many times longer than the umbel, without bracteoles. Segments of the stellate perianth light-violet, with an inconspicuous nerve, 5 mm. long, elliptic, obtuse, unchanged after flowering. Filaments almost 1½ times as long as the perianth-segments, connate and adnate to the perianth at the base, subulate from a triangular base which in the inner ones is 1½ times as broad. Ovary almost sessile, papillose [lit. "scabrid"]. Capsule almost spherical, *c.* 4 mm. in diameter. IV-V.

Gentle slopes in the lower mountain zone.—C. ASIA: 45 Mountain Turkm., 48 Pam.-Al. (S. part). Gen. distr.: Iran. Descr. from the neighbourhood of Merv (?).[53] Type at Leningrad.

218. A. TRAUTVETTERIANUM *Regel* in A.H.P. VIII (1884) 661, t. 21, f. a-b.

Bulb ovoid-spherical, 2-3 cm. thick, with greyish almost papyraceous envelopes. Scape 50-60 cm. high, ribbed owing to the prominent nerves. Leaves 2, lanceolate, 2-3 cm. wide, smooth on the margin, considerably shorter than the scape. Spathe 1/2-2/3 as long as the umbel. Umbel

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[53] [Although Baker and Regel state that Merv was the locality from which E. O'Donovan (1844-83), a British war-correspondent, introduced *Allium giganteum* into cultivation, it is more likely that O'Donovan collected it in the mountains between Merv and Meshed, in adjacent Persia, on his release from detention in the Marv oasis. At a place in the mountains between Meshed and Chacha he recorded that "the ground around us produced an abundance of wild flowers, among them a peculiar alium, the flower stalk of which grew to a height of four feet and was known to the Turcomans by the name of the *deli guzella*" (O'Donovan, The Merv-Oasis, II (1882) 454). It was probably here that he collected the bulbs given to Miles. —*W. T. S.*]

spherical, dense, many-flowered; pedicels equal, 3-5 times as long as the perianth, immersed at the base in the thickened spongy apex of the stem, without bracteoles. Segments of the stellate perianth light-violet (?), with an inconspicuous nerve, 7-10 mm. long, elliptic, obtuse, almost coriaceous after flowering. Filaments slightly shorter than the perianth-segments, connate and adnate to the perianth at the base, subulate from a triangular base which in the inner ones is 1½ times as broad. Ovary on a short stipes, papillose, [lit. "scabrid"]. V.

On outcrops of particoloured rocks (?).—C. ASIA: 48 Pam.-Al. (Ak Su, Tut Kaul). Endemic. Descr. from Baldzhuan. Type at Leningrad.

219. A. Schubertii *Zuccarini* in Abh. Munch. Acad. III (1843) 234, t. 3, f. 1; Boiss. Fl. Or. V (1882) 278.—*A. bucharicum* Regel in A.H.P. VIII (1884) 660, t. 20, f. a-c. [Ic. Bot. Mag. CXXIV (1898) tt. 7587-8]. —Exs. HFAM no. 64.

Bulb spherical, 2-3 cm. thick, with blackish papyraceous envelopes. Scape stocky, 10-30 cm. high. Leaves linear-lanceolate, 6-30 mm. wide, crisped, glaucous, scabrid on the margin, somewhat longer than the scape. Spathe many times shorter than the umbel, with a very short beak. Umbel spherical, more rarely hemispherical, many-flowered, very lax; pedicels usually very unequal, the fertile ones 1-10 cm., the sterile 2-20 cm. long, clavately thickened beneath the flower, especially in fruit, without bracteoles. Segments of the almost stellate perianth whitish or rosy, with a green or dirty-purple nerve, 4-8 mm. long, linear-lanceolate or lanceolate, obtuse or subobtuse, rigid after flowering, pointing obliquely upwards. Filaments in the sterile flowers 1/2-2/3 as long as the perianth-segments, in the fertile ones equalling them or 1/3 shorter, connate and adnate to the perianth for ½-⅓[54] [*sic*] in the sterile ones, for 1/6 in the fertile ones, subulate from expanded almost equal bases. Ovary almost sessile. Capsule *c.* 4 mm. long. V-VI (Tab. XVI, fig. 2a).

Rubbly slopes of the lower mountain zone, and sands.—C. ASIA: 40 Aral Casp., 41 Balkhash, 43 Kyzyl Kum, 48 Pam.-Al., 49 Tien Shan. Gen. distr.: E. Medit. Descr. from Palestine.

220. A. caspium *(Pallas) Marschall-Bieberstein*, Fl. Taur.-Cauc. I (1808) 265; Ledeb. Fl. Ross. IV (1852) 186; Schmalh. Fl. II (1897) 491. —*Crinum caspium* Pallas, Reise . . . II (1773) 736, t. Q.—*Amaryllis caspia* Willdenow, Sp. Pl. II (1799) 62.—*A. baissunense* Lipsky in A.H.P. XVIII (1900) 140.—Ic.: [Bot. Mag. LXXVII (1851) t. 4598]; Fl. Yugo-vost. III (1929) fig. 183.—Exs.: HFAM no. 333.

Bulb spherical, 2-4.5 mm. in diameter, with papyraceous almost black envelopes. Scape more often stocky, 10-30 cm. high. Leaves 1-3, linear or linear-lanceolate to broadly lanceolate, 5-25 mm. wide, scabrid or smooth on the cartilagineous margin, not exceeding the scape. Spathe 1/3 as long as the umbel. Umbel fasciculate, more often hemispherical or spherical, many-flowered, comparatively lax; pedicels 2-4 (and more)

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[54] ["½-2/3" may be intended. —Translator's note.]

times as long as the perianth-segments (up to 15 cm. long), without bracteoles at the base. Segments of the campanulate perianth dirty-greenish-violet or more rarely whitish, 5-11 mm. long, oblong or oblong-oval, more rarely lanceolate, obtuse, the inner ones sometimes denticulate, up to 1½ times as broad as the outer, unchanged after flowering. Filaments violet or more rarely white, 1½-2 times as long as the perianth-segments, edentate, connate and adnate to the perianth at the base, almost equal, linear-subulate from an expanded base. Ovary smooth, on a short stipe. Capsule broadly obovoid, *c.* 4 mm. in diameter.

In sandy deserts and on sands in the regions of outcrops of parti-coloured rocks.—EUROPEAN PART: 19 Lower Volga; CAUCASUS: 20 Ciscauc., 21 Dag.; C. ASIA: 40 Aral-Casp., 43 Kyzyl Kum, 44 Kara Kum, 45 Mountain Turkm. (Kushkin region), 47 Syr. Dar., 46 Amu Dar., 48 Pam.-Al. (S. W. part). Endemic. Descr. from the Caspian desert.

NOTE. It is very possible that *A. baissunense* Lipsky can be distinguished as a white-flowered, local race, of very limited distribution, but this point requires further observation in the field.

221. A. DARWASICUM *Regel* in A. H. P. VIII (1884) 659, tab. VII, f. a-e.

Bulb spherical, 1-2 cm. thick, with greyish papyraceous envelopes. Scape (10)-20-30-(50) cm. high, ribbed owing to the prominent nerves. Leaves 1-2, linear or narrowly linear, 4-20 mm. wide, ± scabrid on the margin, slightly shorter or slightly longer than the scape. Spathe acuminate, slightly or 1/3 shorter than the umbel Umbel fasciculate-hemispherical or hemispherical, ± many-flowered, dense; pedicels equal, slightly shorter than or up to 1½ times as long as the perianth, without bracteoles. Segments of the narrowly campanulate perianth white with a greenish nerve, 8-11 mm. long, linear-oblong, generally acute, the outer ones 1½ times as broad, withering after flowering. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for 3/5-2/3, almost free above, triangular, the inner ones 3 times as broad as, and slightly longer than, the outer. Ovary on a short stipes. Capsule almost spherical, *c.* 5 mm. in diameter. VI-VII.

On gentle slopes in the intermediate and upper mountain zones.—C. ASIA: 48 Pam.—Al. (S. E. part). Endemic. Descr. from Darvaz: Kuh-i-Frush. Type at Leningrad.

222. A. WINKLERIANUM *Regel* in A. H. P. VIII (1884) 661; Regel in A. H. P. X. (1887) 354.

Bulb spherical, 0.75-2 cm. thick, with blackish generally papyraceous envelopes. Scape 15-40-(100) cm. high, ribbed owing to the prominent nerves. Leaves 1-2-(4), linear or narrowly linear-lanceolate, 5-25 mm. wide, smooth, or scabrid on the margin and on the nerves beneath, shorter than the scape. Spathe acuminate, slightly shorter than or half as long as the umbel. Umbel fasciculate-hemispherical or hemispherical, many-flowered, dense; pedicels generally equal, slightly shorter than or 1½ times (to twice) as long as the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth rose-violet with a darker nerve, 7-10-(13) mm. long, linear-oblong, generally obtuse, the outer ones 1½ times as broad, withering after flowering. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for 1/2-2/3, almost free above, triangular, [the inner ones?] twice as broad as and slightly longer than the outer. Ovary on a short stipes. Capsule almost spherical, *c.* 5 mm. in diameter. V-VII. (Tab. XVI, fig. 3a).

Gentle slopes in the intermediate and upper mountain zones.—C. ASIA: 48 Pam.-Al., 49 Tien Shan (Fergana range). Gen. distr.: Dzung.-Kashg. Descr. from "Western Turkestan." Type at Leningrad.

NOTE. A polymorphic species, deserving, like *A. darwasicum*, further study. Especially aberrant are the specimens collected by Lipsky on the Sary Socho pass. They have very unequal pedicels (up to 5 cm.) and filaments adnate to the perianth somewhat higher up.

223. A. CUPULIFERUM *Regel* in A. H. P. III, 2 (1875) 234.—Ic.: Regel, Fl. Turk. (1876) t. 15, f. 4-5.

Bulb spherical, 1.5-2 cm. thick, with blackish papyraceous envelopes, covering (always ?) a large, yellowish, shining, finely-nerved bulblet. Scape 30-50 cm. high, with ± prominent nerves. Leaves 1-3, linear-lanceolate or lanceolate, 5-30 mm. wide, scabrid or smooth on the margin, considerably (up to twice) shorter than the scape. Spathe shortly acuminate, several times shorter than the umbel. Umbel fasciculate or hemispherical, few-flowered, very lax; pedicels unequal, 2-6 times as long as the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth rose-violet with a darker nerve, 10-15 mm. long, linear-oblong, obtuse, the outer ones 1½ times as broad, withering after flowering. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for 2/3, connate above this for 1/3, triangular, the inner ones 1½ times as broad and twice as long as the outer. Ovary on a stipe. Capsule almost spherical, 7mm. in diameter. V.

On stony slopes.—C. ASIA: 48 Pam.-Al. (Nura Tau, Dzhizman gorge, Andak, Tamerlanova's gate; Turkestan range: Kuduk Sai), 49 Tien Shan (Kaplanbek). Endemic. Descr. from the Dzhizman gorge. Type at Leningrad.

224. A. REGELI *Trautvetter* in A. H. P. IX (1884) 275.—*A. cupuliferum* var. *Regeli* O. Kuntze in A. H. P. X (1887) 292.—*A. Yatei* Aitchison et Baker [55] in Trans. Linn. Soc. Ser. 2, Bot. III (1888) 117.—Exs.: H F AM no. 179.

Bulb almost spherical, 1-2 cm. in diameter, clothed with papyraceous or almost coriaceous, blackish, cracked envelopes. Scape 30-70 cm. high. Leaves 2-3, linear-lanceolate, 0.5-1.5 cm. wide, ± scabrid on the margin. Spathe 1/3-1/2 as long as the umbel, shortly acuminate. Umbels (1)-

[55] [*A. Yatei* from the Hari Rud valley, Afgahanistan, is a form with a solitary umbel, not tiered as in typical *A. Regeli.* —*W. T. S.*]

2-3-(4), arranged one above the other, fasciculate, more rarely hemispherical, few-flowered, lax; pedicels 2-3 times as long as the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth rose-coloured, delicate, withering and somewhat twisted after flowering, 9-13 mm. long, narrowing linear-lanceolate, subacute, the outer ones almost twice as broad. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for 3/5, coalescent with each other half-way in the free part, the inner ones triangular, broader and considerably longer than the outer. Ovary sessile. Capsule broadly ovoid, 7-8 mm. in diameter. V-VI.

Sandy deserts and rubbly slopes in the lower mountain zone.—C. ASIA: 45 Mountain Turkm., 44 Kara Kum. Gen. distr.: Iran. Descr. from the neighbourhood of Ashkhabad.

NOTE. Trautvetter doubted whether *A. Regeli* had been collected near Akhal Teke or at Karabakh. There is now no doubt that this species does not exist in the Caucasian flora.

225. A. ILIENSE *Regel* in Bull. Soc. Nat. Mosc. XLI, 1 (1868) 452.—Ic.: Fl. Turk. (1876) t. 15, f. 9-10.

Bulb spherical, 1-2 cm. in diameter, with black-brown papyraceous envelopes. Scape 15-35 cm. high, fairly slender. Leaves linear-lanceolate, ± crisped on the margin, 7-20 mm. wide, almost equalling the scape. Spathe several times shorter than the umbel, shortly acuminate. Umbel 6-30-flowered, fasciculate or more rarely hemispherical, very lax; pedicels unequal, 2-10 cm. long, without bracteoles at the base. Segments of the narrowly campanulate perianth violet-rose with a dirty-green nerve, 10-15 mm. long, subacute, linear-lanceolate or lanceolate, the outer ones slightly or up to 1½ times broader than the inner, erect after flowering. Filaments 2/5-1/2 as long as the perianth-segments, connate, and adnate to the perianth, for 3/5-2/3, coalescent half-way in the free part, the inner ones triangular, broader and considerably longer than the outer. Ovary on a short stipe. Capsule almost spherical, 6 mm. in diameter. V.

On rubbly slopes in the lower mountain zone, on sands and on outcrops of particoloured rocks.—C. ASIA: 40 Aral-Casp. (S. E. part), 41 Balkhash, 45 Mountain Turkm., 48 Pam.-Al. (Alai range), 49 Tien Shan (Mogol Tau). Descr. from R. Ili. Type at Leningrad.

Section 8. CALOSCORDUM *(Herbert) Baker* in Journ. Bot. III (1874) 290.—*Caloscordum* Herbert in Bot. Reg. XXX (1844) Misc. 66.—Bulb solitary, devoid of a rhizome, spherical. Leaf-sheaths subterranean. Pedicels with bracteoles. Perianth-segments with one nerve. Filaments entire, adnate to the perianth half-way. [Sp. 226.]

226. A. NERINIFLORUM *(Herbert) Baker* in Journ. Bot. III (1874) 290.—*Caloscordum neriniflorum* Herbert in Bot. Reg. XXX (1844)

Misc. 67.—*A. Thunbergi* Regel in A. H. P. III (1875) 234, non G. Don.—Ic.: Bot. Reg. XXXIII (1847) t. 5. [sub *C. nerinefolium*].[56]

Bulb spherical, 1-2 cm. thick, with blackish papyraceous envelopes. Scape 10-25 cm. high, slender, often sinuous, with prominent nerves, sometimes 2 from one bulb. Leaves 2-6, narrowly linear, *c.* 1 mm. wide, canaliculate, smooth, shorter than the umbel. Spathe many times shorter than the umbel, acuminate. Umbel fasciculate or fasciculate-hemispherical, comparatively few-flowered, very lax; pedicels unequal, many times longer than the perianth (up to 10 cm. long), with bracteoles at the base. Segments of the campanulate perianth rose-violet with a strong darker nerve, 6-8 mm. long, linear-oblanceolate, acute, united for 1/3. Filaments half as long as the perianth-segments, adnate to the perianth half-way, subulate. Ovary sessile. VII-VIII.

On dry slopes.—E. SIBERIA: 33 Dauria (rarely). Gen. distr.: Mongolia, Japan-China. Descr. from Chusan.

Section 9. NECTAROSCORDUM *(Lindley) Grenier et Godron,* Fl. France III (1855) [57] 212.—*Nectaroscordum* Lindley in Bot. Reg. IX (1836) t. 1913.—Bulb solitary, devoid of a rhizome. Leaves, except the last one, embracing the stem for some distance, devoid of subterranean sheaths. Spathe caducous. Pedicels ± discoidally expanded beneath the flower. Perianth-segments with 3-7 nerves. [Spp. 227-228.]

227. A. TRIPEDALE *Trautvetter* in Tr. S P B. Bot. Sada (A. H. P.) II (1873) 485; Boiss. Fl. Or. V (1882) 284.

Bulb spherical, *c.* 1.5 cm. thick. Scape 50-90 cm. high, clothed for 1/4-1/3 with the sheath of the last leaf. Leaves slender, delicate, 1-1.5 cm. wide. Spathe caducous. Umbel fasciculate, fairly multiflorous, rather dense; pedicels unequal, 2-4 times as long as the perianth, slightly discoidally expanded beneath the flower. Segments of the campanulate perianth white, reddish on the back, 12-15 mm. long, caducous, acute, the inner ones ovate, abruptly narrowed towards the base into a claw, considerably broader than the oblong outer ones. Filaments scarcely more than 1/3 as long as the [perianth-] segments, subulate. Style not exserted from the perianth. VI.

In crevices of rocks.—CAUCASUS: 24 S. Transcauc. Endemic. Descr. from Isti Su in Daralagyoza [Daralageza]. Type at Leningrad.

228. A. DIOSCORIDIS *Sibthorp et Smith,* Prodr. Fl. Graec. I (1806) 222.—*Nectaroscordum siculum* var. *Dioscoridis* (Sibthorp et Smith) Boissier, Fl. Or. V (1882) 286.—*N. siculum* Schmalh. Fl. II (1897) 495 [non Ucria].

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[56] [This was described by Herbert in 1844 as *C. neriniflorum* but figured by Lindley in 1847 as *C. nerinefolium.* Both epithets are fairly apt. On account of this species having no alliaceous odour it is best excluded from the genus *Allium.* The perianth-segments are fused at base as in *Nothoscordum* but the spathe is one-valved. —*W. T. S.*]

[57] [Grenier et Godron, Flore de France, III, was published in two parts:—1, pp. 1-384, in 1855 (probably May or June); 2, pp. 385-779, in 1856 (Sept.). —*W. T. S.*]

Bulb almost spherical, 1.5-2.5 cm. thick, with blackish, almost coriaceous envelopes. Scape 70-125 cm. high, smooth, clothed for 1/3-1/2 with the sheath of the last leaf, which is almost devoid of a lamina. Leaves 3-4, linear, 1-1.5 cm. wide, carinate, glabrous, smooth, approximately half as long as the scape. Spathe caducous. Umbel fasciculate, ± few-flowered, rather lax; pedicels unequal, 2-4 times as long as the perianth, discoidally expanded beneath the flower, without bracteoles. Segments of the broadly campanulate perianth white with a greenish-reddish tinge and red nerves, 12-15 mm. long, acute, the inner broadly ovate, abruptly narrowed towards the base into a claw, considerably broader than the oblong outer ones. Filaments half as long as the perianth, subulate. Style not exserted from the perianth. V.

In shady woods.—EUROPEAN PART: 17 Crimea. Gen. distr.: Balkans-Asia Min. Descr. from Asia Minor.

KEY TO THE ALLIUMS OF EUROPE

Victor de Janka

(Translated by William T. Stearn)

[The following Key is translated from Janka, "Amaryllideae, Dioscoreae et Liliaceae Europaeae analytice elaboratae", pp. 50-56, published in the Hungarian Journal *Termeszetrajzi Fuezetek* 10: 41-77 (Budapest, 1886). It states concisely the leading diagnostic features of various species which on account of their west European distribution are not included in the Flora URSS and Boissier, Flora Orientalis. But it naturally does not deal with species published since 1886 such as *A. Bormuelleri* Hayek (illustrated in Hooker, Icones 5, *3.* t. 3279: 1935), *A. massaessylum* Batt. et Trabut (illustrated in Bull. Soc. Bot. France *39,* t. 3: 1892), *A. melananthum* Coincy (illustrated in Coincy, Ecl. Pl. Hisp. *3.* t. 11: 1897), *A. Parodi* Losc. (illustrated in Willkomm. Illust. Fl. Hisp. *7.* t. 54: 1881-85), *A. Rouyanum* Gautier (illust. in Rouy, Illust. Fl. Europ. *10.* t. 247: 1898) and *A. Schmitzii* Couthino (illust. in Bol. Soc. Broter. *13.* t. 3: 1896). These species are, however, rare in nature and unknown in cultivation. The author, Victor Janka van Bulcs (1837-1890), was for part of his career a cavalry officer and travelled in the Balkan Peninsula and Italy; later (from 1870-1889) he was curator of the botanical section of the Hungarian National Museum at Budapest.]

112 All filaments simple [i. e. undivided] or very rarely the inner three with a short tooth on both sides at base ________________ 113
—Inner three filaments three-cusped at the tip, the middle cusp anther-bearing ________________ 176
113 (112) Umbel typically capsule-bearing [i. e. without bulbils] 114
—Umbel bulbil-bearing ________________ 173
114 (113) Leaves distinctly stalked; blade very broad, oval-oblong 115
—Leaves not stalked; blade narrower ________________ 116
115 (114) Bulb tunics [envelopes] densely fibrous-netted; leaves sheathing the stem for much of its height, narrowed at base into a short stalk, pleated-ribbed; flowers greenish-yellowish.— 1. *Allium victorialis* L.
—Bulb (slender, cylindric) membranous-coated; leaves 2, basal very long stalked, flat; flowers white ____________2. *A. ursinum* L.
116 (114) Leaves (or stem) more or less hairy ________________ 117
—Not hairy ________________ 122
117 (116) Stem extremely short, scarcely emerging from the soil; (leaves flat) ________________3. *A. Chamaemoly* L.
—Stem taller ________________ 118
118 (117) Leaves half-terete, channelled; perianth scarcely 1½ lines (3.3 mm) long ________________4. *A. pilosum* Sibth. et Sm.
—Leaves flat; perianth larger ________________ 119
119 (118) Leaves circinate (i. e. coiled) ______5. *A. circinatum* Sieber
—Leaves not circinate ________________ 120

120 (119) Stamens shorter than the perianth; umbel outspread or slightly fastigiate -- 121
—Stamens overtopping the perianth; umbel hemispherical—
6. *A. vernale* Tenéo (*A. subvillosum* Salzm.)

121 (120) Perianth-segments oblong-lanceolate, bluntish, of uniform colour (i. e. entirely white); umbel outspread; leaves ciliate at the margin or even beneath; filaments ⅓ shorter than the perianth ------------------------------------7. *A. subhirsutum* L.
—Perianth-segments lanceolate, acute, (white) with a purple keel (mid-vein); umbel fastigiate; leaves ciliate-pilose on both sides; filaments ½ shorter than the perianth --------8. *A. trifoliatum* Cyr.

122 (116) Stigma deeply three-lobed ---------------------------- 123
—Stigma entire -- 125

123 (122) Bulb with fibrous tunics, mounted on a horizontal rhizome; stem firm; flowers purplish --------9. *A. narcissiflorum* Vill.
—Bulb simple (i. e. not mounted on rhizome), with membranous tunics; stem very slender; flowers milk-white ---------------- 124

124 (123) Perianth-segments oblong-linear; flowers always pendulous on one side of the umbel; bulbs crowded, oblong—
10. *A. triquetrum* L.
—Perianth-segments elliptic-lanceolate; flowers pendulous on all sides of the umbel; bulb solitary, globose --11. *A. pendulinum* Tenore

125 (122) Perianth-segments spreading or reflexed, never covering the capsule; leaves all basal ----------------------------- 126
—Perianth-segments nearly always erect or coming together at the tip, at length covering the capsule ----------------------- 130

126 (125) Flowers yellow ------------------12. *A. stramineum* Boiss.
—Flowers not yellow ------------------------------------- 127

127 (126) Perianth-segments oblong, blunt ----------13. *A. nigrum* L.
—Perianth-segments narrower ------------------------------ 128

128 (127) Perianth white or rose ----------------------------- 129
—Perianth black-purple; segments linear—
14. *A. atropurpureum* W. et K.

129 (128) Perianth-segments narrowly linear, acuminate, incurved and deflexed; bulb proliferous; leaves several --15. *A. Cyrilli* Tenore
—Perianth-segments lanceolate, stellately spreading; bulb not proliferous; leaves basal, only 1 or 2—
16. *A. decipiens* Fisch. (*A. tulipifolium* Ledeb.)

130 (125) Stem very hollow, part of it swollen-inflated ---------- 131
—Stem nowhere inflated ------------------------------------ 132

131 (130) Stem inflated at the middle; [segments unequal, 6-8 mm. long; filaments uniform, to 1.3 cm. long; style stout, to 1.2 cm. long] --17. *A. fistulosum* L.
—Stem inflated below the middle; [segments plus or minus equal, 4-5 mm. long; filaments alternately broadened at base, 5 mm. long; style slender, to 5 mm. long] ------------------18. *A. Cepa* L.

132 (130) Leaves broad, almost lanceolate-linear ---------------- 133
—Leaves narrow, exactly linear or thread-like ---------------- 140

133 (132) Stem sheathed or bearing leaves for much of its height (up to or above the middle) ---------------------------------- 134
—Stem scapose [leafless]; leaves all basal -------------------- 135
134 (133) Stamens long protruding; umbel densely globose; flowers yellowish; plant tall, more than a foot [i. e. 60-150 cm.] high; filaments all free, awl-like ---------------------19. *A. obliquum* L.
—Stamens included (3 times shorter than the perianth); umbel loosely fastigiate or hemispherical; flowers purple [or rose]; plant 3-4 inches [usually 5-20 cm.] high; filaments joined between themselves, the inner three ovate-triangular with a short anther-bearing cusp. -----------------------------20. *A. oreophilum* C. A. M.
135 (133) Stamens long protruding; spathe 2-valved; pedicels drawn together, elongated, thickened at base.—
21. *A. caspium* (Pall.) M. Bieb.
—Stamens included -- 136
136 (135) Perianth-segments lanceolate, stretched out, grooved; pedicels drawn together. ----------22. *A. phthioticum* Boiss. et Held.
—Perianth-segments broader, smooth, glistening; pedicels spreading --- 137
137 (136) Flowers yellow. -------------------------23. *A. Moly* L.
—Flowers whitish or purplish ------------------------------ 138
138 (137) Stem 3-angled at the tip; spathe entire, 1-valved.—
24. *A. neapolitanum Cyr.*
—Stem not 3-angled at the tip; spathe 3-4-lobed -------------- 139
139 (138) Inner perianth-segments narrower ------25. *A. roseum* L.
—Perianth-segments equal --------------26. *A. permixtum* Cluss.
140 (132) Spathes ecaudate [i. e. without tail-like appendage at the tip], much shorter than the umbel ---------------------------- 141
—Spathes caudate or caudate-cuspidate [i. e. drawn out into a short or long tail-like appendage at the tip], one or both equalling or longer than the umbel --------------------------------- 152
141 (140) Rhizome or bulbs not clothed with thread-like fibres --- 142
—Rhizome clothed with thread-like fibres; (leaves linear, flat)-- 148
142 (141) Leaves terete (i. e. round in section), awl-like or thread-like -- 143
—Leaves linear, flattened ---------------------------------- 146
143 (142) Perianth 5 lines [1.1 cm.] long, longer than the pedicel—
27. *A. Schoenoprasum* L. (*A. sibiricum* L.)
—Perianth not exceeding 2 lines [4.4 mm.], much shorter than the pedicels -- 144
144 (143) Stamens 1½ times as long as the perianth—
28. *A. sabulosum* Stev.
—Stamens not exceeding the perianth ----------------------- 145
145 (144) Perianth-segments extremely blunt or almost truncate; stamens a little shorter than the perianth—
29. *A. maritimum* Raf. (*A. erythraeum* Griesb.)
—Perianth-segments lanceolate, acuminate; stamens 2-3 times shorter than the perianth ------------------30. *A. rubellum* M. B.

146 (142) Flowers yellowish—
31. *A. flavescens* Bess. (*A. ammophilum* Heuff)
—Flowers rose or purplish ---------------------------------- 147
147 (146) Stamens equalling the perianth; leaves distinctly keeled beneath; tall -------------------------32. *A. acutangulum* Schrad.
—Stamens overtopping the perianth; leaves convex below, not keeled; usually dwarf, about a span [about 22 cm.] high—
33. *A. montanum* Schmidt
148 (141) Stamens included ------------------------------------ 149
—Stamens protruding --- 151
149 (148) Pedicels equalling or shorter than the perianth -------- 150
—Pedicels longer than the perianth -------------34. *A. odorum* L.
150 (149) Perianth bell-shaped; segments blunt or bluntish—
35. *A. tataricum* L. f.
—Perianth cylindric; segments acuminate --36. *A. diaphanum* Janka
151 (149) Stamens twice as long as the perianth; tooth-like appendages acuminate, slightly longer than the ovary; pedicels overtopping the spathe. ------------------------------37. *A. lineare* L.
—Stamens not so much overtopping the perianth; tooth-like appendages blunt, shorter than the ovary; pedicels not longer than the spathe; (leaves a little broader; flowers more numerous and deeper coloured) ------------------------38. *A. strictum* Schrad.
152 (140) Stamens distinctly protruding ---------------------- 153
—Stamens included --- 161
153 (152) Bulbs clothed with the withered, closely overlapping, at the tip, truncate and split, leaf-sheaths; leaves flat or flattish 154
—Bulbs with simple [i. e. undivided] tunics; leaves rather terete or thread-like --- 156
154 (153) Flowers purplish; sheaths obliquely truncate at the tip; stamens 1½ times as long as the perianth.—
39. *A. suaveolens* Jacq. (*A. kermesinum* Rchb.)
—Flowers yellowish; sheaths transversely truncate at the tip; stamens twice as long as the perianth ----------------------- 155
155 (154) Leaves narrowly linear, equalling or longer than the stem ----40. *A. ericetorum* Thore (*A. xanthicum* Griesb. et Schlenk.)
—Leaves broadly linear, scarcely more than ½ as long as the stem ---------------------------------41. *A. ochroleucum* W. et K.
156 (153) Umbel densely capitate-globose; spathe-valves shortly caudate (i. e. tailed) -------------------------------------- 157
—Umbel effuse (loose with the pedicels spreading in all directions); spathe-valves elongate-caudate [i. e. long-tailed] -------- 159
157 (153) Perianth-segments acute or acuminate; (Stamens 1½ times as long as the perianth --------------42. *A. globosum* M. Bieb.
—Perianth-segments blunt ----------------------------------- 158
158 (157) Stamens 1½ times as long as the perianth; style much protruding --------------------------------43. *A. Weissii* Boiss.
—Stamens only a little overtopping the perianth; style little protruding ----------------------------44. *A. staticiforme* Sibth. et Sm.

159 (153) Flowers yellow; capsules ovate ----------45. *A. flavum* L.
—Flowers purplish; capsules almost circular ---------------- 160
160 (159) Perianth uniformly purple ------46. *A. pulchellum* G. Don
—Perianth varigated with reddish-violet and yellow and hoary—
47. *A. stamineum* Boiss.
161 (152) Perianth bell-shaped ------------------------------ 162
—Perianth cylindric -- 168
162 (161) Pedicels of equal length, scarcely as long as the perianth; (style protruding) ------------------48. *A. serbicum* Vis. et Panc.
—Pedicels much longer than the perianth -------------------- 163
163 (162) Perianth-segments rounded, apiculate --------------- 164
—Perianth-segments acute ----------------------------------- 167
164 (163) Filaments narrowly awl-like--49. *A. achaium* Boiss. et Orph.
—Filaments attenuate-lanceolate ---------------------------- 165
165 (164) Perianth brown ---------------------50. *A. fuscum* W. et K.
—Perianth white -- 166
166 (165) Perianth-segments not margined --------51. *A. pallens* L.
—Perianth-segments red-margined --------52. *A. marginatum* Janka
167 (163) Style protruding -----------53. *A. frigidum Boiss.* et Held.
—Style included ------------------54. *A. exile* Boiss. et Orph.
168 (161) Spathe 1-valved ---------------------------------- 169
—Spathe 2-valved --- 170
169 (168) Umbel slightly fastigiate; perianth-segments truncate—
55. *A. callimischon* Link
—Pedicels very unequal; perianth-segments acutish.—
56. *A. Cupani* Raf.
170 (168) Spathe-valves spreading from the base -------------- 171
—Spathe-valves forming a cylindric sheath at base; (pedicels very unequal) 57. *A. parciflorum* Viv.
171 (170) Pedicels very unequal ------------58. *A. inaequale* Janka
—Pedicels almost equal in length --------------------------- 172
172 (171) Some of the pedicels nodding; stamens almost equalling the perianth; bulb-tunics membranous ------59. *A. tenuiflorum* Auct.
—All pedicels erect; stamens ⅓ shorter than the perianth; bulb-tunics at length fibrous-netted—
60. *A. moschatum* L. (*A. flexuosum* W. et K.)
173 (113) Perianth cylindric—
61. *A. melanantherum Panc.* (*A. moesiacum* Panc. olim)
—Perianth bell-shaped -------------------------------------- 174
174 (173) Filaments all untoothed --------------------------- 175
—Alternate filaments with a tooth on both sides—
62. *A. cornutum* Clem.
175 (174) Stamens included or scarcely protruding--63. *A. oleraceum* L.
—Stamens markedly protruding -------------64. *A. carinatum* L.
176 (112) Umbel typically capsule-bearing (i. e. without bulbils) 177
—Umbel bulbil-bearing -------------------------------------- 193
177 (176) Stem bearing leaves up to the tip, the uppermost leaf clasping the base of the umbel ----------65. *A. chamaespathum* Boiss.
—Uppermost leaf very remote from the umbel ----------------- 178

178 (177) Stamens ½ shorter than the perianth—
66. *A. gomphrenoides* Boiss. et Held.
—Stamens equalling or overtopping the perianth ______________ 179
179 (178) Perianth-segments elongate, lanceolate ______________ 180
—Perianth-segments elliptic, ovate or oblong __________________ 181
180 (179) Leaves terete, hollow ____________67. *A. Heldreichii* Boiss.
—Leaves linear, flat ______________________68. *A. acutiflorum* Loisel.
181 (179) Umbel fastigiate; (perianth smooth, white with greenish keels) ______________________________________69. *A. sardoum* Moris
—Umbel not fastigiate ______________________________________ 182
182 (181) Leaves very thinly hair-like or thread-like ____________ 183
—Leaves firmer, broader _____________________________________ 184
183 (182) Pedicels shorter or scarcely longer than the perianth; perianth-segments with an acuteolate-scabrid [thornily rough] keel; stem low, 2-6 inches [5-16 cm.]; umbel the size of a hazel-nut; bulb-tunics membraneous __70. *A. rubrovittatum* Boiss. et. Held.
—Pedicels 2-3 times as long as the smooth perianth; bulb-tunics ultimately breaking up at base and tip into fibres; flowers very small ______________________________71. *A. margariaceum* Sibth. et Sm.
184 (182) Leaves broadly linear, about ½ inch [1-3 cm.] broad, keeled otherwise flat; anthers scarcely protruding; perianth-segments scabrid [rough] on back __________________________ 185
—Leaves narrower ____ 187
185 (184) Bulb simple [i. e. solitary] oblong-ovoid, continued upward into the stem; anthers reddish; (style short, included)—
72. *A. Porrum* L.
—Bulb almost rounded, made up of two bulbs comprised within a many-layered common tunic, between which is placed the stem__ 186
186 (185) Perianth purplish; style elongated, equalling or longer than the stamens _________________________73. *A. Ampeloprasum* L.
—Perianth yellowish; style extremely short—
74. *A. pyrenaicum* Costa et Vary.
187 (184) Anthers included or scarcely protruding; leaves keeled, otherwise flat ____ 188
—Anthers much protruding ____________________________________ 191
188 (187) Perianth smooth; bulb-tunics fibrous _________________ 189
—Perianth scabrid on the back; bulb-tunic membraneous ______ 190
189 (188) Flowers white, reddish on the back ____75. *A. baeticum* Boiss.
—Flowers black-purple ________________76. *A. atroviolaceum* Boiss.
190 (188) Leaves flat, keeled; pedicels very unequal, some longer than the perianth; inner perianth-segments entire—
77. *A. rotundum* L.
—Leaves half-terete, hollow; pedicels little unequal, shorter than the perianth; inner perianth-segments laciniate-cristate [i. e. the margin cut or torn into small teeth or crests]—
78. *A. cristatum* Boiss.
191 (187) Leaves half-terete, hollow; spathe persistent, 2-valved; the three simple [i. e. undivided] stamens about as long as the

perianth; capsule (ovate-triangular) shorter than the perianth, the valves cuspidate, at the tip shallowly emarginate [indented]— 79. *A. sphaerocephalon* L.

—Leaves linear, not hollow; spathe deciduous 1-valved; all stamens overtopping the perianth; capsule equalling or overtopping the perianth, the valves at the tip deeply emarginate [indented] 192

192 (191) Leaves keeled, otherwise flat; umbel exactly globose; perianth-segments shortly recurved mucronate at the tip; capsule ovate, almost rounded ------------------80. *A. commutatum* Guss.

—Leaves keeled, triangular; umbel oval; perianth-segments coming together at tip; capsule almost globose-triangular— 81. *A. descendens* L.

193 (176) Leaves flat, linear-lanceolate; stamens shorter than the pedicels -- 194

—Leaves terete, hollow; stamens overtopping the perianth— 82. *A. vineale* L. (*A. affine* Boiss. et Held.)

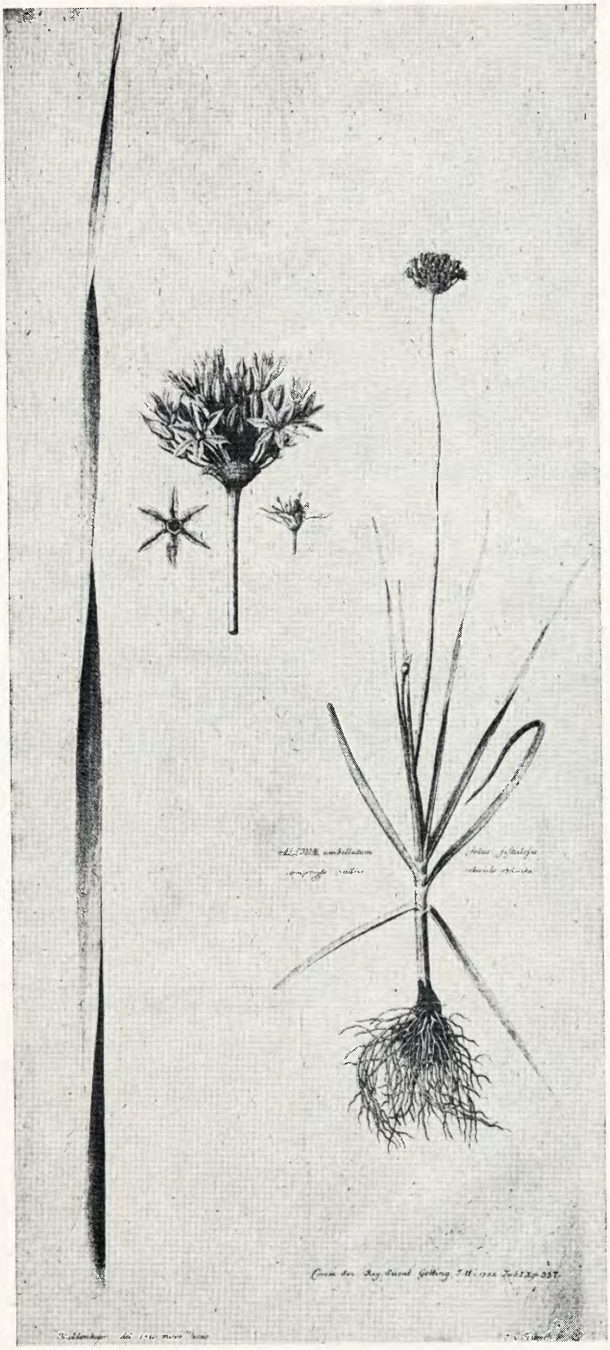
194 (193) Stem bent into a ring below the umbel— 83. *A. controversum* Schrad.

—Stem straight throughout ---------------------------------- 195

195 (194) Spathe much overtopping the umbel, contracted into a beak-like tip --84. *A. sativum* L.

—Spathe shorter than the umbel ----------85. *A. Scorodoprasum* L.

Synonymy and Distribution. For the synonymy and distribution of these European species, see K. Richter, Plantae Europeae I: 198-210 (1890) and the floras of particular areas, e. g., by Rouy (1910) for France, Wilkomm et Lange (1862) for Spain, Couthino (1939) for Portugal, Briqurt (1910) for Corsica, Parlatore (1852) for Italy, Schinz and Keller (1923) for Switzerland, Hegi (1909) for Central Europe in general, Hayek (1931) for the Balkan Peninsula in general, and Halacsy (1940) for Greece in particular.



Allium ramosum, as figured by Haller, from British Museum (Natural History), London.
Plate 263

NOMENCLATURE AND SYNONYMY OF ALLIUM ODORUM AND A. TUBEROSUM

William T. Stearn

Under the name *Allium odorum* L. two distinct species were confused by Eduard von Regel (1815-1892) in his "Alliorum adhuc cognitorum Monographia" *(Acta Horti Petrop.* 3. II) 176 (1875), the last comprehensive survey of the genus Allium, and they are commonly confused under this name in gardens and herbaria today.[1] Investigation of their synonymy shows that one should be called *Allium ramosum* Linn. (1753), with *A. odorum* Linn. (1767) and *A. tataricum* Linn. fil. (1781) as synonyms, the other *A. tuberosum* Rottler ex Sprengel (1825), with *A. uliginosum* G. Don (1827) and *A. tuberosum* Roxburgh (1832) as synonyms. The synonymy, description and distribution given by Regel for *A. odorum* cover both. Sir Joseph Hooker *(F. l. Brit. India* 6.343 :1892) and Y. Prokhanov (in *Bull. Appl. Bot. Leningrad* 24.II.176: 1931) distinguish between them but call them by different names. Hence some explanation seems necessary.

These two species are glabrous plants with many features in common:—clustered narrow conical or almost cylindric bulbs scarcely 1 cm. thick at base, mounted on a rhizome and covered with a light brown reticulately fibrous tunic; numerous linear leaves (about 4 to 9 to a bulb) up to 35 cm. long, their bases sheathing the stem up to 3-10 cm. above the bulb; terete or slightly angled stems about 24-50 cm. high; spathe at first one-valved, usually splitting in two and ultimately only a fragment persisting at the base of the umbel, shorter than the pedicels; umbel hemispherical or fastigiate, many (10-70)-flowered, about 3-5 cm. across, the pedicels ascending, 1-3 cm. long, with fairly large hyaline bracteoles at base; flowers pleasantly scented; filaments slender, shorter than the tepals (perianth-segments) and joined at base into a shallow ring; seeds somewhat flattened and D-shaped, about 3-4 mm. long, 2-2.5 mm. broad. In a living state they can, however, be easily distinguished.

