TAXONOMIC STUDIES

IN THE

ALSINOIDEAE

by

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I. INTRODUCTION

I. INTRODUCTION.

The members of the sub-family Alsinoideae of the Caryophyllaceae are distinguished from the Silenoideae on the one hand by their free sepals, and from the Paronychioideae (including Spergulineae and Illecebraceae) on the other by their exstipulate leaves and by possessing true petals (and not petaloid staminodes).

The present studies have been confined to the free-styled capsular members of the sub-family, that is to the Sub-Tribes Stellariinae and Sabulininae of Pax and Hoffmann (1934, pp.295-296) as amended by Mattfeld (1934, p.367). These sub-tribes are regarded in the "Pflanzenfamilien" as comprising 11 and 10 genera respectively, but the number of generic names referable to them approaches 100.

Within this group of plants, which show all the difficulties of generic delimitation associated with the Caryophyllaceae (Krause, 1901, for example, regards it as comprising a single genus which he calls "Alsine"), there exist three more or less readily recognisable aggregations (plus one very aberrant genus Schiedea, including Alsinodendron, whose true affinities may well be with the Paronychioideae). These aggregations, which do not necessarily follow natural relationships, are what may be described as the Stellaria - Cerastium group (including also Myosoton, Holosteum, Moenchia and possibly Pseudostellaria), the Sagina group (including also Colobanthus) and the Arenaria group. This last is the largest, both in number of species and in generic diversity. In addition to the generic complex making up Arenaria in the very broadest sense, which has been the subject of particular study

in the present work, there are five related genera (four of them monotypic) whose distinctiveness has rarely, if ever, been questioned. These are Thylacospermum, Thurya, Gooringia, Reicheella and Buffonia, the last a very natural Mediterranean genus of 10 species with a very characteristic habit. Of the monotypic genera, Thurya, confined to the Cilician Taurus in Turkey seems very distinct, but the other three could well be no more than extreme derivatives from different groups of Arenaria sensu stricto. This is certainly so in the case of the Tibetan genus Gooringia, whose one species (G. littledalei) is no more than a much reduced representative of Arenaria Subgenus Odontostemma, with which it has been included in this account. Thylacospermum, a densely pulvinate plant of the mountains of Central Asia (including the Himalayas) seems related to A. densissima in Subgenus Dolophragma, while Reicheella from the mountains of Chile would seem either to be related to the South American Subgenus Dicranilla or else to be outside this affinity altogether, and related to genera such as Pycnophyllopsis or Plettkea, with indehiscent fruit.

The synopsis of genera in the "Pflanzenfamilien" (Pax and Hoffmann, 1934 and Mattfeld, 1934) gives only their typical characteristics and is not very satisfactory for the identification of individual specimens. For this reason, and also to define what is regarded as forming the Arenaria complex of genera ('Arenaria sensu latissimo'!) an artificial key to the free-styled, capsular members of the sub-family is given.

1a. Staminal glands ± petaloid, opposite the sepals; petals absent; inflorescence usually very lax, thyrsoid or paniculate.

(Hawaiian Islands) Schiedea

1b. Staminal glands variously developed, not petaloid; petals alternating with sepals, rarely absent; inflorescence various, often a ± regular dichasium:

2a. Petals bipartite or deeply bifid, rarely absent; plants usually diffuse with relatively broad leaves; seeds exstrophiolate; capsule opening by twice as many teeth as styles; rootstock without tubers (except some spp. of Cerastium)

3a. Carpels (styles) (2-)3, rarely 5 and then alternating with the sepals; capsule globose to oblong:

4a. Carpels (2-)3 (Cosmopolitan - especially N. Temperate) Stellaria

4b. Carpels 5 (Eurasia) Myosoton

3b. Carpels (styles) (3-4-)5 opposite the sepals; capsule cylindrical or narrowly conical, often curved

(Cosmopolitan - especially Eurasia) Cerastium

2b. Petals entire, emarginate or fimbriate, occasionally absent, or very rarely ± deeply bifid, if absent leaves subulate or setaceous or plant densely pulvinate or seed strophiolate,

if bifid capsule opening by as many valves as styles (2) or rootstock bearing small tubers (and carpels 3), or leaves spiny, setaceous:

5a. Inflorescence an umbel-like cyme with the long pedicels becoming reflexed; seeds dorsally compressed (scutiform with median hilum); capsule cylindrical (C. Europe, Mediterranean and W. Asia) Holosteum

5b. Inflorescence various, never a lax umbel, pedicels usually erect or spreading; seeds spherical or laterally compressed (usually reniform); capsule various, rarely cylindrical:

6a. Carpels 4 - 5:

7a. Capsule opening by twice as many teeth as styles; leaves linear-lanceolate to lanceolate, not fleshy; petals usually rather large, exceeding the sepals; erect annuals (C. Europe and Mediterranean) Moenchia

7b. Capsule opening by as many valves as styles; leaves small linear-subulate, often rather thick, fleshy; petals usually very small or absent, rarely exceeding the sepals; low-growing annuals or perennials:

8a. Stamens 2-whorled, or 1-whorled and antisepalous;

styles alternisepalous; petals usually present (N. Temperate and Mountains of S. America) Sagina

8b. Stamens 1-whorled alternisepalous; styles antisepalous; petals absent (S. Temperate and Antarctic) Colobanthus

6b. Carpels 2-3 (rarely in a few abnormal flowers 4 or 5)

9a. Flowers dimorphous; chasmogamous fls. arising in the axils of the upper leaves, with 5 large entire or rarely bifid petals and a sterile ovary of 3 carpels; cleistogamous fls. at the base of the stem with petals small or absent; rootstock bearing small tubers; leaves relatively large; plants with habit of Stellaria (Alps; C. & E. Asia) Pseudostellaria

9b. Flowers all chasmogamous or very rarely some in the lower part cleistogamous and then chasmogamous fls. usually with 2 carpels and often fimbriate petals; rootstock without tubers:

10a. Sepals united at the base into a short tube:

11a. Dense low-growing cushion plants; flowers small (c. 2-3mm.) with a rather

membranous calyx enclosed by the upper leaves; capsule opening by twice as many valves as styles (2-3) (C. and S. Asian mountains) Thylacospermum

11b. Erect tufted rather spiny plants; flowers rather large (c.10mm.) in terminal clusters with the calyx hardened at the base; capsule opening by as many valves as styles (3) (S. Turkey) Thurya

10b. Sepals free to the base:

12a. Sepals and petals 4; stamens (4-)8; carpels 2; plants densely pulvinate with tetrastichous leaves or strictly erect with appressed subulate leaves; seed not strophiolate:

13a. Plants low-growing, densely pulvinate, with ovate tetrastichous leaves with a narrow membranous margin; flowers solitary (capsule unknown) (Chile) Reicheella

13b. Plants strictly erect with appressed subulate leaves; flowers in a spike

or panicle; capsule opening by
2 valves (Mediterranean)

Buffonia

12b. Sepals and petals 5, rarely 4 and then carpels 3 or if carpels 2, capsule opening by 4 valves and either diffuse plants with spreading leaves and strophiolate seeds or small mass-like plants with stamens reduced to 2

"Arenaria sensu latissimo"

The aggregation of genera which have at various times been included within Arenaria (notably by Bentham in Bentham & Hooker, 1862) has therefore the following diagnosis:

> Sepals 5 (rarely 4), free to the base; petals 5 (rarely 4 or 0), entire, emarginate, crenate or fimbriate, (very rarely bifid, cf. Lepyrodiclis) stamens 10 (or sometimes 5 + 5 staminodes, or rarely reduced to few, e.g. 2 or 3); carpels sometimes 2 usually 3; seeds globose or laterally compressed (usually reniform).

There is thus no single absolute distinction by which genera such as Buffonia, Reicheella or Pseudostellaria can be distinguished from the Arenaria aggregate (unless it be the presence of small tubers in the last named). In "Arenaria sensu latissimo" however, tetramerous flowers with two carpels are only known to occur in species of Moehringia with its distinctive strophiolate seeds and characteristic habit, and in one (or possibly a few) very reduced speices of Arenaria Subgenus Odontostemma - A. littledalei (= Cooringia littledalei). The discrimination of Buffonia with its bicarpellary tetramerous flowers, undivided capsule valves, and very distinct facies, thus present no difficulty. On the other hand doubts as to the generic position of Reicheella have already been expressed and in the absence of adequate material from South America its status must remain in doubt; indeed no specimens of Reicheella have been seen though it is figured (poorly) in Philippi (1891 t.1. f.7.) (as Lyallia andicola).

Pseudostellaria (=Kraschenninnikovia) appears to be a natural, if ill-defined, "buffer" group between Arenaria on the one hand and Stellaria on the other. (cf. Ohwi (1937), Schaeftlein (1957), and Takeda (1913)).

The present studies on Arenaria in the very broadest sense fall into two parts: in the one a general examination is being made of generic and infra-generic limits on a world basis, with the intention of providing an enumeration, with keys, of the genera, subgenera, sections and series which it is proposed to recognise; the second part will comprise a critical revision of the members of the group which are found in the E. Mediterranean and S.W. Asia region (Boissier's "Orient", excluding Dalmatia, Albania, Crimea and Afghanistan but including Cyrenaica).

Generic delimitation, notoriously confused throughout the Caryophyllaceae, has in this group always been a matter of dispute among taxonomists. For the last 100 years this has largely centred round two opposing viewpoints, the one maintained to-day chiefly by American botanists regards "The unity of the genus Arenaria" (Fernald 1919) as almost axiomatic, while the other, generally held by European workers, divides the group into three main genera (and a varying number of smaller ones) distinguished technically by the number of capsule teeth or valves and the presence or absence of a strophiole on the seed. Although there is probably some basis for this geographical separation, in the distribution of the plants themselves, it should be noted that it has not always been the case, for both Asa Gray and Small kept the group divided while Bentham and Hooker favoured a single

genus. Both the history of the taxonomic treatment of each of these three main divisions and the nature of their variation itself differ greatly, and as a result the present work must take a different form in each case

In Minuartia, in which the capsule opens by as many valves as there are styles (in normal flowers always three), there are about nine or ten clearly defined, natural subdivisions which have been recognised since the time of Fenzl (1840). Moreover the genus was very competently monographed by Mattfeld (1922), and in this work a thoroughly satisfactory classification of these sections was proposed. As a result the present contribution will be confined to slight emendations and to corrections in nomenclature.

As Silene is separated from Lychnis so in Arenaria the capsule opens by twice as many teeth or valves as there are styles (or with an equal number of bifid teeth). Unlike Minuartia, the infra-generic classification of Arenaria is very confused partly because only a few mostly very large natural groupings stand out and partly because the revision published by Williams (1898) employs a rather artificial single-character arrangement which not infrequently overrides recognised affinities. Although Williams' contribution is a very valuable one in providing an orderly enumeration of all the then known species, what is required to bring the same degree of clarity to Arenaria as exists in Minuartia is a reclassification which refers for its basis back to the major groupings recognised by Fenzl in 1833 and 1840.

By far the smallest of the three main subdivisions of the Arenaria

group is Moehringia, which comprises only about twenty species, mostly in Europe, and which is distinguished from Arenaria s.s. by the presence of a white or brown appendage (strophiole) on the seed near the hilum. There has been no general revision of Moehringia as there has been of Arenaria and Minuartia, but the arrangement proposed by Nyman (1854-55; 1878) and followed by Graebner (1915-16) in their accounts of the European species is on the whole a satisfactory one.

The smaller genera recognised by many European and other authors include Brachystemma, Moehringella, Gouffeia, Wilhelmsia (= Merckia), Lepyrodiclis, Greniera, Hymenella, Honkenya, Cherleria, Rhodalsine and Queria; of these the six last are included by Mattfeld in Minuartia (and hence appear in his monograph), while a revision of the three species of Lepyrodiclis was recently published by Wagenitz (1956). The status of each of these small genera, usually representing a single rather "aberrant" type of plant, requires to be examined and their relationship to the major groupings determined.

The determination of the genera and the generic limits which can be recognised is probably the most important part of any taxonomic study of the group. Fortunately there has, in recent times, been little dispute as to the limits of the major sub-divisions, the controversy being only concerned with whether they are best recognised at generic, subgeneric or sectional rank or at various combinations of the three. To achieve a more stable judgement it is necessary to look at the criteria employed -

particularly to their constancy and to correlations with other characters.

The group as a whole occurs throughout the North Temperate regions of the world with an additional centre of distribution in the S. American Andes (almost solely Arenaria s.s.). In the Northern Hemisphere the species are concentrated in three main areas - the Sino-Himalayan region (Arenaria only), the Orient (Arenaria and Mimuartia) and Central and Southern Europe (Arenaria, Mimuartia and Moehringia). In each of these areas, but particularly Sino-Himalaya and the Orient, taxonomic revision of the species is long overdue, at least in the case of Arenaria. In his "Flora Orientalis", Boissier (1867) listed 80 species and about 40 specific synonyms in the group as a whole. Since then no account has been published of the Orient species apart from Williams' (1898) and Mattfeld's (1922) respective general treatments of Arenaria and Mimuartia, but some 25 species have been described from the area, notably by Stapf, Bornmüller, Schischkin and Rechinger fil. The extensive collections made during the last twenty years by Davis from Turkey and the Mediterranean countries provide a wealth of new material for the much-needed critical account of the species in the "Flora Orientalis" area.

During a two month visit to Turkey in 1956 (as botanist on the Oxford Expedition to South Eastern Turkey) the author was able to observe and make collections from a wide range of habitats in both the Mediterranean and Irano-Turanian vegetation regions. A number of species of the group were found growing in the wild and the

insight thus gained into their phytogeography and ecology has been of great value in the present studies.

The taxonomic revisions have been based chiefly on the collections in the Herbaria of the Royal Botanic Garden, Edinburgh and the Royal Botanic Gardens, Kew. Visits have also been made to the Herbaria at the British Museum (Natural History), the Linnean Society, the Manchester Museum and the Department of Botany, University of Oxford. For the revision of the Orient species valuable type material has been borrowed from the Conservatoire et Jardin Botaniques, Geneva, the Museum National d'Histoire Naturelle, Paris and the Instituto Botanico dell'Universita', Turin, while the entire Orient collections of the following Herbaria have been examined: Institut für Spezielle Botanik und Herbarium Haussknecht, Jena; Institutum Botanicum Universitatis Carolinae, Prague (Minuartia only); Naturhistoriska Riksmuseum, Stockholm; Naturhistorisches Museum, Vienna; and Botanische Institut und Botanischer Garten der Universität, Vienna.

I am indebted to the Directors of all these Institutes for their co-operation in giving me facilities to study their collections or in lending herbarium material. In particular my thanks are due to the late Professor Sir William Wright Smith and to Dr. H.R. Fletcher, the present Regius Keeper of the Royal Botanic Garden, Edinburgh, for their generous provision of material and facilities. For advice and assistance throughout my revision and in the preparation of this thesis, I am especially indebted to my supervisor, Dr. P.H. Davis.

II. GENERAL REVISION

II GENERAL REVISION

1. History of the Classification of the Group.

In the first edition of "Genera Plantarum" (1737), Linnaeus included only one genus referable to the Arenaria group, namely Arenaria itself. This he placed in the "Decandria Trigynia", distinguishing it from Tournefort's Alsine (modern Stellaria) with which its species had previously been included, chiefly by the entire petals and the reniform seeds. In the "Hortus Cliffortianus" three species of Arenaria are listed; these are now known as Moehringia trinervia, Arenaria serpyllifolia and Spergularia rubra respectively. From a comparison of the descriptions it is clear that the second, "Arenaria foliis subovatis acutis sessilibus" (A. serpyllifolia) is Linnaeus' "chief species" and hence the type of the genus.

When the second edition of "Genera Plantarum" came to be written in 1742, Linnaeus had not only two new genera in this affinity to add, but had also come to the conclusion that because of the relatively few stamens in the modern Stellaria media, the plants that he had previously included as Alsine represented two distinct genera. He accordingly transferred Alsine with its chief (=type) species "Alsine foliis ovato-cordatis" (his Alsine media - 1753) to the "Pentandria Trigynia" and provided the new name Stellaria for these species which he retained in the "Decandria Trigynia." To this group he added a further genus Cherleria, distinguished from Arenaria by the absence

of petals and the 3-valved capsule, and in "Octandria Digynia" described a new genus Moehringia based on the plant which he later (1753) named M. muscosa.

In "Species Plantarum" (1753) Linnaeus added two further genera referable to Arenaria in the broadest sense, Minuartia and Queria; both were described from Spanish plants of Loefling's and both were placed in the "Triandria Trigynia", Queria being distinguished from Minuartia by its single seed. At the same time Linnaeus added a second species to his genus Alsine - Als. segetalis, the plant now known as Spergularia (or Delia) segetalis. Thus at the starting point of botanical nomenclature, the group was already provided with five generic names: Minuartia and Queria, closely related xerophytic genera with reduced stamens: Moehringia with tetramerous flowers; Cherleria a monotypic apetalous genus; and Arenaria itself with 12 species embracing plants with the capsule splitting by both 3 and 6 valves or teeth. The description of Arenaria mentions the capsule as "quinquefarium dehiscens" but Linnaeus probably mistook the 6-toothed capsule of Ar. serpyllifolia for a 5-toothed one; none of the species which he included in Arenaria has, in fact, a capsule splitting by 5 valves or teeth.

In passing it should be noted that in the second edition of "Species Plantarum" (1762) Linnaeus transferred one of the species originally published in Arenaria (Ar. mucronata) to Alsine and thereby initiated one hundred and fifty years of confusion in the application of this name. The exact identity of Als. mucronata (L.)L.

has not been established but it refers to a species of Minuartia (Sect. Sabulina or Sect. Minuartia - possibly M. rostrata). Stokes in Withering (1787) and Villars (1789), both realised the heterogeneity of Alsine and the latter transferred Als. media to Stellaria, Als. segetalis to Spergula and Als. mucronata back to Arenaria. Gaertner (1791), however, emphasising the character of capsule dehiscence, took up the name Alsine exemplifying it by Als. mucronata and the name came to be used for those Arenarias with a 3-valved capsule (now known as Minuartia). The history of Alsine and of its displacement with the coming of the type concept has been discussed at length by many writers - e.g. Hiern (1899), Briquet (1910), Moss (1914), Fernald (1919 a and b) and particularly Sprague (1920). Not all these authors have been in agreement on details, but the correct application of each name can be seen from the following summary of type species and of the first uniting of genera:

Genus	Type species
Alsine L. (1753)	Als. media L. (≡Stellaria media (L.) Vill.)
Arenaria L. (")	Ar. serpyllifolia L.
Cherleria L. (")	Ch. sedoides L. (≡Minuartia sedoides (L.) Hiern)
Minuartia L. (")	Min. dichotoma L.
Moehringia L. (")	Moehr. muscosa L.
Queria L. (")	Q. hispanica L. (=Minuartia hamata (Hausskn.) Mattf.)
Stellaria L. (")	St. holostea L.

Genera:	first united by:	name chosen
Alsine, Arenaria, Moehringia, Sagina, Spergula and Stellaria (together)	Scopoli (1772)	Stellaria
Alsine and Stellaria (alone)	Cirillo (1784)	Stellaria
Cherleria and Arenaria	Bentham (1862)	Arenaria
Cherleria and Minuartia	Hiern (1899)	Minuartia
Minuartia and Arenaria	Bentham (1862)	Arenaria
Moehringia and Arenaria (alone)	Bentham (1862)	Arenaria
Queria and Minuartia	Mattfeld (1921)	Minuartia

It is clear, therefore, that the name Alsine falls into disuse (so long as Stellaria media is regarded as congeneric with S. holostea), and moreover that when the genera with a 3-valved capsule are united (Cherleria, Minuartia and Queria) the correct name for the resultant genus is Minuartia and not Cherleria as used by Sampaio (1913) or any new name such as Alsinopsis proposed by Small (1903).

As has been noted above, Gaertner (1797) was the first to realise the importance of capsule dehiscence in the classification of the group, and this segregation into two genera, one with as many valves as styles and one with twice as many valves or teeth, was followed by authors such as Wahlenberg (1812) and Desvaux (1816). The latter's little-known paper is the first monographic treatment of the group; in it he recognised two genera, but used the name Arenaria for what Wahlenberg and Gaertner called Alsine and coined the new name Alsinanthus for Arenaria s.s. Authors who followed

the Linnaean tradition more closely, such as Willdenow, Roemer and Schultes, and Sprengel (in their editions of "Species Plantarum" or "Systema Vegetabilium"), either maintained the heterogeneous Alsine in the Linnaean pentandrous sense or else included all the species in Arenaria (i.e. except the few in Cherleria, Minuartia, Moehringia and Queria). Seringe in de Candolle's "Prodromus" (1824) adopted a similar approach, his genus Arenaria comprising not only most of the species of the Arenaria group but also those of the stipulate Spergularia. Minuartia and Queria were widely separated from the other genera and placed (by A. P. de Candolle, 1828) in the apetalous Paronychieae (=Illecebraceae).

The next twenty years were most important, in that they saw the beginnings of a natural classification of the group, although at the same time the generic confusion was greatly increased. Responsibility for this rests chiefly with Reichenbach (Conspectus, 1828; Fl. Germ. Excurs., 1832; Handbuch, 1837; Repert. Herb. Nomenclator, 1841; and Ic. Fl. Germ., 1842), who described at generic rank (or merely named) any natural grouping which he or other botanists detected, and as a result published about 16 new generic names within the Arenaria group. It was during the same period, however, that Fenzl made his very notable contributions to the taxonomy of the Alsinoideae. The monograph which he planned was never completed and his chief writings consist of a discussion of the phytogeography and natural relationships of the sub-family (1833) (in which his arrangement of species appears in

the distributional tables), and accounts of the group in Endlicher's "Genera Plantarum" (1840) and Ledebour's "Flora Rossica" (1842).

Fenzl (1840) recognised eleven genera within Arenaria sensu latissimo - five in the tribe Sabulineae in which the capsule split by as many valves as styles, and four in the Stellarineae with twice as many teeth or valves as styles; the remaining two, Merckia and Dolophragma, he distinguished as a separate tribe Merckieae in which the capsule showed partial septation. Within the Sabulineae the great majority of species were placed in the genus termed Alsine within which he recognised thirteen infra-generic groups. The remaining genera were the digynous Lepyrodiclis with its distinctive habit, and the monotypic Honkenya ('Honkeneja'), Triplateia (=Hymenella) and Queria; each of these were essentially habit genera and the last-named he had previously included in Alsine (1833). Similarly in his Stellarineae by far the largest genus is Arenaria, itself divided into 5 groups, to one of which, Eremogone, he had previously (1833) accorded generic rank. From Arenaria, Moehringia is distinguished by its habit, its strophiolate seeds and its sometimes tetramerous flowers, while Odontostemma and Brachystemma are also largely distinguished by habit, though the former is characterised by its bicarpellary flowers and fimbriate petals and the latter by its bicarpellary flowers, scarious sepals and solitary seeds. Although some of Fenzl's observations and judgements are certainly wrong (e.g. the partial septation in

Dolophragma), each of his genera and infra-generic units are generally accepted to-day as natural groups (with the possible exception of Queria and Dolophragma closely merged with other species of Minuartia and Arenaria respectively).

About the same period J. Gay was engaged in extensive studies on the Alsinoideae but the only notable publication which resulted was his monograph of the genus Holosteum (1845) in footnotes to which there is discussion of members of the Arenaria group (Rhodalsine and Greniera). His manuscripts in the library at Kew show that he was planning an account of all the genera in the Sub-family and was well on the way to completing enumerations of the species of "Alsine" (=Minuartia) and Buffonia. A fragmentary note by Grenier (1841) seems, likewise, to represent the only published part of planned monographic work.

Nyman (1854-55) in his first enumeration of European plants, followed Fenzl in generic delimitation but proposed a classification of Moehringia based on leaf shape, which was later adopted and validated by Graebner (1915-16).

Where Fenzl had recognised eleven genera, Bentham (in Bentham and Hooker, "Genera Plantarum", 1862) maintained only three, Arenaria, Brachystemma, and the peculiar monospermic Queria. The genera of other authors were mostly accomodated as the eleven subgenera or sections into which he divided Arenaria.

Apart from Seringe's (1824) rather ill-arranged conspectus of species and accounts in a few regional floras such as Reichenbach

(1832, 1842), Fenzl in Ledebour (1842) and Grenier and Godron (1847), specific revision lagged considerably behind studies at generic and infra-generic level. However, Boissier recognised 80 species of Arenaria, Moehringia, Alsine, Queria and Lepyrodiclis in "Flora Orientalis" (1867) and in 1872, Rohrbach published a useful enumeration of the known S. American species, while the Flora of British India (Edgeworth and Hooker, 1874), which followed Bentham's broad concept of Arenaria, included 24 species in the genus.

In 1895 Williams published his detailed classification of Arenaria and followed it in 1898 with a full enumeration of species with references, synonymy and often descriptions. This thorough account is marred only by his tendency to base his classification on single characters, and particularly his use of characters which are not always homologous throughout the genus (e.g. "smooth" seeds). The basis of his classification is that of Fenzl, and while some of his modifications reveal new natural groupings (e.g. Leiospermae), others divide up homogeneous groups among unrelated species (e.g. his use of staminal gland structure to spread the species of Eremogone into three different subgenera).

1899 to 1921 was the period of the changeover from the misuse of Alsine to the adoption of Minuartia for the "unspecialised" species with a three-valved capsule. In 1921 and 1922 Mattfeld published his monograph of Minuartia with a detailed discussion of taxonomic criteria and generic limits. His conclusions were that

there is a fundamental distinction between the loculicidal capsule of Minuartia and its allies and the loculicidal and septicidal structure in Arenaria, Moehringia, Stellaria, Cerastium etc. (cf. Mattfeld 1922 a.). Like Williams, Mattfeld based his classification on that of Fenzl but was more successful in defining smaller natural groupings.

In the last thirty-five years there have been three notable contributions to the taxonomy of the group; the first was the enumeration of the Chinese species by Handel-Mazzetti in "Symbolae Sinicae" (1929) which to some extent drew together the numerous species published between 1905 and 1920 by Williams, Diels and W.W. Smith; in 1926 Schischkin's (and others') account of the Caryophyllaceae in the Flora U.R.S.S. was published and in this some new infra-generic groups of Arenaria were proposed (but without validating Latin diagnoses); thirdly the North American members of the group were the subject of studies by Maguire which culminated in the publication in 1951 of a Conspectus of the species occurring north of Mexico. Of these authors, the first two regarded Arenaria, Minuartia, Moehringia and other groups as distinct genera, while Maguire treats each as a section of Arenaria.

Individual sections or species aggregates have been the subject of study by a number of other botanists, notably Turrill (1932), Pawlowski (1939) and Mannfeldt (1954).

Since the time of Fenzl, then, the prevailing view among botanists on the classification of the group has been to recognise two parallel tribes, usually known by Fenzl's names Sabulineae and Stellarineae. The only exceptions to this practice have been by those British botanists who have followed Bentham and Hooker closely, and by those Americans of the last forty years who have accepted Fernald's similar views. Within the Stellarineae, Moehringia, moerover, is normally kept distinct from Arenaria; indeed many of its species have no published name in the latter genus. The treatment of the smaller genera, however, has varied considerably. Mattfeld, for example, includes all the 'loculicidal' members of the group, except the bicarpellary Lepyrodiclis and Wilhelmsia (= Merckia)with its partially septate capsule, in Minuartia; Pax and Hoffmann (1934) ("Pflanzenfamilien") also separate Honkenya, while other recent authors have maintained Cherleria, Greniera, Hymenella, Queria and Rhodalsine as distinct genera. On the 'loculicidal and septicidal' side most authors (including Pax and Hoffmann, 1934) recognise Brachystemma, Gooringia and Moehringia along with Arenaria, while some also maintain Gouffeia and Moehringella.

The present investigation has sought to determine whether any affinities run across these generallyaccepted groupings, and if not to assess their relative distinctness and decide the status which each should be accorded.

2. Criteria of Classification.

Before embarking on a consideration of the nature and rank of the widely recognised subdivisions of Arenaria sensu latissimo it is desirable to examine the characters on which this classification is based, and where possible to trace trends of evolution in these characters. Mattfeld (1922 a.) has already done this in some detail for Minuartia and its allies and for this reason the main emphasis in this discussion will be on Arenaria, Moehringia etc.: comparison with Minuartia will, of course, be made.

Habit: Habit is perhaps the most variable feature in the group; very small slender annuals, densely pulvinate alpines, spiny suffruticose plants, succulent maritime herbs, xerophytes of Mediterranean and steppe climates and lax broad-leaved mesophytes are all to be found. Moreover, as Fernald (1919) and Maguire (1951) have pointed out, plants of widely different habit are frequently placed in the same genus, and are sometimes generically separated from plants of very similar aspect. This is not, however, something which is confined to the Arenaria group, because, although the mesophytic habit predominates, a similar wide range of structure is to be found in Stellaria and Cerastium, while in the Sub-family Silenoideae, convergence of this kind is even more marked and many species of Gypsophila, Dianthus, Saponaria etc. are scarcely distinguishable in the vegetative state from those of Arenaria or Minuartia. In view of the fact that all these groups

are widely distributed over a similar geographical and ecological range, this habit convergence is not surprising, and is to be regarded as one of the features of this, as of many other, families.

In the present state of knowledge of the evolution and affinities of the Alsinoideae as a whole (cf. Pax and Hoffmann, 1934), any consideration of trends within one particular group must involve some speculation. It seems credible, however, to regard the mesophytic perennials as possessing the basic habit form from which other more obviously specialised types have evolved. Such mesophytic perennials are to be found among species of Arenaria Subgenera Leiospermae (e.g. A. lanuginosa) and Odontostemma, though the latter is highly evolved in its bicarpellary flowers. (For a conspectus of the subgenera, sections etc. of the genera recognised cf. pp.82 - 199). Brachystemma is a similar mesophytic perennial group which is very specialised both in having a reduced gynoecium and in being a scrambling climber.

One of the most striking derived conditions is the spreading habit and fleshy leaves which have developed in association with maritime conditions in two apparently unrelated species, Honkenya (Minuartia) peploides and Wilhelmsia physodes (≡Merckia physodes). A different maritime type is represented by the (usually) densely pubescent, Minuartia (Rhodalsine) geniculata which, as a cliff plant, shows the stout caudex associated with many xerophytes or alpines. Some few mesophytic biennials and annuals such as Arenaria gothica, Moehringia trinervia, the bicarpellary genus Lepyrodiclis and species of Arenaria Subgenus Odontostemma (also digynous), can be thought of as

direct derivatives of similar perennial species.

A very important trend has been the development of the oreophilous habit, involving the formation of densely caespitose or pulvinate plants and the reduction of the leaves. Indeed oreophily and the corresponding colonisation of Arctic regions is so much the rule in the group that, although not the most primitive mesophytic type, it can be regarded as the norm and the one from which very many other forms have evolved. In Arenaria, the Sections Rariflorae and Capillares, which are regarded as the least specialised representatives of the great Subgenera Arenaria and Eremogone respectively, are both arctic-alpine groups of this sort, while in Minuartia and its close relatives, no temperate lowland mesophytic perennials are known other than specialised maritime types.

However, the major feature of the habit evolution of the group is undoubtedly the response to the drying out of large areas of the Northern Hemisphere during the late Tertiary period. Indeed the development of the oreophilous habit and the colonisation of maritime regions may also be regarded as resulting from this pressure on the original mesophytic lowland habitats. From their present-day distribution it certainly seems the case that most of the annual members of the genus have evolved under conditions of seasonal drought and their occurrence in regions of more equable rainfall probably represents a secondary colonisation at a recent date (post-Pleistocene). Annual groups of this sort are predominantly Mediterranean (also Southern N. America) and would seem to include Minuartia Section Sabulina and

Arenaria Sections Occidentales and Arenaria (Series Arenaria). The influence of seasonal drought is even more marked in xeromorphic annuals such as Arenaria Series Saponarioides and Mimuartia Series Montanae and Mimuartia in which the leaves and sepals are hardened and their nervation is very prominent (and the stomata thereby sunken?).

The most striking adaptations, however, are those which are directed solely towards the survival rather than the avoidance of dry conditions. In Arenaria Subgenus Eremogone in which the leaves are always narrow and in primitive species (in Section Capillares) all graminaceous, a trend of progressive xerophytic adaptation can be traced. The leaves of the sterile shoots become setaceous in Sections Glomeriflorae and Eremogone, while in some species of Section Rigidae the cauline leaves are also narrowed and the sterile leaves become shorter. Section Scariosae and some species of Section Capillares bridge the gap between rather long setaceous leaves and short spiny ones such as are found in Section Sclerophyllae. The extreme in leaf development is the pungent leaves of A. persica (Iran) and A. stenomeres (California) and of the totally unrelated West Mediterranean A. pungens (Section Pungentes). With the reduction and specialisation of the leaves comes the increased development of caudex and caudiculi until in species such as A. dyrpidea the suffruticose condition is reached. The colonisation of high alpine localities by plants of the Sclerophyllae and similar groups appears to induce a further reduction in leaf size, coupled with secondary loss of spininess and an intensification of the pulvinate growth form (A. tetrasticha,

A. davisii and A. mairei). Similar xerophytic developments in habit to those outlined, can be observed in Minuartia Sections Acutiflorae (e.g. M. juniperina) and Lanceolatae (M. pestalozzae).

In most cases the perennial plants are referable to Raunkiaer's chamaephyte life form; a few species of Arenaria Subgenus Eremogone which grow in meadows and have a tufted habit (e.g. A. holostea) may be hemicryptophytes.

From this brief summary of plant form in the group and its possible evolution as a relatively recent process, it can be expected that if differences in, for example, floral characters had developed in the primitive ancestral plants, these would persist in each of the habit types to which they gave rise. Thus one would expect to find pulvinate alpines, suffruticose perennials, xerophytic annuals etc. etc. in plants with free or united sepals, with 5 or 3 carpels, with bifid or entire petals, with entire or divided capsule valves etc. etc. This is, in fact, the situation which exists and suggests that on the basis of habit alone there is as much justification for uniting Arenaria and Minuartia as there is for uniting Arenaria and Gypsophila.

Leaves: Leaf shape and form are intrinsically bound up with habit and in particular with its evolution under dry conditions; despite this certain features do seem to show correlation with taxonomic groupings and to be independent of habitat. It has already been noted that linear, subulate or setaceous leaves are preponderant in Minuartia, the main exception being the lanceolate leaves

of Sections Lanceolatae and Aretioideae; not even mesophytic plants such as M. flaccida and M. aizoides possess broad leaves, although in the maritime groups Honkenya and Rhodalsine, frequently included in Minuartia, ovate leaves are sometimes retained. Likewise in Arenaria Subgenera Eremogone and Eremogoneastrum, linear, subulate or setaceous leaves are the rule. On the other hand, the development of such leaves in the Subgenera Arenaria and Sikkimenses is unusual and even the strongly xerophytic species of the former (Section Plinthine) have ovate leaves. The marginal thickening and hardening of these leaves and those of Subgenus Sikkimenses probably represents an alternative xerophytic adaptation. The most densely pulvinate plants in the whole group (Arenaria densissima and A. polytrichoides in Subgenus Dolophragma) have also ovate leaves.

Inflorescence: Although the dichasial cyme is the characteristic inflorescence type in the Arenaria group as in the family as a whole, it is not the sole form, because not only are single terminal flowers found but in some supposedly primitive mesophytic annuals and perennials solitary axillary flowers are the rule. Mattfeld (1922 a) claims that no truly axillary flowers exist in the Alsineae and suggests that in Honkenya (Minuartia) peploides, for example, the apparently axillary flowers are in fact terminal flowers, one of whose foliaceous bracts subtend an axillary shoot which in turn produces another terminal flower and axillary shoot; these axillary shoots together appear as a single leafy stem and the flowers are

pushed into a lateral position. Honkenya is the only group in the Minuartia affinity in which this occurs, although it is approached in Subsection Spectabiles. In both Arenaria Subgenus Odontostemma and Subgenus Arenaria Section Rotundifoliae a progression in this feature can be traced; in the latter, A. rotundifolia ssp. rotundifolia has many-flowered terminal and 'axillary' cymes, (the latter clearly resulting from the extension of the original stem by a lateral leafy shoot), while in ssp. pancicii these 'axillary' cymes are often one-few-flowered. In A. balearica, the flowers are all 'axillary' and solitary on long pedicels, a condition resembling that found in Arenaria Subgenus Leiospermae or Moehringia spp. (e.g. M. lateriflora). In the Leiospermae, however, it is not so clear whether this is a primitive or derived condition. Mesophytic perennial lowland species such as A. lanuginosa (which has axillary flowers) have been regarded as present-day representatives of the primitive Arenaria growth-form. In other species of the subgenus, apparently more specialised mountain plants (e.g. A. reptans and A. decussata), the development of a monochasial cyme from the 'primitive' growth form, can be observed; it is of course quite possible that this evolutionary trend is proceeding in the opposite direction, which would accord with Mattfeld's hypothesis. The fact that no dichasia have been seen in Arenaria Subgenus Leiospermae suggests that in this case the monochasium is a derivative from the solitary axillary condition. The whole evolutionary history of this subgenus (and the related Dicranilla) is, however, very obscure.

Floral reduction is very common in alpine species of all groups, though in almost every case additional rudimentary flower buds are present, showing its derivation from the typical cymose structure. The only exceptions are some of the very densely pulvinate species of Arenaria Subgenera Dolophragma and Dicranilla where the flowers are more or less enclosed by the upper leaves; here, as in other groups, the existence of related less densely caespitose species with a cymose inflorescence confirms that in this case, the solitary flower is a derived condition. In one group of Arenaria, however, (Subgenus Sikkimenses) solitary flowers are the rule; these flowers are very large (among the largest and most attractive in the whole group) and the plants are not reduced dwarf alpines.

Within the great mass of species, in which the inflorescence is a dichasial cyme, certain trends of specialisation exist. In the less highly evolved species the bracts are foliaceous and in some cases (e.g. in Arenaria Section Orientales) the transition to subulate or setaceous bracts can be observed. In the more specialised groups such as Arenaria Subgenus Eremogone the bracts are very different from the leaves and are often scarious.

The reduction of peduncles and pedicels and the consequent aggregation of flowers into clusters or terminal heads is a very common feature and occurs in very many groups. The clustered condition, that is the presence of a series of dense partial inflorescences, is particularly characteristic of Minuartia Section Minuartia and Arenaria

Section Scariosae. The terminal head is a feature of Arenaria Subgenera Eremogone and Eremogoneastrum, but also occurs in Arenaria Section Plinthine (S-G. Arenaria) and in Minuartia Subsection Xeralsine (M. leucocephala and M. leucocephaloides). In Subgenus Eremogone the capitate species have in the past been separated as a distinct group (Glomeriflorae) but it is clear that congestion of the inflorescence is something which has developed independently in a number of lines. The three principal species of this form each show different affinities and are placed in different sections - A. cephalotes in Section Rigidae, A. congesta in Section Capillares, while A. dianthoides carries the name Glomeriflorae to the group which includes A. cucubaloides and A. gypsophiloides.

Flowers: With regard to the flowers themselves, the whole group shows a fairly uniform basic structure of pentamerous flowers with ten stamens and three carpels (cf. Introduction p.2); the main deviations from this are reductions in the gynoecium (which will be discussed later) and in the occurrence of tetramerous flowers. These are not uncommon in Moehringia but occur in only one or two species of Arenaria and in one Minuartia. The Moehringia species, all members of Section Moehringia, have generally a digynous ovary, but some transitional species exist in which the flowers are sometimes five-partite and sometimes four (e.g. M. muscosa). On the other hand in Minuartia aretioides there are the usual three carpels and although the affinities with other species are clear, there is no transition to the pentamerous condition; M. aretioides is treated as a separate

section (Aretioideae), distinguished from Section Lanceolatae principally by the number of perianth parts. The only constantly tetramerous species of Arenaria (A. littledalei) has previously been regarded as a distinct monotypic genus (Gooringia), distinguished further by having only two fertile stamens and two carpels. The plant, however, is clearly a reduced representative of Arenaria Subgenus Odontostemma (in which two carpels are the rule) and is very close to A. saginoides and A. reducta, in which tetramery can occur.

As none of these three groups of tetramerous plants show the slightest affinity with one another or to the tetramerous genus Buffonia, it can be assumed that this is a trend of reduction which appears independently in a number of different lines. In the case of Buffonia, the connecting links (with Minuartia) have vanished, but in the other three they are very evident and preclude taxonomic recognition of these tetramerous plants, except in Minuartia where sectional rank is accorded.

In most members of the group the petals and stamens are inserted together on a hypogynous disc; the sepals are free to the point of attachment to the disc which is immediately below the petals and stamens, while the ovary is sessile (or occasionally with a very short gynophore) in the centre of the disc or torus. As a result the ovary is inserted up to about 1mm. above the base (and insertion) of the sepals - an important point in considering the relative lengths of capsule and calyx.

As in all Alsinoideae the petals are arranged opposite the inner whorl of stamens while at the base of the outer whorl are swellings, flap-like processes, or more elaborate structures - the staminal glands. Contrary to Williams' (1895, 1898) statements, these glands (or rudimentary swellings in the same position) are always present; their taxonomic significance is discussed below.

One group of Minuartia (Subgenus Rhodalsine) shows a unique flower structure resembling that of Thurya or Thylacospermum in which the sepals are united at the base. In Subgenus Rhodalsine there is a fused calycal cup up to 1mm. long, at the base of which the ovary is inserted; this gives rise to free sessile (i.e. not narrowed at the base) sepal segments. The petals and inner whorl of stamens are also inserted at this level and in one species (M. vestita) the outer are in the same position. In the common Mediterranean species M. geniculata, however, the outer whorl of stamens is inserted lower down the tube and the inner whorl is clearly attached to the petals. Although no anatomical studies have been made, this situation and the appearance of the flower on dissection, suggest that the base of the filaments and petals have to a greater or lesser extent become fused to the inside of this very short calyx tube. No similar structure is known elsewhere in the group and this and its accumbent cotyledons places Subgenus Rhodalsine in a very isolated position, giving it strong claims to generic recognition.

Sepals: The classification of Minuartia rests primarily on sepal structure, in particular on the number and nature of

the nerves, which are usually very prominent. Most of the major groups have an almost uniform nerve-structure. In Arenaria and Moehringia, however, the nerves are usually much less distinct and branch more freely; it is probably for these reasons that in, for example, Arenaria Section Sclerophyllae, of two apparently closely related species one has obscurely nerved keeled sepals and the other flat ones with many prominent veins. The general form of the sepals seems to be more constant, however, and the natural Subgenera Eremogone and Odontostemma are, among other things, distinguished by the base of the sepals being hardened (Eremogone) or truncate-saccate (Odontostemma). Sepal structure is also very uniform in Subgenera Eremogoneastrum and Sikkimenses, while the obscurely nerved sepals of Moehringia Section Arenarioides differ from those usually found in the genus.

In Arenaria Subgenus Arenaria a trend towards increasing prominence of sepal nerves can be traced. In Section Planosepalae, which is a mesophytic perennial group with large leaves and foliaceous bracts, the sepals are flat with obscure reticulate venation, while in other mesophytic groups such as Sections Rariflorae, Grandiflorae and Orientales, the nervation becomes more prominent. The xerophytic Section Plinthine, which has probably evolved from a Grandiflorae stock, have 5-7 very prominent nerves, while in some of the annual species with subulate- setaceous leaves (e.g. A. sabulinea and A. capillipes) three very distinct nerves are developed, not unlike those in species of Minuartia Section Sabulina.

In the more highly evolved Subgenus Eremogone with its indurate sepals the tendency has been towards changes in the texture rather than

in nerve form. In all sections of Eremogone, except perhaps the primitive Capillares, no part of the sepal can be strictly described as herbaceous, though a median or basal part usually remains green in flower. This green portion is rather leathery and in the keys and descriptions has been termed coriaceo-herbaceous. In the more primitive members of Eremogone (as in Subgenus Arenaria and most species of Mimuartia), the species have a narrow membranous margin, but in the more highly evolved species particularly in Sections Scariosae and Rigidae, this margin is scarious and often very broad. Indeed in A. scariosa and A. armeniaca, the whole upper part of the sepal, as well as the margins, is scarious, a very similar condition to that met with in the totally unrelated species Brachystemma calycinum, a broad-leaved scrambling climber in the lower parts of the Himalayas and Southern China.

Two sepal characters which have no phylogenetic significance in the group but which appear in a number of high alpine species, are the presence of reddish-purple pigmentation and the increase in breadth relative to length. These are, of course, characteristics by no means peculiar to the Alsinoideae and here as elsewhere they are associated with other high alpine features, such as fewer flowers and sometimes larger, broader petals (or, on the other hand, loss of petals).

Petals: Considered in relation to the sepals the petals provide very few criteria for classification, a not surprising situation in view of their very simple structure. With very few exceptions the petals are uniformly white, though in Mimuartia

Section Sabulina Series Californicae they bear numerous pellucid dots. The only coloured petals are the rose pink ones which characterise Minuartia Subgenera Spergella and Rhodalsine and which are found in M. labillardierei and a few species of Arenaria (e.g. A. lychnidea - some plants - A. forrestii and other species of Subgenus Sikkimenses).

It is on the basis of whether the petals are entire or bifid that Arenaria is separated from Stellaria. At least one plant (A. kingii var. kingii) clearly referable to Arenaria because of its affinities, is reported to have bifid petals (Maguire, 1947), but in general, although the apex may be truncate or fimbriate, it is never bifid nor even strongly emarginate. In Lepyrodiclis and Minuartia, however, deeply emarginate petals are not unknown, characterising L. stellarioides and Minuartia Section Uninerviae and Subgenus Spergella; the undivided capsule valves readily distinguish these plants from Stellaria.

The details of petal shape, in particular that of the base (e.g. attenuate, or abruptly contracted) are generally of diagnostic value only at specific level, but in Minuartia, Section Tryphane (Polymechana Mattf.) is characterised by the petals being abruptly contracted into a short claw ("alsinaceous").

Petal reduction is very common throughout the group, particularly in self-pollinating annual species and in some high mountain plants. In some groups a trend in petal reduction can be observed, as in, for example, the annual Section Arenaria. A. conferta has petals longer than

the sepals, whereas in other species of Series Arenaria (e.g. A. serpyllifolia and A. leptoclados) they are always shorter, often only about half as long - as they always are in the more strongly xerophytic Series Cylindricae and Saponarioides. In the habitually very similar species of Minuartia Sections Sabulina and Minuartia (Subsection Minuartia), the reduction has gone much further. In the former group, M. hybrida can range from having petals almost as long as the sepals to their being very minute, while in M. mediterranea they are frequently absent altogether. Similarly in Subsection Minuartia, where the petals are always much shorter than the sepals, extremely minute structures are present in some species (e.g. 0.1-0.25 times as long as the petals in M. intermedia) while in others (e.g. M. sclerantha and M. montana ssp. wiesneri) they are completely absent. In other apetalous species the change is more abrupt, as in the alpine Minuartia (Cherleria) sedoides, which sometimes has small petals, and whose close affinity with the other species of Subsection Spectabiles (in which the petals are at least as long as the sepals) is very obvious.

Androecium (and Staminal glands): Like reduction in petal size, reduction in the androecium is something which occurs independently in a number of unrelated groups and which is usually of very little taxonomic significance, except perhaps at species level. The typical pattern of ten fertile stamens can be disturbed in four main ways. The first is the octandrous condition occurring in tetramerous flowers (which have already been discussed), and the second the loss or

atrophy of all the stamens in species with unisexual flowers (e.g. Minuartia sedoides and Honkenya (Minuartia) peploides). The only other reduction which is at all regular is the presence of only five stamens either alone (Moehringia pentandra), or with five staminodes (Arenaria potaninii). Occasionally, as in this last species, this is correlated with other distinguishing features (in this case, sepal shape and monospermy) which warrant taxonomic recognition. The fourth and by far the commonest form of stamen reduction is the irregular reduction to a few fertile stamens (c. 2-5) often along with a number of staminodes and/or atrophied stamens. In these cases individual flowers on the same plant often vary, the uppermost having fewer stamens, and there may also be wide variation between plants. This type of reduction is very common in Minuartia Section Sabulina and is also to be seen in species of Arenaria such as A. littledalei.

Williams (1895,1898) based his classification of Arenaria primarily on staminal gland structure and in so doing destroyed a number of natural groupings without creating any new circles of affinity (at least on the basis of gland form). He recognised three conditions - no glands, five glands at the base of the outer stamens and ten glands arranged between the stamens. These became the unit character criteria of his three large subgenera, "Euarenaria", Pentadenaria and Eremogoneastrum. In Minuartia, exactly the same range of staminal gland structure exists, and a comparison with that genus might have warned Williams of the danger of resting so much of his classification on this one character alone.

As has already been mentioned, the glands (or equivalent structures) are always present and are always associated with the outer whorl of stamens. Williams' "absence of glands" means very reduced structures which may or may not be glandular, but which show a continual gradation, at least on herbarium material, to the prominent "five-gland" condition. These glands generally lie on the exterior side of the stamens and appear from that angle as a rectangular flap or swelling in front of the base of the filament. Viewed from the interior of the flower they appear when well-developed as two swellings, one on either side of the filament base. In many species there is a median nectar groove which sometimes tends to make the gland appear emarginate or in some species almost crescent-shaped. In Minuartia Section Minuartia this development can be traced to a bifurcate condition in which the glands appear superficially to be ten in number. In some species the nectar furrow remains between the 'horns' of the gland, but in most the secretion is to be found in a cup-shaped pit at the tip of each of the finger-like divisions of the gland. (for illustrations, cf. Mattfeld, 1938) As one would expect, if these glands have an attractive function, this is most often an "all or nothing" condition and species which on other characters are almost identical will have on the one hand single glands with a median nectar furrow and on the other bifurcate structures with apical nectar pits. This is seen most clearly in the distinctive localised Minuartia bosniaca and the polymorphic M. setacea

which can scarcely be satifactorily separated except by the fact that the former possesses prominent bifurcate glands. A similar situation holds with M. decipiens (glands single) and M. intermedia (glands bifurcate), but it is complicated by the existence of an intermediate race (M. decipiens ssp. damascena) which has some of the characters of M. intermedia but the glands and pubescence of M. decipiens. The only question here would be whether staminal gland structure was even of specific value.

In Arenaria itself very similar species such as A. lychnidea and A. capillaris (treated as conspecific by Regel, 1862) have minute and prominent glands respectively, and Williams consequently places the one in Subgenus "Euarenaria" and the other in S-G. Pentadenaria. In the same way A. cucubaloides and A. gypsophiloides, which are satisfactorily distinguished only by flower size and the length of the leaf sheaths, are widely separated from one another in his classification.

The most complex staminal gland structure in the group is that found in Minuartia douglasii (Section Greniera) in which there is a prominent broad flap behind the nectar furrow, and the filament clearly arises in a lateral position in front of the furrow (cf. Mattfeld 1922 1922 a.). The related species, M. howellii, has well-developed simple glands and provides a connecting link with Section Sabulina and other annual groups of Minuartia.

Gynoecium: It was Gaertner in 1797 who first emphasised the importance of the gynoecium in the classification of the Alsinoideae, and to this day it remains the part of the plant from which most of the major taxonomic criteria are drawn. Mattfeld (1922 a.) has discussed at length the importance of carpel number and arrangement in the Alsinoideae as a whole; his conclusion is that in the isomerous condition (i.e. carpels equal in number to the perianth parts), arrangement is very important, but that reduction in number occurs both in plants with antisepalous carpels and those with antipetalous ones. Moreover he found that it was impossible to determine whether a reduced trigynous ovary had originated from the antisepalous or antipetalous condition, except by the implications of close affinity (e.g. in trigynous Cerastium spp.). It seems likely that reduction from five to three carpels has occurred in a number of separate lines, just as further reduction to two carpels is seen in widely separated members of the Arenaria group. (Moehringia Section Moehringia, Arenaria Subgenera Odontostemma and Arenariastrum, Lepyrodiclis, Brachystemma and the distinctive genus Buffonia).

Of all gynoecium characters the one whose evaluation has the most far reaching consequences is, of course, that of capsule dehiscence, the recognition of which we owe to Gaertner. Much has been written on this subject, a lot of it polemic and based on preconceived ideas, half truths and inaccurate observations. As Mattfeld has demonstrated and as all the present writer's observations confirm, there is no doubt

that capsule dehiscence in all the known members of the group takes place in one of two quite separate ways - either along the midline of the individual carpel (i.e. opposite the styles : loculicidal), or else both in this position and along the line of carpel fusion (loculicidal and septicidal). (The dehiscence of the fleshy capsule of Wilhelmsia (Merckia) was not known to Mattfeld, but it appears that when it occurs it is loculicidal - along the line of the partial (false) septa). As Mattfeld has shown, these are not chance lines of fracture but are predetermined at an early stage by the distribution of vascular tissue in the ovary wall.

This being so, it is not altogether surprising that no examples are known of affinity running across the difference in capsule dehiscence. The supposed cases cited by Fernald (1919), Maguire (1951), etc. represent superficial habit similarities which appear more important in the impoverished Arenaria/Minuartia flora of North America than when viewed against a world-wide background. Indeed, in Eurasia a far more formidable list of species of the two genera which are nearly identical in form and habit could be drawn up (cf. pp. 61-62). In each case the examination of usually reliable characters (e.g. in the flower) shows that their closest affinities are clearly with members of their own genus; their superficial resemblance to species of the other genus is due to the same sort of habit parallelism that we find between species in the Silenoideae and Alsinoideae (e.g. Arenaria cretica and Gypsophila nana). - It should be noted in passing that

Maguire (1951) repeats Fernald's (1919) mistake in referring Arenaria paludicola to "Section Alsine", despite Briquet's (1911) and Mattfeld's (1922 and 1922 a.) notes that it is a true Arenaria. Fernald and Maguire are right in linking it with A. lanuginosa, for from the specimens examined it is clearly a member of Arenaria Subgenus Leiospermae.

In Arenaria there is some variation in the extent to which the capsule opens; this variation seems to be directly correlated with the texture of the capsule at time of dehiscence. Thin membranous capsules usually split to the base by six valves, while more coriaceous ones open by valves or teeth of varying depth and sometimes, but not often, the locular division is deeper than the septal one, so that the capsule opens by "three bifid teeth". In lignaceous capsules, which are often flask shaped, the teeth are usually very short. There would appear to be no clear-cut distinction between any of these conditions and they seem to have little taxonomic significance, although in groups such as Subgenus Eremogone, in which the capsule is usually lignaceous, dehiscence is always by short teeth. In Minuartia and Moehringia, only valvular dehiscence of membranous to coriaceous capsules is known.

In at least one species of Minuartia, M. hamata, often regarded as forming a monotypic genus Queria, the one-seeded 'capsule' is often functionally indehiscent, the partial inflorescence being the unit of dispersal and the seeds often germinating in situ. That it is essentially a three-valved structure is obvious because the lines of

dehiscence are very clear and the capsule can be dissected open at a touch along these lines. The strong similarity between M. hamata and the Paronychioideae (including Illecebraceae) may be entirely superficial, but it does seem to lend support to the inclusion of the Illecebraceae within the Caryophyllaceae.

Seeds: Mattfeld makes considerable use of seed characters, particularly the structure of the testa in his classification of Minuartia, while Williams noted that many species of his Arenaria Subgenus "Euarenaria" had smooth shiny seeds (his Section Leiospermae). Most important of all, the genus Moehringia is fundamentally distinguished from Arenaria only by its strophiolate seeds.