Under cultivation *Allium ramosum* flowers from June into July, *A. tuberosum* (kiu ts'ai; Chinese chives) from August into October. During the last seven years I have had them growing side by side at Cambridge and Kew, and I have never seen them in flower at the same time. The flowers of *A. ramosum* are fairly large, rather campanulate, with ascending lanceolate-oblong tepals 6-10 mm. long, marked down the back with a reddish mid-line; the stamens are about half the length of the tepals; the valves of the capsule are broadest about or below the middle and are clasped by the withered tepals. The flowers of *A. tuberosum* are smaller and stellate, with more outspread narrowly ovate

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[1] See *T. H. Everett in Gard. Chron.* 3rd. ser. 101. 185. (March 1937). The species from Mrs. L. B. Wilder's garden described here as "of special value because of its late season of bloom" and illustrated in fig. 71 as *"A odorum"* is *A. tuberosum.* The other two plants (from Oslo and Enfield) belong to *A. ramosum.*

tepals 4-7 mm. long, white with a faint green or brownish mid-line on the back; the stamens are about 4/5ths the length of the tepals; the valves of the capsule are broadest above the middle (hence obcordate), with the tepals usually reflexed or withered away from them. The leaves of *A. ramosum* are usually a little fistulose with the underside convex, those of *A. tuberosum* solid and keeled beneath, but there is no

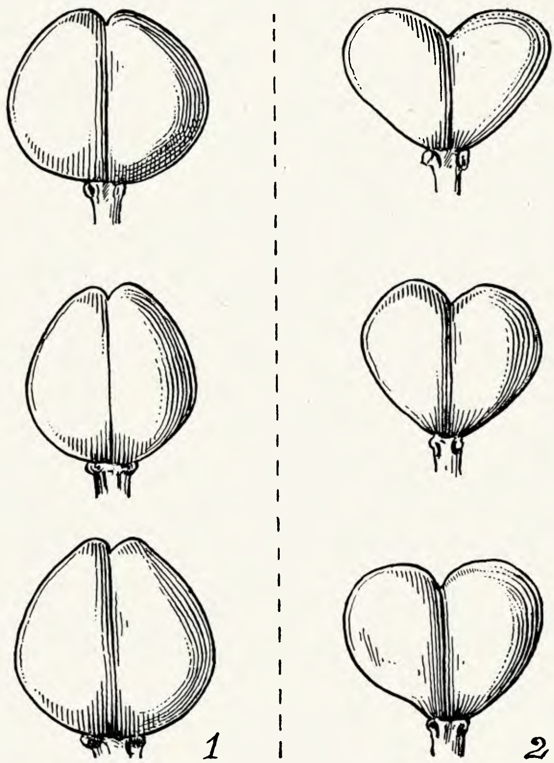

Figure 122. Capsule valves of (1) Allium ramosum Linn., and (2) A. tuberosum Rottler, with the withered perianth-segments removed. X4.5

significant difference in breadth, which varies in both from 1.5 to 8 mm. [For difference in capsule valves of these two species see Figure 122.] In behavior, general appearance and technical characters, the two diverge sufficiently to be rated as distinct species and they also differ in distribution, *A. ramosum* being a native of central Asia, *A. tuberosum* of south-eastern Asia. *A. tuberosum* is cultivated as a potherb and salad crop in China, Japan, the Philippines, the Dutch East Indies and India; its leaves, stems and flowers are eaten, and from a culinary viewpoint it would seem to be the Asiatic counterpart of the European chives *(A.*

Schoenoprasum Linn.) Those authors, such as Ascherson and Graebner (1905), who regard *A. tuberosum* as a broad-leaved, large-flowered form of *A. odorum* are mistaken. The flowers of both species are pleasantly hawthorn-scented with a faint trace of bitter almond but give out a strong onion smell when bruised.

Allium ramosum was the first to become known to European writers, this name being given by Linnaeus in 1753 *(Sp. Pl.* 1.296) to the *Allium scapo nudo tereti fareto, foliis semicylindricis, staminibus corolla longioribus* of Johann Georg Gmelin *(Fl. Sibir.* 1. 52 pl. 11 fig. 1:1747). Gmelin's figure is a fairly good representation of the plant distinguished above as *A. ramosum*—there is a better figure in *Bot. Mag.* 28. pl. 1142 (1808) as *A. tataricum*—and shows that, in his diagnosis "staminibus corolla longioribus," the word "longioribus" is a penslip for "brevioribus." Linnaeus' account (1753) of his *Allium ramosum* is not, however, entirely based on Gmelin's (1747), since he cites Siberian material received from the Russian Prince Gregorei Demidoff. The Linnean herbarium contains a specimen labelled on the face *"A. ramosum"* and annotated on the back as "Gmelin, Fl. I. p. 52 n. 16" with a cryptic sign indicating that it had been collected by Traugott Gerber of Moscow; Demidoff included plants collected by Gerber in Astrachan and elsewhere among those he sent to Linnaeus.[2] This specimen lacks a bulb but is conspecific with Gmelin's plant and that in cultivation to-day. Indeed Gerber is to be credited with its introduction. In 1753 the celebrated Swiss botanist Albrecht von Haller, then a professor at Göttingen, described and figured an *"Allium umbellatum, foliis fistulosis, compressis radice reticulo obducta* quod cum nomine *campestris juncifolii floribus albis umbellatis* Gerberi ad nos pervenit" *(Comment. Soc. Reg. Sci. Gottingensis* 2.337. pl. 9) This is undoubtedly our plant. (Plate 263) A note on Haller's plate states that it was drawn in June 1750 ("Kaltenhofer del. 1750 mense Junio"). Clearly Gerber sent both seed and specimens to his friends in Europe, and *A. ramosum* raised from them was grown in European gardens by 1750. In 1767 *(Mantissa prima,* 62) Linnaeus described as *Allium odorum* a plant grown in the Uppsala Botanic garden. From his description this is clearly the same as Haller's *Allium umbellatum, foliis fistulosis etc.* and Gmelin's *Allium scapo nudo etc.*—his own *Allium ramosum.* That Linnaeus in 1767 failed to recognise in the living *A. odorum* the plant he had earlier named *A. ramosum* from dried material and from Gmelin's account is no argument for our doing likewise. Linnaeus' memory became very bad during his later years and a dried specimen often looks so different from a living plant of the same species as to be almost unrecognizable. Under the international rules of botanical nomenclature the name *A. ramosum* Linn. (1753) takes precedence over *A. odorum* Linn. (1767) and hence is here restored.

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[2] See B. D. Jackson, *Index to the Linnean Herbarium,* 12, 18, 20 (1912) published as a supplement to *Proc. Linn. Soc.* 124th Session, 1911-12.

Regel's monumental work states that *A. odorum* "habitat in Siberia Uralensi, altaica, baicalensi dahurica et orientali, in regione amurensi et ussuriensi, in Mongolia, in omni Japonia, in China boreali et australi et in alpibus Indiae orientalis. In hortis culinariis Asiae mediae et australis saepe colitur . . . Das *A. odorum* L. ist vom Ural an durch ganz Mittelasien verbreitet und wird in den Küchengärten der Chinesen, sowie in Ostindien zum Küchengebrauch kultivirt . . . Diese kultivirte Form ist es vorzugsweise, welche das *A. tuberosum* Roxb. darstellt." As already noted these remarks cover two distinct species. The cultivated "*A. odorum*" is that distinguished above as *A. tuberosum* Rottler. The evidence relating to its identity and nomenclature must now be considered.

By Maximowicz (1859) and Prokhanov (1931) this species is called *Allium chinense* G. Don; by Merrill (1935) *A. uliginosum* G. Don; by other authors, e. g. Sir Joseph Hooker (1892), *A. tuberosum* Roxb. if distinguished from *A. odorum* Linn. sensu stricto. That it is *A. tuberosum* of Roxburgh there can be no doubt. Roxburgh's description (first published in 1832 but available in manuscript to his contemporaries for at least thirty years previously) clearly indicates its main features. Any uncertainty as to the application of the name *A. tuberosum* Roxb. is removed by an authentic specimen in Sir James E. Smith's herbarium (now the property of the Linnean Society of London) and by authentic drawings. William Roxburgh (1751-1815),[3] a Scots doctor in the employ of the Hon. East India Company, reached India in 1776 and set about preparing a *Flora Indica.* He was a good observer and to supplement his descriptions Indian artists made upwards of 2,000 coloured drawings from the living plants. Three hundred of them were published between 1795 and 1819 as *Plants of the Coast of Coromandel.* The rest have never been published. Coloured copies are available at the Royal Botanic Garden, Calcutta, at the India House, London and the British Museum (Natural History), London, those at the last institution having once belonged to Roxburgh's friend, John Fleming (1747-1829); sketches made from them by Sir William Jackson Hooker in preparation for his son Joseph's Indian journey are at the Royal Botanic Gardens, Kew. The drawing of *A. tuberosum* Roxb. in these collections depicts our plant excellently. (Plate 264) Roxburgh died in 1815; that part of his manuscript *Flora Indica* containing the description of his *A. tuberosum* did not appear in print until 1832. His friend the Rev. William Carey (1761-1834) published in 1814 his *Hortus Bengalensis,* but the name *A. tuberosum* Roxb. printed here is simply a nomen nudum: "*Allium tuberosum* R. In Gardens in Bengal. 4."

Not being validly published until 1832, the name *A. tuberosum* Roxb. is apparently invalidated by the earlier published homonym *A. tuberosum* Rottler ex Sprengel *(Systema 2.* 38: 1825). Hence Merrill has adopted for *A. tuberosum* Roxb. the name *A. uliginosum* G. Don, taking this as published in 1832. If that were so, *A. uliginosum* G. Don

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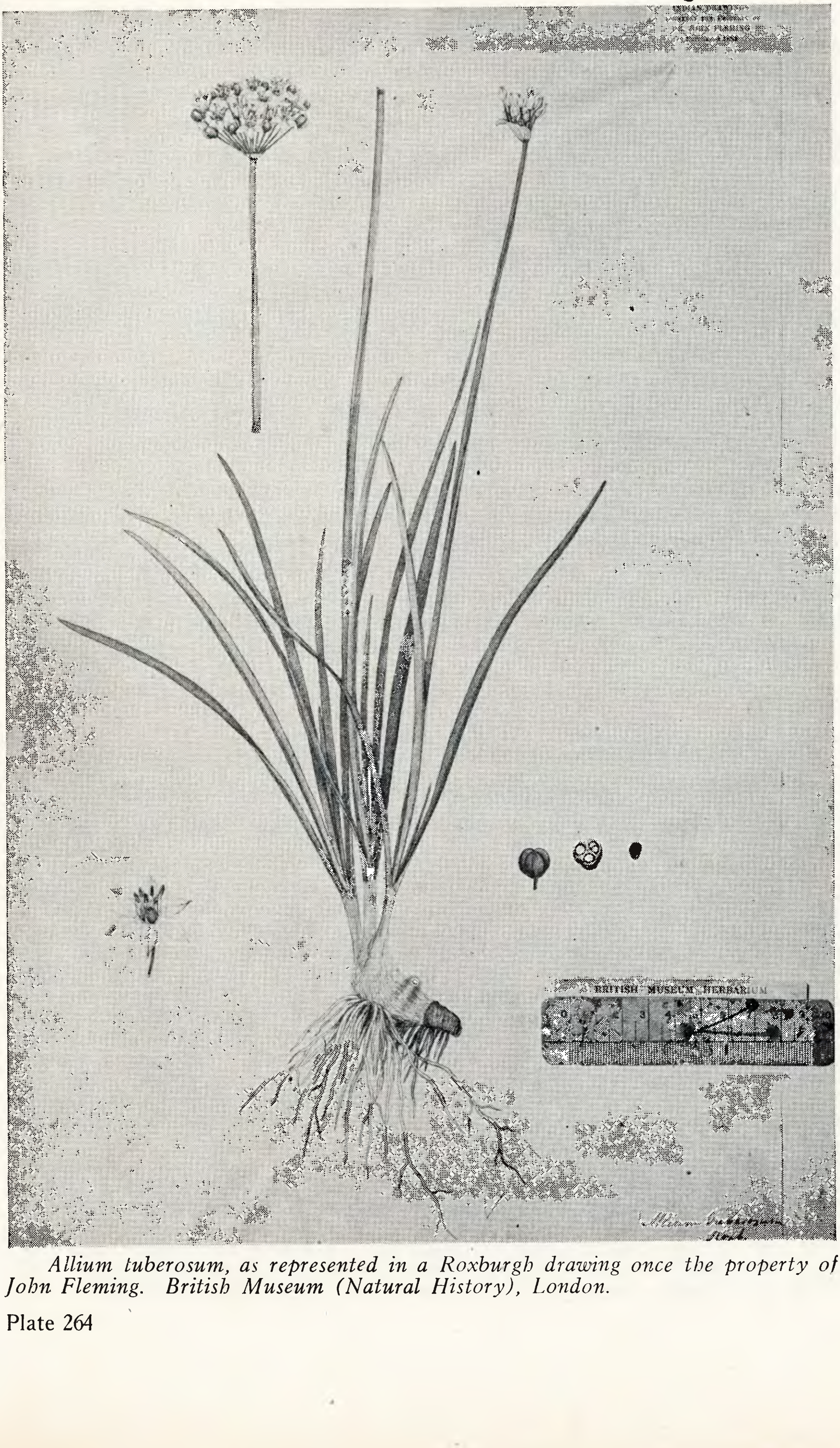
[3] cf. G. King in *Annals Roy. Bot. Gard. Calcutta 5* 1-9 (1895).



Allium tuberosum, as represented in a Roxburgh drawing once the property of John Fleming. British Museum (Natural History), London.

Plate 264

would likewise be invalid, since Ledebour in 1829 described another species as *A. uliginosum* Ledebour (—*A. Ledebourianum* Schultes). George Don's "Monograph of the Genus Allium" *(Mem. Wernerian Nat. Hist. Soc.* 6. 1-102) was, however, published early in 1827,[4] although the title page of volume *6* of the Wernerian Natural History Society's Memoirs for 1826-1831 is dated '1832.' Don proposed three names—*A. uliginosum, A. chinense* and *A. Thunbergii*—which apparently relate to our species. But the earlier hitherto obscure *A. tuberosum* Rottler ex Sprengel must be considered first.

Sprengel's diagnosis is brief:—"*tuberosum* Rottl. 62. A. caule tereti basi foliato, foliis linearibus flaccidis caulem aequantibus, umbella fastigiata erecta spatham superante, petalis oblongis obtusiusculis stamina aequantibus. *Malabar.*"

Johann Peter Rottler (1749-1836),[5] to whom Sprengel credited the species-name *Allium tuberosum,* was attached to the Danish mission at Tranquebar in Eastern Madras. Malabar is in Western Madras, but in former times "Malabaria" indicated southern India in general. No Allium is native to this area. Hence Rottler's obscure *A. tuberosum* must have been a cultivated plant. Rottler had a garden at Tranquebar, and the specimen he sent Sprengel at Halle probably came from this. Wallich knew Rottler well (as did also Roxburgh)[6] and he obtained specimens from Rottler's Tranquebar garden. Hence it is highly significant that the specimens (Wallich 5068) from Tranquebar labelled "*A. tuberosum*" in the Hon. East India Co. Herbarium at Kew belong

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[4] For evidence, see Stearn in *Journal of Bot. 74*.322 (1936).

[5] cf. Christensen, *Den Danske Botaniks Historie 1*.119, 2.98 (1924).

[6] Wight and Arnott's account of the relations between the pioneer botanists of India is illuminating:—

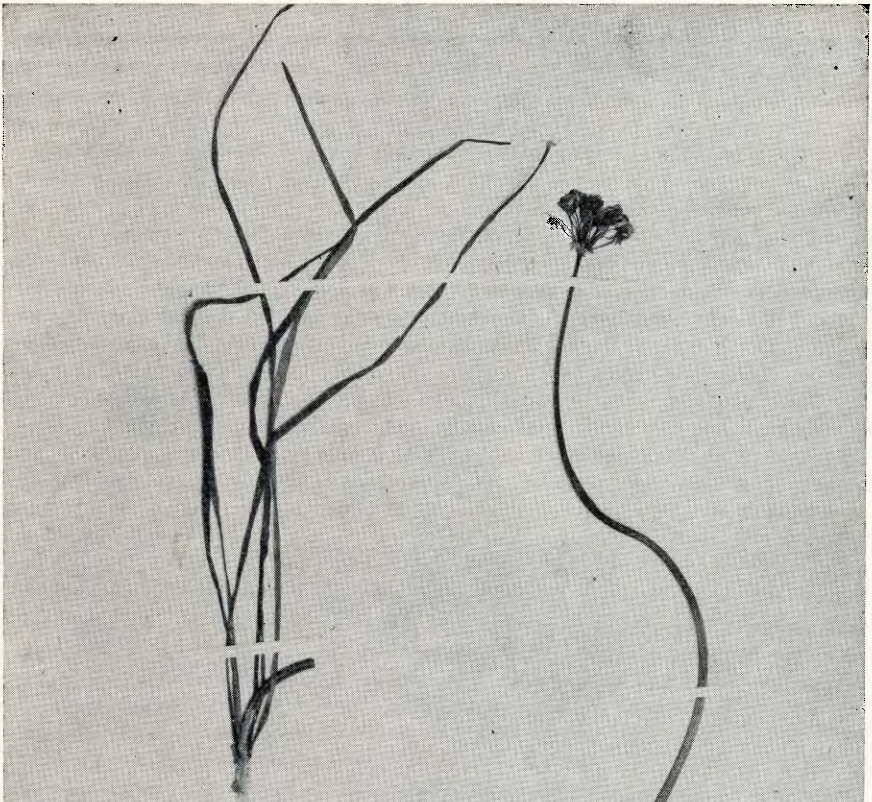
"In the year 1768, John Gerard Koenig, a native of Denmark, a pupil of Linnaeus and an enthusiastic cultivator of natural science, landed in India, as physician to the Tranquebar missions. His example and instructions diffused a similar taste among his companions, and hence originated the botanical labours of the society of "United Brothers"—until Koenig made his appearance no one in India had studied the vegetation according to the Linnean rules. His example was soon followed by many eminent individuals: among whom may be mentioned Jones, Fleming, Hunter, Anderson, Berry, John, Roxburgh, Heyne, Klein, Buchanan, Hamilton, and the venerable Rottler, the only survivor of the illustrious group. Most of these formed themselves into a society for the purpose of promoting Botany: plants were industriously collected throughout all the Peninsula as well as in Ceylon, and were not infrequently examined and named by the society in common —By degrees, however, their opportunities of meeting grew less frequent, and their confidence in themselves greater, so that Roxburgh, Klein and Rottler commenced attaching names without consulting their friends: an interchange of specimens, however, still continued, so that it was rarely difficult for the one to know what was intended by the other. The value of such specimens was quickly felt, nor were they slow in transmitting them to Europe. Many of these plants were published in different works, sometimes under the name given by the donors". (R. Wight & G. Walker-Arnott, *Prodr. Fl. Penin. Ind. Orient. 1*.VII, XI:1834).

to *A. tuberosum* Roxb. The Kew herbarium also possesses Rottler's manuscript list of specimens in his private herbarium. There is no "*Allium tuberosum* Rottl." in this list: there is however "*Allium tuberosum* Roxb."! This evidence suggests that Rottler sent a specimen of *Allium tuberosum* Roxb. to Kurt Sprengel (1766-1833) and that Sprengel took the name *A. tuberosum* to be of Rottler's coining and erroneously attributed it to him. But he describes the stem as terete and the stamens as equalling the tepals, whereas in *A. tuberosum* Roxb. the stem is somewhat angled and the stamens are slightly shorter than the tepals. On account of this discrepancy between the original diagnoses of *Allium tuberosum* Rottler (1825) and *A. tuberosum* Roxb. (1832), Kunth in 1843 renamed the latter *A. Roxburghii* Kunth, presuming them to represent different species.

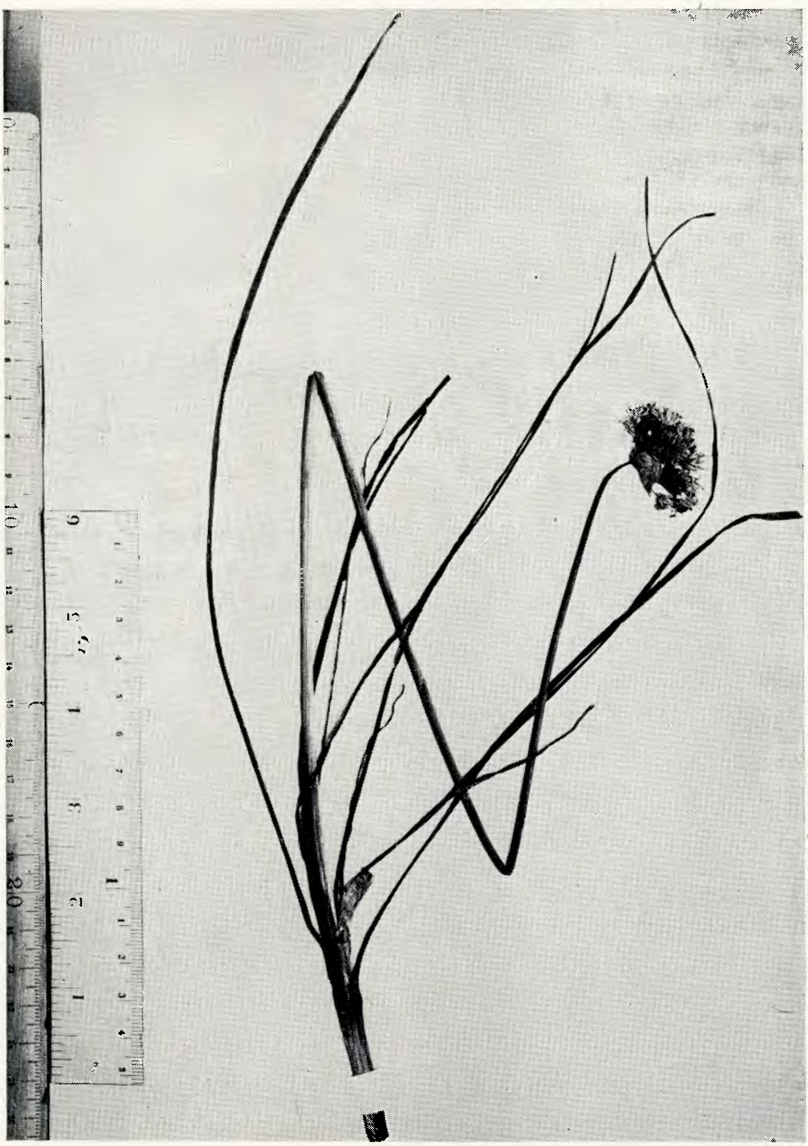
In 1891 part of Sprengel's herbarium came into the possession of the Botanisches Museum, Berlin-Dahlem. It contains the type-specimen of *Allium tuberosum* Rottler and by the courtesy of Prof. Ludwig Diels I have been able to examine this. (Plate 265) The narrow bulb is covered with the remains of a yellowish fibrous netted covering; the six leaves are united into a common sheath for about 6 cm. from the base of the bulb and are up to 25 cm. long, 2-3 mm. broad; the broken stem is about 32 cm. high, with no angling evident in its dry state; the withered spathe is shorter than the pedicels; the umbel is 2.5 cm. across, with about 25 flowers, the pedicels ascending and 1-1.5 cm. long; the tepals are 4-5 mm. long, 2 mm. broad, more or less acute, with the stamen-filaments slender and about 4 mm. long, the dehisced anthers about 1 mm. long; the largest ovary, pressed flat, is about 2 mm. high, 3 mm. broad in its upper part, with the tepals reflexed; the style is up to 3 mm. long. It is *Allium tuberosum* Roxb.! Hence the name *A. tuberosum* is to be retained for the plant with which it has so long been associated, but owing to its premature publication by Sprengel it must be attributed to Rottler ex Sprengel and not to Roxburgh, its original author.

Some other names applied to our plant can now be considered—*A. uliginosum* G. Don, *A. chinense* G. Don and *A. Thunbergii* G. Don. These are all "book species," i. e. not described from specimens actually before the author of their names, George Don the younger (1798-1856), but merely based on descriptions published earlier under erroneous names by Carl Peter Thunberg (1743-1828) and João de Loureiro (1710-1791).

Allium uliginosum G. Don, *Mon.* 60 (1827) is primarily based on "*Allium angulosum,* Lour. Cochin, p. 203," non Linn., with "*A. senescens* Thunb. Jap. p. 132" as a second synonym. Loureiro's note that it loved moist places ("amat loca humida") obviously suggested Don's specific name. The characters attributed to it by Loureiro—the two-edged scape, the white flowers in flattish umbels, etc.—the use of its leaves for culinary purposes—the citation of Gmelin's *cepa scapo nudo, subangulo farcto, foliis linearibus, subtus angulosis, staminibus corolla brevioribus (Fl. Sibir. 1* 58 pl. 14 f. 2) which, though actually representing the true *A. angulosum* Linn., might easily be taken by an inexperi-



Allium tuberosum. Type specimen from Rottler in Sprengel's Herbarium, Botanisches Museum, Berlin.
Plate 265



Allium tuberosum. Specimen under the name. A. odorum in Thunberg's Herbarium Botaniska Museet, Uppsala.

Plate 266

Allium Thunbergii. Type specimen under the name A. orodum in Thunberg's Herbarium, Botaniska Museet, Uppsala.

Plate 267

enced or hasty observer for a crude representation of *A. tuberosum* Rottler—the Chinese name "Kieu tsai"[7] still applied in China to *A. tuberosum* Rottler, as specimens bought in a Pekin market in August 1934 as "Kutai" clearly show—all these together leave no doubt that Loureiro's "*A. angulosum*," and consequently G. Don's *A. uliginosum*, is the same as *A. tuberosum* Rottler.

Allium chinense G. Don, *Mon.* 83 (1827) is based entirely on "*A. triquetrum*, Lour. Cochin p. 202," non Linn. Prokhanov (1931) adopts it as the correct name for *A. tuberosum*, but Loureiro's description of the flowers as "dilute violacea" excludes that species, together with the true *A. triquetrum* Linn. of Europe and North Africa. Don placed it among his "Species non satis notae" and among them it must remain.

A. Thunbergii G. Don, *Mon.* 84 (1827) is based on "*Allium odorum*, Lour. Cochin p. 203. Thunb. Fl. Jap. p. 132" and described as having "Bulbus ovatus, simplex, albus scapus spithamaeus, foliis paulo brevior. Flores violacei." These particulars mostly come from Thunberg's Flora Japonica, 132 (1784). Together with the epithet *Thunbergii*, they indicate that Don intended the name primarily for a species gathered in Japan and erroneously determined by Thunberg as "*A. odorum L.*" There are two sheets thus labelled in Thunberg's herbarium at the Universitetets Botaniska Museet, Uppsala. They represent two quite different species. One is *A. tuberosum* Rottler (Plate 266) but because Thunberg's specimen lacks a bulb it cannot be accepted as the basis of Thunberg's account and consequently as the type of *A. Thunbergii*. The other sheet holds three specimens, one with an ovoid bulb about 2 cm. long, 1 cm. broad, and nine pink-tinged flowers, the tepals about 4 mm. long, the stamens and style long-exserted, which must evidently be taken as the type of *A. Thunbergii* G. Don (Plate 267); it and the other two specimens belong to the species commonly known as *A. japonicum* Regel (*Mon.* 33: 1875) and have nothing to do with the species described as "*A Thunbergi* Don" in Regel's *Mon.* 235 (1875) which is *Caloscordum nerinifolium* Herbert (1847), syn. *Allium nerinifolium* (Herb). Baker.

The involved synonymy of these plants can now be set out:—

ALLIUM CHINENSE G. Don

"*A. triquetrum*" Loureiro, Fl. Cochinch. 202 (1790)—non Linn. (1753).

A. chinense G. Don. Mon. Allium (Mem. Wernerian Nat. Hist. Soc. *6)* 83 (1827); Merrill, Comment. Loureiro's Fl. Cochinch. (Trans. Amer.

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[7] The traditional Chinese name for *A. tuberosum* is *kiu ts'ai,* in modern Pekingese *chiu ts'ai,* in Cantonese *kau ts'oi* or *go choi,* which has given rise to the Malayan and Sundanese name *kuchai* (also rendered *cuchay, kootjaj and kotjaj*) and the Javanese *puchai* (also rendered *pootjaj),* the plant having been carried to the Philippines, Java and Malaya by Chinese settlers; in these hot regions it does not flower freely and seed has continually to be imported from China. To English residents in Malaya it is known as *Chinese chives.*

Phil. Soc., new ser. *24.* II) 106 (1935)—non Maximowicz (1859), cf. *A. tuberosum* Rottler.

Type-locality:—"in China et Cochinchina" (G. Don). An obscure plant, known only from Loureiro's description: "*Folia* redicalia, triangularia, sub-pedalia. *Bulbus* oblongatus tunicatus parvus, albus. *Scapus* nudus, tenuis, teres, foliis subaequalis. *Flos* dilute violaceaus: Umbella plana: *staminibus* simplicibus. Colitur in Cochinchina, & China . . . Usus praecipuus Culinarius." Loureiro gives "Kieu" as its Anamese and "Kiai" and "Kiao theu" as its Chinese names.

ALLIUM RAMOSUM Linnaeus

A. scapo nudo tereti farcto, etc., Gmelin, Fl. Sibir.*1.*52 pl. 11 f. 1. (1747).

Type-locality:—"in omni Sibiria frequens, loca amat aperta et sicca" (J. G. Gmelin).

A. umbellatum foliis fistulosis, compressis, etc., Haller in Comment. Soc. Reg. Sci. Gottingen *2.* 337 pl. 9 (1753).

A. ramosum Linn. (!) Sp. Pl. *1.* 296 (1753), reimpr. in Richter, Caroli Linnaei Syst. Codex Bot. 312 (1840); C. H. Grey, Hardy Bulbs *3.* 60 (1938)—non Jacquin (1781), cf. *A. obliquum* Linn.

Type-locality:—"in Siberia" (Linn.)

A. odorum Linn. Mantissa 62 (1767), reimpr. in Richter, Caroli Linnaei Syst. Codex Bot. 315 (1840); Treviranus, Allii Species Hort. Bot. Wratislav. 14 (1822); G. Don, Mon. Allium (Mem. Wernerian Nat. Hist. Soc. *6)* 97 (1827); Ledebour, Fl. Ross. *4.* 185 (1853); Regel, All. Mon. (Acta Horti Petrop. *3* II) 176 p.p. (1875); Prokhanov in Bull. App. Bot. Leningrad *24.* II (1930) 176 (1931); Vvedensky in Komarov, Fl. URSS. *4.* 163 (1935); Everett in Gard. Chron. 3rd. ser. *101* 185 p.p. excl. icone (1937).

Type-locality:—"in Europa australi" (Linn.)

A. tataricum Linn. fil. Suppl. Pl. 196 (1781): de Candolle in Redoute, Liliac. *2* pl. 98 (1804); Kew-Gawler in Bot. Mag. *28* pl. 1142 (1808)—non Regel (1875), cf. *A. inderiense* Fischer & *A. longiradiatum* (Regel) Vved.

Type-locality:—"Sibiria" (Linn. fil.).

A. Potanini Regel (!) in Acta Horti Petrop. *6.* 295 (1879); *Butomissa tatarica* (Linn. f.) Salisb. ex Jackson et Hooker f., Index Kew. *1.* 362 (1895).

Type-locality:—"Mongolia in valle fluvii Schurik in solo arenoso" (E. Regel).

FIGURES:—Gmelin, Fl. Sibir. *1* pl. 11; Comment. Soc. Reg. Sci. Gottingen *2.* pl. 9; Redoute, Liliac. *2.* pl. 98; Bot. Mag. *28.* pl. 1142.

DISTRIBUTION:—U. S. S. R., widespread in southeastern Siberia and possibly extending into the Far Eastern Area, being recorded by Vvedensky (1935) from the following Soviet floristic regions:—28, Irtysh (east), 29, Altai, 31, Lena-Kolyma, 32, Angara-Sayan, 33, Dauria, 36, Zeya-Bureya and 38, Ussuri (although records from here may refer to *A. tuberosum)* Mongolia (Tannu Ola range). According to Krylov, Fl. Zapad. Sib. *3.* 360 (1929), its western limit in Western Siberia appears to be about 80° E, and its northern limit 54°30 N; it occurs near Kamen and Antonova on the river Ob; in Eastern Siberia it extends further north, being found in the Yenisei region (near Krasnoyarsk and Kansk) as well as in the Yakutsk and Irkutsk regions. It is recorded from southwestern Tibet and western Nepal, but its range as a whole is very imperfectly known.

ALLIUM THUNBERGII G. Don, sec. Koidzumi.

"A. odorum" Thunberg (!), Fl. Jap. 132 (1784)—non Linn. (1767), cf. *A. ramosum* Linn.

A. Thunbergii G. Don, Mon. Allium (Mem. Wernerian Nat. Hist. Soc. *6)* 84 p.p. (1827); Koidzumi in Bot. Mag. Tokyo *39.* 312 (1925); Makino & Nemoto, Nippon Shokubutsu Soran, 2nd. ed. 1537 (1931); Terasaki, Nippon Shokubutsu Zufu 1442 cum icone (1933)—non A. Gray (1859), cf. *A. Grayi* Regel; non Regel (1875), cf. *Caloscordum nerinifolium* Herbert.

Type-locality:—"in China et Cochinchina, Lour. in Koraedo, Thunb." (G. Don).

A. japonicum Regel (!) All. Mon. (Acta Horti Petrop. *3.* II) 33 (1875); Franchet & Savatier, Enum. Pl. Jap. *2.* 77 (1877), 528 (1878); Mikino in Iinuma, Somoku Dzusetsu 3rd ed. *6.* pl. 37 (1910).

Type locality:—"in Japoniae insula Kiusiu in monte Kundchasan inque in insula Nippon prope Yukohama et in monte Fakone, legit Maximowicz." (E. Regel).

A. Taqueti H. Léveillé in Fedde, Rep. Sp. Nov. *5.* 283 (1908); fide H. K. A. Shaw in Notes Roy. Bot. Gard. Edin. *16.* 147 (1931).

Type-locality:—"Corea: Quelpaert, supra 1200 m. oct. 1906; no. 259 (Urb. Faurie); Hallaisan, 1400 m. oct. 1907; no. 385 (Taquet)" (H. Léveillé).

Figures:—Terasaki, Nippon Shokub. 1442; Iinuma, Somoku Dzuset. 3rd ed. *6.* pl. 37.

DISTRIBUTION:—Japan, Korea (Quelpaert Island), north China (Shansi).

ALLIUM TUBEROSUM Rottler ex Sprengel.

Porrum sectivum minus juncifolio Kaempfer, Amoer. Exot. 831 (1712).[8]

[8] Although neither Kaempfer nor Noronha describe their respective plants, the one cultivated in Japan, the other in the Dutch East Indies, it is evident from the Chinese character given by Kaempfer and the vernacular name *cuchay* (a corruption of *kiu ts'ai*) given by Noronha that they refer to *A. tuberosum*. This Chinese character goes back to the Han period (c. 206 B. C.—220 A. D.), being listed in the Han dictionary *Shuo wên* by Hsü Shen as the name of a vegetable which, once sown, grows permanently. It probably began as a diagrammatic representation of two shoots growing out of the ground. Both Chinese and Japanese writers today associate it with *A. tuberosum*, called *kiu, chiu, kau* and *go* by the Chinese, *nira* by the Japanese. The word *ts'ai, ts'oi,* or *choi* means "vegetable", usually one whose green leaves are eaten as food.

"*A. angulosum*" Loureiro, Fl. Cochinch. 203 p.p. excl. syn. (1790)—non Linn. (1753).

A. sinicum Noronha in Verh. Batav. Gen. 1790 art. 4. p. 6 (1790) nomen nudum.[8]

A. tuberosum Roxburgh, Hortus Bengal. 24 (1814), nomen nudum.

Type-locality:—"in gardens in Bengal" (W. Roxburgh).

A. tuberosum Rottler (!) ex Sprengel, Caroli Linnaei Syst. Veg. *2.* 38 (1825); G. Don, Mon. Allium (Mem. Wernerian Nat. Hist. Soc. *6*) 91 (1827); C. H. Grey, Hardy Bulbs *3.*70 (1938); Stearn in Gard. Chron. 3rd. ser. *114.* 88 (1943).

Type-locality:—"Malabar" (K. Sprengel).

A. uliginosum G. Don, Mon. Allium 60 (1827); Merrill, Comment. Loureiro's Fl. Cochinch. (Trans. Amer. Phil. Soc. new ser. *24* II 106 (1935)—non Ledebour (1829), cf. *A. Ledebourianum* Schultes; non Kitaibel apud Kanitz (1864), cf. *A. acutangulum* Schrader.

Type-locality:—"in China, et Cochinchina (Loureiro), in Insula Nipon, Thunberg," (G. Don).

A. tuberosum Roxburgh (!) Fl. Indica, 2nd ed. *2.* 141 (1832); Baker in Journ. of Bot. *12.* 291 (1874); J. D. Hooker, Fl. Brit. India *6.* 342 (1892).

Type-locality:—"cultivated about Calcutta by the Hindoos" (W. Roxburgh).

A. Roxburghii Kunth, Enum. Pl. *4* 454 (1843).

Type-locality:—"cultum prope Calcuttam" (C. S. Kunth).

"*A. tricoccum*" Blanco, Fl. Filipin. 239 (1837), 3rd ed. *1.*301 cum icone (1877)—non Aiton (1789).

"*A. odorum*" auct. p.p., e.g. Regel, All. Mon. (Acta Horti Petrop. *3.* II) 176 p.p. (1875); C. H. Wright in Journ. Linn. Soc. Bot. *36.* 124 (1903); Makino in Iinuma, Somoku Dzusetsu *6.* pl. 42 (1910); Bois, Pl. Aliment, *1.* 511 cum icone (1927); Ochse, Vegetables Dutch East Indies 450 (1931); Teresaki, Nippon Shokubutsu Zufu 1443 cum icone (1933); Gagnepain in Lecomte, Fl. Gen. Indochine *6.* 813 (1934); L. B. Wilder, Adventures with Hardy Bulbs 49 (1936); Everett in Gard. Chron. 3rd. ser. 101. 185 p.p. fig. 71 (1937)—non Linn. (1767), cf. *A. ramosum* Linn.

A. Clarkei Hooker fil. (!) Fl. Brit. Ind. *6.* 344 (1892);[9] Blatter, Beautiful Fl. Kashmir *2.* 174 (1928).

Type-locality:—"Kashmir at Skardo, alt. 7-11000 ft., Clarke" (J. D. Hooker).

A. odorum f. *tuberosum* (Roxb.) Ascherson & Graebner, Synop. Mitteleurop. Fl. *3.* 119 quoad syn. Roxburghii excl. descrip. (1905).

A. Argyi H. Léveillé (!) Nouv. Contrib. Liliac. Chine 16 (1906), ex.

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[9] Hooker describes the filaments of the inner stamens as "broadly oblong, obtusely-toothed below the middle" but they appear to be subulate in his material at Kew.

Mem. Pontif. Accad. Roma, Nuovi Lincei *24.* 350 (1906), reimpr. in Fedde, Rep. Sp. Nov. *3* 371 (1907).[10]

?*A. jalvanum* Nakai in Bot. Mag. Tokyo *27* 214 (1913).[11]

A. yesoense Nakai in Bot. Mag. Tokyo *36* 116 (1922) fide Nemoto, Nippon Shokubutsu Soran Hoi 1051 (1936).

Type-locality:—"Kiang Sou: (d'Argy) xxx Les Chinois mangent les feuilles xxx Nom. Chinois: Kien-Tsai" (H. Léveillé).

"*A. chinense*" Maximowicz, Prim. Pl. Amur. (Mem. Acad. Sci. St. Petersb. Sav. Etrang. *9*) 284 (1859); Prokhanov in Bull. Appl. Bot. Leningrad *24.* II (1930) 164-171, 176, 181 (1931)—non G. Don (1827).

FIGURES:—Blanco, Fl. Filipin. 3rd ed. as "*A. tricoccum*"; Iinuma, Somoku Dzuset. 3rd ed. *6* pl. 42; Bois, Pl. Aliment. *1.* 511; Teresaki, Nippon Shokub. 1443; Bull. Appl. Bot. Leningrad *24.* II. 166, 167; Gard. Chron. 3rd ser. *101.* 185 fig. 71 (March 1937).

Distribution:—eastern Asia, but its original range, like that of many long-cultivated plants, is uncertain; in a wild or naturalized state it has been collected in east Mongolia, Manchuria, Korea (Quelpaert island), Japan, Formosa, China (Chihli, Shantung, Kiangsu, Hong Kong, Hainan, Kwangtung, Hupeh, Hunan, Shensi, Yunnan), west Tibet, Siam, north India (Assam) and Nepal: it is cultivated as a salad crop and pot-herb in Japan, China, Chinese Turkistan, India, the Dutch East Indies and the Philippines, and occasionally as an ornamental garden plant in Europe (France, Switzerland, England, Sweden and possibly elsewhere) and U. S. A. under a variety of names, e.g. *A. odorum, A. Heldreichii* (at Basel), *A. recurvatum* (at Geneva).

No one can study Allium for long without feeling the need for divisions of the genus smaller and more homogeneous than the currently accepted sections of Regel's monograph (1875). Particularly is this true of Regel's section *Rhizirideum* (G. Don) which includes all the Alliums with a persistent rhizome, *A. ramosum* and *A. tuberosum* among them. A provisional survey suggests the restriction of the name *Rhizirideum* to the rhizomatous Alliums with membranous tunics grouped around *A. senescens,* the revival of section *Anguinum* (G. Don) Vvedensky for the fibrous-tuniced broad-leaved Alliums with protruding stamens and rounded seeds typified by *A. Victorialis* and the exclusion from it of *A. ramosum* and allies to form a new section *Butomissa* (Salisbury, Genera of Plants, 91 as a genus: 1866) characterised inter alia by fibrous bulb-tunics linear leaves, more or less included stamens interfused near the base and flattened seeds. But subdivision cannot end here.

The species which come near to *A. ramosum* and *A. tuberosum,* may conveniently be called the "*A. odorum* group." These are *A. fasciculatum Rendle* in Journal of Bot. *44.* 42 (1906), syn. *A. Gageanum* W. W.

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[10] Léveillés' description of the pedicels and filaments as puberulous seems to be erroneous.

[11] The type-specimen of *A. jalvanum* (Komarov 380, from near the river Yalu north Korea) was referred by Komarov to *A. odorum* but is said by Nakai to differ in having chartaceous not reticulately fibrous bulb-tunics.

Smith in Records Bot. Survey Ind. *4.* 247 (1911), with the base of the stem hardly thickened at all and its usual storage function taken over by short tuberous roots; *A. humile* Kunth, Enum. Pl. *4.* 443 (1843), syn. *A. Govanianum* Wallich ex Baker in Journal of Bot. *12.* 293 (1874), with very short stamens; *A. oreoprasum* Schrenk in Bull. Sci. Acad. Imp. St.-Pétersb. *10.* 354 (1842); and *A. weichanicum* Palibin in Acta Horti Petrop. *14.* 143 (1895).

Allied to this group is a group of species which Regel, All. Mon. 165 (1875), and other authors have referred to *A. tataricum* Linn. fil. Apparently no type-specimen of *A. tataricum* now exists; judging from the younger Linnaeus's description, based on a plant cultivated at Uppsala, it is *A. ramosum* Linn. The central and west Asiatic species with rose flowers commonly known as "*A. tataricum*" should be called *A. inderiense* Fischer ex Bunge in Goebel, Reise Stepp. Russlands *2.* 311 (1938),[12] syn. *A. diaphanum Janka* in Linnaea 30, 606 (1860). *A. Beckerianum* Regel, Index Sem. Horti Bot. Petrop 1860 p. 30, *A. tataricum typicum* Regel, All. Mon. 179 (1875), and is illustrated

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[12] C. C. T. Friedemann Goebel, Reise in die Steppen des südlichen Russlands (Dorpat, 1837-38) is a work rarely available in botanical libraries but contains on pp. 247-332 of vol. *2* an "Index Planatarum in Deserto Caspio atque Regionibus prope adjacentibus observatarum" by Carl Claus with the help of Ledebour, C. A. Meyer and Bunge. The name *A. inderiense* appeared as a nomen nudum in F. E. L. Fischer, Cat. Jard. Gorenki 10 (1812) and again in Roemer & Schulties, Caroli a Linne, Syst. Veg. 7. II 1133 (1830) but the first description was supplied by Bunge in Goebel's work:—

"A. Inderiense Fisch. MS. (Roem. et Schult. VII. 2 p. 1122 § 10) A: staminibus lanceolatis simplicibus perigonium aequantibus, umbella capsulifera, spatha universali abbreviata membranacea apice fissa, caule basi folioso, foliis canaliculatis linearibus, bulbo obliquo reticulato. Hab. in montibus ad lacum Inderiensem, in monte Bogdo. Floret Majo, Junioque.

Rhizoma obliquum, radicibus fibrosis sordide albis tectum; bulbus ovato oblongus, gracilis, dense reticulatus reticulis tenerrimis fuscentibus. Caulis pedalis et ultra teres, basi foliosus. Folia plerumque quatuor basi vaginantia; vagina striata; linearia, basin versus canaliculata 4-5 pollices longa, obtusiuscula, Spatha univalvis ante anthesin clausa subacuminata, demum irregulariter rupta, reflexa membranacea. Umbella florens subcapitata sub 20- flora, pedicellis abbreviatis demum perigonio aequalibus. Flores rosei. Perigonii laciniae 3-4 lineas longae lineam latae, erectae; externae paulo latiores, subcarinatae, acutiusculae; internae angustiores oblongo lanceolatae, acuminatae. Stamina tria exteriora subulata, basi parum dilatata, interiora basi latiora lanceolato-subulata, omnia perigonium aequantia, vel parum longiora. Antherae fuscentes oblongae. Stylus perigonium aequans. Capsula triquetra obovata. Semina generis (Bge)."