All the species of the group possess laterally flattened seeds, which are often reniform, with the exception of Brachystemma in which the seed is subglobular (slightly laterally compressed near the hilum), the very broad cotyledons being incumbent and laterally folded near the apex. The normal reniform seeds are very regular in shape in most mesophytic species, but in xerophytic plants often appear to suffer distortion under pressure in the developing capsule; the seeds of Arenaria Subgenus Eremogone and Minuartia Subsection Xeralsine are notably irregular. Frequently the seed is longitudinally compressed so that the long diameter runs from the hilum to the dorsal ridge; such seeds are often more or less pyriform and this is the normal condition in Honkenya and Arenaria Subgenus Eremogone. In at least

two groups the seeds are strongly compressed and to a greater or lesser extent winged by an extension of the testa in which no endosperm is laid down; in Minuartia Section Greniera the main part of the seed is reniform, but in Arenaria Section Compressae the seed is broadly ovate in surface view with the long axis from the hilum to the dorsal ridge. In some species normally placed in Arenaria Subgenus Odontostemma a so-called "winged" seed is formed by the inflation of the testa; here, however, the seeds are not compressed. On account of this feature and a strophiole-like structure (see below) Neumayer, in 1924, raised to generic rank Franchet's Section Moehringella to contain two such species. From the few seeds available of members of Subgenus Odontostemma, it would appear that is the usual condition in the subgenus; it is not recorded elsewhere in the group.

The seeds vary in colour but in Arenaria and Moehringia appear to be either reddish or more often an intense black; a notable exception is A. trichotoma (Section Compressae) in which the mature seed is a buff colour. In Minuartia, on the other hand, even the most fully ripened seeds are no more than a very dark brown while in some species mature seeds may be straw-coloured. Seeds which remain a pale colour on maturity (i.e. red or straw) are also those which lack prominent sculpturing, having a thin seed coat.

The terminology used to describe the form of the testa of species of the group is very confused, partly because the description tends to vary with the magnification at which the seeds are viewed and partly because the same term has been used for two totally different kinds of

seed coat, sometimes even by the same author. In most groups the seeds are of the typical Caryophyllaceous sort in having a testa bearing distinct cellular markings. These cells are often convex in surface view and particularly on the dorsal ridge frequently develop into the tubercles of tuberculate seeds (e.g. in Arenaria Section Arenaria and Minuartia Section Sabulina). In other species the seed surface is quite smooth but with these distinct (at ×10) cellular markings; such seeds are described throughout this account as obscurely reticulate (e.g. Arenaria balansae). In the past such seeds have generally been termed smooth (laevia) but they are quite different from the sculptureless (at ×70) shiny seeds (as in Arenaria Subgenus Leiospermae and most species of Moehringia) to which this term is now confined. This confusion led Williams to place a number of Eurasian species of other groups (e.g. A. halacsyi and A. balansae) in his otherwise natural South American Leiospermae, but as there is no essential difference between the tuberculate and obscurely reticulate condition, it is not surprising that they are sometimes found in closely related species or groups of species.

Tuberculate or obscurely reticulate seeds very frequently bear further markings on the "cells" or tubercles. The most common type is the central spot marking which on the cells of the dorsal ridge, in particular, is often produced into a distinct papilla. Such seeds are here termed papillose, even if the papillae are only visible at high magnification (e.g. ×35). Often, however, the dorsal papillae

(and sometimes the others also) are very large and prominent so that the seeds or merely the dorsal ridge can be described as echinate. Seeds with a fimbriate crest have in fact extremely long dorsal papillae which are often laterally fused to one another; the strophiole of Moehringia Section Arenarioides (with obscurely reticulate seeds) appears to be a similar structure but arises from the cells near the hilum. (The typical Moehringia strophiole is a totally different, whitish amorphous body).

At least one variation on the truly smooth testa structure is known; this is the presence of minute papillae all over the otherwise sculptureless seeds and is a feature of Moehringia pentandra. In Arenaria hispanica there is a similar structure but here the papillae are more dense and the seeds lack the lustre associated with those of Moehringia and Arenaria Subgenus Leiospermae.

Seeds which bear convex cells but are scarcely tuberculate are generally described in the literature as rugulose, but in this account the term obscurely tuberculate is generally preferred. Where, however, the cell pattern is not clear, as in immature seeds, or where the "cells" are very long and narrow and the wrinkles between them prominent, or in groups such as Eremogone or Honkenya with very small cells, the term rugulose has been retained.

Finally there are those seeds which are not smooth in the strict sense of the word but which at X70 magnification have no very prominent cell markings; such seeds have simply been termed rough

(aspera) and seem to occur in Arenaria Subgenera Odontostemma and Eremogoneastrum (although mature seed of the latter has not been seen).

The only other external seed character which has been used in the classification of the group is the presence or absence of a strophiole, a waxy or oily appendage near the hilum. This structure is only well-developed in Moehringia, of which it is the diagnostic character, but in at least some species of Arenaria Subgenus Odontostemma there is a small protrusion of the testa near the hilum, which is opaque and strophiole-like; contrary to Maguire's (1951) assertion, no trace of a hilum appendage could be detected in Wilhelmsia (≡Merckia).

It has already been noted that the strophiole of Moehringia Section Arenarioides differs from that of other species of the genus in being a brown colour and clearly composed of long "papillae" densely packed together. In the rest of the genus the strophiole is a white amorphous body and there must be some doubt as to whether the two structures are homologous. Both are rather oily and serve to attract ants which act as dispersal agents.

Cotyledons: In most species the cotyledons are incumbent (i.e. they are 'back-on' to the radicle and therefore 'back-on' to the endosperm on one side and the dorsal ridge on the other); as a result the ridge is not normally grooved. In certain groups, however, (Minuartia Subgenera Rhodalsine and Spergella and Arenaria Subgenera Eremogone, excluding Section Pungentes and possibly

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Eremogoneastrum and Dolophragma) the cotyledons are in the accumbent position and 'edge-on' to the radicle, endosperm and dorsal ridge; in this case the dorsal ridge is frequently deeply grooved. Arenaria Subgenus Odontostemma has incumbent cotyledons but these are frequently laterally folded near the top, the upper portion being either doubled under the main part or twisted into an accumbent position. This folding over of the cotyledons also occurs in Brachystemma which in seed characters shows a possible origin in an Odontostemma stock. A cotyledon form, which so far as is known is unique in the group, is found in Arenaria trichotoma, the only species of Section Compressae. Here we have broad cotyledons in a strongly compressed seed; these have retained their incumbent arrangement but have become longitudinally folded away from the radicle (i.e. the reverse of orthoploceus).

Cytology: Relatively little cytological work has been done on the group as a whole, although chromosome counts have been made of most of the North European species. Because the counts are so unrepresentative, no very definite taxonomic conclusions can be based on them, but from the existing data certain trends and constant features seem discernible. There are published records of counts made on thirteen species of Arenaria (out of about 250), all in Subgenus Arenaria and all showing a base number of 10 or in two cases additional counts of 2n = 22 (cf. table below), at least one of which, because of the origin of the material, is suspect (cf. table).

The species are distributed in six different sections (out of the eleven in the Subgenus) and are Arctic, Alpine or "Lusitanian."

Seven species of Moehringia representing the Sections Latifoliae, Diversifoliae and Moehringia, have been examined cytologically and a constant base number of 12 found. Böcher and Larsen (1958) note that in addition to the different number, the chromosomes of Moehringia trinervia are much larger (and longer) than those of Arenaria serpyllifolia or A. leptoclados and suggest that this is an added justification for the maintenance of the two genera. Important though this may be, it should be noted that on morphological grounds Moehringia is in any event far removed from these species of Arenaria, and what would be much more revealing would be a comparison with, for example, A. lanuginosa (Subgenus Leiosperma).

The twelve investigated species of Minuartia (in six sections of Subgenus Minuartia) show a very heterogeneous assemblage of recorded numbers (x = 10, 12, 13, 16, 23) including considerable variation in counts of the same species. The most confused species in this respect is, however, Honkenya peploides where the diploid numbers 48, 64 and 66 have been recorded by Rohweder (1939) and Flovik (1940), but Malling (1957), who counted 2n = 68 in all his material, has given good evidence for believing that all the previous counts were erroneous; Blackburn and Morton (1957) have since reported the records of 2n = 48 and 2n = "c.64", once again. The base number of 13 is the most frequent in the known counts of Minuartia spp.

These counts are summarised in the following table (counts in brackets indicate that only the diploid number was reported and that it is not known whether the count was actually on somatic cells; where the number of different collections of material are known, these appear in brackets after the count):-

Section and Species	n	2n	Origin of Material	Reference
			Arenaria	
Rariflorae:				
A. ciliata		(40)	Norway	Horn in Löve & Löve (1948)
A. gothica		(80)	Norway	" " " " "
" "		80	Gt. Britain	Blackburn & Morton (1957)
A. humifusa		(40)	Norway	Horn in Löve & Löve (1948)
A. norvegica		(80)	?	Böcher & Larsen (1950)
" "		80	Iceland	Löve & Löve (1956)
" "		80	Gt. Britain	Blackburn & Morton (1957)
" "		80	Norway	Jorgensen et.al. (1958)
A. pseudofrigida		(40)	Greenland	Sorensen & Westergaard in Löve & Löve (1948)
" "		(40)	Norway	Horn in Tischler (1950) & in Jorgensen et.al. (1958)
" "	20		Greenland	Jorgensen et.al. (1958)
Flinthinae:				
A. aggregata		20	N.W. Spain	Blackburn & Morton (1957)

Section and Species	n	2n	Origin of Material	Reference
Rotundifoliae:				
A. biflora	11	22	*Graian Alps	Favarger (1949)
" "	10-11		Tirol	Mattick in Favarger (1949)
" "	10		Vorarlberg	" " " "
" "		(20)	Tirol etc.	Mattick in Tischler (1950)
Planosepalae:				
A. montana		20	Portugal	Blackburn & Morton (1957)
Occidentales:				
A. conimbricensis		40	Portugal	Blackburn & Morton (1957)
Arenaria:				
A. leptoclados		+20(1)	Alps	Griesinger (1937)
" "		20(1)	Tirol (Sarntal)	Wettstein (1940) & Woess (1941)
" "		20	Gt. Britain	Blackburn & Morton (1957)
" "		20(4)	Italy(3) & Yugoslavia(1)	Böcher & Larsen (1958)
A. marschlinsii		20(4)	Alps	Griesinger (1937)
" "		20(9)	Tirol (Sarntal)	Wettstein (1940) & Woess (1941)

* A. biflora is rare in or absent from this region - identification?

\+ identified as A. serpyllifolia

Section and Species	n	2n	Origin of Material	Reference
Arenaria contd.:				
A. minutiflora		20	Portugal	Blackburn & Morton (1957)
A. serpyllifolia		40(16)	Alps	Griesinger (1937)
" "	20		?	Rohweder (1939)
" "		40(25)	Tirol (Saxntal)	Wettstein (1940) & Woess (1941)
" "		(40)	Tirol etc.	Mattick in Tischler (1950)
" "		40	Gt. Britain	Blackburn & Morton (1957)
" "		44	" "	" " "
" "		40(6)	Denmark(1), Hungary(1), Holland(1), Yugoslavia(3)	Böcher & Larsen (1958)
Moehringia				
Latifoliae:				
M. pentandra		(48)	Corsica	Litardiere (1948)
" "		48	Portugal	Blackburn & Morton (1957)
M. trinervia	12		Schleswig-Holstein	Rohweder (1939)
		(24)	Corsica	Litardiere (1948)
		(24)	Tirol etc.	Mattick in Tischler (1950)
		(24)	Gt. Britain, Portugal	Blackburn & Morton (1957)
Diversifoliae:				
M. diversifolia		24	?	Blackburn in Tischler (1950)

Section and Species	n	2n	Origin of Material	Reference
Moehringia:				
M. ciliata		24	Tirol etc.	Mattick in Tischler (1950)
" "	12		Alps	Favarger (1953)
M. malyi		24	Tirol etc.	Blackburn & Mattick in Tischler (1950)
M. markgrafii	12		Alps	Merxmüller (personal comm.)
M. muscosa		(24)	Tirol etc.	Blackburn & Mattick in Tischler
Honkenya.				
H. peploides subsp. peploides:				
var. peploides	24		Schleswig-Holstein (Baltic)	Rohweder (1939)
" "	32		" (N. Sea)	" "
" "	34(1)		Germany (Baltic)	Malling (1957)
" "		68(5)	Denmark(2), Germany (3)*	" "
" "		48	Gt. Britain	Blackburn & Morton (1957)
" "		c.64	" "	" " "
var. diffusa		66(2)	Spitzbergen, Norway(Tromso)	Flovik (1940)
" "		68(1)	Greenland	Malling (1957)

* including Rohweder's n = 24 locality.

Section and species	n	2n	Origin of Material	Reference
H. peploides subsp. maior*		68(1)	Alaska (Sitka)	Malling (1957)
H. peploides subsp. robusta		68(1)	Montreal Bot. Gdn.	Malling (1957)
Minuartia.				
Sabulina:				
M. hybrida		46	Gt. Britain	Blackburn & Morton (1957)
M. mediterranea		20	Portugal	" " "
Minuartia:				
M. frutescens		32	Hungary	Baksay (1958)
M. setacea		24	Tirol etc.	Mattick in Tischler (1950)
Acutiflorae:				
M. austriaca		c. 24	Tirol etc.	Mattick in Tischler (1950)
M. villarsii		20	N.W. Spain	Blackburn & Morton (1957)
Tryphane (Polymechana Mattf.):				
M. rubella subsp. rubella		26	Greenland	Sorensen & Westergaard in Love & Love (1948)

* identified from recorded origin.

Section and Species	n	2n	Origin of Material	Reference
Tryphane (Polymachana Mattf.) Contd.:				
M. rubella subsp. rubella		26	Iceland	Love & Love (1948)
M. rubella subsp propinqua		26	Iceland	" " "
M. rubella		24	Gt. Britain	Blackburn & Morton (1957)
" "	13		Greenland	Jorgensen et.al. (1958)
M. verna	39		Dolomites	Rohweder (1939)
" "		(c.24)	Tirol etc.	Mattick in Tischler (1950)
" "		24	Gt. Britain	Blackburn & Morton (1957)
" " var. gerardii		24	Gt. Britain	" " "
Alsinanthe:				
M. stricta		(26)	Greenland	Sorensen & Westergaard in Love & Love (1948)
" "		26	Iceland	Love & Love (1956)
" "	13		Greenland	Jorgensen et.al. (1958)
Spectabiles:				
M. biflora		26	Iceland	Love & Love (1956)

Section and Species	n	2n	Origin of Material	Reference
Spectabiles (contd.):				
M. laricifolia	13		Dolomites	Rohweder (1939)
" "	13		Alps (Trient)	Favarger (1949)
" "		(26)	Tirol etc.	Mattick in Tischler (1950)
M. sedoides		48	Gt. Britain	Blackburn & Morton (1957)

3. Evaluation of Genera and Generic Limits.

Although the Arenaria group contains about fifty validly published generic names, only fifteen of these have been extensively recognised or employed by recent authors, and the present discussion will be confined to them.

With the exception of Wilhelmsia (=Merckia) in which the "capsule" is rather fleshy and seems rarely to dehisce, the genera fall very clearly into two groups - those in which the capsule opens by twice as many teeth or valves as there are styles and those with an equal number of valves. The former comprises Moehringia, Brachystemma, Gooringia, Gouffeia, Moehringella and Arenaria itself, while the remaining eight genera fall into the latter division (i.e. Mimuartia, Cherleria, Greniera, Honkenya, Hymenella (Triplateia), Lepyrodiclis, Queria and Rhodalsine); from an examination of developing capsules it is clear that Wilhelmsia also belongs to this group with undivided capsule valves. The constancy of the capsule dehiscence character has already been stressed (cf. pp. 44-46) and the important fact mentioned that there are no similarities between species in the two groups that are not more easily explained by habit convergence , than true affinity. Some examples of such parallel evolution are listed below; the list is not exhaustive, being drawn chiefly from Orient species.

Habit etc.	"Arenaria series" (divided valves)	"Mimuartia series" (undivided valves)
Straggling 'Stellariod" Mesophytes (C. Asia)	Brachystemma	Lepyrodiclis
Densely caespitose Arctic perennials	A. sect. Rariflorae (esp. A. ciliata agg.)	M. verna agg. & M. biflora

Habit etc.	"Arenaria series" (divided valves)	"Minuartia series" (undivided valves)
Densely caespitose alpines with lanceolate leaves	A. purpurascens	M. cerastiifolia
Submesophytic coastland annuals	A. pamphylica	M. mesogitana
Slender steppe annuals	A. leptoclados	M. hybrida
Slender semi-desert annuals	A. sabulinea	M. hybrida
Xeromorphic annuals	A. Series Saponarioides	M. Series Montanae
Linear-leaved tufted perennials (Caucasus)	A. lychnidea	M. circassica
Dense ± spiny steppe plants	A. ledebouriana	M. umbellulifera

In some cases these species pairs have been confused in the field and mixed gatherings, or notes purporting one to be a variant of the other, have resulted. Closer examination, however, invariably reveals that there are marked discontinuities in characters other than capsule dehiscence (e.g. in sepal nervation or leaf shape) and that each plant shows close and obvious connections with other species of its own genus - species which are quite different from any plants to be found in the other group. A possible exception is Arenaria purpurascens which holds a very isolated position in its genus, forming the monotypic Subgenus Porphyrentha, but which in all respects, other than habit, is equally far removed from M. cerastiifolia. Likewise, although Brachystemma and Lepyrodiclis cannot be associated with any groups of

Arenaria or Minuartia, their only resemblance is in having two carpels and "Stellaria-like" leaves and habit, and cannot be thought of as having any close affinity with one another.

It is quite clear then, that we are dealing with two natural divisions. The question which remains, however, is whether they are not so alike in all characters other than capsule dehiscence as to make their inclusion within one genus desirable for the general convenience of botanists. This is the view of Bentham (1862), Fernald (1918), and Maguire (1951), the two American authors being undoubtedly influenced by the fact that relict types are well represented in North America, only one natural group of species having a centre of diversity in that region (Arenaria Subgenus Eremogone in the west).

The strongest argument against such a treatment is the one put forward, in effect, by Fenzl (1840), when he included Arenaria with Stellaria, Cerastium and other genera with divided valves in a tribe (Stellarineae) quite distinct from Minuartia (his "Alsine"), Sagina, Buffonia etc., all genera with undivided capsule valves (Tribe Sabulineae). This treatment, which is followed by Pax & Hoffmann (1934) (treating them as Subtribes), suggests in modern terms that the evolution of Minuartia and its allies was quite separate and distinct from that of Arenaria, Moehringia etc., and that the latter are in fact more closely related to Stellaria and Cerastium. Detailed investigations of the phylogeny of the Alsinoideae are outside the scope of the present work, but the evidence from comparative study of the two genera tends to support the contention that they are not very closely related.

In the first place the more primitive species show scarcely more affinity than do the advanced members and the whole pattern of evolutionary relationship between the two groups seems different. Although Minuartia has what is presumably the more primitive form of capsule dehiscence, the whole genus is in a much more advanced state of evolution than Arenaria; the broad-leaved condition has been almost entirely lost and there are both a greater number of isolated groups of one or a few species which have strong claims to generic recognitions and within Subgenus Minuartia itself Sections which are all very well-marked and clearly definable. The diversity in chromosome base number may also reflect this highly evolved condition. In Arenaria, on the other hand, with its derived form of capsule dehiscence, broad-leaved plants are predominant in three of the major subgenera and are only absent in Eremogone and Eremogoneastrum. Although the generally large subgeneric groups are well-defined, few natural groups stand out within them. Associated with this is the constant base number ($\chi = 10$) met with in Subgenus Arenaria and $\chi = 12$ in the related genus Moehringia.

While it is doubtless in part a reflection of its less advanced condition, it is true that affinities with Stellaria and Cerastium can be detected in Arenaria. Subgenus Odontostemma is very close to the genus Pseudostellaria and may not even be very clearly demarcated from it; in turn Pseudostellaria is not far removed from Stellaria itself (cf. Schaeftlein, 1957). A. purpurascens, forming the

monotypic Subgenus Porphyrantha, shows a strong resemblance to Cerastium in its capsule structure, suggesting, if not a real affinity, at least a close parallelism. Mattfeld (1922 a.) has suggested that an approach to Stellaria or Cerastium is to be seen in Minuartia in the emarginate petals of Section Uninerviae and Subgenus Spergella. Both groups are in other respects highly advanced and the former are not far removed from the other members of Subgenus Minuartia. A more convincing explanation would be that while in one line (Stellariinae) bifid petals evolved in a primitive ancestral type and have given rise to distinct branches, they are a very late development in this, the other line (Sabulininae) - an interpretation favouring the independence of the two subtribes.

The conclusion reached from the present studies is that while the existence of two independent lines of evolution within the Alsinoideae cannot be regarded as established, there is no counter evidence that Arenaria and Minuartia are very closely related. Considering the fact that there is no doubt that the two groups are on the whole natural (i.e. with the possible exception of a few isolated species in each) it has been decided to maintain Arenaria and Minuartia as separate genera. In doing this no departure is being made from the general practice of contemporary botanists (except those in North America) and is in accord with that adpoted to separate Lychnis from Silene in the Silenoideae (cf. Chowdhuri, 1957), where the same character of capsule dehiscence provides the most natural separation of the genera.

Having decided to maintain the two major genera, there remains the not so far-reaching, but much more difficult task of determining the status of each of the thirteen frequently recognised smaller groups, and also of some of the more outstanding groups of Arenaria and Minuartia themselves. The genera will now be considered in turn, dealing first with those which resemble Arenaria in having divided capsule valves.

Moehringia; This is the largest and most important of all these genera and is the only one which has enjoyed the same widespread recognition as Minuartia; indeed many of its species have no published name in Arenaria. The genus was regarded as a very homogeneous group until it was recognised that in M. intricata and M. tejedensis etc. (Section Arenarioides) it included species which, although possessing a strophiole, were very atypical in their seed characters and approached Arenaria Subgenus Arenaria. It is quite possible that these species are in fact true Arenarias and that their strophiole is a totally different structure from that found in Moehringia proper. The latter in its smooth shiny lenticular seeds, its sometimes solitary axillary flowers and its general habit, most closely resembles the predominantly South American Arenaria Subgenus Leiospermae. The two groups come geographically closest in North America where Moehringia lateriflora and M. macrophylla are distinguished from A. lanuginosa (with a taproot) by their rhizomatous habit. This resemblance may, of course, merely represent yet another example of habit

parallelism; the two groups are not sufficiently well-known to the writer for him to express a definite opinion.

It seems not improbable, however, that even excluding Section Arenarioides, Moehringia is not more distinct from Arenaria Subgenus Leiospermae than are the other subgenera (e.g. Eremogone and Arenaria) from one another. A representative sample of European species of Moehringia (excluding Section Arenarioides) has been investigated cytologically and a constant base number of 12 reported; in Arenaria Subgenus Arenaria, on the other hand, there is a base number of 10. Strong evidence on the generic status of Moehringia would almost certainly be provided by cytological data for species of Arenaria outside the type subgenus and for the North American species of Moehringia and those in Subgenus Arenarioides. Until this and other evidence is available, it seems undesirable to make any major changes in generic circumscription, particularly where this involves new combinations. The genus Moehringia is therefore maintained in its currently accepted form, but noting not only that it may prove heterogeneous (Section Arenarioides being aberrant) but also that typical Moehringia may have no stronger claims to generic rank than Eremogone or Odontostemma.

Brachystemma: This genus of one or possibly two species has the distinction of being one of the two which Bentham (1862) maintained as distinct from Arenaria (the other was Queria).

Indeed apart from its inclusion by Williams (1898) in his Subgenus Arenariastrum, it has enjoyed universal recognition. Williams, moreover, had obviously no real understanding of this group and of the two "Sections" which he included with it, Gouffeia and Lepyrodiclis. Their only uniting feature was the bicarpellary gynoecium; Gouffeia is in most other respects typical of Arenaria Subgenus Arenaria, while Lepyrodiclis is in the Mimuartia affinity in possessing undivided capsule valves. Possibly the habit resemblance between Brachystemma and Lepyrodiclis was responsible for the latters inclusion here.

The type species, Brachystemma calycinum, is in a very isolated position taxonomically, and no affinities with other plants can be suggested unless possibly a remote connection in cotyledon structure with Arenaria Subgenus Odontostemma. (The second, recently described species, B. ovatifolium has not been seen and it is not clear from the description that it is correctly placed.) In its specialised inflorescence, scarious sepals and reduced gynoecium it shows highly advanced characters, while it is probably primitive in its Stellaria-like habit, though it is a straggling climber. There is no doubt that Brachystemma is best regarded as a distinct genus, in the general affinity of Arenaria, but having almost certainly followed a separate line of evolution from a very early stage in the development of the Alsinoideae.

Gooringia: Williams described this monotypic genus in 1897 on the basis of Hemsley's tetramerous, bistaminate, bicarpellary

Arenaria littledalei; as is noted elsewhere (pp. 3 and 35), this plant is no more than an extremely reduced representative of Arenaria Subgenus Odontostemma, very close to A. reducta and A. inconspicua, and the genus is therefore reduced to synonymy under that subgenus.

Gouffeia: As noted above, Williams included this monotypic group in his bicarpellary Subgenus Arenariastrum; the single species, a native of S. France, is a slender annual or biennial plant with subulate or setaceous leaves and in most respects resembles Arenaria Subgenus Arenaria, of which it is probably a bicarpellary derivative. There is, however, no group of Subgenus Arenaria to which it can be attached (unless possibly Section Occidentales) and in view of the importance of the bicarpellary condition in other parts of the genus (e.g. Subgenus Odontostemma) it has been maintained as a Subgenus separate from but close to Arenaria itself. Williams' Section Gouffeia has been chosen as the type section of his Subgenus Arenariastrum (cf. p. 118) and so this becomes the correct name for the group at Subgeneric rank.

Moehringella: This genus was proposed by Neumayer (1924) (taking up Franchet's Section of Arenaria) on the basis of its seed having an inflated ("winged") testa. The genus has never been adopted since and Handel-Mazzetti (1929) has shown that this feature is to be found in a number of species typical of Arenaria Subgenus Odontostemma. Although in the present work it has only been

possible to examine seed of a few species of Odontostemma, an inflated testa has always been found. There can be no question of Moehringella being generically distinct from the species of Arenaria Subgenus Odontostemma, and at most it may represent a section of this group. (cf. p. 142).

Arenaria: Since the middle of the last century the circumscription of Arenaria has been a very wide one and has included such groups as Eremogone, Dolophragma and Odontostemma , which had originally been regarded as separate genera. On the whole the wider circumscription appears to be the more desirable on the basis of present knowledge, but it should be noted that some of these groups stand in a very isolated position. Subgenera Eremogoneastrum and Dolophragma may both have branched off early from a primitive Eremogone stock, but none of these three groups show any close relationship with the rest of the genus. Likewise although the existence of species such as A. glanduligera suggests that Odontostemma and Sikkimenses are probably related, no connecting species have been observed between them (taken together) and Arenaria and Arenariastrum, on the one hand, and Leiospermae and Dicranilla on the other.

Cherleria: Turning to the "Minuartia Series" with undivided capsule valves, the first to be considered is the usually apetalous Linnaean genus Cherleria. Until the time of Fenzl (1840) it had been treated as a habit genus for densely pulvinate mountain

plants, but he noted the close relationship of the type species (Cherleria sedoides) with what is now Minuartia and, removing the discordant elements, made Cherleria a monotypic division of the genus he termed "Alsine". This treatment has been generally followed since, notably by Graebner (1918, Mattfeld (1922), Hayek (1924) and Pax & Hoffmann (1934), but recently Clapham in Clapham, Tutin & Warburg (1952) has restored it to generic rank, That this has been done very arbitrarily and without an examination of the situation is strongly suggested by the fact that Clapham records Cherleria as comprising about twelve species, whereas the "group", whatever its rank, has been unquestionably demonstrated, for more than a 100 years, to be monotypic ! (Except under Sampaio's (1913) circumscription, in which it is equated with the whole of Minuartia; the latter name, being chosen by Hiern (1899) for the united genus, has priority - cf. p. 18).

As Mattfeld (1922 a.) notes, Cherleria is very close to Minuartia Section Spectabiles and shares with it the linear obtuse sepals which are not found elsewhere in the genus. In the opinion of the present author there is no justification (other than tradition) for excluding it from Section Spectabiles and it has been included as one of its three subsections. As an Alpine group it very closely parallels in habit and ecology the predominantly Arctic Subsection Spectabiles, which differs chiefly in its larger petals, erect sepals and less prominent glands.

Greniera: The type species (douglasii) of this North American annual group is very distinct from all others in the Minuartia affinity in its discoid seeds with a broad wing and in the structure of its prominent staminal glands (cf. p.43). Minuartia howellii which Mattfeld and many American authors relate to M. douglasii has well developed simple glands and rather flattened narrowly winged seeds. Whether or not it should be included in Greniera is open to question, but it certainly provides a link between M. douglasii and the other species of Minuartia.

In other characters both species are typical of Minuartia and have filiform leaves and the general facies of the genus . Mattfeld (1922) treats Greniera as a section of Minuartia and this has been followed in the present account.

Honkenya (Ammodenia): Like Cherleria, Honkenya comprises a single distinctive habit type, but in this case one which is not met elsewhere in the group except in Wilhelmsia (=Merckia) with its inflated, partially septate capsule. Mattfeld (1922, 1923 a.) was of the opinion that as most of the diagnostic characters were probably associated with its maritime habit it should be included within Minuartia; in this he was followed by Hayek (1924). Authors such as Williams (1909) Graebner (1918), Pax & Hoffmann (1934) and Gorschkova in Komarov (1936) (as Ammodenia), in maintaining it as a distinct genus, have obviously been impressed by the axillary flowers and broad ovate fleshy leaves not

met with anywhere else in the genus, though the latter are approached in the very distinctive group Rhodalsine (q.v.). Malling (1957) has also provided what he considers to be cytological evidence in support of its generic status, but although the high base number of 17 (assuming Malling is correct, cf. p. 53) has not so far been recorded elsewhere in the group, variation in base number in Mimuartia is apparently very great.

Perhaps the most important point in relation to its generic evaluation is its complete isolation from the rest of the group in every respect, not merely in habit. Short of the discovery of some new species which would connect it with a known group of Mimuartia, Honkenya will probably always remain one of these small distinctive taxa whose rank is continually in dispute. Its distinctive facies, so unlike that of Mimuartia, and its complete isolation have been the determining factors in the decision to maintain it as a distinct genus. (for the diagnostic characters cf. key p. 79).

Hymenella (Triplateia): This is yet another distinctive monotypic group in the Mimuartia affinity (in this case a native of Mexico), which with its quadrangular stems and reflexed sepals and capsule-valves has a rather distinct facies. It has, however, the typical narrow leaves of Mimuartia and in the absence of any additional evidence it has been decided to follow Mattfeld's (1922) view and include it in Mimuartia. In view of its distinctiveness and doubt as to its nearest relatives, it has been raised to subgeneric rank along with two

other very isolated groups which Mattfeld treated as sections of Minuartia.

Lepyrodiclis: Lepyrodiclis is the only bicarpellary member of the Minuartia group, and as it combines with this a very distinctive Stellaria-like habit its generic validity has rarely been questioned. The type species was originally included with Gouffeia as the bicarpellary equivalent of the (at that time) tricarpellary Arenaria s.l., but its entire capsule valves were recognised by Fenzl (1840) who established the genus. Williams' (1895, 1898) inclusion of it in Arenaria was due to his failure to realise that the valves were undivided. The genus, which consists of three annual species in South and Central Asia, is here maintained, being regarded as a very early offshoot of a primitive Minuartia stock, which while retaining the mesophytic habit is highly evolved in the reduction of the gynoecium, paralleling the very different xerophytic genus Buffonia.

Queria: Originally distinguished from Minuartia sensu stricto (= M. Series Minuartia and Campestres) by its solitary seed, the placing of this Linnaean genus, now regarded as monotypic, has in the past been subject to considerable uncertainty. The small petals and often functionally indehiscent "capsule" have prompted its inclusion in the Paronychioideae (e.g. de Candolle, 1828).

Fenzl (1833) united it with "Alsine" (=Minuartia) but restored it to generic rank in 1840. Bentham (1862) kept the genus distinct from Arenaria and placed it between Schiedea and Spergula. Mattfeld (1923, 1923 a.) demonstrated its close relationship with Minuartia and included it within Series Minuartia (M. dichotoma and M. sclerantha). despite these detailed studies, many later botanists, probably influenced by its very distinctive appearance when in fruit (though not in flower), have chosen to maintain the genus (e.g. Hayek, 1924, Schischkin in Komarov, 1936). (A notable exception is Pax & Hoffmann, 1934). The reasons for Mattfeld's view being the more correct one are discussed in full in the revision of Orient species. (p. 571)

Rhodalsine: Like Honkenya, this group has to some extent retained the primitive broad-leaved condition, although the leaves are linear in Minuartia vestita and some forms of M. geniculata. In general facies the plants, which grow on maritime cliffs or under rather desert conditions, resemble species of Spergularia rather than any group of Minuartia and this is accentuated by their pink petals. Within the Minuartia affinity they are unusual in having accumbent cotyledons (a character shared only by the Spergella group) and more especially in their flower structure. (cf. p.36).

The distinctiveness of the group was first recognised by Fenzl (1840) who described it as one of the divisions of "Alsine" (Minuartia); in 1845 Gay gave it generic rank under the name Rhodalsine. Most

authors since have regarded it as a section or subgenus of Minuartia ("Alsine")' but Williams (1898 a.) treated it as a distinct genus - publishing a "Note Monographique" on the single polymorphic species complex then known to belong to the group.

The Somaliland species, Arenaria vestita Baker, is clearly referable to this group (a relationship, which so far as is known, has not previously been noted) and its floral structure, although subperigynous like the Mediterranean species, more nearly approaches the normal Minuartia pattern (cf. p. 36).

It has been noted that the status of Honkenya is likely to remain for long a subject of controversy, and the same applies to Rhodalsine. Its tendency to develop narrow leaves, its terminal inflorescence and its typical capsule draw it closer to Minuartia, but it has the additional special features of accumbent cotyledons and subperigynous flowers with an extremely short calyx tube. Within Arenaria differences in cotyledon arrangement occur and the accumbent condition is also found in Minuartia picta and M. formosa (Subgenus Spergella), which have the typical floral structure and habit of Minuartia. Further evidence from cytology and floral anatmony may help in the evaluation of the status of the group which for the moment is retained within Minuartia, where it is treated as a subgenus.

Wilhelmsia (Merckia): This monotypic group is very similar in habit to Honkenya and like it seems to be a relict broad-leaved representative of a primitive Minuartia stock. Except

by those authors who treat Arenaria as a single genus (e.g. Fernald, 1919 and Maguire, 1951), it has always been maintained generically on account of its inflated, partially septate capsule. Mattfeld was unaware of its method of dehiscence, but from the structure of the immature capsule (cf. Mattfeld 1922 a.) it clearly belongs to the loculicidal group. This is also the position of the partial septa (which are therefore false septa) although there are also secondary furrows along the true septal line. The capsule being rather fleshy, if it opens at all, it probably does so rather irregularly.

Were Honkenya to be included within Minuartia there would be some basis for treating Wilhelmsia similarly; it is however completely isolated from any existing group of that genus and its resemblance to Honkenya is almost certainly superficial.

The name Merckia Cham. & Schlecht. (1826) is antedated by Merkia Borkh. (1792), a genus in the Jungermanniales, and the name Wilhelmsia Reichb. (1828) is the correct one (cf. McNeill in Taxon ined.).

Minuartia: Within Mattfeld's concept of Minuartia the distinctive groups Honkenya, Hymenella and Rhodalsine (Psammophilae) have already been discussed, the first named being treated as a separate genus and the last two raised to subgeneric rank (Mattfeld included each of them as sections). A fourth group of Mattfeld's Minuartia seems also to stand in a very isolated position; this is the group Spergella which superficially resembles species of Spergula and which is characterised by its accumbent cotyledons, falsely whorled

leaves (cf. key p. 156) and pink flowers.

The two species have the general habit of Minuartia but cannot be easily related to any other group (Mattfeld's association of them with Section Spectabiles cannot be upheld). This distinctiveness was noted by Gay who in his manuscript notes (in the Library at Kew) proposed the generic name "Godronia" for the group. It is here treated as a subgenus of Minuartia under Fenzl's name Spergella (not to be confused with Reichenbach's genus Spergella which represents pentamerous species of Sagina).

It is therefore proposed, as a result of the present studies, to recognise seven genera, and although no finality can perhaps ever be achieved in so complex a group, it is hoped that by taking a wide view and segregating only such natural groups as stand out clearly, something more stable and satisfactory has been achieved than simply a "via media" between the extremes of Krause and Reichenbach.

The seven genera are keyed below:

1a. Sepals almost completely scarious, more than twice as long as petals; stamens 5 with 5 staminodes; styles 2; capsule 4-valved, 1-seeded; flowers numerous in axillary and terminal panicles; much-branched climber with relatively large lanceolate leaves (Himalaya to Indo-China)

3. Brachystemma

1b. Sepals largely herbaceous or coriaceous, sometimes with a rather narrow scarious margin (rarely margin broad, forming most of the sepal and then petals usually as long as or longer than sepals, stamens 10, styles 3, capsule 3-or 6-valved or toothed, and inflorescence always terminal); inflorescence usually terminal or if (also) axillary usually 1-few flowered; habit various very rarely a scrambling climber;

2a. Leaves fleshy, ovate, sessile, 5-40mm. long; capsule globose, somewhat fleshy; seeds exstrophiolate; plants spreading with ascending stems (maritime strand plants);

3a. Capsule inflated, divided beyond half-way by 3 incomplete false septa, and bearing 3 secondary furrows (opening along the false septa by 3 furrowed valves - sometimes also splitting irregularly along the secondary furrows); staminal glands inconspicuous; seeds reniform, 1.5mm. (E. Asia and N.W. America)

5. Wilhelmsia

3a. Capsule completely unilocular, not inflated, opening by 3 unfurrowed valves; staminal glands prominent; seeds large ($>$ 2.5mm.), pyriform (N. Temperate and Arctic regions)

4. Honkenya

2a. Leaves various, if ovate, either thin and not at all fleshy, or else very small ($<$ 5mm.) and plants $\pm$ pulvinate; capsule completely unilocular, very rarely globose, not at all fleshy; seeds reniform, or globular or flattened ($<$ 2.5mm.), rarely

pyriform (Arenaria Subgenus Eremogone) (plants of various habitats, very rarely sea-shores);

4a. Carpels 2: capsule globose; inflated opening by 2 valves; ovules few (c.4.); seeds 2 (-3) exstrophiolate; inflorescence many-flowered axillary and terminal; petals often indented at apex (sometimes bifid); leaves relatively large and thin, lanceolate and sessile or ovate and petiolate; slender to rather robust straggling annuals (S.W. Asia to C. Asia)

7. Lepyrodiclis

4b. Carpels 3, occasionally 2; capsule ovoid to cylindrical, never inflated, opening by 3, 4 or 6 valves or teeth; petals usually entire, occasionally fimbriate or even emarginate; ovules usually many but sometimes reduced to few or one (particularly where the flowers are aggregated together or the plant is densely pulvinate); leaves usually small, often linear or subulate, if relatively large, broad and thin, then seeds usually smooth, sometimes strophiolate:

5a. Seeds smooth, shiny, (rarely obscurely tuberculate), with a whitish (or brownish) oily appendage (strophiole) near the hilum; flowers 4-merous with 2 carpels or 5-merous with 3 carpels; capsule opening by twice as many valves as styles; slender-stemmed, ± mat-forming, annuals or rhizomatous perennials (N. Temperate regions, esp. Europe)

2. Moehringia.

5b. Seeds without an oily appendage (occasionally winged by the protrusion of the testa, or rarely with a small colourless testa protrusion near the hilum); flowers 5-merous, rarely 4-merous and then with 3 carpels; plants rarely (never?) rhizomatous:

6a. Capsule opening by as many valves as styles; styles 3; leaves usually linear subulate or setaceous, (sometimes linear- lanceolate to lanceolate, sessile and rather rigid and then sepals ± prominently 5-7- nerved, rarely broader, subpetiolate and then flowers subperigynous and stamens usually inserted at two levels); if sepals indurate at the base, then plants annual or sepals with prominent parallel white stripes on either side of the green median nerve (very rarely 3 nerved); inflorescence always terminal. (N. Hemisphere, Chile)

6. Minuartia

6b. Capsule opening by twice as many teeth or valves as styles; styles 2 or 3; leaves various often lanceolate to ovate; if rigid - setaceous, or linear and grass-like, plants perennial and sepals usually indurate at the base, 1-nerved or rather obscurely nerved but without prominent parallel white-stripes; stamens always uniseriate attached to a hypogynous disc; inflorescence terminal or axillary (N. Hemisphere; mts. of S. America)

1. Arenaria

4. Infra-generic classification

1. Arenaria

Arenaria L., Sp. Pl. ed. 1. 423 (1753); Gen. Pl. ed. 5 193 (1754), non Arenaria sec Desv. in J. Bot. Desv. 3 : 219 (1816); Bentham in Bentham & Hooker, Gen. Pl. 1 : 150 (1862). pro parte: Pax & Hoffmann in Engler & Harms, Naturl. Pflanzenfam. ed. 2. 16c : 315 (1934).

Syn.: Gypsophytum Adans., Fam. 2 : 256 (1763) ("Gypsophyton" in indic.) (≡ Arenaria L.).

Alsinanthus Desv. in J. Bot. Desv. 3 : 221 (1816).

Arenaria Sect. Arenarium Ser. in D.C., Prodr. 1 : 401 (1824), pro parte.

Arenaria Sect. Alsinanthus Dumort, Florula Belg. 109 (1827) (cf. p. 2). (=^{t} Alsinanthus Desv.).

Sabulina Subgenus Alsinanthus (Desv.) Reichb., Fl. Germ. Excurs. 785 (1832) quoad basionom., non spp. incl.

Type : A. serpyllifolia L. - cf. p. 10 & Green in Hitchcock & Green (1929).

Key to subgenera.

1a. Styles 2, capsule splitting by 4 valves, (rarely styles 3 & capsule valves 6 in Odontostemma q.v.); plants diffuse:

2a. Calyx cuneate, sepals straight (erect, spreading at anthesis), not at all saccate, acute-acuminate, ± strongly 3-nerved, with a very narrow membraneous margin; seeds minutely tuberculate, testa not inflated; leaves linear-subulate; petals entire, about as long as the sepals; inflorescence a regular many-flowered (>6) dichasium, bracts setaceous; slender annual (or biennial) herb (S. France) V Arenariastrum

2b. Calyx truncate, sepals curving outwards, ± saccate at the base, obtuse, obscurely nerved with a rather broad membraneous margin; seeds rough without cell-like markings, testa usually inflated; leaves linear to ovate, very rarely subulate and never setaceous; petals retuse, emarginate or fimbriate, usually longer than the sepals (but cleistogamous flowers can also occur); inflorescence various, bracts foliose with vegetative shoots arising in the inflorescence region; diffuse annual, biennial or perennial herbs (Sino-Himalaya) X Odontostemma

1b. Styles 3, capsule splitting by 6 valves or teeth, or occasionally 2 and capsule valves 4 and then plants densely pulvinate; petals entire or slightly retuse:

3a. Sepals inflexed at the apex and margins, of one texture throughout (usually coriaceous); flowers small < 5mm., solitary, sessile or shortly stalked, enclosed by or scarcely overtopping the upper leaves which resemble the sepals in structure and often merge

into them; leaves small, usually < 5mm., subulate to ovate, imbricate, coriaceous throughout (not thickened at margins); styles frequently 2; capsule membraneous, seeds usually (? always) smooth and shiny; plants densely pulvinate (C. & S. America) II Dicranilla

3b. Sepals not inflexed at the apex and margins (or only a thin membraneous margin inflexed); inflorescence various, if flowers solitary and scarcely overtopping the upper leaves, then either sepals herbaceous or membraneous markedly dissimilar to the very coriaceous leaves, or else flowers large and sepals and leaves both either hardened or else broadly scarious at the apex and margins; leaves various, if coriaceous then either with a scarious margin or else hardened and thickened round the margins; styles usually (? always) 3; capsule frequently coriaceous or woody:

4a. Capsule cylindrical, long exserted (> twice as long as sepals), membraneous, opening by 6 short teeth; seeds smooth rather shiny (with a very small tuft of white hairs at hilum); caespitose plants with ovate to lanceolate sessile leaves; flowers in 1 - few-flowered terminal cymes (Pyrenees & Cantabrian mts.)

III Porphyrantha

4b. Capsule ovoid, enclosed by or up to twice as long as calyx (very rarely cylindrical and then about as long as calyx), varying in texture but when membraneous, usually opening up completely by valves; seeds various, not usually smooth in plants with a

terminal inflorescence:

5a. Seeds smooth and shiny, without any visible markings at x 70 ; flowers typically solitary, axillary, long- pedicelled, occasionally by the reduction of the leaves and internodes forming a terminal monochasium (bracts usually herbaceous and leaf-like, though reduced in size); leaves and sepals herbaceous not hardened at the base or apex. Plants perennial. S. & C. America, extending into N. America).

I Leiospermae

5b. Seeds usually with cell-like markings on the testa, the 'cells' frequently expanded forming tubercles, rarely testa without any cell-like sculpturing and then bearing numerous minute papillae or with a dull roughened surface; flowers usually in terminal and sometimes also axillary cymes or panicles and bracts usually rather membraneous or scarious very different from the leaves (though frequently showing a gradual transition), rarely flowers solitary and then only terminal (or in a few spp. terminating axillary leafy shoots); plants annual or perennial:

6a. Leaves narrowly linear to ovate, herbaceous, hardened at the margins and apex (very rarely not - cf. Sikkimenses), never truly setaceous or subulate; flowers solitary or

occasionally up to 3 in a cluster, terminal; sepals herbaceous indistinctly veined, not at all hardened at the base; caespitose or pulvinate plants:

7a. Sepals acute, usually hardened at the apex and margins; leaves relatively large (> 5mm. long), ovate, acute to acuminate, ± remote or often overlapping but never densely imbricate or tetrastichous, not or scarcely persistent; flowers always solitary, large, showy (sepals > 5mm.; petals white to pink about twice as long as sepals); plants caespitose, sometimes densely so, but never pulvinate (Sino- Himalaya) IX Sikkimenses

7b. Sepals obtuse, with a membraneous margin, leaves persistent, linear to linear-lanceolate or if ovate, small (< 5mm.) and densely imbricate or tetrastichous; flowers small, or if rather large, leaves linear to linear-lanceolate; plants usually densely pulvinate (rarely somewhat caespitose and leaves not very persistent, and then leaves linear and flowers frequently in clusters of 3) (Sino-Himalaya) VIII Dolophragma

6b. Leaves entirely herbaceous or with a scarious margin, or else setaceous, often pungent; occasionally leaves ± ovate, tetrastichous with a prominently thickened margin, and then sepals prominently veined:

8a. Sepals usually lanceolate to linear-lanceolate, long acuminate (rarely broader and acute and then plants densely pulvinate and flowers subsessile), somewhat hardened at the base, with 1-3 prominent nerves near the centre and a relatively broad scarious margin; leaves subulate to linear with a distinct scarious margin, never long and grass-like and never strictly setaceous; flowers often solitary shortly stalked or inflorescence a long-stalked terminal cluster; plants densely caespitose to densely pulvinate (leaves always persistent) (Sino-Himalaya & W.N. all America)

VI Eremogoneastrum

8b. Sepals various, rarely with a broad scarious margin and then individual nerves not prominent or leaves strictly setaceous or long and grass-like; leaves various, never markedly scarious-margined (very rarely minutely so):

9a. Sepals markedly hardened at the base, often the receptacle and entire lower part of the calyx becoming indurated lignaceous in fruit, rarely only somewhat hardened and then leaves pungent; cotyledons usually accumbent; leaves long linear and grass-like or short strictly setaceous or pungent, never broad or flaccid; inflorescence a terminal cyme or panicle of cymes, occasionally contracted into a head or a number

of cymose clusters, rarely reduced to a single flower; plants perennial, often stoutly caudiculate. (E. Europe, Asia & W.N. America) VII Eremogone

9b. Sepals not or scarcely hardened at the base; cotyledons incumbent; leaves usually lanceolate to ovate, herbaceous or occasionally coriaceous, sometimes linear-subulate and then always flaccid; inflorescence various, sometimes reduced to 1-3 flowers, occasionally axillary as well as terminal; plants annual or perennial. IV Arenaria

I Subgenus Leiospermae (Williams) McNeill, comb. nov.

Syn.: Spergulastrum Michx., Fl. Bor. Amer. 1 : 275 (1803), pro parte (parte aliore = Stellaria).

Arenaria Subgenus Euarenaria Sect. Leiospermae Williams in Bull. Herb. Boiss. 3 : 600 (1895).

Type : A. musciformis Triana & Planch. in Ann. Sci. Nat. ser.4 17 : 150 (1862), non Edgew. & Hook. (1874).

List of species recognised by Williams (1898) and species (names) not included in his revision. For fuller list of synonyms cf. Williams (1898). (N.B. Although there is no reason to doubt the taxonomic position of any of the names listed (other than those marked - ?), authentic material has not always been seen).

A. achalensis Griseb. (1879)

A. alsinoides Willd. ex Schlecht. (1813)

!A. bourgaei Hemsley (1879)

A. catamarcensis Pax (1893)

?A. crassipes Baehni & Macbride (1937)

A. guatemalensis Standley & Steyerm. (1944)

A. jamesoniana Rohrb. (1872)

A. lanuginosa (Michx.) Rohrb. (1872)

A. lycopodioides Willd. ex Schlecht. (1813)

A. mandoniana Wedd. (1864)

A. megalantha (Rohrb.) Williams (1898)

A. microphylla Phil. (1856)

A. muscoides H.B. & K. (1823) (= A. nana)

A. nana Willd. ex Schlecht (1813)

?A. nitida (Bartl.) Rohrb. (1872)

A. orbygnyana Wedd. (1864)

A. paludicola Robinson (1897)

A. palustris Naud in C. Gay (1845), non S. Wats. (1876)

!A. parvifolia Benth. (1845)

A. peyritschii Rohrb. (1872)

A. pleurantha Phil. (1893)

A. poeppigiana Rohrb. (1372)

!A. reptans Hemsley (1879)

A. rohrbachiana Garcke (1872)

A. saxosa A. Gray (1851)

A. serpens H.B. & K. (1825)

!A. soratensis Rohrb. (1872)

A. standleyi Baehni & Macbride (1937)

A. stuebelii Hieron (1895)

A. tetragyna Willd. ex Schlecht. (1813)

A. venezuela Briq. (1911)

Excluded species :

!A. andina Rohrb. - not Arenaria (possibly Minuartia sp.)

!A. balansae Boiss. - (Subgenus Arenaria Section Rotundifoliae)

Excluded species contd. :

A. cerastioides Poir (= A. spathulata Desf. sensu Williams pro parte)	-	(Subgenus Arenaria Section & Series Africanae)
?A. halacsyi Bald.	-	(Subgenus Arenaria Section Rotundifoliae)
A. hispanica Spreng. (=A. arenarioides (Crantz) Fern. = A. spathulata sec. Williams (1898) pro parte, non Desf.)	-	(Subgenus Arenaria Section Africanae Series Papillospermae)
A. spathulata Desf.	-	cf. A. cerastioides & A. hispanica

The subgenus Leiospermae with its smooth shiny seeds, its usually axillary flowers and its entirely herbaceous sepals, is confined to the New World, with its great centre of diversity in the Andes Mountains of South America. It is regarded as a relatively primitive group within the genus, to a large extent paralleling the predominantly old world Subgenus Arenaria. The Leiospermae appear to have given rise to the highly evolved Subgenus Dicranilla and it is difficult with the material available to draw the dividing line between them. Probably all the South and Central American species of Arenaria belong to one or other of these two subgenera (mostly Leiospermae), but with the limited material in British herbaria it has not been possible to establish with certainty the position of many published species. The genus Moehringia, characterised by its strophiolate seed, also shows a close affinity with the Leiospermae and they have probably evolved from a common ancestral type. (cf. figs. 1 & 4).

The subgenus probably includes between 25 and 35 species.

Special references : Hauman & Irigoyen (1923), Macbride (1937), Reiche (1895), Rohrbach (1872), Standley & Steyermark (1946), Steyermark (1951).

II Subgenus Dicranilla (Fenzl) Williams in Bull. Herb. Boiss. 3 : 599 (& 602) (1895)

Syn. : Arenaria e. Dicranilla Fenzl in Endlicher, Gen. Pl. 967 (1840).
Dicranilla (Fenzl) Reichb., Repert. Herb. Nomencl. 205 (1841).
Arenaria Sect. Dicranilla (Fenzl) Pax in Engler & Prantl, Naturl. Pflanzenfam. ed.1 3 1b : 84 (1889).
Arenaria Subgenus Dicranilla Sectiones Radiantes (= Dicranilla), Pycnophyllae, & Pedunculosae Williams l.c. 602 (1895).

Lectotype : A. dicranoides H.B. & K., Nov. Gen. Spec. 6 : 34 (1823) (≡ Lobelia bryoides Willd. ex Roem. & Schult. (1819), non A. bryoides Willd. ex Schlecht. (1813)

Other species : (N.B. Authentic material of only 4 species listed has been seen; the others are included on the authority of Williams (1898) & Macbride (1937)

A. alpamarcae A. Gray (1857)

A. aphanantha Wedd. (1864)

A. bisulca (Bartl.) Rohrb. (1872)

A. boliviana Williams (1898) (≡ conferta Wedd.)

A. bryoides Willd. ex Schlecht. (1813) (paratype species)

A. conferta Wedd. (1864), non Boiss (1842)

A. moritziana Pax (1893)

?A. nitida (Bartl.) Rohrb. (1872)

A. pedunculosa Wedd. (1864)

A. pycnophylla Rohrb. (1872)

A. pycnophylloides Pax (1893)

?A. radians Benth. (1845)

A subgenus of about 12 species confined to the high Andes of South America and the mountains of Mexico and Central America. The species appear to be specialised alpine derivatives of species such as A. decussata and A. lycopodioides in Subgenus Leiospermae. (cf. figs. 1 & 4).

Special references : Hauman & Irigoyen (1923), Macbride (1937), Rohrbach (1872).

III Subgenus Porphyrantha (Fenzl) McNeill, comb. nov.

Syn. : Dufourea Grenier in Act. Soc. Linn. Bord. 9 : 25 (1837) pro parte, non Bory ex Willd. (1810), nec H.B. & K. (1818).

Arenaria c. Porphyrantha Fenzl in Endlicher, Gen. Pl. 967 (1840).

Porphyrantha (Fenzl) Reichb., Repert. Herb. Nomencl. 205 (1841).

Arenaria Sect. Porphyrantha (Fenzl) Gren. & Godr. Fl. Fr. 1 : 262 (1848) ('Porphyranta').

Type : A. purpurascens Ram. ex D.C., Fl. Fr. 4 : 785 (1805)

(≡ Dufourea purpurascens (D.C.) Gren. (1857) ≡ Cerastium purpurascens (D.C.) Fenzl (1833), non Adams in Weber (1805)).

Synonym:

A. cerastioides Pers. (1805), non Poir (1789) : (= A. purpurascens.).

Excluded species :

Dufourea cerastiifolia (D.C.) Gren. (≡ A. cerastiifolia Ram. ex D.C.) - Minuartia cerastiifolia (D.C.) Graebn. (Section & Series Lanceolatae)

A monotypic subgenus confined to the Pyrenees and the Cantabrian Mountains. In habit A. purpurascens resembles members of Minuartia Section Lanceolatae but holds a very isolated taxonomic position. The long cylindrical capsule, resembling that of Cerastium spp., is not found elsewhere in the Arenaria group, but in its entire petals, its three carpels and six capsule teeth it is a typical Arenaria. Its inflorescence form and sepal structure resemble Subgenus Arenaria but its smooth shiny seeds with a tuft of white hairs at the hilum suggest that this resemblance is a superficial one. Subgenus Porphyrantha possibly represents an early offshoot from the Stellariineae stock, paralleling Cerastium but showing a greater reduction of the gynaecium and lacking the divided petals. (cf. figs. 1 & 4).

Special reference : Rouy & Foucaud (1896).

IV Subgenus Arenaria

Syn.: Arenaria b. Euthalia Fenzl in Endlicher, Gen. Pl. 967 (1840).

Arenaria Subgenus Euthalia (Fenzl) Fenzl in Ledebour, Fl. Ross. 1 : 368 (1842).

Arenaria Sect. Euthalia (Fenzl) Grenier & Godron, Fl. Fr. 1 : 257 (1848).

Euthalia (Fenzl) Rupr., Fl. Cauc. 220 (1869).

Arenaria Subgenus Pentadenaria Section Rariflorae Williams in Bull. Herb. Boiss. 3 : 602 (1895), pro parte, (Subsection 3. - spec. typ. A. ciliata incl.)

Key to Sections and Series

1a. Plants perennial, bearing sterile leafy shoots in addition to flowering stems:

2a. Leaves strongly 3-nerved, the lateral nerves marginal; sepals with a prominent median nerve:

3a. Leaves linear to ovate, cuneate; flowers in a lax cymose inflorescence (pedicels 5-50mm. long); sepals with numerous indistinct lateral nerves, often keeled, markedly different from the bracts. (E. & W. Mediterranean)

B. Sect. Grandiflorae

3b. Leaves triangular (sometimes narrowly so), ± truncate at the base; flowers in clusters (usually a terminal head), or

solitary, closely invested by sheathing bracts (pedicels < 2mm.); sepals with 2-3 pairs of rather prominent lateral nerves, the outer bract-like with prominent marginal vasculation. (Spain & N. Africa) C. Sect. Plinthine

2b. Leaves with indistinct vasculation or more usually with a prominent median nerve sometimes giving rise to a number of weak lateral nerves but with no distinct marginal vasculation:

4a. Leaves obovate to orbicular with a rounded apex; seeds obscurely reticulate, the testa 'cells' not tuberculiform; testa 'cells' with a number of minute puncta ('punctate'), but no central papilla ('epapillose'); petals ovate ± abruptly contracted at the base; inflorescence frequently axillary. (S. & C. Europe, Orient, E. to India) D. Sect. Rotundifoliae

4b. Leaves linear to ovate, apex acute to obtuse (rarely broadly ovate and then apex acute); seeds various, often rugulose or tuberculate, papillose; petals usually lanceolate to obovate, cuneate at the base:

5a. Sepals with a broad ± scarious margin becoming very slightly hardened in fruit; inflorescence 8-12 flowered, very lax; seeds strongly compressed, winged, buff; cotyledons longitudinally grooved or folded away from the radicle; leaves broadly linear to linear-lanceolate ± sessile L. Sect. Compressae

5b. Sepals with a rather narrow membranous margin, not at all hardened; inflorescence various, if very lax usually very few flowered; seeds ± reniform, wingless, usually black; cotyledons not grooved or folded;

6a. Sepals obscurely nerved or with a median nerve (often prominent) and sometimes with 1-2 pairs of laterals, always less prominent than the median nerve and usually indistinct; leaves often sessile:

7a. Sepals large (> 5mm.), obscurely nerved and not at all keeled; leaves large 15-35mm. long; plants tegetiform or ascending (Spain & Portugal)

E. Sect. Planosepalae

7b. Sepals small (< 5mm.) with a median nerve, often prominent (& sepals almost keeled) and one or two pairs of less distinct lateral nerves: leaves small 2-7mm. long; plants caespitose often with woody caudex & caudiculi (Panarctic, Mts. of C. & S. Europe & S. W. Asia)

A. Sect. Rariflorae

7c. Sepals small (< 5mm.), obscurely nerved (actually with a number of ± equal parallel nerves); leaves usually large, 6-15mm. long; plants tegetiform (Italy & E. Mediterranean)

F. (i). Sect. Orientales Ser. Anomalae

6b. Sepals ± equally 3-7(-9)-nerved, the nerves distinct (or obscure in densely pubescent sepals); basal leaves usually ovate to ovate-lanceolate, petiolate; stem leaves often similar; plants ± tegetiform (E. Mediterranean, Italy & Spain) F. Sect. Orientales

8a. Seeds rugulose to tuberculate, testa 'cells' with a prominent central or sub-central papilla ('papillose'); basal leaves always petiolate, usually ovate-lanceolate:

9a. Stem leaves ovate to ovate-lanceolate; petals cuneate at the base:

10a. Upper leaves sessile, lower shortly petiolate; seeds large (0.8-1.0mm. x 0.6-0.7mm.) (Greece) F. (ii). Ser. Graecae

10b. All leaves gradually narrowing at the base into a petiole, that of the lower leaves almost as long as the lamina; seeds small (0.5-0.7.mm. x 0.4-0.6mm.) (Aegean Is., Turkey, Levant & Sinai) F. (iii). Ser. Deflexae

9b. Stem leaves linear-lanceolate, shortly petiolate; petals abruptly contracted at the base. (Spain) F. (iv). Ser. Hispidae

8b. Seeds obscurely reticulate, or with a broad fimbriate margin, testa cells with minute puncta ('punctate'), with or without a central papilla; basal leaves ovate-lanceolate to orbicular, petiolate, or linear to lanceolate, sessile. (Italy & E. Mediterranean) F. (i). Ser. Anomalae

1b. Plants annual, without sterile leafy shoots:

11a. Plants robust (15-25cm. tall, stems 1.0-2.0mm. diam.), with large linear-lanceolate to ovate leaves (18-25mm. long); sepals large (> 4mm. long) (Spain & N. Africa) J. Sect. Africanae

12a. Seeds reniform rugulose, with distinct 'cells'; inflorescence generally dichasial. J. (i). Ser. Africanae

12b. Seeds lenticular smooth, the testa without cell-like markings (i.e. as in S.-G. Leiospermae) but bearing minute papillae; inflorescence usually monochasial J. (ii). Ser. Papillospermae

11b. Plants slender to rather robust (2-15cm. tall, stems 0.25-1.0mm. diam.), with small leaves (usually < 8mm. long); sepals small, 2-4(-5)mm. long:

13a. Sepals strongly 3-nerved (as in Minuartia Section Sabulina) without any subsidiary nerves; pedicels

spreading or reflexed; petals much longer than sepals ("Mesopotamia") G. Sect. Pseudosabulina

13b. Sepals with a single median nerve or with a number (> 3) of nerves varying in their degree of prominence; pedicels erect or spreading; (occasionally sepals prominently 3-nerved with very weak additional nerves and then petals about as long as sepals):

14a. Adult leaves (i.e. except the first few pairs of seeding leaves) sessile, usually multinerved; petals usually much shorter than the sepals (rarely as long) (Eurasia) K. Sect. Arenaria

15a. Capsule narrowly cylindrical (> 3 times as long as broad); sepals lanceolate (3-3.5 times as long as broad), narrowly acuminate; plants rather xerophytic (Greece) K.(iii). Ser. Cylindricae

15b. Capsule conical to globose (1-2.5 times as long as broad); sepals ovate to lanceolate (1.5-3 times as long as broad), acute to acuminate:

16a. Plants very xerophytic; leaves and sepals densely glandular pubescent, prominently nerved; upper leaves spathulate, the nerves all alike (Crete, Cyprus & Turkey) K.(ii). Ser. Saponarioides

16b. Plants mesophytic; leaves and sepals not prominently nerved or with a prominent median nerve and less distinct lateral branches; upper leaves broadly ovate, triangular, or linear lanceolate (Eurasia, introduced in N. America & Australia) K. (i). Ser. Arenaria

14b. All the leaves with a single median nerve, either linear or ovate, petiolate; petals as long as or longer than sepals:

17a. Upper leaves linear-subulate, lower narrowly spathulate; sepals obtuse or acute; seeds with minute puncta on the testa 'cells' ('punctate'), papillae absent. (Spain & N. Africa). H. Sect. Occidentales

17b. Leaf blades lanceolate to orbicular.

18a. Leaves lanceolate to ovate-lanceolate, gradually narrowing into a very short petiole (or subsessile); sepals with a distinct median nerve and 1 pair of less prominent lateral nerves; seeds rugulose, 'cells' punctate, epapillose (N. Europe etc.)

A. Sect. Rariflorae

18b. Leaf blades ovate-lanceolate to orbicular, lower leaves long petiolate, if upper shortly petiolate then blade ± abruptly contracted at base; sepals with a number (5-9) of ± equally distinct parallel nerves (median sometimes

rather more prominent); seeds rugulose to sharply tuberculate, 'cells' papillose but not punctate (E. Mediterranean, - Spain) F. (v). Sect. Orientales Ser. Orientales

A. Sectio Rariflorae Williams in Bull. Herb. Boiss. 3 : 602 (1895), pro parte, non Divisio 'Rariflorae' Fenzl (1842), nomen invalidum.

Syn. : Arenaria Subgenus Euthalia Series "Humifusae" Schischk. in Komarov, Fl. U.R.S.S. 6 : 537 (1936) (descr. rossice).

Perennial caespitose plants, rarely annual, often with woody caudex and caudiculi. Leaves (linear to) lanceolate to ovate-spathulate, sessile but cuneate, or very shortly petiolate, bearing a median nerve and sometimes lateral branches; apex acute to obtuse. Inflorescence terminal (rarely a few lateral) bearing 1-5(-9) flowers; bracts narrowly triangular or subulate. Sepals ± acute with a prominent median nerve and 1-3 pairs of inconspicuous lateral nerves (sometimes rather prominent at the base of the sepal). Petals oblanceolate to ovate, long attenuate to obtusely cuneate, longer than the sepals. Seeds ± obscurely reticulate punctate not papillose.

Type species : A. ciliata L., Sp. Pl. 423 (1753).

Other species :

!A. antitaurica McNeill

!A. bulica Stapf ex Williams (1898)

!A. cretica Spreng (1825)

?A. chamissonis Maguire (1951)

A. cinerea D. C. (1815)

A. gothica Fries (1839)

A. gracilis Waldst. & Kit. (1812)

A. humifusa (Swartz) Wahlb. (1812)

!A. huteri Kern. (1872)

!A. minutissima Rech. & Esfand. (1951)

A. norvegica Gunn (1772)

A. pseudofrigida (Ostenf. & Dahl) Juz ex Schischk. (1936)

A. redowskii Cham. & Schlecht. (1826)

!A. uninervia McNeill

Section Rariflorae is a widely distributed Arctic-Alpine group occurring throughout the northernmost parts of Europe and America and extending south into the mountains of C. Europe, Spain, the Balkans, Anatolia and Iran. The Orient and East European species may form a recognisable group within the section, while the Spanish species (A. cinerea) is rather doubtfully referred to this section and should perhaps be placed in a group of its own.

The present circumscription is much more restricted than that of Williams, who applied the name to all those members of his Subgenus Pentadenaria in which the inflorescence was lax, probably taking the name from Fenzl's use of it (in Ledebour, Flora Rossica) in Subgenus Eremogone, (Pentadenaria Williams being composed partly of species in S.-G. Arenaria and partly of ones in S.-G. Eremogone). Fenzl's name is invalid in being ranked as a 'Divisio' and has thus no nomenclatural status whatsoever (e.g. it cannot be considered as an earlier homonym). Williams makes no direct reference to Fenzl, gives a description and

cites A. ciliata as the exemplary species; despite its rather confused use, his name must therefore be adopted.

B. Sectio Grandiflorae McNeill, sect. nov.

Plantae perennes, caespitosae vel tegetiformes; candex et caudiculi lignosi plerumque prominentes. Folia ovato-lanceolata vel linearia, acuta ± sessilia, nervis tribus prominentibus (una mediana, duabus marginalibus) praedita. Inflorescentia terminalia 1-8-floribus instructa. Sepala ovata vel lanceolata, acuta vel acuminata, nervo mediano prominentissimo (aliquanto sepalis carinatis) et nervis lateralibus 2-6 distinctis praedita. Petala ovata vel oblanceolata, cuneata vel attenuata, sepala excedentia.

Type : A. grandiflora L., Syst. Pl. ed.10 1034 (1759).

Other species :

!A. bourgeana Coss. ex Willk. (1876) !A. kotschyana Fenzl (1843)

A. incrassata Lange (1864) !A. tmolea Boiss. (1842)

A. triflora L. (1771)

Section Grandiflorae, which is closely related to Section Rariflorae, comprises two species complexes, one in the Iberian peninsula and one in Turkey. (cf. fig. 2).

C. Sectio Plinthine (Reichb.) McNeill, stat. nov.

Syn.: Arenaria c. Plinthine Reichb., Fl. Germ. Excurs. 792 (1832).

Plinthine (Reichb.) Reichb., Handb. 298 (1837).

Type : A. aggregata (L.) Lois. in G.F. Curier (ed.), Dict. Sci. Nat. 46 : 513 (1827); Fl. Gall. ed.2 1 : 317 (1828)

Other species :

A. armeriastrum Boiss. (1838)
A. capitata Lam. (1778)
A. erinacea Boiss. (1839-45)
A. pseudarmeriastrum Rouy (1882)
A. querioides Pourr. ex Willk. (1847)
A. racemosa Willk. (1847)
A. tetraquetra L. (1753)
A. tomentosa Willk. (1847)

Section Plinthine is a very distinctive group of plants endemic to the Iberian Peninsula and North Africa; its members appear to be highly evolved derivatives of Section Grandiflorae. (cf. fig. 2)

D. Sectio Rotundifoliae Schischkin ex McNeill, sect. nov.

Syn.: Arenaria Subgenus Euthalia Series "Rotundifoliae" Schischkin in Komarov, Fl. U.R.S.S. 6 : 538 (1936) (descr. rossice).

Plantae perennes (? vel rarissime annuae) tegetiformes. Caules longi foliati, inflorescentia lateralia et interdum terminalia gerentes. Folia ovata vel orbiculata, breve petiolata, uninervia, apice subrotundata vel late obtuso. Flores graciles. Sepala acuta vel obtusa

nervo mediano distincto et nervis lateralibus 4-6 indistinctis praedita. Petala ovato-lanceolata vel orbiculata, ad radicem obtusa vel abrupte contractata, sepalis breviora vel longiora. Semina obscure reticulata; 'cellulae' punctatae, epapillosae.

Type : *A. rotundifolia M. bieb., Fl. Taur. Cauc. 1 : 314 (1808)

Other species :

*A. balansae Boiss. (1867)
A. balearica L. (1768)
A. biflora L. (1767)
A. gayana Williams (1898)
*A. halacsyi Bald. (1891)
A. neelgherrense Wight & Arnold (1834)
A. orbicularis Vis. (1850)
A. orbiculata Royle ex Edgew. & Hooker (1874)
A. ovalifolia Somm. & Lev. (1893)
A. tenella Duthie ex Williams (1898)
A. turkestanica Schischk. (1937)

With their characteristic creeping habit and rather round leaves, the members of Section Rotundifoliae are usually readily distinguished. A. balearica, in which the flowers are solitary on long pedicels and the sepals obtuse, stands apart from the other members of the Section. The group as a whole appears to lie intermediate between Section Rariflorae on the one hand and Section Planosepalae and Section Orientales Series Anomalae on the other. (cf. fig. 2)

E. Sectio Planosepalae McNeill, sect. nov.

Plantae perennes laxe tegetiformes vel ascendentes. Folia magna (15-35mm.), linearia vel ovata, uninervia, sessilia. Inflorescentia terminalia, 1-10 floribus instructa; bracteae foliaceae sed foliis multo parviores. Flores magni. Sepala 6-10mm. longa, vena mediana non prominenti praedita. Petala sepalis multo longiora. Semina tuberculata.

Type : A. montana L., Cent. Pl. 1 : 12 (1755).

A. montana, the single species of the section, is confined to the Iberian peninsula and appears to be taxonomically rather isolated. Its closest affinity is possibly with species such as A. bertolonii & A. huteri in Section Orientales Series Anomalae. (cf. fig. 2)

F. Sectio Orientales McNeill, sect. nov.

Plantae perennes vel annuae, caespitosae vel tegetiformes vel graciles, numquam caudice et caudiculis crassis lignosis praeditae. Folia radicalia plerumque ovata vel ovato-lanceolata, petiolata, acuta, uninervia vel nervis lateralibus inconspicuis etiam praedita; folia caulina varia saepe ovata petiolata, semper vena mediana tantum conspicua. Inflorescentia terminalia plerumque multiflora. Sepala ad 5mm. longa, plurinervia; vena mediana venis lateralibus vix prominentior sed plerumque venae omnes ± distinctae (praeter sepala pilissima).

Petala sepalis plerumque paulo vel multo longiora. Semina saepe subtiliter tuberculata, papillosa.

Type : A. pamphylica Boiss. & Heldr. in Boiss., Diagn. Pl. Orient. ser. 1 8 : 102 (1849).

F. (i). Series Anomalae McNeill, ser. nov.

Plantae perennes, saepe tegetiformes. Folia varia (interdum linearia sessilia). Sepala plurinervia; venae saepe obscurae. Inflorescentia plerumque pauciflora; bracteae plerumque foliaceae; pedicelli saepe longi erecti vel patentes. Semina obscure reticulata, punctata raro etiam papillosa.

Type : !A. sipylea Boiss., Diagn. Pl. Orient. ser. 1 1 : 52 (1842).

Other species :

!A. angustifolia McNeill

A. bertolonii Fiori & Paol. (1896-98)

A. libanotica Boiss. (1867) (incl. A. adonidis Post (1896)

!A. speluncarum McNeill

F. (ii). Series Graecae McNeill, ser. nov.

Plantae perennes caespitosae vel ± tegetiformes. Folia radicalia ovata vel ovato-lanceolata, breve petiolata; folia caulina ovata vel lanceolata, sessilia. Inflorescentia pauciflora; bracteae foliaceae. Petala sepalis longiora. Semina 0.8-1.0mm.

longa x 0.6-0.7mm. lata.

Type : A. graeca (Boiss.) Halacsy, Consp. Fl. Graec. 1 : 232 (1900) (≡ A. filicaulis ssp. graeca (Boiss.) McNeill).

Species :

A. filicaulis Fenzl (1843) (incl. type) A. teddii Turrill (1936)

F. (iii). Series Deflexae McNeill, ser. nov.

Plantae perennes ± tegetiformes. Folia ovata vel ovato-lanceolata, petiolata (radicalia longe petiolata). Inflorescentia pauci-vel multiflora; bracteae subulatae. Petala cuneata, sepalis paulo (vel multo) longiora. Semina 0.5-0.7mm. longa x 0.4-0.6mm. lata.

Type : A. deflexa Decaisne, Florula sinaica 53 (1834) (reprint from Ann. Sci. Nat. ser. 2 3 : 277).

Other species : A. fragillima Rech. f. (1939)

F. (iv). Series Hispidae McNeill, ser. nov.

Plantae caespitosae vel tegetiformes. Folia radicalia ovata vel ovato-lanceolata, longe petiolata; folia caulina lineari-lanceolata vel subulata, vena mediana subprominenti venis lateralibus obscuris non marginalibus praedita. Petala ad basem in unguem abrupte contractata, sepalis longiora.

Type : A. hispida L., Sp. Pl. 425 (1753).

Other species : A. ligericina Lecoq. & Lam. (1847) (= A. lesurina Loret).

F. (v). Series Orientales

Plantae annuae; Characteres ceteri instar Seriei Deflexae sed bracteae foliaceae vel subulatae nec semper subulatae.

Species :

!A. kurdica McNeill

!A. luschanii McNeill

!A. muralis (Link) Sieber ex Spreng. (1825)

A. oxypetala Sibth. & Sm. (1806)

!A. pampyhlica Boiss. & Heldr. (1849)

(type)

A. retusa Boiss. (1839-45)

!A. rhodia Boiss (1842)

In Section Orientales both the annual and perennial habits are well developed, although the perennial plants lack a woody base and are probably relatively short-lived. Of the perennial series, Graecae is closest to Section Rariflorae while Series Deflexae appears in most respects intermediate between Series Graecae and the annual Orientales s. s. Series Hispidae would seem to be a linear-leaved group paralleling the Deflexae in the W. Mediterranean. Series Anomalae is placed within the section because of the general habit and flower structure of its members but is a rather heterogeneous group which shows affinity with Sections Rotundifoliae and Planosepalae. (cf. fig. 2)

The centre of distribution of the section is the Eastern Mediterranean area but Series Hispidae is a Spanish group, Series Anomalae has an Italian species (A. bertolonii) and Series Orientales has one species in Spain (A. retusa).

G. Sectio Pseudosabulina McNeill, sect. nov.

Planta annua, gracilis. Folia lineari-subulata flaccida. Inflorescentia magna effusa, multiflora; bracteae subulata; pedicelli patentes vel deflexi. Sepala acuta, prominentissimo trinervia (nervis aliis nullis). Petala oblongo-spathulata sepalis multo longiora (fere duplo). Capsula subglobosa calyce subaequantia vel paulo breviora. Semina subtiliter tuberculata, papillosa.

Type : A. sabulinea Grisebach ex Fenzl, Illustr. Pl. Syr. Taur. 47 (1843).

The single species of Section Pseudosabulina is confined to the semi-desert region on the borders of Turkey, Syria and Iraq. The Section shows a strong superficial resemblance to Minuartia Section Sabulina (particularly in the sepal structure) but its true affinities lie with Arenaria Section Orientales Series Orientales (particularly A. kurdica). (cf. fig. 2)

H. Sectio Occidentales McNeill, sect. nov.

Plantae annuae graciles et humiles, 5-10(-15) cm. altae. Folia

uninervia, < 8mm. longa, saepe subcarnosa; radicalia lineari-subulata vel anguste spathulata; caulina linearia vel lineari-subulata. Inflorescentia dichasia multiflora effusa. Sepala acuta vel obtusissima, nervis obscuris vel paucis (c.3) subprominentis praedita. Petala sepalis multo longiora. Semina reniformia, obscure reticulata, punctata nec papillosa.

Type : A. conimbricensis Brot., Fl. Lusit. 2 : 200 (1804).

Other species :

!A. algarbiensis Welw. ex Willk. (1853)

!A. capillipes (Boiss.) Boiss. (1839-45)

A. ciliaris Loscos (1876)

A. conica Boiss. (1839-45)

A. controversa Boiss. (1839-45)

A. emarginata Brot. (1804) (incl. A. sordida Chaub. 1838)

!A. loscosii Texid. (1877)

A. modesta Duf. (1820)

!A. obtusiflora Kunze (1846)

!A. tenuis Gay (1867)

The linear to subulate leaved Section Occidentales parallels in the Western Mediterranean the annual, ovate to ovate-lanceolate leaved Section Orientales Series Orientales, which is predominantly an Eastern Mediterranean group. Section Occidentales differs further in its punctate and not papillose seeds and probably represents an independent line of development of the annual habit. (cf. fig. 2)

The Section could probably be subdivided into a group with obtuse sepals (A. ciliaris, A. conimbricensis, A. loscosii and A. obtusiflora) and another with acute sepals. Within this second group there is some variation in the degree of prominence of the sepal nerves, species such

as A. algarbiensis and A. capillipes having three prominent nerves, reminiscent of Section Pseudosabulina, but with subsidiary nerves also present.

J. Sectio Africanae McNeill, sect. nov.

Plantae annuae robustae, ex toto glanduloso-pubescentiae. Folia radicalia 10-25mm. longa, ± spathulata, saepe longe petiolata; folia caulina 8-20mm. longa, ovata vel lineari-lanceolata, ± spathulata, breve petiolata vel subsessilia. Inflorescentia effusa multiflora. Sepala magna 4-7mm. longa, plurinervia. Petala spathulata sepalis multo longiora.

Type : A. cerastioides Poir., Voy. Barb. 2 : 166 (1789), non Pers. (1805).

J.(i). Series Africanae

Inflorescentia plerumque dichasia. Semina reniformia, obscure reticulata, punctata, nec lentiformia laevia minute papillosa.

Species :

A. cerastioides Poir. (1789) (type)

A. olloixii Jahandiez, Maire & Weiller (1931)

A. pomeli Munby (1864)

A. spathulata Desf. (sensu stricto) (1798) (= A. cerastioides).

J.(ii). Series Papillospermae McNeill, ser. nov.

A serie typica inflorescentia plerumque monochasia seminis laevibus papillis minutissimis praeditis differt.

Type : A. hispanica Spreng., Syst. Veg. 2 : 396 (1826) (≡ Stellaria arenaria L. (1753) ≡ Cerastium arenarioides Crantz (1766), nom. illeg. ≡ A. arenaria (L.) Graebn. (1916) ≡ A. arenarioides (Crantz) Fernald (1919), nom. illeg.).

Synonyms :

A. fallax Bartl. (1912)

A. cerastioides Poir ssp. arenarioides Maire

A. spathulata sec Williams (1898) pro parte, non Desf.

Section Africanae comprises a small group of Spanish and North African plants which are very uniform in habit and general appearance. They exhibit, however, a remarkable discontuity in seed structure, the Spanish and Moroccan A. hispanica having dull black lenticular seeds rather like Moehringia or Arenaria Subgenus Leiospermae. They differ from these groups, however, in the dull, not shiny, testa covered with numerous minute papillae. The plants now placed in Series Africanae on the other hand have seeds of the type normally found in Subgenus Arenaria. Nothing resembling the testa structure of A. hispanica has been seen (except for Moehringia and the Leiospermae) and on this normally distinctive character, the species stands in a very isolated position. The resemblance to A. cerastioides in both vegetative and floral characters is so strong as to make any claim of convergent evolution difficult to substantiate; for

this reason A. hispanica is included as a separate Series within Section Africanae. (cf. fig. 2)

K. Sectio Arenaria

Annual plants with multi-nerved sessile leaves, acute to acuminate sepals and petals usually shorter than the sepals; seeds tuberculate, papillose

K. (i). Series Arenaria

Species : (for full list of synonyms cf. Graebner (1916) under A. serpyllifolia, incl. leptoclados)

!A. aegaea Rech. f. (1939)
A. benthamii Torr. & Gray (1840)
A. cassia Boiss. (1842)
!A. conferta Boiss. (1842)
!A. foliacea Turrill (1954)
?A. gorgonea Schmidt (1852)
A. leptoclados Guss. (1845)
A. marschlinsii Koch (1841)
A. minutiflora Loscos (1876)
?A. nevadensis Boiss. (1854)
!A. serpentini Jackson (1937)
A. serpyllifolia L. (1753) (type)
!A. tremula Boiss. (1849)

K. (ii). Series Saponarioides McNeill, ser. nov.

Plantae xerophyticae: folia et sepala dense glandulosо-pubescentia venis prominentissimis induratis instructa. Folia superiora spathulata, venis omnibus similibus praedita. Inflorescentia dense conferta; pedicelli brevissimi. Sepala ovata. Capsula ovoidea vel globosa.

Type : !A. saponarioides Boiss. et Bal. in Boiss. Diagn. Fl. Orient. ser.2 6 : 35 (1859).

Other species : !A. macrosepala Boiss. (1842)

K.(iii). Series Cylindricae McNeill, ser. nov.

A seriei Arenaria capsula anguste cylindrica (latitudine >3-plo longiora) sepala lanceolata (latitudine 3-3.5-plo longiora) anguste acuminata divergit.

Planta aliquantum xerophytica: venae sepalorum foliorumque prominentae aliquantum induratae.

Type : A. guicciardii Heldr. in Boiss., Diagn. Fl. Orient. ser.2 5 : 60 (1856).

Section Arenaria is a fairly homogeneous group of annual plants, two of which (A. serpyllifolia & A. leptoclados) are very widespread throughout Eurasia. The remaining species are more localised, five occurring in the Eastern Mediterranean area. A. benthamii in North America and A. nevadensis in Spain are however rather isolated from the other species and are only tentatively included in the section; A. foliacea shows an approach to Section Orientales, while no material has been seen of A. gorgonea (Cape Verde Islands) which Williams (1898) related to A. serpyllifolia.

In the form of the seedling leaves which rarely persist in the adult plant (persistent in A. foliacea), the members of Section Arenaria show an affinity with Section Orientales and have probably evolved from plants

of that type. (cf. fig. 2)

L. Sectio Compressae McNeill, sect. nov.

Sectio inter Subgenus Arenariam sepalis coriaceo-scariosis seminibus compressis valde distincta.

Herbae perennes ad 45cm. altae. Caules erecti rigidi fragiles; nodi turgidi. Folia 10-35mm. longa late lineari vel lineari-lanceolata, ± sessilia, nervo mediano praedita; nervus medianus prominens ad circa medium folium et indistinctus ad apicem percurrens. Inflorescentia c. 8-12-flora, magno diffusa; pedunculi et pedicelli longissimi 10-50mm. Sepala ovata, obtusa (sed in siccis abrupte acuminato, ± cuspidata, ut videtur), ± coriacea, late scarioso marginata, vena mediana distincta et venis lateralibus duabus ramulosis obscuris praedita. Petala lineari-lanceolata calyce excedentia. Stamina fertilia 5 et sterilia (antheris abortis praedita) 5. Capsula membranaceo-coriacea valvis vel dentibus longis 6 dehiscens. Semina valde compressa, ovato-discoidea (c. 2.5 x 1.8mm.) alata, ad basim (hilum) emarginata fulva, obscure tuberculata; ala 0.3-0.5mm. lata, testae productione formata; cotyledones lanceolatae incumbentes canaliculata vel ± conduplicata, sed radicula exclusa (embryo non orthoploceo).

Type : A. trichotoma Royle ex Edgeworth & Hooker in Hooker, Fl. Brit. Ind. 1 : 235 (1874).

An extremely distinctive monotypic section which when more fully known might be better treated at Subgeneric rank. The single fairly uniform species occurs in the Western Himalayas and Afghanistan.

Subgenus Arenaria is centred in Europe and the Eastern Mediterranean with the Panarctic Section Rariflorae in Greenland, Canada and Alaska and one species (A. benthamii - Section Arenaria) in Texas and New Mexico; other species occur in North Africa and Central Asia and one is to be found in the mountains of East Africa (A. foliacea). A. serpyllifolia and A. leptoclados have been introduced into North America and Australasia. (cf. fig. 4)

Special References : Graebner (1916), Nyman (1878), Reichenbach (1842), Willkomm (1855-56), Willkomm & Lange (1878).

V. Subgenus Arenariastrum Williams in Bull. Herb. Boiss. 3 : 599 (& 602-3) (1845).

Syn. : Gouffeia Robill. et Cast. ex D.C., Fl. Fr. 5 (tom.6) : 609 (1815). Arenaria d. Gouffeia (Robill. & Cast.) Fenzl in Endlicher, Gen. Pl. 967 (1840).

Arenaria Sect. Gouffeia (Robill. & Cast.) Gren. & Godr., Fl. Fr. 1 : 262 (1848).

Lectotype (of Arenariastrum) (= type of Gouffeia) : Gouffeia arenarioides Robill & Cast. ex D.C. l.c. (1815), non A. arenarioides (Crantz) Fern. (1919).

Other species names :

A. gouffeia Chaub. (1838), non Puel (1846)

A. massiliensis Fenzl ex Gren & Godr. (1848).

Excluded species :

Gouffeia crassiuscula Cambess. in Jacquem. (1844) (= Lepyrodiclis holosteoides)

Gouffeia holosteoides C.A. Meyer (1831) (≡ Lepyrodiclis holosteoides)

Gouffeia stricta (Sibth. & Sm.) Fenzl (1833) (≡ Buffonia stricta (S. & S.) Gircke).

The subgenus Arenariastrum as established by Williams included three sections, Gouffeia, Lepyrodiclis and Brachystemma. Although Williams' description was presumably intended to cover all three groups, in fact only his Section Gouffeia fits it well. ("Sepala ... rarius subscariosa" suggests that he did not regard Brachystemma as typical of the subgenus and he appears to have been unaware that the capsule of Lepyrodiclis

opens by two valves and is not "4 dentibus ... dehiscens".) For this reason the type species of Gouffeia (G. arenarioides) has been selected to typify the subgenus Arenariastrum.

The correct name for the single species comprising this subgenus is A. gouffeia Chaub. (based on a different type); it is confined to a small area in the south of France. (cf. fig. 4)

The subgenus appears to be a bicarpellary derivative of Subgenus Arenaria and in habit and sepal structure closely resembles such species as A. sabulinea and A. capillipes. More detailed studies on the European members of the genus might suggest that it would be better treated merely as another section of the type subgenus. (cf. fig. 1)

Special references : Rouy & Foucaud (1896).

Subgenus VI Eremogoneastrum Williams in Bull. Herb. Boiss. 3 : 598 (& 601) (1895), (pro parte - Sectio i. & Sectio ii. Subsectio 2. p.p.).

Syn. : Arenaria Sect. Eremogoneastrum (Wms.) Pax & Hoffm. in Engler & Harms, Naturl. Pflanzenfam. ed.2 16c : 317 (1934).

Lectotype : !A. festucoides Benth. in Royle, Ill. Bot. Himal. 81 t.21 f.3 (1839).

Other species :

A. ferruginea Duthie ex Williams (1898)

A. franklinii Dougl. ex Hooker (1833)

A. gulielmi-waldemarii Klotzsch (1862)

A. hookeri Nutt. ex Torrey & Gray (1838)

! *A. ischnophylla* Williams (1909)

A. kansuensis Maxim. (1889)

! *A. kumaonensis* Maxim. (1889)

A. monticola Edgew. (1874)

! *A. perlevis* (Wms.) Hand.-Mzt. (1930) (≡ *A. polytrichoides* β *perlevis* Wms. (1898) ≡ *A. musciformis* Edgew. (1874) non Triana & Planch. (1862).

A. pinetorum A. Nels. (1899)

! *A. pulvinata* Edgew. (1874)

Excluded species :

A. acicularis Williams (Subgenus *Eremogone* Section *Capillares*)

A. armeniaca Boiss. (" " Section & Series *Scariosae*)

A. blepharophylla Boiss. (" " Section *Eremogone*)

A. bourgaei Hemsley (Subgenus *Leiospermae*)

A. densissima Edgew. (Subgenus *Dolophragma*)

A. globiflora (Fenzl) Edgew. (" ")

A. graminea C.A. Mey. (Subgenus *Eremogone* Section *Eremogone*)

A. griffithii Boiss. (" " Section *Sclerophyllae*)

A. polytrichoides Edgew. var. *polytrichoides* (Subgenus *Dolophragma*)

A. scariosa Boiss. (Subgenus *Eremogone* Section & Series *Scariosae*)

A. steveniana Boiss. (Subgenus *Eremogone* Section *Eremogone*)

A. tetragyna Willd. ex Schlecht (Subgenus *Leiospermae*)

The subgenus Eremogoneastrum was erected by Williams (1895) to include those Eremogone-like plants in which the staminal glands were bifurcate and so appeared to be ten in number. As has already been pointed out (p. 42), this character is no more than specifically diagnostic and so not surprisingly his subgenus was very heterogeneous. It did , however, contain the nucleus of two natural groups; one of these is the new subgenus Dolophragma and the other the scarious-leaved group to which the name Eremogoneastrum is now restricted. Williams in 1895 named two species as exemplifying the subgenus; one of these, A. scariosa , is a typical member of Subgenus Eremogone, so the other, A. festucoides has been chosen as the lectotype. (cf. fig. 1)

The subgenus comprises about 10 species which seem to fall into three groups; the three North American species; the type species on its own, and the remaining Sino-Himalayan plants. (cf. fig. 4)

Special references : Edgeworth & Hooker (1874), Maguire (1947)(1951).

VII Subgenus Eremogone (Fenzl) Fenzl in Ledebour, Fl. Ross. 1 : 360 (1842).

Syn. : Arenaria Abteilung "Orientales" Spreng, Syst. 2 : 401 (1825), nomen invalidum.

Eremogone Fenzl, Versuch Verbreit. Vertheil. Alsin. 13 (1833).

Arenaria a. Eremogone (Fenzl) Fenzl in Endlicher, Gen. Pl. 967 (1840) - 'Section' - cf. Fenzl l.c., 1842).

Arenaria Sect. Eremogone (Fenzl) Edgeworth & Hooker in Hooker, Fl. Brit. Ind. 1 : 236 (1874), ("Eremogoneae").

Arenaria Subgenus Pentadenaria Williams in Bull. Herb. Boiss. 3 : 598 (1895), pro parte (Sectio Glomeriflorae p.p. et Sectio Rariflorae subsectiones 1. & 2.).

Arenaria Subgenus Eremogoneastrum Williams l.c. 598, pro parte (Sectio ii Subsection 1.) (excl. spec. typ.).

Arenaria Sect. Pentadenaria (Williams) Gürke in Richter & Gürke, Pl. Europ. 2 : 275 (1899), pro parte.

Lectotype : A. graminifolia Schrad., Hort. Goeth. 1 : 5 (1809).

Key to Sections and Series

1a. Capsule 1-seeded, ovary with 2 ovules; stamens 5 alternating with inner whorl of 5 staminodes; sepals narrowly lanceolate, long acuminate; cotyledons accumbent. (C. Asia) B. Sect. Monogone

1b. Capsule many-seeded; stamens 10:

2a. Leaves long linear or setaceous, not spiny, the leaves of the vegetative rosettes erect tufted (2-)2.5-25cm. long; (when < 4cm., sepals often ± entirely herbaceous, not strongly indurate); sepals various but always with a median herbaceous or coriaceo-herbaceous portion running ± to the apex; plants erect or tufted or with ± creeping caudiculi, never forming cushions; cotyledons always accumbent:

3a. Sepals always obtuse; the median portion ± herbaceous with (1-)3 or more parallel nerves, the margins coriaceous to scarious; cauline leaves linear grass-like, 5-25cm. long., 1-2.5mm. broad; inflorescence many-flowered. (E. Europe & S.W. Asia).

C. Sect. Eremogone

3b. Sepals acute, acuminate or cuspidate, often becoming obtuse when flattened (the thin membraneous margin being normally recurved), rarely truly obtuse and then obscurely nerved and cauline leaves often short 4-8cm. long, subsetaceous, 0.5-1.0mm. broad:

4a. Sepals at and after anthesis appearing cuspidate by the inrolling of the thin membraneous margin at the apex, obscurely nerved, the median coriaceo-herbaceous portion dark brown, purple or black, at least at the tip (forming the cusp); basal part of the sepals often coriaceous in flower; receptacle and basal part of the calyx lignaceous in fruit; cauline leaves linear grass-like (S.W. Asia) D. Sect. Glomeriflorae

4b. Sepals acute or acuminate or appearing so, sometimes obtuse, never cuspidate:

5a. Sepals mostly coriaceous to scarious with a broad scarious margin, ovate to lanceolate, narrowly acute to long acuminate (sometimes obtuse when flattened), buff, or midrib green, never darkened; plants caudiculate loosely tufted; rosette leaves (5-)8-20cm. long (E. Europe & S. W. Asia)

E. (i). Sect. Rigidae Series Rigidae

5b. Sepals almost entirely herbaceous with a narrow ± membraneous margin, often darkened at the tip; plants densely tufted from a thick caudex; rosette leaves short 4-8(-12)cm. long. (Panarctic, W. North America, C. Asia, Caucasus) A. Sect. Capillares

6a. Sepals broadly ovate, obtuse, bluntly acute or very rarely abruptly acuminate. A. (i). Series Capillares

6b. Sepals linear-lanceolate to lanceolate, narrowly acute to acuminate (S. Central Asia, S. United States) A. (ii). Series Coloradenses

2b. Leaves short (0.5-1.5(-2.0)cm.), setaceous rather spiny, or if rather longer (to 3.0cm.) ± pungent; leaves of the vegetative rosettes closely crowded together all appressed or the outer spreading, rarely all erect (& plants ± tufted) and then sepals subcoriaceous or almost entirely scarious; sepals usually strongly indurate at the base; plants forming spiny cushions, occasionally suffruticose and sometimes loosely-tufted (cf. above).

7a. Leaves with one very prominent nerve and 2-4 fine laterals, or 3(-5) ± equally prominent, pungent or spiny setaceous; sepals not strongly indurate, linear-lanceolate, long acuminate, ± flat, with a median nerve and many (4-6) parallel lateral nerves; inflorescence few-flowered; petals shorter than or ± equal to sepals; capsule

coriaceous; cotyledons incumbent (Spain & N. Africa)

H. Sect. Pungentes

7b. Leaves one nerved or obscurely nerved, setaceous, spiny (or rarely pungent and then sepals ovate obtuse); sepals usually strongly indurate at the base, convex or keeled, obscurely nerved or with a single median nerve, or flat and multinerved and then ovate, obtuse; inflorescence few-many-flowered; capsule usually lignaceous; cotyledons accumbent.;

8a. Sepals subglabrous, obscurely nerved, not or scarcely carinate, the central coriaceous (or herbaceous) portion merging with the broad scarious margins and apex; apex bluntly acute, obtuse or almost fimbriate; flowers aggregated into dense clusters or if inflorescence lax, sepals almost entirely scarious; petals shorter or a little longer than sepals; plants sometimes tufted and rosette leaves erect (E. Turkey & Iran)

F. Sect. Scariosae

9a. Staminal glands five, indistinct, at the base of the outer whorl of stamens; sepals with a distinct ± parallel-sided coriaceous-herbaceous median strip, very gradually narrowing to the tip. F. (i). Series Polycnemifoliae

9b. Staminal glands deeply bifurcate (arms 0.3-0.5mm. long), appearing as ten alternating with the stamens; sepals

with a ± triangular coriaceous-herbaceous portion merging into the scarious margin and never extending right to the tip.

F. (ii). Series Scariosae

8b. Sepals distinctly nerved (unless densely pubescent), the herbaceous portion running to the apex and ± clearly demarcated from the (usually narrow) membraneous or rarely scarious margin; inflorescence usually lax, or if congested sepals narrowly acuminate, sometimes flowers solitary; petals always much longer than sepals; plants pulvinate or suffrutescent, outer rosette leaves spreading or all very short appressed :

10a. Sepals 5-8mm. long, lanceolate, with a broad scarious margin, only the prominent keel herbaceous; inflorescence 1(-3)-flowered; plant densely caespitose; leaves setaceous not or scarcely spiny, those of the sterile rosettes ± appressed. (Turkish Kurdistan)

E. Sect. Rigidae (ii). Series Setaceae

10b. Sepals 2-6mm. long, broadly ovate to lanceolate with a rather narrow membraneous or subscarious margin; inflorescence many-flowered, rarely 1-few-flowered and then sepals ovate or obscurely nerved; plant usually either suffruticose or forming spiny cushions, the outer sterile rosette leaves often spreading or the fascicles dense small and axillary, occasionally leaves appressed, not spiny, and then sepals short (< 5mm.) and obscurely nerved (not at all keeled) (S.W. Asia: Afghanistan-Turkey, W. North America)

G. Sect. Sclerophyllae

A. Sect. Capillares McNeill, sect. nov. (i). Series Capillares

Syn.: ?Brewerina A. Gray in Proc. Amer. Acad. 8 : 620 (1872).

Arenaria Subgenus Eremogone Series Sclerophyllae sec Schischkin in Komarov, Fl. U.R.S.S. 6 : 529 (1936), pro parte, non Boiss.

Plantae dense caespitosae; turiones steriles et caules floriferi ± dense confertae. Folia turionum sterilium erecta, setacea, (2-)2.5-10cm. longa, 0.5-1.0mm. lata. Inflorescentia 6-25cm. alta, ± pauciflora (3-7). Sepala ovata (plerumque late), obtusa vel acuta raro abrupte acuminata, subherbacea saepe leviter indurata. Petala calyce longiora. Capsula subligmosa calyce vix excedens, dentibus longis 6 dehiscens.

Type : A. capillaris Poir., Encycl. Meth. 6 : 380 (1804).

Other species :

A. congesta Nutt. ex Torr. & Gray (1838)

(!)A. lychnidea M. Bieb. (1808)

A. formosa Fisch. ex Ser. (1824)

A. meyeri Fenzl (1842)

A. juncea M. Bieb. (1819)

?A. mongolica Schischk. (1937)

A. (ii) Series Coloradenses McNeill, ser. nov.

A Serie Capillares sepala lineari-lanceolata vel lanceolata anguste acuta vel longe acuminata differt.

Type : A. fendleri A. Gray, Mem. Amer. Acad. ser. 2 4 : 13 (1849).

Other species:

A. acicularis Williams (1909)

A. eastwoodii Rydb. (1904)

Section Capillares with its pan-arctic distribution is to be regarded as the most primitive group of Eremogone from which the other Sections have been evolved. The relationship with Section Sclerophyllae, a polyphyletic xerophytic derivative, is particularly close and it is sometimes difficult to draw the dividing line. In Asia species such as A. formosa come very near to Section Sclerophyllae while in North America, at least one of Maguire's (1946, 1947) varieties of A. congesta (var. charlestonensis - possibly also var. crassula) is referable to Section Sclerophyllae. The variety in question would seem, however, better attached to the sclerophyllous A. kingii in which congestion of the inflorescence also occurs. The geographically isolated Caucasian A. lychnidea is distinctive among Eurasian plants in its very weakly devloped staminal glands and in its sepal structure which shows an approach to Section Glomeriflorae; in North America - in the Colorado - New Mexico region - a group with very narrow pointed sepals has evolved, and this is described as a separate series Coloradenses; an identical type occurs in Tibet (A. acicularis). Full synonymy of the North American species is to be found in Maguire (1947) and (1951). (cf. fig. 3)

B. Sectio Monogone Maxim. in Bull. Acad. Sci. St.- Petersb. 26 : 436 (1880).

Syn.: Arenaria Subgenus Monogone (Maxim.) Schischkin in Komarov, Fl. U.R.S.S. 6 : 536 (1936).

Type : !A. potaninii Schischk. l.c. (1936) (≡ A. pentandra Maxim. l.c. (1880), non Dufour (1820), nec Wallr. (1822), nec Turcz. (1834) nom. nud., nec Ardoino (1867).

A monotypic group endemic to the Tien Shan and Altai regions. In general facies and in leaf and sepal structure it is typical of Subgenus Eremogone and the reduced androecium and gynoecium do not seem to warrant separation at more than sectional rank. The plant appears related to Section Capillares of which it is probably a reduced derivative; it differs also in the rather spiny leaves (as in Section Sclerophyllae) and in the narrower long acuminate sepals reminiscent of Section Rigidae. (cf. fig. 3)

C. Sectio Eremogone

Syn.: Arenaria Subgenus Eremogone Divisio "Rariflorae" Subdivisio "Xerolemmae" Fenzl in Ledebour, Fl. Ross. 1 : 361 (1842), (nomen invalidum).

Arenaria Series Xerolemmae Fenzl ex Schischkin in Komarov, Fl. U.R.S.S. 6 : 525 (1936).

Species (and species names) :

A. asiatica Schischk. (1930)

A. biebersteinii Schlecht. (1816)

!A. blepharophylla Boiss. (1867)

(incl. !A. steveniana Boiss. (1867)

A. filifolia M. Bieb. (1808), non Forsk.

(!)A. graminea C.A. Mey (1831)

A. graminifolia Schrad. (1809) (type)

A. isaurica Boiss. (1867)

A. koriniana Fisch. ex Fenzl (1842)

A. longifolia M. Bieb. (1808)

A. micradenia Smirnov (1939)

A. oosepala Bordz. (1931)

A. pineticola Klokov (1952)

A. polaris Schischk. (1936)

?A. saxatilis L. (1753)

A. stenophylla Ledeb. (1823) (ex Klokov 1952?)

A. syreistochikowii Smirnov (1939)

A. ucranica Spreng. ex Klokov (1952)

Section Eremogone is distributed from Central and Eastern Europe across to Central Asia and extends south into the Caucasus, Armenia and probably S. Turkey. The type species, A. graminifolia, is very polymorphic and Smirnov (1939) and Klokov (1947) (1952) have divided it into a large number of microspecies.

D. Sectio Glomeriflorae Fenzl ex Williams in Bull. Herb. Boiss. 3 : 602 (1895) (sub Subgenus Pentadenaria).

Syn. : Arenaria Subgenus Eremogone Divisio "Rariflorae" Subdivisio "Chromolemmae" Fenzl in Ledebour. Fl. Ross. 1 : 365 (1842) (nomen invalidum).

Arenaria Subgenus Eremogone Series Glomeriflorae (Fenzl ex Williams) Schischkin in Komarov, Fl. U.R.S S. 6 : 520 (1936).

Arenaria Subgenus Eremogone Series Chromolemmae Fenzl ex Schischkin l.c. p. 528 (1936).

Type : A. dianthoides J.E. Smith, Icon. ined. 16 t.16 (1789)

Other species :

A. cucubaloides Sm. (1789) A. gypsophiloides L. (1767)

Excluded species :

A. cephalotes M. Bieb.	-	Section & Series Rigidae
A. congesta Torr. & Gray	-	Section & Series Capillares
A. juncea M. Bieb.	-	" " "
A. przewalskii Maxim	-	Subgenus Dolophragma

A rigid application of the type concept is an essential in unravelling the confusion of infrageneric nomenclature, but it can have unfortunate results as in this case where, because of the inclusion of A. dianthoides, the inappropriate name Glomeriflorae must be applied to the group which Fenzl and Schischkin termed Chromolemmae. Fenzl's name being in a misplaced rank (subdivision) is invalid and can have no bearing on the nomenclature of the group.

The section is confined to the Caucasus, E. Turkey and Iran and appears to have evolved from the basic Capillares stock by way of plants similar to A. lychnidea. (cf. fig. 3)

E. Sectio Rigidae Schischkin ex McNeill, sect. nov.

Syn. : Arenaria Subgenus Eremogone Series "Rigidae" Schischkin in Komarov, Fl. U.R.S.S. 6 : 521 (1936) (descr. rossice).

(i). Series Rigidae

Plantae laxe caespitosae, erectae, 15-50cm. altae. Folia turionum sterilium subsetacea vel linearia (graminea), 5-20cm. longa; folia caulina graminea. Inflorescentia cymosa multiflora, laxa vel congesta; bracteae latissime scarioso-marginatae. Sepala ovata vel lanceolata, anguste acuta vel acuminata, maxime coriaceo-scariosa, late scarioso-marginata. Petala sepalis breviora vel subaequilonga. Capsula calyce inclusa, lignacea.

Type : A. rigida M. Bieb., Fl. Taur.-cauc. 1 : 346 (1808).

Other species :

A. cephalotes M. Bieb. (1808) (!)A. holostea M. Bieb. (1808)

!A. szowitsii Boiss. (1867)

E. (ii). Series Setaceae McNeill, ser. nov.

Plantae dense caespitosae vel subpulvinatae. Folia omnia brevia (0.5-1.2 cm. longa), setacea. Inflorescentia c. 5mm. alta, 1(-3)-flora. Sepala lanceolata, 5-8mm. longa, latissime scariosa, subcarinata; pars herbacea (carina) anguste oblonga. Petala sepalis multo longiora. Ceteri instar Serie Rigidae.

Type : !A. angustisepala McNeill (cf. p.388)

Section Rigidae resembles Section Eremogone in having its main centre of distribution in E. Europe, S. Russian and the Caucasus.

It does not, however, extend into Central Asia, but occurs in Eastern Turkey and N.W. Iran. The section is closely related to Section Capillares with which it was linked by Fenzl in Ledebour (1842) (both in his "Chromolemmae) and from which it has probably evolved by the sepals becoming more hardened, coriaceous, scarious, and acuminate. In the Series Setaceae it shows some affinity with Sections Sclerophyllae and Scariosae. (cf. fig. 3)

F. Sectio Scariosae McNeill, sect. nov.

Plantae caespitosae (plerumque dense) vel spinoso pulvinatae, caudices et caudiculi crassi praeditae. Folia rigida spinosa vel setacea 5-20mm. longa; folia rosularum sterilium erecta vel ± patentia. Inflorescentia ± pauciflora (2-10) plerumque congesta. Sepala ex toto coriaceo-herbacea vel scariosa, obscure nervosa sed interdum subcarinata. Petala calyce breviora vel sublongiora.

Type : *A. scariosa Boiss., Diagn. Pl. Orient. ser.1. 1 : 48 (1842).

F.(i). Series Polycnemifoliae McNeill, ser. nov.

Flores in inflorescentiis partialibus densis terminalis vel axillaribus semper aggregati. Sepala aliquantum anguste scarioso-marginatae; pars coriaceo-herbacea ± anguste oblonga, mediana, ad apicem percurrens. Glandulae staminorum 5 indivisae ad basim staminorum exteriorum obsessae.

Type : *A. polycnemifolia* Boiss., Diagn. Fl. Orient. ser.1 1 : 48 (1842).

Other species :

A. pseudacantholimon Bornm. (1910) *A. zargariana* Parsa (1947)

F.(ii). Series Scariosae

Sepala scariosissima; pars coriaceo-herbacea basalis subtriangularis in apicem et marginem scariosum transiens. Petala calyce semper sublongiora. Glandulae staminorum exteriorum bipartitae ut 10 inter stamina positae videantur.

Species :

A. armeniaca Boiss. (1842) *A. scariosa* Boiss. (1860) (type).

A highly evolved section of five species in Northern Iran and Turkish Armenia, but absent from the Caucasus; its affinities appear to lie on the one hand with Section Rigidae Series Rigidae which it resembles in sepal structure, and on the other with Section Sclerophyllae with which it shares the sclerophyllous habit. (cf. fig. 3)

G. Sectio Sclerophyllae (Boiss.) McNeill, comb. et stat. nov.

Syn.: Arenaria § 2 Sclerophyllae Boiss., Fl. Orient. 1 : 690 (1867).

Arenaria Series Sclerophyllae (Boiss.) Schischkin in Komarov, Fl. U.R.S.S. 6 : 529 (1936).

Lectotype : !A. ledebouriana Fenzl, Illustr. Pl. Syr. Taur. 45 (1843) (reprint from Russegger, Reise 1 (2) : 951).

Other species :

A. aberrans M.E. Jones (1930)

!A. acerosa Boiss. (1849)

A. aculeata S. Wats. (1871)

!A. acutisepala Hausskn. ex Williams (1898)

A. calcicola Gilli (1956)

!A. davisii McNeill

!A. drypidea Boiss. (1842)

?A. ferganica Schischk. (1932)

A. griffithii Boiss. (1853)

!A. insignis Litw. (1907)

A. kingii (S.Wats.) M.E.Jones (1896)

A. litwinowii Schischk. (1932)

A. macradenia S. Wats. (1882)

?A. mongolica Schischk. (1937)

A. multiflora Gilli (1956)

A. paulsenii Winkl. (1901)

!A. persica Boiss. (1842)

A. pumicola Coville & Leiberg (1897)

A. stenomeres Eastwood (1944)

!A. tetrasticha Boiss. (1842)

A. tschuktschorum Regel (1862)

A. ursina Robins. (1894)

(Gilli, A., (1956) - Fedde Repert. 59 : 162-178)

Section Sclerophyllae is a xerophytic derivative of the pan-Arctic Section Capillares and as such occurs in two disjunct areas, the steppes of Central and South-West Asia and the dry regions of the Western United States. In both areas the species have been very confused taxonomically, and like Section Capillares but unlike most other groups of Subgenus Eremogone, its members seem to be in a state of active evolution and speciation. (cf. fig. 3)

Despite its apparent polyphyletic origin, no satisfactory discrimination can be made between the Asian and North American species of the Section. Within each, however, there is considerable variation; in North America the very pungent leaved A. stenomeres holds an isolated position and is very different from the pungent Iranian species, A. persica (= A. lessertiana) and A. insignis, while the small and not very spiny-leaved A. tetrasticha and A. davisii (S. Iran and E. Turkey) could perhaps form a third group to be separated from the main aggregation of rather spiny caespitose or suffruticose species.

H. Sectio Pungentes McNeill, sect. nov.

Plantae pulvinatae vel dense caespitosae, spinosae. Folia rigida setacea vel pungentia, 3-30mm. longa, nervo mediano prominentissimo et nervis lateralibus 2-4 (saltem ad basim) vel nervis 3-5) aequalibus praedita. Inflorescentia 1-3-flora. Sepala lineari-lanceolata vel ovato-lanceolata, longe acuminata, leviter indurata, nervo mediano prominenti et nervis lateralibus parallelis 4-6 praedita. Petala calyce breviora vel subaequilonga. Capsula subcoriacea, nec lignosae, calyce inclusa. Semina (vix matura) spadicea aspera; cotyledones incumbentes.