The type-locality of *A. inderiense* is in south-west U.S.S.R., Uralsk district, near the Inderskoje lake (the Indersksсher Salzsee or Indersk-Sea of German writers) about 48° 32 N, 51° 50-52° E, about 100 miles north of the Caspian Sea and 350 miles east of Sarepta (48° 32 N, 44° 30 E), the type-locality of *A. Beckerianum* Regel and *A. diaphanum* Janka. *Eremurus inderiensis* (M. Bieb.) Regel takes its name from the same region: Tauscher collected plants and insects there in 1806 on behalf of Fischer's employer, the Russian count A. K. Razumovsky. With the exception of *Triglossum* and *T. bambusinum,* all the new names (e. g. *Allium inderiense, A. virescens, A. oroprasum, A. albidum, A. decipiens, A. cinereum*) appearing in Fischer's Catalog du Jardin des Plantes de son Excellence Monsieur le Conte Alexis de Razoumoffsky à Gorenk: (Moscow, 1812) are nomina nuda and not validly published there.

in Acta Horti Petrop. *40.* 360 fig. 180 (1929). The group typified by it may conveniently be called the "*A. inderiense* group." Following A. Vvedensky in Komarov, Fl. URSS *4.* 124-126, 156-162 (1935) this comprises the following:—*A. Barsczewskii* Lipcky in Acta Horti Petrop. 18. 114 (1900), illustrated in Regel, Turkestanaya Fl. *1* (Izvyest. Imp. Obshchest Lyubitel. Estest., Antropol; Etongraf., Moskva *21.* II) pl. 14 figs. 1-5 (1876) as "*A. tataricum* L. *typicum*"; *A. dolichomischum* Vvedensky in Sched. Herb. Fl. Asiae Med. no. 606 (1935), Komarov, Fl. URSS *4.* 160 pl. 166 fig. 1 (1935); *A. dolichostylum* Vvedensky in Bull. Univ. Asie Cent. *19.* 120 (1934); *A. drepanophyllum* Vvedensky in Bull. Univ. Asie Cent. *19.* 120 (1934); *A. inconspicuum* Vvedensky in Notulae Syst. Herb. Hort. Bot. Reipubl. Ross. *5.* 93 (1924); *A. longiradiatum* (Regel) Vvedensky in Povov, Opredel. Rast. Okrest. Taschkent *1.* 67 (1923) and in Sched. Herb. Fl. Asiae Med. no. 60 (1925) in Bull. Univ. Asie Cent. *9.* suppl. 8 (1925), syn. *A. tataricum* B. *longiradiatum* Regel, All. Mon. 180 (1875); *A. lutescens* Vvedensky in Sched. Herb. Fl. Asiae Med. no. 610 (1935), Komarov, Fl. URSS. *4.* 159 (1935); *A. stephanophorum* Vvedensky in Notulae Syst. Herb. Hort. Bot. Reipubl. Ross. *5.* 94 (1924); *A. tenuicaule* Regel in Acta Horti Petrop. *10.* 348 pl. 4 fig. 4 (1887), reimpr. in Regel, Allii Sp. Asiae Cent. 70 pl. 4 fig. 4 (1887); and *A. xiphopetalum* Aitchison et Baker in Trans. Linn. Soc. Bot. 2nd ser. *3.* 118 pl. 48 (1888).

The following is a key to these two groups, the contrasts from 8A onwards being adapted from Vvedensky in Komarov, Fl. URSS *4.* 124-126 (1935):—

1A. Leaves almost basal, all parting from the stem at about the same level. Flowers starry or open campanulate, mostly white. (*A. odorum* group; genus *Butomissa* Salisb.)

2A. Tepals (perianth-segments) rose.

3A. Tepals acuminate, 5-6 mm. long, 3-4 mm. broad. Central Asia ....*A. oreoprasum* Schrenk.

3B. Tepals blunt, 8-9 mm. long, 2.5-3 mm. broad. North China (prov. Chihli) ....*A. weichanicum* Palibin

2B. Tepals white, usually with a green or purplish red dorsal mid-vein.

4A. Tepals 5-6 mm. long, 3-4 mm. broad, i.e. less than twice as long as broad. Inner filaments nearly 2 mm. broad towards the base, about twice as broad as the outer filaments. Central Asia (Dzungaro-Tarbagatai, Pamir-Alai and Tien Shan floristic regions of U. S. S. R.; Tibet) ....*A. oreoprasum* Schrenk[13]

4B. Tepals twice to three times as long as broad. Filaments subulate, almost of equal width.

5A. Perianth fairly large; tepals 6-11 mm. long. Stamens ¼ to ½ the length of the tepals.

[13] In a living state the tepals of *A. oreoprasum* are pinkish with a marked dirty purple mid-vein (fide Vvedensky); in a dried state they often appear white or whitish; hence the inclusion of *A. oreoprasum* twice in this key.

6A. Leaves somewhat fistulose. Tepals acute. Stamens ½ the length of the usually 9-11 mm. long, 2-3 mm. broad tepals. Capsule broadest at or below the middle. Central Asia.
A. ramosum Linn.

6B. Leaves flat. Tepals blunt. Stamens ¼ to ⅓ the length of the 6-9 mm. long, 1.5-2.5 mm. broad tepals. Capsule broadest above the middle. West Himalaya (Kashmir, Simla, Garhwal).
A. humile Kunth.

5B. Perianth smaller; tepals 4-7 mm. long. Stamens almost equalling the tepals in length.

7A. Stem-base covered with finely interwoven fibres. Roots long and slender, in a dry state usually about 1.5 mm. (rarely 3 mm.) thick. Tepals narrowly ovate (usually about 4-5 mm. long, 2-2.5 mm. broad). South-east Asia, from Japan to India, cultivated as a salad crop. ....*A. tuberosum* Rottler.

7B. Stem-base covered with loose parallel coarse fibres. Roots short and tuberous, in a dry state about 4 mm. thick. Tepals lanceolate (about 4 mm. long, 1 mm. broad). Tibet, Sikkim.
A. fasciculatum Rendle.

1B. Leaves separated from one another, parting from the stem at intervals of (0.5-) 1-4 (-5) cm. Flowers campanulate or narrowly campanulate, mostly rose or purplish with the tepals lanceolate, acuminate, persistent, becoming papery, erect and clasping the capsule. Central Asia (Pamir-Alai and Tien Shan floristic regions of U. S. S. R. unless otherwise stated below; cf. *A. inderiense, A. xiphopetalum*). (*A. inderiense* group).

8A. Ovary with small teeth at the apex, forming a small crown around the base of the style.

9A. Tepals dirty purple, unequal, the outer ¼ longer than the inner. Pedicels unequal, at first ½ the length, equalling or slightly longer than the (6-) 8-12 mm. long perianth, in fruit sometimes twice the length of the perianth.
A. stephanophorum Vved.

9B. Tepals beautiful dark rose, almost equal. Pedicels almost equal, 1-4 mm. long, ½ the length (or less) of the 8 mm. long perianth. ....*A. tenuicaule* Regel.

8B. Ovary without small teeth at the apex.

10A. Filaments equalling or slightly longer than the 7-10 mm. long perianth. Style (especially in fruit) protruding.

11A. Umbel hemispherical or almost globose, rarely fastigiate; pedicels equalling or 1½ (to twice) the length of the perianth. Anthers yellow. ....*A. dolichostylum* Vved.

11B. Umbel fastigiate, rarely hemispherical; pedicels ½, equalling or (in fruit) 1½ times the length of the perianth. Anthers violet. Southwest and central Asiatic U. S. S. R. (Lower Volga, Upper Tobel, Aral-Caspia and Balkhash floristic regions). ....*A. inderiense* Fischer.

10B. Filaments 1/4-2/3 the length of the perianth. Style (even in fruit) not protruding.

12A. Tepals yellowish, 8-12 mm. long. ....*A. lutescens Vved.*
12B. Tepals purple or rose without any yellowish tinge (though sometimes greyish when dried).
13A. Tepals dirty or brownish purple, 8-10 mm. long.
14A. Leaves 1-3, narrowly linear, often almost filiform, 0.5-1 mm. broad. Channelled. ....*A. inconspicuum* Vved.
14B. Leaves 4-5, linear, 2.5-10 mm. broad, flat, falcate.
A. drepanophyllum Vved.
13B. Tepals pale rose, rose, pale purple or purple with a darker mid-vein.
15A. Umbel globose or hemispherical, rarely fastigiate, loose; pedicels (2-) 3-6 times the length of the perianth.
16A. Leaves channelled, fistulose, 1-3 mm. broad. Pedicels 4-6 times the length of the 7-10 mm. long perianth.
A. longiradiatum (Regel) Vved.
16B. Leaves flat, not fistulose, (1-) 3-4 mm. broad. Pedicels (2) 3-4 times the length of the 5-7 mm. long perianth.
A. dolichomischum Vved.
15B. Umbel fastigiate or hemispherical, dense; pedicels ½, equalling or more rarely 2-3 times the length of the 7-14 mm. long perianth.
17A. Leaves flat, 3-5 (-10) mm. broad. Anthers usually purple. Afghanistan; Mountain Turkmenia and Pamir-Alai floristic regions of U. S. S. R. *A. xiphopetalum* Aitch. & Baker
17B. Leaves channelled, 1-3 mm. broad. Anthers yellow.
A. Barsczewskii Lipsky.

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LITTLE KNOWN ALLIEAE OF SOUTHWESTERN NORTH AMERICA

J. C. Th. Uphof

Among the Allieae there are a number of genera that are little known. In southwestern North America these include *Muilla, Milla, Androstephium, Behria, Pharium,* and *Diphalangium.* In most cases these genera are monotypic, and the species have received little attention. They are rarely found in collections of living plants, but they are represented as a rule by dried specimens in the larger herbaria.

These genera are so closely related that K. Krause,[1] for instance, placed *Androstephium* with the genus *Pharium (Bessera).*

A few of the species have been illustrated. Cavanilles has given us in his beautiful folio work[2] an excellent plate of *Milla biflora.* Herbert[3] and Lemaire [4] have provided good illustrations of *Pharium elegans.*

These species are distributed in southwestern North America.

Some of the species under consideration produce very beautiful flowers and deserve a place in our plant collections.

In the following pages the writer gives a brief review of the genera and species, and something about their history together with complete descriptions.

1. Genus MUILLA S. Watson

Bulbous plant similar to *Allium;* leaves narrow, linear, flat to terete; Scape simple, leafless, broadened toward the base; flower-cluster an umbel, composed of few to 40 or more small flowers; inflorescence subtended by 3 acuminate scarious bracts that are already distinctly formed in the bud, or may be overlapping or connate at the base; pedicels thin, often slender, subtended by small membranous bractlets; flowers composed of 6 segments, similar in appearance, free or slightly united at the base, subrotate, persistant; stamens 6, adnate near the base of the perigone; filaments filiform (in *M. martima)* or greatly dilated (in *M. coronata);* anthers ovate to elongated; ovary 3-celled, ovules many 8-10) in each cell; style short, clavate, persistant; stigma thick; fruit a capsule, globose, 3-angled, containing many small compressed, angled, black seeds. The herb does not have the flavour or odor that is characteristic to the onion.

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[1] K. Krause. Liliaceae in Engler & Pranti. Die Natuerlichen Pflanzenfamilien. 15a: 324. 1930.

[2] *Ant. Josephii Cavanilles.* Icones descriptiones plantarum quae out sponte in Hispanica crescent out in horti hispanitur. 2: t.196 Matriti 1791-1801.

[3] *William Herbert. Pharium fistulosum.* Edward's Botanical Register. T.1546, 1832.

[4] *Ch. Lemaire. Bessera miniata.* Flore des Serres et des Jardins de l'Europe. T. 424, 1848.

At present six species of *Muilla* are known, and these are described below.

Notes.—The original description of this genus is entirely bound up in the morphological description of *Hesperoscordium ? maritimum,* as originally described by Torrey as a doubtful species in 1856.[5] In 1871 it was named *Milla maritima* by S. Watson,[6] who later on renamed it *Muilla maritima*[7] in 1879. He gives here a description of the species, mentioning some of the synonyms, but gives no description of the genus itself. Watson apparently recognized the plant from the description given by Torrey. It is clear that the name *Muilla* is an anagram of *Allium,* the name being spelled backward.

1. Muilla coronata, Edw. Greene, Misc. Species, New or Rare, Pittonia 1: 165, 1887-1889; W. L. Jepson, A Manual of the Flowering Plants of California. 223, 1923.

Description.—Bulb 15 to 18 mm. in diameter, developing about 2.5 cm. below the surface of the ground; leaves 2 to 3, narrow, linear, double the length of the scapes; scape 3.5 to 5 cm., sometimes 10 cm. high; umbels 3 to 10 flowered; perigone rotate, segments 3 to 4 mm. long, pale blue to nearly white within, green with bluish margins on the inside; segments of the perigone are characterized by a narrow white scarious border; filaments hyaline, petaloid, retuse at the apex, broadly oblong; anthers sub-sagitate, erect, fixed at about the middle to the abrupt incurved median point of the petal-like filament.

Notes.—The type specimen was collected by the western pioneer Dr. C. C. Parry who collected the plant late in March 1888 in the Mohave Desert. Greene compares the color of the flowers with those of *M. transmontana,* Greene, adding "the filaments taking an unexpected phase, their broad margins overlapping, though wholly distinct, thus forming as it were a cylindrical cup or crown, from the orifice of which the yellow anthers are exserted a little less than half their length."

2. Muilla transmontana, Edw. Greene, Misc. Species, New or Rare, Pittonia 1:73, 1887-1889; Ivar Tidstrom, Flora of Utah and Nevada, Contrib. U. S. Nat. Herb. 25:;22, 1925.

Description.—Bulb 2.5 to 3 cm. or more in diameter; scape 30 cm. or less in length, fusiform-enlarged; umbel 12 to 30 flowered; pedicels 2 to 3 cm. long; perigone rotate, white, fading with a tinge of lilac; segments 6 mm. long; filaments petal-like, white, ovate-acuminate, relatively thick and fleshy, the margins grown together at the base, forming a shallow nectar-containing receptacle around the ovary; anthers about 1 mm. in length.

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[5] *John Torrey.* Description of the General Collections. Rep. Explor. and Surv. Pac. Railr. 4: nr. 4, 148-149, 1856.

[6] *Sereno Watson.* Botany: U. S. Geol. Explor. Fortieth Parallel. Clarence King, Geologist-in-Charge. 5:354-355, 1871.

[7] *Sereno Watson.* Contributions to American Botany. Proc. Am. Acad. Arts & Sciences. 14:235, 1879.

Notes.—Greene states that this species is very clearly distinct from *M. maritima* (Torr.) Wats. stating that the flowers vividly suggest "the idea of a generical affinity with *Hesperoscordium* Lindley; but the inarticulate pedicels of *Muilla* forbid the suggested union of this genus and that section of *Triteleia.*"

This species was described from Reno-Nevada, from fresh specimens that were communicated by Miss Amy Pease.

3. Muilla maritima, (Torr.) S. Watson, Contrib. to Amer. Botany, Proc. Am. Acad. Arts and Sci. 14:235, 1879; W. J. Jepson, A Manual of Flowering Plants of California, 222-223, 1923; *Hesperoscordium ? maritimum,* John Torrey, Description of the General Botanical Collections. Reports, Explorations and Surveys. Pacif. Railr. 4 : nr. 4, 148-149, 1856; *Allium maritimum,* G. Bentham, Plantae Hartwegianae. 339, 1857; *Nothoscordum maritimum,* J. D. Hook., Curtis' Bot. Mag. under descr. of plate 5896. vol. 27, 1871; *Milla maritima,* S. Watson, Botany; United States Geological Exploration of the Fortieth Parallel. Clarence King, Geologist-in-Charge. 5:354-355, 1871.

Description.—Bulb 1.5 to 2 cm. in diameter, fibrous-coated; scape 7 to 22, sometimes 30 cm. high; leaves narrowly linear, almost terete, about as long as the scape; umbel 4 to 12 flowered; pedicels 0.6 to 2.5 cm. long, the lower pedicels frequently 2-4, sometimes 5 cm. long, the others much shorter; bracts 4-6, subulate-linear, connate at the base; perigone segments 4 to 6 mm. long, acute to obtuse, the petals generally wider than the sepals; the midnerve broad thickened, brownish, margins greenish-white; filaments filiform, inserted a little above the base of the segments, not connected; anthers oblong, yellow or pale purple; ovary ovate, obtuse; style filiform, erect, slightly clavate upward, stigma minutely 3-cleft.

Notes.—On saline fields, Sacramento Valley and Marin Co., California. Torrey, who seems to have been in doubt as to the exact affinity of this species, states "It differs from *Hesperoscordium* in the petals being distinct nearly to the base, and in the slender filaments." The original plant came from the sea shore, Punta de los Reyes, California, and belonged to the greater part of the botanical collections made by Dr. J. M. Bigelow, in the Pacific Railway Survey, under the charge of Captain Whipple and were submitted for examination to John Torrey in accordance with the instructions of the War Department.

4. Muilla serotina, Edw. Greene, Novitates Occidentales IV: Erythea 1 : 152, 1893; W. L. Jepson, A Manual of the Flowering Plants of California. 223, 1923; Le Roy Abrams, Flora of Los Angeles and Vicinity. 85, 1904.

Description.—Bulb 1 to 1.5 cm. in diameter; leaves 30 to 40 cm. in length, subterete, the upper-side almost flat, only slightly concave; the lower surface convex and distinctly 7-striate; scape 35 to 50 cm. high; umbels 10 to 20, in some instances as much as 40-flowered, (Greene records 70-flowered), glabrous, glaucous; pedicels about 5 cm. long (?); perigone rotate, 1.5 cm. broad, dull-white; broad green veines branch to the segments; sepals oblong-linear, petals oblong; filaments stout-subulate, slightly compressed; anthers 1 mm. long, pale purple.

Notes.—This species is found in the mountains and half-open foothills, in the upper Joaquin Valley. Plants are especially common in the mountains and toward the interior of Southern California. Le Roy Abrams states, in his Flora of Los Angeles, that the plants are frequent in dry stony places in the plains and foothills. Green says that under cultivation in Berkeley plants flower in June and July, whereas *M. maritima* flowers in March and April.

5. Muilla tenus, J. W. Congdon, Some California Plants, Zoe 5: 135, 1901.

Description.—Bulb 1.5 cm. in diameter, growing about 2 to 3 cm. deep in the soil; stem very slender, 15 to 30 cm. high, having a membranaceous sheath around the base; leaves 6 to 15 cm. long, filiform; umbel 12-15 flowered; pedicels 2 to 2.5 cm. long, slender; bracts around the umbel 4 to 6, long-acuminate, 3 to 10 cm (?) long; flowers whitish, 4 mm. in diameter; sepals oblong, somewhat obtuse, the broad midvein slightly yellowish-brown; filaments filiform, anthers versatile, ovate; capsule depressed-globosed, somewhat 3-lobed; seeds flattened, irregularly angled, few in number.

Notes.—This species, which is closely related to *M. maritima* of which it may be a variety, is distinguished from it, by its extreme slenderness of all its parts, and by its different sepals.

This species was first reported from California, foothills, Raymond, April.

6. Muilla Purpusii, T. S. Brandegee, Plantae Mexicana Purpusianae, III, Univ. of Calif. Pub. in Botany. 4: nr. 11, 177 1911.

Description.—Bulb 1.5 cm. in diameter, tunicate; scape hispid at the base, about 2 dm. long; leaves filiform; umbel bracteose at the base; pedicels about 3 cm. long; perigone-segments 9 mm. long, oblong-lanceolate, margins bluish; flowers rotate, bluish with green in the center of the perigone-segments; tube short; filaments bluish, anthers oblong; capsule with 3 to 5 seeds in each cell.

Notes.—This species was first collected on Sierra de la Paila, Coahuila, Mexico. no. 4959 Type Herb. Univ. Calif. no. 148555. In the U. S. National Herbarium, I observed a specimen from Limon Mt., Guerrero, Mexico, alt 1200 meters.

2. Genus MILLA Cavanilles

Bulbs small, tunicate; leaves few, narrow; perianth 6-lobed, funnel-shaped; tube cylindric, narrow; anthers 6, filaments short, inserted at the apex of the tube of the perianth; filaments short; anthers of equal size, nearly the same length of the style; style filamentous, stigma slightly lobed; ovary superior, elongated; fruit a capsule, membraneous, obtuse; seeds many; compressed; seed-coat black.

About thirty years after the description by Cavanille,[8] it was apparently listed by Rafinesque under the names of *Askolame,*[9] *Ipheion*[10] and *Tulophos*[11]. Only one species is recognized at present. Cavanille named this genus in honor of Juliani Milli of Madrid, Spain, stating: "In honorem D. Juliani Milla Regii horti matritensis primarii hortulani."

1. Milla biflora Cav. Icon. descr. Hisp. 2:76, T. 196, 1791-1801. Torrey in: Rept. U. S. and Mex. Bound. Surv. 2:219, 1859. *Description.*—Bulb subglobose, small; scales light brown. Leaves 15 to 20 cm. long and 3 to 4 mm. wide, linear, acute, green, glabrous. Scape 2 to 4-flowered, seldom bearing one flower, as long as the leaves, round. Spathe-valves small, lanceolate, acute. Flowers white, funnel-shaped, 6-lobed; lobes oval; tube small, narrow, cylindric. Stamens much shorter than the perianth; filaments very short, inserted on the apex of the tube. Ovary cylindric, becoming narrower at both ends; style filamentous; stigma slightly lobed. Capsule membranous, elongated, 6-parted; seeds many, flattened, black.

Notes.—Native to Mexico and Guatemala. Cavanille observes that his specimen came from Mexico, stating: "Habitat in Imperio Mexicano, vivi floridam et fructiferam mense Octobris in regio horto Matritense." John Torrey states that his plant resembles Mexican specimens collected by Dr. Halsted and others.

3. Genus ANDROSTEPHIUM Torrey

Bulbous plants. Scape forming an umbel. Flowers pedicellate. Perianth funnel-shaped, 6-lobed, regular; tuber narrow. Stamens 6; filaments inserted on the tube; anthers bilocular, introrse. Ovary sessile, oblong, 3-celled, with 12 to 14 ovules; style filiform; stigma 3-lobed. Capsule obovate, truncate, 3-lobed. Seeds 8 to 14 in each section, compressed, black.

John Torrey[12] states that the Mexican genus *Bessera* most resembles *Androstephium,* but it differs in the very short tube of the perianth, in the tube of the filaments, having only a short tooth between the filaments, and in the form of the capsule.

1. Androstephium coeruleum (Scheele) Greene, Pittonia 2:57. 1890; Morton, Herbertia 7:77-78. 1941; *Milla coerulea* Scheele, Linnaea 25:260. 1852; *Androstephium violaceum* Torr. Bot. Mex. Bound. 219. 1859. *Description.*—Bulb globose, outer scales brown. Leaves linear, 15 to 20 cm. long and 2 to 4 mm. wide. Scape of the same length as the leaves, round, stout, terminating in a 2 to 7-flowered umbel. Flowers have a faint sweet scent. Spathe-valves 3-nerved, scarious,

[8] *Ant. Josephii Cavanilles.* Icones descriptions plantarum que out sponte in Hispanica crescent out in horti hispanitur. 2:76, Matriti 1791-1801.

[9] *C. S. Rafinesque.* Flora Telluriae. 2:11, 1836.

[10] *C. S. Rafinesque.* Flora Tilluriae. 2:12, 1836.

[11] *C. S. Rafinesque.* Flora Tilluriae. 3:71, 1836.

[12] *John Torrey.* in: William H. Emory. Report of the United States and Mexican Boundary Survey. Vol. II Botany of the Boundary. 218, 1859.

lanceolate, acuminate. Pedicels usually shorter than the flower. Perianth violet, 2 to 2.5 cm. long, 6-cleft to the middle; segments oblong, obtuse, spreading. Stamens 6; filaments united into a tube, arising from the orifice of the perianth, being conspicuously exserted, forming between and beyond the anthers into a crown of 6 oblong emarginate lobes. Anthers linear-oblong. Style of the same length as the stamens. Ovary free. Capsule sessile, having 3 prominent laterally compressed cells. Seeds suborbicular, compressed, narrowly winged.

Notes.—Native to Texas and adjacent Mexico. Was observed by John Torrey originally on hills and prairies on the rivers Blanco and Colorado, Texas. He states: "We have excellent specimens from Dr. R. Gleason, United States Army, collected near Fort Arbuckle, and it occurs in Lindheimer's Texas Collection fasc. IV."

4. Genus BEHRIA Greene

Perianth tubular, abruptly subglobose and 6-lobed above the attenuate base, afterward becoming contracted into a long, narrow, 6-toothed tube. Stamens 6; filaments free toward the base of the tube of the perianth where they are abruptly dilated and united into a short crown. Ovary superior, 3-celled; ovules many; style long exserted, filiform, terminated by a small, 3-lobed stigma.

Greene [13] dedicated this genus to his friend H. Herman Behr, M. S. Professor of Botany in the College of Pharmacy of the University of California. One species is known.

1. Behria tenuifolia Greene. Bull. Calif. Acad. Sci. 2:143-144, 1887. *Description.*—Bulb ovoid. Leaves linear, 2 to 4. Umbel 8 to 17 flowered; pedicels very slender, 2 to 5 cm. long. Perianth 20 mm. long; tube 6 mm. wide. Lobes of the perianth ovate-oblong; spreading, bright scarlet. Anthers linear oblong, 2 mm. long, obtuse at each end. Capsule ovate, 1 to 1.5 cm. long.

Notes.—Greene states that the original specimen was labeled San José del Cabo which means that it was found near Cape St. Lucas or thereabouts, however, the name of the collector is unknown, "the fragments have been lying in the herbarium of the Academy for many years."

5. Genus PHARIUM Herbert

Pharium Herbert, Bot. Reg. 18: pl. 1546. 1832; Morton, Herbertia 4: 102-103. 1937; syn. *Bessera* Schultes f. Linnaea 4: 121. 1829.

Bulbous plants. Leaves lanceolate. Flowers united into an umbel. Perianth bell to funnel-shaped. Lobes united at the base to form a small tube. Stamens 6, longer or almost as long as the perianth. Lower part of the filaments united to the tube. Ovary superior, cylindric, tapering

[13] Edw. L. Greene. Studies in the Botany of California and parts adjacent. Bull. Calif. Acad. Sci. 2:143-144, 1887.

slightly at both ends; style filiform; stigma slightly 3-lobed. Capsule ovoid, 3-ribbed. Seeds many, compressed.

Schultes who gives a lengthy description of this genus states that it was dedicated to Prof. Besser [14]—"Genere Bessereae a patre olim condito non recpto, Besseraque Sprengelii nunc ab ipso auctore ad Drypetem et Rumean amandata, novam inde constitui Besseram in honorem D. D. et Prof. Besser, patris mei amici optimi, et de rebus botanicis, ut libi omnibusque Botanicus notum, optime promeriti."

1. Pharium elagans (Schult.) Steud. ex Morton, Herbertia 4: 102-103. 1937; syn. *Bessera elegans* Schult. in Linnaea 4:121-127, 1829; *Pharium fistulosum* Herb. in Edw. Bot. Reg. T. 1546, 1832; *Bessera multiflora* Mart and Gal. Bull. Acad. Bras. 9, 1842; *Bessera miniata* Lem. in Flore d. Serres. T. 424, 1848; *Pharium elegans* Steud. Nom. Ed. II, 2, 316; *Pharium Herbertii* Stud. Nom. Ed. II, 2, 316.

Description.—Bulb small, subglobose, tunicate, membranous, brown. Leaves 2 to 3, about 10 to 16 cm. long, 3 to 4 mm. wide, linear, acute, glabrous, fistulose, attenuate, canaliculate, often reddish at the base. Scape of the umbel 5 to 12-flowered; about as long as the leaves, cylindrical, glacous, reddish toward the base. Spathe-valves small, acute. Pedicels slender, 3 to 4 cm. long, green often reddish below the flower. Flowers more or less pendulous, bell to funnel-shaped; lobes of the perianth ovoid to lanceolate, reddish-purple; tube very small, turbinate. Stamens as long or slightly longer than the perianth. Anthers small oval; filaments slender; the base being connected with the tube of the perianth. Ovary cylindric; style filiform; stigma 3-lobed.

Notes.—Native to Mexico. William Herbert who described this plant under the name of *Pharium fistulosum,* states that this little bulbous plant flowered in the Greenhouse at Spofforth in September, having been imported from Mexico by Mr. Tate of the Sloane-Street Nursery, Chelsea. He observes, "It will be an interesting plant to the Botanist. The cup which connects its filaments seems to furnish a link between *Asphodelae* and *Amaryllidae.*" He calls this species *Hollow-leaved Pharium.*

6. Genus DIPHALANGIUM Schauer

Perianth hypocratheriform, actinomorphic; limb 6-lobed; tube cylindric. Stamens 6, inserted on the tube of the perianth. Anthers bilocular, introrse. Ovary superior, 3-celled with many ovules; style filiform; stigma 3-lobed. Capsule 3-ribbed, many seeded.

Schauer[16] who proposed this genus, considers it closely related to *Tristigma* and *Milla.* He placed it in the "Subordo Agapanthae" of the "Ordo Liliaceaea." Only one species is known at present.

[14] *Jul. H. Schultes, D. F. L. de Schlectendal. S. P. D.* Bessera elegans. Genus novum Hexandrae monogynae. Linnaea 4:121-127, 1829.

[15] *S. Scheuer.* Enumeratio descriptiones generum novarum specierum que plantarum in terris mexicanus crescentium. Linnaea 19:702-703, 1847.

1. Diphalangium graminifolium Schauer in Linnaea. 19:702-703, 1847. *Description.*—Bulb round; tunic fuscate. Leaves linear, canaliculate. Perianth 6-lobed, funnel-shaped; tube cylindric; lobes laciniate. Stamens 6; part of the filaments inserted on the perianth tube. Filaments very short; anther-sacs linear-oblong. Ovary ovate, 3-celled, containing many ovules. Fruit a capsule; 3-ribbed, many seeded.

Notes.—Native to Mexico.

DAYLILY CHECK-LIST —ANNOUNCEMENT

The first draft of a Daylily Check-List was prepared by Dr. L. H. MacDaniels before he left for the Near East in 1943. The work of completing the Check-List has fallen on the shoulders of *Prof. J. B. S. Norton, 4922 40th. Place, Hyattsville, Maryland.*

Up to the present about 1000 daylily clones have been described in the literature and it is necessary to have an easily accessible check-list in order to obviate duplication of names. This list will be published in Herbertia as soon as completed.

All persons interested in the future of the daylily as a garden subject are requested to cooperate with Prof. Norton so as to make the check-list complete and thus of maximum usefulness. Daylily breeders and introducers should send to Prof. Norton, if complete information is not now accessible, a complete list of clones together with the following information—

(a) Date when the clone was first described in a recognized publication (book, periodical, trade catalog, mimeographed list, etc. All of these should be dated). Exact volume and page reference should be given, and date of publication. If possible copies of trade catalogs, mimeographed lists, etc., should be furnished.

(b) If a good illustration has been published of the clone, an exact reference to it should be furnished.

(c) If there are any other names, synonyms, for the clone, these should be indicated, together with exact references. If it has been confused with other clones this information should be included.

(d) The originator, and the introducer of the clone should be indicated.

Such information as indicated above will greatly assist Prof. Norton, and speed up the final checking of the list.—*Ed.*

REGIONAL DAYLILY TEST GARDENS

Prof. John V. Watkins,
University of Florida, Gainesville

Consistent with the policy of full collaboration with the five Regional Test Gardens, the University of Florida sent out twenty-nine different plants of Hemerocallis on November 4, 1944. These plants were all varieties which were originated by Dr. Hamilton P. Traub. In the past it has been the policy of the University of Florida to send three plants of each variety, but in order to disseminate the new originations as quickly as possible, it was necessary, this season, to limit each garden to a single division of each variety.

RATING OF HEMEROCALLIS

George Gilmer, *Virginia*

We need a good system for rating daylilies generally. The American Amarylis Society has published several times a list of ten or twelve best. To get on that list daylilies had to be *good* and *widely* distributed. The *excellent* daylilies with limited distribution had no chance. Judges were asked to list their ten favorites. They were rated according to the number of lists including the variety without regard to their position on the list. To illustrate, a variety named Cream might be at the bottom of one on thirty lists, and rated top. Pink Rose might be top on fifteen lists and yet not included in the ten best.

There should be a definite number assigned to each variety and those averaged to rate a variety, with only a tentative rating assigned to those receiving less than ten votes. Judges should be careful not to be unfair to any variety by rating an immature plant. It might be suggested that five to ten percent of a grower's best varieties be rated at 90 or better, and that those without sufficient quality to be replaced if destroyed should be rated at 65 or less. A rating of 65 or less would indicate that the plant should be discarded. Fair plants worth keeping because available from many commercial growers at low cost should be rated at 65 to 79, good plants 80 to 89, with outstanding plants 90 to 100. None but the best should be rated 95 or better. Such a system would accurately indicate what a grower might expect from a plant, although he might be personally inclined to rate it slightly above or below the average.

No rating system is perfect but a person could rely on such a system in buying plants that he had never seen and be satisfied with nine out of ten purchases. I found this true in regard to peonies and iris. Last Fall I bought twenty-four French lilacs based on a rating of the American Association of Botanical Gardens and Arboretums. I expect to be satisfied with at least twenty-two, possibly more.

I will be glad to assign numerical ratings to fifty or more varieties and send them in this year for tabulation. Some forty daylily enthusiasts could make a list of 50 to 200 varieties each. I doubt if a person growing less than fifty varieties would have enough experience to make reliable ratings of value to others. Ratings based on such a tabulation would be of big help to me in buying top quality plants. The preparation of such a rating schedule I believe would increase the interest of anyone who would take the trouble to prepare it. There are so many interesting details to be considered, durability, fragrance, color, shape, size of bloom, branching, etc., as well as season of bloom, foliage, vigor, etc.

Figure 123. Hybrid Daylily—Cherokee Maid (Introduced 1945 by J. Marion Shull)

CHEROKEE MAID DAYLILY

J. Marion Shull, *Maryland*

The following pedigree of the *Cherokee Maid* Daylily (Shull, 1944) may be of interest to other daylily breeders.

Hemerocallis serotina (Thunbergii) X *H. fulva Europa*

:

Iris Perry X *"Thulva"*

:

B-1 (Shull) X *Rajah*

:

Cherokee Maid

Cherokee Maid just full blown is a Van Dyke Red self according to Ridgway. The throat is a harmonious deep orange, with the eye zone not conspicuously darker than the petalage. Flower is of good size and form, petals ruffled edged and the sepals recurved at tips (Fig. 123).

The foliage is medium green, leaves broad and arching, the mass reaching a height of slightly more than two feet. Scape tall, to 52 inches, sinuously erect and sturdy with multiple compound branching and a maximum of 53 buds so far reported.

The outstanding characteristics are color novelty, a rich purplish bronze rather than red in mass effect, and the exceptionally large number of flowers per scape.

The color suffers some diminution of richness late in the day but does not burn as so many of the darker varieties do in prolonged hot sun. Nor does the color spot in rain as it does in many of the reds or other dark sorts. Best color is maintained, however, by growing in partial shade.

This is Seedling No. 42-26 referred to by Claar in HERBERTIA for 1942, page 30, as "A sort of raspberry purple."

HYBRID AMARYLLIS IN KANSAS

GARNALD D. ZEINER, *Kansas*

Hybrid *Amaryllis* that I have named include *Summer Rose, Giant Orange, Big Chief, Deceit,* and *Triple Trest.* These are described and registered elsewhere in this issue.

I have under test various named clones of the Mead Strain as grown by the Commercial Bulb Gardens, Orlando, Florida. *Garnet King* is an almost solid red and although not of the largest size it is satisfactory. *American Beauty* has not bloomed for me although I have had it over a year. *White Star* is the best that I have received from the Florida firm. The flowers are medium in size and are rose white stripe. With me the clone *Pink Tipped* is not tipped pink at all but what I call "frosted." The ground color is white and between the rose stripes the area can be best described by the word "frosted." *Exhibition* is a scarlet with a white stripe, small in size and fair form.

I have recently secured *Johnsonii,* apparently the first introduced hybrid *Amaryllis.* From Cecil Houdyshel I am to receive the clone *Sibyl Houdyshel,* and from W. E. Rice, *W. M. Campbell, Lady Helen* and *Zulu.* When these flower I will report further on my *Amaryllis* activities.

HYBRID CRINUM—EDMUND STURTEVANT

Cecil Houdyshel, *California*

I think it was the year 1914, my first year on this Rancho de las Flores, but it could have been a year or so later, that I was advertising Hybrid *Crinum J. C. Harvey* among other items, in the Los Angeles *Times*. One of the results was an inquiry from E. D. Sturtevant, a famed Water Lily specialist of Hollywood, then retired.

Mr. Sturtevant stated that the late J. C. Harvey had been a friend of his and he wished to purchase one of his Crinums. At once, I mailed him one of my finest bulbs, gratis and wrote to him. He replied, thanking me and invited me to visit him and see his own plants and bulbs.

This invitation was promptly taken advantage of. At his home I was met by a very tall, very feeble old man who wore a shawl over his shoulders. But the fires of an intelligent, keen mind and a spirit, that neither age nor physical weakness could daunt, showed from his eyes. Slowly he guided me around his garden, showed me his crinums and other bulbs, plants, greenhouses and the lovely large trees. He told me about his Water Lilies.

Most interesting to me were his crinums. He had a number of *Crinum asiaticum* and *C. Moorei.* Of the latter he had the variety "alba" and one he called "*platypetalum*" or "*platyphyllum.*"

The best of all was a hybrid which he had raised by crossing the two species, *C. asiaticum* x *C. Moorei.*

Although these species belonged to different sub-genera, *C. asiaticum* to Stenaster and *C. Moorei* to Codonocrinum, and are not very closely related and in the past, thought probably to be sexually incompatible, yet there can be little doubt that Sturtevant had actually crossed them.[1]

Three very logical reasons point to this conclusion. The statement of Mr. Sturtevant, a sincere and capable man. He apparently had no other species. The hybrid shows unmistakably the characters of both the Stenasters and Codonocrinums.

Mr. Sturtevant gave me a large bulb of his crinum. It is a good multiplier, but I must admit I have only a dozen bulbs after possessing it thirty years. Once I thought I would lose them all by way of mosaic.

It is unlikely that this crinum has ever been observed by any other amaryllid specialists and I doubt if any exists besides these I have.

I have named this Hybrid *Crinum Edmund Sturtevant* (Fig. 124) in honor of its originator Edmund D. Sturtevant. I hope sometime to introduce it because it is most worthy of cultivation and as a memorial to a most worthy man. May it become common in California gardens and perpetuate his name.

I will leave the botanical description of this to Dr. Traub at a later date. A popular description such as I would use in my catalog would be

[1] The question as to the self —or inter-fertility of the hybrid apparently remains to be answered —*Ed.*

as follows: "Bulb and plant quite large and similar in appearance to *C. asiaticum*. The bulb is long, with rather more slender neck than *C. asiaticum* and a more definitely expanded bulb. It increases by fission

Figure 124. Hybrid Crinum—Edmund Sturtevant (Introduced 1945 by Cecil Houdyshel)

like the seed parent as well as by offsets as in both parents. The flower is of outstanding beauty, 6 inches wide, delicate pink, and sometimes 30 or more in an umbel. The lanceolate petals are horizontal to ascending, not reflexing like *C. asiaticum.* It has a longer scape than *C. asiaticum* and thus the flowers are well above the foliage as in *C. Moorei.*"

I still have the individuals from the reciprocal cross from Mr. Sturtevant but they do not appear to be of horticultural importance.

As I hope that my esteemed friend, Ernest Braunton, may at a future date give us a brief biography of Mr. Sturtevant, as well as those of other California pioneer Amaryllid breeders like Harvey and Comperé, I will not attempt to do so.

WHITE AGAPANTHUS CLONE—FRANK McCOY

L. S. Hannibal, *California*

Some time back the writer obtained several species of *Agapanthus* with the thought in mind that there may be possibilities in hybridization within the genus, but he soon learned that climatic conditions were not entirely favorable in Concord, California, for seed rarely set. The cooler areas along the coast are more conducive to pollination than the dry inland temperatures of the central valleys. But in spite of his troubles, interest in the group did not die; in fact it was greatly stimulated when he learned that Mr. Giridlian had produced a hybrid *agapanthus clone.* Further search of the catalogues led to the discovery of the Australian hybrid *Intermedius* whose petals were pure white with a yellow keel. Then out of blue sky he received a note from Frank McCoy saying that he had a seedling plant with large white flowers. Since the white flowered plants that we knew were not larger than the usual blue *A. Orientalis (umbellatus),* our interest hit a new high. It sounded almost too good to be true.

This fall the writer had the opportunity to be in Santa Maria, and to stay at the beautiful inn that Mr. McCoy operates, a virtual paradise for flower lovers. And if anything, his reports regarding his *Agapanthus* had been very modest, for his collection consists of a great number of seedling plants, many of fine form and substance, but his whites are really exceptional.

His breeding experiments date back to the visit of Miss K. C. Stanford, of Stellenbosch. She sent him some seed of several wild clones that she had growing in her garden at Bloem Erf. The bees apparently had done a good job of cross pollination as no two seedlings were quite the same. Many turned out to be some shade of blue, but out of the mixture Mr. McCoy selected several fine white clones for propagation. One, a large vigorous plant which he carefully isolated into an inner court of the hotel, bears 12-inch umbels carrying 200-300 white blossoms. Each flower is 2 or more inches across, has relative wide segments, and yellow anthers.

In front of the inn several other large white clones are to be found, but in contrast to the one mentioned above these have black anthers—a condition which apparently is new to us as nothing could be found in the literature regarding black anthers. Both strains have foliage somewhat like that of *A. orientalis*, producing numerous leaves 1½ inches wide by

30 inches long, but a third type worth noting is very distinct as the leaves are only 14 inches long, and are over 2½ inches wide, being very blunt in the tip. All clones are of possible natural or garden hybrid source and any close identification is difficult, but it appears that Mr. McCoy has introduced material that is new to our gardens, and it should be of excellent value for breeding purposes.

The above described clones are not available at present for distribution, but to further activity in the breeding of giant white plants Mr. McCoy has turned over a number of unflowered seedlings to the society. These were grown from selfed seed taken from the giant white with the yellow anthers—A clone which now bears the official name of Frank McCoy. True, seedlings are seedlings, and only a part may prove up, but the society deeply appreciates receiving these plants. Given time and suitable breeding conditions it is apparent that much can be done. *Agapanthus* may possibly rival the daylily in California. The white flowers have particular value, for, during the summer when they are produced, few other white blossoms are available to the cut flower trade. Do you wonder why we are so enthusiastic?

AMARYLLID GENERA AND SPECIES

In this department the descriptions of amaryllid genera and species translated from foreign languages will be published from time to time so that these will be available to HERBERTIA readers.

GENUS HEMEROCALLIS

Hemerocallis Forrestii Diels, Notes Bot. Gard. Edinb. 5:298.1912

Plant 30-45 cm. high. Stem at the base densely surrounded by the fibrous remains of the former leaves. Leaves 20-35 cm. long, 1.3-1.7 cm. wide, obtusely acuminate. Corymb 8-10 flowered, the pedicels 1.5-2 cm. long, the bracts ovate or lanceolate. Flowers reddish-orange, inodorous, the tube short (1-1.5 cm. long), gradually enlarged to the limb, the outer segments oblanceolate, 5.5-6 cm. long, 1-1.5 cm. broad when dry, brownish especially toward apex, the inner equally long, broader, thinner.

Habitat: China, Yunnan Province.

Hemerocallis nana Forrest & Smith, Jour. Roy. Hort. Soc. XLII (I), fig. 12, 1916; Notes Bot. Gard. Edinb. 10:39.1917.