Type : A. pungens Clem. in Lagasca, Gen. Sp. Nov. 15 (1816).

Other species : A. mairei Emberger (1933).

Section Pungentes, confined to Spain and North Africa, is a very isolated group whose nearest affinities are not apparent. The type species has usually been placed in Eremogone, and because of its semi-terete pungent leaves and superficial resemblance to A. stenomeres and A. persica, it is retained for the present in that subgenus; it differs however from the members of the other sections in that its cotyledons are incumbent and not accumbent. It is even more distant from Subgenus Arenaria (in which the cotyledons are always incumbent) and with more evidence may come to be placed in a subgenus of its own.

Subgenus Eremogone in effect replaces the largely European and Arctic Subgenus Arenaria to the East and South, being abundant in Asia and Western North America. Its main centres of diversity are the mountains of Central and South-West Asia and Western North America. It, in its turn, is replaced in China and the Himalayan region by Subgenera Eremogoneastrum and Dolophragma. (cf. figs. 4 & 5)

Special references : Fenzl in Ledebour (1842), Maguire (1947), (1951), Schischkin & Knorring in Komarov (1936).

VIII Subgenus Dolophragma (Fenzl) McNeill, comb. et stat. nov.

Syn.: Dolophragma Fenzl in Ann. Wien. Mus. 1 : 63 t.71 (1836).

Cherleria sec D.Don, Prodr. Fl. Nepal 214 (1825), non L. (1753).

Lectotype : !A. globiflora (Fenzl) Edgew. in Hooker, Fl. Brit. Ind. 1 : 238 (1874) (≡ Dolophragma globiflorum Fenzl l.c.)

Other species (& synonyms):

!A. densissima Edgew. (1874) (≡ Cherleria juniperina D.Don (1825) ≡ Dolophragma juniperinum Fenzl (1836), non Arenaria juniperina L. (1767)

!A. lichiangensis W.W. Smith (1913)

!A. oreophila Hooker (1874)

!A. oresbia W.W. Smith (1920), non Greenm. (1904) (≡ A. smithiana)

!A. polytrichoides Edgew. (1874) s.s.

!A. przewalskii Maxim (1880)

!A. smithiana Mattf. (1932) Cherleria grandiflora D. Don. (1825), non Ar. grandiflora L. (1759)

Excluded taxon :

A. polytrichoides β perlevis Williams (1898) (≡ A. perlevis (Wms.) Hand-Mat. - S.-G. Eremogoneastrum)

Considerable confusion exists in the identification and classification of the densely pulvinate Sino-Himalayan Arenarias. Much of this is due to the failure to distinguish between those plants with long pointed sepals and scarious leaf margins to which the name Eremogoneastrum is now confined and those with short obtuse sepals and a swollen coriaceous leaf margin. This latter group includes the two species on which Fenzl founded his genus Dolophragma (in the false belief that the capsule was partially septate) and

that name is adopted for the new subgenus. The species included within the group show a gradation from very densely pulvinate types such as A. polytrichoides (sensu stricto), A. densissima and A. globiflora to linear-leaved densely caespitose species like A. smithiana and A. przewalskii. The subgenus is probably made up of eight species, all in the Sino-Himalaya region. (cf. figs. 1 & 5)

IX Subgenus Sikkimenses (Williams) McNeill, comb. nov.

Syn.: Arenaria Subgenus Euarenaria Sect. Sikkimenses Williams in Bull. Herb. Boiss. 3 : 600 (1895).

Lectotype : A. ciliolata Edgew. in Hooker, Fl. Brit. Ind. 1 : 240 (1874)

Other species:

!A. forrestii Diels (1912)
!A. ramellata Williams (1909)
!A. glanduligera Edgew. (1874)
!A. rosecincta W.W. Smith (1913)
A. stracheyi Edgew. (1874)

Excluded species :

A. brotherana Trautv. (Minuartia Section Spectabiles Series Laricinae ; ≡ M. trautvetteriana)

A. bulica Stapf ex Williams (Subgenus Arenaria Section Rariflorae)

A. melandryoides Edgew. (Subgenus Odontostemma)

A. nitida (Bartl.) Rohrb. (?Subgenus Leiospermae - ? S.-G. Dicranilla)

Williams distinguished his section Sikkimenses within the type subgenus principally on the basis of its solitary flowers, and thereby included within it a number of very dwarf alpine species with a reduced inflorescence, whose true affinities lie elsewhere. As here defined it forms a small but very distinctive group with solitary flowers, broad leaves, and the sepals hardened (coriaceous) at the apex and margins. A. glanduligera is rather atypical in that the sepals lack this coriaceous tip and possibly shows an approach to Subgenus Odontostemma (e.g. A. monantha Williams). There are probably five species in the group; A. forrestii Diels being apparently conspecific with the earlier A. ramellata Williams. (cf. figs. 1 & 5)

Special reference : Edgeworth & Hooker (1874)

X Subgenus Odontostemma (G. Don) Williams in Bull. Herb. Boiss. 3 : 603 (1895)

Syn. : Odontostemma Benth. ex G. Don Gen. Syst. 1 : 449 (1831) ("Adenostemma" Hook).

Arenaria Sect. Macrogyne Franchet in Bull. So. Bot. Fr. 33 : 432 (1886).

Arenaria Sect. Odontostemma (G. Don) Pax in Engler & Prantl, Naturl. Pflanzenfam ed.1 3 (1b) : 84 (May 1889); Franchet, Pl. Delavay. 93 (1889).

Arenaria Sect. Moehringella Franchet, Pl. Delavay. 96 (1889)

Arenaria Subgenus Odontostemma Sectiones Barbatae & Yunnanenses (≡ Odontostemma) Williams l.c. 603 (1895).

Arenaria Subgenus Macrogyne (Franchet) Williams l.c. 603 (1895).

Gooringia Williams in Bull. Herb. Boiss. 5 : 530 (1897).

Moehringella (Franchet) Neumayer in Verh. Zool-Bot. Ges. Wien 78 : p.(14) (1924).

Type : A. blinkworthii McNeill, nom. nov. (: Odontostemma glandulosum Benth. ex G. Don, Gen. Syst. 1 : 449 (1831) ≡ Ar. glandulosa (G.Don) Williams (1895), non Jacq. (1798), ≡ Ar. benthamii Edgew. in Hook. (1874), non Fenzl ex Torrey & Gray (1840)).

Other species :

!A. barbata Franchet (1886)

!A. cerastiiformis Williams (1909)

!A. debilis Hooker (1874)

!A. delawayi Franchet (1886)

A. dsharaensis Pax & Hoffm. (1922)

!A. eudonta W.W. Smith (1920)

A. fridericae Hand.-Mzt. (1920)

!A. inconspicua Hand.-Mzt. (1929)

!A. inornata W.W. Smith (1920)

!A. ionandra Diels (1912)

!A. leucasteria Mattf. (1932)

A. linearifolia Franchet (1889), non Poir. (1804)

!A. littledalei Hemsley (1896) (Gooringia littledalei (Hemsl.) Williams 1897)

A. longistyla Franchet (1886) (type species of Macrogyne)

A. melanandra (Maxim.) Mattf. ex Hand.-Mzt. (1929)

!A. melandryiformis Williams (1909)

!A. melandryoides Edgew. (1874)

?!A. monantha Williams (1909)

!A. napuligera Franchet (1886)

!A. nigricans Hand.-Mzt. (1929)

!A. pogonantha W.W. Smith (1920)

?A. quadridentata (Maxim.) Wms. (1898)

A. reducta Hand.-Mzt. (1920)

A. roseiflora Sprague (1916)

A. saginoides Maxim. (1880)

!A. salweensis W.W. Smith (1920)

!A. schneideriana Hand.-Mzt. (1920)

!A. szechuensis Williams (1899)

!A. thangoensis W.W. Smith (1911)

A. trichophora Franchet (1886)

!A. weissiana Hand.-Mzt. (1920)

!A. xerophila W.W. Smith (1920)

!A. yunnanensis Franchet (1886)

Moehringella linearifolia (Franchet) Neum. (1924)

Moehringella roseiflora (Sprague) Neum. (1924)

Subgenus Odontostemma is a natural group of about thirty species in the eastern Himalayas and the mountains of South-Western China. In habit it is relatively unspecialised and in this it parallels the predominantly South American subgenus Leiospermae and the type subgenus centred in Europe; it differs from both however in its floral structure particularly in the reduction to two carpels. (cf. figs. 1 & 5)

The monotypic genus Gooringia was distinguished by its tetramerous flowers with only two perfect stamens, but the specimen on which it was based appears merely to be a very reduced representative of Odontostemma closely related to species such as A. thangoensis, reducta and inconspicua; indeed it may prove conspecific with the last-named.

Franchet (1889) recognised a section Moehringella which Williams

referred to Moehringia and which Neumayer (1924) raised to generic rank. This taxon was distinguished by the possession of winged seeds, but as Handel-Mazzetti (1929) notes, this is not a wing as in Spergularia but merely an inflated testa, a character which appears to be shared by many if not all the species of Subgenus Odontostemma.

Itwas also found impossible to maintain as distinct from Odontostemma Franchet's Section Macrogyne (Subgenus in Williams), supposedly differing in the length of the style. Further study however will undoubtedly reveal subdivisions of Odontostemma, and Moehringella, Macrogyne and Gooringia may possibly come to typify sections or series within the group.

Special references : Franchet (1886) (1889), Handel-Mazzetti (1929), Mattfeld (1932), Neumayer (1924), Smith (1913) (1919) (1920), Williams (1909a).

2. Moehringia L.

Moehringia L., Sp. Pl. ed.1 : 359 (1753); Gen. Pl. ed 5 : 170 (1754); Pax & Hoffmann in Engler & Harms, Naturl. Pflanzenfam. ed.2 16c : 319 (1934).

Syn. : Arenaria Subgenus vel Sectio Moehringia (L.) Bentham in Bentham & Hooker, Gen. Pl. 1 : 150 (1862).

Strophium Dulac, Fl. Hautes-Pyr. 247 (1867) (≡ Moehringia).

Arenaria Section Moehringia (L.) Post & Kuntze, Lexicon 43 (cf. Preface p.V.) (1903).

Type : M. muscosa L., Sp. Pl. 359 (1753).

Key to Sections

1a. Leaves not narrowly linear, subulate, or semi-terete, the lower usually elliptical to ovate, the upper linear-lanceolate to ovate, flowers pentamerous :

2a. Seeds obscurely reticulate, the strophiole brown composed of long tightly appressed papillae; plants perennial; leaves suborbicular to oblanceolate, petiolate; sepals obscurely nerved (Spain & N. Africa) A. Sect. Arenarioides

2b. Seeds shiny, smooth or sometimes minutely papillose or rarely subrugulose, never reticulate, the strophiole white amorphous; plants annual or biennial, or if perennial upper leaves linear-lanceolate

or ovate and sessile; sepals with a prominent median nerve (usually keeled) :

3a. Leaves all ovate; plants annual or biennial, rarely perennial (Eurasia & N. America) B. Sect. Latifoliae

3b. Lower leaves usually ovate to elliptical, upper linear-lanceolate plants always perennial (C. Europe) C. Sect. Diversifoliae

1b. Leaves all linear, usually very narrow or semi-terete; plants perennial; flowers pentamerous or more often tetramerous; seeds shiny, smooth or subrugulose with a white amorphous strophiole (C. & E. Europe) D. Sect. Moehringia

A. Sectio Arenarioides McNeill, sect. nov.

Herbae perennes, caespitosae vel tegetiformes, 5-20cm. altae, caudiculis fragilibus numerosis praeditae. Folia suborbiculata vel oblanceolata, latissime acuta, in petiolum brevem sensim attentuata. Inflorescentia terminalia 2-5-florata; pedicelli longi (10-40mm.); bracteae minutae, subulato-setaceae. Sepala ovata, acuta, obscure nervata. Petala oblanceolata vel obovata, longe attenuata, sepalis multo longiora. Semina reniformia obscure reticulata; strophiolum fuscum, evidente tuberculis longis dense compactis formatum.

Type: !M. intricata Willk., Enum. Pl. Nov. Rar. Hisp. Austr. 14 (1852).

Other species :

?M. alleizettei Battand. (1917) ?M. fontqueri Pau (1930)

!M. tejedensis Willk. (1893)

B. Sectio Latifoliae Nyman ex Graebner in Ascherson & Graebner, Syn. Mitt.-Eur. Fl. 5 (1) : 449 (1915).

Lectotype : M. trinervia (L.) Clairv., Man. Herb. 150 (1811).

Other species : (cf. also synonymy given by Graebner, 1915-16).

M. elongata Schischk. (1936) !M. pentandra J. Gay (1832)

?M. fontqueri Pau (1930) !M. platysperma Maxim. (1873)

M. lateriflora (L.) Fenzl (1833) M. radiolata Pancic (1874)

M. macrophylla (Hook.) Fenzl (1833) !M. stellarioides Cosson (1862)

M. minutiflora Bornm. (1919) M. umbrosa (Bunge) Fenzl (1833)

C. Sectio Diversifoliae Nyman ex Graebner in Ascherson & Graebner, Syn. Mitt.-Eur. Fl. 5 (1) : 453 (1915), sensu ampl.

Lectotype : M. diversifolia Dolliner ex Koch in Flora 22 : 2 (1839).

Other species :

!M. jankae Griseb. ex Janka (1873) M. pendula (W. & K.) Fenzl (1833)

M. papulosa Bertol. (1839) M. villosa (Wulf.) Fenzl (1833)

D. Sectio Moehringia

Syn.: M. Sect. Angustifoliae Nyman ex Graebner in Ascherson & Graebner, Syn. Mitl.-Eur. Fl. 5 (1) : 455 (1915).

Species :

M. bavarica (L.) Gren. (1841)
(≡ "M. bavarica (L.) Dalla Torre")
"M. bornmuelleri Anger." (cf. Hayek, Ost. bot. Z. 52 : 149 (1902)).
M. ciliata (Scop.) Dalla Torre (1882)
(= M. polygonoides (Wulf.) Mert. & Koch (1831)).
M. dasyphylla Bruno (1804)
M. dielsiana Mattf. (1925)
M. frutescens Panizzi (1889)
M. glaucovirens Bertol. (1844)
M. grisebachii Janka (1873)
M. insubrica Degen (1926)
M. malyi Hayek (1902)
M. markgrafii Merxmuller & Guterman in Phyton 7 : 1-7 (1957)
M. muscosa L. (1753) (type)
M. sphagnoides (Froel. ex Reichb.) Bluff, Nees & Schauer (1837)
(≡ "M. sphagnoides (Froel. ex Reichb.) Reichb." (1842))
M. tommasinii Marches. (1880)

Excluded species :

M. linearifolia (Franch.) Williams ≡ Arenaria linearifolia Franch. (Subgenus Odontostemma)

M. nemorosa (H.B. & K.) Fenzl ex Hemsley ≡ Arenaria nemorosa (Subgenus Leiospermae)

M. nodosa (L.) Clairv. ≡ Sagina nodosa (L.) Fenzl.

M. sedoides (L.) Clairv. ≡ Minuartia sedoides (L.) Hiern (Sect. Spectabiles Subsect. Cherleria).

M. stricta Sibth. & Sm. ≡ Buffonia stricta (Sibth. & Sm.) Gürke.

M. subulata Clairv. ≡ Sagina saginoides (L.) Karst. (non Sagina subulata (Sw.) Presl.)

M. thomasiana J. Gay ≡ Minuartia grigneensis (Reichb.) Mattf. ("Min. grineensis (Thomas)") (Sect. Lanceolatae Series Grineenses)

A genus of about 20 species mostly in Central and Southern Europe but M. lateriflora and its relatives (Section Latifoliae) extend across Northern Asia to Western North America. (cf. fig. 6)

The sectional delimitation is a revision of that first proposed by Nyman (1854-55), (1878), and validated by Graebner (1915 - p.455), who, although adopting the classification, suggested that it might not be a very natural arrangement. The two modifications proposed above are an attempt to achieve a classification more in accord with inter-specific affinities.

The new Section Arenarioides, confined to Spain and North Africa, is most markedly distinguished by its Arenaria-like seeds. A strophiole is of course present (unlike Arenaria) but it is possible that this is not homologous with that found in the other members of the genus (cf. key). This raises the question as to whether the genus Moehringia may not be diphyletic, or perhaps that the species of Section Arenarioides

might be more correctly placed within Arenaria itself. (cf. Discussion of seed characters, p. 51 , and generic evaluation, p. 66).

The other three sections form a more homogeneous group and it is rather difficult to draw dividing lines between them. This is particularly so in the case of the Sections Diversifoliae and Moehringia. M. villosa (Diversifoliae) is supposed to have elliptical lower leaves but these are frequently absent in fruiting specimens and the species is obviously very close to M. pendula, which Nyman and Graebner place in Section Moehringia (≡ Angustifoliae). It has been thought better to confine the latter section to those species with narrow linear (or semi-terete) leaves, many of which are tetramerous; M. pendula and M. papulosa have therefore been transferred to Section Diversifoliae. (M. grisebachii to which Graebner refers under Diversifoliae, has entirely linear leaves and is therefore placed in Section Moehringia).

Only two species, members of Section Latifoliae, occur in the Orient (cf. p. 425).

Special references : Bornmüller (1919); Graebner in Ascherson & Graebner (1915-16) pp. 449-469; Nyman (1878) p. 112: Pax & Hoffmann (1934) (bibliography); Schischkin in Komarov (1936) pp. 540-544.

3. Brachystemma D. Don

Brachystemma D.Don, Prodr. Fl. Nepal. 216 (1825);

Bentham in Bentham & Hooker, Gen. Pl. 1 : 149 (1862);

Pax & Hoffmann in Engler & Harms, Naturl. Pflanzenfam. ed. 2. 16c : 319 (1934).

Syn. : Arenaria Subgenus Arenariastrum Section Brachystemma (D.Don) Williams in Bull. Herb. Boiss. 3 : 603 (1895).

Type : B. calycinum D.Don, Prodr. Fl. Nepal. 216 (1825) (≡ A. nepalensis Spreng, non A. calycina Poir.)

Other species : ?B. ovatifolium Mizushima (1955)

A genus of one or two species, the type species common in the Himalayas and southern China and extending into Siam and Indo-China. A second species was recently described from Tibet, but no material has been seen and on the basis of the description there must remain some doubt as to its correct taxonomic position. (cf. fig. 6)

4. Honkenya Ehrh.

Honkenya Ehrhart, Beitr. Naturk. 2 : 180 (1788) ("Honckenia" Rafin., "Stonckenya" Rafin., "Honckenya" Bartl., "Honkeneja" Endl., "Honckeneya" Steud., "Honckeneja" Maxim.), non Honckenya Willd. (1793) (Liliaceae);

Pax & Hoffmann in Engler & Harms. Naturl. Pflanzenfam. ed. 2 16c : 328 (1934) ("Honckenya").

Syn.: "Ammodenia" J.G. Gmelin ex S.G.Gmelin, Fl. Sibir. 4 : 160 (1769), pro syn. Arenariae peploides.

Ammonalia Desv. in J. Bot. Desv. ser.2 3 (5) : 223 (1816) (≡ Honkenya).

Halianthus Fries, Fl. Halland. 75 (1817).

Adenarium Rafin., New Fl. N. Amer. 1 : 62 (1836) (Rafin. in Amer. Monthly Mag. Crit. Rev. 2 : 266 (1818) - nomen).

Arenaria b. Halianthus (Fries) Reichb. in Mössler, Handb. Gewächsk. ed.2. 1 : 740 (1827) ("Section" - Pfeiffer, Nomenclator (1870).

Ammodenia J.G.Gmelin ex Rupr., Beitr. Pfl. Russ. 2 : 25 (1845) ("Ammadenia") (nomen) (: "Ammodenia" J.G. Gmelin ex S.G. Gmelin - descr.).

Arenaria Subgenus vel Sectio Ammodenia (Rupr.) Bentham in Bentham & Hooker Gen. Pl. 1 : 151 (1862).

"Hallia" Dumort. ex Pfeiffer, Nom. 1 :1549 (1874), in syn.

Alsine Sect. Honkenya (Ehrh.) Pax in Engler & Prantl. Naturl. Pflanzenfam. 3 (1b) 83 (1889) ("Honckenya").

Minuartia Sect. Honkenya (Ehrh.) Mattf. in Bot. Jb. 57 Beibl. 126 : 27 (1921) ("Honckenya").

Type : H. peploides (L.) Ehrh., Beitr. 2 : 181 (1788) (: Arenaria peploides L.).

Other specific names :

H. diffusa (Hornem.) A. Löve

H. oblongifolia Torr. & Gray

Adenarium marinum S.F. Gray ("Adenaria marina") (≡ peploides)

Adenarium peploides (L.) Rafin.

Ammodenia major (Hook.) Heller

Ammodenia maxima (Fern.) Heller

Ammodenia oblongifolia (Torr. & Gray) Heller

Ammodenia peploides (L.) Rupr. ("Ammadenia")

Ammonalia peploides (L.) Desv.

Halianthus peploides (L.) Fries

Excluded species :

Adenarium maritimum Rafin. (≡ Honkenya maritima (Rafin.) Rafin. ("Honckenya") ≡ Ammodenia maritima (Rafin.) E.P. Bickn.) - excluded nomenclaturally ∵ basionom. ≡ Holosteum succulentum L. = Stellaria media L. (cf. Fernald, 1909); taxonomically interpreted

by Rafinesque (1836) and Bicknell (1910) etc. as Honkenya peploides ssp. robusta.

A genus of a single polymorphic species complex, in which 4 taxa are usually recognised - the type of peploides from Western Europe, the Arctic diffusa, the eastern N. American robusta (incl. "maritimum") and the North Pacific major or oblongifolia.

Special references ; Fernald (1909), Graebner in Ascherson & Graebner (1919) pp. 695-698.; Mattfeld (1922) pp. 8-12; Williams (1909).

5. Wilhelmsia Reichb.

Wilhelmsia Reichb., Consp. 206 (1828), non Koch (1848).

Syn.: Merckia Fischer ex Chamisso & Schlechtendal in Linnaea 1 : 59 (1826) ("Merkia" - Reichb.), non Merkia Borkh. (1792); Pax & Hoffmann in Engler & Harms. Naturl. Pflanzenfam. ed. 2 16c: 333 (1934).

Arenaria Subgenus vel Sectio Merckia (Cham. & Schlecht.) Bentham in Bentham & Hooker, Gen. Pl. 1 : 151 (1862).

Arenaria Section Merckia (Cham. & Schlecht.) Post & Kuntze, Lexicon 43 (cf. Preface p.V.) (1903).

Species :

W. physodes (Ser.) McNeill ined. (≡ Arenaria physodes Fisch. ex Ser. in D.C. ≡ Merckia physodes (Ser.) Cham. & Schlecht.)

Excluded species :

Merckia peploides (L.) G.Don ≡ Honkenya peploides (L.) Ehrh.

A monotypic genus confined to the Arctic coasts of eastern Asia and North-western America. (cf. fig. 6)

Special references : Hulten (1928) p. 88, McNeill (Taxon ined.), Maguire (1951).

6. Minuartia L.

Minuartia L., Sp. Pl. 89 (1753); Gen. Pl. ed. 5 100 (1754); Pax & Hoffmann in Engler & Harms., Naturl. Pflanzenfam. ed. 2 16c : 329 (1934).

Syn. : Alsine sec Crantz, Inst. 2 : 404 (1766), Gaertn., De Fruct. 2 : 223 (1791) et auctt. saeculi XIX, non L., Sp. Pl. 272 (1753), nec auctt. plur. amer. anni 1890-1925.

Arenaria L. Subgenus vel Sectio Alsine Bentham in Bentham & Hooker, Gen. Pl. 1 : 150 (1862), quoad descr. et syn. nec quoad basionom.

Alsinopsis Small, Fl. S.-E. U.S. 419 (1903).

Cherleria L. sensu ampl. Sampaio, Lista Herb. Portug. 82 (1913).

Type species : M. dichotoma L. (cf. Hitchcock in Hitchcock & Green (1929); Stearn (1957) pp. 136-142).

Key to Subgenera

1a. Stamens and petals subperigynous arising on or at the top of a very short calyx tube, inner whorl of stamens frequently adnate to the petals; leaves ovate to linear, rounded or bluntly obtuse at the apex; petals frequently pink; cotyledons accumbent; plants perennial (Mediterranean, Atlantic Is., E. Africa)

I Rhodalsine

1b. Stamens and petals arising from a hypogynous disc, petals & stamens always free to the base; leaves frequently linear-subulate, if

broader then acute to acuminate :

2a. Cotyledons accumbent; seeds pyriform with a dorsal groove, obscurely tuberculate, papillose on the dorsal surface; petals pink, rarely white, emarginate; plants annual; leaves setaceous, single-nerved, usually bearing axillary fascicles of equally long leaves (the leaves superficially appearing to be whorled) (S.W. Asia). II Spergella

2b. Cotyledons incumbent; seeds usually reniform (discoid in Sect. Greniera) with a flat or rounded dorsal ridge; petals white, rarely pink (M. labillardierei - Sect. Spectabiles, a caespitose to pulvinate perennial); fascicular leaves when present, shorter than the subtending cauline leaves :

3a. Sepals and capsule valves spreading in fruit; stems ± quadrangular; seeds reniform, verrucose (Mexico) III Hymenella

3b. Sepals (and capsule valves) erect in fruit; stems terete or subterete IV Minuartia

I Subgenus Rhodalsine (J. Gay) Graebner in Ascherson & Graebner, Syn. Mitt.-Eur. Fl. 5 (1) : 774 (1918).

Syn. : Alsine 13 Psammophilae Fenzl in Endlicher, Gen. Pl. 965 (1840).

"Psammanthe" Reichb., Repert. Herb. Nomencl. 205 (1841), nomen, basionom. non indic.

Alsine n. Psammophilae (Fenzl) Endlicher, Enchir. 505 (1843) ("Psammophila").

Rhodalsine J.Gay in Ann. Sci. Nat. ser.3 4 : 25 (1845).

Arenaria Subgenus vel Sectio Rhodalsine (J.Gay) Bentham in Bentham & Hooker, Gen. Pl. 1 : 150 (1862).

Alsine §1. Rhodalsine (J.Gay) Boiss., Fl. Orient. 1 : 669 (1867).

Alsine Sect. Rhodalsine (J.Gay) Amo y Mora, Fl. Espana Port. (Herb. Penins. Iber.) 6 : 133 (1873).

Alsine Subgenus Rhodalsine (J.Gay) Pax in Engler & Prantl. Naturl. Pflanzenfam. ed.1 3 (1b) : 83 (1889).

Minuartia Sect. Psammophilae (Fenzl) Mattf. in Bot. Jb. 57 Beibl. 126 : 33 (1921).

Type : Rhodalsine procumbens (Vahl) J.Gay l.c. (≡ Arenaria procumbens Vahl, Symb. Bot. 2 : 50 (1791) ≡ M. procumbens (Vahl) Graebner (1918)).

Other species and synonyms : cf. also Williams (1898a) for names in Arenaria.

Alsine gayana Webb ex Christ (1888), non R. geniculata var. gayana Williams, nec M. gayana (Wms.) Maire

Alsine platyphylla Gay ex Christ (1888)

M. gayana (Wms.) Maire (1936), non Als. gayana Webb ex Christ

M. geniculata (Poir.) Thellung (1912)

M. platyphylla (Christ) McNeill*

M. vestita (Baker) McNeill †

R. geniculata (Poir.) Williams (1898)

Plants of Subgenus Rhodalsine are common throughout the more southerly Mediterranean coasts extending to Portugal and the Canary Islands and with a distinctive species in Somaliland. Throughout the greater part of its range, however, the subgenus is only represented by one rather variable species for which M. geniculata is the correct name. (Williams, 1898a, recognised two species in this area but the criteria by which he distinguished the other, M. (Rhodalsine) procumbens, are not at all satisfactory. - cf. also Jackson, 1933). On the Canary Islands one or possibly two other distinct taxa occur; one of these (Alsine gayana Christ) may not be specifically separable from M. geniculata, but the other, which Maire (1936) called M. gayana but which was first published (in 1888 with the same type) as Alsine platyphylla certainly seems

* M. platyphylla (Gay ex Christ) McNeill, comb. nov.
Syn.: (≡) Alsine platyphylla Gay ex Christ, Spicil. Canar. in Bot. Jb. 9 : 159 (1888).
(≡) Rhodalsine geniculata var. gayana Williams in Bull. Herb. Boiss. 6 : 10 (1898) ("δ"), non Als. gayana Christ (1888).
(≡) M. gayana (Wms.) Maire in Bull. Soc. Hist.-Nat. Afr. Nord. 27 : 213 (1936), in obs.

† M. vestita (Baker) McNeill, comb. nov.
Syn.: Arenaria vestita Baker in Kew Bull. 1895 : 212 (1895).

to merit specific recognition. The third distinct species is the Somaliland plant which Baker described as Arenaria vestita and whose true position has not previously been noted.

Special references : Christ (1888), Jackson (1933), Williams (1898a).

II Subgenus Spergella (Fenzl) McNeill, comb. nov.

Syn. : Alsine 10. Spergella Fenzl in Endlicher, Gen. Pl. 965 (1840), non Spergella Reichb.

"Phlebanthia" Reichb., Repert. Herb. Nomencl. 205 (1841), nomen, basionom. non indic.

Alsine Sect. Spergella (Fenzl) Fenzl in Ledeb., Fl. Ross. 1 : 356 (1842).

Minuartia Sect. Spergella (Fenzl) Mattf. in Bot. Jb. 57 Beibl. 126 : 33 (1921).

Type : M. picta (Sibth. & Sm.) Bornm., in Beih. Bot. Zbl. 28 (2) : 148 (1911).

Other species : M. formosa (Fenzl) Mattf. (1921)

A very distinctive group of two sympatric species in the Irano-

Turanian to Saharo-Sindian regions of the Levant, southern Turkey and Iraq.

III Subgenus Hymenella (Moc. & Sesse ex Ser.) McNeill, comb. nov.

Syn.: Hymenella Moc. & Sesse ex Ser. in D.C., Prodr. 1 : 389 (1824).

Triplateia Bartl. in Presl, Rel. Hankeanae 2 : 11 (1831).

Arenaria Subgenus vel Sectio Hymenella (Ser.) Bentham in Bentham & Hooker, Gen. Pl. 1 : 150 (1862).

Alsine Sect. Hymenella (Ser.) Rohrb. in Linnaea 37 : 246 (1872).

Minuartia Sect. Hymenella (Ser.) Mattf. in Bot. Jb. 57 Beibl. 126 : 27 (1921).

Type : M. moehringioides (Moc. & Sesse ex Ser.) Mattf. l.c. (1921).

The distinctive facies of the single species of this subgenus makes its retention within Minuartia open to question but in the absence of any more definite characters than the quadrangular stem and the spreading calyx and capsule, it has been thought wisest to follow Mattfeld's treatment, but raising it to subgeneric rank. M. moehringioides is only known from Central Mexico.

IV Subgenus Minuartia

Key to Sections, Subsections and Series

(modified from Mattfeld 1922)

1a. Seeds strongly compressed, discoid, winged by the expansion of the testa; staminal glands prominent, simple or with a broad hyaline flap (c. 0.6mm. diam.) on the outside, surrounding the introrse nectar pit, the stamen borne on the middle of the interior face of the gland; plants annual; petals entire
(W. North America) K. Sect. Greniera

1b. Seeds ± reniform, occasionally fimbriate or crested, never winged; glands indistinct or prominent, simple, globular or quadrate, and the stamen ± terminal, or bifurcate and the stamen lying between the two arms :

2a. Annual or biennial herbs; petals ± emarginate, twice as long as the calyx; sepals obscurely or reticulate nerved, erect at anthesis; leaves 1-nerved (or almost 3-nerved), slender or rather fleshy; seeds obscurely tuberculate to tuberculate, sometimes echinate (W. North America) J. Sect. Uninerviae

2b. Suffruticose or herbaceous perennials, or if annuals petals shorter than or ± equal to calyx; petals entire, very rarely shortly emarginate (never in annual species) :

3a. Sepals rounded to obtuse at apex, linear; calyx cylindrical (Pan-Arctic & Temperate) A. Sect. Spectabiles

4a. Petals longer than calyx, usually very prominent; sepals erect at anthesis; staminal glands subglobose or minutely emarginate; leaves flat or subterete :

5a. Flowering shoots very distinct, not producing turions or bearing fascicles of leaves (rarely with small ones); leaves slender or rigid, obscurely or 3-5-nerved A.c. Subsect. Laricifoliae

6a. Leaves densely imbricate toward the apex of the sterile shoot forming a small rosette, 3-5-nerved, flat and linear-lanceolate or linear-setaceous and sometimes becoming ± triquetrous towards the apex (Caucasus, Armenia etc.) A.c.(i). Series Caucasicae

6b. Leaves of sterile shoots ± fasciculate, never rosulate - spreading, linear-subulate or setaceous ± semiterete, obscurely nerved or ± 1-3-nerved at the base; petals rarely pink (C. & S. Europe, Levant) A.c.(ii). Series Laricifoliae

5b. Sterile shoots gradually passing into flowering shoots, rarely flowering shoots distinct and then bearing large

fascicles; leaves fleshy, rarely rather rigid, traversed by 1 ± prominent nerve

A. a. Subsect. Spectabiles

7a. Leaves flat, laneolate or linear-lanceolate; entire leaf, or the margin near the base, setose, bearing long acute hairs; seeds with a fimbriate crest on the dorsal ridge (W. Arctic, N. America, Arctic & E. Asia & Caucasus) A. a. (i). Series Laricinae

7b. Leaves linear-subulate, the margin near the base ± scabrid with short obtuse hairs, rarely glabrous; seeds obscurely reticulate to obscurely tuberculate all over (Pan Arctic, W. North America, C. Asia, N. Europe & Alps) A. a. (ii). Series Spectabiles

4b. Petals filiform shorter than the calyx or often absent; sepals spreading at anthesis; staminal glands deeply bi-partite; leaves triquetrous; sterile shoots gradually passing into flowering shoots (C. Europe, Scotland)

A. b. Subsect. Cherleria

3b. Sepals acute or acuminate, rarely obtuse and then ovate; calyx ovoid or urceolate :

8a. Leaves recurved, rigid with a very thick median nerve; fascicular leaves spreading; seeds

irregularly rugulose to obscurely tuberculate (N. America)

E. Sect. Sclerophyllae (& 3 Series)

8b. Leaves of the sterile rosettes closely fasciculate, or if spreading, slender :

9a. Petals shorter than sepals; sepals erect at anthesis; leaves 1-nerved; seeds obscurely tuberculate; perennial herbs with elongate pedicels (Pan-Arctic, C. Asia & C. Europe)

H. Sect. Alsinanthe

9b. Petals longer than sepals, or if shorter sepals spreading at anthesis :

10a. Plants annual, sepals 1-3-nerved, or perennial and sepals usually 1-nerved (rarely 3); calyx often hardened at the base (always so in perennial plants); seeds obscurely tuberculate, papillose or echinate :

11a. Calyx not or scarcely hardened at the base; sepals 3-nerved; seeds small (0.25-0.70mm. long diam.), plants always annual

M. Sect. Sabulina

12a. Petals white with translucent dots; leaves single-nerved, fleshy, spathulate; very slender annuals (Chile, California). M. (ii). Series Californicae

12b. Petals entirely white; leaves usually 3-nerved, subulate, rarely spathulate; slender or often robust annuals. (Europe, W. Asia, N. Africa, W. North America)

M. (i). Series Sabulina

11b. Calyx strongly hardened at the base; sepals 3-nerved, or 1-nerved with a broad white coriaceous margin; seeds large (0.70-1.50mm. long diam.) (C. & S. Europe, N. & E. Africa, S. W. Asia) L. Sect. Minuartia

13a. Sepals 3-nerved (outer sometimes 5-nerved) with a very narrow white margin, the central green portion extending beyond the lateral nerves L.a. Subsect. Minuartia

14a. Leaves linear to linear-lanceolate, flat, 5-7(-9)-nerved, the basal margin glabrous, scabrid or sparsely clothed with erect glandular hairs; bracts similar to the leaves, shorter or longer than the partial inflorescenses; seeds few - many, dark brown, obscurely tuberculate (E. & W. Mediterranean)

L.a. (i). Series Montanae

14b. Leaves setaceous, narrowing from the base, basal margin lanuginose with long crisp hairs; bracts elongate, recurved or incurved, longer than the partial inflorescences; seeds few (1-4) yellow-brown, opaque, obscurely reticulate or ± smooth (E. & W. Mediterranean) L.a. (ii). Series Minuartia

13b. Sepals 1-nerved, nerve white with two narrow green lines on either side and with broad white scarious margins (rarely 3-nerved and then green portion not extending beyond the lateral nerves & plant perennial); plants usually perennial, sometimes biennial or annual (often overwintering)

L. b. Subsect. Xeralsine

15a. Sepals prominently 3-nerved; flowers aggregated into terminal clusters; plants perennial (Southern Turkey)

L. b. (i). Series Leucocephalae

15b. Sepals 1-nerved (or with 2 weak lateral nerves at the base and then flowers not clustered) :

16a. Plants annual; partial inflorescences sessile, glomerulate; sepal nerves with prominent crystals (cf. p.537); calyx infundibular; seeds few; stems and upper leaf bases clothed with crisped glandular hairs (Spain & N. Africa)

L. b. (iv). Series Campestres

16b. Plants perennial, biennial, or rarely annual; inflorescence lax, or partial inflorescences densely fasciculate, usually pedunculate; sepal nerves without prominent crystals; calyx often truncate; seeds usually many :

17a. Plants biennial, rarely annual or perennial; inflorescences densely fasciculate, clothed with long straight spreading hairs (C. & S. Europe) L. b. (iii). Series Xeralsine

17b. Plants perennial, often suffruticose; inflorescence laxly dichasial to densely corymbose or subcapitate; indumentum various (often glabrous, puberulent or with erect hairs, rarely lanuginose or with spreading hairs) (C. & E. Europe, N. Africa, S. W. Asia) L. b. (ii). Series Setaceae

10b. Plants perennial; sepals 3-many (5-9)-nerved with a rather narrow membraneous or scarious margin; calyx not hardened at the base :

18a. Sepals 5-7(-9)-nerved, rarely 3-nerved and then seeds fimbriate :

19a. Leaves linear-subulate or setaceous; sepals spreading at anthesis; seeds obscurely tuberculate or muricate (Mountains of C. & S. E. Europe, S. W. Asia) B. Sect. Plurinerviae (Tryphane sec Mattfeld)

19b. Leaves lanceolate or linear-lanceolate, rarely linear; sepals erect or scarcely spreading at anthesis; seeds fimbriate on the dorsal ridge :

20a. Flowers pentamerous (Mountains of C. & S. Europe & S. W. Asia) C. Sect. Lanceolatae

21a. Leaves lanceolate, obovate, oblong, linear-lanceolate or narrowly triangular, never narrowly linear; sepals 5-many nerved; peduncles and pedicels glandular pubescent; pedicels very short, scarcely exceeding calyx :

22a. Sepals many-nerved or if only 5-nerved, marginal nerves conspicuous beyond the middle, acuminate; inflorescence few-flowered (rarely 1); capsule shorter than calyx :

23a. Petals longer than or rarely equalling sepals, obovate, narrowly cuneate at the base; stems terete, short, 0.5-5.0(-7.0) cm. tall; bracts similar to all the stem leaves (mainly C. & S. Europe)

C. (i). Series Graminifoliae

23b. Petals shorter than the sepals ovate to lanceolate abruptly contracted at the base, clawed or sessile; stems angled, elongate, 4-20cm. tall; bracts broader than at least the lower cauline leaves (S. W. Asia)

C. (ii). Series Dianthifoliae

22b. Sepals 5-nerved, marginal nerves inconspicuous and evanescent above the middle, acute, suberect to sub-spreading at anthesis; inflorescence 1 (rarely 2) -flowered; capsule much longer than calyx; petals ovate contracted into a claw (C. Europe) C. (iii). Series Lanceolatae

21b. Leaves narrowly linear; sepals 3 nerved; glabrous herbs; pedicels elongate much longer than the calyx; speals ovate, acute spreading at anthesis; capsule a little longer than calyx; petals lanceolate, contracted at the base into a claw (Alps)

C. (iv). Series Grineenses

20b. Flowers tetramerous (Alps) D. Sect. Aretioideae

18b. Sepals 3-nerved; seeds obscurely tuberculate and sometimes echinate :

24a. Sepals acuminate, erect at anthesis; petals obovate or oblong gradually narrowing to the base, 1.5-2 times as long as sepals (C. & S. Europe, W. & C. Asia) F. Sect. Acutiflorae

25a. Leaves of sterile shoots spreading at anthesis (usually widely so), rather long (12-20mm.), herbaceous flat and linear-lanceolate to hard ± terete, never subulate-setaceous (rarely leaves short, 3-10mm., and then linear-lanceolate and rather fleshy); the median nerve of the leaves thicker than the laterals or leaves one-nerved (Spain, C. Europe, W. & C. Asia to Kashmir & Pakistan)

F. (i). Series Acutiflorae

25b. Leaves of sterile shoots densely fasciculate to somewhat spreading, short, 4-10mm. long, subulate-setaceous, rarely linear :

26a. Leaves of sterile shoots usually somewhat spreading with three ± equal nerves, narrowly linear to subulate-setaceous; petals oblanceolate (Greece & S. Turkey) F. (ii). Series Pichleriae

26b. Leaves of sterile shoots densely fasciculate, one-nerved or with lateral nerves present only at the base, subulate-setaceous to semi-terete; petals obovate (Asia Minor) F. (iii). Series Umbelluliferae

24b. Sepals acute spreading at anthesis; petals ovate abruptly contracted at the base into a claw, about as long as or a little longer than sepals (N. Temperate & Subarctic regions & mountains S. to 35° - 40° N.) G. Sect. Tryphane (≡ Polymechana Mattf.)

A. Sectio Spectabiles (Fenzl) Hayek, Fl. Steierm. 1 : 274 (1908).

Syn.: Alsine 7 Spectabiles Fenzl in Endlicher, Gen. Pl. 965 (1840).
Wierzbickia Reichb., Repert. Herb. Nomencl. 205 (1841) (nomen); Ic. Fl. Germ. 5 : 30 (1841) (descr.).
Alsine Sect. Spectabiles (Fenzl) Fenzl in Ledebour, Fl. Ross. 1 : 352 (1842).

Lectotype : M. biflora (L.) Schinz & Thell. in Bull. Herb. Boiss. ser. 2 7 : 403 (1907).

a. Subsectio Spectabiles

(i). Series Laricinae Mattf. in Bot. Jb. 57 Beibl. 126 : 32 (1921) (nomen); in Fedde Rep. Beih. 15 : 182 (1922) (diagn. in clave).

Lectotype : M. laricina (L.) Mattf. in Bot. Jb. 57 Beibl. 126 : 33 (1921).

Other species :

M. brotherana (Trautv.) Woronow (1914)

M. colchica Kharadze (1938)

M. imbricata (M.B.) Woronow (1914)

M. inamoena (C.A.Mey) Woronow (1914)

M. macrocarpa (Pursh) Ostenf. (1920)

M. rhodocalyx (Alb.) Woronow (1914)

M. trautvetteriana Sosnowsky & Kharadze (1938)

A series of two species, widely distributed in Western North America and Arctic Asia, extending south to Japan, and of a species complex in the Caucasus, considered by Kharadze (1938) to comprise six species (cf. pp. 442 - 452).

(ii). Series Spectabiles

Syn. : Minuartia Sect. Spectabiles Series Biflorae Mattf. In Bot. Jb. 57 Beibl. 126 :32 (1921) (nomen); in Fedde Rep. Beih. 15 : 182 (1922) (diagn. in clave).

Species :

M. arctica (Steven) Graebn. (1918)

M. biflora (L.) Schinz & Thell. (1907)(type)

?M. marcescens (Fern.) House (1921)

M. obtusiloba (Rydb.) House (1921)

A series of three species throughout Arctic Eurasia and extending southwards into western United States and central Asia (to the Himalayas).

b. Subsectio Cherleria (L.) McNeill, comb. nov.

Syn. : Cherleria L., Sp. Pl. 425 (1753); Gen. Pl. ed. 5 194 (1754).

Alsine 8 Cherleria (L.) Fenzl in Endlicher, Gen. Pl. 965 (1840) ("Cherleriae").

Alsine Sect. Cherleria (L.) Fenzl in Ledeb., Fl. Ross. 1 : 356 (1842) ("Cherleriae").

Arenaria Subgenus vel Sectio Cherleria (L.) Bentham in Bentham & Hooker, Gen. Pl. 1 : 150 (1862).

Arenaria Sect. Cherleria (L.) Post & Kuntze, Lexicon 42 (1903) (cf. Preface p.V.) ("Cherlera").

Alsine Subgenus Cherleria (L.) C.E.Moss, Cambr. Br. Fl. 3 : 32, 36 (1920).

Type : M. sedoides (L.) Hiern in J. Bot. Lond. 37 : 320 (1899) (≡ Cherleria sedoides L. ≡ Gherleria caespitosa Lam., 1779).

Excluded species :

"C. bipartita" Fisch. ex Steud. (1841) = ?

C. bisulca Bartl. (1830) ≡ Arenaria bisulca (Bartl.) Rohrb. - (Subgenus Dicranilla)

C. dichotoma (L.) Sampaio (1913) ≡ Minuartia dichotoma L. (Section & Series Minuartia)

C. dicranoides Cham. (1826) ≡ Arenaria chamissonis Maguire (Subgenus Arenaria ?Sect. Rariflorae)

C. geniculata (Poir.) Sampaio (1913) ≡ Minuartia geniculata (Poir.) Thelling (Subgenus Rhodalsine)

C. grandiflora D. Don (1825) = Arenaria globiflora (Fenzl) Edgew. (Subgenus Dolophragma)

C. imbricata Ser. (1824) = Minuartia aretioides (Somerauer) Schinz & Thell. (Sect. Aretioideae)

C. juniperina D. Don (1825) ≡ Arenaria densissima Edgew. Subgenus Dolophragma)

C. laevis Bartl. (1825) = ?

C. nitida Bartl. (1825) ≡ Arenaria nitida (Bartl.) Rohrb. Subgenus Leiospermae or Dicranilla)

C. octandra Sieber ex Spreng. (1825) = Minuartia aretioides (Somerauer) Schinz. & Thell. (Sect. Aretioideae)

"C. pedunculariis" Bunge ex Steud (1841) ("= C. bipartita") = ?

C. sedoides sec Forsk (1775) = Minuartia geniculata (Poir.) Thelling (Subgenus Rhodalsine)

" " sec Sibth. & Sm. (1806) = Minuartia confusa (Boiss.) Maire & Petitm. (Section Minuartia Series Xeralsine)

" " sec Turcz. (1842) = Stellaria sp. (fide I.K.)

C. sibirica Regel & Tiling (1859) = Minuartia biflora (L.) Schinz & Thell. (Sect. & Series Spectabiles)

C. stellata Clarke (1816) ≡ Minuartia stellata (Clarke) Maire & Petitm. (Sect. Lanceolatae Series Graminifoliae)

C. tenuifolia (L.) Sampaio (1913) ≡ Ar. tenuifolia L. = Minuartia hybrida (Vill.) Schischk. (Sect. & Series Sabulina)

C. verna (L.) Sampaio (1913) ≡ Minuartia verna (L.) Hiern (Sect. Tryphane)

A monotypic group restricted to the mountains of Central Europe and the Scottish Highlands.

c. Subsectio Laricifoliae (Mattf.) McNeill, comb. nov.

Syn.: Minuartia Sect. Spectabiles Series Laricifoliae Mattf. in Bot. Jb. 57 Beibl. 126 : 32 (1921) (nomen): in Fedde Rep. Beih. 15 : 182 (1922) (diagn. in clave).

Lectotype : M. laricifolia (L.) Shinz & Thell. in Bull. Herb. Boiss. ser.2 7 : 403 (1907).

(i). Series Caucasicae Mattf. in Bot. Jb. 57 Beibl. 126 : 32 (1921) (nomen); in Fedde Rep. Beih. 15 : 182 (1922) (diagn. in clave).

Lectotype : M. caucasica (Adams ex Rupr.) Mattf. in Ascherson & Graebner, Syn. Mitt.-Eur. Fl. 5 (1) : 941 (1919), (nom. illeg.) (= M. circassica (Albow) Woronow, 1914).

Other species : M. aizoides (Boiss.) Borrm. (1914).

A series of two species in Western Anatolia and the Caucasus; for a discussion of the nomenclature of M. circassica cf. p. 457.

(ii). Series Laricifoliae

Syn. : Minuartia Sect. Spectabiles Series Laricifoliae Mattf. et Series Labillardiereae Mattf. in Bot. Jb. 57 Beibl. 126 : 32 (1921) (nomen); in Fedde Rep. Beih. 15 : 182 (1922) (diagn. in clave).

Species :

M. baldaccii (Halacsy) Mattf. (1919)
M. capillacea (All.) Graebn. (1918)
M. garckeana (Boiss.) Mattf. (1922)
M. handelii Mattf. (1923)
M. labillardierei Briquet (1911)
M. laricifolia (L.) Shinz & Thell. (1907) (type)
M. wettsteinii Dorfl ex Matff. (1922)

A series of seven species on the mountains of Southern Europe extending into N.W. Anatolia and in the Lebanon mountains (one species).

Section Spectabiles probably represents the most primitive known forms of Subgenus Minuartia; one species, M. rhodocalyx, has generally five carpels, which may represent a primitive character. The section as a whole comprises about twenty species distributed on the mountains of Eurasia and throughout the Arctic.

B. Sectio Plurinerviae McNeill, nom. nov. : Minuartia Sect. Tryphane sec Mattf. in Fedde Rep. Beih. 15 : 113 (1922) (descr.) non Fenzl emend. Boiss. (1867).

Syn.: Alsine 3 Tryphane Fenzl in Endlicher, Gen. Pl. 965 (1840), pro parte excl. lectotyp.

Tryphane (Fenzl) Reichb., Repert. Herb. Nomencl. 205 (1841), pro parte excl. lectotyp.

Type : M. recurva (All.) Schinz & Thell. in Bull. Herb. Boiss. ser.2 7 : 404 (1907).

Other species :

M. bulgarica (Velen.) Graebn. (1918)

M. engleri Mattf. (1922)

M. eurytanica (Boiss. & Heldr.) Hand.-Mzt. (1909)

M. hirsuta (M.B.) Hand.-Mzt. (1909) M. juressi (Schlecht.) Lacaita (1930)

A section comprising about six closely related species on the mountains of Central and Southern Europe and S.W. Asia.

Fenzl named two "species prototyp." for his infrageneric group Tryphane - Alsine recurva and Als. verna. When he divided the group into two Sections Mattfeld chose recurva as lectotype, ignoring the fact that Boissier, more than 50 years before, had by excluding that species (and placing it in the Lanceolate) effectively typified Tryphane by Alsine verna. A new name is, therefore, required for this very homogeneous section which includes M. recurva and M. hirsuta; the name Plurinerviae, which has been given (above), refers to the 5-7-nerved sepals, the major distinguishing feature between this section and Tryphane s.s. (= Polymechana Mattf.).

C. Sectio Lanceolatae (Fenzl) Graebner in Ascherson & Graebner, Syn. Mitt.-Eur. Fl. 5 (1) : 756 (1918).

Syn.: Alsine 5 Lanceolatae Fenzl in Endlicher, Gen. Pl. 965 (1840)
Alsine Sect. Lanceolatae (Fenzl) Fenzl in Ledebour, Fl. Ross. 1 : 350 (1842).

Type : Alsine lanceolata (All.) Mert. & Koch, Fl. Deutschl. 3 : 275 (1831), non (Poir.) Macloscie; (= M. lanceolata (All.) Mattf., 1921) (= M. rupestris (Scop.) Schinz & Thell,, 1907).

(i). Series Graminifoliae Mattf. in Bot. Jb. 57 Beibl. 126 : 31 (1921) (nomen); in Fedde Rep. Beih. 15 : 130 (1922) (diagn. in clave).

Syn.: Pettera Reichb., Repert. Herb. Nomencl. 205 (1841) (nomen); Ic. Fl. Germ. 5 : 33 (1841) (descr.)

Lectotype : M. graminifolia (Arduino) Javorka in Fl. Hung. exs. Cent. 2 : 142 Schedae 22 (1914).

Other species :

M. saxifraga (Friv.) Graebner (1918) M. stellata (Clarke) Maire & Petitm. (1908)

A series of three species in South-Eastern Europe (centred in the Balkans) extending into N.W. Anatolia (M. saxifraga subsp. tmolea).

(ii). Series Dianthifoliae Mattf. in Bot. Jb. 57 Beibl. 126 : 31 (1921) (nomen); in Fedde Rep. Beih. 15 : 130 (1922) (diagn. in clave).

Lectotype : M. dianthifolia (Boiss.) Hand.-Mzt. in Ann. naturh. Hofmus. Wien 26 : 147 (1912).

Other species :

M. acuminata Turrill (1929) M. pestalozzae (Boiss.) Bornm. (1915)

A series of three species with a restricted distribution in Asia Minor, Nakhichevan & Northern Iran.

(iii). Series Lanceolatae

Syn.: Dufourea Grenier in Act. Soc. Linn. Bord. 9 : 25 (1837) pro parte, non Bory ex Willd. (1810), nec H.B. & K. (1818).

Facchinia Reichb., Repert. Herb. Nomencl. 204 (July 1841) (nomen); Ic. Fl. Germ. 5 : 29 (1841).

Alsine e. Dufourea (Gren.) Endlicher, Enchir. 505 (1843).

Alsine Sect. Facchinia (Reichb.) Griseb., Spicil. Fl. Rumel. 1 : 202 (Dec. 1843 - Jan. 1844).

Minuartia Sect. Lanceolatae Series Cerastiifoliae Mattf. in Fedde Rep. Beih. 15 : 136 (1922).

Species :

M. cerastiifolia (Ram. ex D.C.) Graebn. (1918)

M. rupestris (Scop.) Schinz & Thell. (1907) (non Als. rupestris (Labill.) Fenzl) (incl. M. lanceolata - type)

A series of two species, one confined to the Alps, the other to the Pyrenees.

(iv). Series Grineenses Mattf. in Bot. Jb. 57 Beibl. 126 : 31 (nomen); in Fedde Rep. Beih. 15 : 130 (diagn. in clave).

Type : M. grigneensis (Reichb.) Mattf. l.c. (1921) ("M. grineensis (Thomas)").

A monotypic series endemic to the Bergamo Alps in Northern Lombardy.

The species was first named "Arenaria grineensis" by Thomas in 1842 without a description. Reichbenbach, when he validated the name (in Tryphane) a few months later (1842-43), used the spelling "grigneensis". As it is named after the Grigna mountain group, this seems a deliberately chosen spelling, and being in the first valid publication of the name, must be regarded as the correct form. Mattfeld uses "grineensis" and consequently his series is spelled "Grineenses", and must be retained as such.

D. Sectio Aretioideae (Fenzl) Mattf. in Fedde Rep. Beih. 15 : 144 (1922).

Syn.: Siebera Schrad. ex Hoppe in Flora 2 : 24 (1819), non J. Gay (1827) nom. cons.

Somerauera Hoppe l.c. 26 (1819).

Cherleria a. Somerauera (Hoppe) Reichb., Consp. 206 (1828).

Alsine 4. Aretioideae Fenzl in Endlicher, Gen. Pl. 965 (1840).

Alsine d. Somerauera (Hoppe) Endlicher, Ench. Bot. 505 (1841) ("Sommerauera").

Alsine Sect. Aretioideae (Fenzl) in Ledeb., Fl. Ross. 1 : 350 (1842).

Alsine Sect. Siebera (Hoppe) Pax in Engler & Prantl. Naturl. Pflanzenfam. 3 (1b) : 83 (1889).

Minuartia Sect. Siebera (Hoppe) Graebner in Ascherson & Graebner, Syn. Mitt.-Eur. Fl. 5 (1) : 752 (1918) ("Section" cf. p. 700).