Plant 25-50 cm. high. Stem densely surrounded at base by the fibrous remains of former leaves. Leaves 8-12 cm. long, 4-6 mm. wide, linear, somewhat obtusely acuminate. Flowers solitary or paired, reddish-orange, the peduncle 4-12 cm. long, the pedicels about 1 cm. long, the bracts membranaceous, ovate or linear-lanceolate. Perianth 6 cm. long, more or less, the tube a little exceeding 1 cm., gradually enlarged into the limb; outer segments linear, about 5 cm. long, 4-5 mm. broad, reddish at apex, the inner a little shorter, very thin; immature fruit 1.5 cm. long and about 1 cm. wide when dry.

Habitat: China; Northwest Yunnan.

Hemerocallis esculenta Koidyumi, Bot. Mag. Tokyo, 39 :28.1925.

This species is to be compared with *Hemerocallis Thunbergii* Baker, but the perianth is pale reddish-yellow (not pale yellow), the perianth segments oblong (not narrowly oblong), all similar in form (not with the exterior lanceolate, acutish at apex), the tube shorter, the anthers broadly elliptic (not long-oblong), longitudinally white-striate at middle, the connective shorter; the root sometimes tuberous-inflated.

Scape glabrous, 70-90 cm. high, altogether naked, exceeding or sometimes subequalling the leaves. Leaves all basal, 8-13 to a plant, distichously arranged at the base of the scape, 20-90 cm. long, 8-10 mm. wide, linear, acuminate, entire, deep green. Corymbs 3-4-flowered, the bracts and bracteoles scarious, 10-20 mm. long, ovate or ovate-lanceolate, acuminate, the pedicels 10-24 mm. long, the flowers 9.5 cm. long, pale reddish-yellow, funnel-shaped; perianth tube cylindric 2-2.5 cm. long, the lobes 6, oblong, all similar in shape.

Habitat in alpine regions on Mt. Asamayama, Prov. Shinano, Japan, collected by Koidyumi, July 28, 1924.

Genus CYBISTETES Milne-Redhead & Schweickerdt

Jour. Linn. Soc. Lond. Bot. 52: 159-197. 1939

Bulb spheric-ovoid, tunicate, often conspicuously attenuate upwardly. Leaves falcate-ligulate, the 1 to 3 unimpaired young leaves rounded at apex, the older ones always truncate and lacking the apex, distichous, biflabellately disposed, mostly spreading or the younger appressed, gradually withering down to the apex of the bulb after a certain period of time, the same leaves growing again the next season from the base and forming new leaves, the same leaves probably persisting through several seasons, the margins mostly scarious, conspicuously erose. Scape lateral, compressed, solid. Umbel 13-24-flowered, the flowers manifestly serially (centripetally) expanded. Spathe valves 2, persistent, thin coriaceous. Bracts filiform, mostly broadened toward the apex, persistent. Pedicels more or less 3-angular, variable in length, very elongate in fruit, rigid and spreading in every direction. Flowers zygomorphic. Perianth tube often forming an angle with the pedicel, subcylindric, slightly broadened upwardly, obtusely angled. Perianth lobes subequal, very obtusely keeled, much longer than the tube, imbricate below anthesis, gradually spreading at apex, forming with the tube a funnel-shaped perianth, the outer lobes strongly hooded at apex, the interior broader and less hooded, more or less reddish in age. Stamens inserted in the throat of the perianth tube; filaments filiform, strongly exserted from the tube, declined, unequal, the inner a little longer than the outer; anthers linear-oblong, curved, dorsally attached a little below the middle of the connective, versatile. Ovary obtusely angled; ovules 8-18 in each cell, two-seriate, inserted all over the side of the placentae. Style filiform, 3-angled, well exserted, declined. Stigma entire, minutely 3-sulcate, papillose. Capsule indehiscent, club-shaped or fusiform-obovoid, 3-angled, strongly 6-ribbed, the persistent membrane between the ribs irregularly ruptured and withering, thus liberating the seeds. Seeds fleshy, pale ashy-green, subglobose or obtusely angled, often germinating in the capsule; embryo straight; endosperm copious.

Genus AMMOCHARIS Herb. emend. Milne-Redhead and Schweickerdt, Journ.

Linn. Soc. London. Bot. Vol. 52:159-197. 1939.

Bulb spheric-ovoid, tunicate, often conspicuously attenuate upwardly. Leaves falcate-strap-shaped to linear, the 1 to 3 unimpaired younger leaves rounded at apex, the older truncate and always lacking the apex, distichous, biflabellately disposed, mostly spreading or the younger appressed, gradually withering down to the apex of the bulb after a certain period of time, the same leaves growing again the next season from the base and forming new leaves, the same leaves probably persisting through several seasons, the margins mostly scarious, conspicuously erose. Scape lateral, compressed, solid. Umbel 1—many-flowered. Spathe valves 2, persistent, papery. Bracts filiform, mostly broadened toward apex, persistent. Pedicels more or less terete, variable in length, not elongating in fruit, the lower not delexed. Flowers actinomorphic. Perianth tube forming a straight line (not an angle) with the pedicel, narrowly cylindric, mostly obtusely angled, more or less broadened in the throat. Perianth lobes equal or the inner a little shorter and narrower, mostly much shorter than the tube or morely rarely longer, spreading, recurved or spirally revolute at apex, narrowly oblanceolate, obtushish, the outer strongly hooded, obtusely keeled, red or white, the color varying in age. Stamens slightly or strongly exserted from the perianth tube, affixed in the throat or near the mouth of the tube; filaments filiform, straight or more or less curved upwardly, subequal or the inner longer, regularly disposed, erect or more or less divergent, never declined, white to red; anthers linear-oblong, straight or curved, dorsifixed, attached at the middle or well below the middle of the connective, more or less versatile, yellow or pale; pollen pale yellow. Ovary obtusely angled; ovules 4-30 in each cell, biseriately disposed, inserted all over the side of the placentae. Style filiform, included or well exserted, sometimes the length varying with age, straight or at length more or less curved, the same color as the filaments. Stigma entire, minutely 3-sulcate, papillose. Capsule indehiscent, membranaceous, subglobose, finally irregularly ruptured, the pericarp not at all strongly ribbed, finally completely withdrawing from the pedicel. Seeds fleshy, pale green, subglobose or obtusely angled, often germinating in the capsule; embryo straight, endosperm copious.

GENUS STENOMESSON

Stenomesson Morrisonii Vargas, Nat. Hort. Mag. 22:132-135. fig. p. 133. 1943.

Bulb subglobose, produced into a robust neck up to 8 cm. long; leaves oblanceolate, up to 50 cm. long and 22.5 cm. broad, numerous, coetaneous;

peduncle solid, 35 cm. long, 8 mm. broad; flowers 3-11, umbellate, the pedicels thin, pendent, 3.5 cm. long; perigonium greenish white, 3.5-4 cm. long, funnel-shaped, narrow in the lower third, 12 mm. broad above, the cup bifid; stamens a little longer than the perigonium; style filiform, very much exserted.

REGISTRATION OF NEW AMARYLLID CLONES

Description of new clones of hybrid amaryllids for this section should reach the editor by June 1 if at all possible. Information sent after that date may be held over to the next issue if space is not available. This information is published to avoid duplication of names, and to provide a place for authentic recording of *brief* descriptions. Names should be as short as possible—*one word is sufficient.* It is suggested that in no case should more than two words be used.

At present there is a limit to the number of descriptions included from any one member. Not more than five brief descriptions of clones under each generic heading will be published free of charge from any one member in any issue of HERBERTIA. Additional descriptions will be published in the advertising section at regular ad rates. The first five descriptions will appear in this section and the excess will be continued in the section entitled, "Buyers Guide."

AGAPANTHUS CLONE

Introduced by Frank J. McCoy, Santa Maria, Calif.

Frank McCoy. Flowers large pure white, 2 or more inches in diameter across face, segments relatively wide, anthers yellow; umbel about 12 inches in diameter, with 200-300 flowers. An outstanding white clone selected from a large number of seedlings raised from seeds secured from Miss Kate Stanford of South Africa.

HYBRID CYRTANTHUS CLONES

Introduced by Mrs. J. Norman Henry, Gladwyne, Penna.

Rosalie. Near Coral Pink (Ridgway); pale pink with cream face and pale pink edge.

Moonlight. Baryta Yellow (Ridgway); creamy waxy yellow.

North Star. Pure white.

Delicious. Light Jasper Red (Ridgway); coral pink, white.

Bunker Hill. Coral Red (Ridgway); coral red, pale face.

HYBRID CRINUM CLONE

Introduced by Cecil Houdyshel, La Verne, Calif.

Edmund Sturtevant (Houdyshel, 1945). For description see article appearing elsewhere in this issue, and also Figure 124.

HYBRID DAYLILY (HEMEROCALLIS) CLONES

Trial Gardens. Cooperative daylily trial gardens have been established at (1) *Cornell University, Dept. of Floriculture, Ithaca, N. Y.;*

(2) *University of Florida, Dept. of Horticulture, Gainesville, Fla.,* (3) *Southwestern Louisiana Institute, Dept. of Horticulture, Lafayette, La.;* (4) *Whitnall Park Arboretum, Milwaukee City and County Park Board, Milwaukee, Wisc.;* (5) *Texas Agricultural Experiment Station, Dept. of Horticulture, College Station, Texas;* and (6) *Des Moines Park Board, Des Moines, Iowa.* [Complete addresses are given under *Officers and Committees,* below.]

Introducers should send complete collections of hybrids to these cooperating agencies in order that the new daylily clones may be impartially evaluated.

Introduced by Elmer A. Claar, Wilmette, Ill.

Chinese Lacquer. Height 3½ ft., reddish copper, July-Aug.; name suggested by Mrs. Marjorie Brooks.

Old Copper. Height 3½ ft., henna with red brown eyes fluted segments; very prolific and long blooming; selected and named by Mr. Ralph Schroeder; July-Aug.

Nimble Wit. Height 3 ft., overlapping orange red (fire red); star-shaped; July-Aug.

Little Cherub. Height 2½ ft., monochrome yellow, no green in throat; full clear yellow; flower 3½″ across; flower full, segments overlapping; June 10.

Little Imp. Height 2 ft., very small full black flower with orange throat; overlapping segments; multiflora type, 1¼″ across; August; named by Miss Shirley Gesme.

Note.—The following named clones were described in Mr. Claar's article in 1942 HERBERTIA to which the reader is referred.—*Prima, Twinkle Eye, So Big, Vladimir Horowitz, Cadet, Buddie,* and *Flamingo.*

Introduced by Ralph W. Wheeler, Winter Park, Florida.

Amherst. A large, somewhat irregular flower in purple and white, segments purple with milk white bands through the center. The 30 inch stems often have proliferations; flower well open; segments frilled which are sometimes twisted and sometimes recurved at the tips.

Ballet Girl. This pert flower is medium in size on 22 inch stems and intermediate in form; color is bright crimson, shading lighter to pink along the edges of both sepals and petals.

Robin Hood. A striking bicolor with brilliant carmine petals and sulfur sepals slightly dusted with carmine, the sulfur of the sepals blending into a vivid green throat. The flower is large, has full, roundly recurved petals which are frilled and creped. The 3 foot stems are multiflora and carry proliferations.

Tarrytown. This is a large, compact, roundly recurved flower with wide segments. The all over color is one of the deep wines, close to Claret of the Standard Color Card (S.2167), possibly a little more towards the purple. Vigorous, free blooming on 3 foot stems.

Victoria. A very large, handsomely colored flower of the finest form. A definite break in Hemerocallis, it opens with a flat face, shallow trumpet and circular effect, in the way of a fine Dutch Amaryllis. The segments are wide, beautifully fashioned and with uniform twists at the tips, enhancing the circular effect of the flower. The main color is Old Rose of the Standard Color Card (S.2183) and the deeper Eye Zone is Bacchus (O.2174), a violet sheen suffusing the entire flower. The stems are 4 feet and gracefully carry these unusually large flowers. A recurrent bloomer in Florida.

Introduced by J. Marion Shull, Chevy Chase, Maryland.

Cherokee Maid (Shull, 1945). For description see article appearing elsewhere in this issue, and also Figure 123.

Introduced by L. Ernest Plouf, Craemore Gardens, Lawrence, Mass.

September Red, 3½ ft. Sept., excellent and deep in red tone; inner segments very broad, deep fulvous-red, decidedly recurved at tips; outer segments slightly toned; bicolor effect from distance; 4″ well open flower; wide yellow throat; yellow midrib on inner; no deeper zone; distinct from multiflora-formed flowers.

Subtle Pleasure, pastel shade of soft rich fulvous-ecru; veined deeper; yellow throat olive-cast; inner segments decidedly crinkled yet good form and substance; keeps well late.

Twillo, rose chocolate on tips only; unusually wide flaring lemon throat extending high to tip-coloring, ending in spray-fashion; inner segments very spatulate, overlapping, round and blunt at tips; well and broadly open; not recurved; round outline; fine smooth form; outer segments paler than throat; small flower; distinct pattern.

Odakim, 3½ ft. July-Aug., wide gold throat; maroon blotch bisected on inner segments by midrib; inner segments crinkled and broader than outer; rest of flower brownish orange; large; good form and substance; good grower.

Pasha Boy, 3½ ft. July-Aug., bold 6″ flower; rich coloring; wide bright orange throat ending abruptly on outer segments; inner segments deep maroon—deeper at edge of throat with cream midrib; outer much paler; even firm form; well open; evenly recurved; keeps well late.

Introduced by Hamilton P. Traub, and J. S. Cooley.

Santa Lucia. Plant of medium height; very attractive in bud, outside of sepaline-segments before opening Chinese Yellow 606/1(R.H.S. Chart) in upper part changing to greenish-yellow in lower part, waxlike in appearance, and with a very small green spot at apex; open flowers of medium size, clear Buttercup Yellow 5/2(R.H.S. Chart), and with a very slight whitish-yellow halo; a recurrent bloomer in lower Salinas Valley.

Introduced by Prof. J. B. S. Norton, Hyattsville, Md.

Colonial. Height 2 ft., flower 4″ in diam., petaline-segments Honey Red, spot Hydrangea Red, sepaline-segments Mustard Yellow; late June to mid-July.

Ethel. Height 2 ft., flower 4″ in diam., petaline-segments Strontium Yellow to Wax Yellow, with zigzag line of pale vinaceous, sepaline-segments Strontium Yellow washed with pale vinaceous; late June to mid-July.

Havilah. Height 3 ft., flower 5″ in diam., throat wide, greenish; petaline-segments apricot yellow, sepaline-segments chrome orange; segments extra thick; late June to late July.

Introduced by E. J. Kraus, Chicago, Illinois.

Joanna Hutchins. Height 36 inches. Leaves erect, deep green, evergreen. Scape erect, 3 to 4 branched 30 to 40 flowered. Each flower points slightly upward, shed quickly after blooming. Flowers regular, clear pure orange with glistening sheen, diameter six inches, sepals and petals wide, reflexed. Texture smooth, thick, waxy. Odorless. Does not fade or wilt in bright sun. Season July 10 to August 20. Vigorous; rapid propagation. Seedling of J. S. Gayner X Midas selected 1938.

Hybrid Amaryllis Clones

Introduced by Garnald D. Zeiner, Lost Springs, Kansas.

Summer Rose. Eight-inch flower, rose with white stripe; fine form, wide segments.

Giant Orange. Medium size, orange with white stripe, fine form.

Big Chief. Seven-inch flower, solid red.

Deceit. Eight-inch flower, peculiar shade of rose with white stripe when flower first opens, but after a few days the color changes to scarlet.

Triple Trest. Six-inch flower, tri-color; outer edge of segments scarlet, next to outer edge the color is rose and with a white stripe in center.

RICKETT'S "THE CLASSIFICATION OF INFLORESCENCES"[1]

Hamilton P. Traub, *California*

In the last two issues of Herbertia (9(1942): 53.1943; 10(1943): 134.1944) the writer pointed out that the subject of the origin of the inflorescence in the Amaryllids was a promising field for research, and it is gratifying to have before us now a review of previous work in the whole field of the classification of inflorescences by an eminent authority at the New York Botanical Garden, Dr. H. W. Rickett, who emphasizes the need for much basic research in this field. The review is in two parts—an historical account, and a summary of present day theories including Dr. Rickett's stimulating views.

Dr. Rickett points out that legislation in this field—*attempts to compel the use of definitions of inflorescences*—would not be in the scientific tradition, and adopts as his guide the sound principle, "A rational terminology mirrors that upon which it is based—an understanding of the things concerned."

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[1] H. W. Rickett. The Classification of Inflorescences. Botanical Review 10:187-231. 1944. (Address: Botanical Review, Fordham P. O., New York City.)

In this very brief review no attempt will be made to touch on the historical part of Dr. Rickett's article, but the statements made will be confined to that portion concerning the contemporary theories of the inflorescence.

Dr. Rickett states that "we have a right to expect a statement of the fundamental nature of the inflorescence which should underlie any classification" and that the most satisfactory theory, that of Pilger, "begins with a large number of branches which remain simple but are condensed into a system by the disappearance of intervening leaves and shortening of internodes." The primitive inflorescence may have been a much branched system, but it may also be that the compound dichasium was derived from the basic unit the dichasium. Thus the fundamental unit of the inflorescence is indicated as the dichasium, "a cluster formed by the apparent dichotomy beneath a terminal flower." In its simplest form the dichasium consists of three flowers. The compound dichasium could be obtained by repetition of branching. The "clusters originally representing the primitive type have been combined and aggregated in a variety of ways with reduction and loss of intervening foliage, to form what Goebel has termed a synflorescence." The evolutionary steps are (a) "limitation of the individual dichasia to a few flowers, often two or one; (b) grouping of branches bearing leaves and terminated by dichasia on a common axis, a grouping which involves a shortening of the branches and of the internodes between them; and (c) reduction of the leaves and bracts."

As applied to the Amaryllidaceae, the monochasial systems as in *Hemerocallis* and *Allium,* "are easily derivable from a dichasium and, in fact, often begin in one."

In the conclusion, Dr. Rickett discusses the definitions of the various kinds of inflorescences, which are defined as flower-bearing branches or systems of branches. He claims that the definitions of the raceme, spike, corymb, umbel and capitule "are usually clear enough in current treatments." Definitions of the cincinnus or bostryx, cyme, thryse and panicle are given.

What is evidently needed is a complete text in English covering the subject on the order of Goebel's *Bluetenbildung und Sprossgestaltung.*[2] An American edition of this work revised and brought up-to-date would serve the immediate need. It may be that Dr. Frans Verdoorn will come to the rescue with a Chronica Botanica edition of Goebel's work in the English Language.

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[2] [Supplement 2 to Organographie der Pflanzen, ed. 3] i-vii, 1-242, figs. 1-219. 1931.

THE SYNFLORESCENCE OF AMARYLLIS HYBRIDS

A. B. Stout
The New York Botanical Garden

An examination of a considerable number of horticultural Amaryllis hybrids grown at The New York Botanical Garden revealed that the highest number of flowers on any scape was four. Two of these were primary flowers of the main axis of the scape and for them the disposition and sequence of development were undoubtedly those of a raceme. But of the two secondary flowers one was lateral to each of the primary flowers in a cymose relation. Thus there are two distinct branching systems in such a synflorescence. The primary inflorescence of two flowers is a monopodial determinate raceme. But each of its flowers and its own lateral form a sympodial helicoid cyme or bostryx. The entire group of flower branches is not only compound but heterogeneous in regard to the branching. The external features of these conditions are fully evident in a typical but relatively simple four-flowered synflorescence, a term applied by Goebel (2), such as that shown in Plate 268. In it, and in the diagram of it that is shown in 1 of Plate 269, the bracts, bracteoles, and flowers or pedicels are numbered in respect to their relative positions and the flowers are also numbered in sequence of anthesis. A description of this synflorescence follows.

There are two primary flowers (nos. 1 and 2) and for each there is a large bract that arises from the main axis. One of these flowers is the terminal of the main axis of the scape; the other is terminal for a lateral on this axis. On flower (1) matures first and it is larger than the other (2). Its bracteole is larger than that of the other flower (compare b1 with b2).

In various monocots which have synflorescences less compacted than those of Amaryllis hybrids the positions of the bracts indicate beyond any doubt that the primary branching is monopodial, determinate and racemose. When there are only two bracts one is entirely below the other and the flower in its axil is the first to mature (see diagram 6 in Plate 269). When there are more than two primary bracts the racemose development is often evident both in compacted synflorescences as in *Clivia* (5 in Plate 269) and in loosely branched compound heterogeneous inflorescences as in most species of *Hemerocallis* (4). But in Amaryllis hybrids the two primary bracts are much modified in growth, in position, and in symmetry which is associated with the development of the laterals to the primary flowers.

In the four-flowered synflorescence here illustrated (Plate 268 and no. 1 in Plate 269) the flower 1-1 is lateral on the axis of the primary flower 1. The internode constituting the peduncle of flower 1 is the section between bract B1 and the bracteole b1, and that of the flower 1-1 is between bracteole b1 and b1-1. These sections of the false axis of the bostryx are much compressed and interposed and each bracteole on this axis is spaced at 90° from the bract or bracteole below in an ascending spiral that is anti-clockwise as indicated in the diagram. This two-flowered unit is a helicoid cyme or bostryx. The two sections of its axis are compressed into thin plates, but the branching is definitely sympodial. The same structural relations exist for the flowers 2 and 2-1 and for their bracteoles, peduncles and pedicels which comprise another two-flowered bostryx.

The compression in vertical growth of the internode between bracts B1 and B2 and of the internodes representing the peduncles of the four flowers and their expansion in diameter result in an aggregate of nodes and internodes that may be called a *synnode.* Each enlarged bract (B1 and B2) encompasses a flower and its auxillary bostryx. Each is keeled in the line of the greatest diameter of the synnode and each has a wide lobe and a narrow one. The nodes at their origin in the stem are almost at the same level and the two bracts fully encircle the scape and the synnode. Their margins expand laterally and the adjacent margins of the two overlap from the base to the apex of an unopened spathe. The excentric growth in the base of each bostryx is such that the narrow lobe of a bract is always on the side of the lateral in the bostryx and the wide lobe of the other bract is interposed between it and its bracteole. Thus the bract that is outside in the overlap on one side of the spathe is the bract that is inside on the opposite side (see diagrams 1 to 4 in Plate 269). It would be of some interest and perhaps of significance to determine the extent of this modification in the synflorescences of the Amarylladaceae and their relatives.

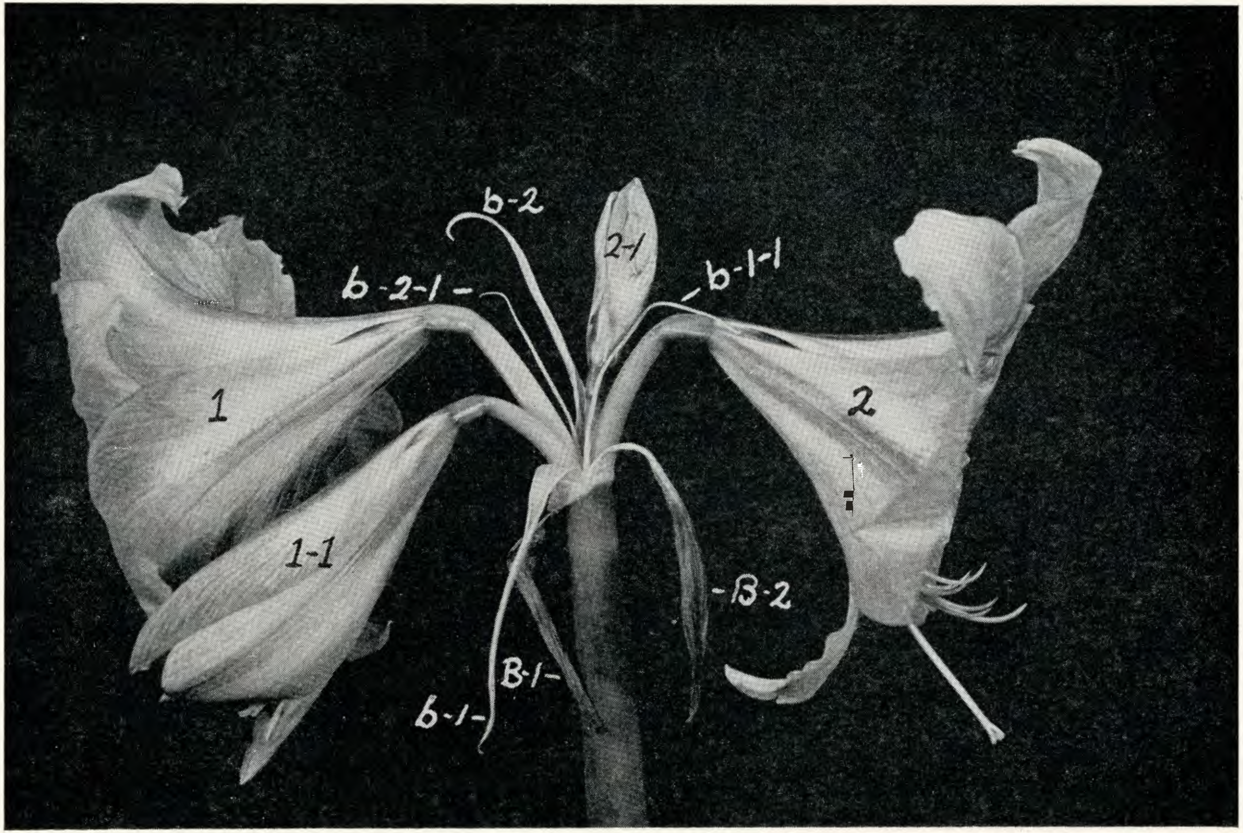
In the Amaryllis hybrids observed by the writer, three-flowered scapes bear one solitary primary flower. In two-flowered inflorescences both flowers are primary but a second bracteole often represents the position of the aborted false axis of the bostryx. The pedicels of the flowers arise at nearly the same level in the synnode and they are elongated. Though they differ in length and size, as do the flowers, according to sequence in development, the entire compound heterogeneous inflorescence simulates an umbel, and it is so designated in most taxonomic literature of *Amaryllis.*

It may be reported that an examination of the 8- to 17-flowered scapes of *"Clivia nobilis"* grown at The New York Botanical Garden in 1944 revealed that there were as many as four different helicoid cymes in a synflorescence and that the arrangement of these units was racemose. The stem of a scape at the level of the bracts was enlarged excentrically to a greater degree than in the Amaryllis hybrids, in response to the increase in the number of collateral primary and secondary branches. The number of flowers in a bostryx was as many as four and all of their peduncles were much compressed. A diagram of one of the synflorescences observed in *Clivia nobilis* is shown in 5 of Plate 269. There were four bracts and four bostryxes. In each of the lower two (nos. 1 and 2) the position of the bracts, bracteoles, and pedicels was quite regular. But in each of the third and fourth bostryxes the bract did not encompass its primary flower which stood well toward the center in the synnode of the entire synflorescence while its bract was more toward the outer border. For each bostryx there was a bract and for the base of each pedicel there was a bracteole. The four bracts of the primary raceme and each series of bracteoles all had a spiral spacing of approximately 90°.

According to Goebel (*1*) the true umbel, either simple or compound, is exclusively racemose, but there are cymose umbels with dichasial branching which superficially resemble true umbels. More recently Goebel (*2*) has emphasized that especially in monocots inflorescences which appear to be umbels may be composed of several different cymose inflorescences. For an example of this he illustrates an inflorescence of *Allium Suwarovii* and refers to the studies made by Weber (*6*). This investigator observed that there is little difference in the time of the maturity of the primary flowers, that within each unit inflorescence there is repeated cymose branching, and that the number and relative positions of the many branches are not always evident. Goebel recognizes that in the many-flowered and much-condensed synflorescences which surmount greatly thickened scapes (as in *Allium, Clivia,* etc.) the developments involve interpolations and displacements of stem elements and the elimination of bracteoles to the degree that the stem units below the pedicels are not distinct from one another. It may be added that these developments also obscure the disposition of the several units of a compound inflorescence which is heterogeneous in respect to branching.

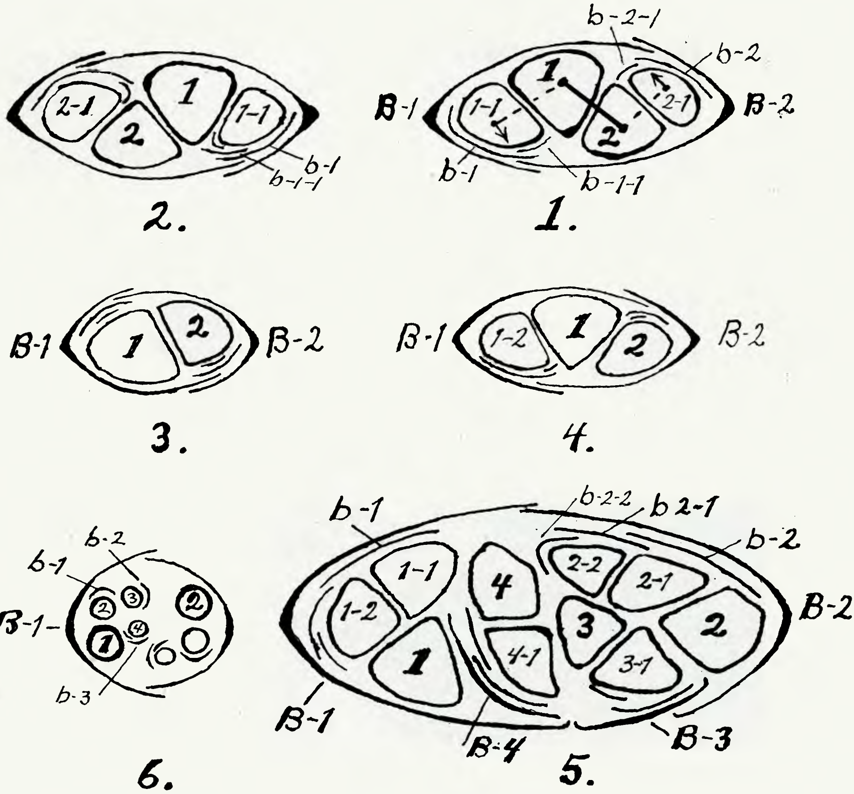
The character of the inflorescence, and especially the judgment as to whether it is a raceme or an umbel, has been the basis of rather important distinctions in evaluating the status and relationships of genera and of still larger groups of plants. In his evaluation of the Liliaceae and the Amaryllidaceae, Hutchinson (*3*) considers that the character of the inflorescence is more important than is the position of the ovary. In his revision of the Amaryllidaceae several new families were made by extractions largely on the view that of the legitimate members of this family the "most distinct and constant feature is the umbellate scapose inflorescence."

Frequently in discussions of taxonomy and phylogeny the reference to a racemose inflorescence actually refers to secondary branches that are helicoid cymes. Also many references to an umbel refer to synflorescences in which the basic or primary branching is racemose and the secondary branching is cymose. Usually an inflorescence of *Hemerocallis* is termed "racemose." But the extended secondary branches are helicoid cymes; the arrangement of the primary flowers of these bostryxes is, however, racemose. The sequence of the heterogeneous branching, primary and secondary, is the same as that in the Amaryllis hybrids. In the genus *Hemerocallis* (*4*) there is much diversity and specificity in such features as (a) degree of branching, (b) fusion of stem elements, (c) dichotomy, and (d) displacement of bracts and bracteoles. In one species (*H. nana*) there are only primary flowers in racemose development, and often scapes bear a single terminal flower whose axis has only one bracteole and one bract. For the species that have much-branched



A typical four-flowered heterogeneous synflorescence of an Amaryllis hybrid. The primary flowers 1 and 2 form a raceme. The flowers 1 and 1-1 form a helicoid cyme or bostryx; and the flowers 2 and 2-1 form another bostryx. For the arrangement and position of the bracts and bracteoles see diagram 1 in Plate 269.

Plate 268



Diagrams 1 to 4 inclusive are of inflorescences of Amaryllis hybrids. No. 1 is for the inflorescence shown in figure 1, and the numbering of the flowers, bracts and bracteoles is the same in both. In diagrams 1 and 4 the spiral disposition is counter clockwise; in 2 and 3 it is clockwise. In diagram 3 the two flowers are primary ones; in 4 there is a lateral (1-2) to only one (1) of the primaries.

Diagram 5 is of a compound heterogeneous synflorescence of **Clivia nobilis** in which there were four primary flowers (1 to 4) and bracts (B1 to B4). Each of these flowers was the first flower of a bostryx and each flower had a bracteole..

Diagram 6 is for an inflorescence of **Hemerocallis Middendorffii** which had only two primary flowers (1 and 2); the two bracts overlapped and one was entirely below the other. On the false axis above flower no. 1 there were three flowers; above flower no. 2 there were two flowers as indicated. Usually in **Hemerocallis** there is at least one small bracteole of the aborted end of the false axis and occasionally this is present in Amaryllis hybrids.

Plate 269

terminal inflorescences there are several secondary units each of which is an extended bostryx. In one species the two branching systems (*H. Middendorffii*) are condensed into a synflorescence.

A recent revision of the genus *Amaryllis (5)* includes species formerly called *Hippeastrum.* In the tentative key to the subgenera and species it is indicated that the number of flowers "per umbel" is different for certain species. For three species the number is *one;* for five species the number is 1-2; for two species the number is 2-6; and for seven species the number is 3-10. These differences suggest that there may be specificity either (a) in reduction to a single primary system of branching that is confined to a main axis or (b) in modifications which retain both the racemose and the helicoid cymose systems seen in the Amaryllis hybrids in horticultural culture. The ten-flowered inflorescenses may involve either (a) increase in the primary units of the raceme or (b) increase in the number of flowers per bostryx or (c) both of these conditions.

At any rate the term umbel is scarcely adequate for complete descriptions and critical comparisons. It needs further qualification in respect to what the branching is, especially when there is heterogeneous branching that includes both the monopodial raceme and the sympodial bostryx. The umbel is the expression of a habit of vegetative growth characterized by a differential repression of elongation in a series of internodes. In the Amaryllis hybrids this condition is localized in the apical internode of the scape and in the peduncles of the several flowers, secondary as well as primary, and racemose as well as cymose in development. To this condition the elongation of the pedicels which are next above is in sharp contrast as is also the greatly elongated and expanded internode which forms the scape below. These highly specialized features of vegetative growth are so fundamental that they may affect, and transform, and combine both a monopodial racemose branching and a sympodial cymose branching.

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[AMARYLLIDS; SAN FRANCISCO SCHOOLS, continued from page 44.]

We finally agreed that during normal times after the war, we could expect a number of students whose abilities would give promise of a scientific career. Such students could assist with breeding and cultural experiments and thus secure an introduction to plant science. If this work should lead to something of value in the field of plant breeding, we would accomplish two worth while ends.

Accordingly we are making as broad a collection as possible at this time and then we can begin to work with them as soon as we have a definite program of work. Our school is trying to obtain the back numbers of HERBERTIA and Mr. Silva has become a member of the Society so that we can keep up with current amaryllids activities.

That is all of the story that has any interest and I am sorry it is not more complete. I will take grateful advantage of your suggestion about writing to Mr. Huey. I already have some information regarding school gardens in other parts of the country but the more I have the fewer mistakes will be made.

With the best of regards, I remain,

yours sincerely,

Harry E. Nelson,
Division of Horticulture

3. CYTOLOGY, GENETICS AND BREEDING

PROBLEMS AND PROGRESS IN ONION BREEDING

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According to written records, the onion has always been one of the most popular of vegetables. Its culture and use date back to a very remote antiquity. According to Sturtevant, as reported by Hedrick (7), it is:

> One of the things for which the Israelites longed in the wilderness and complained about to Moses. * * * Onions were prohibited to the Egyptian priests, who abstained from most kinds of pulse, but they were not excluded from the altars of the gods. * * * They were introduced at private as well as public festivals and brought to the table. The onions of Egypt were mild and of an excellent flavor and were eaten raw as well as cooked by persons of all classes.

Vavilov (30) names the middle-Asiatic center, comprising northwestern India, all of Afghanistan, the Soviet Republics of Tajik and Uzbek, and western Tien Shan, as the primary place of origin of the commonly cultivated onion, *Allium cepa* L. As secondary centers of origin of this species he lists (1) the Near East, which includes inner Asia Minor, the whole of Transcaucasia, Persia (Iran), and the alpine Turkmen Republic, and (2) the Mediterraneon region. For the Japanese onion, *A. fistulosum,* which is cultivated extensively in the Orient, Vavilov gives the primary place of origin as the Chinese center, which comprises alpine central and western China and the adjacent lowlands.

From these centers of origin the onion has spread to all countries where the crop can be grown at some season of the year. Just when the cultivated onion was first introduced into North America is not known, but at present it is cultivated everywhere in this country, in home gardens, in market gardens, and as a truck crop. Immature onions are found on the markets everywhere at some season of the year and onion bulbs are found on most markets throughout the year. As a rule, onions are used by most families in comparatively small quantities, but fairly constantly, for seasoning, in salads, and as a main dish prepared in a variety of ways. The onion is especially suitable for dehydration. Onion salt is used extensively for seasoning catsup, chili sauce, soups, and sausage. Though the quantity of onions consumed per capita is not large, the total amount used gives this crop a commercially important place among the vegetables. The average onion acreage for the United States during the 10-year period 1931 to 1940 was about 130,000 acres with a production of about 15 million 100-pound sacks, giving a yearly return to the producers of approximately 12 million dollars.

Growers in every onion district meet with production difficulties. The crop is attacked by a number of very destructive insects and diseases, and these exact an enormous toll every year. For most of these problems satisfactory chemical control methods have not been developed, and the breeding of resistant varieties seems to be the only solution. Unfavorable weather conditions cause losses from sunburn, blast, and freezing. The use of inferior strains or varieties poorly adapted to the region may cause losses from bolting, doubling, or scallion formation.

Adaptation

The onion is very sensitive to its environment, therefore selections, especially for yield and time-of-maturity, should be made in the region where the new variety is to be grown. This is especially important in developing onion varieties for the far South. A variety that is early maturing at Bakersfield, Calif., or Charleston, S. C., may be late maturing in the lower Rio Grande Valley of Texas. At Bakersfield, Calif., the variety San Joaquin matures at about the same time as Crystal Wax, but in the lower Rio Grande Valley it matures too late to make a good bulb. As shown by Magruder and Allard (23) and Thompson and Smith (28), the adaptation of varieties to certain regions is determined largely by the conditions which affect bulbing, chiefly temperature and length-of-day. The minimum length-of-day necessary to cause bulbing varies with the different varieties but is affected by temperature. At favorable lengths-of-day, temperatures below 60° F. may inhibit bulb formation, whereas temperatures above 70° F. accelerate it. Any increase in temperature or length-of-day above the minimum will hasten maturity. In the South varieties such as Crystal Wax, Yellow Bermuda, Early Grano, and Creole are grown as a winter crop. During the short days of winter when the mean temperatures are fairly low these varieties make a large foliage development and bulbing does not occur until early spring when the days become longer and the weather warmer. During the long winter growing season a large plant is formed, and this usually insures the development of a large bulb in the spring. In the North it is almost impossible to secure good yields of these extra-early varieties by sowing seed directly in the fields. Even when thus seeded as early as possible the length-of-day necessary for bulbing of these early varieties has already passed the minimum. Also, before the plants are many weeks old the minimum temperature necessary for bulbing is reached, and the bulbing begins even though the plants are small, consequently only a few leaves and a small bulb are formed. Besides temperature and length-of-day, different regions vary in light intensity, relative humidity, rainfall, and other environmental factors, and all these exert a modifying effect on the development of certain characters. Thus a variety may do well in one district and be worthless in another, and a selection made in one part of the country may have little value elsewhere. For this reason selections for yield, time-of-maturity, and to a certain extent resistance to various diseases should be made in the region for which the new varieties are being developed.

The Use of Greenhouse Facilities

Though it is desirable to make bulb selections in the important onion regions the selfing and crossing necessary in a breeding program can be done where most convenient. In the national onion-breeding program much of the crossing and selfing work is done in the greenhouses at the Plant Industry Station, Beltsville, Md. As a rule, crossing and selfing can usually be conducted more satisfactorily in a greenhouse than in the open, especially under humid conditions, as the greenhouse environment is almost always satisfactory for pollination.

The chief difficulty in the greenhouse has always been the control of Botrytis rot. In the growing plant this rot starts on the outer scales of the sheath region and gradually works toward the center of the plant. Later on, the seed stems are attacked and may be completely girdled. The use of fungicides has never given satisfactory control. The best control has been secured by providing good aeration and keeping the foliage dry. When bulbs or transplanted seedlings are planted in the greenhouse bench they should be set on raised beds, and after the roots have become established water should be applied only to the furrows between the rows. The soil adjacent to the plant should be kept dry. When plants are grown in pots they are watered from below by use of saucers supplying water to the roots but keeping moisture from the surface soil. The seedstalks are as susceptible to Botrytis rot as the foliage. In the spring when the seed stalks are well developed, about the time the buds break the surrounding bracts, the leaves are stripped away until the seed stem is bare to its base. This may appear to be rather severe treatment, but it keeps the seed stalk dry and thus prevents infection; the flowers open normally; and heavy sets of seed are obtained.

The onion thrips *(Thrips tabaci* Lind) are also very destructive to the crop in the greenhouse, damaging the foliage and later the flower heads as they develop. Frequent applications of liquid sprays, such as tartar emetic and brown sugar, are required to keep the infestation within reasonable control. These control measures of necessity wet the plant and encourage the development of Botrytis rot. Fumigation with heavy dosages of calcium cyanide kills large numbers of exposed adults, but few or none of the larvae in the plant interstices. Recent tests by Floyd F. Smith and L. D. Goodhue, of the Bureau of Entomology and Plant Quarantine, and the author with aerosols containing DDT have indicated that this method of control is much more effective than any previously used and may go far toward solving the problem when DDT is commercially available. The results of this work have been published by Smith and Goodhue (27A) in the *Journal of Economic Entomology.*

The Use of Flies as Pollinators

At practically all places where onion breeding is under way flies are being grown or trapped to do the necessary pollinating. At Beltsville, Md., both house flies and blow flies are raised under controlled conditions. Flies do a better job of pollinating under cages than any other insects that have been tested. House flies are used in the greenhouse in early spring before blow flies can be trapped or raised out-of-doors. The method of raising house flies is that recommended by the National Association of Insecticide and Disinfectant Manufacturers, Inc., for growing test flies for evaluating liquid household insecticides. The rearing room is held at 80° to 85° F. and between 40 to 70 percent relative humidity. For growing the larvae a special culture medium is made of 400 grams of soft wheat bran (coarse) and 200 grams alfalfa meal. These are mixed together thoroughly. To this is then added a mixture of 16 cubic centimeters of malt extract, 10 grams of compressed yeast, and 900 to 1,000 cubic centimeters of water. This is then stirred into the bran-alfalfa to obtain a loose mixture and placed in the culture jars until they are about three-fourths full. The proportion of liquid to dry ingredients may be varied slightly to prevent mold growth.

Flies 4 and 5 days old oviposit readily on rolls of cotton impregnated with milk placed in petri dishes or other containers. Egg masses are readily removed from the cotton, and about 2,000 eggs are transferred from the moist cotton to each culture jar. This number of eggs will produce 1,500 to 1,800 flies. The number of eggs can be estimated volumetrically by gently shaking in water and allowing them to settle in a graduated tube. When settled, one-tenth cubic centimeter contains about 500 eggs. By the eighth or ninth day after preparation the larvae have usually migrated to the top inch of media and pupated. The pupae are separated from the medium by lifting off the top half-inch of the medium, loosening the exposed pupae, and then pouring the pupae with adhering particles of medium on a cafeteria tray. The mixture is placed in a fan blast until dry enough for the pupae and medium to separate readily in a stream of air. Funnels or other equipment may be used to help in the separation. The pupae must be handled gently to avoid injury.

If the flies are to be used for pollination just as soon as they emerge the pupae can be held in cotton-stoppered bottles and then placed into the pollination cages as soon as the adults begin to emerge. If the flies are to be held for a few days they should be placed in screen cages. Each cage is supplied with a dish containing a 1:1 milk-water mixture. A small ball of cotton will provide a good feeding area. Forty percent formaldehyde solution added to the diluted milk at the rate of 1:1,500 delays souring of milk for several hours. Satisfactory food must be available to the flies at all times.