Minuartia Sect. Somerauera (Hoppe) Mattf. in Bot. Jb. 57 Beibl. 126 : 31 (1921).

Type : M. aretioides (Somerauer) Schinz & Thell. in Bull. Herb. Boiss. ser.2 7 : 405 (1907) (= M. cherlerioides (Hoppe) Becherer)

A section of one species, a tetramerous derivative of Section Lanceolatae.

The specific nomenclature has been greatly confused, chiefly on account of the first effective publication being, so far as is known, in the "correspondence columns" of "Flora" (1819). As Becherer (1956) has pointed out the basionym of M. aretioides (Arenaria aretioides) is invalid not being accepted by the author who published it. (Somerauer in his letter). Thus Siebera cherlerioides described by Hoppe in his reply (based on a different plant) is the earliest validly published name and so Becherer's new combination, M. cherlerioides, is the correct name for the species. The full synonymy is as follows:

M. cherlerioides (Schrad. ex Hoppe) Becherer, Fl. Vall. Suppl. 167, in Denkschr. schweiz. naturf. Ges. 81 (Aug. 1956); in Ber. schweiz. bot. Ges. 66 : 230 (Dec. 1956).

Syn. : "Cherleria octandra" Sieber, Herb. Fl. Austr. 149 (1813) (nomen) (publ. ineffect. ?)

"Siebera cherlerioides" Schrader ex Sieber, Fl. Austr. exs. nr. 149 (1813) (nomen - in syn. ?) (publ. ineffect. ?)

"Arenaria aretioides" Portenschl. ined. (?) (1818).

"Arenaria aretioides" ? Portenschl. ex Somerauer in Flora 2 : 20 (1819) (nom. altern. invalid); Portenschl. ex J. Gay in Ann. Sci. Nat. ser.1 3 : 34 (1824).

"Arenaria styriaca" Somerauer l.c. (1819) (nom. altern. invalid.) (≡ aretioides).

Siebera cherlerioides Schrader ex Hoppe in Flora 2 : 24 (1819) non Arenaria cherlerioides Vill. (1779).

Somerauera quadrifaria Hoppe l.c. 26 (1819) (≡ aretioides) (? nom. provis.), non Arenaria quadrifaria Desv. (1816).

?"Siebera argentea" Hoppe ex Steudel, Nomencl. ed.1 777 (1821) ("Sieberia") (nomen).

Cherleria imbricata Ser. in D.C., Prodr. 1 : 421 (1824).

Cherleria octandra Sieber ex Sprengel, syst. 2 : 416 (1825).

Alsine aretioides (Portenschl. ex Gay) Mert. & Koch, Deutschl. Fl. 3 : 277 (1831).

Alsine cherlerioides (Schrad. ex Hoppe) Dalla Torre, Anleit. Beob. Alpenfl. 2 : 76 (1882)

Alsine octandra (Sieber ex Spreng.) Kerner, Fl. exs. Austro-Hung. no. 564 Schedae 2 : 85 (1882); Dalla Torre & Sarnthein, Fl. Tir. 6 (2) : 161 (1909).

M. aretioides (Somerauer) Schinz & Thell. in Bull. Herb. Boiss. ser.2 7 : 407 (1907).

E. Sectio Sclerophylla Mattf. in Bot. Jb. 57 Beibl. 126 : 28 (1921) (nomen); in Fedde Rep. Beih. 15 : 22 (1922) (diagn. in clave).

Lectotype : M. michauxii (Fenzl) Mattf. l.c. (1921) (≡ Arenaria stricta Michx.) (Series Michauxiae Mattf. ll.c. 1921, 1922).

Other species :

M. carolinana (Walt.) Mattf. (1921) (Series Carolinianae Mattf. ll.c.)

M. dawsonensis (Britton) House (1921) (= M. michauxii fide Maguire, 1951)

M. nuttallii (Pax) Briq. (1911), non (Torr. & Gray) Mattf. (1921), (≡ M. pungens (Nutt.) Mattf.) (Series Pungentes Mattf. ll.c.)

?Arenaria filiorum Maguire (1946) (aff. M. nuttallii)

A section of three or four species in eastern and western North America (chiefly U.S.A.). The three species known to Mattfeld were each placed by him in monotypic series. They are very distinct species and the section appears rather heterogeneous. As no material of Maguire's Arenaria filiorum has been seen, a new combination in Minuartia is not proposed, meanwhile.

Special references : Maguire (1946a) (1951).

F. Sectio Acutiflorae (Fenzl) Hayek, Fl. Steirm. 1 : 274 (1908).

Syn.: Alsine 6. Acutiflorae Fenzl in Endlicher, Gen. Pl. 965 (1840).

Alsine Sect. Acutiflorae (Fenzl) Fenzl in Ledeb., Fl. Ross. 1 : 350 (1842).

Alsine f. "Calasine" Endlicher, Enchir. 505 (1843) (nomen, basionom non indic.).

Lectotype : M. austriaca (Jacq.) Hayek, Fl. Steierm. 1 : 274 (1908).

(i). Series Acutiflorae

Syn.: Neumayera Reichb., Repert. Herb. Nomencl. 205 (Jul. 1841) (nomen); Ic. Fl. Germ. 5 : 30 (1841) (descr.).

Minuartia Sect. Acutiflorae Series Flaccidae Mattf. in Bot. Jb. 57 Beibl. 126 : 31 (1921) (nomen); in Fedde Rep. Beih. 15 : 148 (1922) (diagn. in clave).

Minuartia Sect. Acutiflorae Series Juniperinae Mattf. l.c. p.32 (1921) (nomen); l.c. p.148 (1922) (diang. in clave).

Species :

M. afghanica Rech.f. (1951)

M. aucheriana (Boiss.) Bornm. (1910)

M. austriaca (Jacq.) Hayek (1908) (type)

M. biebersteinii (Rupr.) Schischk. (1928)

M. flaccida (All.) Schinz & Thell. (1907)

M. gracilis McNeill

M. gracilipes (Komarov) Komarov (1936)

M. helmii (Fisch. ex Ser.) Schischk. (1928)

M. lineata Bornm. (1910)
M. jacutica Schischk. (1936)
M. juniperina (L.) Maire & Petitm. (1908)
M. kashmirica (Edgew.) Mattf. (1921)
M. kryloviana Schischk. (1930)
M. litwinowii Schischk. (1936)
M. subuniflora (Alb.) Woronow (1914)
M. taurica (Stev.) Schischk. (1936)

A series of about eleven to sixteen species occurring on the mountains of Central Europe and Central Asia from the Pyrenees to the Himalayas - extending southwards into the steppe lands of South-west Asia. Mattfeld's separation of the more xerophytic species into a separate series (Series Juniperinae) cannot be maintained as a complete gradation exists in a number of different areas (notably in the Caucasus and Armenia and in Afghanistan).

(ii). Series Pichleriae Mattf. in Bot. Jb. 57 Beibl. 126 : 32 (1921) (nomen); in Fedde Rep. Beih. 15 : 148 (1922) (diagn. in clave), sensu ampl.

Type: M. pichleri (Boiss.) Maire et Petitm., Etude Fl. Graec. 4 : 49 (1908).

Other species :

M. rimarum (Boiss. & Bal.) Mattf. (1921).

Mattfeld based the Series Pichleriae on M. pichleri, a species endemic to the Peloponnese, but it is clear that M. rimarum which

he placed in his Series Flaccidae should be included with it. M. rimarum which is widely distributed throughout Southern and Eastern Anatolia, shows some resemblance to M. umbellulifera (Series Umbelluliferae =t Heldreichianae sec Mattf.) but differs in the more spreading equally three-nerved leaves. Series Pichleriae holds an intermediate position between the Series Acutiflorae and Umbelluliferae.

(iii). Series Umbelluliferae McNeill, nom. nov.

Syn.: Minuartia Sect. Acutiflorae Series Heldreichianae Mattf. l.l.c. (1921, 1922), quoad descr. et spec. cit. typo (Heldreich 1018) excl.

Type : M. umbellulifera (Boiss.) McNeill (cf. p. 523) (= M. heldreichiana Mattf. pro parte maiore).

Other species :

M. pontica (Bornm.) Mattf. (1921)

?M. subuniflora (Albow) Woronow (1914)

A series of two or three species confined to the Caucasian and Anatolian mountains.

Section Acutiflorae as a whole comprises about fifteen species distributed throughout Central Europe and Central and South-west Asia. The specific limits are very obscure in many cases.

G. Sectio Tryphane (Fenzl) Hayek, Fl. Steierm. 1 : 271 (1908).

Syn.: Alsine 3 Tryphane Fenzl in Endlicher, Gen. Pl. 965 (1840), pro parte.

Tryphane (Fenzl) Reichb., Repert. Herb. Nomencl. 205 (1841).

Alsine Sect. Tryphane (Fenzl) in Ledeb. Fl. Ross. 1 : 346 (1842).

Minuartia Sect. Polymechana Mattf. in Bot. Jb. 57 Beibl. 126 : 32 (1921) (nomen); in Fedde Rep. Beih. 15 : 169-170 (1922) (descr.).

Lectotype : Alsine verna (L.) Wahlb. (≡ M. verna (L.) Hiern, 1899) - cf. Boissier, Fl. Orient. 1 : 670 (1867).

Other species names (cf. also lists in Mattfeld, 1922 and Graebner, 1918)

M. decandra (Reichb.) Fritsch (1909)

?M. facchinii (Reibh.) Fritsch (1909)

M. oxypetala (Woloszcz.) Kulcz. (1921)

M. parvulorum Rech.f. (1951)

M. rubella (Wahlb.) Hiern (1899)

M. zarecznyi (Zapal.) Klokov (1952)

M. attica (Böiss. & Sprun.) Vierh. (1914)

A section comprising one highly polymorphic species complex widely distributed throughout Eurasia and North America and extending southward onto the mountains of the Mediterranean region. There are probably at least four, and not more than ten, good species in the group.

Having illegitimately applied the name Tryphane to the Section Plurinerviae (cf. p. 177), Mattfeld coined the new name Polymechana

for this section; the name Tryphane must be regarded however as typified by M. verna, and so must be restored to this group.

H. Sectio Alsinanthe (Fenzl) Graebner in Ascherson & Graebner, Syn. Mitt.-Eur. Fl. 5 (1) : 771 (1918).

Syn.: Alsine ll. Alsinanthe Fenzl in Endlicher, Gen. Pl. 965 (1840), non Alsinanthus Desr. (1816).

Alsinanthe (Fenzl) Reichb., Repert. Herb. Nomencl. 205 (Jul. 1841); Ic. Fl. Germ. 5 : 29 t.209 (1841).

Alsine Sect. Alsinanthe (Fenzl) Fenzl in Ledeb., Fl. Ross. 1 : 356 (1842).

Lectotype : M. stricta (Sw.) Hiern in J. Bot. Lond. 37 : 320 (1899), non Arenaria stricta Michx.

Other species :

M. elegans (Cham. & Schlecht.) Schischk. (1936)

M. rolfii Nannfeldt (1954) (≡ M. rossii auctt, non (R. Br.) Graebn.)

M. rossii (R. Br.) Graebn. (1918) (= M. stricta)

A section of two or three species with a pan-Arctic distribution, but occurring in the Alps and on the mountains of C. Asia.

Special reference : Nannfeldt (1954).

J. Sectio Uninerviae (Fenzl) Mattf. in Bot. Jb. 57 Beibl. 126 : 28 (1921).

Syn.: Alsine 12. Uninerviae Fenzl in Endlicher, Gen. Pl. 965 (1840).

"Mononeuria" Reichb., Repert. Herb. Nomecnl. 205 (1841) (nomen) (baionom. non indic.)

?Alsine m. "Alsinocarpus" Endlicher, Enchir. 505 (1843) (nomen) (basionom. non indic.)

Lectotype : M. patula (Michx.) Mattf. l.c. (1921) (Series Patulae Mattf. l.c. (nomen); in Fedde Rep. Beih. 15 : 16 (1922) (diagn. in clave).

Other species :

M. brevifolia (Nutt.) Mattf. (1921) (= M. uniflora fide Maguire, 1951) (Series Groenlandicae Mattf. l.c. 1921, 1922)

M. glabra (Michx.) Mattf. (1921) (Series Groenlandicae)

M. groenlandica (Retz) Osterf. (1920) (Series Groenlandicae)

M. drummondii McNeill* (≡ M. nuttallii (Torr. & Gray) Mattf.) (Series Groenlandicae)

* M. drummondii McNeill, nom. nov. : Stellaria nuttallii Torrey et Gray, Fl. N. Amer. 1 : 183 (1838).
Cet. syn.:
"Alsine drummondii" Fenzl ined.; Torrey & Gray, Fl. N. Amer. 1 : 675 (1840), pro syn.
Alsine nuttallii (Torr. & Gray) Gray, Gen. Pl. U.S. 2 : 34 (1842).
Alsinopsis nuttallii (Torr. & Gray) Small, Fl. S.-E. U.S. 420 (1903).
Minuartia nuttallii (Torr. & Gray) Mattf. in Bot. Jb. 57 Beibl. 126 : 28 (1921), non (Pax) Briquet (1911).
Arenaria nuttallii (Torr. & Gray) Stemen & Myers, Oklahoma Fl. 140 (1937), non Pax (1893).

M. uniflora (Walt.) Mattf. (1921) (Series Uniflora Mattf. l.c. 1921, 1922).

?Arenaria muriculata Maguire (1951) (aff. M. patula).

An eastern North American section, extending to Greenland, comprising about six annual species.

K. Sectio Greniera (Gay) Mattf. in Bot. Jb. 57 Beibl. 126 : 27 (1921).

Syn.: Greniera J. Gay in Ann. Sci. Nat. ser.3 4 : 27 (1845).

Lectotype: M. douglasii (Fenzl) Mattf. l.c. 1921 (≡ Alsine douglasii Fenzl in Torrey & Gray, Fl. N. Amer. 1 : 674 (1840)) (cf. Mattfeld l.c.).

Other species : M. howellii (Wats.) Mattf. (1921).

Excluded species :

Greniera tenella (Nutt.) Torrey (1858) (Minuartia Section Sabulina Series Sabulina)

A section comprising two annual species confined to western North America.

L. Sectio Minuartia

Syn.: Alsine § 5. Minuartiae * Perennes Boiss., Fl. Orient. 1 : 679 (1867) (= Series Leucocephalae & Setaceae) (nom. subnud.).

Alsine § 5. Minuartiae ** Annuae Boiss. l.c. 681 (1867) (= Subsect. Minuartia & Subsect. Xeralsine Series Campestres & Xeralsine).

Minuartia §§ Euminuartia * Annuae (Boiss.) Graebn. in Aschers. & Graebn., Syn. Mitt.-Eur. Fl. 5(1) : 710 (1918).

Minuartia §§ Euminuartia ** Perennes (Boiss.) Graebn. l.c. (1918).

a. Subsectio Minuartia

(i). Series Montanae Mattf. in Bot. Jb. 57 Beibl. 126 : 29 (1921) (nomen); in Fedde Rep. Beih. 15 : 53 (1922) (diagn. in clave).

Lectotype : M. montana L., Sp. Pl. 90 (1753).

Other species :

M. decipiens (Fenzl) Bornm. (1914)

M. globulosa (Labill.) Schinz & Thell. (1907)

M. intermedia (Boiss.) Hand.-Mzt. (1912)

M. meyeri (Boiss.) Bornm. (1910).

M. multinervis (Boiss.) Bornm. (1915)

M. sandwithii Maire & Simpson (1949)

M. sintenisii (Lindb.) Rech.f. (1951)

A series of eight xerophytic annual species centred in the

Eastern Mediterranean region but extending eastward to northern India and occurring in Spain and W.N. Africa (a subsp. of M. montana).

(ii). Series Minuartia

Syn.: Queria L., Sp. Pl. 90 (1753): Gen. Pl. ed.5 100 (1754).
Minuartia Sect. Euminuartia Series Hispanicae Mattf. l.l.c. (1921, 1922).

Species :

M. dichotoma L. (1753) (type) (≡ M. hispanica sec Mattf.)

M. hamata (Hausskn.) Mattf. (1921) (= Queria hispanica L.)

M. sclerantha (Fisch. & Mey.) Thell. (1912)

The type series comprises the three most highly specialised annual members of the genus, all native in the Mediterranean region. M. hamata with its recurved fruiting bracts has a very distinctive facies and is often maintained in a separate monotypic genus (Queria hispanica). In fact, as Mattfeld (1922 p.69) has pointed out, it is merely a reduced derivative of Minuartia and is very close to M. dichotoma the type species of the genus. For fuller discussion of this and of the nomenclature of the species of the series cf. pp. 570 -573.

b. Subsectio Xeralsine (Fourr.) McNeill, comb. et stat. nov.

Syn.: Xeralsine Fourr. in Ann. Soc. Linn. Lyon ser. 2 16 : 347 (1868).

Lectotype : M. fasciculata (L.) Reichb, Ic. Fl. Germ. 5 : 28 (1841) (≡ Xeralsine fasciculata (L.) Fourr. l.c.).

(i). Series Leucocephalae Mattf. in Bot. Jb. 57 Beibl. 126 : 30 (1921) (nomen); in Fedde Rep. Beih. 15 : 54 (1922) (diagn. in clave).

Type : M. leucocephala (Boiss.) Mattf. l.c. (1921).

A series of one perennial species on the Taurus mountains in Turkey.

(ii). Series Setaceae Mattf. l.l.c. (1921, 1922

Syn.: Chetropis 7).

Lectotype : M. setacea (Thuill.) Hayek, Fl. Steierm. 1 : 271 (1908).

Other species (& species names) :

M. abchasica Schischk. (1937)
M. adenotricha Schischk. (1937)
M. anatolica (Boiss.) Woronow (1914)
M. antilibanotica McNeill
M. aucta Klokov (1947)
M. bosniaca (Beck) Maly (1908)
M. buschiana Schischk. (1936)

M. confusa (Boiss.) Maire & Petitm. (1908)

M. corymbulosa (Boiss. & Bal.) McNeill

M. erythrosepala (Boiss.) Hand.-Mzt. (1912)

M. filifolia (Forsk.) Mattf. (1921)

M. granuliflora (Fenzl) Grossh. (1930)

M. krascheninnikovia Schischk. (1937)

M. lanuginosa (Coste) Braun-Blanquet (1931)

M. leiosperma Klokov (1937)

M. leucocephaloides (Bornm.) Bornm. (1915)

M. libanotica (Boiss.) Bornm. (1914)

M. micrantha Schischk. (1936)

M. mutabilis (Lapeyr.) Schinz. & Thell. (??)

M. rostrata (Pers.) Reichb. (1842)

M. stereoneura Mattf. (1922)

M. tchihatcheffii (Boiss.) Hand.-Mzt. (1912)

M. tenuissima (Pomel) Mattf. (1922)

M. thyraica Klokov (1947)

M. woronowii Schischk. (1936)

A series of about eighteen perennial species in C. Europe and the Mediterranean region (incl. Anatolia and the Caucasus).

(iii). Series Xeralsine

Syn.: Minuartia Sect. Euminuartia Series Fasciculatae Mattf. l.l.c. (1921,1922).

Species :

M. fasciculata (L.) Reichb. (1842) quoad basionom. (≡ M.f. (L.) Hiern, 1899) (type)

M. funkii (Jord.) Graebn. (1918)

M. glomerata (M.B.) Degen (1910)

Excluded species :

M. urumiensis (Bornm.) Bornm. (Section & Series Sabulina)

A series of three usually biennial species on the mountains of Southern Europe, extending into N. Africa.

(iv). Series Campestres Mattf. in Fedde Rep. Beih. 15 : 54 (1922) (in clave).

Type : M. campestris L., Sp. Pl. 89 (1753).

A series of one annual species in Spain and North Africa.

M. Sectio Sabulina (Reichb.) Graebn. in Aschers. & Graebn., Syn. Mitt.-Eur. Fl. 5(1) : 700 (1918).

Syn. : Sabulina Reichb., Fl. Germ. Excurs. 785 (1832), pro parte.

Alsine l. Sabulina (Reichb.) Fenzl in Endlicher, Gen. Pl. 964 (1840) ("Sabulineae").

Alsine Sect. Sabulina (Reichb.) Fenzl in Ledeb., Fl. Ross. 1 : 342 (1842) ("Sabulineae")

Lectotype : Minuartia tenuifolia (L.) Hiern. in J. Bot. Lond. 37 : 321 (1889), non Nees ex Mart. (cf. Fenzl in Endlicher l.c.)

(i). Series Sabulina

Syn.: Minuartia Sect. Sabulina Series Tenuifoliae Mattf. in Bot. Jb. 57 Beibl. 126 : 28 (1921) (nomen); in Fedde Rep. Beih. 15 : (1922) diagn. in clave).

Species (& species names) :

M. bilykiana Klokov (1952)

M. birjuczensis Klokov (1947).

?M. densiflora (Vis.) Fritsch (1909)

M. hybrida (Vill.) Schischk. (1936) (incl. M. tenuifolia (L.) Hiern (1899) - type)

M. hypanica Klokov (1947)

M. mediterranea (Ledeb.) Maly (1908)

M. piskunovii Klokov (1952)

M. regeliana (Trautv.) Mattf. (1921)

M. subtilis (Fenzl) Hand.-Mzt. (1912).

M. thymifolia (Sibth. & Sm.) Bornm. (1914).

M. urumiensis (Bornm.) Bornm. (1915).

M. viscosa (Schreb.) Schinz. Thell. (1907).

M. washingtonia McNeill* (≡ M. tenella (Nutt.) Mattf.)

A series of nine or ten annual species centred in S. Europe and The Mediterranean area but with one species in North America. The

* M. washingtonia McNeill, nom. nov. : Arenaria tenella Nutt. in Torrey & Gray, Fl. N. Amer. 1 : 179 (1838), non Kit. in Schultes (1814), nec Duthie ex Williams (1898) (nec Turcz ex Steud. 1840, in syn.).

Cet. syn.:
Alsine temuifolia "americana" Fenzl ined; in Torrey & Gray l.c. 674 (1840), pro syn.
Greniera tenella (Nutt.) Torrey in Emory, Rep. U.S. & Mex. Bound. Surv. 2 : 36 (1858), non (Schur.) Fuss (1866), nec Sabulina tenella Schur. (1859).

European and Orient forms are highly polymorphic and many named taxa have been described (cf. Enumeration of Orient Species pp.633 - 687).

(ii). Series Californicae Mattf. ll.c. (1921, 1922).

Syn.: Alsine 9. Saginella Fenzl in Endlicher, Gen. Pl. 964 (1840).
Saginella (Fenzl) Reichb., Repert. Herb. Nomencl. 205 (1841).
Alsine Sect. Saginella (Fenzl) Fenzl in Ledeb., Fl. Ross. 1 : 356 (1842) ("Saginellae")

Type : M. californica (Gray) Mattf. l.c. (1921).

Other species :

M. acutiflora (Fenzl) Mattf. (1921)

M. pusilla (Wats.) Mattf. (1921), non Schischk. (1936)

A series of three annual species, two in California and one in Chile.

The genus Minuartia as a whole comprises 115 to 130 species, distributed throughout the Northern Hemisphere and with one species native in Chile.

Evolution from mesophytic perennial types has proceeded in two main directions: towards xerophytic perennial groups such as Section Sclerophyllae and some species of Sections Lanceolatae and Acutiflorae, and towards annual groups such as Section Sabulina chiefly in the Old World and Sections Uninerviae and Greniera in the New. Mattfeld's interpretation of these annual groups as being primitive cannot be accepted, and the present order of Sections and Series consequently represents a considerable change from his arrangement.

7. Lepyrodiclis Fenzl

Lepyrodiclis Fenzl in Endlicher, Gen. Pl. 966 (1840);
Pax & Hoffmann in Engler & Harms, Naturl. Pflanzenfam. ed. 2. 16c : 333 (1934).

Syn.: Arenaria Subgenus vel Sectio Lepyrodiclis (Fenzl) Bentham in Bentham & Hooker, Gen. Pl. 1 : 150 (1862).
Arenaria Sect. Lepyrodiclis (Fenzl) Edgeworth & Hooker in Hooker, Fl. Brit. Ind. 1 : 241 (1874).

Type : L. holosteoides (C.A. Mey.) Fenzl ex Fisch. & Mey., Enum. Pl. nov. Schrenk 1 : 110 & 93 (1841) (: Gouffeia holosteoides C.A. Mey.).

Other species and specific names :

L. cerastioides Kar. & Kir. (1842), non Stapf, nec Arenaria cerastioides Poir., nec Pers. (= L. stellarioides cf. p. 690).

L. cerastioides Stapf (1886), non Kar. & Kir., nec Arenaria cerastioides Poir., nec Pers. (= L. stellarioides cf. p. 690).

L. stellarioides Schrenk ex Fisch. & Mey.

L. tenera Boiss.

Excluded species :

L. giraldii Diels ≡ Arenaria giraldii (Diels) Mattf. (Subgenus Odontostemma)

L. paniculata Stapf (Ar. holosteoides § paniculata (Stapf) Wms.) = Stellaria kotschyana Fenzl ex Boiss.

L. quadridentata Maxim. ≡ Arenaria quadridentata (Maxim.) Williams

(Subgenus Odontostemma).

A genus of three species extending across Asia from Eastern Turkey and the Caucasus to western Tibet and the western Himalayas. (cf. fig. 6).

Special reference : Wagenitz (1956).

III CRITICAL REVISION OF ORIENT SPECIES

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1. Introduction

As has already been noted, the region covered by Boissier's "Flora Orientalis" is one of the major centres of diversity of both Arenaria and Minuartia. Apart from the two general revisions of these genera (Williams, (Arenaria) 1898, Mattfeld (Minuartia) 1922), no full account of the species has been published since Boissier's treatment (1867), and in that time extensive botanical exploration has taken place and many new taxa have been described.

The present work covers an area rather more restricted than that of Boissier's, in that it excludes Albania and the Dalmatian coast on the one hand and Afghanistan on the other. It was felt that the inclusion of the former would introduce too much of a European element not represented elsewhere in the region, while the flora of Afghanistan, at least in this group, shows more affinity with that of N.W. Pakistan and Central Asia than it does with Iran and the countries to the west. Although its inclusion might have been desirable, the Crimea has also been omitted because of the paucity of the available material. One extension of Boissier's limits is made; this is the inclusion of Cyrenaica with its East Mediterranean phytogeographical affinities. The southern limit of the area (in N.E. Africa and Arabia) has been taken along the 25° line of latitude. (cf. fig. 7)

The following countries are therefore covered in this revision: Greece, Turkey, U.S.S.R. - Caucasus, Cyprus, Syria, Lebanon, Israel, Jordan, Iraq, Kuwait etc., Iran, Libya - Cyrenaica, south to 25° N., Egypt (south to 25° N.), Saudi Arabia (south to 25° N.). No records of members of the group are, however, known from Kuwait or the parts of Saudi Arabia north of the 25th Parallel (Minuartia filifolia occurs on the mountains in the South-west and in the Yemen).

Zohary (in an unpublished map) recognises within the region (excluding the Caucasus and Greece) twelve different vegetation types. These, however, include a number of transitional zones and subdivisions of more general types; omitting and uniting these, it is possible to regard the region as comprising five main phytogeographical areas:-

1) Along the southern coasts of the Black Sea and Caspian Sea and on most of the Caucasus mountain range, all areas of high rainfall, there is extensive mesophytic evergreen forest often dominated by Fagus orientalis. This forms the Hyrcano-Colchic phytogeographical region which in Turkey and Iran consists of a narrow zone, passing rather abruptly into the Irano-Turanian vegetation to the south.

2) The mountains of Northern and Central Greece are drier and their vegetation represents an extension southward of the Central European type closely allied to that of Atlantic Europe; here the place of Fagus orientalis is taken by F. sylvatica.

3) The coastlands of Greece, west and south Turkey, the Levant south to Israel and Cyrenaica, as well as the whole of Crete, Cyprus and the Aegean Islands, possess in the main a true Mediterranean flora with Pinus brutia, Quercus coccifera and Maquis vegetation abundant. Enclaves of Mediterranean vegetation occur elsewhere, particularly within the Hyrcano-Colchic region of northern Turkey.

4) Hyrcano-Colchic and Mediterranean vegetation are both replaced further inland by the Irano-Turanian phytogeographical region which stretches across Central and Eastern Anatolia and Iran and extends southwards into Syria, Iraq and Jordan. In Central and Eastern Anatolia and on the Iranian mountains this generally takes the form of "mountain steppe" vegetation, with scrub oak and juniper, though on the high mountains of Turkish Armenia and Kurdistan, altitudinal stratification reflecting trends otherwise associated with latitude, permits an admixture with some Caucasian elements. The lower ground in Southern Turkey (Turkish Mesopotamia), Syria, and the Irano-Turanian parts of Iraq and Jordan support a more herbaceous type of vegetation often represented by Artemisia steppe. This is distributed in Iraq and Jordan generally south to about 32° N., but extends further south as a narrow strip in Jordan (towards Petra) and occurs again from Gaza to Jerusalem, east and south of the Mediterranean areas of Israel.

5) Most of the region south of 32° N. falls however into the Saharo-Sindian region of desert vegetation with a higher winter temperature

and this extends throughout Saudi Arabia, Kuwait, Egypt and Cyrenaica, except on the higher ground. Shrubby Chenopodiaceae (e.g. Arabis articulata) are frequently dominant though considerable areas are bare of vegetation. This is the region of Date palm cultivation. Species of Arenaria and Minuartia etc. are normally absent from Saharo-Sindian vegetation, the only known exception being Minuartia picta, which however is still essentially an Irano-Turanian species. The steppes and deserts of central and eastern Iran have yet to be studied phytogeographically, but it would appear that this is largely a Saharo-Sindian region with Irano-Turanian vegetation on the higher ground.

The main centres of speciation in the group are in the European, Mediterranean and Irano-Turanian areas, particularly the last named in which Arenaria Subgenus Eremogone and many groups of Minuartia reach their greatest development. Both genera are well represented in the mountains of Northern Greece and the Caucasus by plants with strong Central European affinities, while the Mediterranean region is characterised by Arenaria Section Orientales and Minuartia Section Sabulina. The two species of Moehringia are confined to what are in the main, European or Hyrcano-Colchic areas, while Lepyrodiclis is widely distributed in damp places in the Irano-Turanian zone.

The pattern of variability within the group varies widely; on the one hand there are a number of very distinct restricted endemic species showing little variation (typical of Minuartia Subsection Minuartia and most groups of Arenaria Subgenus Arenaria), while on the other hand at

least seven large species complexes exist within the area, all rather difficult to classify.

Two of the most complex are Arenaria Series Orientales and Minuartia Series Sabulina, both annual groups in which self-pollination is probably the rule (cf. Fryxell, 1957). Most perennial species are probably pollinated by unspecialised insect visitors, but in some of the 'difficult' ones, it seems that the nature of the breeding system is to some extent responsible for the taxonomic complexity. In Minuartia Series Setaceae, for example, a high incidence of male sterility has been noted, suggesting extensive hybridisation or even apomixis (being often associated with normal seed-setting) (cf. p. 606).

It has not been possible to obtain seed after self-pollination of species of Arenaria Sections Sclerophyllae and Grandiflorae (both perennial) in cultivation, but as no plants were available for parallel cross-pollination, there is no evidence as to whether this failure was due to internal self-sterility or merely to environmental conditions unfavourable to seed-setting. The self-pollinated annual species of both Arenaria and Minuartia, on the other hand, set seed very freely in cultivation.

In the course of the revision material has been examined from eleven European herbaria (cf. p.14), but the work has been primarily based on the collections at Edinburgh and Kew. In the citation of specimens, where no herbarium abbreviation is given, the gathering is represented at either Edinburgh or Kew (or both), but in other cases the herbarium

in which a sheet has been seen is indicated by the standard abbreviation* (cf. 'Index Herbariorum' part 1. ed.4., 1959). Two special abbreviations are also used : W-H and W-R for the Halácsy and Rechinger collections respectively, stored separately at the Naturhistorisches Museum, Vienna (Wien).

In order to make the distribution of each taxon more immediately apparent from the citation of specimens, these are arranged under headings of country and region within country. The former follow current (1959) political boundaries and the latter are generally based on modern administrative provinces, but for phytogeographical reasons it is frequently necessary to make considerable modifications. For general convenience, the size of the subdivisions of country tends to be inversely proportional to the number of specimens seen. Thus the small administrative provinces used in Cyprus are very different in extent from the fourteen large areas into which Iran is divided.

The divisions of each country are defined as follows (cf. also figs. 8 - 14):-

* For the Herbaria consulted, or from which loans were obtained, the abbreviations are briefly as follows:-

BM	-	British Museum	OXF	-	Oxford, Botany Dept.
E	-	Edinburgh	P	-	Paris
G	-	Geneva	PRC	-	Charles University, Prague
JE	-	Jena	S	-	Stockholm
K	-	Kew	TO	-	Turin
MANCH	-	Manchester Museum	W	-	Vienna Museum
			WU	-	Vienna University

GREECE (reference maps: The Times Atlas of the World Mid-Cent. Edition vol.4, 1956; The Oxford Atlas, 1952).

	Administrative Province	
1.	Ionian Islands	Ionioi Nisoi
2.	Epirus	Ipiros
3.	Macedonia	Makedhonia (incl. Thasos)
4.	Thrace	Thraki (incl. Samothraki)
5.	Thessaly	Thessalia (incl. Voriai Sporadhes - Northern Sporades)
6.	Central Greece	Sterea Ellas, incl. Evvoia (Euboea), & Skiros but excl. Kithira (Cerigo).
7.	Peloponnese	Pelopponnisos and Kithira (Cerigo) (in Sterea Ellas).
8.	Aegean Islands	Aigaion Nisoi (all islands excluding groups mentioned under other districts).
9.	Crete	Kriti

TURKEY (reference maps: Prof. Faik Sabri Duran map of Turkey (Türkiye) Istanbul c.1956; The Oxford Atlas, 1952).

	Vilayets (provinces)	
1.	Pontus	Çoruh; Trabzon; Giresun; Ordu.
2.	Paphlagonia	Samsun; Sinop; Kastomonu.
3.	Bithynia	Zonguldak; Bolu; Adapazari; Koçaeli (İzmit); İstanbul (Asian); Bursa; Bilecik.

4.	Thracia	All of European Turkey:- Kirklareli; İstanbul (European); Tekirdağ; Edirne; Çanakkale (European).
5.	Mysia	Çanakkale (Asian); Balikesir.
6.	Lydia	İzmir; Manisa.
7.	Caria	Aydin; Denizli; Muğla excl. distr. Fethiye (i.e. West of R. Dalaman).
8.	Lycia	Muğla distr. Fethiye (cf. above); Antalya (west of a line N.N.W. of Antalya to the point where the border with Burdur turns from E.S.E. to E.N.E.).
9.	Pamphylia	Antalya (eastern part - cf. above)
10.	Cilicia	Konya distr. Ermenek (region south of a line drawn between the points in the Isaurian Taurus where the boundary of Konya turns ± due south); İçel (Mersin); Seyhan (Adana), southern part (i.e. south and west of distrs. Feke and Bahçe - cf. under Cataonia and Amanus).
11.	Amanus	Hatay; Seyhan (Adana) distr. Bahçe (i.e. east of a line running ± N.E. from the coast of Hatay - Adana boundary to the point where the R. Ceyhan crosses the border with Maras and where the border turns from S. to E.)
12.	Phrygia	Kutahya; Eskişehir; Afyonkarahisar.
13.	Pisidia	Burdur; Isparta; Konya distr. Beyşehir (i.e. west of of a line drawn just E. of S. from Beyşehir to the

		point where the border with Antalya turns from E. to S.).
14.	Lycaonia	Konya excl. distrs. Beyşehir & Ermenek (cf. under Pisidia & Cilicia, above).
15.	Galatia	Ankara; Çankiri; Çorum; Amasya; Tokat.
16.	Cappadocia	Niğde; Nevşehir;* Yozgat; Sivas; Kayseri.
17.	Cataonia	Malatya; Maraş; Seyhan (Adana) distr. Feke (i.e. region north of a line drawn E.S.E. from the point where the 35° N. (Long.) line crosses the border with Niğde to point where the R. Ceyhan crosses the border with Maras, and where the border turns from S. to E.)
18.	South-west Armenia	Erzincan; Tunceli (Kalan); Elazig; Bingol.
19.	North-east Armenia	Gümüşane; Erzurum; Kars; Ağri (Karakose); Mus.
20.	Kurdistan	Bitlis; Siirt; Van; Hakâri.
21.	Mesopotamia (i.e. incl. Commagene)	Gaziantep; Urfa; Diyarbakir; Mardin.

* In earlier editions of Duran's map and in The Oxford Atlas, older boundaries are given in which Nevşehir does not appear. It is formed from parts of Niğde & Kayseri along with the southern half of the old vilayet of Kirşehir which now disappears. The eastern & northern parts of Kirşehir are attached to Ankara (Galatia) & Yozgat (Cappadocia) respectively.

U.S.S.R. (reference map: The Oxford Atlas, 1952)

	S.S.R. & provinces
1. Ciscaucasia	Russia: Krasnodar; Adygei; Stravopol; Cherkessk; Groznyy.
2. Kabardino	Russia: Kabardino; N. Osetia
3. Daghestan	Russia: Daghestan
4. Georgia	Georgia.
5. Armenia	Armenia; Azerbaijan: Nakhichevan autonomous district
6. Azerbaijan	Azerbaijan (excl. Nakhichevan)

CYPRUS (reference map: Administrative Map of Cyprus. Land Registration & Survey Dept., Cyprus, 1952)

The six administrative areas are followed without modification:-

1) Kyrenia; 2) Famagusta; 3) Nicosia; 4) Larnaka; 5) Paphos; 6) Limassol.

SYRIA (reference map: The Oxford Atlas, 1952)

The eight provinces are followed without modification:-

1) Aleppo; 2) Deir ez Zor; 3) Latakia; 4) Hama; 5) Homs; 6) Damascus; 7) Hauran; 8) Jebel Druz.

LEBANON The country is arbitrarily divided into three districts as follows:-

1) North Lebanon	Region North of the Beirut-Riyaq - Damascus railway and west of the line of the R. Litani and Nahr el Assi.
2) Antilebanon	North of the Beirut-Damascus railway as above, and east of the Litani - Nahr el Assi line.
3) South Lebanon	Region south of the Beirut-Damascus railway.

ISRAEL:- The country is arbitrarily divided into three districts as follows:-

1. Galilee	Region north of a line drawn from the sea at Haifa (mouth of R. Qishon) S.E. to the point where the border with Jordan (1959) turns from N.E. to E.S.E.
2. Central Israel	Region south of "Galilee" & north of the "Negev" (q.v.)
3. Negev	Region south of a line drawn from the point where the 'Gaza strip' (Egypt) boundary turns S.W., E S.E. to the point where the border with Jordan turns from S. to E.N.E.

JORDAN: The country is arbitrarily divided into five districts as follows:-

1. Cisjordania	Entire area west of the R. Jordan and the Dead Sea.
2. Gilead	Region north of a line drawn from the mouth of the R. Jordan (Dead Sea) ± E.N.E. to the point south of the Jebel Druz where the border with Syria turns from E.S.E. to ± E.N.E.
3. Moab	Region bounded to the north by Gilead (q.v.), to the east by the Eastern Desert (q.v.), to the west by the Dead Sea and to the south by Wadi el Hasa from the Dead Sea to the Amman-Ma'an railway, thereafter by a line drawn due east to the Eastern Desert (q.v.).
4. Edom	Region south of Moab (q.v.) and east of the Eastern Desert (q.v.)
5. Eastern Desert	Entire area east of line drawn ± S.S.W. from the point where the Syrian border turns from E.S.E. to ± E.N.E. to the point near 36° E. (Long.) where the (undemarcated) border with Saudi Arabia turns from E.S.E. to E.N.E.

IRAQ (reference map - The Oxford Atlas, 1952) The liwa (province) boundaries have been followed except for the definition of the Desert

regions as being the area west and south of a line drawn from the point where the Euphrates crosses the border with Syria, S.E. to the point where the border with Kuwait crosses the 30° N. line of Latitude. The 'Western Desert' is divided from the 'Southern Desert' by a prolongation of the part of the border with Saudi Arabia running ± due North (i.e. near 43° 30' E.). Some of the liwas have been taken together, as follows:-

1. Mosul; 2. Erbil; 3. Kirkuk & Sulaimaniya; 4. Dulaim; 5. Baghdad & Diyala; 6. Western Desert; 7. Central Iraq (Karbala, Kut & Diwaniya); 8. Southern Desert; 9. Estuary (Muntafiq, Amara, Basra).

KUWAIT (including neutral territories).

IRAN (reference map - Master Joint Fund Operations map of Iran, 2nd revised edition - Tehran 22.1.1956 including (new) Ostan (administrative division) boundaries as at 24.9.1955) The fourteen subdivisions recognised for the citation of specimens are based on the Ostan boundaries and their constituent Shahrestans.

	Ostans	Ostans & Shahrestans
1.	Azerbaijan	Azerbaijan (all)
2.	Kordestan & Zanjan	Kordestan (all); Lorestan, Bijar; Rasht, Zanjan.
3.	Caspian Sea	Rasht (excl. Zanjan); Mazanderan (excl. Kashan,

		Semnan, Damghan & Shahrud)
4.	Lorestan	Lorestan, Kermanshah, Shahabad & Ilam; Ahwaz, Korramabad.
5.	Northern Zagros	Lorestan, Hamadan, Tusergan, Malayer & Nahavand; Ahwaz, Borujerd & Golpayegan; Tehran, Mahallat; Arak (all).
6.	Tehran	Tehran (excl. Mahallat).
7.	Central Desert	Mazanderan, Kashan, Semnan, Damaghan & Shahrud; Esfahan, Ardestan & Nain; Khorasan, Kashmar & Sabzevar.
8.	Eastern Khorasan	Khorasan (excl. Ferdows, Kashmar & Sabzevar).
9.	Ahwaz	Ahwaz (excl. Korramabad, Borujerd & Golpayegan).
10.	Southern Zagros	Bakhtiari (all); Esfahan (excl. Ardestan, Nain & Yazd); Beybahan (all).
11.	Fars	Fars (all).
12.	Kerman & Yazd	Kerman (all); Esfahan, Yazd.
13.	Baluchestan	Baluchestan (all).
14.	Persian Gulf	Bushehr (all); Bandar-Abbas (all).

LIBYA (reference maps - The Times Atlas of the World Mid-Cent. Edition Vol. 4, 1956 ; The Oxford Atlas, 1952) The administrative boundary of Cyrenaica is followed south to the 25th parallel

EGYPT (reference maps - cf. Libya)

1. Lower Egypt — Region west of the Suez Canal & north of 25° N. line of Latitude.

2. Sinai — Region east of the Suez canal.

SAUDI ARABIA - not subdivided (but area south of 25° N. line of Latitude not included).

In the citation of specimens the following procedure is adopted: The locality is given first, (preceded by the province or district where necessary) followed by the name of the collector and the number of the gathering, where such exists. If the specimen is unnumbered the date of collection is given (as exactly as possible) instead; in the case of those collectors who are known to have more than one numbered series, the year of collection is placed in brackets before the collection number. Where a number of gatherings have been made in the same locality any details relating to one particular specimen (e.g. altitude or nearby village) are placed in brackets after the collectors name and number. Misidentifications are only noted in important (i.e. widely distributed) exsiccata; names listed in the synonymy are not usually referred to as misidentifications in the cited specimens, unless a particular gathering represents the type of the synonym. A question mark preceding the locality indicates that although it probably lies in the subdivision

of the country indicated, it has not been possible to check its exact position; a similar mark in brackets after the locality or after a particular word indicates doubt as to the spelling of the place-name etc. Localities which have not been traced at all are listed as ?? after the country to which they refer. No taxonomic doubt attaches to any specimen seen, except as indicated by phrases such as "approaches subsp. -----".

The use of the exclamation mark (!) before the names in the synonymy indicates that type material of that synonym has been examined; where the mark is enclosed in brackets, only a photograph of the type has been seen. The synonymy is confined in general to names which have been used for Orient plants, but an attempt has been made to include all names based on the same type as the accepted name. Only the very important misidentifications appear in the synonymy, which is arranged in strict chronological order, the basionym where such exists taking its place according to date of publication.

2 Synopsis of Accepted Taxa

(New taxa and new combinations are underlined twice; Afghanistan species are inserted at appropriate numbers in the sequence).

Arenaria

Subgenus Arenaria

Section Rariflorae

1. A. antitaurica McNeill
   - (i). var. antitaurica
   - (ii). var. intermedia McNeill
2. A. uninervia McNeill
3. A. minutissima Rech.f. & Esfandiari
4. A. bulica Stapf
5. A. cretica Spreng.
   - (i). var. cretica
   - (ii). var. stygia Boiss. & Heldr.

Section Grandiflorae

6. A. kotschyana Fenzl
7. A. tmolea Boiss.
   - (i). var. tmolea
   - (ii). var. stenophylla (Bornm.) McNeill

Section Rotundifoliae

8. A. balansae Boiss.
   - (i). var. balansae
   - (ii). var. glaberrima (Fenzl) McNeill

9. A. rotundifolia M. Bieb. A. subsp. rotundifolia

B. subsp. pancicii (Degen & Baldacci) McNeill

(var. colchica Albow)

(var. flaccida Rupr.)

(9a. A. ovalifolia Somm. & Lev.)

(9b. A. orbiculata Edgew. & Hook. - Afghanistan)

Section Orientales Series Anomalae

10. A. speluncarum McNeill

11. A. sipylea Boiss.

12. A. libanotica Boiss.

13. A. angustifolia McNeill

Series Graecae

14. A. filicaulis Fenzl A. subsp. filicaulis

B. subsp. graeca (Boiss.) McNeill

C. subsp. euboica McNeill

15. A. teddii Turrill

Series Deflexae McNeill

16. A. deflexa Decaisne A. subsp. deflexa

B. subsp. pubescens McNeill

C. subsp. pseudofragillima McNeill

D. subsp. microsepala McNeill

17. A. fragillima Rech. f.

Series Orientales

18. A. luschanii McNeill

19. A. oxypetala Sibth. & Sm.

20. A. muralis (Link) Sieber ex Spreng.

21. A. rhodia Boiss.
    - A. subsp. rhodia
        - (i). var. rhodia
        - (ii). var. macropetala McNeill
    - B. subsp. cypria (Holmboe) McNeill

22. A. pamphylica Boiss. & Heldr.
    - A. subsp. pamphylica
        - (i). var pamphylica
        - (ii). var. maritima McNeill
        - (iii). var. alpestris McNeill
    - B. subsp. kyrenica McNeill
        - (i). var. kyrenica
        - (ii). var. turcica McNeill

23. A. kurdica McNeill

Section Pseudosabulina

24. A. sabulinea Grisebach ex Fenzl

Section Arenaria Series Arenaria

25. A. conferta Boiss.

26. A. serpyllifolia L.
    - (i). var. serpyllifolia
    - (ii). var. macrosepala Rech.f.

27. A. leptoclados Guss.

28. A. aegaea Rech.f.

29. A. cassia Boiss.

30. A. tremula Boiss.

Series Saponarioides

31. A. saponarioides Boiss. & Bal. A. subsp. saponarioides

B. subsp. boissieri (Pax) McNeill

32. A. macrosepala Boiss.

Series Cylindricae

33. A. guicciardii Heldr.

Section Compressae

(33a. A. trichotoma Royle ex Edgew. & Hook. - Afghanistan)

Subgenus Eremogone

Section Capillares

34. A. lychnidea M. Bieb.

Section Eremogone

35. A. graminea C.A. Mey

36. A. blepharophylla Boiss. (i). var. blepharophylla

(ii). var. parviflora (Fenzl) McNeill

37. A. isaurica Boiss.

Section Glomeriflorae

38. A. dianthoides J. E. Sm. (i) var. dianthoides

(ii). var. paniculata McNeill

39. A. cucubaloides J.E. Sm.

(var. confertiflora Bordz.)

40. A. gypsophiloides L. (i). var. gypsophiloides

(ii). var. glabra Fenzl

Section Rigidae

Series Holosteae

41. A. holostea M. Bieb. A. subsp. holostea

B. subsp. micrantha (Schischk.) McNeill

42. A. szowitsii Boiss.

Series Setaceae

43. A. angustisepala McNeill (i). var. angustisepala

(ii). var. glandulosa McNeill

Section Scariosae

Series Polycnemifoliae

44. A. pseudacantholimon Bornm.

45. A. polycnemifolia Boiss.

46. A. zargariana Parsa

Series Scariosae

47. A. armeniaca Boiss. (i). var. armeniaca

(ii). var. minor McNeill

48. A. scariosa Boiss.

Section Sclerophyllae

49. A. acerosa Boiss. (i). var. acerosa

(ii). var. glabra Boiss.

50. A. drypidea Boiss.

(50a. A. griffithii Boiss. - Afghanistan)

(50b. A. multiflora Gilli - Afghanistan)

51. A. ledebouriana Fenzl (i). var. ledebouriana

(ii). var. pauciflora McNeill

(iii). var. parviflora Boiss.

52. A. acutisepala Hausskn. ex Wms. (i). var. acutisepala

(ii). var. laxa McNeill

53. A. persica Boiss.

54. A. insignis Litwinow

(54a. A. calcicola Gilli - Afghanistan)

55. A. tetrasticha Boiss.

56. A. davisii McNeill

Moehringia

Section Latifoliae

1. M. trinervia (L.) Clairv.

2. M. pentandra J. Gay

Minuartia

Subgenus Rhodalsine

1. M. geniculata (Poir.) Thell.

Subgenus Spergella

2. M. formosa (Fenzl) Mattf. (i). var. formosa

(ii). var. glabra Oppenheim.

3. M. picta (Sibth. & Sm.) Bornm.

Subgenus Minuartia

Section Spectabiles Subsection Spectabiles

Series Laricinae

4. M. rhodocalyx (Albow) Woronow
5. M. trautvetteriana Sosnowsky & Kharadze
6. M. inamoena (C.A. Mey.) Woronow)
7. M. brotherana (Trautv.) Woronow
8. M. colchica Kharadze
9. M. imbricata (M. Bieb.) Woronow

Subsection Laricifoliae

Series Caucasicae

10. M. aizoides (Boiss.) Bornm.
11. M. circassica (Albow) Woronow

Series Laricifoliae

12. M. garckeana (Aschers. & Sint.) Mattf.
13. M. baldaccii (Hal.) Mattf. A. subsp. baldaccii

(B. & C. subsp. skutariensis & dorfleri in Albania etc.)

14. M. labillardierei Briquet

15. M. wettsteinii Dorfler ex Mattf.

Section Plurinerviae

16. M. hirsuta (M. Bieb.) Hand.-Mzt. A. subsp. falcata (Griseb.) Mattf.
(B. & C. subsp. hirsuta & frutescens in Crimea & N. Balkans)

17. M. curytanica (Boiss. & Heldr.) Hand.-Mzt.

18. M. juressi (Willd. ex Schlecht.) Lacaita A. subsp. asiatica McNeill
(i). var. asiatica
(ii). var. caespitosa McNeill
B. subsp. juressi

19. M. recurva (All.) Shinz & Thell. A. subsp. recurva
B. subsp. oreina (Mattf.) McNeill
C. subsp. carica McNeill

Section Lanceolatae Series Graminifoliae

20. M. saxifraga (Friv.) Graebn. (A. subsp. saxifraga in Bulgaria)
B. subsp. tmolea Mattf.

21. M. stellata (Clarke) Maire & Petitm. A. subsp. pseudosaxifraga Mattf.
B. subsp. stellata

Series Dianthifoliae

22. M. dianthifolia (Boiss.) Hand.-Mzt. A. subsp. dianthifolia
B. subsp. cataonica McNeill
C. subsp. kurdica McNeill

23. M. acuminata Turrill

24. M. pestalozzae (Boiss.) Bornm.

Section Acutiflorae Series Acutiflorae

25. M. bieberstеinii (Rupr.) Schischk.

(25a. M. kashmirica (Edgew.) Mattf. - Afghanistan)

(25b. M. afghanica Rech.f. - Afghanistan)

26. M. gracilis McNeill

27. M. aucheriana (Boiss.) Bornm.

28. M. lineata Bornm.

29. M. juniperina (L.) Maire & Petitm.

30. M. glandulosa (Boiss. & Huet) Bornm.

Series Pichleriae

31. M. pichleri (Boiss.) Maire & Petitm.

32. M. rimarum (Boiss. & Bal.) Mattf.
(i). var. rimarum
(ii). var. multiflora McNeill

Series Umbelluliferae

33. M. umbellulifera (Boiss.) McNeill
A. subsp. fimbriata McNeill
B. subsp. pontica (Bornm.) McNeill
C. subsp. salbacica McNeill
D. subsp. umbellulifera (i). umbellulifera
(ii). var. kurdica McNeill

Section Tryphane

34. M. parvulorum Rech. f.

35. M. attica (Boiss. & Sprun.) Vierh.

36. M. verna (L.) Hiern

Section Minuartia Subsection Minuartia

Series Montanae

37. M. multinervis (Boiss.) Bornm.

38. M. akinfijewii (Schmalh.) Woronow

39. M. meyeri (Boiss.) Bornm.

40. M. sandwithii Maire & Simpson

41. M. sintenisii (Lindb.) Rech. f.

42. M. globulosa (Labill.) Schinz & Thell.

43. M. montana L. (A. subsp. montana in West Mediterranean)

B. subsp. wiesneri (Stapf) McNeill

44. M. intermedia (Boiss.) Hand.-Mzt.

45. M. decipiens (Fenzl) Bornm. A. subsp. decipiens

B. subsp. damascena McNeill (i). var. damascena

(ii). var. persica McNeill

Series Minuartia

46. M. hamata (Hausskn.) Mattf.

47. M. sclerantha (Fisch. & Mey.) Thell.

Subsection Xeralsine

Series Leucocephalae

48. M. leucocephala (Boiss.) Mattf.

Series Xeralsine

49. M. setacea (Thuill.) Hayek
    ((i). var. setacea in C. & E. Europe)
    (ii). var. athoa (Griseb.) Hayek
    (iii). var. thracica McNeill

50. M. woronowii Schischk.

(50a. M. buschiana Schischk.)

51. M. micrantha Schischk.

52. M. tchihatchewii (Boiss.) Hand.-Mzt.

53. M. antilibanotica McNeill

54. M. anatolica (Boiss.) Woronow
    (i). var. anatolica
    (ii). var. arachnoidea McNeill
    (iii). var. lanuginosa McNeill
    (iv). var. tetrasticha McNeill
    (v). var. scleranthoides (Boiss. & Noë) McNeill
    (vi). var. phrygia (Bornm.) McNeill
    (vii). var. polymorpha McNeill

55. M. erythrosepala (Boiss.) Hand.-Mzt.
    (i). var. erythrosepala
    (ii). var. orientalis McNeill
    (iii). var. cappadocica (Boiss.) McNeill

(55a. M. granulifera (Fenzl) Grossh.)

(55b. M. abchasica Schischk.)

56. M. libanotica (Boiss.) Bornm.

57. M. corymbulosa (Boiss. & Bal.) McNeill (i). var. corymbulosa

(ii). var. gypsophiloides McNeill

(iii). var. breviflora (Boiss.) McNeill

58. M. leucocephaloides (Bornm.) Bornm.

59. M. confusa (Boiss.) Maire & Petitm.

Series Fasciculatae

60. M. glomerata (M.B.) Degen A. subsp. glomerata

B. subsp. macedonica (Degen & Dorfler) McNeill

Section Sabulina

Series Sabulina

61. M. thymifolia (Sibth. & Sm.) Bornm. (i). var. thymifolia

(ii). var. syriaca (Boiss.) McNeill

62. M. mesogitana (Boiss.) Hand.-Mzt. A. subsp. mesogitana

B. subsp. lydia (Boiss.) McNeill

(i). var. lydia

(ii). var. kotschyana (Boiss.) McNeill

(iii). var. turcomanica (Schischk.) McNeill

C. subsp. velenovskyi (Rohlena) McNeill

((i). var. velenovskyi in Montenegro)

(ii). var. orphanidis (Boiss.) McNeill

D. subsp. brachycarpa (Boiss. & Bal.) McNeill

E. subsp. macrocarpa McNeill

F. subsp. flaccida McNeill

63. M. subtilis (Fenzl) Hand.-Mzt. A. subsp. subtilis

B. subsp. filicaulis (Lindb.) McNeill

64. M. viscosa (Schreb.) Schinz & Thell.

65. M. hybrida (Vill.) Schischk. A. subsp. hybrida (i). var. hybrida

(ii). var. parviflora McNeill

(iii). var. palaestina McNeill

B. subsp. turcica McNeill

66. M. mediterranea (Ledeb.) Maly

67. M. regeliana (Trautv.) Mattf.

68. M. urumiensis (Bornm.) Bornm.

Lepyrodiclis

1. L. holosteoides (C.A. Mey) Fenzl ex Fisch. & Mey.

2. L. stellarioides Schrenk ex Fisch. & May.

(2a. L. tenera Boiss. - Afghanistan)

3. Critical Revision

Arenaria L.