During the first warm days of spring blow flies can be trapped in large numbers in the open. Fish heads and chicken entrails have made very attractive bait. Trapped flies can no longer be used when there is danger of contamination from onions flowering in the home garden. Blow flies are then grown under controlled conditions, as described by Jones and Emsweller (13). Lungs of beef, upon which the adult blow flies lay their eggs, are exposed in the open. The lungs are placed under a roof to provide protection from high temperature and rain which might kill many of the larvae. In most places it is necessary to screen the meat to protect it from predatory meat-eating birds and animals. Within a few days the eggs hatch and the maggots begin to feed. When mature they begin to wander about to find a place to pupate. As they leave the meat they are trapped in buckets partly filled with screened sand. Once a day the pail is removed and replaced by another so that each container will have larvae of approximately the same age. The larvae soon burrow into the sand to pupate, and later the pupae are separated from the sand by screening. The pupae are held at room temperature in bottles or paper bags until the flies start to emerge. The pupae are then placed in the cloth pollination cages or in small screen cages. The latter are about 6 inches by 6 inches and have a cone-shaped top, at the apex of which is a small opening closed by a cork. As the flies emerge they gradually move up into the cone. When adding flies to the pollination cages the cone is inserted into the lower end of the cloth cage, the cork is removed, and as many flies as needed are allowed to escape (Plate 270). The number of flies admitted depends upon the number of flowers to be pollinated. The flies in the pollination cages need to be replenished every 4 or 5 days, especially during hot weather.

Inbreeding

In the onion, selfing or inbreeding, accomplished when a plant is self-pollinated, is not an end in itself but merely one of the tools used in the breeding program. Inbreeding in the onion is almost always accompanied by a loss of vigor for a number of generations. However, it permits many undesirable characters that have been carried along in the germ plasm to express themselves so that the lines possessing them can be rogued out. The main purpose of inbreeding is to develop lines that will breed true for certain characters. Unquestionably the production of hybrid-seed is going to play an increasingly important role in onion production. As inbred lines are used almost exclusively for the production of hybrid seed, the need for developing selfed lines that possess certain outstanding characteristics will become increasingly important.

Selfing is accomplished in the onion by enclosing the flower heads of a plant to prevent contamination with foreign pollen. Formerly single inflorescences were covered with 1-pound manila paper bags. Then once or twice each day, when the pollen was dry, the bags were tapped rather vigorously to help circulate the pollen within. As a rule, the amount of seed obtained by this method is rather small. Much larger quantities can be secured by enclosing one or more flower heads under a cloth cage and introducing flies to do the pollinating.

Jones and Davis (12) reported on the effects of inbreeding for six varieties of onions that had been inbred from one to six generations. Some years certain inbred lines yielded as much as the commercial parent, but, in general, the weight became less as inbreeding was continued. Usually the loss in weight was greatest in the first generation of inbreeding. Many inbred lines of onions were isolated that were superior to the commercial parent in many characters except for vigor. Certain inbred lines were less inclined to bolt, had better keeping quality, and were more uniform in size, shape, color, and time of maturity.

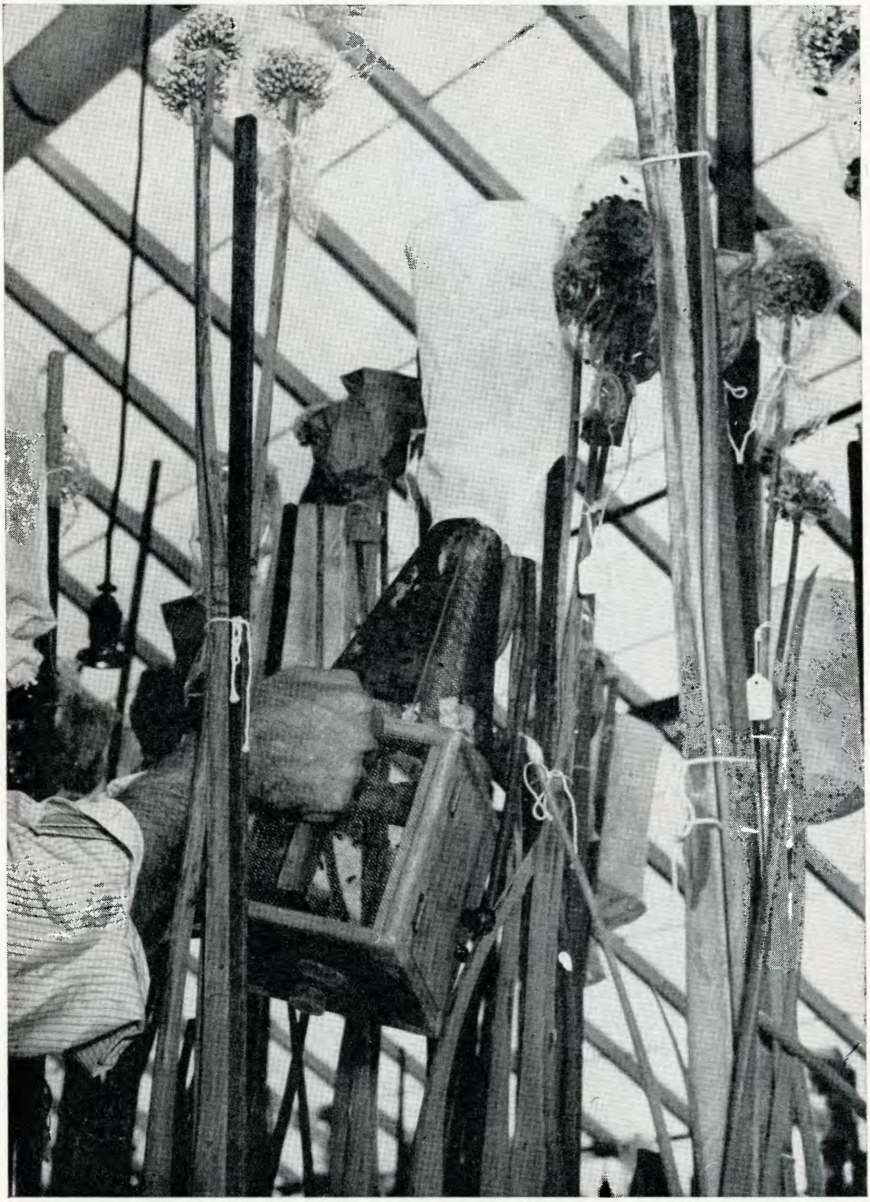
The results indicate that the probability of developing good high-yielding commercial lines by inbreeding are remote, but superior lines can be isolated for hybridization purposes.

It is possible, nevertheless, occasionally to isolate inbred lines that are sufficiently outstanding to make a place for themselves in commercial competition. Red 21 is such a variety. This variety, released by the California Agricultural Experiment Station in 1935, is an inbred line of California Early Red. In 1924 a bulb selected from a lot of California Early Red, grown at Davis, Calif., was given the pedigree number 21-22. In 1925 this plant was selfed and in 1926 the progeny was grown. A bulb selected from this progeny lot, pedigree number 21-22-1, was grown and selfed in 1927, and its progeny was grown in 1928. The best bulbs were massed, and a supply of seed—Red 21—was secured for trial. Repeatedly in several districts of California, Red 21 proved much superior to commercial stocks of California Early Red. It matured somewhat earlier, was more uniform in size, shape, color, and time-of-maturity, and kept better in storage than the older strains of this variety. Thus it is sometimes possible to develop commercially acceptable varieties by inbreeding. The yielding ability of this strain has not been compared with that of the older strains of California Early Red because seed of the latter has not been available for some time; no doubt some vigor was lost in the two generations of inbreeding. Though it is possible occasionally to obtain inbred lines with sufficient vigor to make good commercial onions, methods of improvement must be adopted that increase rather than decrease yields.

Inbreeding, however, becomes an integral part of a program for the production of hybrid seed. As a rule, most lines are fairly uniform after two generations of inbreeding, but if inbreeding is continued most of the lines become rather weak and difficult to propagate. After about two generations of inbreeding the plants within a line can be massed to prevent further loss of vigor. Certain lines, however, become fairly uniform after five or six generations of inbreeding.

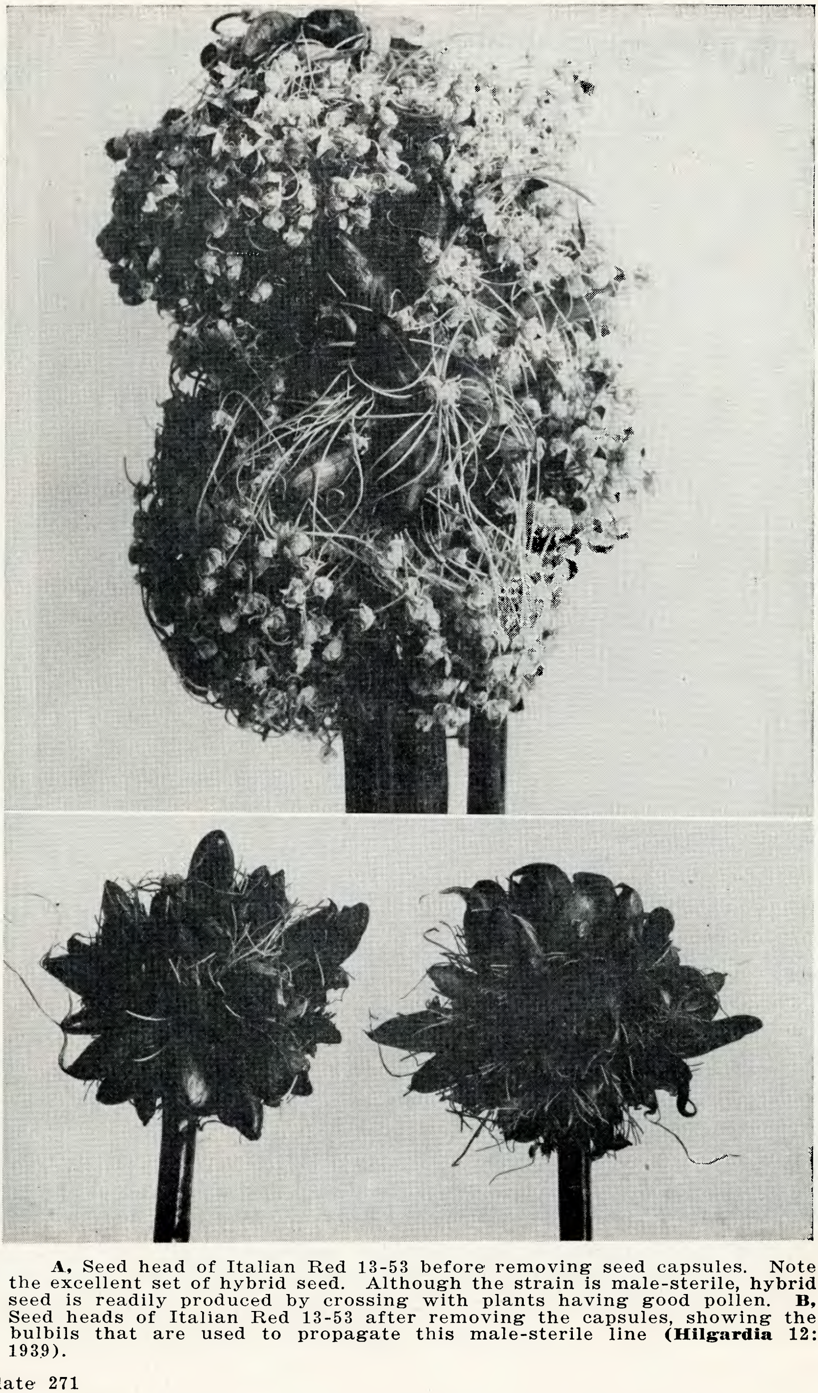
Crossing

When new characters are to be incorporated in a variety, a breeder must resort to crossing. At first only a few flowers in an umbel open daily, but the number increases until full bloom, when 50 or more may open in a single day. During this early period the open flowers are removed several times daily from the umbel of the female parent. When the weather is hot they must be removed often because anthers shed their pollen very soon after the flower opens. When blossoming is at or near its peak open flowers are no longer removed but are emasculated and used for crossing. Umbels must be examined frequently and the anthers



Method of introducing flies into small cloth pollination cages. The cages are made of cheesecloth stretched over wire frames and tied at both ends. These cloth cages are used for both crossing and selfing.

Plate 270



A, Seed head of Italian Red 13-53 before removing seed capsules. Note the excellent set of hybrid seed. Although the strain is male-sterile, **hybrid** seed is readily produced by crossing with plants having good pollen. **B,** Seed heads of Italian Red 13-53 after removing the capsules, showing the bulbils that are used to propagate this male-sterile line **(Hilgardia** 12: 1939).

Plate 271

removed from the open flowers before pollen is shed. When 50 to 75 flowers have been emasculated the remaining buds of the inflorescence are removed. The emasculated and disbudded umbel is then enclosed under a small cheesecloth cage, as is shown in Plate 270. The inflorescence of the male or pollen parent is cut off and enclosed within the same cage with the base of the stalk standing in a bottle of water. When handled in this manner the flowers continue to open and shed pollen for a week or more. In greenhouses the pollen parents can be grown in pots, and these can be moved freely from place to place, so that the inflorescences need not be cut off. Flies are used as pollinators.

Breeding for Resistance to Thrips

Thrips are present wherever onions are grown. It is estimated that they cause more loss than all other insect pests and diseases combined. Chemical control in the field has thus far been unsatisfactory, and this necessitates a different mode of attack. Jones, Bailey, and Emsweller (9) showed that certain varieties of onions have definite resistance to thrips, White Persian being the most resistant. The resistance of this variety seems to be determined by certain growth characters which help to hold the thrips population to a minimum and perhaps by anatomical and physiological characters which help the plant to withstand injury. The shape of the leaves is probably of importance in restricting the thrips population. In most onion varieties the leaf blades have a flat side; in opposite leaves these sides are face to face, and the young leaves are closely pressed together so that the environment may be more favorable for the larvae and they may have greater protection against insect enemies and adverse weather conditions. In White Persian the leaves are almost circular in cross section, and this protection is thus reduced. The wide angle between the two innermost leaves, especially in the young plant, is another White Persian character that helps restrict the thrips population by further reducing their protection. Another character that may be of some importance is the vertical distance between the leaf blades, each new leaf extending farther beyond the one encircling it than in other known cultivated varieties. If commercial varieties had these leaf characters the thrips population per plant would be reduced to a minimum, and it would be possible to secure more efficient control by spraying and dusting.

Peterson and Haber (24) showed that the nearly mature leaves of White Persian had a thicker epidermis than either Sweet Spanish or Scott County Globe. They suggest that a thick epidermis probably reduces thrips damage by offering greater mechanical resistance to puncturing and by limiting the depth to which the thrips stylets can penetrate the leaf tissue. Migrating adults probably do not remain on such plants because the food supply is not easily available. The thickness of the epidermis on young center leaves of resistant plants may be no greater than on mature leaves of the susceptible plants. Thus a small portion of the total leaf area of a resistant plant may be as vulnerable to attack as a susceptible plant. However, in these young leaves the cells are enlarging rapidly and soon attain what might be termed protective proportions.

The White Persian and a strain selected from Australian Brown have glossy foliage and glossy seed stalks. In field tests the glossy plants show considerable resistance to injury by thrips, consequently this character is being used in breeding for thrips resistance (9).

The development of thrips-resistant varieties has been a major cooperative project for a number of years between the United States Department of Agriculture and experiment stations in a number of States, and as a result varieties much more resistant than our present commercial varieties will soon be available.

Breeding for Resistance to Various Diseases

Downy mildew. The onion downy mildew (*Peronospora destructor* (Berk.) Casp.) is practically world-wide in distribution. Though sporadic in occurrence it is probably the most destructive disease of onions in the United States. In the North, damage is chiefly to the bulb crop. On the West Coast it is particularly serious on the crop grown for seed. Primarily because of mildew a large part of the onion seed acreage has been shifted from the West Coast to other areas less subject to this disease. No entirely satisfactory control method by the use of fungicides has been developed. Apparently the only satisfactory means of control will be the use of resistant varieties. Jones, Porter, and Leach (15) report that the male-sterile Italian Red 13-53 is the best parent isolated to date for the breeding of mildew-resistant onions. It has a high degree of foliage resistance in field plantings, the amount of injury being negligible. Infection on this selection is usually confined to the tips of the leaves, and growth of the fungus toward the base is exceedingly slow. The seed stalks of Italian Red 13-53, however, are immune, lesions have never been found even during the most severe epidemics. The high resistance of Italian Red 13-53 is being bred into a number of the important commercial varieties, and definite progress is being made. Most of the populations are being tested at Milpitas, Calif., where mildew appears in epidemic form every year.

Pink root. Pink root of onions, caused by the fungus *Phoma terrestris* Hansen, is a major disease in most of the onion-growing districts of the United States. As the organism lives and multiplies in the soil, chemical control is not practicable, and again the use of resistant varieties seems to be the only permanent solution. Early Grano is one of our most susceptible varieties. Felix (5) reported that the Winterhecke and White Welsh varieties of *Allium fistulosum*, as well as different strains of Nebuka, are resistant to pink root. Yellow Bermuda is also fairly resistant. Porter and Jones (25), working in California, found that Sweet Spanish was slightly resistant and that certain selections from this variety were able to produce fair crops on highly infected soil. A highly resistant selection called Spanish 2 was released by the California Agricultural Experiment Station in 1939. This selection and resistant bulbs from various other sources are being used to develop resistant varieties.

Smut. Onion smut (*Urocystis cepulae* Frost) is widely distributed and is of considerable economic importance in the northern onion-growing sections of the United States. Only in the seedling stage is the host susceptible to attack. Onion smut in commercial fields is controlled by applying formaldehyde in the row at the time of seeding. Nevertheless the development of resistant varieties would be of value since their use would eliminate considerable labor and expense. Anderson (1) tested 54 varieties of cultivated onions, and since none of these showed any marked resistance to the disease it appeared probable that all commercial varieties of *Allium cepa* are susceptible. However, in a test of 39 other species of *Allium* 8 did appear to be immune. The description of one of these suggests that it belongs to *A. fistulosum.* Felix (5) also found that the Nebuka type of *A. fistulosum* was highly resistant to smut. Fortunately *A. cepa* and *A. fistulosum* cross fairly readily, and hybrids of these species have been obtained by Emsweller and Jones (4), Levan (17), and Maeda (22). *A. fistulosum* is then a source of smut resistance that may be bred into commercial varieties of onions. Unfortunately, these hybrids have been highly self-sterile. Data presented by Walker, Jones, and Clarke (33) show that the F_1 hybrid is somewhat resistant to smut. Though the F_1 hybrid is highly self-sterile it usually has sufficient good pollen so that a fair set of seed is secured when the hybrid, used as the pollen parent, is crossed again with *A. cepa.* Unfortunately, these backcross plants have given as high a percentage of smutted plants as the *A. cepa* varieties. Since this backcross method has not thus far been very successful other methods are being tried. An amphidiploid resulting from the cross *A. cepa* x *A. fistulosum* has been successfully crossed with the two parents and with their diploid hybrid. Autotetraploids have been successfully crossed with the amphidiploid. Work is being continued with all this material in an attempt to get smut-resistant commercial varieties.

Purple blotch. Purple blotch, caused by the fungus *Alternaria Porri* (Ell.) Cif., is fairly widespread and may cause considerable damage to both the bulb and seed crop. The Italian Red 13-53 selection is somewhat resistant to purple blotch and is being used as a source of resistance in the breeding program. The variety Red Creole is reported by Riollano (27) as showing considerable resistance to this disease and may be one of the chief reasons why this variety has been cultivated so successfully in the humid regions of the South.

Yellow dwarf. Yellow dwarf is a virus disease of the onion that causes a characteristic yellowing, wrinkling, twisting, and drooping of the leaves and dwarfing of the plant. In a field test of 34 varieties Henderson (8) found that Sweet Spanish was the only variety showing marked resistance. Plants of this variety did not contract the disease when inoculated artificially and furthermore did not carry the disease in a masked form. Breeding work is under way to incorporate resistance to yellow dwarf in other varieties.

Smudge. A number of investigators have shown that colored onion bulbs are much more resistant than white to the smudge organism

(*Colletotrichum circinans* (Berk.) Vogl.). The factors responsible for resistance have been given considerable study during recent years chiefly with the hope of developing resistant white varieties.

In a series of studies by Walker and his associates (19, 20, 21, 31, 32, 34, 35) it was shown that a water-soluble substance extracted from pigmented scales was toxic to the smudge organism and that this substance was not found in unpigmented scales. Moreover, these studies showed that certain volatile substances present in onions were toxic, killing ungerminated spores and checking the growth of the mycelium.

The genetic factors responsible for color in the onion were first described by Rieman (26) who demonstrated the occurrence of two kinds of factors for white, one a dominant inhibitor and the other a recessive white factor. Later Clarke, Jones, and Little (3) confirmed these results, but showed that the factors differentiating red and yellow pigments were not allelomorphic with the recessive white factor, as postulated by Rieman. The dominant allele *C* is necessary for color development. A variety of onion homozygous for red has the genotype *ii CC RR;* for yellow, *ii CC rr;* and for recessive white, *ii cc RR, ii cc Rr,* or *ii cc rr.* The *I* gene is incompletely dominant in the heterozygous condition, but all bulbs homozygous for *II* are white.

Though it has been known for a long time that colored bulbs are more resistant than white bulbs to the smudge organism, it has not been definitely known whether bulbs heterozygous for the *I* gene are more resistant to smudge than the homozygous whites. In six different crosses Jones and others (16) showed that *Ii* bulbs were more resistant than the *II* bulbs to smudge. These crosses showed also that the heterozygous bulbs *Ii* are approximately intermediate between the two homozygous types in susceptibility.

The fact that heterozygous cream bulbs are approximately intermediate in resistance between the pure white and colored bulbs is important from the standpoint of breeding. It would be highly desirable to obtain varieties of white onions that are resistant to smudge, but if resistance is inevitably associated with the presence of pigment it would be difficult if not impossible to attain such an objective. However, cream bulbs with the genetic constitution *Ii,* though containing some pigment, might be as acceptable as pure white bulbs for certain purposes. The increase in resistance to smudge would probably more than compensate for the sacrifice in color purity. Although it would be impossible to obtain true-breeding strains with the constitution *Ii,* the production of onions with this constitution would be very simple. This could be accomplished through the use of male-sterile strains.

Polyploidy

Jones and Clarke (10) found a natural amphidiploid among their crosses between *Allium cepa* (var. Australian Brown) and *A. fistulosum* (type Nebuka). This amphidiploid shows greater vigor than either parent, as evidenced by increased height, larger stomata, larger flowers, larger pollen grains, heavier seeds, and more rapid growth of seedlings.

The amphidiploid is highly fertile, whereas the diploid hybrid is sterile. Walker, Jones, and Clarke (33) have shown that this amphidiploid is also highly resistant to smut. The amphidiploid behaves as a perennial, although some bulbing does occur. Another natural amphidiploid, from the cross White Portugal x Nebuka, has been obtained at Beltsville, Md. This also shows greatly increased vigor. Because of greatly increased vigor and high resistance to smut an amphidiploid would seem to have

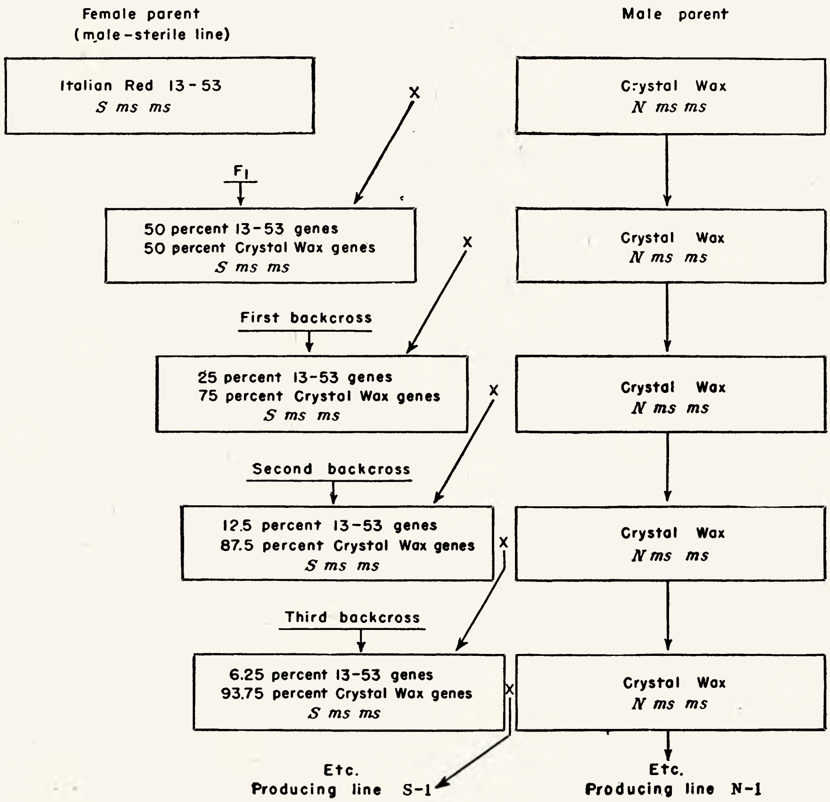


Figure 125. Method of developing male-sterile lines of **Crystal Wax** from **Italian Red** 13-53, showing the rate at which **Crystal Wax** genes are incorporated into the male-sterile line by backcrossing. From USDA Tech. Bull. 874.)

great possibilities as a green bunch onion. Though the above amphidiploids appeared spontaneously, it is not expedient to depend on this method of origin. After seed of the species cross has been secured, doubling can be produced by use of colchicine.

Toole and Clarke (29) secured autotetraploids in both *Allium cepa* and *A. fistulosum* by treating germinating seeds with 0.1 and 0.5 percent aqueous solution of colchicine for 3 hours. Less killing occurred in the 0.1 percent treatment. The killing was also less when the treatment was applied while the roots were less than 0.5 millimeter long. According to these authors the very young seedling stage seems to be the appropriate time for treatment in order to get colchicine into the meristematic tissue of the growing point of the stem. The stem plate is located just above the tip of the radicle and is carried outside the seed coat with the radicle when the latter is only a few millimeters long. At this early stage the meristematic cells of the stem tip are protected only by the cotyledon. As the seedling develops true leaves are differentiated from the stem plate, the growing point becomes more and more deeply embedded, and it becomes increasingly difficult to get the colchicine into contact with the growing tip.

Onion Hybrids

Utilization of hybrid vigor in the onion has created considerable interest and has far-reaching possibilities. The historical and technical details of hybrid onion development are of as great interest to plant breeders as the results have proved to be to laymen. Jones and Davis (12) some years ago obtained very productive hybrids by crossing suitable inbred lines of onions. A cross between Stockton Yellow and Italian Red produced hybrid bulbs more than three times as heavy as either parent. Hybrids of Giant White Italian Tripoli x Red 21, Italian Red x Stockton Yellow Globe, and Italian Red x Italian Red gave highly significant increases in yield when compared with their inbred parents. The results showed great inherent possibilities in the use of hybrid seed for crop production. To get hybrid seed of these varieties it was then necessary to emasculate one of the parents. In the onion the male and female parts are in the same flower, and emasculation is not easily performed as it is in corn where this operation consists merely in removing the tassel. Production of hybrid seed in the onion would not be practicable on a commercial scale if emasculation were necessary. If onion plants are available with impotent pollen these plants are solely female as far as breeding is concerned, and emasculation is not necessary. A plant of this nature was found in the breeding plots at Davis, Calif., in 1924, in the variety Italian Red and was described in some detail by Jones and Emsweller (14). The pedigree designation of this plant was Italian Red 13-53. The plant flowered profusely, failed to set seed when self-pollinated, but set seed in abundance when cross-pollinated (Plate 271-A). Because of self-sterility this selection cannot be carried along as a selfed line, but fortunately it usually produces large quantities of head sets or bulbils (Plate 271-B), so it has been carried along since 1924 as a clonal line. In California the small sets produced in the flower head are planted in early fall, and large bulbs are produced the following summer, maturing in late June or July. These large bulbs are stored for a time, then planted in the field in alternate blocks with a desirable pollen parent. Insects do the pollinating, and all the seed produced on Italian Red 13-53 is hybrid seed.

A large number of varieties and inbred lines have been crossed with Italian Red 13-53, but only one of the hybrids has so far been introduced —a cross between Italian Red 13-53 and Lord Howe Island. This hybrid was introduced cooperatively by the California Agricultural Experiment Station and the United States Department of Agriculture and has been named California Hybrid Red No. 1.

The clonal line Italian Red 13-53 does have certain limitations as a female parent in the production of hybrid seed. It keeps poorly in storage, and this character to a certain degree is exhibited in the hybrids. Its use confines production to red varieties, and the demand for these is

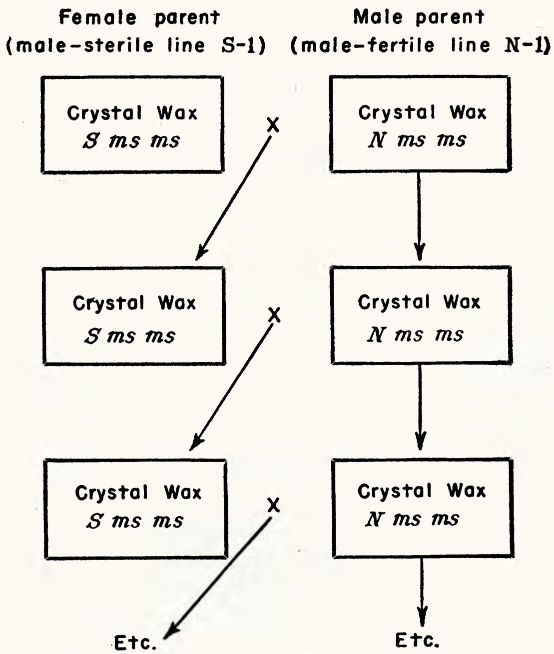


Figure 126. Method of seed perpetuation of a male-sterile line of the variety Crystal Wax. (From USDA Tech. Bull. 874.)

usually rather limited. Being male-sterile, this line cannot be inbred to obtain greater uniformity. Even though inbreds are used as pollen parents in combination with 13-53 the progenies are not as uniform as when both parents are inbreds. The danger of contracting and disseminating the yellow dwarf virus through clonal propagation is ever present. If the mother bulb is infected all the bulbils will also be infected, and these, in turn, may be planted and grown for some time without the disease being recognized.

Despite these difficulties, Italian Red 13-53 is probably destined to be the most important single-bulb selection ever made. As previously stated, it is being used in breeding for resistance to downy mildew and purple blotch. As a clonal line it is itself being used in the production of hybrid seed, and its male-sterile character has now been transferred to most of the important commercial varieties.

Ever since the discovery of the male-sterile Italian Red 13-53, its limitations when used as a clonal line in the production of hybrid seed has been recognized. Studies have been under way for some time to determine the mode of inheritance of the male-sterile character to determine if it could be incorporated into other varieties and therefore used more widely in the production of hybrid seed.

Inheritance of Male Sterility

Jones and Clark (11) showed that when male-sterile plants of the clonal line 13-53 were crossed with various male-fertile plants three types of breeding behavior were observed in the F_1 generation, some progenies being entirely male-fertile, others entirely male-sterile, whereas still others produced both male-sterile and male-fertile plants in a 1 : 1 ratio.

When a male fertile F_1 plant is selfed the F_2 approximates the ratio 3 normal : 1 male-sterile. When a male-sterile F_1 is backcrossed to the male-fertile parent three types of segregation are obtained as in the F_1 progenies. When the 13-53 male-sterile parent is backcrossed with an F_1 male-fertile plant a 1 : 1 segregation is obtained. In crosses between certain F_1 male-fertile plants used as the female parent and the male-fertile parent line a ratio of 1 male-fertile to 1 male-sterile is obtained. But in the reciprocal backcross when the F_1 male-fertile plant is used as the pollen parent all the progeny are male-fertile.

These results may be accounted for by assuming that the male-sterile condition results from an interaction between a nuclear recessive gene and a non-nuclear or cytoplasmic factor. On this hypothesis it is assumed that there are two types of cytoplasm. All plants with normal cytoplasm (N) produce viable pollen. All male-sterile plants possess the sterile type of cytoplasm (S). The experimental results throw no light on the nature of the non-nuclear or cytoplasmic factor which differs in the two types. A recessive gene for male-sterility *(ms)* also influences pollen development when carried by plants with *S* cytoplasm but has no effect when carried by plants with *N* cytoplasm. Consequently, the 13-53 male-sterile plants belong to the genotype *S ms ms*. Plants with *N* cytoplasm are male-fertile always and may belong to the genotypes *N Ms Ms, N Ms ms,* or *N ms ms,* since the *ms* gene has no effect in the *N* cytoplasm. Plants with the genetic constitution *S Ms Ms* and *S Ms ms* will also be male-fertile, in spite of the *S* cytoplasm, because they carry the dominant gene *Ms*.

The non-nuclear or cytoplasmic factor is inherited only through the egg (maternal inheritance) and not through the male parent, presumably because of the very small amount of cytoplasm present in the male gamete. From the cross *S ms ms* x *N Ms Ms* all F_1 plants will be *S Ms ms* and, in spite of the *S* cytoplasm, will be male-fertile because they carry the gene *Ms*. *S. ms ms* x *N ms ms* will give all male-sterile, and *S ms ms* x *N Ms ms* will give 1 male-sterile : 1 male-fertile. When a male-fertile F_1 plant (*S Ms ms*) is selfed, the expected F_2 ratio is 3 normal : 1 male-sterile.

All male-sterile F_1 plants belong to the genotype *S ms ms* and behave the same as the original male-sterile parent. When the 13-53 male-sterile parent is backcrossed with an F_1 male-fertile plant, *S ms ms* x *S Ms ms*, a 1 : 1 segregation is expected.

When an F_1 male-fertile plant, *S Ms ms*, is used as the female parent and backcrossed to *N ms ms* a ratio of 1 male-fertile to 1 male-sterile is obtained. But in the reciprocal backcross *N ms ms* x S *Ms ms* all of the progeny are male-fertile, since all carry *N* cytoplasm. The unlike behavior of these reciprocal backcrosses is critical evidence in support of the validity of this hypothesis.

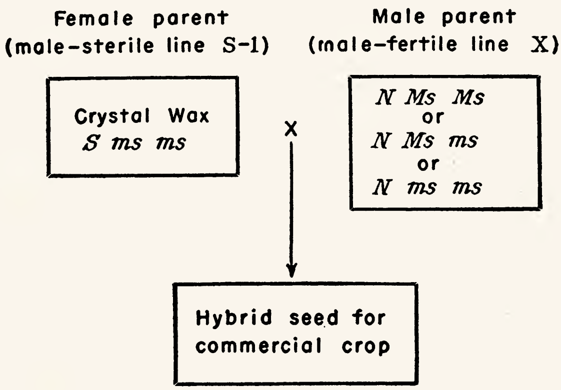


Figure 127. Method of producing hybrid seed for the commercial onion crop. (From USDA Tech. Bull. 874.)

Second backcrosses of the type *S ms ms* x *N Ms ms* gave a 1 : 1 segregation. Second backcrosses of the type *S ms ms* x *N ms ms* gave all male steriles. This confirms the expectation that 100 percent male-sterile progenies can be obtained in repeated backcrosses to a stock with the genetic constitution *N ms ms*. As will be shown later, this is of great practical importance in developing a breeding program.

Practical Utilization of Male Sterility

Male-sterile lines have now been developed for practically all the important commercial onion varieties by crossing with Italian Red 13-53. Fortunately, male-fertile plants with the genotype *N ms ms* have been found in most varieties so far tested. The only means of determining whether a fertile line is pure for *N ms ms* is by a breeding test. The method of incorporating the male-sterile character of Italian Red 13-53 into different varieties is illustrated graphically in Figure 125, the variety Crystal Wax being used as an example. The rate at which the Crystal Wax genes are incorporated into the male-sterile line is somewhat faster than indicated in Figure 125, because in all the backcross progenies selection is for the Crystal Wax type. The numbers given in the figures show the rate expected for random sampling. After being backcrossed two or three times to the male-fertile parent, the male-sterile and male-fertile lines appear almost identical.

The production of hybrid onion seed of all types and in quantity is now possible. To perpetuate the pure male-sterile line two lines (a male-sterile line of the genotype *S ms ms* and a fertile line of the genotype *N ms ms)* must be carried along. All the progeny of this cross will be male-sterile. Figure 126 illustrates the method of perpetuating the male-sterile line through the seed.

As the male-sterile plants cannot be selfed, seed is obtained by continually backcrossing to the normal, or male-fertile, line. Backcrossing continues as long as the particular male-sterile line is to be perpetuated. After a few backcrossings the male-sterile line should be practically identical with the male-fertile except for the sterility factor of the cytoplasm. This backcross seed makes it possible to perpetuate the male-sterile line, as well as to produce the male-sterile female parents used in the production of hybrid seed.

The next step is to make crosses between the male-sterile line and other selected lines to determine which combination produces the best commercial hybrid (Figure 127). The constitution of the male parent that enters into the cross for the production of commercial hybrid seed may be N ms ms, N Ms ms, or N Ms Ms, the particular one selected being based on progeny tests. The behavior of the commercial hybrids as to fertility is not important, because the commercial onion crop must be grown from hybrid seed each year. It is important, however, to get a favorable combination of growth factors.

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Chromosome behavior and fertility of colchicine-induced tetraploids in *Allium cepa* L. and *A. fistulosum* L.

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CHROMOSOME BEHAVIOR AND FERTILITY OF COLCHICINE-INDUCED TETRAPLOIDS IN ALLIUM CEPA AND A. FISTULOSUM

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The common onion, *Allium cepa* L., and the Japanese onion, *A. fistulosum* L., both have eight pairs of chromosomes, but they are characterized by different types of pairing during meiosis. At first metaphase the chiasmata of the chromosome bivalents of *A. fistulosum* are interstitial and localized at the kinetochore, whereas in *A. cepa* they are terminal or subterminal. An amphidiploid between these two species has been reported by Jones and Clarke *(3)*[1]. The experiments with colchicine reported in this paper were undertaken to obtain material for a study of chromosome behavior in autotetraploids of the two *Allium* species and to compare such behavior with that found in the amphidiploid.

Materials and Methods

Three onion varieties were used in this study: Nebuka, a type of *Allium fistulosum;* Creole, a variety of *A. cepa;* and a backcross line of *A. cepa,* namely, (male-sterile 13-53 x Crystal Wax) x Crystal Wax. For convenience this backcross line will be referred to in this paper as the male-sterile backcross. The genetics of male sterility and a method of producing male-sterile lines have been described by Jones and Clarke (4).

At the suggestion of P. C. Burrell seeds of each of the three varieties were sown onto blotters which were moistened with distilled water and placed in a seed germinator at 19.5° C. Germinating seeds of each variety were selected for treatment before the protrusion of the radicle, as well as after the radicles had attained lengths of 1 millimeter, 2 to 5 millimeters, 5 to 10 millimeters, and over 1 centimeter. In addition, seeds germinated directly in colchicine were used in the experiment. For each of the four colchicine solutions there were therefore 6 different lots of germinating seed, making 24 treatments for each variety. In addition, a control lot of untreated seeds was planted. Each lot consisted of 22 seeds, so that in all 550 seeds were planted for each variety.

Four colchicine solutions were used to induce tetraploidy: Aqueous solutions of 0.1 percent and of 0.5 percent colchicine, with and without morpholine. Morpholine is a wetting agent or penetrant and was included to determine if it favored the production of tetraploids by promoting a more rapid penetration of colchicine.

The germinating seeds were placed for 3 hours in vials containing the aqueous solutions of colchicine. The solution was then decanted and the seeds were washed twice in distilled water. The seeds to be germin-

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[1] Italic numbers in parentheses refer to Literature cited at end of article.

ated in the colchicine solution were placed in petri dishes on blotters moistened with colchicine solution, allowed to sprout, and then washed in distilled water. The untreated seeds were placed in distilled water for 3 hours to eliminate any difference in time of soaking between them and the

TABLE I.

Number of onion seedlings alive 6 weeks after treatment with colchicine. Twenty-two seeds or seedlings were planted in each lot.

Variety	Strength of aqueous colchicine 0.1%	0.1% + morpholine	0.5%	0.5% + morpholine	Development at time of treatment
Nebuka	18				
Nebuka	15	0	3	0	Seed germinated in colchicine.
Creole	17*	0	0	1	
Male-sterile backcross	13	0	2	2	
Nebuka	19	17	15	17	Seeds swollen.
Creole	18	19	17	21	
Male-sterile backcross	18	18	20	21	
Nebuka	13	0	6	0	Radicle 1 mm.
Creole	10*	0	10*	3	
Male-sterile backcross	10	0	1	0	
Nebuka	12***	0	5	0	Radicle 2 to 5 mm.
Creole	17**	0	3	0	
Male-sterile backcross	4	0	4	0	
Nebuka	12	0	2*	0	Radicle 5 to 10 mm.
Creole	1	0	0	0	
Male-sterile backcross	9	0	0	0	
Nebuka	7****	0	1	0	Radicle over 1 cm.
Creole	2	0	0	0	
Male-sterile backcross	1	0	1	0	

Number of untreated seedlings

Nebuka	18
Creole	20
Male-sterile backcross	17

* The asterisks indicate where 13 of the 18 tetraploids occurred. Each asterisk indicates one tetraploid plant. Data for 5 plants were lost.

treated lots. Immediately after treatment each seed or seedling was planted in a thumb pot in sterilized soil.

When the plants were 3 months old the average size of the stomata of each treated plant was determined and compared with that of the check plants. A small piece of epidermis was peeled and mounted in aceto-carmine. The length of the guard cells was measured by means of an ocular micrometer. Care was taken to compare stomata from leaves as near the same age as possible and from the same relative position on each leaf. Twenty-five measurements were made for each plant. For cytological studies, propiono-carmine smears of pollen mother cells and of first microspore divisions were used. All plants having a constant haploid count of eight chromosomes in the first microspore division were discarded. At first, pollen mother-cell smears from tetraploid plants were made in the usual way, but later Clarase was used to obtain a better spread of the chromosomes, as described by Stuart and Emsweller (*7*).

All seed heads of tetraploid plants were bagged and selfed, using flies to ensure pollination, as described by Jones and Emsweller (*5*).

Experimental Results

Approximately 25 percent of the germinating seeds survived transplanting after being treated with colchicine. Six weeks later 407 plants were living. The number of living plants in each lot 6 weeks after planting is given in table I. Of these plants, 8 Nebuka, 7 Creole, and 3 male-sterile backcross plants were classified as tetraploids.

Sixteen of the eighteen tetraploids were from the 0.1 percent colchicine treatment. Five of the tetraploids were from seedlings with radicles over 5 millimeters long. The percentage of killing was higher, however, in these lots having the long radicles. The mortality among the swollen seeds was no greater than among the untreated seedlings.

The amount of killing was noticeably greater after treatment with 0.5 percent than with 0.1 percent colchicine. Addition of a drop or two of 1-percent morpholine solution also greatly increased the mortality. An analysis of variance showed that this increase in the amount of killing exceeded the 1-percent level of significance both for strength of colchicine and for the addition of morpholine. Differences among varieties, however, were not significant.

The gametic number of chromosomes in both *Allium cepa* and *A. fistulosum* is 8, the number being doubled, of course, in the tetraploid plants. At the first postmeiotic division of the microspore in the tetraploid Nebuka plants the chromosome count varied from 13 to 20, the greatest number of microspores (42 percent) having 16 (table II). Two microspores had the reduced haploid number of 8. Sometimes a small chromatin body, possibly a chromosome fragment, was also present, but such cases have been omitted from the table. Metaphase plates during the first postmeiotic division of the microspore in the autotetraploid *A. fistulosum* are illustrated in Plate 272.

TABLE II.

Number of chromosomes counted at the first postmeiotic division in the microspore of the Nebuka onion.

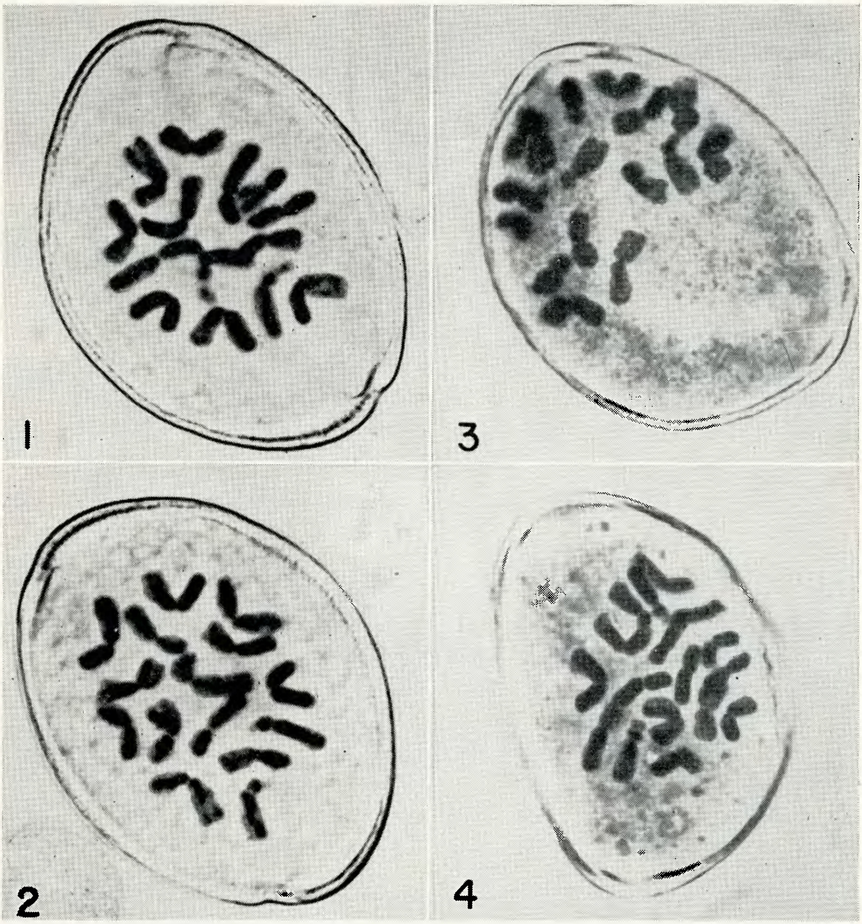
Number of chromosomes	Frequency	Percentage
8	2	1.3
13	4	2.5
14	15	9.6
15	26	16.6
16	66	42.0
17	32	20.3
18	8	5.1
19	3	1.9
20	1	.7
	157	100

Tetravalents, trivalents, bivalents, and univalents are found at the first meiotic metaphase in the tetraploid plants (Plate 273). Chromosomal irregularities are more common in *Allium cepa* than in *A. fistulosum*. In a count of 91 cells of *A. cepa* tetraploid the number of multivalent associations (quadrivalents and trivalents) per cell averaged 6.5, whereas in a count of 103 cells of an *A. fistulosum* tetraploid they averaged only 2.5, this difference being sufficiently great to exceed the 1-percent level of significance. Univalents are also more frequent in *A. cepa* than in *A. fistulosum* tetraploids.

The quadrivalents formed in the two species differ in appearance as illustrated in Plate 273. In *Allium cepa* they form a variety of rings or chains held together by terminal or subterminal chiasmata, whereas in *A. fistulosum* the most common type of quadrivalent consists of two localized pairs of bivalents joined together by a terminal or subterminal chiasma.

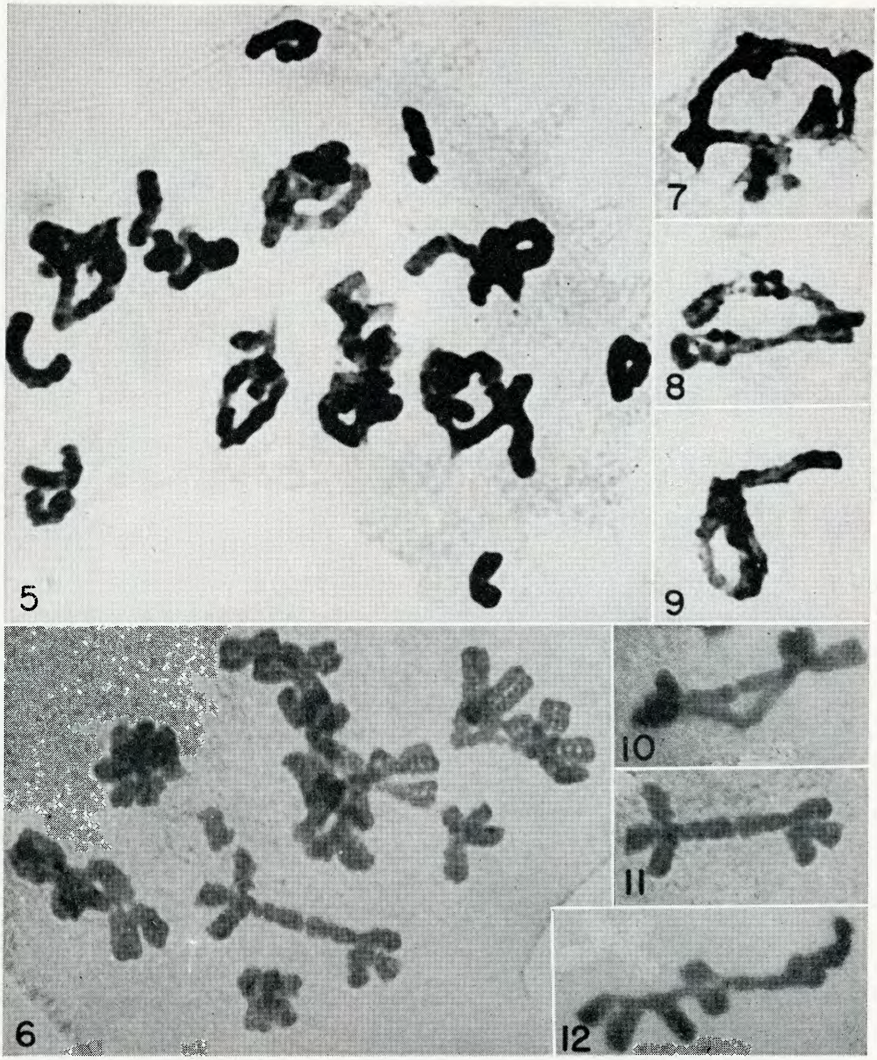
The tetraploid plants were characterized by larger pollen grains. Fifty Nebuka diploid pollen grains average approximately 36 microns and 50 tetraploid pollen grains 42.5 microns in length. Of a total of 1,253 pollen grains counted from several tetraploids, the percentage of pollen grains that were normal in appearance and presumably fertile varied from 40 to 68 percent. Two-thirds of the plants set seed.

The number of seeds per head in the autotetraploids ranged from 3 to 66. These seeds were planted in the fall of 1942 in the greenhouse, and the seedlings were examined in the spring of 1943. With the exception of 2 progenies all the populations were tetraploid, the individual plants giving counts of $\pm$ 32 chromosomes. One Creole plant yielded both diploid and tetraploid offspring, indicating that the inflorescence consisted of mixed tissue. One Nebuka plant yielded only diploid progeny. It is possible that this plant was erroneously classified as tetraploid, but more likely it was partly diploid and partly tetraploid, the inflorescence developing from diploid tissue.



First postmeiotic division in the microspore of tetraploid Allium fistulosum; metaphase plates showing (1) 14 chromosomes, (2) 15 chromosomes, (3) 16 chromosomes, and (4) 17 chromosomes.

Plate 272



Chromosome pairing during first reduction division in tetraploid Allium Cepa and A. fistulosum; (5) first meiotic metaphase in tetraploid Allium Cepa, showing type of chromosome pairing; (6) first meiotic metaphase in tetraploid Allium fistulosum, showing type of chromosome pairing; (7 & 8) quadrivalents in Allium Cepa; (9) trivalent in Allium Cepa; and (10 to 12) quadrivalents in Allium fistulosum.

Plate 273

The size of stomata was unreliable as a criterion for the preliminary determination of tetraploids. Some tetraploids when 3 months old did not have larger stomata than the diploids of the same variety, but of four tetraploids measured at maturity three had stomata larger than those of the corresponding diploids. Three of the plants examined had both large and small stomata on the same leaf, those of different sizes being restricted to definite portions of the leaf.

Discussion

In treatments to induce polyploidy in onions, the best response seems to be obtained by applying colchicine to the plant in the very young seedling stage in order to get the material into the meristematic tissue of the growing point of the stem. In the embryo the stem plate is located just above the tip of the radicle, and when the latter has elongated only a few millimeters the stem has already been carried outside of the seed coat. At this early stage the stem tip is surrounded only by the cotyledon. As the seedling develops, true leaves are differentiated from the stem apex, thus the growing point becomes more and more deeply embedded, and it becomes increasingly difficult to get the colchicine to the growing point.

Treating swollen onion seeds with colchicine before emergence of the radicle is not effective as such an application yielded no polyploid plants. Table I shows that this particular treatment is the only one in which mortality was not high, either from colchicine or from morpholine. This is probably due to the lack of penetration by these agents through the seed coat to the embryo. With the exception of this group, every lot representing different protruded lengths of radicle gave at least one tetraploid plant.

The chromosome pairing in these autotetraploids is very different from that found in the amphidiploid hybrid, *Allium cepa x A. fistulosum,* described by Jones and Clarke (*3*). In the latter, multivalent associations were not found at first metaphase, and the pairing of the bivalents was quite regular. In the hybrid tetraploid described by Levan (*6*), polyvalent associations occurred but their frequency at first metaphase averaged less than one per cell. In the *A. cepa* and *A. fistulosum* herein reported averages of 6.5 and 2.5 polyvalents, respectively, were found.

The difference between the amphidiploid and the autotetraploids in regularity of chromosome pairing results in a marked difference in fertility. As shown by Jones and Clarke (*3*) the amphidiploid regularly forms 16 bivalents and is highly fertile. Regular formation of bivalents, however, does not necessarily result in high fertility, as Greenleaf (*2*) has reported an amphidiploid in *Nicotiana* which has regular chromosome pairing but is completely female-sterile. In our autotetraploids the chromosome pairing was much more irregular than in the *cepa-fistulosum* amphidiploid and the plants were highly self-sterile, although most of them did produce a few seeds. Undoubtedly the meiotic irregularities are largely, if not entirely, responsible for this.

Levan (*6*) studied meiosis in *Allium porrum* and found almost complete localization of pairing. He considers this species an autotetraploid. Quadrivalents were formed rather frequently during prophase but were rarely found at first metaphase since they generally separated into two bivalents before that stage was reached. Quadrivalents in this autotetraploid were undoubtedly less frequent than in autotetraploids with a random distribution of chiasmata, as in *A. cepa.* Darlington (*1*) had previously suggested that a reduction in number of quadrivalents is to be expected in tetraploids with localized chiasmata.

In the autotetraploid *A. fistulosum* reported in this paper the percentage of quadrivalents at the first meiotic metaphase is significantly less than in the autotetraploid *A. cepa,* but the number is nevertheless much higher than in *A. porrum.* The behavior of this autotetraploid shows that it is possible to obtain an autotetraploid with the localized type of chromosome pairing which can, nevertheless, form a substantial percentage of quadrivalents at first metaphase.

Summary

1. Autotetraploids of both *Allium cepa* and *A. fistulosum* were produced by treating germinating seeds with 0.1 and 0.5 percent aqueous colchicine for 3 hours.

2. A study of chromosome behavior during meiosis in autotetraploids showed that quadrivalents, trivalents, and univalents are more frequent in *Allium cepa* than in *A. fistulosum.*

3. Quadrivalents in the *Allium cepa* tetraploid form a variety of rings and chains held together by terminal or subterminal chiasmata, whereas those in the *A. fistulosum* tetraploid usually consist of two localized pairs of bivalents joined together by a terminal or subterminal chiasma.

4. These autotetraploids are highly self-sterile, owing to meiotic irregularities in chromosome behavior, but some seeds were obtained after self-pollination.

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Figure 128. Hybrid Brunsvigia—Hathor. Photo by L. S. Hannibal

AMARYLLIS BREEDING REPORT, 1944

Hermon Brown, *California*

This report is not as favorable a one as the writer would like to make. He has not had the required labor due to the war effort. Weeds have grown up in his Amaryllis beds, and many seedlings have not been transplanted. The Public was not invited to see the flowers in bloom due to the gasoline shortage. However, the closer neighbors did come to visit us during Amaryllis Time.

The writer has raised a lot of fine hybrid seedlings in flats that are doing nicely. The seedlings blooming for the first time were interesting. Two new beauties have appeared—an Azalea Pink and one with white tepals edged pink, and with green throat. The seedlings from crosses of light red on pure whites are excellent—light pink with faint markings, dots or lines. These are more beautiful than the pure whites. Another year is awaited with anticipation.

Apparently every Amaryllid breeder has some excellent clones that that he would not sell or otherwise dispose of. However, he will have more pollen from such plants than he can use. This season the writer has both sent out and received pollen from such plants. Pollen can be placed in gelatine capsules, and packed in small pasteboard boxes for mailing. With reasonable care the pollen will be viable for a week or two. It is suggested that the breeder receiving the pollen send back to the cooperating breeder half of the seeds from each matured capsule produced from such crosses. The writer would like to see the plan tried, and is willing to cooperate with other breeders. His address is Gilroy, California.

HYBRID BRUNSVIGIA—HATHOR

L. S. Hannibal, *California*

Hathor is probably one of the finest *Brunsvigia* hybrids available (Figure 128). H. B. Bradley, a nurseryman in Sydney, Australia, developed it some 40 years ago. Since it multiplies rapidly it has come into wide use through many Australian gardens, being more popular than the old Cape Belladonna, *Brunsvigia rosea.* The parentage is uncertain, but it is assumed that one parent was a Bidwell *Multiflora* Hybrid *(Brunsvigia Grandiflora* X *Brunsvigia rosea)* and the other may have been *Parkeri (Brunsvigia gigantea* (Van Marum) Traub X *Brunsvigia rosea).*

G. K. Cowlishaw in Vol. 2, Herbertia, reports that it never produces seeds, but both the writer and Mr. W. M. James at the trial garden have noted otherwise. In fact the seeds are one of the most interesting things about the plant. Many of us are acquainted with the large fleshy seeds of the Cape Belladonna, but few have seen the seeds of Eubrnusvigias which are seldom larger than a small garden pea, and just as round. When selfed *Haythor* produces three types of seed; the first being the large albumenous irregular seed of the Cape Belladonna type, usually 5-10 mm in diameter and rose pink, the second group is small (under 5 mm. in diameter), round, and colored a mottled rust red, and the third and larger proportion of the seed are intermediate between these two extremes, being slightly irregular and colored deep rose minutely spotted with a rust red granulation. It is not often that we see the manifestation of Mendel's Law as applied to the F-2 generation in the seed stage, but there is little doubt here. Out of 222 seeds, 30.5%

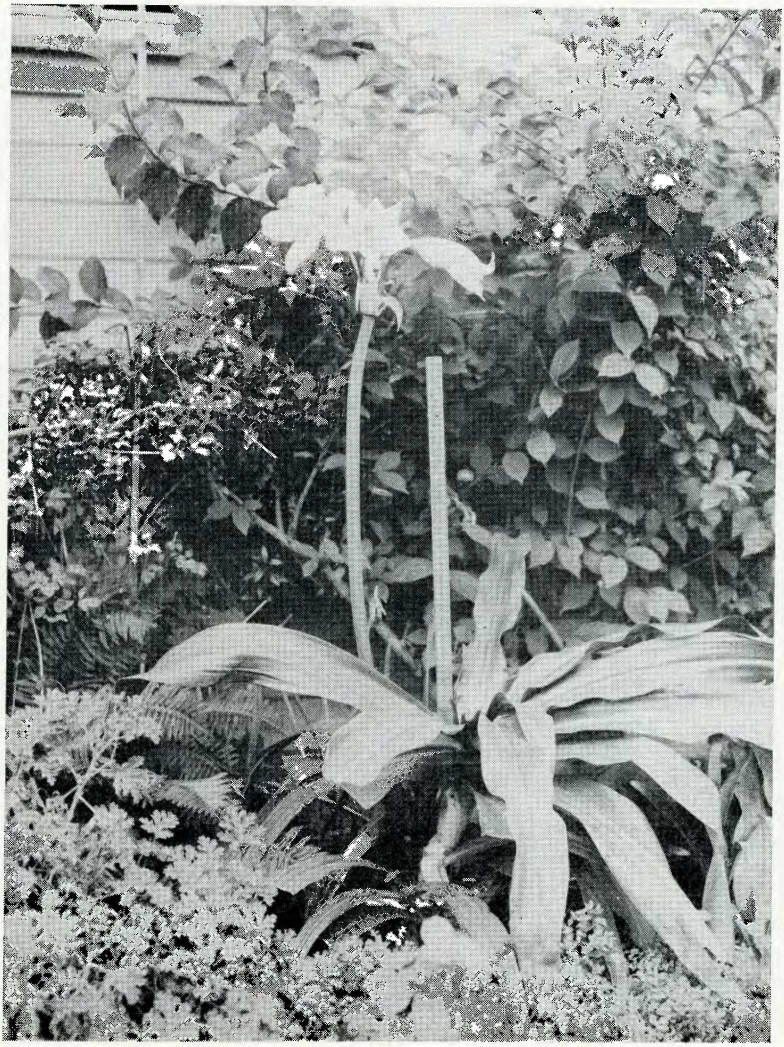

Figure 129. Crinum clone—Frank Leach. Photo by L. S. Hannibal.

Two Hemerocallis flower scapes with open flowers showing several degrees of the quilled-petal character. (For full description see opposite page.)

Plate 274

were the Eubrunsvigia, 38% were intermediates, and 31.5% were of the Cape Belladonna type. These seeds are now in the 1 leaf stage. It is a bit premature to make predictions, but their development is being watched with keen interest.

Haythor should be better known in California gardens. Its open umbel of many large krinkly white blossoms makes a striking appearance, and the yellow eye deep in the throat of the flower offers a contrast that no other hybrid *Brunsvigia* so far has equaled.

A QUILLED-PETAL CHARACTER IN DAYLILIES

A. B. Stout
The New York Botanical Garden

There is a clone of daylilies in cultivation which has in some of its flowers what may be called quilled-petals. Ramets of this particular clone were obtained by the writer in 1925 from the nursery of C. G. van Tubergen, Jr., and in 1926 from the Royal Moerheim Nurseries in Holland, and also in 1930 from Carl Purdy in California. All these plants came under the name "*Hemerocallis aurantiaca major.*" This clone is, I judge, a hybrid of the *H. Dumortierii* and the so-called "*H. aurantiaca Major.*" The foliage has the evergreen habit of growth but the plant is much more hardy than the clone that is the true *H. aurantiaca Major.* The flowers are clear orange in coloring and they resemble the flowers of *H. Dumortierii* in shape but are somewhat larger.

In a fully quilled petal the two sides of a petal are inrolled and overlapping especially at the base. Often the quilled petals stand in front of one or more of the outer set of stamens. Both or only one of the two lateral sides of a petal may be inrolled and there are gradations in the degrees of inrolling as shown in Plate 274. There is variation in the number of petals that are quilled in a flower and there is irregularity from day to day in the relative proportion of normal flowers and quilled flowers. The quilled feature is hence decidedly fluctuating in expression.

Description of Plate 274. Two scapes with two open flowers showing several degrees of the quilled-petal character. In flower to the left one petal is strongly quilled and the other two are somewhat inrolled. In the flower at the right, one petal is nearly normal, but the others are more or less inrolled, and three of the normal stamens stand between the sepals and the petals.

The flowers resemble those of *H. Dumortierii* in shape but are somewhat larger. The scape is coarsely but rather compactly branched and bears empty bracts below the inflorescence. These features are characteristic of the F_1 hybrids that the writer has obtained from the cross *H. Dumortierii* X *H. aurantiaca Major.*

Occasionally a flower of this clone has an extra petal and sepal (pseudo-double). When all of the petals in a flower are strongly quilled the effect somewhat simulates doubleness, but thus far petalody has not been observed in any of the flowers of this clone. During the years that ramets of this clone have been grown at The New York Botanical Gerden they have produced no capsules. A considerable number of flowers have been self-pollinated. No cross-breeding has been attempted with this clone. Possibly the quilled character would have some value if it became complete and constant for all petals of all flowers of a clone. Thus far the quilled character has been observed in no other daylily.

It is possible that it was this clone that gave rise to a report that was evidently first printed in the Cyclopedia of American Horticulture, edition of 1900. This brief statement is as follows:—"*H. Dumortierii* var. *flore pleno (H. disticha pleno* Hort.)." There is no description. The synonym given suggests confusion with the true *H. fulva* clone *Flore Pleno.* This mention was continued in the later editions of this Cyclopedia of Horticulture, but in the latest edition of the latter there is omission of the synonym. In the treatment of *Hemerocallis Dumortierii* in "Hortus" there is no mention of a double-flowered clone, and Dr. L. H. Bailey made no reference to such a clone in his treatment of *Hemerocallis* in 1930 (Gentes Herbarum *2*:143-156.). I have not located any information that can serve as the basis of the above references to a double-flowered clone of *H. Dumortierii.*

The clone with the quilled petals is, I judge, of no value as a garden plant, but possibly its quilled character may have some potential value for use in breeding, especially if it could be combined with the petalody of true doubleness.

CRINUM—FRANK LEACH

L. S. Hannibal, *California*

This fine plant was first described last year. It is by far the largest of the *Crinum Moorei* strain. The blossoms are a blush pink and over ten inches long, and in Figure 129 one can see how the scape towers well above the meter stick placed beside it. Several plantings have been reported about the San Francisco Bay area, so the plant is not exactly rare, but it is not common to the trade. From its size and indifferent seedling habit we are inclined to consider it a tetraploid, although this is not proved. As far as we know such has not been reported previously in *Crinum,* but it is not impossible, and it may be of value in hybridizing in the future.

DAYLILY BREEDING IN IOWA

Vivian Christenson, *Iowa*

The writer is trying for a near white daylily but so far, of the seedlings that have bloomed, the palest were poor in quality or type of flower. It takes a good flower not to burn in the hot sun and wind that are experienced here. This season the writer shall use *Moonbeam* and *Starlight* and will keep trying for a near white.

The writer also is trying to produce some large dark shades. Some dark ones have been secured but they seem small. This season *Potentate,* and next season *San Juan* will be used as parents.

Last summer a glowing orange seedling, which always blooms at Iris time, flowered again in July and *Fulva Rosea* was used as a pollen parent on it in the hope that some worth while colored seedlings may be secured. *Fulva Rosea* seedlings grown in the house, were set out in May 1942. Fifty of these seedlings bloomed in July 1943. In August 1943, 250 seedlings were set out that may bloom this year, and an additional 350 seedlings were planted out in May of this year. The soil in the writer's garden is rich black loam, mellow. It is necessary to cover the seedlings for the first winter or they will heave out. The seedlings are also shaded during the hottest part of the summer.

The writer's best seedlings are the following: No. 15, *Soudan* X *Fulva Rosea,* 5-inch flower, withered rose, even color with thin pale cream line around segments; No. 5, brilliant copper self produced by a deep goldenglow yellow smoothly burnished Rufous Orange-velvet; No. 7, segments Yucatan with star of De Medici Purple which blends into the Yucatan coloring.

4. PHYSIOLOGY OF REPRODUCTION

THE DISTRIBUTION OF THE MALE-STERILITY GENE IN VARIETIES OF ONION

T. M. Little, *formerly assistant geneticist,* H. A. Jones, *principal olericulturist, and* A. E. Clarke, *associate cytologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture.*

Male sterility in the onion was first reported by Jones and Emsweller (1) in a planting of the variety Italian Red. Jones and Clarke (2) found that the inheritance of male sterility resulted from the interaction of a cytoplasmic factor with a nuclear factor. The gene for male sterility is capable of expression only when it is associated with the male-sterile cytoplasm, and it appears to have no effect whatsoever on plants containing normal cytoplasm. Moreover, plants with male-sterile cytoplasm are male-sterile only when they contain two recessive genes for male sterility, one or two dominant male-fertile alleles being sufficient to produce male fertility.

Though such a gene is rather unique because it has no apparent effect on the plants with normal cytoplasm, there is probably little, if any, natural selection brought to bear either for or against plants possessing this gene. It is therefore of interest to know how this gene is distributed among the commercial varieties of onion. The answer to this question is also important from the point of view of the plant breeder, as it has been suggested that the male-sterile lines of various varieties be developed for use in producing hybrid seed.

Plants of the original male-sterile clone, designated as Italian Red 13-53, and its male-sterile descendants have been crossed with plants from nearly all the important commercial varieties. From the breeding behavior of these crosses, the genotype of the pollen parent was determined with respect to the *Ms* : *ms* factor pair. If both male-sterile and male-fertile plants appeared in the hybrid progeny, it was certain that the genotype of the pollen parent was *Ms ms.* If five or more male-sterile plants appeared in a progeny and no male-fertile ones, it was considered that the genotype of the pollen parent was *ms ms,* the probability of obtaining a 5:0 ratio from an *Ms ms* plant being only about 3 percent. Likewise, populations containing five or more male-fertiles and no male-steriles were interpreted as coming from a pollen parent with the genotype *Ms Ms.* Populations containing four or less plants, all of the same phenotype, do not give conclusive evidence as to the genotype of the pollen parent, but do eliminate the possibility of the pollen parent belonging to the alternative homozygous genotype. The results of these investigations appear in table 1.

It will be seen that out of 29 varieties tested, 25 contained both the *Ms* and the *ms* gene. One of the two varieties containing only the *ms* gene, Stockton G-36, is known to have arisen from an individual plant selection which evidently had the constitution *ms ms*. In the other, Southport Yellow Globe, only one plant has been tested, and further testing may bring to light the presence of the *Ms* gene in this variety. The thrips-resistant strain of Australian Brown is descended from a single plant that doubtless had the constitution *Ms Ms*, and the single plant of Australian Brown designated as *Ms ms* is in doubt, as only one male-sterile plant appeared in a population of 14.

One of the most interesting facts brought out by these tests is the occurrence of both the *ms* and the *Ms* gene in the shallot. Though this form is usually given specific rank as *Allium ascalonicum*, many authorities consider it to be only a variety of *A. cepa*. It is, however, widely different from other varieties of *A. cepa* in many respects.

Table 1

Frequency of different genotypes involving the *Ms* : *ms* factor pair among commercial varieties of onion, as indicated by crossing with male-sterile Italian Red 13-53.[1]

Genotype of plants used as pollen parents

Variety	*ms ms*	*ms ms* or *Ms ms*	*Ms ms*	*Ms ms* or *Ms Ms*	*Ms Ms*
Stockton G-36	19	0	0	0	0
Southport Yellow Globe	1	0	0	0	0
Italian Red	7	0	1	0	0
Southport White Globe	17	0	3	0	0
Yellow Bermuda	7	3	1	0	0
Crystal Wax	45	1	11	1	3
Utah Sweet Spanish	12	0	8	0	0
Brigham Yellow Globe	13	2	4	0	2
Red Rocco	1	0	1	0	0
Early Yellow Globe	8	2	7	1	1
Colorado #6	3	1	7	0	0
Creole	25	1	32	0	7
Scott County Globe	0	1	2	0	0
California Early Red	0	0	1	0	0
Red Wethersfield	0	0	1	0	0
Shallot	0	0	2	0	0
Yellow Danvers Flat	0	0	1	0	0
Ebenezer	0	0	3	1	0
San Joaquin	0	1	2	0	1
Crystal Grano	0	1	6	0	2
White Portugal	1	0	7	0	3
Golden Globe	0	0	1	1	0
White Grano	0	0	1	0	1
Lord Howe Island	0	0	1	0	1
Mountain Danvers	0	0	2	0	3
Early Grano	0	0	1	0	3
Australian Brown	0	0	1(?)	0	23
Do, thrips resistant	0	0	0	0	33
Burrell's Sweet Spanish	0	0	0	0	1
Total	159	13	107	4	84

[1] Arranged in order of the proportions of *ms* genes indicated for the varieties.

The widespread occurrence of both the *Ms* and the *ms* genes throughout the varieties of *Allium cepa* indicates that the mutation (presumably from *Ms* to *ms)* took place a long time ago, or else has taken place more than once; otherwise, the *ms* gene should be found in comparatively few varieties. The nearly equal frequency of the two alleles further indicates that in the presence of normal cytoplasm, there must be practically no selection for or against plants possessing the *ms* gene. The fairly large proportion of heterozygous plants found leads to the conclusion that there is considerable natural cross-pollination among onions, for a high degree of selfing would tend to eliminate the heterozygotes in favor of the two types of homozygotes.

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5. AMARYLLID CULTURE

REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION, USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.

ORNAMENTAL ALLIUMS FOR NORTH AMERICAN GARDENS

A SYMPOSIUM

(This symposium on ornamental alliums for North American gardens was arranged by Sgt. Bernard Harkness, Chairman, Allieae Committee, who is now in the U. S. Armed Forces. Under date of March 18, 1944, he sent some notes which are reproduced below.—*Editor)*

1. *Allium Notes*

SGT. BERNARD HARKNESS

Francis Marion Fultz in his book, *Lily, Iris and Orchid of Southern California,* published in 1828, points out that there are a score of alliums native to that region though frequently passed over as most of them are not outstanding. He names *Allium haematochiton* as the most common on the dry foothills. Its rosy-purple flowers on six to ten inch stems are attractive except as they begin to fade. This species is not mentioned in Grey's *Hardy Bulbs* as grown in England. As representative of high mountain species Mr. Fultz speaks of *Allium tribracteatum*—its rose-pink and white flowers appearing in solid patches on the higher mountains in the northern part of Ventura County. *A. tribracteatum* is mentioned in most of the *Allium* literature; Grey classes it as "quite worth growing in a sunny rock garden." Representing the desert species in the book is *Allium fimbriatum.* Mr. Fultz's locale for it is "almost anywhere around the borders of Antelope Valley," where the flowers vary from rose to purple, with some white. It is grown in England as Grey recommends a light sandy soil in full sun. Seven photographs of the above and other alliums are included in the book.

It is interesting to note that from two Canadian gardens, F. Cleveland Morgan's (HERBERTIA, 1943) and F. L. Skinner's at Dropmore, Manitoba, (article in present symposium), *Allium zebdanense* is recommended. The locale for *A. zebdanense,* so-named by Boissier and Noe, is given as near Bebdan, in Lebanon, and in Turkish Armenia. I find Zebdan(y) to be a village on the map of Syria between Damascus and Beirut at close to 6,000 feet elevation. C. H. Grey recommends it as one of the best of the white-flowered species but notes that it requires an extremely dry, well-drained position if it is to survive for any length of time.

2. *The Decorative Onions*

HELEN M. FOX, *New York*

Some of the decorative alliums are exquisite in their daintiness and come in charming hues. *Allium flavum, pulchellum,* and *caeruleum* brighten the rock garden when the spring refulgence has become dimmed while *glaucum* var. *senescens,* with its silvery pink blossoms, is harmonious with the greys of herbs as is the grey-white *tuberosum.* Here in North America the native onions form part of the colorful spring tapestry of western meadows along with brodiaeas, calochortus, camassias and erythroniums, or are found springing up in woods.

Many gardeners do not like the odor of allium, describe it with unpleasant adjectives and nouns and bar it from the garden. It is true that all flower garden alliums with few notable exceptions, such as *tuberosum* and *flavum,* smell like their cousins, leek and garlic. Though almost all people in the whole world like the flavor of onion in their food, the odor is not popular in gardens. Even the enthusiast for the decorative members of the Genus *Allium* must admit it would be unpleasant to have a whole garden smell of them, yet a whiff here and there between the spice of carnation, the tang of savory and sweetness of the rose has the virtue of contrast. Moreover, with a few exceptions, onions do not give off their smell without first being touched. People who do not know the decorative onions are always surprised when told they are cousins of the leek and it is the smell that convinces them, so it has its place.

The onions increase rapidly under cultivation and many species are so hardy they are likely to become pests, but it is a simple matter to dig up superfluous clumps. Just the same, as with all plant collecting, it is difficult to procure certain species. So often a form of something already present in abundance comes up when a rarity has been ordered and waited for with breathless suspense. This is one of the hazards of eclectic gardening that cause the final attainment of a rare species to be all the more appreciated.

Seeds of many species bloom the second summer and some are biennial and have to be renewed from seed and almost all of them can be increased by dividing the clumps. Instead of ripening seeds some of the onions form little bulblets where the flowers should be. If these bulblets are planted, the new plants will in all likelihood again bear a harvest of knotty, green lumps instead of flowers.

The comparatively few species grown by me did not seem sufficient for an article to interest the public so I have read the writings of other gardeners to find onions they thought attractive, and have consulted various authorities. Louise Beebe Wilder—Adventures with Hardy Bulbs—has done a thorough piece of research and has grown many of the bulbs herself. For American onions there are notes in Ira N. Gabrielson, Western American Alpines; Joseph E. Harned, Wild Flowers of the Alleghanies; Leslie L. Haskin, Wild Flowers of the Pacific Coast; and Anderson McCully, American Alpines in the Garden. For European onions there is Hippolyte J. Coste, Flore Descriptive et Illustrée de la France, de la Corse, et des Contrées Limitrophies; and for scant but accurate notes Clarence Elliott, Rock Garden Plants; as well as Reginald Farrer, The English Rock-Garden; and of course L. H. Bailey, Hortus; as well as the herbarium and botanical literature at the New York Botanical Garden.

Onions grow wild over the northern hemisphere. The slender spears rising from bulbous roots are among the earliest greens to appear in woods and meadows in spring. Later in the season, stems grow up bearing umbels either round or flat, full or sparse, with more or less colorful flowers. Certain wild onions besides *Allium Cepa,* the usual table onion, leek, garlic, chives, Welsh onions and ciboule have been gathered for food. Some of the wild onions are sweeter than others but this article is concerned only with the decorative members of the genus.

There are some charming native American onions. Among the North Western species is the handsome *Allium acuminatum,* Hooker's Onion, often so prevalent it is like a weed in dry sandy soil of sage brush slopes and open meadows from British Columbia to Idaho and California. It is hardy, as is true of so many western plants, only, where there is no winter wetness. The bulb coats are netted, the flower stem 8-15 inches high and near its base grow the short leaves. The flower heads are in good proportion to the scape which is one reason the plants are so good looking. The full umbel is composed of bell-like flowers with the tips of the segments slightly reflexed, colored purple, varying to soft pink, and on stalks slightly longer than the perianth. According to Ira N. Gabrielson they cover mountains and plains with the purple mist of their bloom in June and July. Two papery bracts of iridescent pink and white enclose the flower clusters before they open. As the blossoms age they fade to a lighter tone. They last long after being cut and those left standing in pastures and along hillsides retain their bright color after the summer grasses have dried.

Also from the North West, Washington, Colorado and south to New Mexico and Texas, grows *Allium Geyeri,* a woodland onion partial to high altitudes. The bulbs have fibrous coats, the leaves are very narrow and two-thirds the length of the scape which is about 10 inches or more high. From June to September the heads of rose, some say flesh colored blossoms, with broad, oval segments and awl-shaped filaments, are borne on fleshy pedicels a little longer than the flowers.

From the same region and similar to *Geyeri* is *Allium falcifolium* only that it grows in full sun, blooms the end of May and has very differently shaped leaves. These are 6 inches or so long and twist along the ground as do leaves of some species of tulips. The flat scape carries an umbel of purple-tinged-pink blossoms, held erect, with prominent white anthers not longer than the petals which are slightly reflexed. The leaves disappear before the flowers mature.

A species of dry hillsides growing in coarse granite sand in California and Nevada, is *Allium atrorubens* with a habit of sending up one leaf only. The scape is 5 inches high with umbels almost 2 inches across, composed of stalks the same length as the flowers, which are reddish, tinged with a deeper purple tone.

An upland bog plant is *Allium brevistylum* blooming in June in the high mountains of Utah, Wyoming, Montana and Colorado. The rootstock ends abruptly and is crowned by one or more bulbs with many dead coats. The scape is 1-2 inches thick, and obscurely winged. The narrow leaves are half as long as the scape, which is from 12-15 inches and carries a showy umbel of roseate pink blossoms borne on pedicels twice their length. The filaments are deltoid at their bases. Since it requires moisture, *brevistylum* might be grown at the edge of a stream.

In Californa and Baja California grows the fairly tall *Allium unifolium,* which is probably not hardy. It is described as 2 feet high with bright umbels of many fairly large rose pink flowers borne on pedicels twice their length. The leaves are shorter than the scape.

According to Leslie L. Haskin, *Allium attenuifolium,*[1] of the Pacific Coast, is the most beautiful of wild onions and grows in many types of situations, though another writer, Anderson McCully, says it needs dry soil and sun. The outer coats of the small, round, truncated bulbs are marked with tiny V's on the network. Two radical grass-like leaves with scabrous margins sheath the base of the scape, but leave it close to the ground. The scape is round, about 1 foot high, smooth and glaucous and minutely speckled. A photograph of the plant in Mr. Haskin's book shows a globe-shaped crowded umbel with 50 or more flowers, each with petals separated and star-like. The flowers are described as campanulate-rotate. The stamens are as long as the petals and in color the blossoms vary from white to bright pink.

In April in the Mojave Desert and nearby mountains and also in San Bernardino County of California, *Allium fimbriatum* grows abundantly and is said to be one of the outstanding attractive Westerners. Since it grows in hot dry situations it is not likely to be hardy where winters are wet, drainage poor or cold intense. The thick bulb coats have rectangular markings; there is a thin solitary leaf, longer than the scape which is not higher than 2-8 inches. When the scapes are their shortest the crowded deep rose to purple umbels are sometimes as big across as their support is high. Flower stalks are twice as long as segments while stamens are shorter than sepals. Even in a dried state on a herbarium sheet, the plant looks charming, partly because of the large size of the umbel in relation to the stem.

Another low growing onion, *Allium Nuttallii,* is generally not over 5-6 inches high but sometimes reaches 10 inches or even 15 inches. It blooms from March to June in rocky prairies from Texas and Arizona to South Dakota. The bulb has a reticulated coat, there are a few slender leaves growing from the base of the scape, while the umbel is few flowered, dainty and colored rose or white.

Four onions have grown particularly well in my garden in southern New York and can be recommended for their beauty and hardiness. They are *A. cernuum, senescens* var. *glaucum, pulchellum* and *tuberosum.* A fifth of equal beauty has not been as long lasting and is probably biennial.

Almost unique among onions because of the sweet fragrance of their flowers are *tuberosum* and *ramosum* natives of Northern Asia. Former-

[1] This is referred to *Allium amplectens* in Morton's Check-List, Herbertia 1940.—*Bernard Harkness.*

ly both came under the heading of odorum. In Hortus, Dr. Bailey says *A. ramosum* is distinguished by having hollow leaves, shorter than the scape, the white flowers have a reddish midrib and pedicels 2-3 times as long as the segments. Of *tuberosum* he says it differs from *ramosum* in not having hollow leaves and that the flowers are expanded instead of funnel form, the segments reflexed and marked with an inconspicuous greenish midrib. From seeds I have grown plants to 2 feet high which quickly form large clumps and bloom from July to September and bear umbels of starry white blossoms, that look grey from a distance. I find them handsome because the grey-white blossoms, standing on their tall stems, form accents among the greys of herbs such as artemisias and lavenders, and they are charming as a cut flower with red foliage plants and pink annuals. I call these plants, which came to me as *odorum*, *Allium tuberosum*, because the leaves are not hollow, the flowers are expanded and on the back of each segment is a greenish-lavender line. The bulbs of this onion are cream white with a thin brown sheath. The grey-green leaves of different lengths are linear, thick and all joined one inside the other to the scape. They stand up to 1 foot or a little more, like flat narrow green ribbons and are 3/16 inches across. The flower umbel, 2½ inches across, is subtended by a paper like bract ,and carries about 40 flowers, ½ inch across on stalks of 1 inch or so. The flowers are greenish-white, have pointed perianth-segments, and anthers, brown when ripe. The flowers mature quickly but other umbels keep coming along so the bloom lasts fairly long. To me, as well as to Mrs. Wilder, the blossoms have a fragrance reminiscent of heliotrope, but only if one smells them without touching, for as soon as this happens, the odor of onion pervades the air, like an enchanted princess in a fairy story.

Spread over the whole of North America and variable in height, shape of leaves and color of flowers, is *Allium cernuum*. The narrow clustered bulbs are oval at the base and have reticulated coats, tinted tan-rose. Plants growing in the Rocky Mountains have narrow channelled leaves while in the East they are broad and flattened. My seed came from the West so the leaves are slightly concave, and narrow and from 3-12 inches high. They are pointed at the apex and held in place by brown magenta bracts. They cluster around the base of the scape and all leave it at the same point about 1 inch above the ground. The tallest and biggest plants 12-18 inches high come from Virginia and the Middle West. The scape is ridged, ⅛ inch wide, flat and two-sided. In my garden the bell-like flowers, ⅜ inch long, bloom in September, in the Middle West from July on to September. They grow in nodding umbels on dark, green pedicels ½ inch or more long. The 3 inner segments are shorter than the outer. The color has been described as rose lavender, but in mine the buds begin pale green, then are overcast with violet and lastly open to a lovely tone of pale pink. The whole inflorescence is graceful and lasts a long time in flower.

In contrast to all the pinks are two yellow onions, *Allium flavum* and *Allium Moly*. I have never been able to procure *Moly* though I have sent repeatedly for seeds and bulbs. It comes from southern Europe, is hardy and has been an Old World garden plant for centuries.

The bulb is ovoid, the leaves are 2 inches wide, and the flowers golden yellow with the perianth enclosing the ovary. A sketch of the plant in Coste's book shows it to have few-flowered umbels of starry flowers.

Also from southern Europe, and hardy, comes the exquisite *Allium flavum* forming dainty clumps in the flower border or rock garden and blooming in July in full sun with flowers fragrant of Lily-of-the-Valley. The brittle, glaucous, blue-green scapes, 1 foot high, grow out of long hollow or semi-circular leaves that envelope the base. Before the umbel emerges it is enclosed in an ecru paper-like, ribbed envelope. After the envelope opens the tips of it, like 2 insect feelers, turn down and a cluster of tiny yellow bells appear borne on stalks of different lengths, yellow in color but with a green tinge. The bells hang down or stand up with the still unopened buds among them and give the effect of a minuscule, windblown fountain. The umbel measures 3 inches across, each floret 3/16 inch. Stamens and pistils protrude beyond the segments. The whole umbel, because of the pointed feeler-like tips of the bracts, seems to be in motion, *Flavum* sets seeds readily and a new batch is grown every year as the plants are not long lived.

Except for its color, *Allium pulchellum,* from southern Europe and Western Asia, is very like *flavum.* In my garden it blooms in July and August and is renewed constantly from seed. The scapes are 1-1½ feet high, glaucous, blue-green as are the leaves which clasp the stalk at the base and are rounded at the tips. The flower head is fountain-like, more dome shaped than in *flavum,* and opens out of two spathe-like leaves, one shorter than the other which persist and stand out at fantastic angles. The umbel is 4 inches high and 2½ inches across. The stalks are colored like the flowers, a roseate lavender or, according to Ridgway's Color Chart, "mallow purple" shaded "phlox purple." The effect is a Victorian color, a dusty light plum. There is no scent until the flowers are touched and then ——!!!

The scape and umbel of *Allium caeruleum,* formerly called *azureum,* and coming from Siberia and Turkestan, is bright steel blue, a most unusual color. The shape of the plants resembles chives. The triangular leaves are yellow green, long and linear and lower than the scape and grow almost parallel to it. In my garden plants were 18 inches high but Dr. Bailey says they grow to 4 feet. Sometimes two flower stalks grow out of one spathe. The rounded umbel is 1¾ inch across, "greyish violet blue" is the color of the segments but the presence of many unopened buds on green stems gives a slaty tone to the whole. The stalks of fully open florets are violet tinged and much longer than the blossoms which are ¼ inch across. A dark line runs down the centre of the segments. Though unpleasant to record, the flowers smell of a combination of onion and perspiration. They bloom in June and are handsome to have in a distant corner perhaps close to pink beebalm where color and scent will harmonize and quiet the hard effect of the onion.