Subgenus Arenaria

Section Rariflorae Williams

1a. Dwarf caespitose plants, flowering stems < 1cm. long; leaves very small, 1.5-4.5mm. long, sessile to very shortly petiolate; petals obovate or oblanceolate with a long cuneate base, 1.5-1.75 times as long as the sepals; sepals obtuse to acute:

2a. Leaves minute, < 3mm. long, ovate to lanceolate, 2-3(-3.5) times as long as broad; sepals c. 4.5mm. long
3. A. minutissima

2b. Leaves larger, 3-4.5mm. long, linear-lanceolate, 3.5-4 times as long as broad; sepals 3.5mm. long 4. A. bulica

1b. More robust caespitose or almost cushion-forming plants; flowering stems > 2cm. long; leaves 5-11mm. long:

3a. Leaves sessile but somewhat cuneate at the base; petals ovate 2-2.5 times as long as broad with a cuneate base, about 1.5 times as long as the sepals; sepals acute to acuminate, 3.5-4.5mm. long:

4a. Mature leaves linear-lanceolate to linear, 5-7 times as long as broad; vegetative shoots arising directly from the caudiculi, numerous, as many as the flowering shoots;

those arising in the leaf axils of the flowering shoots rarely beyond the developing rosette stage (2-4 leaves) at flowering time 1. A. antitaurica

4b. Mature leaves ovate-lanceolate, 3-4 times as long as broad; vegetative shoots arising directly from the caudiculi, few or absent, but those arising in the leaf axils of the flowering shoots often well-developed at flowering time 2. A. uninervia

3b. Leaves narrowed into a very short petiole; petals obovate to oblanceolate, 2.5-3.5 times as long as broad with a long attenuate base, about twice as long as the sepals; sepals obtuse to acute, 4-5mm. long 5. A. cretica

1. A. antitaurica McNeill, sp. nov.

Ab A. uninervia McNeill cui proxima, foliis multo angustioribus, ramulis sterilibus sub anthesi bene evolutis (1-2.5cm. longis) e caudiculis emergentibus distinguenda; in var. intermedia McNeill ad A. kotschyanam Fenzl sectionis Grandiflorae approximat, sed margine foliorum ut videtur evenuloso differt.

Herba perennis, pulvinata. Planta ex toto pilis brevibus

simplicibus vel glandulosis vestita. Caudex ± gracilis, 1.25-1.75mm. diam., in caudiculos fragiles numerosos foliis persistentibus mortuis superne praeditos transiens. Caudiculi 1-10cm. longi, ramulos steriles et floriferos abientes. Ramuli steriles sub anthesi 1-2.5cm. longi, inferne foliis 1-3-jugis ± remotis praediti, superne foliis 2-3-jugis rosulam formantibus. Ramuli floriferi ad 4cm. longi, in parte inferiore jugis foliorum 2-4 ± aequaliter disjunctis turiones novellos steriles e foliolis 2-4 fasciculatis compositos interdum subtendibus praediti. Folia vena mediana prominenti et per laminam venis multis tenuissimis anastamosantibus, eis ad marginem non validius evolutis; folia matura superiora 8-10mm. longa, lineari-lanceolata vel linearia, latitudine 5-7-plo longiora, sessilia, apice acuta vel etiam acuminata, Inflorescentia ad 2cm. longa, floribus 1-2 instructa; bracteae anguste triangulares, ad 3mm. longae, membranaceo-marginatae; pedicelli 5-15mm. longi. Sepala vena mediana prominenti ad apicem percurrens, 3.5-4mm. longa, in forma et textura gradatim inaequalia, venis lateralibus saepe 6 inconspicuis; sepalum extimum lanceolatum (latitudine 3-3.5-plo longius) acuminatum, leviter carinatum fere omino herbaceum; sepalum intimum ovatum (latitudine c. duplo longius), acutum vel acuminatum, ± prominente carinatum, herbaceum sed late membranaceo-marginatum, ad basim sub-coriaceum. Petala ovata vel ovato-lanceolata, cuneata, 5-5.5mm. longa et 2-2.25mm. lata, apice obtusa. Stamina 10, exteriora basi glandulis minutissimis praedita; filamenta 4mm. longa; antherae 0.6mm. longae. Ovarium globosum, 1.25mm. diam.; styli 2.5mm. longi. Capsula 3-3.5mm. longa,

calycem ± aequans, dentibus 6 qequalibus dehiscens; ovula c.30. Semina vix matura c.15, probaliter rugulosa.

Key to varieties

Leaves with the marginal vasculation no more developed than the extremely faint traces anastomosing throughout the lamina; sepals 3.5-4mm. long. (i). var. antitaurica

Leaves with a distinct but very weak pair of marginal veins (not visible macroscopically); sepals 4-5mm. long. (ii). var. intermedia

(i). var. antitaurica

Typus: TURKEY: Cataonia: "prov. Maraş, distr. Göksun: Binboğa dağ in ravine above Yalak, 2200m. Rocks. 17 July 1952. Davis, Dodds, & Çetik (D.20130)" holo. E!, iso. K!

Specimens seen:

TURKEY:-

Cataonia:- Binboğa dağ, above Yalak, 2300-2400m., Davis 20114.

(ii). var. intermedia McNeill, var. nov.

A typo sepalis longioribus (4.5-5.5mm.) venis marginalibus ceteris lateralibus anastomosantibus multo validioribus differt, venis lateralibus omnibus gracillimis ab oculo vix distinguendis.

Typus: TURKEY: Cataonia: "In monte Nimrud Dagh prope vicum Kjachta districtus Mamuret-ül-Asis, in declivitatis septentr.-occid. rupibus. Substrato calcareo: ca. 2000-2500m. 12:vii:1910, Handel-Mazzetti 2060" sub "Arenaria Tmolea Boiss." (cf. Ann. naturh. Hofmus, Wien 26 : 149, 1912), holo. WU!

Geographical distribution (of species): Endemic

Biology (of species): Collected in flower and fruit in mid-July between 2000 and 2400m. Dead leaves infected with Pyrenophora sp. (Pyrenomycetes)

Discussion :- Davis's two gatherings of this new species were at first mistaken for specimens of A. kotschyana Fenzl, which were unusual in that their petal shape and size seemed nearer to that of A. tmolea. It was found on closer examination, however, that their leaves showed no trace of the prominent marginal veins which characterise Section Grandiflorae and that they did in fact differ chiefly in leaf shape from another Davis specimen (19413) which was obviously related to A. cretica from Greece. This other plant from the Anti-Taurus with only a single median vein visible in the leaves is now being described as the type of another new species (A. uninervia) under which the inter-relationships of both will be discussed.

Among specimens obtained on loan from the Vienna University Herbarium were two from the eastern Anti-Taurus collected by Handel-

Mazzetti, determined by him as A. tmolea and published as such in a list of his Mesopotamian and Kurdistan collections in Ann. naturh. Hofmus., Wien, 26 : 149 (1912). These, like the Davis specimens from Binboğa dağ, were found to have no visible marginal veins on the leaves, and for this reason, supported by differences in sepal structure and in the general facies, they could not be referable either to A. tmolea or to A. kotschyana. One of them (Handel-Mazzetti 2060) had the narrow leaves of A. antitaurica but had longer sepals and on microscopical examination of the leaves was found to have the marginal vasculation more strongly developed than that of the faint traces anastomosing throughout the lamina. This marginal vasculation, however, remains quite undetectable macroscopically and is sufficiently unlike the prominent veins of A. kotschyana for it to be quite certain that the specimen should be referred to Section Rariflorae rather than to Grandiflorae. The differences between it and typical A. antitaurica, although not great, are accentuated by the marked similarity to one another of the two gatherings of the latter (admittedly from the same mountain). For this reason, and because of its apparent approach towards Section Grandiflorae, it has been described as a distinct variety of A. antitaurica - var. intermedia. The other Handel-Mazzetti specimen misidentified as A. tmolea is referable to A. uninervia and under that species there will be further discussion of these hitherto unknown Turkish representatives of Section Rariflorae. (cf. fig. 15)

2. A. uninervia McNeill, sp. nov.

Ab A. antitaurica McNeill, cui proxima, foliis multo latioribus et omnino ramulis sterilibus sub anthesi perpaucis vel nullis (rosulae steriles evolutae ex axillis foliorum ramorum floriferorum emergentes) distinguenda; in forma foliorum A. creticam Spreng. accedit sed petiolis nullis, sepalis acutis vel acuminatis, petalis latioribus sepalis ½ longioribus (nec ± duplo longioribus) facile distinguenda.

Herba perennis, pulvinata. Planta ex toto pilis brevibus glandulosis (et eglandulosis?) dense vestita. Caudex gracilis vel mediocriter crassus, 1.0-2.5mm diam., caudiculos ± fragiles numeros foliis persistentibus mortuis superne obtectos transiens. Caudiculi ad 12cm. longi ramulos fere omnes floriferos abientes. Ramuli ad 4cm. longi, foliis 3-6-jugis sub anthesi ± aeque disjunctis praediti; folia ramulos steriles novellos vel rosulas saepe subtendentia. Folia matura superiora 5-11mm. longa, ovato-lanceolata, latitudine 3-4-plo longiora, sessilia, apice acuta; folium costa prominenti promissum; lamina venis lateralibus multis anastomosantibus tenuissimis (vix ab oculo distinguendis), eis ad marginem aliis non magis evolutis. Inflorescentia (1-)2(-3)-flora; bracteae infimae 2-5mm. longae, anguste triangulares, membranaceo-marginatae, vel (in typo) foliosae sed minores; bracteae superiores breviores, 1-3mm. longae, semper membranaceo-marginatae; pedicelli 3-10mm. longi. Sepala c. 3.5-4mm. longa, in forma et textura gradatim inaequalia, vix (in typo) vel aliquantum carinata sed vena mediana prominenti ad apicem percurrens, venis lateralibus (6-8)

inconspicuis; sepalum extimum ovatum vel ovato-lanceolatum (latitudine 2-3-plo longius), acutum, margine angustius membranaceo excepto, herbaceum; sepalum intimum latius ovatum (latitudine 1.7-2-plo longius), apice obtusius (in typo), ad margineum latius membranaceum (0.4mm. latum), ad basim subcrassius. Petala ovata vel ovato-lanceolata, 5-6mm. longa, 2.25-2.75mm. lata. Stamina 10, exteriora basi glandulis minutissimis praedita; filamenta 4mm. longa; antherae 0.75mm. longae. Ovarium globosum, 1.5mm. diam.; styli 3mm. longi. Capsula ignota.

Typus: TURKEY: Cataonia: "Prov. Adana. distr. Feke: Bakir dağ nr. top of Sencan Dere : 2200m. 30 June 1952", Davis, Dodds & Çetik (D. 19413). holo. E!, iso. K!

Specimens seen:

TURKEY :-

Cataonia :- Ak dagh, inter Malatja et Kjachta, 2500-2670m., Handel-Mazzetti 2336 (as A. tmolea) (WU).

Geographical distribution: Endemic

Biology: The two known gatherings of this new species were in an early flowering stage at the end of June at 2200m. and mid-July at 2500 - 2670m. Dead leaves infected with Pyrenophora sp. (Pyrenomycetes)

Discussion: The type specimen, which in habit and leaf structure closely resembles A. cretica, was at first the only known gathering of this new species. It was obviously closely related to the Davis

plants described as A. antitaurica but seemed distinct from the typical variety of that species, not only in leaf shape, but also in the colour of the leaves (a yellowish-green), in the bracts being more leaf-like and in the broader, less acuminate sepals. The discovery that two Handel-Mazzetti specimens in the Vienna University Herbarium, published as A. tmolea, did in fact belong to Section Rariflorae (cf. Discussion of A. antitaurica) made the position much more complex. The possibility was considered of regarding all the five known gatherings as representing one extremely variable new species but was rejected when it was discovered that the obvious discontinuity of variation existing in leaf shape was correlated with a different growth habit. This difference lies in the fact that in the three narrow-leaved specimens now referred to A. antitaurica there are, at flowering time, two distinct types of shoot arising directly from the caudiculi - the one terminating in an inflorescence and the other entirely vegetative ending in a rosette of leaves which will presumably develop into a flowering shoot, in the following year. In the broad-leaved plants consituting A. uninervia, all or almost all the shoots end in an inflorescence; the next season's fertile shoots are presumably formed by the vegetative rosettes which are well-developed at anthesis in the axils of the leaves of the flowering shoots. As all the plants are from the same type of habitat in about the same altitudinal range, there seems no reason to suppose that this difference is not genetically controlled. The collection of further material of the group may lead to the establishment of other distinguishing criteria. (cf. fig. 16)

3. A. minutissima Rech. f. et Esfandiari in Bot. Jb. 75 : 342 (1951).

Type: IRAN: Fars: "Kuhé Dena Gardaneh Sieni, 1.8.49, in fissuris, Behboudi". holo. W!

Specimens seen:

IRAN:-

Kerman & Yazd:- Kuh-i-Lalesar, 3800m., Starmuehlner 138 (W).

Geographical distribution: Endemic.

Biology: A high mountain plant growing on rocks. Flowering in August.

Discussion: A. minutissima is a very recently described species from southern Iran only known from three gatherings. Rechinger in his original description merely referred it to "Sect. Euthalia Fenzl subsect. Perennes Boiss.", but of the species which Boissier placed in this group (now arranged in four different sections) it is most closely related to A. cretica. Within Section Rariflorae it appears to lie intermediate between A. cretica and A. uninervia. The leaves are more nearly sessile than those of the former, yet not completely so as in the latter. Likewise its floral characters, particularly petal shape, lie between those of the other two species. A. minutissima like A. bulica, is of course very clearly distinguished by its minute leaves and the general size of the plant (< 3cm. in height); the solitary or occasionally paired flowers are however within the size range of the other members of the section. Along with A. bulica,

A. minutissima greatly extends the range of the section Rariflorae and appears to be a relict type adapted to high mountain conditions.

4. A. bulica Stapf ex Williams in J. Linn. Soc. 33 : 374 (1898).

Type: IRAN: Fars: "In felsenspalten des Gipfels des Kuh Bul, 6.9.85", Stapf. holo. K!

Geographical distribution: Endemic

Biology: A dwarf caespitose high mountain plant growing in rock cracks. In fruit in September.

Discussion: A. bulica, only known from Stapf's very poor original specimen, was placed by Williams in the section Sikkimenses, on the basis of its having solitary terminal flowers. The type specimen has only one plant flowering (in fact fruiting) and that with only one flower, but it seems quite certainly a reduction of the normal cymose inflorescence, and is in fact very closely related to Rechinger & Esfandiari's A. minutissima which has 1-2-flowered inflorescences. The two may indeed be conspecific being equally dwarf plants which noticeably differ only in A. bulica having longer narrower leaves. Moreover the two type localities are in the same area of southern Iran, about 100 km. apart. It has been decided to retain A. bulica as a separate species,

partly because it seems undesirable, with the limited material at present available to reduce A. minutissima to a variety of the earlier but very imperfectly known A. bulica, and partly because the specimens of the former from its two known localities, about 500 km. apart, are remarkably uniform in leaf size and shape.

The taxonomic position of A. bulica appears, like A. minutissima, to lie between A. cretica on the one hand and A. uninervia on the other, tending perhaps towards the latter in that the leaves are all sessile.

5. A. cretica Spreng., Systema 2 : 396 (1825).

Key to varieties

Vegetative part of plant glabrous	(i). var. cretica
Entire plant densely pubescent	(ii). var. stygia

(i). var. cretica

Syn.: !A. gracilis var. intermedia Baldacci; !A. cretica Spreng. var. intermedia Baldacci (nomina alternativa), in Malpighia 8 : 87 (1894).

!A. gracilis β cretica (Spreng.) Williams in J. Linn. Soc. 33 : 354 (1898).

Illustrations: Marret. Ic. Fl. Alp. Pl. ser.3 t.179 nos. 1, 5, 6 & 7.

Type: GREECE: Crete: "M. Sphaciot. Cretae", Sieber (as "A. hirta Sieb."). holo. AWH, iso. JE! (predominantly var. stygia), K! (mixed with var. stygia).

Specimens seen: (those marked * are mixed gatherings with var. stygia)

GREECE:-

Epirus:- Papingon, Guiol.

Peloponnese:- Taygetus (Taiyetos), Heldreich 369 (14.8.1844) (1825m.) (W-H), Heldreich Herb. Graec. Normale 1412 (8.1897) (Hag. Elias, 1825-2150m.).

Crete:- Levka Ori (White mts.):- M. Sphaciotices, Heldreich 7.1846, 1612 (27.6.1846) (supra Omalo, 1850m.). M. Omalo, 2750m., Heldreich 6.1846 (as A. gracilis β glandulosa at E). M. Hellenoselli, Heldreich 6.1846 (1525m.), Atchley 1729 (1975m.). M. Hagion Pneuma, Atchley 1719 (2325m.), Lemperg 587, Guiol 2126. Maderos (Aspiorum), Baldacci (1893) 111*. R. Luisfeli, Volakia, M. Gigilos, Baldacci (1893) 56*. Hagios Theodoros, Spreitzenhofer 53 (WU). Sronricht, 2200m., Davis 18123*. M. de Drakena, Reverchon 9.7.1883 (JE, MANCH).

Geographical distribution: Albania (Nëmerçke, above Permet; Delvine, etc.)

Biology: Altitudinal range, 1500-2750m.; an alpine plant growing among rocks, especially in cracks (occasionally on scree), forming loose cushions or mats. Flowers June - August.

(ii). var. stygia Boiss. et Heldr. in Boiss., Diagn. Fl. Orient. ser.2 1 : 91 (1853).

Syn.: !"A. hirta" Sieber ex Presl in Oken, Isis 21 : 272 (1828), pro syn, non Wormsk. (1819).

!"A. Sieberi" Spreng. ex Presl. l.c., nom. nud.

!"A. stygia" Boiss. & Heldr. ined.

A. ciliata sec Sibth. & Smith. fl. Graeca 5 : t.438 (1825), non L. (quoad saltem planta cretica).

!A. gracilis δ stygia (Boiss. & Heldr.) Williams in J. Linn. Soc. 33 : 355 (1898).

Illustrations:

Sibthorp & Smith, Fl. Graeca 5 : t.438 (1825) (as A. ciliata L.);

Marret, Ic. Fl. Alp. Fl. ser. 3. sched. 179; l.c. t.179 nos. 2, 3, 4, & 8.

Syntypes: GREECE: 1.) Peloponnese: "Chelmos ad fontem Stygia" Heldreich. holo. G. 2.) Macedonia/Thessaly: "Olympus Thessaliae" 31.7.1851, Heldreich Herb. 2136. holo. G, iso. K! 3.) Central Greece: "in monte Parnasso" 8.1852, Heldreich Herb. 2136. holo. G, iso. K! 4.) Peloponnese: "in rupibus excelsis montis Ziniae (Kyllenes), 5000-6500 ft." (1525-1830m.) 17/29.7.1851 Orphanides Fl. Graec. Exs. 158. holo. G, iso. JE!, K!, S!, W-H!

Specimens seen: (Those marked ≡ are mixed gatherings with var. cretica)

GREECE:-

Macedonia/Thessaly:- m. Olympus (Olimbos), Orphanides 3700 (2425m.)

(W-H), Adamović (1905) 211 (W-H), Rycroft 6.7.1918, Handel-Mazzetti 15-17.7.1927 (2200-2700m.), Dibowski 1.7.1928 (supra Mikri Kazonia, 2400m.), Guiseppi (1929) 41 (2275-2450m.), Guiol (1929) 683, Grebenchikoff 23.7.1937 (c. Litochora supr. monast. Ag. Dionisios, 2200m.), Stojanoff & Jordanoff 27.7.1937 (inter Spilea et Ag.Tlija ?), Goulimy 214 (S. of Alpine Club Shelter, 2200m.).

Central Greece:- m. Parnassus (Parnasos), Heldreich Herb. Graec. Norm. 8(18-19.8.1856) (1825-2150m.) 6.8.1862 (JE), Orphanides 14.7.1851 (W-H), 3.7.1854 (nr. Clisto-Zasteno, 1225m.), Guicciardi 8.1855, Halacsy 16.7.1888 (1825m.) (W-H), Guiol 11.7.1934, Davis 326 (2125m.).

Peloponnese:- Chelmos (Aroania Oros), Dörfler Fl. Graeca 416 (leg. Leonis), Guiol, Atchley 1478 (above Kalavryta, 1375-1525m.), 2095 (2125m.), Guiseppi (1934) 49 (2275-2450m.), Lemperg 1114, Grebenchikoff 29.7.1939 (c. Kalavryta, 2000m.). m. Kyllenes (Killini Oros), Baenitz Herb. Eur. 23387 (leg. Heldreich 29.7.1883), Guiol 1473, Grebenchikoff 24.7.1938 (supra Trivvala, 2300m.), Thomson 1172 (m. Zinia, 1750m.). m. Taygetes (Taiyetos Or.), Pichler 6.1876 (1525m.), Davis & Barneby 9.1938 (supra Tripi, 1825m.).

Crete:- Levka Ori (White Mts.), Sieber (m. Sphaciotes)*, Baldacci (1893) 56 (R. Luisfeli, Volakia, m. Gigilos)*, (1893) 111 (Maderos, Aspiorum)*, Davis 18123B (Svourichti, 2200m.)*.

Geographical distribution: Endemic.

Biology: Altitudinal range: 1200-2700m.; otherwise as var. cretica.

Discussion (of sp.): A. cretica is a species which has been collected very frequently but from relatively few localities on Crete, the mainland of Greece and southern Albania. (51 gatherings have been seen from 7 mountain groups in Greece including Crete). Sprengel described it first in his edition of Linnaeus' "Systema Naturae" (1825) on the basis of a specimen collected by Sieber "in m. Sphacioticis Cretae" and labelled by the collector as "A. hirta", a name already used by Wormsk (1819) for a plant referable to the Minuartia verna complex. Sprengel appears to have intended at one stage to call the new species "A. Sieberi", labelling some sheets this way; Presl (1828) uses this name, referring "A. hirta Sieber" to it as a synonym, but gives no description. The earliest collections (by Heldreich) from the mainland of Greece were distributed under the manuscript name "A. stygia Boiss. & Heldr." but this name has never been published at specific rank, the authors coming to the conclusion that it was to be regarded as a variety of A. cretica and publishing it as such in Boissier's "Diagnoses" in 1853. The variety was distinguished by its being densely hairy throughout (whereas in typical cretica the leaves are glabrous and only the inflorescence is hairy) and by having broader sepals. The latter character does not appear to be constant and on some occasions the two indumentum types have been found growing together (cf. lists of specimens seen). Davis (1953) claims that in his gathering (D.18123) from the White mountains in Crete both varieties and intermediates are present. An examination of all his copious material shows that the

plants are all either densely hairy or with completely glabrous leaves - the confusion being due to admixture with the slightly hairy Gypsophila nana. Because intermediates have not been detected in any of the abundant material examined (including all the Kew specimens - cf. Davis' note) and because of the greater abundance of stygia on the mainland of Greece and the comparative rarity there of cretica, it has been decided to maintain the two varieties. Only cretica has been recorded from Epirus and Albania.

Sibthorp and Smith illustrate this species in Flora Graeca (1825) under the name A. ciliata L., recording it from Cyprus as well as from the White mts. in Crete. As the plant has never been found since on Cyprus this record is very doubtful; there may have been confusion over its origin or it may represent a plant of the A. deflexa group, but the figure is certainly of cretica. Sibthorp and Smith's misidentification is usually cited as being of var. cretica (doubtless on account of the locality) but their description and plate make it quite clear that their plant is var. stygia.

Williams (1898) treats both cretica and stygia as varieties of the North and West Balkan species, A. gracilis Waldst. & Kit., which Boissier distinguishes from A. cretica by its glabrous habit, obtuse leaves and shorter petals. All the specimens of A. gracilis which have been examined have acute leaves, but Boissier's other two distinguishing characters appear to hold, in particular that of pubescence. The inflorescence - the upper part of the stem, the pedicels and the sepals - is always strongly pubsecent in A. cretica, whereas A. gracilis is

entirely glabrous. The leaves of A. gracilis are also often rather narrower than those of A. cretica. In 1894 Baldacci described from Albania a variety (var. intermedia) which he regarded as being referable either to A. cretica or A. gracilis, but his specimens appear in fact to be typical A. cretica. Apparently unaware of Baldacci's paper, Williams in his revision (1898) also described a var. intermedia as a third variety of A. gracilis (with cretica & stygia). This he based on a gathering from Hercegovina which he presumably regarded as coming morphologically between typical A. gracilis and his var. cretica. Some doubt must attach to this plant, however, as the rather inadequate diagnosis describes it as puberulent and the leaves as linear; even at their narrowest the rosette leaves of A. gracilis are scarcely linear. As all four gatherings examined from Hercegovina are entirely glabrous and appear indistinguishable from the specimens of A. gracilis from Croatia and Dalmatia, it has been decided, despite their close affinity, to maintain A. gracilis and A. cretica as distinct species and thus not to depart from the usual taxonomic treatment (e.g. by Hayek 1924, p.195-196, Halacsy 1900, Rechinger 1943, and Ascherson & Graebner 1918) until there is more certain evidence of a morphological gradation between the two species.

Section Rariflorae - Discussion

Excluding A. minutissima and A. bulica, Section Rariflorae in the Orient is made up of two groups of plants, rather variable within their own limits, but quite distinct from each other. On the one hand there

is in Greece A. cretica which extends north into Albania and is morphologically very close to the west Balkan A. gracilis, while the other group comprising the two new species, A. antitaurica and A. uninervia, occurs about 750 miles to the east, in the Turkish Anti-Taurus, and appears to have a close affinity with Section Grandiflorae. The most important difference between the Anatolian and Balkan groups would appear to be the fact that the Turkish plants lack the very long narrow petals with an attenuate base which characterise some of the European species and help to distinguish them from the members of other sections with single-nerved leaves (e.g. A. biflora in the Rotundifoliae). It is possible that through A. antitaurica var. intermedia the Anatolian group is closer to A. kotschyana or A. tmolea var. stenophylla than it is to A. cretica. It was decided, however, to draw the demarcation line between the Sections on the basis of the presence or absence of the prominently visible marginal veins of the leaves which so characterise the Grandiflorae in both the Eastern and Western Mediterranean. This decision was fully justified by the discovery, on examining the type specimens, that Rechinger's A. minutissima and Stapf's A. bulica were referable to Section Rariflorae and that, although very distinct otherwise, they bridged the gap in the characters separating the Balkan and Anatolian species of this section.

Section Grandiflorae McNeill

Petals ovate, 1.5 - 2.5 times as long as broad, a little longer than the sepals (< 1.5 times); mature leaves linear-lanceolate to linear, (6-)8-9(-11) times as long as broad 6. A. kotschyana

Petals oblanceolate, 2.5 - 3.5 times as long as broad, much longer than the sepals (1.5 -2.5 times); mature leaves ovate-lanceolate to lanceolate, 3-4(-6) times as long as broad, or occasionally (var. stenophylla) linear-lanceolate, (5-)6-7(-8) times as long as broad 7. A. tmolea

6. A. kotschyana Fenzl, Illustr. Pl. Syr. Taur. 44 (1843), (Reprint of Russegger, Reisen 1 (2) : 930).

Syn. : !A. tmolea var. kotschyana (Fenzl) Boiss., Fl. Orient. 1 : 698 (1867) ("β").

!A. tmolea β macropoda Hausskn. ex Williams in J. Linn, Soc. 33 : 352 (1898).

!A. tmolea γ sintenisii Hausskn. ex Williams l.c.

Type : TURKEY : Cilicia : "in deliviis alpis Maaden-Tepessi circa fodinas Tauri occidentalis; aestate 1836." Kotschy 60. holo. destroyed (W), iso. BM!, K!, S!.

Specimens seen :

TURKEY :-

No locality :- Siehe 151 (JE).

Cilicia :- No locality, ex leg. A. Prior (K). Taurus mts., Kotschy 14, 15. Öst Taurus, 2899m., Siehe 3 (JE). Bulgar Maaden, Kotschy 17, Balansa (1855). Gullek Gala, 1520-2130m., Kotschy 6, 142. Cilician Gates, Balansa (1855) 604, Balls 1217 (900m.), Siehe (1895) 287 (Karli Boghas, 1800m.) (mixed with Minuartia hirsuta at JE). Namrun, 2000m., Siehe (1895) 156 (as Als. recurva var., mixed with Minuartia heldreichiana at E).

Amanus :- nr. Düldül, 1500-2000m., Haradjian 2547, 3830.

Cappadocia :- Masmutli dagh (Ala dağ), 1800m., Siehe (1907) 103 (as Alsine heldreichiana ssp. elongata).

Cataonia :- Beryt dagh, 2100-3050m., Haussknecht 1172 (JE).

S.W. Armenia :- Egin: Kyl-Maghara dagh, Sintenis (1890) 2844 (type of var. sintenisii). Egin: Yokardidagh, Sintenis (1890) 2844b (type of var. macropoda). Egin: Aergu, Sintenis (1890) 2685. Munzur dağ above Ovacik, 1800m., Davis 31481, 31488. Erzincan: Keşiş dağ above Çimin, 2700m., Davis 31659.

Geographical distribution : Endemic.

Biology : Altitudinal range, 900-2100m. Cliff or scree plant, often in shaded places, forming rather dense mats. Flowers June to August.

Discussion : see end of Section.

7. A. tmolea Boiss., Diagn. Fl. Orient. ser.1 1 : 50 (1842).

Key to varieties

Mature leaves ovate-lanceolate to lanceolate, 3-4(-6) times as long as broad (i). var. tmolea

Mature leaves linear-lanceolate (5-)6-7(-8) times as long as broad (ii). var. stenophylla

(i). var. tmolea

Type : TURKEY : Lydia : "Tmolus supra Philadelphiam", 6.1842, Boissier. holo. G, iso. E', JE', K' (mixed with Minuartia saxifraga ssp. tmolea).

Specimens seen :

TURKEY :-

Lydia :- Cadmus (Honaz dağ) above Collossa, Boissier 6.1842 (JE).

Caria :- Muğla: Girdev dağ, Davis 13775 (2200m.), 13989 (2300m.). Denizli: Baba dağ, 2000m., Davis 18598.

Lycia :- Tahtali dağ, 2300m., Davis 14174, 15083 (mixed with Gypsophila sp.). Calbali dağ, Davis 15291 (2000-2100m.), 15411 (Tesliken Yayla - Kar Çukuru). ?Subasihi Zaillah, 2000m., Luschan 16.7.1882 (WU).

Pamphylia :- Ak dağ, 1850m., Davis 14654. Bozburun dağ, Davis

15617 (2000m.), 15706 (2300m.).

Pisidia :- Isparta: Sütçüler (Isauria): Dedegöl dağ, Davis 15983 (nr. cinque Anici, 2200m.), 16069 (Taş Cluk yayla, 2100m.). m. Boudroun, Heldreich 7.1845, 8.1849 (?5) (nr. Saglassum, 1850m.). Aglassan dağ, Heider (WU).

(ii). var. stenophylla (Bornm.) McNeill, comb. et stat. nov.

Syn.: A. tmolea forma stenophylla Bornm., Symbolae Fl. Anatol., in Fedde Rep. Beih. 89 : 254 (1940).

Syntypes : TURKEY : Galatia : 1) "Amasia : in montis Ak-dagh regione alpina, 1600-1900m., 9.7.1889" Bornmüller 990 holo. JE!, iso. K! 2) "in rupestr. regionis alpinae 'Sana-dagh', dist. Amasiae, 1550m. 15.7.1889", Bornmüller 991 holo. JE!

Geographical distribution (of sp.): Endemic.

Biology : Altitudinal range 1800-2300m. Plant forming rather dense mats or even cushions among rocks. Flowers June to August.

Section Grandiflorae - Discussion

The section Grandiflorae in the Orient is confined to Turkey, and is represented by the two closely related species detailed above. A. kotschyana was first collected in 1836 (in the Cilician Taurus by Kotschy, while travelling as botanist with Russegger on one of his 'journeys') but it was not described by Fenzl as a new species until 1843, by which time Boissier had published his description of A. tmolea, which he himself collected on Boz dağ in Lydia (ancient Tmolus) in 1842.

Fenzl, when he described A. kotschyana, made no mention of Boissier's A. tmolea (indeed he may not have known of it as the two species were published within a few months of each other), but in "Flora Orientalis" (1867) Boissier unites the two species, treating kotchyana as a variety of tmolea. This procedure is followed by Williams (1898), who also describes two other varieties, (macropoda and Sintenisii), taking up Haussknecht's manuscript names on specimens collected by Sintenis from one small area near Kemaliye (Egin) in western Armenia. The only other taxon known to have been described from the Orient in this section is Bornmüller's formastenophylla (1940).

Boissier presumably reduced kotschyana to varietal rank because he believed intermediates existed between it and typical A. tmolea (e.g. he describes a specimen of kotschyana collected by Balansa in 1855 as "forma transitum ad typum praebens"). However there is in reality a very marked discontinuity in distinguishing characters between A. kotschyana and typical A. tmolea, and Boissier appears to have been confused (as Williams certainly was) by using a number of false criteria to delimit

kotschyana. He characterises it as having narrower usually glabrous leaves with prominent nerves on the underside, more flowers in each inflorescence with much longer pedicels, and usually keeled glabrous sepals. None of these characters, except leaf shape and possibly sepal structure, does in fact distinguish the species as delimited here, but they were adopted by Boissier (and copied by Williams) from the rather scanty material then available. In 1947 and 1949 Davis made 12 gatherings of A. tmolea from 7 different mountains in the western Taurus. These new collections, along with those of A. kotschyana made by Sintenis, Siehe, and Haradjian, not only show that most of Boissier's intergrading characters are probably environmentally induced, but confirm on other grounds the existence of two morphologically and geographically distinct taxa. Although the earlier collections were mostly glabrous, on the basis of the specimens examined for this revision, A. kotschyana would appear to be as frequently pubescent, while glabrous specimens of A. tmolea have been found (Davis 14174, 15083). Some specimens of A. tmolea seem to have less prominently keeled sepals than is generally the case in A. kotschyana, but this is affected so much by the stage of development of the flower that it is almost impossible to evaluate it on herbarium material alone. Certainly the innermost pair of sepals of both species can be prominently keeled (A. tmolea being rather variable in this respect) and in neither are the outer truly keeled at flowering time, but the median nerve is much more prominent on glabrous than on hairy sepals and to this must be due in part the association of this character with A. kotschyana. The number of flowers in each inflorescence and the length

of the pedicels appear, along with the habit of growth, to be associated with environment. Plants of shaded places have more flowers and longer pedicels as well as a laxer habit and larger thinner leaves. On these thinner leaves the nerves underneath are more prominent, as they also are on glabrous leaves. As illustrative of this environmental effect, Davis 14654 and 13989, both gatherings of tmolea from shady rocks, possess nearly all the characters by which Boissier distinguished kotschyana, while some plants of Siehe (1895) 287 (A. kotschyana) are very tmolea-like in their inflorescence characters. (Other plants with the same collection number even Boissier would have had no hesitation in calling kotschyana.)

Of the features which do, in fact, distinguish the species (cf. key) the leaf shape is the most easily observed, but the existence of A. tmolea var. stenophylla calls for caution in the use of this character. The leaf measurements given in the key refer to the large mature leaves on sterile or fertile shoots.

The three Sintenis gatherings from Armenia, which Haussknecht named 'var. kotschyana', 'var. macropoda', and 'var. Sintenisii', are more or less identical to one another (macropoda is pubescent, the others glabrous) and to typical A. kotschyana.

From the distribution of the specimens examined, it will be seen that each of the three taxa recognised (A. kotschyana, A. tmolea var. tmolea and A. tmolea var. stenophylla) is geographically separated from the others. A. kotschyana is distributed in the South and East, being centred in the Cilician Taurus and extending north-eastwards into the

Armenian mountains; typical A. tmolea replaces it to the west, occurring in the western Taurus and in the mountains of Lydia and Caria, while A. tmolea var. stenophylla is only known from two mountain localities in northern Turkey. (cf. fig. 17)

Section Rotundifoliae Schischkin ex McNeill

Entire plant glandular-pubescent, usually densely so, or entire plant glabrous; petioles never ciliate; petals equalling or longer than the sepals; leaves ovate, 1.5-2.5 times as long as broad

8. A. balansae

Leaf blades glabrous; stems and peduncles with short crisp hairs (often running in rows); petioles with a few long simple hairs on the margin; petals often shorter than the sepals; leaves varying from orbicular to ovate

9. A. rotundifolia

(incl. A. ovalifolia Somm. et Lev.)

8. A. balansae Boiss., Fl. Orient. 1 : 700 (1867).

Key to varieties

Entire plant glandular-pubescent, usually densely so — (i). var. balansae

Entire plant glabrous — (ii). var. glaberrima

(i). var. balansae

Syn.: ?A. neelgherrense Wight & Arnott var. γ glanduloso-pubescens Fenzl, Diagn. Pl. Orient. 12 (1860) (Reprint of Fenzl in Tchihatch., Asie Min. 3 (Bot.) (1) : 237) ("neelgerensis").

Lectotype: TURKEY: Cilicia: "Region alpine du Taurus, au-dessus de Boulgarmaden. Juillet-Septembre.", B. Balansa, Fl. d'Orient, 1855, 602 (as Arenaria Neelgerensis Walk. et Arn. (sic.) var. γ glanduloso-pubescens Fenzl) HM.', G, JE.', K.'

Specimens seen:

TURKEY:-

Pamphylia:- Geyik dağ, North Screes 2275m., Davis 14578.

Cilicia:- No locality, ex legato Alex. Prior (K). Öst-taurus, Siehe 4 (JE). Bulgar Dagh, Gisyl Deppe, 2450m., Kotschy 224 & 260a (one sheet) (paratype and syntype of glanduloso-pubescens Fenzl). Above Boulgarmaden, Balansa (1855) 602. Bulghar Magara, 2700m., Siehe (1895) 322.

Cappadocia:- Ulukişla: Bulgar dağ nr. Sari tepe yayla, 2700m., Davis 16564.

Kurdistan:- Bitlis; Meleto Dagh (Sason Dağlari), 2600-3100m., Handel-Mazzetti (1910) 2720. Karz dağ nr. Kotum above Kamer, 2300m., Davis 24583. Hakkari: Kara dağ, 3505m., Davis 24455. Hakkari: Çilo tepe, 3350m., Davis 24061.

IRAN:-

Southern Zagros:- Kuh Daena, Kotschy 766 (paratype).

Geographical distribution: Endemic.

Biology: Altitudinal range 2280-3500m. Grows in rock cracks among stones

or in gravel, often in channels or dry stream beds, sometimes near melting snow. Granite and limestone substrata are recorded. Flowers August-September.

(ii). var. glaberrima (Fenzl) McNeill, comb. nov.

Syn.: A. neelgherrense Wight & Arnott var. ∝ glaberrima Fenzl, Diagn. Pl. Orient. 12. (1860) (Reprint of Fenzl in Tchihatch., Asie Min. 3 (Bot.) (1) : 237) ("neelgerensis").

Syntypes: TURKEY: Cilicia: 1) "Bulgardagh m. Kizil-tepe. alt. 2600m. Kotschy" holo. destroyed (W). 2) "reg. alp. supra Bulgarmaden. Balansa pl. d'Or. an. 1855" holo. destroyed (W).

Specimens seen:

TURKEY:-

Kurdistan:- Cilo dağ; 10km. W. of Cilo tepe, 3660m., Davis 24188.

IRAQ:-

Erbil:- Arl Gird Dagh, BAG 9602 (2800-3200m.) (coll. J.B.Gillett), 15832 (3000m.) (coll. Guest & Husham). Ser Kurawa, 2900-3200m., BAG 9726 (coll. J.B.Gillett).

IRAN:-

(Southern Zagros ?):- m. Kellal et Ssebsekuh, Haussknecht 9,1868 (as A. rotundifolia).

Geographical distribution : Endemic

Biology: Altitudinal range 2800-3700m. Recorded as growing among rocks, on rock ledges and in gravel near melting snow on limestone and on igneous or metamorphic substrata. Flowers August - September.

Discussion: Arenaria balansae was first collected by Kotschy in 1842 in the Zagros mountains in south-western Persia. It was collected again by him in 1853 in the Cilician Taurus and Balansa also found it in that area in 1855. Fenzl, who was responsible for parts of the Alsinoideae in the botanical portion of Tchihatcheff's account of Asia Minor, regarded these three gatherings as conspecific with Wight and Walker Arnott's Arenaria neelgherrense (from the Nilgiri Hills in Madras) and published them as such in that work. He recognised 3 varieties, var. α glaberrima, var. β ciliata and var. γ glanduloso-pubescentia, of which var. ciliata, only known from India, was what would now be called the type variety. He claimed that the other two varieties (one entirely glabrous and the other densely glandular-pubescent throughout) grew together in the Cilician Taurus (the glabrous form rarer) and were to be found mixed in the gatherings from there, both of Kotschy and Balansa. The Vienna Museum sheets (which were presumably the ones Fenzl examined) were destroyed during the Second World War, but the Kew, British Museum and Jena (only Balansa) specimens have been examined and are all entirely composed of densely glandular-pubescent plants. Fenzl does not refer here to Kotschy's Persian plant, although it was determined by him as "A. Neelgerensis Wight et Arn. var. eciliata"! Boissier in "Flora Orientalis" (1867) recognised that the Indian plants were

specifically distinct and described a new species (A. balansae) on the basis of the three Turkish and Persian gatherings. As a glabrous variety of this species is being recognised, it has been thought advisable to select one of these specimens, appropriately Balansa's, as a lectotype. Boissier, like Fenzl, described the leaves as being "glabris vel hirtis" and similarly with the sepals, and the lectotype is of plants which are densely glandular-pubescent. Most later collections, like the lectotype, are densely hairy, thus readily distinguishing them from A. rotundifolia M.B., which invariably has a glabrous leaf lamina and ciliate petiole. One early gathering, that collected by Haussknecht from "m. Kellal et Ssebsekuh" in Persia, is, however, entirely glabrous and recently three further gatherings of such plants have been made from very high alpine localities in Kurdistan, all within the one small area but extending across the Turkish-Iraqi border. With the exception of a rather sparsely glandular-pubescent gathering from near Bitlis (about 250km. to the north-west) (Handel-Mazzetti 2720), intermediates have not been seen (e.g. the other 3 known gatherings from Kurdistan are all typically densely pubescent) and apart from Fenzl's claim, populations seem to be quite uniform with respect to pubescence. In view of this the glabrous plants, which seem to occur principally in Turkish and Iraqi Kurdistan, are being given recognition at varietal rank (var. glaberrima first published by Fenzl under A. neelgherrense Wight & Arnott).

9. A. rotundifolia M. Bieb., Fl. Taur. Caucas. 1 : 343 (1808).

Key to subspecies etc.

Mature leaves orbicular, 1-1.5 times as long as broad, abruptly contracted at the base into a short petiole; petals shorter than the sepals A. subsp. rotundifolia

Mature leaves ovate, 1.75-3 times as long as broad, gradually tapering at the base into a short petiole; petals as long as or longer than the sepals. B. subsp. pancicii

(Leaves ovate; petals shorter than the sepals; inflorescence many-flowered, > 10. A. ovalifolia)

A. subsp. rotundifolia

Syn.: ≡Alsinanthus rotundifolius (M.B.) Desv. in J. Bot. Desv. 3 : 221 (1816).

A. biflora sec Griseb., Spicil. Fl. Rumel. Bithyn. 1 : 203 (1843), non L.

≡Buthalia rotundifolia (M.B.) Rupr., Fl. Caucas. 220 (1863).

≡A. rotundifolia M.B. var. pauciflora Boiss., Fl. Orient. 1 : 700 (1867) ("β").

≡A. pauciflora (Boiss.) Prodan, Fl. Roman. 1 : 394 (1923), non Kit. (1863).

Illustrations:

Grossheim. Fl. Kavkaza ed. 2 3 : 221 t.21 f.4 (1945)

Komarov, Fl. U.R.S.S. 6 : 352 t.30 f.3 (1936).

Type: U.S.S.R.: "in alpibus caucasicus - in alpe Kaischaur, Septembri florentem", M. von Bieberstein. holo. LE(photo!), iso. BM! ?

Specimens seen:

GREECE:-

No locality:- ex herb. Karl Grimus v. Grimburg "specimina viva accepta ex arboreto nationali Dr. Diels" (WU).

Macedonia:- Athos, Dimonie 7.1908 (Hagion Oros, 1200-1500m.) (WU). Athos summit, Grisebach, Janka 22.7.1871 (JE), Cyren 8-10.6.1936 (2000m.) (S). m. Pangeon (Purnar Dagh) 1700m., Rechinger 10187 (W-R).

Thessaly:- Olympus, Aucher-Eloy 574 (syntype of var. pauciflora), Montbret, Handel-Mazzetti 26.7.1927 (convallis Malta, 1700m.).

Central Greece:- Parnassus, Guiol 30.6.1934.

TURKEY:-

Pontus:- Artvin: Kordevan dağ (Yalnizcam Dağlari) nr. Kütül Yayla, 2200m., Davis 30239. above Artvin, Davis 29785. Artwin: Mesre-Nekerav, 1300m., Holmberg (1912) 2004 (S). Trabzon: m. Ulugoba nr. Fol, Handel-Mazzetti (1907) 600 (1400-1700m.,), 664 (2000m.). Trabzon: Kisyl Ali Yaila, Eseli nr. Goerele (Elehu), 1300m., Handel-Mazzetti (1907) 685. Trabzon: Sumila, Sintenis (1889) 1581, 1584.

Bithynia:- Olympus, Boissier 8.1842, Aucher-Eloy 574 bis, Montbret (as Stellaria), Pichler 7.1874.

Lycia:- Çalbali dağ between Kar Çukuru & Fesliken Yayla, 1800m., Davis 15404.

Cilicia:- Taurus, Kotschy 17. Gullek Boghas, 1160m., Kotschy 39a & 32 (as A. serpyllifolia). Bulgar Dagh, M. Gisyl Deppe et Gullek Magara, 1980-2440m., Kotschy 67g 111e 280b & 55b (S) (one sheet). Boulgarmaden, Balansa (1855) 612. Karli Boghas, 1800m., Siehe (1896) 281.

Pisidia:- m. Anemas (Anamas Dağ), Heldreich 8.1845.

Lycaonia:- Akscheher (Akşehir), Sultandagh, Bornmüller (1899) 4183 (above Çay, 2200m.) (WU), 4184.

Cappadocia:- Kayseri: Bakir dağ between Kisge & Akoluk yayla, 1700m., Davis 19481.

Cataonia:- Berytdagh, 2745m., Haussknecht 9.8.1865. Ak dagh (Aryly Tash) inter Malatja et Kjachta (Kâhta) ad fontem Terk, 2350m., Handel-Mazzetti (1910) 2374.

N.E. Armenia:- Erzincan: Karagoelldagh supra Artabir, Sintenis (1894) 7264.

U.S.S.R.:-

No locality:- "Caucasus" (ex Herb. R.J. Shuttleworth, ex herb. Roemer) M. Bieberstein (BM).

Georgia:- Ossetia: Koschka ad fl. Didi Liachva, Brotherus 1850. Batum: Goderski Pereval, 1800m., Holmberg 1814.

Geographical distribution: According to Williams (1898) recorded from Afghanistan by Regel in Iter Turkestan 1882, but possibly a misidentification of A. orbiculata Royle or A. turkestanica Schischkin; otherwise endemic.

Biology: Altitudinal range 1200-2750m. A prostrate creeping plant frequently forming mats. Grows among rocks and in stony places often by streams and in shade. The subspecies is recorded as growing on siliceous and calcareous substrata and also on diorite and basalt.

B. ssp. pancicii (Degen et Baldacci) McNeill, comb. et stat. nov.

Syn.: !A. rotundifolia M.B. var. pancicii Degen et Baldacci in Mem. R. Accad. Bologna, Sci. fis. ser.5 9 : 10 (1900).

Syntypes: 1) "Iter Albanicum (Montenegrinum) Sextum m. Karivan prope Rikavic distr. Kuci", Baldacci 174, 14th July 1898. holo. BOLO ?, iso. K!, WU! 2) "m. Planinica (et Majan) ad fines turcorum distr. Kuci", Baldacci 174 bis, 17th July 1898. holo. BOLO ? iso. WU!

Specimens seen:

GREECE:-

Macedonia:- Hagion Oros, M. Athos summit, Sintenis & Bornmüller 839, Tedd 1503 (1950m.), Charrel 7.1895 (MANCH).

Geographical distribution: Albania, S. Yugoslavia and Bulgaria.

Biology: Altitudinal data very incomplete, but it does occur between 1800 and 2400m. and is found in pasture, on bare ground, among rocks or on scree; it is not recorded from moist shady places (cf. ssp. rotundifolia). Siliceous and calcareous substrata are recorded.

Taxa incompletely known but probably referable to A. rotundifolia M.B. :-

A. rotundifolia M.B. var. colchica Alboff, Prodr. Fl. Colch. 36 (1895).

"Dense caespitosa microphylla nana, foliis ovatis, cymis 1-3-rarius sub 5-floris, floribus minutis.

Caules 1-3cm. Folia 1½-2½mm. longa x 1½mm. lata, majora vix 4 x 2½mm. Flores vix 2½mm.

Samurzakania: m. Okhaczkue, prat. alp. (N. Alboff 1894)

Mingrelia: m. Lekudeli, ad rupes, 2000m. (N. Alboff 1893)."

Euthalia rotundifolia (M.B.) Rupr. var. flaccida Rupr., Fl. Cauc. 221 (1863).

"caulibus tenuioribus saepe 10-floris, pedunculis florum alarium fere semipollicaribus, glabrioribus, sepalis acutioribus 1½ lin.

Abchasia ad fontes f. Kodor in m. Nachar alt. 782-1095 (in sched 1000) hex. 6 Aug. fl. (Radde ! p.157)"

A. ovalifolia Somm. et Lev., Fl. Caucas. nov. in Act. Hort. Petrop. 13 : 40 (1893).

"---------- foliis -----glabris, petiolo hinc inde ciliis paucis consperso ---------- sepalis glabris ------."

"Hab. Abchasia in valle fluminis Kliutsch, 1600m. circ. 26 Aug. fl. et fr."

"Caules 30cm. et ultra longi, folia 5 - 6mm. longa, 2 - 4 lata, pedicelli usque ad 15mm., sepala 3-4mm. longi.

Affinis varietati flaccidae Arenariae rotundifoliae M.B. (Ruprecht Fl. Cauc. p.221) a cl. Radde in monte Nachar lectae; ab ea differt ramis multifloris elongatis, foliis ovatis nec orbiculatis plerumque acutiusculis, et bracteis omnibus praeter supremas foliaceis, petalis lanceolatis calyce manifeste brevioribus."

Discussion: Arenaria rotundifolia was first described from the Caucasus by Marschall von Bieberstein who collected it there sometime before 1808 (Flora Taurico-Caucasica) but owing to the lack of much Russian material in this country the species is better known from Turkey, Greece and Albania. There is a specimen in the British Museum, distributed from Leningrad (where Bieberstein's original material is preserved) labelled as "Arenaria rotundifolia M.B." and described as having been collected by Bieberstein in "Caucasi ibirici alpestris" and "Alpes caucasi". This agrees in leaf shape etc. with a photograph of the type from Leningrad and may possibly be an iso-type; it certainly appears identical with A. rotundifolia as it is known in Northern and Central Anatolia. The importance of this rests in the fact that three taxa within or closely related to A. rotundifolia have since been described from the Caucasus. These are A. ovalifolia Somm. & Lev., A. rotundifolia var. colchica

Alboff and Euthalia rotundifolia var. flaccida Rupr. No material of these taxa has been seen but Schischkin (1936) regards them all as synonymous with A. rotundifolia. Reference is made to these taxa in the key to the subspecies of A. rotundifolia and their original diagnoses etc. are reproduced in the account of the species.

The history of the taxonomic treatment of the species in the more westerly part of its range is equally complex but its better representation in Western European Herbaria allows a more satisfactory classification to be achieved. Boissier was the first to give taxonomic recognition to the variation in A. rotundifolia by describing in "Flora Orientalis" (1867) a variety (β pauciflora) in which the inflorescence branches were very short with only one or two flowers. This variety was based on plants which Aucher-Eloy and Heldreich had collected on Thessalian Olympus and on a specimen of Grisebach's from Scardo (Schar dagh) in Macedonia. Grisebach had earlier (1843) recorded A. biflora L. from Macedonia and, from the description given, Boissier concluded that this was a misidentification of his new 1-2-flowered variety of A. rotundifolia. It appears that this reduction of the inflorescence in A. rotundifolia noted by Boissier and Grisebach is largely an environmental effect generally characteristic of caespitose plants of particularly exposed habitats. Every gradation appears to exist, moreover, between lax inflorescences of 6 or more flowers and very short branches with a pair or even only a single flower. For these reasons, Boissier's variety is not recognised here. Another few-flowered variety of A. rotundifolia (var. pancicii) was described in 1900 by Degen and Baldacci

from Albania; in this case the variety was also characterised by having ovate leaves and petals exceeding the sepals. Since then, this taxon has been found to be the only representative of the group in Albania, southern Yugoslavia and Bulgaria (excluding the very restricted and doubtfully distinct A. halacsyi from south-west Hercegovina) and in its typical form differs very markedly from Asian material of A. rotundifolia and indeed from the majority of the gatherings from Greece. One would therefore be inclined to raise pancicii to specific rank but for the very confused position of plants from the Athos peninsula. Seven gatherings have been seen from the mountains there, all of which, except Dimonie's specimen (in Herb. Vienna Univ.), were collected on the summit. Two of these (Grisebach & Cyren) cannot, on the basis of leaf shape, be regarded as other than typical rotundifolia although the Cyren specimen has rather large petals. By the same criterion Bornmuller & Sintenis 839 and Charrel's specimen are unmistakably pancicii while the remaining three occupy somewhat intermediate positions, one (Tedd 1503) being rather nearer pancicii (to which it has been provisionally referred) and the other two (Dimonie & Janka) being more like typical rotundifolia (to which they have been likewise attached). No other specimens have been seen which cannot at once be referred to one or other of the two taxa, and so in view of its distinctiveness outside the Athos peninsula it has been decided to treat pancicii as a subspecies of A. rotundifolia, replacing the typical subspecies in the north-western part of its range.

Section Rotundifoliae - Discussion

Although Boissier (1867) had recognised their affinity, Williams placed the two well-known Orient species of this Section (A. balansae and A. rotundifolia) in entirely different groups. A. rotundifolia, although separated from its closest relatives, was rightly retained in the large section Euthalia (= Subgenus Arenaria), but A. balansae, presumably on the basis of Boissier's description "seminibus laeviusculis", was placed along with A. halacsyi in the otherwise natural South and Central American section (now Subgenus) Leiospermae. In the section Rotundifoliae the seed-coat is obscurely reticulate, i.e. it is marked by flat 'cells' homologous with the tubercles of tuberculate or rugulose seeds (cf. Infra-generic classification p.49). There is a complete gradation from long narrow seed-coat 'cells' in A. balansae to broadly rectangular 'cells' in A. rotundifolia ssp. rotundifolia.

The following Table, which includes two gatherings of A. orbiculata from Afghanistan, shows the relative size of the seeds and of the 'cells' on the lateral faces of the seed coat. The seeds of any one gathering are very uniform and the table has been drawn up from an examination of about 5 - 10 seeds in each case.

Taxon	Gathering	Size of Seed (μ)		Size of cells on face (μ)		
		Lth.	Bth.	Lth.	Bth.	L/B
balansae	: BAG 9602	770	640	100	15	6.67
pancicii	: Bornmüller (1917) 395	770	640	65	15	4.33
"	: Baldacci (1897) 255	680	615	60	15	4.00
orbiculata	: Neubauer 348	575	420	60	20	3.00

Taxon	Gathering	Size of Seed (μ) Lth.	Bth.	Size of cells on face (μ) Lth.	Bth.	L/B
orbiculata	: Koelz 12138	640	515	80	35	2.30
rotundifolia	: Grisebach (Athos)	730	580	50	25	2.00
"	: Sintenis (1894) 7284	680	540	80	40	2.00
"	: Siehe (1896) 281	640	525	70	45	1.56
"	: Sintenis (1889) 1584	795	720	80	50	1.40

A. rotundifolia and A. balansae show a marked difference in their geographical distribution . Both are mountain species but the former is European, Hyrcano-Colchic and Mediterranean, while the latter is typical of the Irano-Turanian region, in particular the not so arid high mountain part. As a result A. balansae completely replaces A. rotundifolia in south eastern Turkey and western Persia. The distribution of the two species overlaps in southern Turkey on the mountains above the Mediterranean seaboard, particularly the Cilician Taurus. The two species remain completely distinct even in this area, and indeed A. balansae seems less closely related to A. rotundifolia than the other species of this Section which replace it geographically - e.g. A. biflora in the northern Balkans and A. orbiculata in Afghanistan and India. (cf. fig. 18)

Section Orientales McNeill

Series Anomalae McNeill

1a. Leaves large (6-12mm. long), ovate-lanceolate to orbicular, the lowest with a distinct petiole (2-4mm. long), the upper gradually or abruptly narrowed at the base; sepals 3-4mm. long:

2a. Stem leaves ± orbicular, about as long as broad; petals nearly twice as long as the sepals; capsule exceeding the calyx (c. 1.5 x as long) 10. A. speluncarum

2b. Stem leaves ovate-lanceolate, 2.5-3.5 times as long as broad; petals a little longer than the sepals; capsule a little shorter than the calyx 11. A. sipylea

1b. Leaves all ± sessile, short (2-8mm.), linear to ovate-lanceolate, often spathulate, or if long (up to 15mm.) always linear; sepals up to 3mm. long.

3a. Stem leaves short (2-8mm.), ovate-lanceolate to linear-spathulate (2.5-8 times as long as broad); seeds with a fimbriate margin formed by a number of prominent protuberances (c. 40 μ long) on each of the dorsal cells (= tubercles).

12. A. libanotica

3b. Stem leaves long (6-15mm.), linear (c. 10 times as long as broad); seeds without any prominent cellular protuberances

13. A. angustifolia

10. A. speluncarum McNeill, nom. et stat. nov.

Syn.: A. graveolens Schreb. var. grandiflora Boiss., Fl. Orient. 1 : 701 (1867) ("β").

Species affinitatis incertae; floribus tenerrimus foliis caulinis suborbiculatis Sectionem Rotundifoliae approximat, sed foliis acutis sepalis aliquanto prominente nervatis inflorescentiis semper terminalis recedit; fortasse affinis A. sipyleae, quam habitu sepalis aliquanto-prominenti nervatis revocat, sed foliis caulinis suborbiculatis capsula calyce excedente facile distinguenda. A speciebus orientalis omnibus affinis petalis sepalis fere duplo longioribus seminibus obscure reticulatis (nec papillosis nec punctatis) distinguitur.

Slender perennial herb, rather matted at the base, sparsely pubescent throughout. Stems ascending, up to 25cm. long, bearing 4-8 pairs of leaves, occasionally branching below the inflorescence. Leaves thin, light green in colour, abruptly contracted at the base into a short distinct petiole (2-3mm. long in the basal leaves, becoming progressively shorter up the stem); the middle stem leaves ± orbicular but with a broadly acute apex, the basal and upper leaves narrower but at least broadly ovate (up to twice as long as broad). Inflorescence very lax, 4-10-flowered; bracts small (c. 1-2mm.) ovate, very much smaller than the uppermost leaves; pedicels long (1-3cm.), slender. Sepals 3.0-3.5mm. long, lanceolate, 3 times as long as broad, subacute with 3 rather prominent veins and a number (2-5) of indistinct ones. Petals oblanceolate, c. 6mm. long and 2mm. broad. Stamens 10; filaments 2.5-3.0mm. long;

anthers 0.5mm. long. Capsule cylindrical, 5mm. long, splitting to at least half-way by 6 equal valves. Seeds c.12, 0.5-0.6mm. long, with numerous small rectangular or orbicular "cells" on the testa (40-80 μ x c.40 μ) without any markings or protuberances. ("obscurely reticulate").

Type: TURKEY: Cilicia: "In valle speluncarum supra Ermenek Isauriae - 1845" ("in rupibus Tauri, Isaurici"), Heldreich (as A. pubescens d'Urville var. grandiflora") holo. G, iso. E!, K!

Specimens seen:

TURKEY:-

Cilicia:- Ermenek - Oyuklu dag, Kinmis dere (Sara), 1400-1500m., Peronin 165, Davis 16182, 16182B.

Geographical distribution: Endemic

Biology: A slender shade-loving plant growing on limestone rocks at the mouths of caves. Only known from one locality, at 1400-1500m., Flowering July - August.

Discussion: This species has apparently been collected only three times on each occasion in the same place at the mouths of the caves between Ermenek and Karaman in the Isaurian Taurus. On account of its lax habit and long petals Boissier described the first gathering, by Heldreich in 1845, as a variety (β grandiflora) of the species he called A. graveolens Schreb. (= A. deflexa). Examination of the more copious material collected by Peronin in 1872 and by Davis in 1949 confirms that the

plant is not a mere shade form of A. deflexa but that it is best treated as a distinct species as Turrill (1932) suggested. The petal length is far beyond the range of variation found in A. deflexa, the leaves are mostly orbicular and abruptly contracted at the base, while those of deflexa are ovate to ovate-lanceolate and gradually tapering at the base, and in particular, the testa 'cells' are not raised into tubercles and lack the prominent median papilla characteristic of the series Deflexae (and of Graecae and Orientales s. s.). The taxonomic position of this rare plant is thus very doubtful; it possesses the delicate flowers, and broad leaves of Section Rotundifoliae along with the relatively prominent sepal nerves of Section Deflexae. The testa structure is distinctive by its very lack of any special features and can easily be related to that of Rotundifoliae or that of A. sipylea, a species in all other respects typical of Section Deflexae. The characters of leaf shape and the general flower form can be regarded as modifications to the specialised environment and for this reason A. spelunearum ("of the caves") is tentatively linked with A. sipylea in the series Anomalae. The same caves support several other endemic species (e. g. Teucrium cavernearum and Campanula leucosiphon). (cf. figs. 20 -21)

11. A. sipylea Boiss., Diagn. Fl. Orient. ser.1 1 : 51 (1842).

Syn.: ?A. graveolens Schreb. var. glabrescens Boiss., Fl. Orient. 1 : 701 (1867) ("γ").

Type: TURKEY: Lydia: "ad rupes verticales Sipyli supra Magnesiam" (Manisa dağ), Boissier 7.1842 holo. G!

Geographical distribution: Endemic.

Biology: A densely caespitose plant of rock faces, flowering in July.

Discussion: This species is probably represented in European herbaria only by Boissier's holotype specimen at Geneva. From an examination of it, it is clear that Boissier's original treatment as a distinct species is more correct than his later reduction of it to varietal rank. Apart from its being only sparsely pubescent with short hairs and having the crystalline inclusions of the leaves and sepals prominent ("sepala..... tuberculata" - Boissier), A. sipylea is distinctive in its seed coat structure. Instead of the large central papilla as in A. deflexa, it has a number of very small papillae round the margin of each testa cell or tubercle. These papillae are not well-developed (as for example in A. libanotica), but are just visible at a x 35 magnification.

12. A. libanotica Boiss., Fl. Orient. 1 : 699 (1867).

Syn.: A. adonidis Peyron ex Post, Fl. Syr. Palest. Sinai 6 (1896).

Illustrations: Bouloumoy, Fl. Liban Syrie, t. 57 f. 2 (1930) (as Alsine libanotica) (t. 58 f. 2 = Minuartia (Als.) libanotica) (photo)

Syntypes: LEBANON: North Lebanon: 1) "in rupestribus summis Libani

loco Djerd Drasya ad boream Cedreti sito", Kotschy, holo. G,
2) "in cacuminibus inter Yamouny et Dimam," Blanche, holo. G.

Specimens seen:

LEBANON:-

North Lebanon:- Hasroun, Gaillardot 813 (JE). between Bcharre and The Cedars (Arz Er Rab), Samuelsson 2332, 5989, 6193, 6194, 6195, (all 1650m.) (all at S), Davis 10102 (1830m.) (K). Ehden, Samuelsson 5911 1500m.) (S), 6192 (S). between Ehden and The Cedars, Blanche 1552 (as A. cretica var.). Qadisha gorge below Mar Lisa (nr. Bcharre), 915-1065m., Davis 10151. Akoura (Agoura), Gambault 2207 (S), 3513 (S) (W).

Other records: North Lebanon:- Afka, Post. Nab el Hadid nr. Sannin, Post. (cf. Post 1896) (syn-types of A. adonidis). Yamouny-Dimam, Blanche (cf. Boissier l.c.).

Geographical distribution: Endemic.

Biology: Caespitose or mat-forming plants of calcareous rocks on the western side of mt. Lebanon between 900 and 1830m. Flowers July-August.

Discussion: For a species with so restricted a geographical distribution that its most distant recorded localities (Ehden and Nab El Hadid) are only 40km. apart, A. libanotica, as here circumscribed, is very variable. There are two main directions of variation, the one in indumentum and the other in leaf shape. The range from a dense velutinous covering

of glandular hairs (Samuelsson 5989) to completely glabrous plants (Samuelsson 6192) can be traced within plants collected in a small area of 5km. radius round Bcharre. Indeed Samuelsson's material shows that even within the one gathering entirely glabrous and densely hairy plants as well as intermediate forms can be present. Material from or near the type localities of A. libanotica and agreeing well with Boissier's description has been seen, but it has not been possible to examine authentic specimens of A. adonidis. According to Post (1896) and Dinsmore (1932) the main differences between the two species lay in those characters whose variability has already been noted - A. adonidis being supposedly entirely glabrous with linear leaves, while A. libanotica had broader leaves and hairy stems and inflorescences. Gombault 2207 from Akoura, 6km. north of Afka (one of the type localities of A. adonidis), agrees very well with the description of that species and is probably representative of it. A complete gradation, however, exists between these plants and the broad-leaved pubescent forms, and for this reason, supported by the fact that individual populations may show the same range, it has been decided to regard A. adonidis and A. libanotica as conspecific. From Samuelsson's herbarium labels it appears that he was of the same opinion separating his single gathering from between Bcharre and The Cedars as "A. libanotica var. velutina", "A. libanotica f. ad var. velutina vergens", "A. libanotica f. typica", and A. libanotic f. ad var. adonidis vergens". These manuscript varietal names have not been published and in view of the variation within populations it does not seem desirable to recognise any infra-specific taxa.

It is possible that this great diversity of form results from hybridisation between two previously distinct and reproductively isolated species. If this is the origin of the variation, the herbarium material would suggest that the parent species have been more or less "hybridised out of existence".

13. A. angustifolia McNeill, sp. nov.

A speciebus orientalibus subgeneris Arenariae, praeter A. sabulineam, A. kotschyanam et aliquando A. libanoticam foliis omnibus anguste linearibus distinctissima. Ab A. sabulinea habitu perennis et planta glabris, ab A. kotschyana foliis uninerviis et habitu multo graciliore, et ab A. libanotica, affini, foliis semper linearis, numquam lineari- spathulatis vel lanceolatis, seminis laeviusculis non fimbriate marginatis facile distinguenda.

Herba perennis gracillima caespitosa. Planta ex toto glabra. Caudex ± gracilis, c. 1mm. diam., in caudiculos gracillimos numeroso foliis vel basibus foliorum persistentibus mortuis praeditos abiens. Caudiculi 1-2cm. longi ramulos steriles breves (1-2cm.) et floriferos longos (6-15cm.) abientes. Ramuli inferne foliis 1-2 jugis approximatis superne foliis remotis 1-2 jugis (ramulis sterilibus) vel 4-5 jugis (ramulis floriferis) praediti. Folia uninervia, 4-15mm. longa, linearia, latitudine 4-15-plo longiora (ea caulina 6-15mm. longa et latitudine 8-15-plo longiora). Inflorescentia ad 4cm. longa floribus 1-6 instructa; bracteae anguste triangulares 1-3mm. longae herbaceae; pedicelli 8-25mm.

longi, tenuissimi. Sepala ovata vel ovato-lanceolata, acuminata, 3-5-nervia (nervo mediano prominentiore), carinata, late membranaceo-marginata; sepalum extimum 2.5-3.0 (-3.25) mm. longum, ovato-lanceolatum, latitudine 2.75-3-plo longius; sepalum intimum brevius (ab 2.2mm.) latius (latitudine c. duplo longius), latius membranaceo-marginatum et frequenter tantum trinervium. Petala 3.75 - 4.5mm. longa, ovata, latitudine c. 2.5-plo longiora. Stamina 10, exteriora basi glandulis minutissimis praedita; filamenta 2.5-3mm.; antherae 0.4-0.5mm. longae. Ovarium globosum; styli c. 1.5mm. longi, caduci; ovula 20-30. Capsula 2-2.5mm. longa, calyce brevior, dentibus vel valvis 6 aequalibus dehiscens. Semina c. 5-10, 0.5mm. longa; cellulae haud prominentae in centra papilla minutissima (c. 8μ longa) gerentes.

Typus: TURKEY: Cilicia: "Prov. Konya, distr. Ermenek (Cilicia Trachea): Hamitsaydi boğaz between Sarivadi and Beşkuyu. 1500-1700m., mossy rocks, Perennial, 16.8.1949, P.H. Davis 16227" holo. E', iso. K'

Geographical distribution: Endemic.

Biology: A very slender plant, vegetatively rather moss-like and found growing on mossy rocks at 1500-1700m. Flowering and fruiting in mid-August.

Discussion: This new species is very distinctive, being one of the few truly linear-leaved members of the sub-genus Arenaria outside of the annual Section Occidentales and it is a little difficult to assess its

affinities. It has been placed in the series Anomalae largely because of its resemblance to glabrous narrow-leaved forms of A. libanotica (formerly separated as A. adonidis), but it shows unusual features for this group in the relatively strongly keeled sepals and the presence of central papillae on the testa 'cells'. These 'cells' are not, however, like those of A. deflexa or A. pamphylica, being less prominent (i.e. the seed not noticeably tuberculate) and having what appear (at x140 magnification) to be extremely minute marginal papillae of the A. sipylea type. This has been the deciding factor in placing it in Series Anomalae rather than in a group of its own, possibly showing affinity with A. kotschyana in Section Grandiflorae. (cf. fig. 22)

Series Anomalae - Discussion

This series, unlike the other Orient groups of the sub-genus Arenaria, is a somewhat heterogeneous assemblage of four, very distinct species, each with an exceptionally restricted distribution. None can with certainty be closely related to any other members of the subgenus, but all show possible affinities in more than one direction. The four species have been grouped together in the basis of their general resemblance to other members of Section Orientales, coupled with the assumption of their possessing a common basic type of testa sculpturing, namely the presence of minute papillae on the margins of the indistinct tubercles ('cells'),

rather as in section Rotundifoliae. This is to be seen clearly only in A. sipylea and A. libanotica, but the structures found in A. speluncarum and A. angustifolia could readily have been derived from it. On other grounds A. speluncarum seems possibly related to A. sipylea, and A. angustifolia has probably a close affinity with A. libanotica. All four species have much in common with the other members of the section Orientales. Although this is particularly true of A. sipylea and A. libanotica, both of which resemble forms of A. deflexa, all four share, for example, the sepal structure and general habit of growth of the group. The other possible affinities of the species are more diverse; A. speluncarum may possibly be related to A. rotundifolia; A. sipylea rather resembles A. filicaulis ssp. graeca, while A. angustifolia could well be a rather distant slender derivative of A. kotschyana.

A. libanotica is the most collected and as far as is known most widely distributed of the four species although it is confined to a small area, 40km. in extent, in the mountains of Lebanon. The others are each only known from one locality and indeed A. sipylea (Manisa dag in Lydia) and A. angustifolia (nr. Ermenek in Western Cilicia) have only once been collected. A. speluncarum has been found at least three times but on each of these occasions from the same caves above Ermenek to which it may well be confined. The four species are thus all mountain plants of the Mediterranean coastal ranges. (cf. fig. 19)

Series Graecae McNeill

Leaves ovate to lanceolate, acute, lowest pair of bracts ovate to lanceolate, acute, sessile with a cuneate base; pubescence and testa structure variable (cf. key to subspecies). 14. A. filicaulis

Leaves ovate, usually acuminate; lowest pair of bracts broadly ovate, acuminate, sessile with a truncate or cordate base; plant rather densely hairy with somewhat coarse hairs, few of which are glandular (confined to the peduncles and pedicels), those on the sepals 130-170 μ long and 25-35 μ broad at the base; seeds with small fine papillae (c. 25 x 10 μ) centrally placed on the tubercles of the dorsal surface. 15. A. teddii

14. A. filicaulis Fenzl in Grisebach, Spcil. Fl. Rumel. Bithyn. 1 : 203 (1843).

Key to subspecies

1a. Pedicels long, those of the first flower 1.5 to 3cm. long; plant sparsely hairy with rather fine, usually glandular hairs, those on the sepals 120-150 μ long and 25 μ broad at the base; seeds with shortish very fine papillae (20-40 μ x 5-10 μ) centrally placed on the tubercles of the dorsal surface; the tubercles ("cells") of the lateral surfaces somewhat shiny black, rather irregularly shaped in surface view. C. subsp. euboica

1b. Pedicels rather short, those of the first flower 0.5 to 1.5 (-2) cm. long; seed papillae stouter ($>15\,\mu$ broad); the tubercles ("cells") of the lateral surfaces of the seed dull dark brown to black, regularly round or oval in surface view:

2a. Leaves ovate to ovate-lanceolate, uppermost 2-2.5 times as long as broad; entire plant densely hairy with relatively coarse hairs, often only those in the inflorescence region glandular, those on the sepals (200-)300(-400) μ long and (40-)45(-50) μ broad at the base (very rarely glandular throughout or with pubescence as ssp. filicaulis); seeds with longish fine papillae (c. 50-70 μ x 15 μ), centrally placed on the tubercles of the dorsal surface

B. subsp. graeca

2b. Leaves lanceolate, uppermost c. 3 times as long as broad; plant moderately hairy with rather fine mostly glandular hairs throughout, those on the sepals 120-150 μ long and and 20-30 μ broad at the base; seeds with longish stout papillae (c. 50-70 μ x 70 μ), often excentrally placed on the tubercles of the dorsal surface.

A. subsp. filicaulis

A. subsp. filicaulis

Syn.: !A. graveolens Schreb. var. athoa Boiss., Fl. Orient, 1 : 701

(1867) ("ε").

'A. filicaulis Fenzl α rumelica Williams in J. Linn. Soc. 53 : 563 (1898).

Type: GREECE: Macedonia: "in reg. m. Athus pr. Panagia 4500ft." (1370m.), Grisebach. holo. destroyed (W), iso. K'

Specimens seen:

GREECE:-

Macedonia:- Hagion Oros, m. Athos, Aucher-Eloy 598, Janka 22.7.1871 (above Kellaeon Kerasia), Sintenis & Bornmuller 834 (Stratidochi), 834b, Dimonie 6.1908 (1800-2000m.) (WU).

Thrace:- Samothrake, m. Phengari, 1800m., Rechinger 9867 (as var. graeca) Karlik dagh nr. Komotini (Gümüldschina), 1400m., Rechinger 10455 (W-R).

TURKEY:-

Mysia:- m. Ida (Kaz dağ), m. Kapu Dagh, Sintenis (1883) 502 (as var. graeca).

Geographical distribution: Yugoslavia: S. Macedonia (Demir Kapija by the R. Vardar).

Biology: Altitudinal range 110 - 120m. (Demir Kapija); 1400-2000m. A mat-forming plant usually growing among rocks. Flowers June- July.

B. subsp. graeca (Boiss.) McNeill, comb. et stat. nov.

Syn.: !A. graveolens Schreb. var. graeca Boiss., Fl. Orient. 1 : 701 (1867) ("δ").

!A. filicaulis Fenzl var. graeca (Boiss.) Williams in J. Linn. Soc. 33 : 365 (1898).

!A. graeca (Boiss.) Halacsy, Consp. Fl. Graec. 1 : 232 (1900).

Lectotype: GREECE: Central Greece: "ad rupes umbrosas m. Parnassi", Karkaria nr. Hag Nikolass, 5000ft. (1525m.), 24.8.1856, Heldreich (Herb. Graec. normale 9) G, JE!, K! (mixed with A. cretica var. stygia), S!, W-H!

There are 6 paratypes, of which:- 1) "Creta in montibus Ida" Heldreich (W-H!) = A. fragillima Rech. & 2) "Creta in montibus Lassiti" Heldreich; not seen, probably = A. fragillima Rech. For other paratypes see below.

Specimens seen:

GREECE:-

Central Greece:- m. Parnassus (Parnasos), Heldreich Fl. Graec. Exs. 8.1855, Dörfler Fl. Graeca 180 (nr. Dekanistra) (W-H) (WU), Halacsy (1903) 34 (W-H), Maire & Petitmengin (1906) 1296 (Trypia Spilia, 1800m.). M. Korax, Pyrgos above Musinitza, 1675m., Heldreich 26.7.1879. m. Kiona (Giona); Platylithos, 1830m., Halacsy 11.7.1888.

Peloponnese:- Chelmos (Aroania Oros), Orphanides 159 (6.1854) (W-H)

(WU) (paratype), Grimburg (1893) 5 (m. Kastro nr. Kalavritam) (W-H)(WU), Bornmuller (1926) 240 (fl. Stygis, 1600-1800m.), Guiol 2203. M. Kyllenes (Killini Oros), Balansa 3.7.1848 (nr. Trikala, 1220m.) (JE), Orphanides 159 (10/22.6.1851) (nr. Trikala) (paratype), Heldreich 7.1848 (1495m.) (paratype), 3.7.1848 (1220m.)(as A. pubescens var. ? grandiflora), 24.6.1887 (nr. Trikala, 1065-1220m.), 2.8.1871 (Hagios Vlassies) (W-H), Pichler 1876 (with A. cretica var. stygia at K).

Other record: GREECE: Peloponnese: Chelmos: Heldreich (paratype) cf. Boissier (1867) l.c.

Geographical distribution: Endemic.

Biology: Altitudinal range 760-1800m. A mat-forming plant, occasionally somewhat cushion-forming, growing among rocks on mountains. Flowers June - August.

C. subsp. euboica McNeill, ssp. nov.

A subspeciebus aliis duabus, pedicellis pedunculisque longis, tuberculis in superficiebus lateralibus seminarum irregularibus formatis et eis in superficie dorsali papillis subtilissimis gerentibus distinguenda; a subsp. filicauli singulariter, papillis centralibus in tuberculis dorsalibus testarum divergit et a subsp. graeca pubescentia sparsissima subtilium plerumque glandulosum pilorum differt.

Herba perennis tegetiformis. Rami plurimi intertexentes fragiles, in inferiore parte folia persistentia mortua gerentes, et aut inflorescentia floribus 1-2 instructa aut ramulo sterili terminantes. Planta ex toto pilis subtilibus brevioribus glandulosis sparsissimis vestita, eis in sepalis 120-150 μ longis et 25 μ latis ad basem (eis ad radicem plantae gradatim maioribus). Pedicelli et pedunculi (ubi utrique) longissimi 1.5-3.0(-4.0) cm., sub fructescentia elongatantes. Sepala 3.5-4.5mm. longa (in typo); extremum plerumque 7 venis, intimum 3-5 venis praeditum. Capsula calycem subaequans sed valvae recurvantes. Semina 0.8-1.0mm. longa et 0.6-0.7mm. lata, nigerrima nitentiora; tuberculi testae parvi, ei in superficiebus lateralibus irregulariter formati, ei in jugo dorsali papilla breve subtilissima (20-40 x 5-10 μ) in centro gerentes.

Typus:- GREECE: Central Greece: "Insula Euboea : in saxosis regionis superioris mt. Dirphys, Aug. 1910, Dr. B. Tunta Plantae exsicc. Florae Hellenicae" sub "Arenaria graeca Boiss." holo. JE!, iso. JE!

Specimens seen:

GREECE:-

Central Greece:- Euboea:- mt. Xerovum (Xiron?), Tunta 20-22.9. 1910. (W-H).

Geographical distribution: Endemic.

Biology: Both localities, "in regionis superioris" of mountains 1745 & 991m. high. Mat-forming plants growing among rocks. Flowers July - August. (type specimen fruiting in September).

Discussion (of sp.): Arenaria filicaulis was first described by Fenzl on the basis of a Grisebach specimen from Mt. Athos. Boissier (1867) however reduced it to a variety (var. athoa) of the polymorphic species which he termed A. graveolens Schreb. and in which he recognised five varieties (incl. the type). One of these, var. graeca from southern Greece, shares with typical filicaulis the sessile leaves and much larger seeds which distinguish them from the true A. deflexa (A. graveolens sensu Boiss.) complex. Williams (1898) recognised their distinctiveness and adopted Fenzl's A. filicaulis treating graeca as a variety thereof. (While stating that the specimens referable to A. filicaulis "differ materially in other respects" Williams chose to distinguish them only as having narrower leaves, which they most certainly do not possess, covering about the same range in this respect as the series Deflexae). Halacsy (1900) raised graeca to specific rank and in this has been followed by Hayek (1924) and Turrill (1932), but Rechinger (1943) returns to William's evaluation. The two taxa do appear to be quite distinct from one another in seed characters (see key) and have quite separate geographical distributions. When seed is not available the two groups can usually be separated on the basis of the different size and type of hairs throughout the plant and to some extent on leaf shape.

Plants have been seen among gatherings of graeca made by Orphanides from M. Kyllenes in which the pubescence is not typical. No other plants of this type exist among the 34 other sheets examined (including 9 from M. Kyllenes), but the existence of these sparsely hairy forms which on other grounds appear to be referable to graeca adds to the difficulty

of certain identification of non-fruiting material. For this reason it has been decided not to treat filicaulis and graeca as separate species but to recognise them at subspecific rank under A. filicaulis, the older name.

On examining material from Jena and Vienna, it was found that the two known gatherings from Euboea both made by Tunta in 1910 differ notably in habit both from ssp. filicaulis and ssp. graeca. The plants have a much laxer habit and longer inflorescence, exemplified in particular by the very long pedicels and peduncles (where these are distinguishable - the inflorescence often consisting of a solitary flower.). On examination of the seeds it was found that the structure of the testa is also very distinctive, although its features are difficult to describe. The seeds of the Euboea plants are more densely black and light reflecting, yet appear (under a x70 magnification) much "rougher" with less clearly defined testa tubercles than those of typical filicaulis or graeca. This appears to be due to the outline of the tubercles (or "cells") where they cohere, being more irregular and possibly to the greater reflection of light from the surfaces of these individual tubercles. It is proposed to recognise these plants as a third geographical subspecies of A. filicaulis - ssp. euboica.

15. A. teddii Turrill in Kew Bull. 1936 : 100 (1936).

Syn.: ?A. nervosa Halácsy et Charrel in Öst. bot. Z. 42 : 272 (1892), nomen subnudum, non Lamarck (1778).

Type: GREECE: Macedonia: "mt. Pangaion (S. side) 2200ft. (670m.) Rocky crevices, dry place overhung by lofty rock. Fls. white 5.10.1935.", H.G.Tedd 1249, holo. K!

Specimens seen:

GREECE:-

Macedonia:- m. Pangaeon (Purnar Dagh), Rechinger 10208 (1700m.) (as A. filicaulis var. graeca), 10317 (750m.).

Geographical distribution: Endemic.

Biology: The three known gatherings were collected in July and October (fruit only) on calcareous and siliceous substrata. Mat forming plants growing among rocks.

Discussion: A. teddii, described by Turrill from a specimen collected by Tedd in 1935, is only known from Mt. Pangaeon in Greek Macedonia where it was collected again by Rechinger in 1936. Rechinger made two gatherings on the mountain, one about the same altitude as Tedd and the other higher up at 1700m. Turrill distinguishes A. teddii at length from the Cretan A. muralis with which it is not very likely to be confused, yet dismisses the very closely related A. filicaulis ssp. graeca merely as having larger flowers. Rechinger's collections cover a range of flower size from that of Tedd's specimen to the largest found in graeca, and so show that this character does not in fact distinguish the species. The small flowers of Tedd's plant may well be due to its being abnormally late-flowering. The most useful of the features which are in fact

discriminatory (see key) is the cordate base of the lowest bract. Rechinger's specimen from higher up the mountain (10208), which he identified as A. filicaulis var. graeca, does differ from the type of A. teddii in the direction of graeca, but from the shape of the bracts, among other things, it is much better placed with the other mt. Pangaeon specimens. A. teddii is very closely related to A. filicaulis ssp. graeca, but as it is much more readily distinguished macroscopically than are the other two subspecies of filicaulis, it is retained at specific rank.

A plant from Mt. Pangaeon collected by Charrel (Nadji effendi) was listed by him (1892) (cf. Turrill 1936) as "Arenaria graveolens Schreb. varietas Pangea mihi", but without a validating description. Later that year, what is presumably the same plant was "described" by Halacsy & Charrel as follows: "Arenaria nervosa Halacsy et Charrel, species vel varietas A. graveolentis Schreber, foliis subtus bene trinerviis, Pournar daghe. Studio digna." This plant has not been seen and the description is quite inadequate for its identification. The veins, however, are more prominent on the underside of the leaves in A. teddii than is usual in A. filicaulis, and there is sometimes only one pair of prominent laterals. This and more particularly the fact that Charrel's plant comes from Mt. Pangaeon, where of this section only A. teddii is known, makes it very possible that A. nervosa and A. teddii are conspecific. The latter is, however, the correct name because, apart from A. nervosa's doubtful nomenclatural validity (inadequate description and uncertainty as to rank), it is a later homonym of A. nervosa Lamarck, itself an

illegitimate substitution for A. trinervia L. (≡ Mochringia trinervia (L.) Clairv.).

Series Graecae - Discussion

Although Boissier (1867) included the then known plants of this series (A. filicaulis ssp. filicaulis and ssp. graeca) as varieties of A. deflexa (= A. graveolens sec Boiss.), there is no doubt that along with A. teddii and the Euboean plants (A. filicaulis ssp. euboica), they form a distinct group to some degree removed from the other members of section Orientales. The members of Series Graecae are much more robust plants than those of Series Deflexae; they are also probably longer lived and have seeds about twice as large. The series appears to occupy an intermediate position between Section Humifusae and Section Orientales Series Deflexae.

The series Graecae is almost entirely confined to Greece - A. filicaulis ssp. filicaulis being, however, recorded from one locality in N.W. Anatolia. The three geographical subspecies of A. filicaulis can be somewhat difficult to separate without ripe seed, and the only other species, A. teddii, although usually easily recognised by its cordate bracts, is very close to ssp. graeca. A. teddii, like the three subspecies of A. filicaulis, is also geographically distinct, being apparently confined to Pirnar dagh in Greek Macedonia. (cf. fig. 19)

Series Deflexae McNeill

Outer sepals 3.5-4mm. long, acute, ovate-lanceolate, c.2.5 times as long as broad; inflorescence few-flowered (2-5), pedicels short (< 1cm.), stout (that of the lowest flower 0.2-0.3mm. diam); seeds with long papillae on the tubercles of the dorsal ridge (60μ)

17. A. fragillima

Outer sepals acuminate, rarely acute and then usually < 3.5mm. long; inflorescence few to many-flowered (3-15), pedicels usually long (1-2cm.) and slender (< 0.2mm. diam.); seeds with short papillae on the tubercles of the dorsal ridge (< 25μ)

16. A. deflexa

16. A. deflexa Decaisne, Florula Sinaica 53 (1834) (reprint from Ann. Sci. Nat., ser. 2 3 : 277).

Syn.: (? A. graveolens Schreb. in Nov. Act. Nat. Cur. 3 : 478 (1767)).

Key to subspecies

1a. Outer sepals 2.5-3mm. long, acuminate, ovate-lanceolate to lanceolate 2.5-3.5 times as long as broad. D. subsp. microsepala

1b. Outer sepals 3.25-5mm. long, rarely c.3mm. and then acute:

2a. Outer sepals narrowly lanceolate, 3.5-4.5 times as long as broad, (3.5-) 4.0-5.0mm. long A. subsp. deflexa

2b. Outer sepals ovate-lanceolate, 2.5-3.25 times as long as broad, 3.0-4.0(-4.5)mm. long:

3a. Petals lanceolate, 2.5-3.5 times as long as broad; pedicels stout, that of the lowest flower 0.3mm. diam.
C. subsp. pseudofragillima

3b. Petals linear-lanceolate, 4-6 times as long as broad; pedicels slender, c.0.1(-0.25) mm. diam. B. subsp. pubescens

A. subsp. deflexa

Illustrations: Bouloumoy, Fl. Liban Syrie t.58 f.1 (1930) (photo) (as A. graveolens Schreb.) - (? ssp. deflexa).

Syntypes: EGYPT: Sinai: 1) "Entre les rochers granitiques du Sinai, Juin 1832, N. Bove 176" (as A. procumbens Vahl) holo. P, iso. K! 2) "Entre les rochers du Sinai, Juin 1832, N. Bove 177", holo P. iso. K!

Specimens seen:

GREECE:-

Aegean Islands:- Chios, Aucher-Eloy 600, Rechinger 5275 (Livadi, 400m.), 5404 (m. Plaka, 700m.).

TURKEY:-

Lycia:- Muğla: Kara tepe nr. Seke yaila, 1370m., Davis 13889. Mt. Massicytus (Girdev dağ), 915m., Forbes 10.1841. Elmalu, Pichler (1883) 124 (WU). Muğla-Fethiye, 6km. beyond Goltschük, 300m., Huber-Morath 5123 (JE).

Amanus:- Düldül, 1525-2135m., Haradjian 2350.

SYRIA:-

Latakia:- Djebel Ansarieh, Nebe Younes above Slenf, 1400m., Samuelsson 5828 (S).

Damascus:- between Mezze & el Rabone, Gaillardot 1648 (JE).

LEBANON:-

No locality or unlocated:- Lowne (1863-4) (as A. serpyllifolia) (K), (1863-4) (as Gypsophila sp. no.1) (K). Feitscur, 1220m., Samuelsson 2046 (S).

North Lebanon:- Merj Scun above Hermel, 1675-1830m., Davis 9847. above Sir, 1220-1525m., Davis 6371A. Ehden (Eden, Ehedin), Boissier 6.1846, Gaillardot (6.1855) 2768, Post 9.1855. Dimane, Blanche (8.9.1864) 2968 ter (JE). Hasroun: Blanche 6.1865 (JE). Beine (Baynu?), Blanche 23.?.1867 (JE). Tannourin, Post 868. J. Sanin, Bornmüller 200 (1800m.), 201 (JE)(WU). Tripoli: Eilius, Blanche 2969 (JE). Reyfoun, 1200m., Samuelsson 1993 (S). ?Nahr el Kanolum nr. Marassia, Gaillardot 2588 (JE). Wadi Hammana, 1050-1100m., Bornmüller 11467.

Antilebanon:- ? Quadi el Kam, 1200m., Samuelsson 1738 (S).

South Lebanon:- Jezzine (Gezzin), Ball 5.1877 (1000m.), Davis 5422. Ain Zehalteh, 1100-1300m., Ball 26.5.1877. Mt. Hermon (J. Cheikh): Chebaa (Shibah), Gaillardot 1648 bis (JE), Plantae Palaestinae 4156 (leg. Eig), 6156 (leg. R.C.S.). Mt. Hermon: Rasheiya, 915m., Kotschy 7.1855 (S).

ISRAEL:-

Northern Israel:- ? mts. E. of Duma, Post 4.5.1865.

JORDAN:-

Cisjordan:- Praq Buren on mt. Gerazim, Davis 5180.

EGYPT:-

Sinai:- no locality, McDonald (1849) ("Arabia Petraea"), Kaiser 182 (S). Jebel Musa, Drake 16a, Drar 576 (S). mt. Sinai (mt. St. Catharinae), Schimper 348, Cogh 5.1868. Wadi Farran, Cogh 5.1868. Wadi el Lega, Drar 426 (S), 457 (S).

Geographical distribution: Endemic.

Biology: Altitudinal range 400-1800m. A straggling plant, sometimes rather caespitose, of rocks, screes and cliffs. Recorded from calcareous substrata. Flowers May - July.

B. subsp. pubescens McNeill, subsp. nov.

Syn.: !A. pubescens d'Urv. in Mem. Soc. Linn. Paris 1 : 306 (1822), non Steudel (1821).

A subsp. deflexa sepalis ovato-lanceolata 3.0-4.0 (-4.5) mm. longis, nec anguste lanceolatis (3.5-)4.0-5.0mm. longis sat distinguenda; a subsp. pseudofragillima petalis lineari-lanceolatis et pedicellis tenuis (plerumque c. 0.1mm. diam.) divergit; proxima subsp. microsepalae sed sepalis longioribus (sepalis plantarum Aegaerum interdum aequilongis sed acutis nec acuminatis) differt.

Herba perennis caespitosa vel tegetiformis ex toto glanduloso-pubescens, caulibus floriferis foliatis erectis vel ascendentibus praedita. Inflorescentia pauci - vel multi-flora (3-10); pedicellis brevis vel longis (0.5-2cm.) tenuis c. 0.1mm. diam. (raro ad 0.25mm.). Sepala exteriora 3.0-4.0mm. longa ovato-lanceolata, latitudine 2.5-3.25-plo longiora, acuta vel acuminata. Petala 3.75-4.75mm. longa lineari-lanceolata, latitudine 4-6-plo longiora. Capsula ovoidea. Semina brevissime papillosa vel epapillosa (papillis 0-12 longis).

Typus: TURKEY: Lycia: "Vil. Antalya: Takhtali Dagh (Kemer) below Chukur yaila 5000ft. 1525m. shady rocks, Perennial, 17.8.1947", P.H. Davis 14148. holo. E! iso. K!

Specimens seen:

GREECE:-

Aegean Islands:- no locality (Kos?), d'Urville (P) (type of

A. pubescens d'Urv.). Kos (Coo): m. Dikaio (Dichoo), 800m., Rechinger 8040. Rhodes: mt. San Elio nr. Salakos, Bourgeau (1870) 9. Rhodes, nr. Rhodes, Bourgeau 5.1870.

TURKEY:-

Cilicia: No locality, leg. Alex Prior (K). Taurus mts. Kotschy 14 & 15, 59. Gulek Boghas, Balansa (1855) 608. Karli Boghas, Siehe (1896) 281, 327. Gisyl Deppe, 2440m., Kotschy (1853) (S). Cilician gates, 1400m., Siehe 263.

?LEBANON:-

not located:- Ain ab: Hooker & Hanbury 9/10.1860.

Geographical distribution: Endemic.

Biology: Recorded at 800, 1400 and 2400m., and appears to flower May - August, otherwise as subsp. deflexa.

C. subsp. pseudofragillima McNeill, subsp. nov.

A subspeciebus aliis A. deflexae petalis latioribus et pedicellis crassioribus recedit; ab A. fragillima, quam accedit, sepalis acuminatis pedicellis multo longioribus et petalis latioribus differt.

Herba perennis subcaespitosa. Caules erecti, ad 15cm. longi, crassi,

ad nodos fragiles. Inflorescentia ad 6cm. longa, floribus 4-7 instructa; pedicelli longi, crassi; infimi 15mm. longi et 0.3mm. diam. Sepala extima 3.5-4.5mm. longa, late lanceolata (latitudine 2.5-3.5-plo longiora), acuminata. Petala 4.25-5.25mm. longa, lanceolata (latitudine 2.5-3.5-plo longiora). Capsula ovidea. Semina vix matura, minute papillosa.

Typus: TURKEY: Lycia: "Prov. Antalya distr. Kemer (Lycia). Teke dağ near Ovacik. 1200m. 12.7.1949" P.H. Davis 15333 holo. K!

Specimens seen:

GREECE:-

Aegean Islands:- Chios: Msui, 700m., Platt 204.

Geographical distribution: Endemic.

Biology: Somewhat caespitose plant growing among rocks with long stout flowering stems which in the dried state are rather fragile at the nodes. Found in flower in mid-July at 1200m. in Lycia and in mid-May in Chios.

D. subsp. microsepala McNeill, subsp. nov.

A subspeciebus aliis A. deflexae sepalis parvioribus differt; a specimina Aegaea subsp. pubescentis ad quae sepalis approximat, sepalis acuminatis (nec acutis) distinguenda.

Herba perennis, caespitosa, sparse vel dense glanduloso-pubescens. Caules numerosi ascendentes, ad 10cm. alti. Inflorescentia ad 5cm. longa,

floribus 3-15 instructa; pedicelli longi tenues; infimi 10-15mm. longi et minus 0.1mm. diam. Sepala 2.5-3mm. longa, ovato-lanceolata vel lanceolata (latitudine 2.5-3 plo longiora) acuminata. Petala 3.5-4mm. longa, lineari-lanceolata (latitudine c. 4-plo longiora). Capsula ovoidea. Semina in jugo dorsali breviter tuberculata (c. 40 longa); tubercula (= cellulae) ± quadrata, c. 60 lata, papillosa; papillae c. 20 longae.

Typus: TURKEY: Caria: "Vilajet Denizli (Caria): Boz dagh nr. Ceyran yaila. 4500ft. 1370m. shady rocky places. 16.7.1947", P.H. Davis 13352, holo. E' iso. K'

Specimens seen:

TURKEY:-

Lycia:- Calbali dag nr. Fesliken yaila, 1800m., Davis 15354

Pamphylia:- Antalya: Gebiz (Pisidia): Bozburun dag at Kurucasra, 1800m., Davis 15691.

Geographical distribution: Endemic.

Biology: A mat forming plant with ascending flowering stems, growing among rocks, often shaded, between 1370 and 1800m. Flowers June - July.

Imperfectly known variety within A. deflexa:

A. graveolens Schreb. var. minuta Post, Fl. Syr. Pal. Sinai 153 (1896).

"Flowers .002 long" (= 2mm.)" "Woods, Ajlun"

(Ajlun - Gilead, JORDAN).

Discussion (of sp.): This relatively widespread species with a range from the Aegean Islands through the coastal mountains of the Levant to Sinai has had a very unfortunate nomenclatural history. At first it was generally known as A. pubescens d'Urville, a name published in 1822 on the basis of a specimen from the island of Kos in the Aegean. Boissier, however, decided that Schreber's much earlier name, A. graveolens (1767) referred to this species and accordingly used it in "Flora Orientalis". This usage was followed by most botanists until Turrill in a revision of the group in 1932 pointed out that Schreber's description was of an annual plant and applied better to Sibthorp and Smith's A. oxypetala from Greece than to the plant usually known as A. graveolens. In view of this uncertainty of application Turrill proposed to abandon the name A. graveolens, and for this perennial species to adopt once again d'Urville's A. pubescens (1822) as the next earliest name. Rechinger, in "Flora Aegaea" (1943) follows Turrill in this, but in fact the name A. pubescens d'Urv. is illegitimate, post-dating by one year A. pubescens (Haworth) Steudel, a valid, though also illegitimate, name referable to Spergularia media. The earliest legitimate name about which there is no ambiguity is thus Decaisne's A. deflexa (1834) based on plants from Sinai, and this name is adopted here.

A. deflexa is a very polymorphic species but only one infraspecific taxon has hitherto been described within it - a var. minuta described by Post (1896) from "Palestine", of which no material has been seen (cf. above). Of Boissier's four varieties of A. graveolens Schreb. (i.e. in addition to the type which includes deflexa), two are distinct species

referable to the series Anomalae and the other two are subspecies of A. filicaulis in Series Graecae. The type of A. deflexa from Mt. Sinai, with its long narrow sepals, is typical of the usual form of the species from there north to Syria. The plants of the Aegean and southern Turkey are more heterogeneous and in addition to the type (seen from Lycia and the island of Chios) three new subspecies have been recognised. One of these with broader rather shorter sepals, often almost acute like those of A. fragillima occurs in Cilicia and on the Aegean Islands. It includes what is believed to be the type of d'Urville's illegitimate A. pubescens and so, treating it as a new name, it has been called subsp. pubescens. Of the other two subspecies one is an exceptionally small-sepalled form from S.W. Anatolia (subsp. microsepala) and the other (subsp. pseudofragillima) approaches A. fragillima in its stout pedicels and brittle stems, but has a laxer inflorescence and unusually broad petals; it is only known from two specimens, one Lycian and the other from Chios. (cf. fig. 19)

17. A. fragillima Rech. f. in Fedde Repert. 47 : 49 (1939).

Lectotype: GREECE: Crete: "Distrikt Monophatsi. Felsritzen des Kophina 5.7.1904", "A. oxypetala S. & S. det Vierhapper", "A. fragillima det. Rech.", Dörfler (1904) 1212. WU!

Illustration: Rechinger, Fl. Aegaea t.2 f.3 (1943).

Specimens seen:

GREECE:-

Crete:- M. Ida, 1220m., Heldreich 1553 (W-H) (paratype, also paratype of A. filicaulis ssp. graeca q.v.). Hierapetra: M. Aphendi Kavusi, 1450m., Rechinger 15240 (S).

Other records: GREECE:- Aegean Islands:- Karpathos: "Felsritzen am Westhang des Kalolimni, 1100m.", Rechinger 3184a, Crete:- "Hierapetra: Aphendi Kavusi", Dorfler 1218, "Berg Aph. Christos" Dorfler 1222a - paratypes, destroyed (W) cf. Rechinger l.c.

Geographical distribution: Endemic.

Biology: Rather dwarf plant growing among rocks; recorded at 1200 and 1450m. Flowers late May - July.

Discussion: A fragillima from Crete and the Aegean Islands is very closely related to A. deflexa, in particular to subsp. pubescens and subsp. pseudofragillima. Many of Rechinger's (1943) key characters appear to be rather variable, but the species can usually be distinguished on the basis of its acute sepals, rather larger than those of the Aegean plants of A. deflexa subsp. pubescens which occasionally also have acute sepals. The dorsal tubercles on the seeds of A. fragillima have much longer papillae than any found in A. deflexa.

Series Deflexae - Discussion

The series Deflexae is a very natural group of rather slender, and probably short-lived, perennial plants, sometimes scarcely more robust than the closely related annuals in Series Pamphylicae (particularly A. oxypetala and muralis) with which imperfect specimens lacking the perennial rootstock can easily be confused. Taxonomically, the series comes intermediate between Series Graecae and Series Orientales, but also shows an affinity with A. sipylea and A. libanotica in Series Anomalae.

The phytogeographical status of the series is chiefly Mediterranean, being represented in Crete, the Aegean Islands and on the mountains of the Mediterranean seaboard south to Israel and thence to Sinai, thus replacing to the east, Series Graecae. The plants of Series Deflexae are found at relatively low altitudes on mountains but become more alpine in the southern part of the range, whereas the members of the annual Series Orientales are chiefly lowland and even coastal plants. (cf. fig. 19)

Series Orientales

1a. Bracts subulate or setaceous with an abrupt change in size and (usually) shape between the uppermost leaf and the lowest bract:

2a. Sepals 2-2.5mm. long, petals about 1.5 times as long; capsule when fully mature greatly exceeding sepals (almost twice as long)

18. A. luschanii

2b. Sepals 2.5mm. long; petals usually slightly longer than the sepals (< 1.25 times) rarely almost twice as long; capsule up to 1.5 times as long as the sepals:

3a. Leaf-blades ovate-lanceolate gradually narrowing into the petiole (average length/breadth ratio of whole mature leaf > 2.75); seeds greyish-black prominently tuberculate with rhomboid 'cells' (tubercles) on the lateral faces:

4a. Sepals acuminate, linear-lanceolate, c.4 times as long as broad; seeds with longish papillae (c.25 μ) on the tubercles of the dorsal ridge 19. A. oxypetala

4b. Sepals acute, ovate-lanceolate to lanceolate, 2.5-3.5 times as long as broad; seeds with short papillae (c.10 μ) on the tubercles of the dorsal ridge. 20. A. muralis

3b. Leaf blades orbicular to ovate, often abruptly contracted into a long petiole (average length/breadth ratio of whole mature leaf usually < 2.5); seeds dark reddish-brown weakly tuberculate

with oblong 'cells' (tubercles) on the lateral faces ('cells' 3 times as long as broad) 21. A. rhodia

1b. Bracts foliaceous (upper becoming subulate) showing a gradual reduction in size from the stem leaves upwards:

5a. Sepals 2.25-5.5mm. long, with 3(-5) almost parallel nerves; capsule ovoid-cylindrical more than twice as long as broad; if sepals < 3.0mm., then much exceeded by the petals (1.3-1.5 times as long) 22. A. pamphylica

5b. Sepals < 2.25mm. long, 3-nerved, the lateral nerves almost marginal strongly divergent at the base; capsule ± globose (< 1.25 times as long as broad); petals about as long as the sepals.

23. A. kurdica

18. A. luschanii McNeill, nom. nov.

Syn.: !A. pusilla Stapf in Denkschr. Acad. Wiss., Wien 51 : 355 (1886), non S. Wats. (1881-82), nec Alsine pusilla Stapf. l.c. 354.

!A. pamphylica Boiss. & Heldr. var. lycia Boiss., Fl. Orient. Suppl. 116 (1888) ("β"), quoad planta Pestalozzae.

Type: TURKEY: Lycia: "Acropolis bei Aziyram Zeilany 1882", Luschan. holo. WU! (as A. pusilla).

Specimens seen:

TURKEY:-

Lycia:- Castellrosso, Pestalozza (1846) (G) (type of A. pamphylica var. lycia). Gölbaşi (Gölbaktschy), Luschan 4.5.1882 (WU) (as A. pamphylica), 29.5.1882 (WU) (as A. graveolens).

Geographical distribution: Endemic.

Biology: An erect or ascending much-branched annual.

Discussion: Although the four known specimens are provided with two validly published names, the distinctiveness of this species has not hitherto been recognised. Boissier at first (1867) included Pestalloza's plant in typical A. pamphylica, and when he later separated it as a distinct variety (β lycia) he only distinguished it by its long capsules and included with it a specimen (Peronin : Cilicia trachea) referable to A. pamphylica subsp. kyrenica var. turcica. Each of the three Luschan specimens was determined differently by Stapf. One he made the type of a new species, A. pusilla Stapf (a later homonym of A. pusilla S. Wats.) another he identified as A. pamphylica Boiss. & Heldr. and the third as A. graveolens Schreb. Neither Boissier nor Stapf noticed that these plants lacked the foliaceous bracts of A. pamphylica. The small sepals, longish petals and very long capsules readily distinguish this very uniform species from those of its relatives with subulate or setaceous bracts (A. oxypetala, muralis and rhodia). A distinctive feature of the species appears to be the relatively strong development of a

receptacle at the base of the sepals. This is unusual in the section Orientales, but the receptacle is well-developed in the strictly perennial sections such as Grandiflorae, and of course is hardened and very prominent in most groups of the subgenus Eremogone. There are not known to be any specimens of this species in British herbaria and hence it is not mentioned by Turrill (1932).

19. A. oxypetala Sibth. et Sm., Prodr. Fl. Graec. 1 : 373 (1806).

Syn.: ?A. graveolens Schreb. in Nov. Act. Nat. Cur. 3 : 478 (1767).

Illustration: Sibthorp & Smith, Fl. Graec. 5 t.437 (1825).

Type: GREECE: Central Greece: "in agro Eliensi", Sibthorp. holo. OXF.

Specimen seen:

GREECE:-

Central Greece:- m. Parnes, Pinatzi 4.1930.

Geographical distribution: Endemic.

Biology: An erect annual collected by Pinatzi on wet rocks.

Discussion: The confusion which existed as to the status and nomenclature of the Greek and Aegean plants of this group was largely resolved

by Turrill (1932), who recognised that A. oxypetala Sibth. & Sm. was restricted to the mainland of Greece, the Cretan and Aegean material often referred to it being in fact a distinct species (A. muralis) differing in having broader acute sepals. Turrill discusses the application of the very early name A. graveolens Schreb. (1767) and concludes that it is not possible to determine to which, if any, of the species in this whole section, it should be applied. The name has usually been used for the perennial plants of the series Deflexae but the original description refers to the habit as annual and could be applicable to A. oxypetala. A. oxypetala also differs from A. muralis in having much longer papillae on the tubercles of the dorsal ridge of the seed.

20. A. muralis (Link) Sieber ex Spreng. Syst. 2 : 397 (1825).

Syn.: !Stellaria muralis Link, Enum. Hort. Berol. 1 : 429 (1821).

A. oxypetala auctt. non Sibth. & Sm.

Type: - GREECE:- "in Creta" (Lacida in Mirabello), Sieber. holo. ?B iso. JE!, K!, S!

Specimens seen:

GREECE:-

Aegean Islands:- Samos: Koumarika, Davis 1637.

Crete:- "Creta", (PRC). m. Sphaciotices: Heldreich (as A. cretica Spreng.) (BM). Malana, Reverchon 8.5.1883, 16.5.1883, 19.5.1883.

Amalos, Reverchon (1884) 279. Caneé: Akrotiri, Gandoger 3297. Caneé: Koraki, Gandoger 8360. Kissamos: Titiron peninsula, Akropharango nr. Spatha, Rechinger 12194. Sphakia: Samaria ravine, Dörfler (1904) 315 (W-H)(WU). Hag. Vasilis: Paximadhia Isl., Dörfler (1904) 987 (WU). Hag. Vasilis: Spili, Dörfler (1904) 231 (WU). Monophatsi: Kiphina, Dörfler (1904) 1213 (WU).

Geographical distribution: Endemic.

Biology: An erect or prostrate annual with a much branched inflorescence, growing on dry rocks. Flowers April - June.

Discussion: As indicated above, this species has not always been distinguished from A. oxypetala (e.g. by Halacsy, 1900), but Turrill (1932), followed by Rechinger (1943), recognised its distinctiveness. The latter, however, includes typical A. rhodia within it (but not subsp. cypria) and his records (in "Flora Aegaea") from Chios, Phurni and Kalymnos may refer to that species.

21. A. rhodia Boiss., Diagn. Pl. Orient. ser.1 1 : 52 (1842).

Key to infra-specific taxa

1a. Sepals 2.5-3.5mm. long, ovate-lanceolate, < 3 times as long as broad; pollen grains 25-30 μ diam. A. subsp. rhodia

2a. Petals linear (5-6 times as long as broad), slightly exceeding the sepals (< 1.25 times as long) A. (i). var. rhodia

2b. Petals oblanceolate (c.3 times as long as broad), nearly twice as long as the sepals A. (ii). var. macropetala

1b. Sepals 3.5-5.0mm. long, lanceolate, 3-4 times as long as broad; pollen grains 31-36μ diam. B. subsp. cypria

A. subsp. rhodia (i). var. rhodia

Syn.: !A. oxypetala Sibth. & Sm. var. strictiuscula Boiss., Diagn. ser.1 5 : 85 (1844).

Type: GREECE: Aegean Islands: "Insula Rhodos", Aucher-Eloy 575 holo. G, iso. BM!, K!