Coming in August and September and therefore doubly welcome, is *Allium senescens* var. *glaucum,* called narcissus-leaved garlic. The bulbs are ¾ inch or more across, tinted purple, with a thin integument, and form thick clumps in a few years. The leaves grow in clusters, are concave, twisted, as if made of two thicknesses, about 1/4 inch across and 12 inches or less long. The scapes are ridged and hollow and rise to 2 feet carrying heads of dusty lavender or mauve pink. In the var. *glaucum* the flowers are more campanulate and the umbels denser than in the type. The umbels of my plants measure about 2 inches across and are spherical. The pedicels are longer than the flowers which measure 3/8 inch across. These flowers open violet and fade to pale pink and give the effect of being "pale amparo purple." The anthers are dark lavender before the pollen ripens, when they turn yellow and since they project beyond the segments they help color the whole umbel as well as to give it a feathery lightness. The plants are odorless, until they are touched.

Two South European onions to be grown where the climate is warm and dry sound entrancing. The first *Allium narcissiflorum*, also known as *pedemontanum*, is described as the showiest of the family, with nodding, fairly large flowers of brilliant purple borne on scapes 1 foot high. It blooms in July in lime stone mountains of south and eastern France and northwestern Italy. The bulbs make large clumps and are covered with dense fibre. The upstanding leaves are strap-like, broad, numerous and 6-9 inches high. They sheath the base of the scape and leave it at the same point about 3-4 inches from the ground level. The flowers 2-10 in an umbel, grow on short pedicels and are campanulate, shaped somewhat like *Campanula carpatica* with points at the centre of the wide segments which overlap at their bases. Each flower measures from 3/4 inch to 1/2 inch across.

The other south European onion *Allium Neapolitanum*, also called *album-santi*, blooms from March to May. Before the war it was picked, tied into bunches and exported to England for decoration. The plants smell faintly and the flowers, in loose heads, are shaped like open cups with wide obtuse segments overlapping at the base. The bulbs have numerous coats, the leaves are flat and wide, oval-obtuse at their tips and similar to daffodil leaves. They are almost as high as the scape which rises to 1 foot and are rough on the margins. The flower pedicels are all the same length and 3 times as long as the blossoms. Stamens and pistils are enclosed in the perianth.

The giant onions are so striking they draw the eye from every other plant in the garden and for that reason I have never grown them. But they are frequently planted in rock gardens or along stream beds but far enough away not to get their roots wet. The hardly *Allium albopilosum* from mountain regions in north Persia and westward in Asia Minor flowers in mid June, with scapes reported 3 feet high. The leaves 1 3/4 inch wide are hairy on their under surfaces, and strap-like. The umbels are huge, from 8-12 inches across, and composed of starry lilac flowers which Mrs. Wilder says have a metallic sheen. The pedicels are 2-3 times as long as the perianths.

From the Himalayas comes the giant of them all, rising to 4 1/2 feet, *Allium giganteum* with leaves 2 inches wide, likely to lie on the ground and a scape bearing globes of bright lilac flowers.

This ends the account of onions with blossoms qualifying them to an honored place in the garden. The ones described are not all hardy in cold, or wet regions, but there are enough pretty onions for every gardener who so chooses to have a variety of them.

3. *Ornamental Alliums in North Carolina*

Elizabeth Lawrence, *North Carolina*

When I am asked to name the three best alliums in my garden, I must first inquire: best for what? If we are choosing the most beautiful I think I must say none. For none of the outstandingly beautiful *Allium* species has ever succeeded with me. *A. validum* blooms sparingly and does not persist, and *A. Moly*—the loveliest of all of the alliums that I have seen—remains a failure after many trials. If we are considering distinction, I would mention *A. albopilosum* first, for the broad heads of metallic lavender flowers are fascinating. For abundance of bloom *A. senescens* would be one of the three, for it blooms from late May to late August, and blooms freely and continuously. But I think that with me the late-blooming alliums fill the greatest need, and therefore I choose *A. subroseum, A. tanguticum,* and *A. ramosum* or the plant that grows in my garden under that name.

A. subroseum is somewhat drab in color, but it is dainty enough to make a neat rock plant, and in the South in midsummer, we do not ask too much. It does not appear in *Hortus Second,* so all I know about it is that it takes to cultivation easily, and braves the worst part of the season—late August and September. It is only five or six inches tall with spherical heads of pale lavender (not pink) flowers.

Years ago, Elizabeth Rawlinson gave me *A. tanguticum* as one of the best garden species, and I still think that it is. The pale opalescent flowers are showy only in mass, but the clumps increase rapidly and can be divided frequently. In a few years mine have made a border that is very pretty in July and August, and blooms on into September. And this in a poor part of the garden where there is seldom bloom at any season. Colonel Grey describes the leaves of this species as four to six inches long, and the stems as rather longer. With me the stems are more than a foot tall.

Table 1. Alliums grown, and blooming dates.

Species	*Blooming time*
Allium Albopilosum	Late April
ascalonicum	
Aschersonianum	Mid May
Beesianum	Failure
* *caeruleum (azureum)*	May 5-June 7
cernuum	Summer
* *cyaneum*	Failure
flavum	Mid June
flavum minor	Late June, again in July
globosum	Mid June

karataviense	Failure
Moly	Failure
Mt. Cenis	July
neopolitianum	April
odorum	May
Porrum	Early June
Przwalskianum	Failure
ramosum (tuberosum ?)	Late July to early September
Rosenbachianum	Failure
sativum	
schoenoprasum	May
senescens	May-August
sphaerocephalum	Mid June
* *stellatum*	Late August
subroseum	August
tanguticum	July-August
tataricum	End of August
triquetrum	April
* *validum*	End of May

* Did not persist.

The plant that came to me as *A. ramosum* is more like *A. tuberosum* as described by Colonel Grey and in *Hortus Second.* The flowers are not especially fragrant and the segments are keeled with green, not red. Whatever it is, it is a good one. I did not think much of it the first season, but by the second summer it made a very fine showing from late July to early September. The quantities of silvery flowers above the narrow grey foliage were refreshing in the scorched borders. It is the tallest *Allium* I have had, with stems three feet long. From another source I have what seems to be the same plant, as *A. odorum,* and what seems to be the same, but blooms late in May, also as *A. odorum.*

4. *Alliums of Western United States*

Lester Rowntree, *California*

That was a rash moment when I promised Bernard Harkness material on alliums of western United States in the field, for now that I open the *Allium* folder I find a scanty collection of notes and it is never safe to put botanical information down from memory. What sticks indelibly in my mind these caged days, when field work is no longer possible, is the gorgeous wild flower pictures alliums help to make and these recollections bolstered by the folder and botanical manuals must be the source of these notes. Already the remembrance of *Allium* stands in the wild revives my duration spirit and it may be that suggested environmental preferences and associated species may help those who grow onions.

The cold Monterey Peninsula, where our gardens see more fog than sun, is no place for most of the western alliums for though a few of them are found in moist places and one or two are coastal, the majority inhabit hot dry places in the sun. Even *Allium unifolium* which is native not many miles from here and takes more readily to garden conditions than any of the others, drags out, on my wind racked hillside (where it can get neither hot sun nor moisture nor rich soil), a sadly half-hearted existence. It is not one of the brightly colored alliums but there are sections where it is one of the conspicuous wild flowers of rich grassy meadows, especially when it grows with the tall and brilliant crimson-red fire cracker brodiaea, *Brodiaea ida-maia,* and it is very lovely with wild iris along the sides of streams.

Figure 130. Allium validum. Photo by Lester Rowntree

Shelter-loving, moisture-minded ***Allium validum*** is no more at home here for it is species common to bogs and wet meadows and rivers (Figure 130). In the Oregon Cascades, in the mountains of Washington state and in the Californian Sierra it hobnobs with the tall and strong growing flora of moist places. Architectually beautiful *Sphenosciadium* *capitellatum* is one of this community, rising high above the stiff thick, angled, three-foot allium stalks. Further back from the water, the low willows, ledums and twin honeysuckles are pierced by the sturdy racemes of purple-blue *Lupinus columbianus* and the deep bright blue spikes of *Delphinium scopulorum.* Down beside the brown clearness of the swiftly moving stream, right in among the narcissus-like allium leaves the Sierra Rein orchis may be growing and the glistening white flowers and rich lush foliage of grass of parnassus, *Parnassia palustris,* lean over to where moist, dappled frogs, the exact shade of the wet granite, bask silently in the sun.

On the wet rocks of the lower mountains of that collector's paradise, in central northern California where the Trinity, the Scot and the Salmon ranges come together, *Allium amplectens* looks like dainty white or very pale pink thrift with prominent pink anthers and is frequently growing with blue delphiniums. I have found it more often though, especially in Washington and Oregon, with its deep red bulbs sunk in sunny gravelly openings or rock-broken adobe. It is a charming thing with eight-inch upright, red stems capped by rather flat heads of pale pink or white flowers, and in the yellow pine zone it is sweet with *Brodiaea congesta* and *Eriogonum umbellatum.* In drier spots it enjoys being with *Penstemon heterophyllus* but I like it best among the taller squaw-root, *Carum gairdneri.* These two sometimes take over moist clayie May meadows in the lower mountains dappling them with white delicacy, the narrow foliage of the carum covering the nakedness of the allium. *Allium dichlamydeum* is one of the maritime onions and is plentiful on Point Reyes north of San Francisco. It looks something like *A. peninsulare* but is not so tall. The rose colored flower heads are quite compact and the pressed specimens now on my desk are, like most alliums in herbaria, much darker than when they were picked.

One of my pet mountain alliums is *A. falcifolium,* the sickle-leaved onion. If only there were more summer's sun on this hillside it would do well with me for it is fond of loose rocky soil. Its pleasing sturdy blue-green leaves are considerate enough to remain intact until the flattened, succulent flower-stems have developed their bloom. This comes in heavy close clusters which may be rich red-purple, dark wine-crimson or good lavender-pink. Sometimes one finds a pure white form and occasionally, I regret to report, a horrid washed-out pink. Arduous field work, with me, has always been delightfully leavened by that phase of ecology which embraces the association of plants and the gladdening sights of many species of wild flowers growing happily together. *Allium falcifolium* is one which is always found in good company. In the June and July woods of northern California and southern Oregon it joins *Lilium bolanderi* in sunny openings, and *Phlox speciosa, Collinsia torreyi, Viola cuneata* and *V. lobata* are very likely to be there too. It is nice among the bright and shiny green-leaved lilac-flowered northern form of *Monardella odoratissima* and with its strong determined heads piercing flat, white-flowered mats of prostrate ceanothus. On the mountains of Oregon's Curry County grows the narrow-leaved variety *A. f.*

var. *brevius* and just below the snow line on the June slopes of Mount Shasta as well as in General Grant Park, variety *demissum,* very dwarf, blooms with that perky little solitary or two-flowered dutchman's breeches, *Dicentra uniflora.*

Figure 131. Allium campanulatum. Photo by Lester Rowntree.

For an allium, *A. platycaule* is an exceptionally good shade of pink. It grows in high Sierra valleys east of Sacramento, and often on hot slopes with *Lewisia rediviva.* It has flat stems and its narrow petals and exserted stamens give the flower a dainty feathery look. When, by means of feathery petals and protruding stamens, or flowers carried loosely in the head, alliums lose that heavy stodgy look, they become a great addition to the landscape even though they may not have vivid coloring. *Allium sanbornii* is one of these delicate ones, white or pale pink where, growing on the lower slopes of the northern Sierra, above Grass Valley, a lovely pink form feathers sections of the yellow-pine zone, looking in some lights almost pure light blue and in others a clean soft pink. *Allium campanulatum* is a common species in the mountains of central and northern California (Figure 131). It is not one of the most decorative ones, being a dull lilac and having a white petal stripe which in no way adds to its beauty. In late May and in June it covers the ground very thickly usually keeping to dry places.

If I wanted to see western alliums in quantity I would go to the southwest and follow the slopes which edge the deserts. In such places of grandeur are the best allium pictures to be found. *Allium haematochiton* though not strictly a desert species often grows on these hot and sunny slopes. It is quite common and very lovely having pale rose pink flowers with very deep veinings so that seen en masse the stands seem to be composed of purple blossoms.

In early May strawberry-red *Allium peninsulare* spreads stunning patches across cismontane southern and central California, in pure stands or mixed with other flowers. During the early stages of blossoming there are many shades in these brilliant flecks for the buds are deep mauve and the mature and aging blooms much darker. The stalks are reddish, the pedicels gray pink and the tips of the petals often deep rich crimson. *Allium peninsulare* var. *crispum* is particularly appealing because of crisped inner perianth segments and because these crinkled segments are pure white, contrasting strongly with the rich purple of the rest of the flower. In many places near the desert (Red Rock Canyon is an easy one to reach—if you have gas—), *Allium peninsulare* grows in with the taller, flaming orange-red desert mariposa, *Calochortus kennedyi* and in this sandy rocky ground along with these two may grow yellow pepper grass, *Lepidium flavum,* while the ground beneath these taller plants is brilliant gold with the tufts of two of the desert's composite carpeters, *Syntrichopappus fremontii* and *Eriophyllum pringlei.* Further north, along the Cuyama River Road *Allium peninsulare* joins dark-eyed lilac *Calochortus venustus,* deep purple *Collinsia bicolor,* blue delphiniums and the purple form, and the white of *Lupinus densiflorus.*

The ovaries of *Allium fimbriatum* sport fancy little fringes and give this species the name of fringed onion. It may go down on to the flat floor of the desert and lend its clear rose-pink to sky-blue splotches of *Linanthus parryae* and that dainty little platystemon-like poppy, creamy *Canbya candida,* while above these lower flowers flares glorious *Calochortus kennedyi. Allium fimbriatum* var. *mohavense* is a pale pink form found locally on the western slopes of the Mohave Desert.

On the crested onion, *Allium cristatum,* the ovary crests are very prominent. It grows in Arizona, Utah, Nevada and in southwestern California. It is a single-leaved onion—not one of the conspicuous species—and interesting chiefly because the pale flowers, striped with reddish veins, have a transparent, papery look. Another desert onion, keeping to the Western side and even growing on one of the Santa Barbara Channel Islands, is tall-stemmed *A. lacunosum,* the pitted onion, named because the light brown outer coat of the bulb is pitted by tiny holes which are almost square. The flowers may be deep red-purple but are usually pale pink with dark midveins. In late May one comes across almost wholly unbroken fields of this species. It is quite lovely in the granite rocks of the Kern River Canyon, and particularly striking when it grows in with a flat raspberry-red mass of turking rugging, *Chorizanthe staticoides.*

These few onions of the west belong to a multiform clan. I could go on and on with wild flower scenarios, quite too bedight and lengthy for the pages of HERBERTIA, of other species. Of one thing I am certain, when next, on thick tires and with full gas tank, I take to the byways, instead of hastily posting the bulbs I dig to onion growing friends, I shall first sit down with my microscope and note book and write for my files the bulb descriptions,—coat reticulations and all.

5. *Ornamental Alliums for Manitoba*

F. L. SKINNER, *Manitoba*

In Manitoba, where winters are both long and severe and the summers hot and sometimes rather dry, the variety of really hardy bulbous perennials is somewhat restricted and we appreciate all the more those hardy species that can be grown under these trying conditions without special care and protection.

The alliums, though not so showy as some of the other bulbous plants like the Liliums, still have some species that in their quiet way are quite beautiful. The following species are well worthy of cultivation in Northern gardens:

Allium flavum from Siberia grows about 9 to 12 inches high, with narrow somewhat glaucous foliage. The yellow flowers are about the size of those of our native *A. cernuum,* with the individual flowers drooping somewhat. Though not one of the showier alliums, *A. flavum* has one decided attraction for those who love fragrant flowers: its blossoms, especially in the evening, have a decided Old Rose fragrance.

Allium Kansuense, from Western China, when not in bloom looks more like a tuft of very dark glossy green grass than anything else. It only grows to 4 or 5 inches tall, and is quite tufted in habit. The flowers, borne on 6 inch stems, are fair size, almost as large as those of *A. cernuum,* but in smaller panicles, and the color is quite a good blue. This, on account of its dwarf nature, is strictly a rock garden species, as it would soon get overgrown by its neighbors in the border.

Allium odorum [2] of Siberia, if it had the clear color of *A. Zebdenense* would be one of the very best of alliums for general cultivation. It grows 20 to 30 inches high, with stiff straight stems, and heads of

[2] This is apparently *A. ramosum;* not the later flowering *A. tuberosum,* also known as *A. odorum.—Bernard Harkness.*

flowers as large as those of *A. Zebdenense* that have the added attraction of fragrance. The color of the flowers, however, is rather a washy white which cannot compare with the purity of that of an *A. Zebdenense.*

Allium Ostrowskianum, from Turkestan, is one of the easiest grown of the alliums suitable for rock garden cultivation. As it grows in Manitoba it only reaches a height of from 6 to 8 inches high. The individual flowers, however, are of good size, being about one-half inch in diameter, and the panicles, which are held upright, are about 2 inches across. The color is quite a bright rosy red, and with the exception of the root system, this *Allium* very much resembles the European *A. narcissiflorum. Allium Ostrowskianum* forms hard firm round bulbs up to fully half an inch in diameter, while *A. narsissiflorum* forms clumps, more after the style of *A. Kansuense,* and in some cases even running under ground to a certain extent.

Allium Zebdenense, from the Mountains of Asia Minor, is one of the earliest of June flowering bulbs that are hardy in this climate. The 2 to 2½ inch broad umbells of wide open cup-shaped flowers are of good form and quite large for this genus, and a glistening white in color. They are borne on very slender and graceful stalks from 12 to 18 inches tall that sway with the slightest breeze. Few people recognize this beautiful little plant as an *Allium* until they are asked to smell a cut stem or leaf. *A. Zebdenense* has small white bulbs, and in suitable good well-drained soil these increase rapidly and soon form wide drifts that are an ornament to any garden fortunate enough to contain them. *Ixiolirion tataricum,* with its bright blue trumpets, flowers at the same time as *A. Zebdenense,* and the combination of blue and white makes a very pleasing picture.

6. Three Alliums for the Great Plains

Claude A. Barr, *South Dakota*

The growing and enjoyment of Alliums in my western South Dakota garden is greatly limited by the conditions of natural moisture supply to which they are of necessity subjected. Of some dozens of species that have been tried only eight or ten kinds endure. These superhardy ones not only undergo extreme cold, with soil either wet or dry, but must withstand the more crucial test of prolonged droughts in the growing time which in this environment often entail total exhaustion of accessible moisture.

Though actual rainfall in this portion of the Plains exceeds that of the famed Matanuska Valley, or of England, factors of altitude, 3250 feet, high proportion of sunny hours, ever active winds and a normally dry atmosphere combine to dissipate at a high rate the store of moisture. Climatic phases thus may vary from highly favorable for growth to unequivocal desert. Obviously, many species are not fully adapted.

Allium nuttalli, native to the Plains from South Dakota to New Mexico and to Arizona, is quite at home in a sandy footing and is a prime favorite. It is low, eight inches or less, bears its blossoms in May in somewhat lax, upright umbels of a pleasing color which is more than pink but not quite red and above all has no noxious taint of mauve or purple, and they are delightfully fragrant. The slender, terete leaves die down and disappear by Midsummer, a circumvention of the desert employed by many Plains plants.

A charming foreigner is *A. flavum minor* which has been content in the first place offered it, some thirty inches out from the north base of a wall. Here it has full shade but otherwise strong light through several hours of the day, a moderately rich light soil and such moisture as falls. Its color is a distinct attraction and the clear soft yellow umbels have been produced freely and regularly. It grows to eight or nine inches, flowers in late July, its foliage dense, somewhat sedgy in appearance and permanent through the warm season.

My choice of a third favorite is very different, a large plant that I received from the late D. M. Andrews under the name of *Allium recurvatum superbum,* and I believe I had from Mr. Andrews in correspondence the note that it was known as the Pagosa Onion, native only in the neighborhood of Pagosa Springs in the south foothills of the high San Luis Valley in southern Colorado. Hortus Second, as I find, fails to consider the varietal name and of course refers ''recurvatum'' to *A. cernuum.* But one is impressed by familiarity with this plant that it requires further consideration taxonomically. Its garden effect is wholly different, the leaves nearly flat, a quarter of an inch to three-eighths in width, glaucous, and eight to twelve inches long at maturity. The strong scapes may reach to twenty or twenty-four inches and the July borne umbels of large blossoms are a definite pearly pink carrying a hint of lavender, very handsome. This Allium is much at home in the lath house where approximately forty-five percent shade is maintained and evaporation is delayed. In eight years or so a large clump of bulbs has formed and a few seedlings have appeared and thrived in the surrounding clay soil. Its all-summer foliage is a valuable feature.

SOME NUTRIENT DEFICIENCY EFFECTS IN THE ONION

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Little information is available concerning the effect of nutrient deficiencies on plant growth, bulb development, and seed production in the onion, *Allium cepa L.* There is no available information for diagnosing deficiency symptoms in the field. Woodman (7) grew onions in sand supplied with solutions containing (in terms of parts per million) nitrogen 0.41, phosphorus 0.27, potassium 1.12, calcium 0.90, and magnesium 0.25. Deficiencies of nitrogen and phosphorus reduced yields more than did deficient amounts of the other elements. Knott (4) demonstrated that application of copper sulfate to certain New York muck lands resulted in thicker scales and improved bulb color in onions. Fertilizer trials in various sections of the country have produced somewhat variable results, depending upon the soil type and fertility level. In general rather heavy fertilizer applications containing relatively more phosphorus and potassium than nitrogen have been recommended (1, 2, 6). It is known that onions do not thrive on strongly acid or alkaline soils, and lime or sulphur, respectively, have been recommended as correctives (1, 3, 5). Less information is available with reference to specific nutrient requirements for onion seed production. The objectives of the present study were to develop nutrient deficiency symptoms of onion plants and to determine their influence on seed production.

Materials and Methods

In the present study seed of an inbred line of the Yellow Bermuda variety, designated as Texas 986, was planted in 2-inch pots containing burned shale (Haydite) on September 1, 1943. The pots were plunged in Haydite and watered with a complete nutrient solution until November 17. At that date plants selected for uniformity were washed free of shale and planted singly in glazed crocks 4 inches in diameter and 7½ inches deep containing quartz sand. This sand, manufactured by the Pennsylvania Glass Sand Corporation, was of the "F" grade particle size. The plants were watered twice weekly with a complete nutrient solution. This solution, made up in tap water and arbitrarily designated $N_2P_2K_2$, was composed of .002 M $Ca(NO_3)_2.4H_2O$, .0005 M $(NH_4)_2SO_4$, .00125 M K_2SO_4, .000625 M $CaH_2(PO_4)_2.H_2O$, .002 M $MgSO_4.7H_2O$ and contained 2 p.p.m. of Fe, 1.5 p.p.m. of Mn, 0.5 p.p.m. of B, .15 p.p.m. of Zn, .06 p.p.m. of Cu, and sufficient H_2SO_4 to be approximately .0002 N. Additional plants were trans-planted to crocks containing soil composed of 1 part composted soil, 1 part sand, ½ part manure, and ½ part muck.

On January 4 the crocks were separated into 16 lots of 6 each. Two liters of the complete nutrient solution ($N_2P_2K_2$) were applied twice weekly to one lot of plants and solutions deficient respectively in N, P, K, Ca, Mg, B, Mn, and Fe to 8 other lots. In addition a complete solution ($N_1P_1K_1$) one-fifth as concentrated as the $N_2P_2K_2$ preparation and three other solutions containing very low concentrations of N, P, or K, respectively, were used. In order to compare the effect of different concentrations of calcium without affecting the level of other elements varying amounts of calcium carbonate were applied to three further sets of crocks at monthly intervals by distributing over the surface of the sand. The amounts used were equivalent to solutions containing 15, 75, and 300 p.p.m. of calcium. In these solutions the $Ca(NO_3)_2$ was replaced with NH_4NO_3 and the $CaH_2(PO_4)_2$ with KH_2PO_4. Additional potassium was supplied by K_2SO_4. Concentrations of major elements in the 16 solutions are shown in Table 1.

During the winter the greenhouse temperature was maintained at 50° to 55° F. at night and 60° to 65° in the daytime. The plants were sprayed at intervals with derris, nicotine sulfate, and Santomerse in order to control thrips.

Table 1

Calculated concentration of various elements in parts per million of nutrient solution.

Nutrient solution[1]	Nitrate as N	Ammonium as N	P	K	Ca	Mg
1. —N	—	—	38	97	105[2]	48
2. —P	56	14	—	97	105[2]	48
3. —K	56	14	38	—	105	48
4. —Ca	56[3]	14	38[4]	97	—	48
5. —Mg	56	14	38	97	105	—
6. —B	56	14	38	97	105	48
7. —Mn	56	14	38	97	105	48
8. —Fe	56	14	38	97	105	48
9. N1 P1 K1	11.2	2.8	7.6	19.4	21	9.6
10. N2 P2 K2	56	14	38	97	105	48
11. N low P2 K2	2.3	0.46	38	97	105	48
12. N2 P low K2	56	14	1.4	97	105	48
13. N2 P2 K low	56	14	38	3.5	105	48
14. N2 P2 K2, Ca 15	28	42	38	97	15[5]	48
15. N2 P2 K2, Ca 75	28	42	38	97	75[5]	48
16. N2 P2 K2, Ca 300	28	42	38	97	300[5]	48

[1] See text for details of preparation.
[2] Additional Ca from calcium chloride.
[3] Nitrate from sodium nitrate.
[4] Phosphate from sodium phosphate.
[5] Calcium from solid calcium carbonate.

Seed stalks were produced on some of the plants during April. A hive of bees was placed in the greenhouse to assure pollination. When mature the seed heads were threshed by hand, washed in water, and only the seeds that sank were retained. After air drying, total and 100-seed sample weights were determined for each plant. The seeds were tested for germination under the supervision of Dr. E. H. Toole. They were germinated between blotting paper, generally in quadruplicate 100-seed tests, at a constant temperature of 20° C. for 14 days. Plants from some treatments produced bulbs instead of seed stalks. When they were mature their air dry weight was determined. These data are shown in Table 2.

Results

Nutrient deficiency symptoms

Nitrogen.—Plants lacking nitrogen grew slowly, became stiff and upright in growth habit with short leaves of small diameter, very light green in color. Later the tips of the older leaves died and assumed a bleached, yellowish color. (Figure 132)

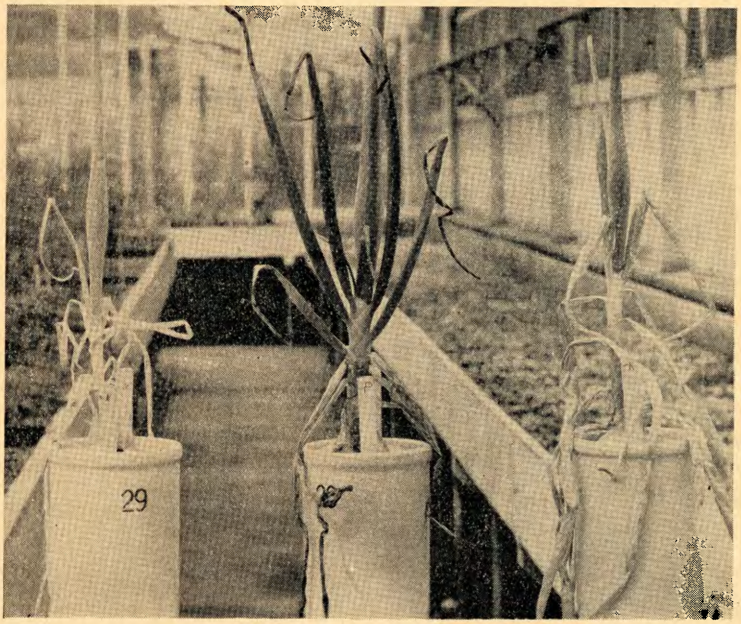


Figure 132. Nutrient deficiency symptoms in onion seedlings. Left to right: Deficient in nitrogen, in phosphorus, in potassium, respectively.

Phosphorus.—Absence of this element was apparent by February 7. First deficiency symptoms appeared as wilting and death of the tips of the oldest leaves. These leaves soon become mottled in appearance, with green islands appearing among yellow and brown tissue as necrosis advanced toward the leaf base. The dead leaves turned black. (Figure 132).

Potassium.—Earliest symptoms of potassium deficiency appeared as a slight yellowing of the oldest leaves. This was followed by wilting and death of the leaf tips, particularly on the upper side of the leaf. The wilted areas exhibited a satiny texture and the entire leaf dropped, remained somewhat inflated, gradually assuming a crepe-paper-like appearance. Finally the leaves became about the same color as those deficient in nitrogen but retained the crepe-paper-like appearance. (Figure 132).

Table 2

Seed and bulb production in onions grown with different nutrient solutions.

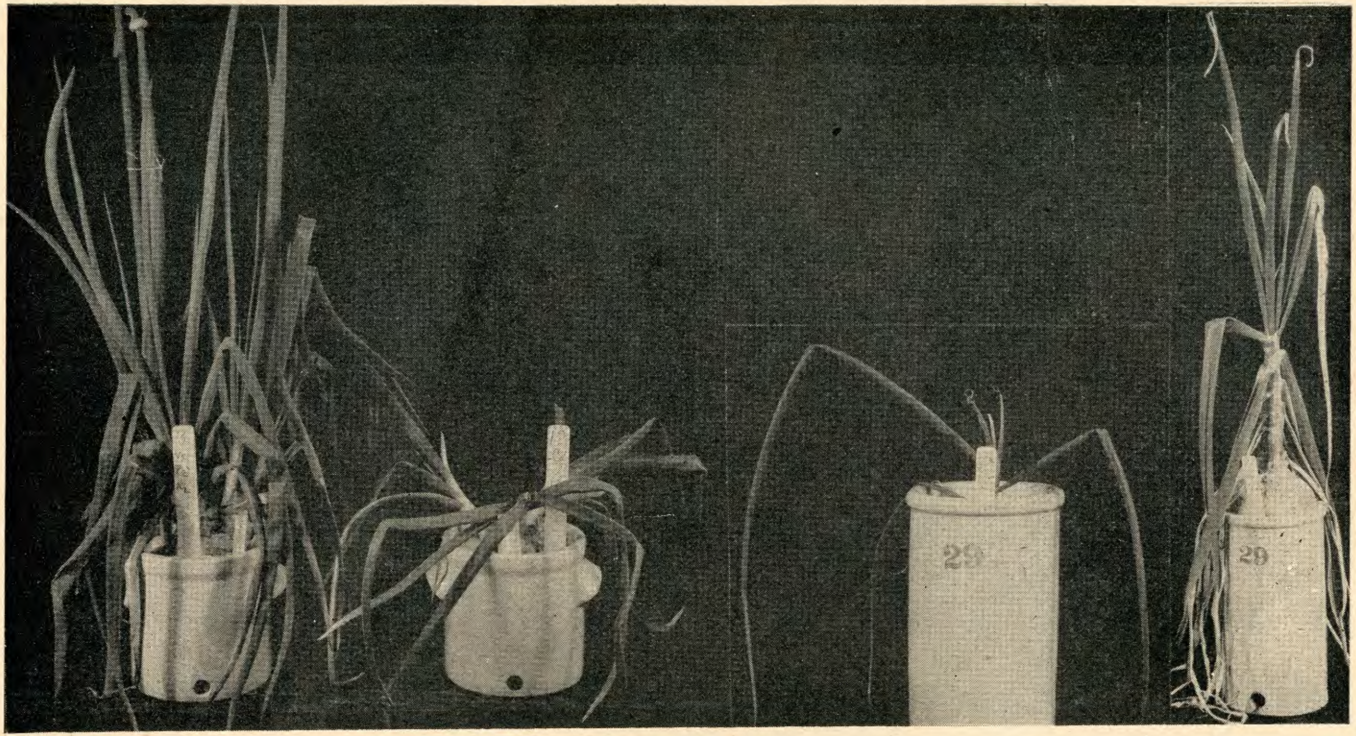
Nutrient solution[1]	No. of plants with seed stalks[2]	Wt. of seed per plant	Wt. of 100 seeds	Percent Germination	Mean wt. of bulbs from plants without seed stalks
		Mg.		Mg.	Grams
1. —N	6	611	283	94.5	—
2. —P	6	773	268	93	—
3. —K	3	1231	281	92	130
4. —Ca	2	3085	318	92	272
5. —Mg	1	3870	325	97	285
6. —B	0	—	—	—	140
7. —Mn	5	4779	325	95.6	293
8. —Fe	3	5627	335	97.3	273
9. N1 P1 K1	1	1583	275	95	184
10. N2 P2 K2	4	4669	362	94.8	314
11. N low P2 K2	6	1003	266	96	—
12. N2 P low K2	2	1979	285	96	244
13. N2 P2 K low	1	2429	277	97	175
14. N2 P2 K2, Ca 15	2	3622	312	92	251
15. N2 P2 K2, Ca 75	3	4282	302	96	291
16. N2 P2 K2, Ca 300	5	5384	320	96	330
17. Soil	6	2422	307	96.8	—
Mean	3.5	2959	303	95.1	244.8

[1] See text for details of preparation.
[2] Six plants in each test lot.

Calcium.—Preliminary tests with onion plants grown from bulbs as well as seedling plants, to which no calcium was supplied, resulted in death of the youngest leaves, collapse of the roots, and ultimate death of the plants (Plate 275). However, in the present study when calcium was supplied to such plants during their early growth and then withheld, deficiency symptoms were never severe, including death of the leaf tips but no serious reduction in growth.

Boron.—Plants deficient in this element assumed a deep blue-green color. Later the youngest leaves became conspicuously mottled yellow and green and developed distorted shrunken areas. Ladder-like transverse cracks appeared on the upper sides of the basal leaves. These leaves became very stiff and brittle (Figure 133).

Magnesium, manganese, and iron deficiency symptoms were not evident during the present study.



Calcium deficiency symptoms. Left to right: Plant from a bulb, supplied with complete nutrient solution; calcium deficiency in plant from a bulb; calcium deficiency in a seedling; calcium deficiency in a seedling started on complete nutrient.

Plate 275

Effect of Nutrient Supply on Seed Production

Plants watered with solutions lacking boron formed no seed stalks and only small bulbs. Obviously an adequate supply of boron is of prime importance in onion bulb and seed production.

All six plants without nitrogen after January 4 (solution 1, Table 2), all those with very low nitrogen (solution 11), and all those in soil bolted and set seed. However, of plants receiving $N_2P_2K_2$ (solution 10) only four of the six produced seed stalks, while only one plant watered with $N_1P_1K_1$ (solution 9) produced seed. It appears that only a small amount of nitrogen in the nutrient solution is sufficient for seed stalk formation provided the other elements are not also deficient. A large amount of nitrogen accompanied by abundant phosphorus and potassium results in vigorous vegetative growth that is unfavorable for seed stalk formation. It should be added that of the plants producing seed stalks the yield of seed per plant was roughly proportional to the total nitrogen in the nutrient solution (—N=611 mg, Nlow=1003 mg, N_1=1583 mg, soil=2422 mg, and N_2=4669 mg).

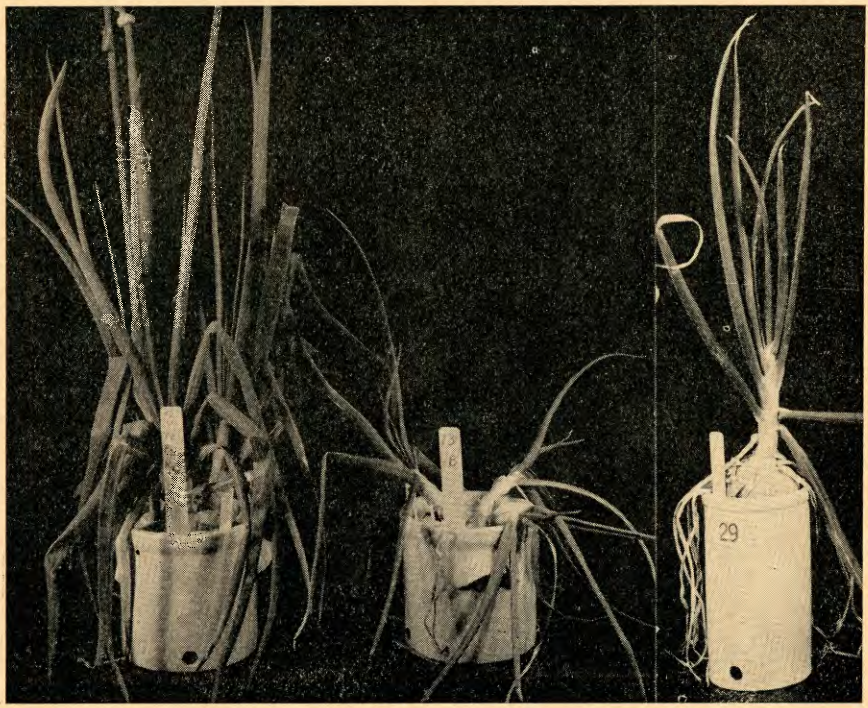


Figure 133. Boron deficiency symptoms. Left, plant from bulb supplied with complete nutrient; center, boron deficiency in plant from a bulb; right, boron deficiency in a seedling started on complete nutrient.

Phosphorus is usually considered to be very necessary for seed formation. Yet in the present study plants that had received no phosphorus (solution 2) for more than 3 months prior to bolting and that showed leaf symptoms of phosphorus deficiency for 2 months of that period, were able to produce seed having a germination percentage of 93 percent. Plants receiving very low phosphorus (solution 12) produced fewer seed stalks but more seed per plant than did those completely deficient in this element.

Absence of potassium in the nutrient solution (solution 3) reduced the number of seed stalks, the yield of seed per plant, and the weight of the bulbs produced by plants that did not bolt. Small amounts of potassium, 3.5 p.p.m. (solution 13), nearly doubled the amount of seed produced per plant.

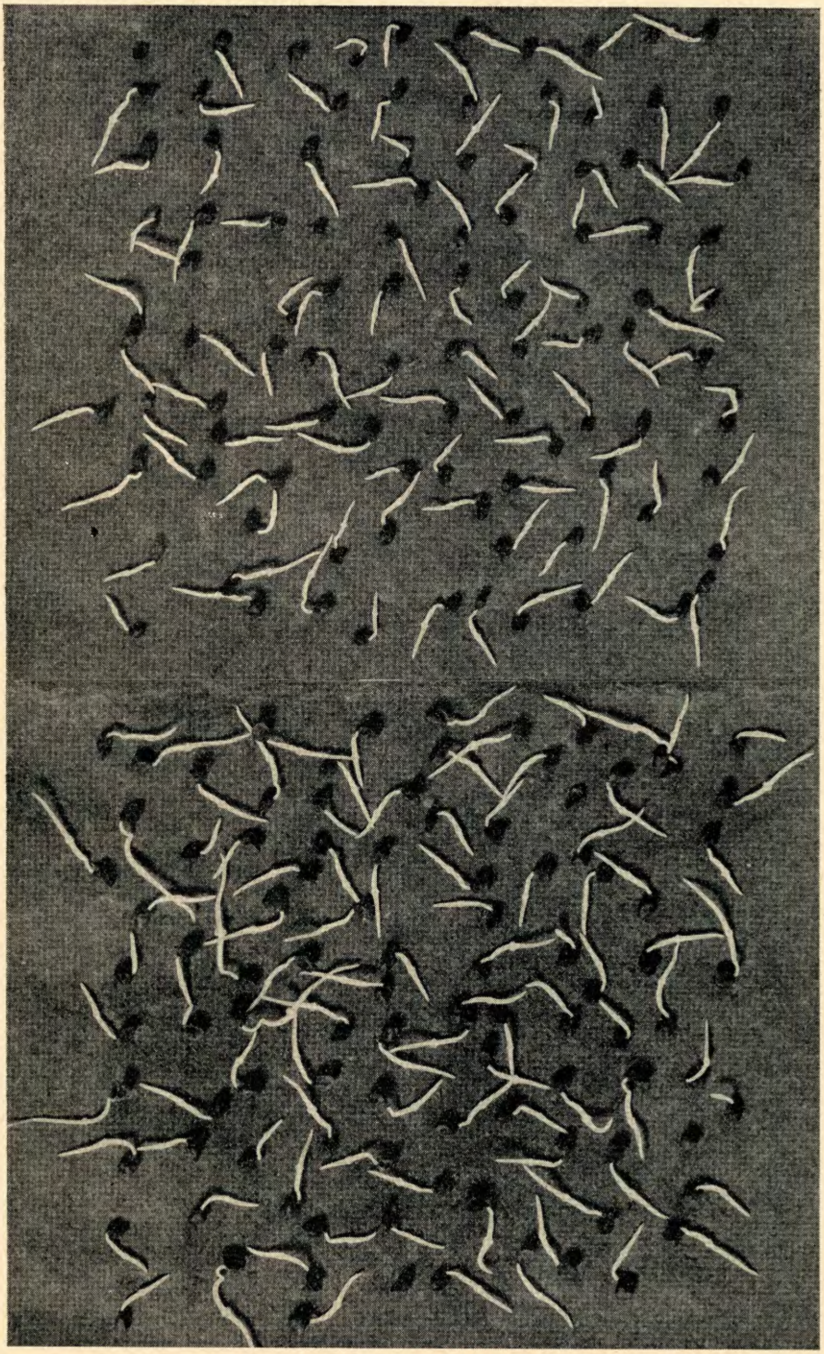
Calcium deficiency appeared to exert less effect on seed production than did lack of nitrogen, phosphorus, or potassium. Where differential amounts of calcium were supplied (solutions 13, 14, and 15), the yield of seed increased with increasing amounts of calcium added.

Half of the total number of plants receiving magnesium, manganese, and iron-deficient solutions produced seed stalks and yields of seed greater than the mean for all treatments. The other plants in these lots produced bulbs larger than the mean bulb weight for all treatments. Apparently the plants absorbed ample amounts of these elements during their preliminary growth with complete nutrient. It is also recognized that the tap water furnished small amounts of these elements, which may have been adequate for their requirements.

The major differences among the treatments were quantitative rather than qualitative insofar as total seed yield and percentage of germination were concerned. There were differences in individual seed weights among the treatments. As shown in Table 2, 100 seeds from the plants deficient in nitrogen, phosphorus, and potassium ($N_1P_1K_1$) weighed 275 mg., while 100 seeds from the $N_2P_2K_2$ treatment weighed 362 mg., an increase of 31 per cent. The difference in seed size as well as in sprout vigor is clearly evident in Plate 276.

Discussion

The strain of onions used in the present study has proved to be resistant to bolting in the field. When grown in the greenhouse under conditions favorable for bolting not all of the plants differentiated seed stalks but some continued to grow and produced bulbs. Formation of a seed stalk instead of a bulb by an onion seedling depends upon genetic and environmental factors. The latter include temperature, photoperiod, and available nutrient supply, plant size being a reflection of the last. The data in Table 2 show that only 56 of 102 plants produced seed stalks. All that did bolt set seed that had a germination percentage above 91 percent. Since there is little difference in quality of seed, the best treatment is the one producing the highest total yield. Most seed was produced by plants receiving the



Germination tests of onion seed. Top, seed from a plant supplied with low level of nutrients (N1P1K1); bottom, seed from a plant supplied with high level of nutrients (N2P2K2).
Plate 276

highest level of nitrogen in the nutrient solution. Evidence from this and from collateral experiments indicates that too high a level of nitrogen during the vegetative growth of the plant inhibits seed stalk differentiation while too low a level reduces seed yield per plant. It would seem that maximum seed yields might be produced by the use of ample nitrogen during the early growth of the plant, by restriction of this element until seed stalks are differentiated, and finally by further applications of nitrogen during seed development. Experiments to test this hypothesis are now in progress.

Summary

Seed of a Yellow Bermuda strain of onion, Texas 986, was planted September 1 and grown in sand with complete nutrient until January 4. At that time 16 series of nutrient treatments were applied until bulbs or seeds were mature. Symptoms of nitrogen, phosphorus, potassium, calcium, and boron deficiencies are described and the influence of these deficiencies on seed yield, weight, and germination is discussed.

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A PERSONAL SELECTION OF DAYLILIES

Elmer A. Claar, *Illinois*

For a period of years before the war I took an annual trip to the gardens of the daylily hybridizers and the various daylily trial gardens throughout the United States. With the coming of the war and the advice against traveling I have been unable to make these trips. I miss very much the pleasant times I have had at the homes of the people who hybridize daylilies, and especially in meeting the hybridizers themselves, but I suspect that I am essentially very selfish in that most of these trips were made with the idea of acquiring the fine new things these people were raising. So the report that I make this year has more to do with the daylilies that have come to make their home at my garden rather than seeing something that is being grown elsewhere.

Among the most satisfactory perennials for our garden, with its many trees, is the daylily. Daylilies stand neglect and are free from most insect pests. They thrive with lots of rain or through extended drought. I have seen them grown in all types of soil—rich, poor, acid, alkali, sandy or clay. Daylilies can "take it," but like everything else they do best when you are kind to them. They are available at varying flowering seasons and with a wide range of heights—from one to six feet—and colors—lovely shades like cream, yellow, orange, pink, rose, raspberry, red, maroon, purple and brown; bicolors alternating three petaloid-segments of cherry red, maroon, brown or purple with three sepaloid-segments of yellow, ivory or orange. Many of the individual flowers have a number of different colors. Many have a number of different colors overlapping each other like shot silk. The flowers are large—up to nine inches—and as small as one inch; they are as fine as the finest liliums. A single scape may have as many as fifty flowers with large numbers of scapes to an established plant. One plant may have several hundred flowers during the season and a profusion of flowers in bloom at one time. It is generally claimed but not true that they are entirely free of insect pests; I have seen some damage done by thrips and Japanese beetles, some varieties winter kill, and I have also seen the leaves of some turn yellow. However, I have found from experience that most plants have some limitations and that I get a maximum amount of pleasure with a minimum of work by raising daylilies in our garden, shady as it is. They are at their best when the heat of July and August is here and other favorites are out of season. Buy a few of the new hybrids and you will soon be lustily singing their praises.

If I had no daylilies and I wished to buy a few varieties for a small sum of money, I would select the following:

Group I

Early Bloomers (approximately before June 10 in the Chicago suburbs)

Lemon Yellow: *Flava*
Yellow: *Gold Dust*
Orange: *Dr. Regal*

Intermediate Bloomers (approximately between June 10 and 20 in the Chicago suburbs)

Creamy Yellow: *Winsome*

Summer Bloomers (approximately June 20 to August 1)

Light Yellow: Hyperion or Patricia
Yellow: *Golden Bell*
Orange Yellow: *Ophir*
Orange: *Golden Dream*
Eyed Variety: *Mikado*
Red: *Cissy Guiseppe*
Polychrome: *Fulva*
(*Mikado, Hyperion, Patricia* and *Ophir* are all near the top of the ten best daylilies selected by a vote of those interested in the flowers.)

Late Bloomers (approximately August 1 on): *Multiflora*

Group II

If I wished to add another twelve plants to my collection and keep the additional price down between $12 and $15, I would select the following:

Early Bloomers

Yellow: *Flavina* or *Estmere*

Intermediate Bloomers

Orange Yellow: *Queen of May*

Summer Bloomers

Cream: *Moonbeam*
Light Yellow: *Hesperus*

Yellow: *Golden Bell*
Orange: *Mrs. A. H. Austin*
Orange Yellow: *Golden West*
Polychrome: *Linda, George Yeld* and *Chengtu*
Red Orange: *Imperator*
Bicolor: *Chisca*

Late Variety: *Dorothy McDade*

Group III.

The above selection of daylilies, with the first group, could be chosen as standard for the colors involved. If I were interested in some of the new colors such as the pink, raspberry, rose, red, maroon and purple, inasmuch as these are the newer novelties and therefore rare, I would expect to pay more money for them. Among the first plants that were introduced in these color classes, therefore arbitrarily selected by me as typical, are:

Pastel Pink: *Pink Charm*
Raspberry: *Piquante*
Rose: *Fulva Rosalind*
Red: *Emperor Jones*
Maroon: *Wolof*
Ruby: *Royal Ruby*
Purple: *Theron*

If my tastes were not satisfied with the first selections as named in the above group, I would make a comparison of the pastel pink, *Pink Charm,* with *Sweetbrier, Heather Rose, Dolly Varden, Sri Chandra, Bertrand Farr, Mandalay, Buddy, Flamingo, Helen Wheeler* and *Salmon Rose.* In the raspberry class compare *Piquante* with *Highland Chieftain, Lady Franklin, Tarrytown, Ramona* and *Red Aroma.* In the purple class compare *Theron* with *Purple and Gold, Empress, Black Falcon, Black Prince, Purple Finch, Purple Elf, Black Sambo, Potentate, The Sultan, Northwestern Purple, Purple Waters* and *Purple Flash.* In the rose class compare *Fulva Rosalind* with *Petra, Dawn Play, Tara, Indian Chief, Wekiwa, Minnie, Mrs. Houston, Elizabeth Wheeler* and *Lady Franklin.* In the reds compare *Emperor Jones* with *Red Bird, Port, Matador, Red Hussar, Crimson, Mrs. B. Martin, General MacArthur, Fire Red, Sachem, Carnival, Peony Red, Vulcan, Neon, Vladimir Horowitz, Blood, Bold Commando, Warpath, Tejas, Spitfire, San Juan, Royalty, Victory Taierhehwang, Kanapaha, Ohred, Morocco Red, Warren Hutchings, Ruby Queen, Orlando, Tahiti Belle, Brackel, Wolof, Red Sox, Red King, Demon* and *Granada.* In the ruby class compare *Royal Ruby* with *Craemore Ruby, Ruby Supreme* and *Ruby T.* In bicolors compare *Chisca* with the pastel bicolors *Debutant, Cantabile, Sulin, Boutonnierre, Peaches and Cream* and *Merriewoode Star* and with the strongly contrasting bicolors *Gay Troubadour, Bold Courtier, Royal Lady, Festival, Purple and Cream, Caballero, Bicolor, Mildred Orpet, Regal Lady, Betty Sleight, Tacoma, Bobolink* and *Jean.*

If I wished to attempt to improve upon my yellow and orange varieties I would compare those in the first and second groups with the following recent introductions, whose originators believe them superior or different from the flowers in Group I and II:

Early Bloomers

Yellow: *Earliana*
Orange Yellow: *Judge Orr*

Intermediate Bloomers

Light Yellow: *Little Cherub*
Orange: *Queen of Gonzales* and *Gloriana*
Bicolors:
Pastel: *Symphony*
Vividly contrasting: *Zoave*
Polychrome: *Dominion*
Eyed Varieties: *Aladdin, Buckeye* and *Gay Coquette*

Summer Bloomers

Cream: *Canari, Vespers, Moonbeam* and *Duchess of Windsor*
Light Yellow: *Mission Bells, Mrs. B. F. Bonner, Mongol* and *Gorgio*
Yellow: *Anna Betscher, Circe* and *So Big*
Orange: *Majestic, Joanna Hutchins, Gipsy Lass* and *Turbani*
Orange Yellow: *Annus Victoria Russell*
Polychrome: *Twinkle Eye, Painted Lady, Honey Redhead, Rajah, Dr. Stout, Dauntless, Melo, Afterglow* and *Chloe*

Late Bloomers: *August Prince* and *Boutonnierre*

The following are noted for their special characteristics as indicated:

Eyed Varieties: *Mikado, Rajah, Aladdin, Buckeye* and *Gay Coquette*
Curled and Twisted: *WauBun, Curly Pate, Taruga* and *Emily Hume*
Fragrance: *H. Flava, H. Citrina, Lemon Queen, Ophir, Princess, Soudan, Yellow Hummer* and *Patricia*
Bold Striking Contrast: *Mikado, Bagdad, Twinkle Eye, Gay Coquette* and *Rajah*
Small Sized Flowers: *Prima, Bijou, Boutonnierre, Multiflora, So Big, Little Imp, Summer Multiflora, Black Sambo, Saturn, Little Cherub, Yeldrin* and *Tom Thumb*
Large Sized Flowers: *Star of Gold, Hesperus, Indian Chief, Mongol, Golden Dream, Byng of Vimy, Hyperion, Ophir, Twinkle Eye, Annus Victoria Russell, Flavia, Mission Bells, Gorgio, Massasoit, George Yeld, Swan* and *Aristocrat*
Evening Bloomers: *Calypso, Gold Standard, Baroni, Citronella* and *Gold Imperial*
Extended Bloomers: *Orangeman, Estmere, Tangerine, Apricot, Gold Dust, Sovereign, Aureole, Winsome, Sirius, WauBun, Sir Michael Foster, Soudan, Radiant, Royal, Ophir, Mikado* and *Vesta*

Tall Plants: *Massasoit, Lady Fermoy Hesketh* and *Nebraska*
Short Plants: *Pigmy, Minor, Gracilis* and *Nana*
Semi-Dwarf: *Tangerine, Estmere, Orangeman, Gold Dust, Apricot* and *Sovereign* (all intermediate bloomers)
Double-Flowered: *Kwanso, Flora Pleno* and *H. Fulva Variegata*

A selection of the named varieties of daylilies which I like best, irrespective of price, in some color classes is simple but in others it is most difficult. Here is my selection

Early Bloomers:

Yellow: *Earliana* or *Elizabeth*
Orange: *Judge Orr*

Intermediate Bloomers

Cream Yellow: *Winsome*
Light Yellow: *Little Cherub* (This is my seedling so I am definitely prejudiced, but I like it very much)
Orange: *Queen of Gonzales*
Red: *Wekiwa*
Bicolor—
Pastel: *Symphony*
Strongly Contrasting: *Zoave*
Polychrome: Dominion
Eyed Variety: *Gay Coquette* (again a seedling of mine)

Summer Bloomers

Cream: *Vespers*
Light Yellow: Either *Hesperus, Mission Bells* or *Mrs. B. F. Bonner* (I cannot decide at this time)
Yellow: *Anna Betcher*
Orange: *Majestic*
Orange Yellow: *Golden West*
Pink: *Sweetbriar*
Raspberry: *Piquante*
Purple: *Potentate*
Rose: *Dawn Play*
Red: *General MacArthur, Red Sox* or *Tejas*
Maroon: *Morocco Red* or *Wolf*
Bicolor—
Pastel: *Debutante*
Contrasting: *Bold Courtier*
Polychrome: *Painted Lady, Twinkle Eye, Honey Redhead* and *Dr. Stout* (all different and very good in my garden)
Eyed Varieties: *Mikado*

Late Bloomer: *August Prince*

However, I have seen many as yet unnamed seedlings which I am sure will replace some of the above named varieties in time.

DAYLILIES AS A HOBBY

George Gilmer, *Virginia*

Daylilies are my hobby. A relative gave me two varieties some years ago. I have added 78 kinds to my collection since. I have only discarded two but will let others go as I get newer and better ones.

I get a few new ones by purchase or exchange nearly every year. During blooming season my son and I hurry out every morning before breakfast trying to be first to find a bloom on a new variety. In two years the plants are usually large enough to divide. I often want several dozen plants of a fine kind. This means a second division after another two years.

I like daylilies because they are almost free from insects or disease. I have had brown spots on the foliage of one variety. They need no spraying, dusting or winter protection.

When I plant them I water them and put a mulch of leaves, weeds, grass, corn shucks, pea hulls or other vegetation around them. I *never* work around or between them! Mine generally produce as large and numerous blooms as the catalogue descriptions. They are as vigorous as any I have seen at a commercial growers or at the United States Experiment Station, Beltville, Maryland. My roots are larger than any I have bought. I have practiced on my daylilies for years the method of cultivation recommended in "Plowman's Folly," except that there has been no discing. If weeds or grass try to choke the daylilies while young, they are pulled up, dirt knocked off the roots and added to the mulch. After daylilies are well established they form such a dense compact mass that a weed seldom appears among them. I plant daylilies all around my place, under trees and among the shrubs. They succeed where they have full sunlight one-fourth the time . I plant my newer and better ones where they have sunlight one-half the time or more. As far as I can tell they grow just as well with full sunlight half the time as they do with more light.

The season of bloom here is from May to the middle of November. They can be moved at any time. My losses have been less than one plant in a hundred. Frequently I move them during blooming season to be sure of the variety. The first plants I received came in July. I hurriedly set out some sixty plants of two kinds one evening after work. A dry spell followed when water was so scarce we were not allowed to water any plants. All the foliage died to the ground in August and I thought the plants were dead. A rain came in September. Up they came like springtime and I had good October blooms from plants that normally bloom in May. Ever since I have been a daylily fan.

Trading with growers is a lot of fun. Plants multiply so in a few years you can share them with friends. Twice the Farr Nursery has given me some of their newest introductions for my surplus stock of plants they had previously sold me.

I love to watch the difference in growth. Some start much earlier than others in the spring. Some, like *Chengtu* are very drought resistant. Some form only compact clumps. Others send out underground roots and throw up shoots a considerable distance from the parent plant. The foliage of some die in the fall while others are blooming. Some have good green foliage after heavy frost. *Linda, Vulcan* and ''Summer Multiflora Hybrids'' have plant buds on the flower stems. They start roots about when the last flowers on the stem have bloomed. Planted in the open ground with the bud an inch deep and a few leaves above ground, 75% will develop into plants. They are always the true parent stock. I believe you can raise 100% with care that bloom the second year.

Daylilies are a relatively inexpensive hobby with lots to interest the grower during most of the year. I find seedlings interesting. It is fun to try to figure from parentage plants, blooms, stalk, etc., what the blooms will be before they open. The chance of getting a worth while plant is less than one in a thousand, but it is fun and there are people glad to get seedlings. They can be used on roadsides and along streams and open woods. No wonder they are the favorite flower of an increasing number of enthusiasts.

FEEDING DAYLILIES

J. S. Cooley, *Maryland*

Good gardeners have learned by experience that if they expect to get an abundance of fine flowers from such plants as the peony, the narcissus or the chrysanthemum that a mellow and fertile soil must be provided and that even better results are obtained if the soil is prepared and enriched the year before planting. For the daylily, however, the idea often prevails that all one has to do is to plant them, that they grow in any climate, in any kind of soil, in full sun or in full shade. It is true that *Fulva* and some other kinds will stay alive and even bloom under very adverse conditions. But most varieties will respond just as much to a deep fertile mellow soil and to good culture as any other garden flower. That naturally raises the question, what is good treatment? Some varieties will respond better than others to good treatment or conversely some varieties will take adverse soil and moisture conditions better than others, but in general a deep friable soil well stocked with humus is desirable. It is also important that daylilies be planted far enough away from trees and shrubs so they will not be robbed of moisture and fertility by the adjacent trees or shrubs. An application of a tablespoon full to the square foot of such mineral fertilizer as a 5-8-5 has given good results with the writer. A word of caution, however, should be given, for although the daylily is a vigorous feeder it is very easy to overdo the application of commercial fertilizer at the rate of 600 lbs. to the acre is usually sufficient. A compost pile where leaves, dead plants and even brush are rotted is just as necessary for the grower of daylilies as for the grower of other garden flowers. A liberal application of such compost worked into the soil at planting time will always repay the effort. The response of daylilies to a deep fertile soil may be observed if one sets a plant in soil that has been dug and enriched to a depth of 16 or 18 inches. After a year or more if the clump is taken up he will note the mass of deep roots and realize that the daylily is a vigorous feeder when one provides the food and the feeding space.

It may be inferred that since daylilies thrive in a fertile soil that the application of fresh manure would be beneficial, but such is not the case just as with many other plants. In the experience of the writer there is some constituent in fresh manure especially in such concentrated manure as chicken manure that is toxic to daylilies. Soon after the application of fresh manure growth stops and the leaves begin to turn yellow. Cases have been reported where there was good evidence to show that daylily plants have actually died from the application of fresh manure.

WHAT CAUSES RICHNESS OF COLOR IN DAYLILIES?

J. S. Cooley, *Maryland*

The summer of 1943 was unusually dry with few cloudy days. It was common observation of daylily growers here in the vicinity of Washington, D. C. that the colors of daylilies were decidedly disappointing. During these bright and warm days with little humidity the flowers of such varieties as *Pale Moon, Anna Betscher, Sunny West, La Tulipe,* and *Vulcan* faded or burned considerably while other varieties such as *Rajah* that do not burn even on a hot day did not burn but they did not seem to have the sprightly character that one expected judging from remembrance of the color in other years. One of our seedlings that seemed to be such a strikingly brilliant red in 1942 seemed to be less bright in the summer of 1943, apparently because of an excessive amount of an under color of yellow making for dullness. In the summer of 1943 a situation occurred that very materially affected the color of daylilies. When the mid-season varieties were in the height of their blooming season there was a local rain of nearly an inch followed by moderate temperature—not especially cool. The flowers the next day after the light rain and the weather conditions mentioned above were particularly beautiful. Such varieties as *Dr. Stout* that is always beautiful *was especially charming for the gold that seems to be dusted over the flower now had a glistening reddish sheen that was gorgeous. Rajah* was very much brighter than usual. In fact those varieties usually having a copper tone on this particular occasion had a pleasing reddish under tone.

One might very properly ask the question, what makes rich tones and bright colors in daylilies? Are daylily flowers different from other flowers with respect to the causes of bright colors? Bright colors are usually associated with cool weather. As one drives from the lower elevations to the higher in the Cascade Mountains and observes the color in the bracts of Indian paint brushes *(Castilija)* growing by the road side, it is very obvious that the red tones get richer as one advances to the greater elevation. This change in color from a yellow to a flame color as greater elevation is attained is usually considered due to temperature. Where flower color is concerned there is probably a different situation than obtained in the bracts and leaves. With *Narcissus* which is also an amaryllid, it is a common belief that such varieties as ***Fortune, Fire Tail, Mrs. Brewster,*** and others, when growing here in the vicinity of Washington, D. C., have much more red in the cups and are much richer color in those years when the weather is cool at blooming time than on those years when the weather is hot. Dryness is seldom considered a limiting factor in the early spring when *Narcissus* are blooming. It would be interesting if one were to grow certain varieties of daylilies in different moisture and temperature conditions with other factors the same and thus determine to what extent these things influence quality of color. It may be that the available supply of certain mineral nutrients has its effect on color. Or it may be due to such an interaction of the temperature, moisture and nutrition factors so that one cannot separate out any one element and say this is the responsible agent. At any rate it would be interesting if the readers of this publication would record their experience and observations of the things that make for richness of color in daylilies.

HYBRID AMARYLLIS CULTURE AT MIAMI, FLORIDA

Miami, Florida,
September 16, 1944.

Dear Members:—

It gives me a great deal of pleasure to read the many good articles in HERBERTIA, particularly those on types, cultivation, hybridization and propagation of hybrid *Amaryllis.*

I am an amateur grower of hybrid *Amaryllis,* Mead strain, and it might be of interest to other growers to give an account of some of the experiences I have had, which I have not seen mentioned by any other *Amaryllis* growers. Here in the region of Miami, Florida, I started about 10 years ago with a small number of Mead Strain Hybrid *Amaryllis* bulbs as a hobby, and through vegetative propagation and seedlings the increase has been tremendous.

Field culture in this semi-tropical climate, where the sun shines almost constantly although the thermometer does not rise so very high, calls for partial shading of hybrid *Amaryllis.* This shade has been supplied in my garden largely by Avocado trees, erroneously called "Alligator pear." It is hardly necessary to add that all who visit here are delighted with the delicious Avocado fruits as grown in the Miami region.

Additional shade is supplied by the bi-annual planting of the *Carica papaya* trees which produce most delicious and delightful fruits of this region or any other region. The fruit when eaten fresh has a gentle laxative effect and is served as an excellent dessert. Some of these Papaya trees give leaf shade from eight to twelve feet and produce fruit at the rate of from 25 to 300 pounds per tree. We plant the Papaya trees about 12 feet apart.

In addition to the above, we plant an extra cover crop to protect the soil from the penetrating rays of the sun with a vining pea, called Nassau Red, which literally covers the entire area from six to eighteen inches deep, providing ample shade for the soil and bulbs during the summer season. In the fall the hybrid *Amaryllis* are not in very active growth after growing about ten months in the year. It may be well to state, that when nature does not furnish sufficient moisture that we rely on over-head irrigation to supply the necessary moisture for my garden. In general it may be truthfully said that my garden in the Miami area is a very busy portion of nature's playground of activity, including Avocado trees, Papaya trees, Pea vines and the many thousands of *Amaryllis* bulbs; and were it not for the wonderful sunlight above referred to, nature could not exert herself in such a wonderful degree of activity and productivity.

One of my main reasons for the writing of this letter is to state, that in the commercial cut flower market in the Miami area the demand for this most beautiful Lily by the buying public shows that the appreciation of this gorgeous flower is an established fact. We have for the past twelve months been supplying *Amaryllis* blooms as cut flowers through the trade in this city even in the months of July, August and September, and have this date sent several dozen to the flower market, when customers can hardly believe that *Amaryllis* blooms are available at this season of the year.

It is my opinion that the *Amaryllis* will become one of the standard cut flowers on the market due to its keeping qualities from its bud stage to its decline. When kept in vases with the water changed daily, it will retain its brightness and beauty from three to seven days. I believe the growers of *Amaryllis* would do well to encourage the introduction and marketing of these beautiful lilies of nature.

Of course experienced growers of *Amaryllis* know that the blooming period varies in different climates. Here in Miami, our volume of bloom is between February 15th and April 15th. During this time when the blooms are out in full glory by the many thousands in my garden, the varying shades of miscellaneous colors, patterns appear to the eye of the lover of nature in a manner that no words can express—the wonder, beauty and glory of nature in flowers. It is truly ''A wonderful sight to behold.''

Through the publication of HERBERTIA we have and are receiving many nice orders for our bulbs from all parts of the United States.

I sincerely trust that all the *Amaryllis* growers get as much kick and pleasure out of their activity with these beautiful lilies as I do out of mine as a hobby and diversion from the active practice of Medicine and Surgery.

Yours very truly,

J. G. Du Puis, M.D.

AMARYLLIS PSITTACINA

W. M. James, *California*

This flower should be seen in color to gain a true impression of it. The green and red color in the petals reflect so near the same light value that the difference in color does not show well in a "black and white" (Figure 134).

Figure 134. Amaryllis psittacina. Photo by W. M. James

The flowers were about five inches across and about six inches long. The scape was eighteen inches high. The segments are slightly wavy, crimson on the edge and with the keel and most of the lower part a bright vivid green. There is no distinct separation between the red and green. Many colored lines radiate from the green into the red. The stamens are shorter than the perianth. The flower was on a bulb received from the United States Department of Agriculture several years ago. It would be interesting to know whether this green color is produced by anthoxanthin or chlorophyll. The color is very different from the green color of the vegetative parts.

AMARYLLIS IN WEST TEXAS

IRENE STEWART, *Texas*

It is possible, my love for flowers, and especially bulbous plants, started from babyhood. At the country place where I was born in Louisiana, there was a brick walk from the front "gallery" steps to entrance gate. On either side of walk, there was first a border of violets, then blue and pink Roman hyacinths and lastly red *Amaryllis Johnsonii.*

By the back "stoop," which was wreathed in Madeira vines, was a clump of what we called "crow's foot" lilies *(Hymenocallis)* and scattered about the landscaping were groups of "Milk and Wine Lilies" or crinums.

The beauty and fragrance of these plants lingered in my mind and senses as later the family moved about—finally landing at El Paso, on the extreme Western Border of Texas, where growing any sort of flower, was then thought a miracle.

Mother and I longed for verdure and the lush growth to which we had been accustomed, so the quest began for things which would transform our desert home, survive the heat and drouth of summer and the winds and frosts of winter, at which time the temperature sometimes dropped to 10° F.

The ventures were mostly costly and disappointing until the rocks were mined from our mesa garden, far above the City proper, and the soil built up with good valley dirt, sand, barn-yard fertilizer and all the humus we could accumulate from a compost heap. It certainly was a process of evolution and survival of the fittest.

When the shrubs and trees began to give shade, there was more reward with bulbs, as not many can stand the constant baking to which they are submitted and the drying, battering thrusts of the wind.

My mother has passed on but I have continued with the garden and therein found comfort and solace with my flowers including various bulbs. Each year a few new specimens are added.

One time an *Agapanthus africanus* var. *Mooreanus minor* was bought and at another *A. orientalis (unbellatus)*—both lived several years without increasing in size, multiplying or blooming and finally each failed to put in an appearance at all.

Amarcrinum Howardii grew for at least five years and multiplied before showing a bloom. There are now five bulbs from the original; all thrifty, fine plants but they fail to bloom but the one time per season, usually in late August.

Brunsvigia rosea is nipped back by the freezes each winter and this seems to prevent blooming, although the bulbs are fine and large.

Crinums are found to be especially satisfactory and are both admirable for their flowers and tropical appearance. To do well in this section, they need a copious amount of water during the growing season. The only one bought, which has failed to respond, has been *Crinum bulbispermum var. alba* but it was in a rather dry, shrivelled condition when received from the dealer and although it lived for two years it never grew—was moved twice hoping that a new location might help. There are three types of "Milk and Wine Lilies" but they were not identified when acquired. Two of these bloom during the summer but not at the same time, and then repeat when the first bloom scape has fallen. The third is late fall flowering, very fragrant but recently has become quite erratic in its blooming habits, probably due to the fact it hasn't been moved in some years and has become too crowded, however it looks thrifty and fine. There is another unidentified *Crinum,* probably *C. bulbispermum* var. *rosea,* which I dug from the yard of an old house which was being dismantled. It is hardy but the flowers are small, of light pink color and usually fade with the coming of dawn.

C. Ellen Bousanquet is most gratifying, both as to bloom and the setting of off-shoots. *C. Cecil Houdyshel* is lovely but foliage is so long and trailing that the stiff winds tend to twist and damage the plants, which do not stand erect as do the other specimens in the garden. The original bulb has multiplied to three and at this writing, in late July, all are blooming, making a pleasing sight. With me, these bulbs do not bloom throughout the year as in California. My first crinum seedling, now a year old, from *C. Cecil Houdyshel* is doing well. Even though I have tried making crosses only a very few seed are ever set on any of my plants and usually those produced are not from crosses but are naturals. The dry atmosphere seems to dehydrate the pollen too quickly. *C. Moorei* has been in my possession for two years but has not flowered yet. *C. Powelli alba* is one of my favorites, and its behavior, in every way, is beyond reproach. *C. White Queen* is another which should receive an award of merit for it is both beautiful and hardy, although its lovely curving, snowy petals do not withstand the bright sunshine as well as *C. Powelli alba.* My city lot has now become so crowded, I am afraid I shall not be able to further increase my crinum collection until a suitable new location is found.

Hemerocallis haven't been much of a success, especially the hybrid ones. *H. fulva* and *H. Kwanso* are the most satisfactory but even they can not stand the full rays of the blistering sun without the foliage burning.

Amaryllis have been a joy and I have exhibited and received prizes at several local flower shows. Bulbs have been bought mostly from the best Western hybridizers. Use enriched soil and plant in about 50% shade. Before Mr. Diener's death I obtained a few of his Equestris and "everblooming mammoth flowering" hybrids. The former are most robust, but the latter larger and more exquisite as to color and shape, although some plants have a tendency to multiply too rapidly, produce rather spineless foliage and bloom very little. I have never had any of these bulbs to bloom more than once per season, however at times, some produce flowers later than average. From a pure white Dutch hybrid, I have made some crosses and have some nice bulbs but as yet they have not blossomed. It seems to take more than two or three years here for a bulb to reach full maturity. Have had no trouble getting seed to germinate from crosses made but as I have no greenhouse and plant exclusively in open ground, only the hardiest survive, and possibly these will not be the finest. Was truly pleased with *Amaryllis ambigua* which I secured from Mr. Houdyshel this spring. It rewarded me with two healthy scapes but I was not successful in making any crosses on other stock. Did not try on *A. ambigua* itself considering that it was not sufficiently established. *A. Johnsonii* hasn't responded as well as the others but possibly it would do better with less shade and pampering. I tried out a McCann's double amaryllis—it lived several years but did not increase in growth, nor did it bloom—finally rotted. *A. advena* or Ox-blood Lily has been highly successful in every respect.

An acquaintance has a number of small salmon-pink amaryllis, not identified, which bloom at the same time as *A. Johnsonii* and although it does beautifully for her, the small bulb which I was able to secure does not seem to make much headway in growing. This spring I sent for what was said to be an *"Orange Amaryllis,"* advertised by a private party, but as bulb was small and has not yet bloomed I have been unable to find out what it is.

Hymenocallis calathina has been growing in my garden for about ten years and has now made a large clump, seems hardy in every way but has never bloomed, although, for a time, I transplanted it regularly. Several weeks ago I saw one of these Peruvian Daffodils blooming in a neighbor's yard. I was quite thrilled as I had never seen its flower before. Her plants have broader and more robust looking foliage, large white flowers with green markings. She acquired her bulbs from a friend last fall. I have never bought any of the hybrids as they have been quite expensive and I was afraid my experience with *H. calathina* might be repeated. Have two large groups of *Hymenocallis* species No. 2, one of which is in bloom at the present time—very satisfactory.

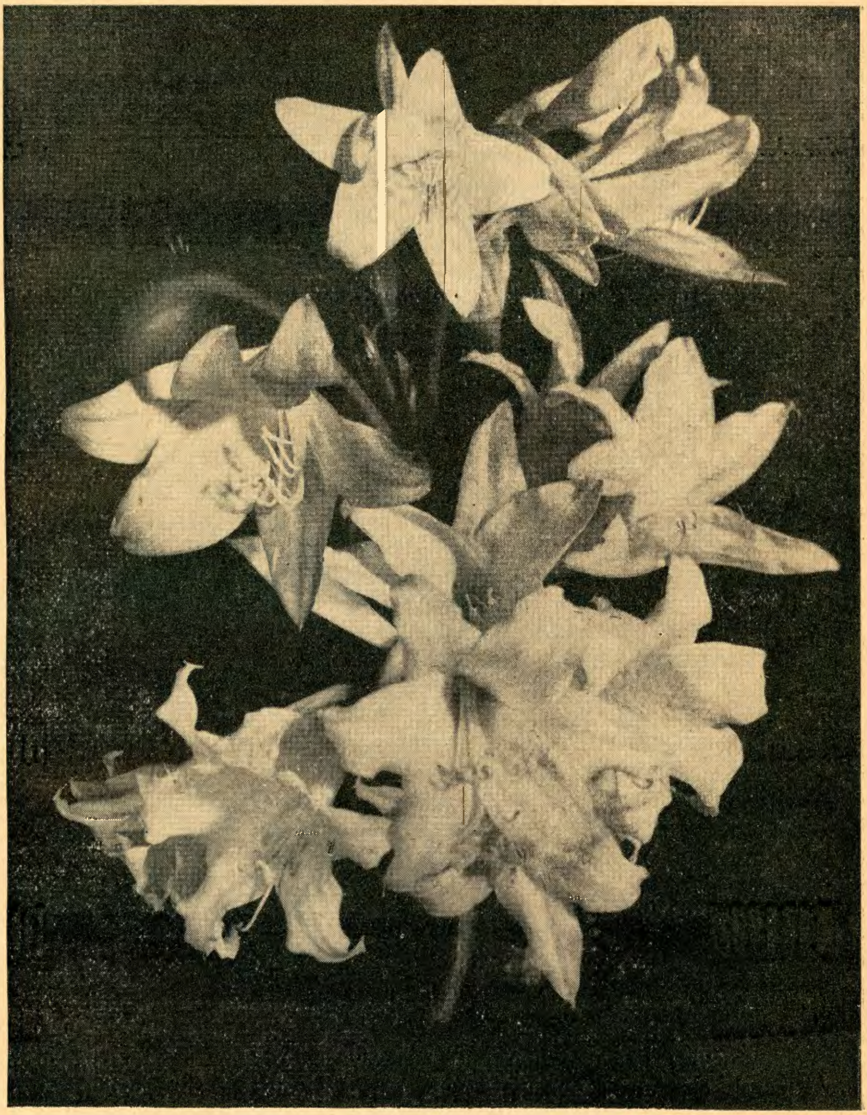
Have had only fair success with three species of *Lycoris,* namely *L. aurea, L. radiata* and *L. squamigera.* The latter is in flower now but they all seem to require a two year rest period after blooming. Have bought other species and also Nerines but they have failed to respond to the treatment I have been able to give them.

Sprekelia formosissima superba bloomed the first year after planting and although it is a robust grower and has multiplied wonderfully has never repeated the performance.

Tulbagia violacea, now in flower, has proven a valuable addition to my collection, however it has one specific season of bloom here.

Vallota purpurea has been tried out twice but both bulbs rotted. *Zephyranthes* are good subjects and very hardy in this climate. There is a small yellow "rain lily" which thrusts itself up through the hard soil and rocks on vacant lots around me and is most lovely but when transplanted to my garden refuses to exist.

I have the very best results with *Narcissus*—various species of tazetta and poetaz—but not much luck with trumpet daffodils. The latter may or may not come up after bulbs are planted, may bloom once and after dying never appear again. The double "Twink" has proven the exception however, for it is gratifying in every way.



Hybrid Brunsvigieae: right top, Crinum Cecil Houdyshel; left top, Crinum Ellen Bosanquet; left bottom, Brunsvigia Frank Leach; and right bottom, Brunscrinum Corsii. Photo by Perry Coppens.

Plate 277

There have been many species of smaller bulbs, such as *Chlidanthus fragrans,* which have come and gone, however there is one little bulb I will tell about which has proven itself more or less of a nuisance. It is the most prolific thing I have ever seen and really is very pretty in a border. This one is *Brodiaea uniflora* or whatever one wishes to call it —there are so many names under which it is listed one becomes bewildered. When I start that long dreamed of new garden I am afraid I shall leave this little fellow out in the cold. Now isn't that human nature?

HYBRID BRUNSVIGIEAE

L. S. Hannibal, *California*

We are indebted to Mr. Perry Coppens for Plate 277 showing several hybrid Brunsvigeae. *Crinum Cecil Houdyshel* is well known to many for it is a hardy hybrid that is very free-flowering. Usually the plant requires some shade to keep the bloom from burning, but this is typical of all hybrids having *Crinum Moorei* percentage.

Crinum Ellen Bosanquet in some respects resembles the crinum above, but its color is a deep wine. The parentage of this plant has never definitely been established, but *Crinum Moorei* characteristics are quite evident. It too needs some shade to get the best flowers.

Brunscrinum Corsii is nearly identical with Mr. Howard's hybrid, known as the "Amarcrinum." This is a cross of *Crinum Moorei* on *Brunsvigia rosea* (syn. *Amaryllis belladonna* Ait. et Herb., non Linn.). We don't believe that there is a prettier sight than a clump of these plants in flower. The blossoms resemble the Cape Belladonna seed parent, but the *Crinum* foliage adds a much needed touch of green that accentuates the richness of the soft apple blossom pink.

Brunsvigia Frank Leach was introduced last year. Excluding some of the white *multiflora* hybrids it represents one of the better Cape Belladonnas so far developed, or should we say discovered, since it was a chance seedling found in an old California garden. The blossoms open nearly white, but turn to a beautiful warm pink as the flowers age. The ruffled texture of the segments place it apart from the usual class of hybrids now being produced.

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[Members of the Hemerocallis Jury are *ex-officio* members of the Hemerocallis Committee.]

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Those in charge of Official Cooperating Trial Gardens are ex-officio members of the Daylily Jury.

[Reports from official trial gardens, indicated below, should be made directly to Dr. Post, Chairman, by July 1 in order to be included in annual summary for Herbertia.]

OFFICIAL COOPERATIVE DAYLILY TRIAL GARDENS

Prof. John V. Watkins, in charge of Daylily Trial Garden, College of Agriculture, University of Florida Gainesville, Fla.

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Mr. Chas. E. Hammersley, 714 Majestic Building, Milwaukee, Wisc., in charge of Daylily Trial Garden, Milwaukee City and County Parks.

Note.—Introducers of new daylily clones should send plants directly to the Trial Gardens for testing. As soon as practicable each trial garden will publish, in Herbertia, lists of the 10, 25, 50 and 100 best daylilies, on the basis of the clones tested, for the climatic region in which it is located.

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PUBLICATIONS OF THE AMERICAN AMARYLLIS SOCIETY

A complete file of HERBERTIA, the year book of the American Amaryllis Society, is indispensable to all who are interested in Amaryllids. A limited number of copies of the following are still available:—

Volume 1 (1934). DEDICATED TO HENRY NEHRLING. Containing the biography of Henry Nehrling, and many valuable articles on amaryllids; with a portrait of Henry Nehrling and 16 other illustrations; a total of 101 pages.

Volume 2 (1935). DEDICATED TO THEODORE L. MEAD. Containing the autobiography of Theodore L. Mead, and many excellent articles on varieties, breeding, propagation, and culture of amaryllids; with portraits of Theodore L. Mead and David Griffith and 18 other illustrations; a total of 151 pages.

Volume 3 (1936). DEDICATED TO ARTHINGTON WORSLEY. Containing the autobiography of Arlington Worsley, and important articles on description, genetics and breeding, physiology of reproduction, and amaryllid culture; with 3 portraits of Arlington Worsley, one color plate and 30 other illustrations; a total of 151 pages.

Volume 4 (1937). DEDICATED TO WILLIAM HERBERT. Containing the biography of William Herbert; the reprint of Herbert's essay, on Crosses and Hybrid Intermixtures in Vegetables; Dr. Darlington's essay, The Early Hybridizers and the Origins of Genetics, and many important articles on description; cytology, genetics and breeding; physiology of reproduction, and amaryllid culture; with two portraits, forty-four other plates and three figures; a total of 280 pages.

Volume 5 (1938). DEDICATED TO ERNST H. KRELAGE. Containing the autobiography of Ernst H. Krelage; the history of amaryllid culture in Holland by Ernst H. Krelage, Dr. Uphoff's important article in which the name *Hippeastrum* is rejected; a revision of the tribes of the Amaryllidaceae; and the species of Amaryllis; outstanding articles on forcing amaryllids by Dr. Grainger and Prof. Dr. van Slogteren; and many other articles on description, cytology, genetics and breeding; physiology of reproduction, and amaryllid culture; with 33 plates and 2 figures; a total of 218 pages.

Volume 6 (1939). DEDICATED TO THE UNION OF SOUTH AFRICA, and containing articles on South African amaryllids, including the history of botanical exploration for amaryllids in South Africa, the distribution of South African amaryllids in relation to rainfall, and a review of the Genus *Agapanthus* by Frances M. Leighton; a review of the Genus *Cytranthus,* with many excellent line drawings, by Dr. R. A. Dyer; other articles—*Zephyranthes* of the West Indies by Dr. Hume; the Tribe *Gilliesieae* by Dr. Hutchinson; rating of daylilies for garden value by Mr.

Kelso; daffodil articles by Jan de Graaff, and many other items on description, cytology, breeding, propagation, and amaryllid culture; with 44 plates and 10 figures; a total of 258 pages.

Volume 7 (1940). DEDICATED TO LATIN AMERICA, and featuring articles on Latin American amaryllids; biographies of Drs. Philippi and Holmberg; report by Dr. Goodspeed on the amaryllids collected by the Univ. of Calif., Second Andean Expedition; reports on the flowering of the "Blue Amaryllis," *A. procera;* and many other important articles on the description, propagation, breeding, culture, harvesting and storage of amaryllids. Of special interest are the important articles on the description, breeding and culture of daylilies by noted authorities. With 45 illustrations—30 plates and 15 figures—and a total of 242 pages.

Volume 8 (1941). DAYLILY EDITION. The first extensive symposium on the daylily, containing biographies of George Yeld, Amos Perry, Hans Sass, and Paul Cook, and important articles on daylily evaluation, breeding, propagation and culture. Also important articles on *Narcissus* and other amaryllids. Thirty-eight illustrations—27 plates and 11 figures—and a total of 185 pages.

Volume 9 (1942). ALSTROEMERID EDITION. Dedicated to Harry L. Stinson, the outstanding authority on this plant group, who contributes a summary of his work on Alstroemerid taxonomy, breeding, propagation and culture. This volume contains the autobiography of Prof. Dr. Abilio Fernandes, the Check-List of Amaryllids by Major Pam, and a review of the species of *Crinum* by Dr. Uphof, and also many important articles on daylilies, *Narcissus, Cyrtanthus,* hybrid *Amaryllis, Ixiolirion* and other amaryllids. Thirty-five illustrations—17 plates and 18 figures—and a total of 243 pages.

Volume 10 (1943). 10TH ANNIVERSARY EDITION. Dedicated to Elizabeth Lawrence, the outstanding authority on the use of amaryllids in the garden, who contributes a summary of her work in this field. This volume contains the review of *Agapanthus* and *Tulbaghia,* by Dr. Uphof; an article on *Brunsvigia rosea* and hybrids by Mr. Hannibal; a symposium on *Narcissus* breeding by Messrs. Powell, Reinelt, Berry, and Reynolds; a review of amaryllid chromosomes by Dr. Flory; articles on hybrid amaryllis, daylilies, and many other important articles on amaryllids. Forty-one illustrations—12 plates and 29 text figures—and a total of 205 pages.

Volume 11 (1944). ALLIEAE EDITION. Dedicated to Dr. Henry A. Jones, the eminent American authority on the onion. This is one of the most outstanding issues up to the present for its record making contributions on the systematics of *Allium* by British authorities, and on onion breeding, propagation, and culture by American authorities. It contains Mr. Airy Shaw's translation of Vvedensky's Alliums of the Soviet Union; Stearn's essay on the onion in the Old World and other articles; and articles on onion breeding, propagation and culture by Dr. Jones and his colleagues. There are also important contributions on ornamental Alliums for North America, and Allieae of North America. There are excellent articles on hybrid *Amaryllis, Narcissus,* Daylilies and various other amaryllids. Forty-three illustrations—25 plates and 18 text figures—and a total of 369 pages.

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Mr. E. Frederick Smith, Asst. Secy,
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DATA CARD FOR HEMEROCALLIS

When describing daylily clones, all breeders and growers are requested to use the Official Data Card for Hemerocallis, devised by the eminent artist and horticulturist, J. Marion Shull, and fully described in HERBERTIA, Vol. 7, 1940. These cards should not only be used in describing new clones but also for the description of all older clones grown in the various climatic regions.

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7. THE BUYER'S GUIDE

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It is recorded that the Garden of Eden was the first garden to be planted with all the plants necessary for Man's sustenance in comfort and luxury. A life of ease soon grew irksome to him and in a moment of idleness he ate of the forbidden fruit. For this disobedience he and his descendants were denied the fruits of the garden and were cast out to earn their daily bread by the sweat of their brow.

Many centuries were spent in shepherding their herds and flocks from place to place in constant search of forage and herbage. Here was the beginning of our science of Botany. Life was simple, and their primitive wants were easily satisfied by the increase of their flocks and the few vegetables picked up along the way. Family feuds and quarrels with the inhabitants of the adjacent valley furnished excitement and conversation around the campfire, as well as propaganda for posterity. Clothing, likewise was simple and in abundance. As yet no mail order catalogue had diffused dissatisfaction among them with pictures of what the well dressed man of the world was wearing. When his present habiliment became hair-bare, he hied himself to the hills, selected for himself a bullock with the proper pattern of spots, and with the assistance of his womenfolk he soon had a replenished wardrobe.

The passing of the centuries brought increased population. The quarrels grew into battles and wars. Gradually as thteir wanderings were hampered and restricted, it became necessary to confine their herds to smaller areas and to bring the fodder to them instead of allowing them to wander in search of it. Thus, they came in less conflict with their closer and closer approaching neighbors, and soon isolated communities became villages seeking mutual benefits and organized resistance against their common enemies. Communal life brought them into closer contact with each other and soon competition was keen and spirited for a greater share of the worldly goods.

Fundamentally, all food, clothing and most shelter is derived from plant material, and with their smaller areas for cultivation they were forced to cultivate that little more intensively, and to be constantly on the alert for other and better plants to meet their economic needs. From the study of the plants they learned many new uses and virtues of them which eventually became our modern Pharmacopoeia. Since many of these plants gave relief to man's many aches and pains, fancied or real, they devoted a space in the yard for their cultivation in order to have them close at hand when urgently needed. Having these "Herbals" in the yard added to the general appearance of their environments, and no doubt many an alien plant was smuggled among the herbals, not because of any virtue it might possess, but that "It was purty to look at". This habit soon became quite universal and travellers were searching the world for plants to contribute to our food supply or beautify our habitations. This search continues so intensively that it has been caught, tamed and given an euphonious name, —Advertising. All good gardeners are seeking new material for their gardens, and possibly you have just the plant that some gardener in the next village is diligently seeking. Now, how are they going to know what you have to sell if you do not tell them on the following pages, which are yours to use at a very nominal cost.

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