Specimens seen:

TURKEY:-

Caria:- Marmaris - Emecik, 200m., Davis 25328.

Lycia:- Fethiye: Kizil dere to Dalaman Çay, 100m., Davis 25547.

A. (ii). var. macropetala McNeill, var. nov.

A varietate typica, petalis oblanceolatis (latitudine c.3-plo longioribus) calycem valde excedentibus, circiter duplo longioribus differt.

Typus: TURKEY: Lycia: "Prov Muğla, dist. Fethiye: between Kizil dere and Dalaman Çay, 100m. Serpentine scree. Annual. Fls. large. Leaves purplish. 1 April 1956.", Davis & O. Polunin (D. 25543) holo. E!, iso. K!

Specimens seen:

TURKEY:-

Caria:- Muğla: Marmaris, 30m., Davis 25254.

Geographical distribution (of ssp.): Endemic.

Biology (of ssp.): Erect or ascending much branched annuals growing on serpentine rocks or scree between 30 and 200m. All the known specimens (including Aucher-Eloy 575 for which there are no ecological data) show the purplish leaves associated with serpentine soils. Davis 25547 (var. rhodia) is recorded as growing in moister places than Davis 25543 (var. macropetala). Flowers March to April.

B. subsp. cypria (Holmboe) McNeill, comb. et stat. nov.

Syn.: A. cypria Holmboe, Stud. Veg. Cyprus 68 (1914) (in Bergens Mus. Skr. N.S. 1 (2).

Illustration: Holmboe l.c. (1914).

Type: CYPRUS: Limassol: "Rocky places in the Troodos mountains near the village of Prodromo", Holmboe 888. holo. ?O, iso. ?C.

Specimens seen:

CYPRUS:-

Paphos:- Akamas: between Smyéz and Drousha, Davis 3311. Akamas: Ayia Nicola (above Neokhoria), Davis 3325.

Limassol:- m. Troödos, Sintenis & Rigo (1880) 763, Haradjian, 400, 476 (both 1525-1950m.). Troödos: Kannoures Spring, Lindberg 22.6.1939. Chionistra, southern slope, 1735m., Kennedy 375. Prodromos, 1525m., Davis 1782. above Prodromos, 1525-1830m., Davis 2048. Platres - Troödos road, Kennedy 373 (1400m.), 377 (1510m.), 379 (1495m.). Chionistra: Xerokolymbos - Troöditissa, 1510m., Kennedy 376. Xerokolymbos, 1510m., Kennedy 378. Platres, 1250m., Kennedy 1214, 1215. Kryos Potamos, 1800m., Kennedy 1216. Chionistra nr. Asprokrimos, 1525m., Davis 3170.

Geographical distribution: Endemic.

Biology: Habit resembles ssp. rhodia. The two localities on the Akamas peninsula are both on serpentine rock but there are no data for the remaining specimens from the Troödos range; the cap of Troödos, however, is entirely serpentine (above c.1500m.). Some of Kennedy's gatherings have somewhat reddish leaves and are recorded as growing on "igneous rock". Grows between 1200 and 1950m. on m. Troödos. Flowers April - May.

Discussion (of species): Neither A. rhodia nor A. cypria have ever enjoyed general recognition at specific rank. The former was given

varietal status by its author (Boissier) only two years after its original publication as a species, and later in 'Flora Orientalis' reduced completely to synonymy under A. oxypetala, where it remained until Turrill's revision of the group in 1932. Meanwhile Holmboe (1914) had described A. cypria on the basis of two specimens from Troödos but Turrill united it with A. rhodia only known from Aucher-Eloy's type specimen from Rhodes. He distinguished his thus enlarged A. rhodia from the Cretan A. muralis solely on sepal size, a distinction which Rechinger (1943), who united the two species, rightly found to be unreliable. Both authors disregarded the very well-marked differences in seed structure, although Holmboe (1914) had noted the characteristic seed structure of A. cypria in his description of that species. The same testa features (cf. key) are also found in the type specimen of A. rhodia and in recent gatherings of Davis from the mainland of Turkey just opposite Rhodes. Another character which these plants have in common and in which they differ from A. muralis and A. oxypetala is the possession of broad leaves, the blades being almost orbicular; moreover many of them, if not all, are from serpentine rocks, whereas A. muralis is more characteristic of calcareous substrata. For these reasons A. rhodia has been recognised as a distinct species, separated geographically and probably ecologically from A. muralis and A. oxypetala. The Cyprus plants (Holmboe's A. cypria) differ from those from Rhodes and the mainland of Turkey in having longer narrower sepals and larger pollen grains, and have been accorded subspecific status. Within the type subspecies there is further variation, two of Davis' specimens having

linear petals about as long as the sepals, as in the Rhodes plant, and two having very large and prominent obovate petals. The two plants were growing in the same locality between Kizil dere and Dalaman Çay, and Davis notes that the typical form was growing in damper places than the large-flowered plants, which have been named var. macropetala.

22. A. pamphylica Boiss. et Heldr. in Boiss., Diagn. Fl. Orient. ser.1 8 : 102 (1849).

Key to infra-specific taxa

1a. Petals much longer than sepals (1.3-1.5 times as long)

A. subsp. pamphylica

2a. Sepals 2.25-2.75mm. long; pollen 24-27μ diam.

A.(i). var. pamphylica

2b. Sepals 3-5mm. long; pollen 27-32μ diam. :

3a. Sepals 3.0-3.75mm. long, 3-4 times as long as broad

A.(ii). var. maritima

3b. Sepals 4.25-5.0mm. long, c.5 times as long as broad

A.(iii). var. alpestris

1b. Petals shorter than or scarcely exceeding the sepals (< 1.25 times as long)

B. ssp. kyrenica

4a. Sepals 3.75–4.75 times as long as broad with a narrow membraneous margin (about a third as broad as median herbaceous part)

B. (i). var. kyrenica

4b. Sepals 3–3.5 times as long as broad with a broad membraneous margin (> half as broad as median herbaceous strip)

B. (ii). var. turcica

A. subsp. pamphylica (i). var. pamphylica.

Type: TURKEY: Pamphylia: "ad ampith. dirutum Perge Pamphyliae, Mart. 1845, de Heldreich" ("sur les pierres de murs de l'Amphitheatre de Perga, 19 mars. 1845, [de Heldreich] 490"). holo. G! iso. BM!, E!, JE!, K!

A. (ii). var. maritima McNeill, var. nov.

A varietate typica, sepalis maioribus (3.0–3.75mm. longis) et granulis maioribus (27–32 μ diam.) recedit, a varietate alpestri sepalis minoribus lanceolatis (latitudine 3–4-plo longioribus) differt.

Typus: TURKEY: Pamphylia: Prov. Antalya. Manavgat - Kara point 3m. White dunes. Tall specimen growing in protection of Lentisc. Annual, erect, 18 April 1956, Davis & O. Polunin (D.25828) holo. E!, iso. K.

Specimens seen:

TURKEY:-

Lycia:- Atbukii (Antalya - Finiki), 10m., Tengwall 531.

Pamphylia:- Adalia, Forbes 132. Alanya promontory, 100m., Davis 25871. Alanya - Gazipaşa, 10m., Davis 25920. ? Konya Alti, 10m., Tengwall 172. Çarma Dağ, 215m., Smith 24.

A. (iii) var. alpestris McNeill, var. nov.

A varietatibus aliis duabus, sepalis longioribus (4.25-5.0mm. longis) et angustioribus (latitudine c. 5-plo longioribus) divergit, a varietate typica granulis maioribus (27-32 μ diam.) praeterea differt.

Typus: TURKEY: Cilicia: "Prov. Mersin. distr. Anamur (Cilicia Trachea) Camurla yayla - Olucak (Ermenek - Anamur), 2000m. among shady rocks (limestone). Annual fl. white. 18.8.1949, P.H. Davis 16316" holo. E!, iso. K!

Specimens seen:

TURKEY:-

Pisidia:- Bucak, 915m., Little 142, Truman 190.

Geographical distribution (of subsp.): Endemic.

Biology (of subsp.): Erect annual growing among rocks (often limestone), or on dunes; var. maritima recorded from 3-215m., var. pamphylica at about 100m., but var. alpestris at 915-2000m. Var. pamphylica and var. maritima flower March - April; var. alpestris June - July.

B. subsp. kyrenica McNeill, ssp. nov.

A subspecie typica petalis sepalis brevioribus vel vix excedentibus (non multis excedentibus) differt.

Planta annua gracilis erecta vel ascendens, 5-35cm. alta. Inflorescentia ad 18cm. longa, floribus paucis vel plurimis instructa; bracteae inferiores foliaceae ad superiores bracteas subulatas sensim transientes; pedicelli ad 20mm. longi. Sepala 3-4mm. longa, linearilanceolata; sepalum extimum latitudine 3.75-4.75-plo longius anguste membranaceo - marginatum (margine membranaceo mediis herbaceis c. 0.7-plo angustior). Petala 3.0-4.5mm. longa sepalis < 1.25-plo longiora. Stamina 10: filamenta 1.75-2.25mm. longa; antherae c. 0.25mm. longae; granula 27-36 μ diam. (plantis Cypri 31-36 μ diam.; plantis Syriae et Libani 27-31 μ diam.). Capsula calycem ± aequans.

Typus: CYPRUS: Kyrenia: "Kornos (Kyrenia range) abundant on limestone rocks above Larnaca-tis-Lapithos, 1000-2000ft. [305-610m.] Annual, petals white, linear, obtuse. 3.4.1941., P.H. Davis 2990" holo. E!, iso. K!

B. (i). var. kyrenica.

Specimens seen:

CYPRUS:-

Kyrenia:- "Kyrenia", 60m., Merton 2095, Atherton 1349 (sea-level). Lapithos, Druce 91. Larnaca-tis-Lapithos, Davis 3011. above Agirdha, Davis 2511. Buffavento, Davis 2806. Yaila, Davis 2849, 3601 (610-915m.)

Halefka above Kythnea, Davis 2771. Armenian monastery nr. Halefka (mt. Pentadactylos), Davis 1753 (610m.), Lindberg 5.7.1939. Carpas bei Kantara (mt. Pentadactylos), Sintenis & Rigo (1880) 233. Ayios Hilarion, Lindberg 6.7.1939, 7.6.1939 (? = 6.7) (W)(S), Kennedy 1571 (640m.) 1572 (640m.). St. Chrysostoma, Pichler 1.4.1889 (WU).

SYRIA:-

Latakia:- M. Nusairy: Ain Halakeni, 800-1000m., Haradjian 3522.

LEBANON:-

North Lebanon:- The Cedars, Blanche ser. II (30.5.1866) (JE).

B.(ii). var. turcica McNeill, var. nov.

A varietate kyrenica sepalis latioribus et margine sepalorum latius membranaceo differt.

Sepala 2.75-3.25mm. longa, lanceolata; sepalum extimum latitudine 3.0-3.5-plo longius, late membranaceo-marginatum (margine membranaceus mediis herbaceis < 0.5-plo-angustior). Petala 2.75-3.25mm. longa calycem ± aequans. Stamina 10; filamenta 1.25-1.75 longa, granula 27-29 μ diam. Capsula calycem aequans vel excedens.

Typus: TURKEY: Pamphylia: "Adalia, in rupestribus maritimis, 5 Maio 1860", Bourgeau holo. G!

Specimens seen:

TURKEY:-

Cilicia:- Cilicia trachea: Genova, Peronin 229 (5.1872) (as

"A. lycia Boiss. mss.") (G).

Geographical distribution (of subsp.): Endemic.

Biology (of subsp.): Erect or ascending, usually much branched, annual, growing among limestone rocks from sea-level to 1000m. Flowers March - June.

Discussion (of species): A. pamphylica is a variable Mediterranean species which to some extent parallels A. rhodia in its distribution and particularly in the distribution of its infra-specific taxa. As in A. rhodia two subspecies are recognised, the one predominantly Cyprian and the other confined to southern Turkey, but whereas A. rhodia subsp. cypria only occurs in the southern part of the island (mostly in the Troödos mts.), A. pamphylica subsp. kyrenica is confined to the province of Kyrenia where it is widespread along the limestone mountain range. The type subspecies of A. pamphylica has a more easterly distribution on the Turkish mainland than has A. rhodia ssp. rhodia. There appears also to be an ecological difference between the two species, A. rhodia being probably confined to serpentine while A. pamphylica is typically calcicole. The known specimens of A. pamphylica readily separate into five groups (the varieties recognised above), but the small-petalled var. kyrenica is more distinct in appearance and distribution and appears to deserve subspecific status. This subspecies (kyrenica) is characterised by having short petals, not or scarcely exceeding the sepals, and hence the two small-petalled Turkish specimens comprising var. turcica

have been attached to it. From the analogy of A. rhodia ssp. rhodia var. macropetala the significance of this character can be questioned, but in the absence of evidence that a parallel situation holds in this respect (e.g. var. turcica shows no particular affinity to any of the varieties of ssp. pamphylica) it seems justifiable to use this convenient and very marked petal character to distinguish the subspecies.

? Polyploidy

23. A. kurdica McNeill, sp. nov.

Ab A. pamphylica affini, sepalis parvis trinerviis petala subaequantibus nervis lateralibus sepalorum ± marginalibus divergentibus capsula subglobosa et ab A. sabulinea foliis ovatis vel lanceolatis nec linearis petalis minoribus facile distinguenda.

Herba annua humilis, ad 5cm. alta. Planta ex toto pilis brevibus simplicibus vel glandulosis vestita. Folia 10-16mm. longa, ovata vel ovato-lanceolata, in petiolum (3-4mm. longum) sensim contracta, pauca, sub anthesi marcescentia. Inflorescentia divaricata, floribus 5-9 instructa; bracteae foliosae lanceolatae, infimae 8mm. longae; pedicelli 4-7mm. longi. Sepala 2.0-2.5mm. longa, ovato-lanceolata vel lanceolata (extimum latitudine 2.5-3.5-plo longius), trinervia; nervi laterales nervo medio indistinctiores divergentes submarginales. Petala 2.0-2.5mm. longa, lanecolata. Stamina 10; filamenta 0.5-0.8mm. longa; anthera 0.2-0.3mm. longa; granula 34-38 μ diam. Capsula subglobosa (latitudine ad 1.25-plo longior) calcyem vix excedens valvis 6 dehiscens;

ovula c.15-25. Semina vix matura c.12-18, probaliter rugulosa.

Typus: 'IRAQ: Erbil: "Sefin Dagh above Shaqlawa 1200m. Oak forest formation, limestone crats (sic) N. aspect. Flowers white. Frequency occasional 9.5.47, Collector: J.B. Gillett." National Herbarium of Iraq (BAG) 18076 holo. K!

Geographical distribution: Endemic.

Biology: A small annual plant, the only known specimen growing at 1200m. on limestone in an early flowering stage at the beginning of May.

Discussion: In one of his enumerations of the flora of 'Iraq, Blakelock (1957) commented on the distinctiveness of Gillett's plant (the type and only known specimen of this new species), noting that it resembled A. sabulinea but differed in its wider leaves and shorter petals. He suggested that it might be a new species, but was unwilling to describe it as such without further study in view of the scanty material existing and the notorious taxonomic complexity of the annual Arenarias. The present revision of the genus in the whole of the Easter Mediterranean area enables the position and distinctiveness of Gillett's specimen to be seen more clearly, and viewed in this context there is no doubt as to its status. The new species is most closely related to A. pamphylica, but differs in well-marked floral characters (cf. key to the species). Although quite typical of Section Deflexae Series Pamphylicae in the broad petiolate leaves and the not very distinct sepal

nervation, it appears to show an approach towards Section Pseudosabulina of which A. sabulinea is the only species. This is most noticeable in the reduction to three more or less unbranched sepal nerves (particularly in the outer sepals) and in the rather globose capsule. (cf. fig. 24)

A. kurdica is the only Irano-Turanian member of a predominantly Mediterranean section.

Series Orientales - Discussion

There are two groups of plants within the series Orientales - the one in which there is an abrupt change of shape and size between the leaves and bracts which are all subulate or setaceous, and the other where the leaves and bracts merge into one another, the lower bracts being foliaceous. The former group contains four species and is more closely related to the perennial series Deflexae of which this abrupt change is also characteristic. The group with foliaceous bracts comprises the polymorphic A. pamphylica and the new Iraq species, A. kurdica, through which an approach is made to the monotypic section Pseudosabulina (A. sabulinea). A. retusa in Spain appears to be linked to this latter group.

The range of the two groups of species in the Orient is rather distinct, that of the former being more to the west although both occur in Lycia and on Cyprus (though in different parts). The more deflexa-like group comprises A. oxypetala, a rare endemic of Central Greece,

A. muralis confined to Crete and some of the Aegean Islands, A. luschanii in Lycia and the polymorphic A. rhodia with one geographical subspecies on Rhodes and the adjacent part of Turkey (Caria and Western Lycia) and the other in the southern part of Cyprus. On the other hand A. pamphylica, also polymorphic, has one subspecies in Eastern Lycia and Pamphylia and the other in northern Cyprus. Pamphylia, Cilicia, the Amanus and the Lebanon, while A. kurdica is at present only known from N. 'Iraq. (cf. fig. 23)

The species of the series, although they have been much confused, are on the whole rather well-marked, A. oxypetala and A. muralis being the only two whose distinctiveness from one another is open to doubt. The major taxonomic problem in the series rests in the treatment of the considerable variation within A. rhodia and A. pamphylica. Some of this variation appears to be correlated with geographical and ecological factors, while other variable features are not. The present treatment appears fairly satisfactory on the basis of the material now available, but a knowledge of the genetics of petal-length inheritance and of the effect of environment on flower size in the group, may lead to considerable revision of opinion, particularly in the case of A. pamphylica.

Section Orientales - Discussion

This is one of the larger sections of the subgenus Arenaria, comprising about twenty species of which fourteen lie within the area covered by this revision. The inter-relationships of the different species have been discussed under each of the four series and it is apparent that apart possibly from the four species of the series Anomalae this is a very homogeneous group of plants characteristically Mediterranean (the only exception being A. kurdica). In its relationships with other sections, Series Graecae appears to have an affinity with Section Graciles, Series Orientales with Pseudosabulina and Series Anomalae with Rotundifoliae and possibly Grandiflorae. The annual series Orientales also shows a considerable resemblance to A. serpyllifolia and A. leptoclados in Section Arenaria, the latter differing in the many-nerved sessile leaves and the usually very short petals (about half as long as the sepals).

Section Pseudosabulina McNeill

One species:-

24. A. sabulinea Grisebach ex Fenzl, Illustr. Fl. Syr. Taur. 47 (1843) (reprint of Russegger, Reisen 1 (2) : 933) ("subulinea" mendum typograph).

Syn.: A. sabulina Fenzl in Grisebach, Spicil. Fl. Rumel. Bithyn. 1 : 204 (Dec. 1843 - Jan. 1844).

Illustrations: Bouloumoy, Fl. Liban Syrie t. 57 f. C (1930) (photo).

Type:- "in Mesopotamiae sabulosis", Grisebach holo destroyed (W).

Specimens seen:

TURKEY:-

Mesopotamia:- "ad Euphratem" (= Birecik cf. Jaubert 1843), Aucher-Eloy 607. Urfa (Orfa), Haussknecht 6.5.1865 (610m.), Davis 27996 (700m.) Urfa Castle, 600m., Davis 28040. Top dagh above Urfa, Haussknecht 15.5.1865 (JE). Urfa-Siverek (Suerek), Kotschy (1841) 75. Nimrud dagh, Sintenis (1888) 825 (as Alsine tenuifolia β macropetala). Mardin castle, 1200m., Davis 28337. Rişmil (Mardin-Savur, 7-8 mls. from Mardin) 900m., Davis 28524. ?m. Singarne. Haussknecht. 5.1867? (JE).

Geographical distribution: Endemic.

Biology: Slender much-branched annual of calcareous rocks between 600 and 1200m. Flowers May. Often grows along with A. leptoclados.

No material has been seen of:

Ar. sabulinea var. brevipes Bornm. in Beih. bot. Zbl. 28 (2) : 149 (1911).

"pedicellis calyce subduplo tantum (nec 'multoties') longioribus"

Type: IRAQ: 1) Erbil: "Ostlich von Erbil am Wege nach Schaklawa, am Kuh-i-Sefin", 700m. 6.V.1893, Bornmüller 941. 2) Kirkuk & Sulaimaniya: "inder Ebene bei Kerkuk, Kalkhügel", 400m. 28.IV.1893 Bornmüller 941b holo. ? (not traced at JE).

Section Pseudosabulina - Discussion

The solitary species in this section is extraordinary in having both the linear leaves and the three prominent sepal nerves of Series Sabulina in the genus Minuartia. This is probably the most extreme case of parallelism between the two genera. In actual fact there is never difficulty in distinguishing A. sabulinea from species of Minuartia Series Sabulina because in addition to its quite typical 6-valved capsule, its petals are about twice as long as the sepals whereas in all the Minuartias of this type the petals range from being almost absent to just exceeding the sepals. There is, moreover, no doubt that the resemblance is entirely due to convergence, the relationships of each group being easily traceable along a continuous line to the other members of their respective genera - e.g. A. sabulinea to A. kurdica in Series Orientales and thence to the perennial Deflexae and the rest of the sub-genus Arenaria. (cf. fig. 23)

Section Arenaria

Series Arenaria

1a. Seeds large, 0.85-1.10mm. long, 0.70-0.85mm. broad; petals a little shorter than the sepals (> 0.75 times as long), or if much shorter (c.0.5 as long), then sepals c.4.5mm. long, broadly ovate, 2.5 (in flower) - 1.5 (in fruit) times as long as broad, bluntly acute :

2a. Capsule ovoid, 1.75-2 times as long as broad, with thin, rather hard and brittle walls; seeds rather short, scarcely longer than broad, 0.85-0.90(-0.95) mm. long; inflorescence many-flowered (c.10-40), usually rather contracted; pedicels short, 3-8mm. long; sepals 2.75-3.75mm. long, slightly exceeding the petals 25. A. conferta

2b. Capsule ± globose, c.1.3 times as long as broad, with thick and very hard walls, not breaking easily; seeds distinctly longer than broad, 0.95-1.10mm. long; inflorescence few- to many-flowered (c.3-20), with long pedicels :

3a. Leaves linear-lanceolate, 3.5-4 times as long as broad; inflorescence a many-flowered regular dichasium; pedicels very long (15-25mm.); sepals 3.25-3.75mm. long, slightly exceeding the petals 30. A. tremula

3b. Leaves broadly ovate, 1.75-2 times as long as broad; inflorescence rather few-flowered (c.3-10), frequently monochasial; pedicels shorter (8-10mm.); sepals 4.5-5mm. long, greatly

exceeding the petals 29. A. cassia

1b. Seeds rather small, 0.40-0.70mm. long, 0.35-0.65mm. broad; petals much shorter than the sepals (< 0.7 times as long); sepals 2.5-4.0(-5.0)mm. long, ovate-lanceolate to lanceolate, c.3 times as long as broad, narrowly acute to acuminate :

4a. Seeds 0.55-0.70mm. long, (0.50-)0.55-0.65mm. broad; capsule subglobose, abruptly narrowing towards the top (< twice as long as broad), with rather hard walls, breaking under pressure; inflorescence usually an irregular monochasium; sepals 3-4(-5) mm. long. 26. A. serpyllifolia

4b. Seeds 0.40-0.55mm. long, 0.35-0.50mm. broad; capsule conical, ± gradually tapering to the top (> twice as long as broad), with thin, membraneous, rather flexible walls; inflorescence usually dichasial, but often somewhat irregular :

5a. Stem internodes usually long (10-30mm.); leaves and bracts narrowly acute to acuminate; sepals 2.5-3.0mm. long 27. A. leptoclados

5b. Stem internodes very short (2-8mm.); leaves and bracts obtuse to broadly acute; sepals c.4.0mm. long 28. A. aegaea

25. A. conferta Boiss., Diagn. Pl. Orient. ser.1 1 : 51 (1842).

Type: GREECE: Thessaly: "in petrosis Olympi Thessali", Aucher-Eloy 599. holo. G, iso. K!

Specimens seen:

GREECE:-

Epirus:- Mt. Smolika, Balls 3499 (2040m.) (as Cerastium) (mixed with A. serpyllifolia at E), 3511 (Zmilyan, 2040m.), Atchley 968 2440m.), Baldacci (1896) 106. Ioannina: M. Tauka Rossa nr. Vavousa (Vovousa, Viosa), 1600-1980m., Rechinger 18591 (W). Katara ridge above Metsova (Metsovon), 1600-1800m., Rechinger 18347 (W). Mt. Zygos above Metsova, Heldreich 19-20.7.1885 (1370-1525m.), Haussknecht 7.1885 (1370-1525m.), Maire & Petitmengin (1906) 1729 (nr. Laid-Pacha, 1200m.) (W-H).

Thessaly:- Malakasi: M. Sina, Sintenis (1896) 943. Grevena: M. Aphtia, Arkudolaka valley (Valea Kalda) nr. Perivoli, 1700-2100m., Rechinger 18433 (W), 18479 (W). Olympus (Olimbos), Aucher-Eloy 599, Orphanides 3714 (nr. Mairos-laughos), Handel-Mazzetti 19.7.1927 (Prophet Elias, 1950-2700m.).

Central Greece:- near Tatoi (Dhekelia), Heldreich 28.4.1875 (W-H).

Geographical distribution: Albania, Montenegro.

Biology: A robust annual growing on mountain slopes between 1370 and 2700m. Recorded from limestone and serpentine substrata. Flowers June - August.

Discussion: A. conferta Boiss., as here circumscribed, can readily be distinguished from A. serpyllifolia L. by its longer petals and much larger seeds. The inflorescence is not always contracted as in the type and the species is very closely related to the Albanian endemic, A. serpentini A.K. Jackson, which may indeed prove not to be specifically distinct from it.

26. A. serpyllifolia L., Sp. Pl. 423 (1753).

Key to varieties

Sepals 3-4mm. long, ovate to ovate-lanceolate (c.2.5-3 times as long as broad (i). var. serpyllifolia

Sepals 4.5-5mm. long, lanceolate (c.3.5 times as long as broad) (ii). var. macrosepala

(i). var. serpyllifolia

Syn.: Alsine serpyllifolia (L.) Crantz, Instit. 2 : 406 (1766).

Stellaria serpyllifolia (L.) Scop., Fl. Carn. ed.2 1 : 319 (1772).

Alsinanthus serpyllifolius (L.) Desv. in Journ. de Bot. 3 (5) : 222 (1816).

Alsinella serpyllifolia (L.) S.F. Gray, Nat. Arr. Br. Pl. 2 : 664 (1821).

Euthalia serpyllifolia (L.) Rupr., Fl. Cauc. 220 (1869).

Illustrations:

Bouloumoy, Fl. Liban Syrie t.57 f.5 (1930) (as A. cassia) (t.57 f.4 = A. cassia?) (photo).

Komarov, Fl. U.R.S.S. 6 : 532 t.30 f.2 (poor - habit resembles A. leptoclados).

Javorka & Csapody, Ic. Fl. Hung. 138 f.1102 (1930).

Moss, Cambr. Br. Fl. 3 t.40 a,b,c,d,e.

Reichenbach, Ic. Fl. Germ. Helv. 5 t.216 f.4941 (excl. β) (1841).

Sowerby & Smith, Engl. Bot. 13 t.923 (1801).

Syme, Engl. Bot. 2 t.235 (1864) (as var. sphaerocarpa).

? Type in Herb. Linn.

Specimens seen:

GREECE:-

Epirus:- mt. Smolika, 2040m., Balls 3499 (mixed with A. conferta at E), 3499A (K). Joanina: Katara ridge above Metsovo, 1600-1800m., Rechinger 18360 (W). mt. Peristeri, 2196m., Halacsy 17.7.1893, mt. Tsumerka (Tzoumerka) above Vulgarelion, 1300m., Halacsy 8.7.1893 (W-H).

Macedonia:- Pisoderion, Alston & Sandwith 597. Kozani: mt. Vourinos, 1600m., Rechinger 17458 (W). S. of Lake Doiran, Rechinger 9115b (6.6.1936 ?) (W-R), 6.5.1936 (W-R). Boz-dagh near Serrai, 1600m., Rechinger 11012 (W-R). mt. Athos, Hill, Sandwith & Turrill 2374 (nr. Karyes), Adamovic (1905) 215 (WU), anon. 4.1889 (WU) (as A. viscida).

Thrace:- Pindus: mt. Karava, 1675-1980m., Heldreich 1-3.7.1885.

mt. Pelius (Pilion), 915m., Atchley 2360.

Central Greece:- mt. Kiona (Giona) 1830m., Halacsy 12.7.1888 (W-H). mt. Helikon (Elikon), 1370m., Atchley 2009. m. Parnes, 1200-1400m., Rechinger 18143 (W) (as A. leptoclados). mt. Pentelikon (Pendelikon), Heldreich 5.1878 (nr. Pikermi) (W-H), Atchley 5.1936 (305-915m.). M. Gerania (Yerania) nr. Megara, Tunta (1910) 804 (W-H) (as A. leptoclados).

Peloponnese:- Chelmos (Aroania), nr. R. Styx, Goulimy 16.

Crete:- M. Ida (Idhi, Psiloriti) above Nida plateau, Dörfler (1904) 956 (WU), Rechinger 14314 (1700-1900m.).

TURKEY:-

Pontus:- Lazistan: nr. Djimil (Cimil), 2000m., Balansa 7.1866 (P).

Bithynia:- Bolu-Gerede, 1000m., McNeill 259.

Mysia:- m. Ida (Kaz dağ) nr. Kareikos, Sintenis (1883) 1067.

Caria:- Boz dağ above Geyran yaila, Davis 13376. Girdev dag Davis 13859 (? 13889) (2200m.), 13995 (2400m.).

Pamphylia:- Antalya, 30m., Tengwall 124 (as A. leptoclados). Bozburun dağ, Davis 15636 (above Tozlu Cukur Yayla, 1900-2100m.), 15657 (2100-2200m.). Geyik dağ, 2440m., Davis 14509.

Lycaonia:- Serai dagh nr. Konya, 1400m., Zederbauer 1902 (WU) (as A. viscida).

Galatia:- Ankara - Kizilcahamam: Camlideri Osmani, Herbarium Turcicum 226 (leg. B. Kasapligil).

Cappadocia:- Hasan dağ, nr. Taspinar Yayla, Davis 18975 (2100m.), 18996 (1900m.).

S.W. Armenia:- Lake Goldschik (Hazar Gölü), 1350m., Handel-Mazzetti 2557 (WU) (as A. leptoclados).

N.E. Armenia:- "Armenia", Calvert & Zohrab 5.1867. Gümüşane: Chromdere near Godonandt, Sintenis 5874.

U.S.S.R.:-

Kabardino & N. Osetia:- Balkharia: above lake Takhala-Stovat, 3000m., Wisniewski 88.

IRAN:-

Azerbaijan:- nr. Tabriz, Gilliat-Smith 1856 (as A. leptoclados). Yam, Gilliat-Smith 24.7.1929 (= K807 cult. Kew).

Caspian Sea:- Gargan (Asterabad): M. Shahvar nr. Hadjilang, 2400-2600m., Rechinger 6202 (W).

Teheran:- Keredj: by R. Keredj, Rechinger 820.

Eastern Khorasan:- Kopet-Dagh; Kučan-Alamli ridge, 1600m., Rechinger 7225 (W).

? localities:- N. Persia: Ispili Yehlah, Lindsay 1223. Tang von Abdui, Stapf 1259.

Geographical distribution: Throughout Europe, except Iceland and north of 70° N. in Scandinavia and the U.S.S.R.; Asia east to Japan and south to northern India; on mountains in N. Africa and in Ethiopia at 2700m. Introduced into N. America and possibly also Australia.

(ii). var. macrosepala Rech. f. in Fedde. Repert. 48 : 41 (1940).

Type: IRAN: Caspian Sea: "Mazanderan: Grasige Hange der Buschwald-zone im Čalus-Tal, etwa 2400m., 9.6.1937", Rechinger 901 holo. W!

Geographical distribution: Probably endemic (but see Discussion).

Biology (of sp.): A very widely distributed annual plant of open communities in a wide range of habitats, often a weed of light arable land. Less xerophytic than A. leptoclados and in the region extending to higher altitudes - recorded from 30- 100m. and from 1000 - 2500m. (Frequent below 1000m. in Europe). Flowers May - July, automatically self-pollinated.

Chromosome number: 2n=40, Böcher & Larsen (1958), Blackburn & Morton (1957), Griesinger (1937), Rohweder (1939), Woess (1941); 2n = 44, Blackburn & Morton (1957).

Discussion: A. serpyllifolia is one of the most widespread species of the genus, not only being found as a native plant throughout Eurasia from Ireland and Northern Scandinavia across to India and Japan but also having established itself in North America and Australia. It is not, however, so common a plant in the Orient as is A. leptoclados nor does

it extend so far south. The southern limit of A. serpyllifolia appears to run south of Crete and the Aegean Islands, across Turkey north of the Cilician Taurus and the Kurdish mountains, then south-west through northern Iran into Afghanistan.

A. serpyllifolia is a very variable species and many named varieties and forms exist, most apparently occurring widely throughout its range. As the species is probably mainly homogamous, it has been though unwise, in this type of study, to attempt any infra-specific classification. An exception has been made in the case of a variety (var. macrosepala) described by Rechinger from Northern Iran. This plant has long narrow sepals outside the normal range for the species, yet in other respects is of normal size. Rechinger refers to two other specimens with sepals approaching 5mm., one from the Epirus and the other from Asiatic Russia; the former has been examined (Halácsy 17.7.1893) and has been found to have the broader sepals typical of the species; also the sepal length (c.4.5mm.) is not markedly greater than that of many other Greek specimens, so that it has been referred to the typical variety. More extensive collections from Asia may show that this large-sepalled variety merely represents another widely distributed variable character frequent in the easterly part of the species range.

A. serpyllifolia, apparently a tetraploid, can usually be readily distinguished from the diploid A. leptoclados, the seed size being the most satisfactory character. A few doubtful specimens have been seen, all rather alike, and all from near the southern limit of A. serpyllifolia. Seeds of one of these gatherings are being grown for cytological exam-

ination, but meantime, on the balance of probability, they have been referred to A. leptoclados (cf. discussion of that species).

27. A. leptoclados Guss., Fl. Sicul. Syn. 2 : 824 (1845): A. serpyllifolia sec. Guss. l.c. 1 : 495 (1843), non L.

Syn.: A. serpyllifolia var. tenuior Mert. & Koch, Fl. Deutsch. 3 : 266 (1831).

A. serpyllifolia var. leptoclados Reichb. Ic. Fl. Germ. 5 : 32 (1841).

A. serpyllifolia subsp. tenuior (Mert. & Koch) Arcangeli, Comp. Fl. Ital. 101 (1882).

A. serpyllifolia subsp. leptoclados Rouy & Fouc., Fl. Fr. 3 : 242 (1896).

A. serpyllifolia subsp. leptoclados var. viscidula Rouy & Fouc. l.c. (1896).

A. leptoclados β viscidula (Rouy & Fouc.) Williams in J. Linn. Soc. 33 : 368 (1898).

A. tenuior (Mert. & Koch) Gürke in Richter-Gürke, Fl. Eur. 2 : 273 (1899).

A. leptoclados Guss. forma viscidula (Rouy & Fouc.) Rech., Fl. Aegaea 141 (1943).

Illustrations:

Bouloumoy, Fl. Liban Syrie t. 57 f. 7 (1930) (photo).

Grossheim, Fl. Kavkaza ed.2. 3 : 221 t.21 f.3 (1945).

Moss, Cambr. Br. Fl. 3 t.40 f,g,i,j. (1930).

Reichenbach, Ic. Fl. Germ. Helv. 5 t.216 f.4941 (β leptoclados) (1841).

Sowerby & Smith, Engl. Bot. Suppl. 5 t.2972 (1863).

Syme, Engl. Bot. 2 t.236 (1864).

Original citation: "In muris, secus vias, in ruderatis, et in collibus aridis in Sicilia" ? Type Gussone ? holo. FI (& NAP ?)

Specimens seen:

GREECE:-

Ionian Islands:- Corfu (Kérkira): Korakiana near Kripero, Pernits 19.5.1896 (W-H).

Macedonia:- M. Vermion nr. Naussa (Náousa), Rechinger 8623 (300m.) (W-R), 8910 (500m.) (W-R). Kozani: M. Siatsiko (Siniatsikon) between Bara & Siatista, 750-950m., Rechinger 17664 (W). Voden (Edhessa), Adamovic 5.1903. nr. Salonika, Wilson 16. Kaputsides nr. Thessaloniki, Rechinger 9003 (W-R). M. Korphiati, nr. Thessaloniki, Rechinger 17292 (W). Asbestochari Cemetery, N. of Salonika, Hill, Sandwith & Turrill 2661. Mikra Cemetery, N. of Salonika, Hill, Sandwith & Turrill 2666, 2667. Chalkidike: head of Cassandra (Toronaios) gulf, Hill, Sandwith & Turrill 2629. Mt. Athos, Sintenis & Bornmüller 835 (as A. serpyllifolia var. glandulosa), Hill, Sandwith & Turrill 2674 (nr. Chilarderi), Dimonie 4.1909 (nr. Prodrom, 300m.) (WU). S. of Lake Doiran, Rechinger 9115 (W-R), 9048 (W-R), Burgoff 1129 (Nikolic)(JE), Bornmüller (1918) 3549 (Hudova, 100-200m.) (JE). Struma (Strimón, plain: Kopriva -

Kopriva Bridge, Turrill 323. Serrai, Rechinger 9169 (W-R). Boz-dagh nr. Serrai: Prodromos monastery, 300m., Rechinger 11049? (as 11049?) (W-R). Boz-dagh below Granitis (Juricik), 300m., Rechinger 6267 (W-R). Thasos: Potamia, Sintenis & Bornmüller 371.

Thrace:- R. Nestos (Mesta) nr. Toxotai (Oktschilar), 60-100m., Rechinger 9345 (W-R). Xanthus, Forbes 133. Porto Lagos, Tedd 907. M. Rhodope above Iasmos (Jasi-köy), Rechinger 9454 (W-R). Makri, Adamovic 6.1905. Samothraki: m. Phengari, 500m., Rechinger 9787. Tchal (? Greece), Tedd 10.6.1934.

Thessaly:- Kalampaka (Kalabaka): Saraskina (Sarakina), Sintenis (1896) 196. M. Baba (? Ossa) above Klinova, 1500m., Maire & Petitmengin 1624 (W-H). N. Sporadhes: Peristeri, Heldreich & Halacsy 19-20.5.1896 (W-H). N. Sporadhes: Skopelos, Heldreich & Halacsy 27.4-18.5.1896 (W-H).

Central Greece:- Akarnania: Lakes Lisimakhia & Trikhonis nr. Agrinion, Reiser 2.5.1899 (W-H). Pindus: Agrapha (Agrafa) nr. Korona monastery, 1065-1130m., Heldreich 20-28.6.1885, Haussknecht 20-28.6.1885 (JE). M. Hymetto (Imitos), Haussknecht 5.1885 (JE), Heldreich 7.4.1879 (W-H). Lycabeto nr. Athens, Orphanides (1849) (W-H). Korydalis (Eleusinia, Aigaleos), Heldreich 27.3.1884, Atchley 760 (245m.). nr. Athens, Heldreich H.G.N. 505 (8.5.1856). M. Kerata: Nauplia, Haussknecht (1885) (JE). M. Kerata: Eleusiis, Haussknecht 4.1885.

Peloponnese:- Achaia: Mt. Panakhaikon, 1000m., Halacsy 5.6.1893

(F)

(W-H). Mts. of Lake Stymphyly (Stimfolias) (Killini), Herb. J. Stuart Mill 5.1855 (K).

Aegean Islands:- Cyclades:- Cythno (Kithnos), leg. Tunta 4.1900 (Heldreich pl. exs. Fl. Hell.) (W-H), Syra (Siros), Gandoger (1920) (as A. viscida), Kimolos, Heldreich & Halacsy 18.3.1889 (W-H).

Crete:- la Canee (Khania), Reverchon 13.5.1883 (JE). Khania: Panagia Chrysoskalitissa nr. Kounemi, nr. sea, Davis 1338. Lasithi: below Aphendi Khristos (Aphentis), ? Neukirch 4.1911 (W-H).

TURKEY:-

Bithynia:- Constantinople (Istanbul), Herb. Hookerianum (1867) (K). Ulu dağ (Olympus), Herb. Noeanum (1844) (K).

Thracia:- Gallipoli: Helles, Ingoldby 66.

Mysia:- Renkoei, Sintenis (1883) 142.

Lycia:- Armotte, Forbes 133.

Pamphylia:- Kara pt. - Fığla pt.: between Manavgat & Alanya, 3m., Davis 25824.

Amanus:- Bahçe: Haruniye, 500m., Davis 26758.

Pisidia:- Bucak, 915m., Truman 162.

Cataonia:- Pazarcik: between Narli & Karabiyikli, 600-700m., Davis 27836.

S.W. Armenia:- Elazig: N. side of Hazar Gölü, 1200m., Davis 28998*. Tunceli-Pulumar: 6 mls. from Pulumar, 1000m., Davis 29200B (mixed with Mimuartia hybrida).

N.E. Armenia:- Erzerum: Pasinler - Horasan, 1650m., Davis 29405*.

Mesopotamia:- 2km. E. of Mardin, 1150m., Davis 28436, 28438B. Rismil, between Mardin & Savur 900m., Davis 28528. Diyarbakir-Çinar (8km. from Diyarbakir), 650m., Davis 28769.

U.S.S.R.:-

Azerbaijan:- Baku: Sangatschal, Holmberg: 546.

CYPRUS:-

Kyrenia:- Yaila, 825m., Davis 2840. Kharcha-Halefka 610m., Davis 2887. Buffavento, 760-915m., Davis 2807. above Agihrdha, 610m. Davis 2487. Ayia Irini, Davis 2533.

Famagusta:- Sina Oros, summit, 714m., Davis 2463. nr. Apostolos Andreas, Davis 2324.

Larnaka:- Skarinou, 150m., Davis 2688.

Limassol:- Troödos, Sintenis & Rigo 223. Chionistra, Kennedy 1205 (1860m.), Lindberg 16.6.1939*. Kryos Potamos, 885m., Kennedy 1204.

SYRIA:-

Aleppo:- nr. Aleppo, Kotschy (1841) 213. Aleppo - Antakya, nr. Tell Akibrim, 430m., Samuelsson 3936 (S). Aleppo - Harim: Kasr-el-Banat, herb. Post. 12.4.1900 (as A. oxypetala).

Homs:- Palmyra: S. base of Djebel el Abiad, 15km. N.W. of Ain el Beida, 500m., Samuelsson 3584 (S).

Jebel Druz:- nr. Kafer, 1350m., Samuelsson 4624 (S). Soueida - Saleh, 1500m., Samuelsson 4559 (S).

LEBANON:-

North Lebanon:- Amouah, Jebel Akar, 1370m., Davis 6669A (with Minuartia hybrida) Reyfour, 1200m., Samuelsson 1288 (S).

ISRAEL:-

Central Israel:- Ramath Gan nr. Tel Aviv, Fl. Palaest Exs. 234 (leg. Zohary). Sarona, Aujeh R. (Hayarqon in Tel Aviv), 15.m., Dinsmore 4892. Jerusalem, Dinsmore 2892, 6892.

JORDAN:-

Edom:- Petra, Davis 9323 (in the Sik), 8974 (Deit Petra). Wadi Ram, 915m., Davis 9029.

'IRAQ:-

no locality:- "Expedition to Euphrates, Chesney 198.

Mosul:- Eski Kellet, 250m., BAG 10378 (coll. Gillett & Rawi).

Erbil:- R. Zab nr. Kau Gossik, 250m., BAG 10535 (coll. Gillett).

Kirkuk & Sulaimaniya:- Penjwin, 1400m., BAG 8549 (coll. Rawi). Jarmo: Helbaek 449.

Dulaim:- opp. Rawa, 140m., BAG 7041 (coll. Gillett & Rawi).

Central 'Iraq:- Badra, 100m., BAG 6604 (Coll. Gillett).

IRAN:-

Azerbaijan:- Sir, 2135m., Cowan & Darlington 2188.

Caspian Sea:- Rescht (Rasht), Pichler 23.4.1882 (WU). M. Elbrus (Elburz ?) nr. Derbend (Demavend ?), Kotschy (1843) 124. Gorgan: Minudasht, Sharif 450 (W).

Lorestan:- Chah-Bozan (Shah Bozan), 60km. N.E. of Dizful (Dezful) 500m., Koie 306 (W).

Eastern Khorasan:- M. Kuh-e Nishapur, Darreh Abshar above Akhlomet, 1600-1800m., Rechinger 4495 (W).

Southern Zagros:- Bakhtiari: Tale, Koelz 15141 (W)*

Fars:- Gere (Jareh ?), Buschir (Bushehr) - Schiras (Shiraz), Kotschy (1842) 501A. Mulla Saveh nr. Schiras, Stapf 18.6.1885.

Kerman & Yazd:- M. Djamal Bariz between Bam & Djiroft above Deh Bakri, 2400m., Rechinger 3775 (W). Kuh-i-Lalesar, Starmuehlner 136 (W).

Persian Gulf:- Hadjiabad nr. Tarum - Bandar Abbas, 900m., Rechinger 7529 (W).

? ? :- Daeschtaerdshin, Herb WU (Cult. Wien.).

EGYPT:-

Lower Egypt:- Damiette (Dumyat), Muschler 12.1905 (as A. serpyllifolia).

Geographical distribution: Throughout Southern and Central Europe extending north to Caithness in Scotland and to S. Scandinavia. Probably more widely distributed in U.S.S.R. than reported by Komarov (1936) (only from Caucasus) - e.g. in the Ukraine - Klokov in Kotov (1952); Asia, east to Japan and south to India; N. Africa, Upper Egypt Socotra. Introduced into N. America and Australia.

Biology: A slender annual of dry light soils, often growing among rocks, found from sea-level to 1500m. throughout most of the region but extending to 2400m. in southern Iran. Flowers February to June. Automatically self-pollinated.

Chromosome number: 2n = 20, Blackburn & Morton (1957), Böcher & Larsen (1958), Griesinger (1937), Weiss (1941).

Discussion: A. leptoclados shows the same type of extensive variability as does A. serpyllifolia, again probably largely due to the frequency and importance of self-pollination. None of the many named variants has been thought to warrant taxonomic recognition. A. leptoclados differs from A. serpyllifolia not only in its continuous range extending much further south (to the Sudan and Socotra) but also in its ecological preferences, being a plant of drier places and thus more frequently found among rocks or on sand, whereas the more robust A. serpyllifolia is, in the Orient, typically a field weed or mountain plant.

As has already been stated under A. serpyllifolia, the two species are usually readily distinguishable but four gatherings have been seen

which seem to be extreme forms of A. leptoclados varying in the direction of the other species. These specimens are all very similar to one another and come from localities near the southern limit of A. serpyllifolia. The plants referred to are Lindberg 16.6.1939 from Cyprus, Davis 28998 and 29405 from Armenia and Koelz 15141 from the Zagros mountains in Iran; these are marked with an asterisk (*) in the enumeration of specimens above. Seeds of one of the Davis gatherings are being grown for cytological investigation.

A. leptoclados has also some nomenclatural complexity, the first recognition of its distinctiveness from A. serpyllifolia being Mertens and Koch's description of A. serpyllifolia var. tenuior in "Flora Deutschland" in 1821. Reichenbach, apparently unaware of this, used the name var. leptoclados in "Icones Florae Germanicae" in 1841. The name leptoclados is thus illegitimate at varietal rank. Gussone in "Flora siculae synopsis..." (1843) was the first to regard the two taxa as specifically distinct but applied the name A. sphaerocarpa Tenore to Linnaeus' A. serpyllifolia, retaining serpyllifolia for the more slender plant (leptoclados). In a supplement to the second volume (1845), he corrected this mistake and uses the name A. leptoclados for the new plant, referring to Reichenbach's variety and figure. Thus the earliest name at specific rank is A. leptoclados Guss. treated as a new name and legitimised by reference to his description of "A. serpyllifolia" in 1843.

28. A. aegaea Rech. f. in Fedde Repert. 47 : 50 (1939).

Syntypes: GREECE: Aegean Islands: 1) "Kykladen, Grabusa; Rechinger 5147f" 2) "Kykladen, Arhydros: Rechinger 5238" 3) Dyo Adelphi, West-Insel: Rechinger 7766" 4) "Tria Nisia, Sud-Insel: Rechinger 7731" 5) "Saphrania: Rechinger 7661" iso K! 6) "Kinaros: Rechinger 7801" iso K!
holotypes W (destroyed).

Specimens seen:

GREECE:-

Aegean Islands:- Cyclades:- Kinaros, K 1919 (cult. at K from Rechinger 7801, syntype). Nikouria nr. Amorgos, sea-level, Davis 1418.

Other records: cf. list of syntypes; Aegean Islands: Dyo Adelphi, Ost-Insel - Rechinger l.c.

Geographical distribution: Endemic.

Biology: A small annual plant of sea-shores, showing characteristic halophytic modifications of hairiness and rather fleshy leaves.

Discussion: A. aegaea appears to be closely related to A. leptoclados and a specialised type adapted to maritime habitats. Not only are its characters maintained in cultivation (cf. K 1919 grown at Kew from seed of Rechinger 7801), but also a maritime form of A. leptoclados has been seen (Davis 1338 from Crete) which, although showing halophytic modifications, is typical and quite distinct from A. aegaea in its diagnostic characters.

Most of the known specimens (cf. Rechinger, 1939) were destroyed at Vienna as a result of war damage.

29. A. cassia Boiss., Diagn. Fl. Orient, ser.1 1 : 51 (1842).

Illustrations: ? Bouloumoy, Fl. Liban Syrie t.57 f.4 (1930) (as A. serpyllifolia) (t.57 f.5 = A. serpyllifolia ?) (photo).

Type: TURKEY/SYRIA (Amanus/Latakia): "in sylvaticis regionis mediae montis Cassii Syriae borealis", Boissier. holo. G.

Specimens seen:

TURKEY:-

Amanus:- Saouk Oluk, 800m., Samuelsson 7026 (as A. serpyllifolia) (S).

SYRIA:-

Latakia:- Djebel Ansarieh: Nebi Younes above Slenfe, 1300m., Samuelsson 5229 (S).

LEBANON:-

North Lebanon:- Qurnet Aruba, herb Post D6268, Davis 6664A (1830m.) J. Sannin, Bornmüller (1897) 203 (2200-2300m.), Kneucker 11.6.1904 (2400m.) (JE). J. el Kenisseh (Knaisse), 1800m., Samuelsson 5729 (S).

South Lebanon:- Modairej below Dahr el Baidar (Deir el Beida),

Samuelsson 1336 (S), Gombault 31 (15.5.1932) (1370m.) (S), Davis 6044A, (1430m.). J. Barouk, Bornmüller 11469 (above Ain Zahalta, 1700-1800m.) 11468 (1800m.), 11468b (1800m.), Ball 2093 (above Ain Zahalteh, 1600-2200m.), 1997 (above Baruk, 1500-2100m.), 1683 (Tomat Niha, 1500-1850m.) Gombault 31 (28.5.1933) (1800m.) (S).

Geographical distribution: Endemic

Biology: A robust annual of calcareous or schistose rocks and gravel on mountains. Recorded at 800m. in the Amanus, at 1300m. in Latakia and between 1370m. and 2400m. in Lebanon. Flowers May - June.

Discussion: A. cassia is a very distinct species restricted to the mountains of the Levant coast from the Amanus to Mt. Lebanon and replaces A. serpyllifolia there. A large-seeded robust plant, it bears in its morphology a similar relation to A. serpyllifolia as that species does to A. leptoclados.

30. A. tremula Boiss., Diagn. Pl. Orient. ser.1 8 : 101 (1849).

Type: TURKEY/SYRIA:- (Amanus/Latakia):- "in sylvaticis jugi Cassii in Syria boreali Jun. 1846", Boissier. holo. G iso. K!

Specimens seen:

TURKEY:-

Cilicia:- Guzel-Dere, m. Sedichig, N.E. of Mersin, Balansa 610

(24.5.1855), 20.5.1855 (JE).

Amanus:- Saouk Olouk, 850., Samuelsson 5378 (S). Dere Bagtche below Beylan, 320m., Samuelsson 3988 (S), 5353 (S). mt. Cassius (Cebel Akra), Samuelsson 5160 (Ain el Aramie, 600-700m.) (S). 5037 (Zinsof, 760m.) (S). Daphne (Bêt el Ma), S.E. of Antakya, 50m., Dinsmore 14459 (21.4.1938).

SYRIA:-

Latakia:- 20km. S. of Urdu (in Hatay), 800-900m., Dinsmore 14459 (14.5.1938) (S) (as Als. tenuifolia). J. Ansarieh: Slenfe, 1100m., Samuelsson 5128 (S).

LEBANON:-

South Lebanon:- Ain Zahalta (Zhalta), Bornmüller 11473 (1200-1300m.), 11473b (cult. Weimar) (JE), 11472 (JE).

ISRAEL:-

Galilee:- J. Jermak, Fl. Terrae Israelis Exs. 425 (leg. Zohary & Amdursky).

Geographical distribution: Endemic.

Biology: A robust annual of calcareous or schistose rocks and gravel on the lower slopes of mountains, sometimes in pine woods. Recorded between 50m. and 900m. in the Amanus region and between 1100 and 1300m. in the Lebanon. Flowers April - May.

Discussion: A. tremula, like A. cassia, is a very distinct, large-

seeded annual species with a mountain distribution in the Levant. It occupies a lower altitudinal range than A. cassia where the two occur, and its geographical range extends further south, into Israel.

Series Arenaria - Discussion

Series Arenaria is a very natural group of plants, apparently forming the basic stock from which the Saponarioides and Cylindricae, the two highly specialised series of Section Arenaria, have been derived. Two of the species, A. serpyllifolia and A. leptoclados are widespread and variable plants of a wide range of habitats, while the remaining four are plants most closely related to A. serpyllifolia - A. conferta in the southern Balkans, apparently the least specialised type in the section, A. cassia and A. tremula, broad and narrow-leaved derivatives respectively of A. serpyllifolia and replacing it in the Levant at two different altitudinal ranges. The fourth species, A. aegaea, appears to be a maritime derivative of A. leptoclados, confined to a few Aegean Islands.

Series Saponarioides McNeill

Sepals 4.5-5.0mm. long in flower, extending to 6.5mm. in fruit; seeds with a smooth testa, the 'cells' not developing into raised tubercles — 31. A. saponarioides

Sepals 6.25-7.0mm. long in flower, extending to 9.0mm. in fruit; seeds tuberculate — 32. A. macrosepala

31. A. saponarioides Boiss. et Bal. in Boiss., Diagn. Pl. Orient. ser.2 6 : 35 (1859).

Key to subspecies

Sepals linear-lanceolate, 4-6 times as long as broad in flower, becoming c.3.25 times in fruit; petals lanceolate, c.3 times as long as broad. — A. subsp. saponarioides

Sepals lanceolate, 3-3.5 times as long as broad in flower, becoming 2.5-2.75 times in fruit; petals ovate-lanceolate 2-2.5 times as long as broad — B. subsp. boissieri

A. subsp. saponarioides

Syn.: ?A. macrosepala Boiss. β minor Boiss., Fl. Orient. 1 : 703 (1867).

Type: TURKEY: Phrygia: "Bords de la route conduisant d'Ouchak a Yachamichlar-keui (Phrygie) 6 Juin 1857" ("in Phrygia inter Ouchak

et Yachamichlarkeui"), Balansa 1297, holo. G iso. K!, S!

Geographical distribution: Endemic.

B. subsp. boissieri (Pax) McNeill, comb. et stat. nov.

Syn.: !A. nana Boiss., Diagn. ser.1 8 : 103 (1849), non Willd. (1813).

!A. boissieri Pax in Bot. Jb. 18 : 30 (1893).

Type: GREECE: Crete: "rarissima in cacumine Authenti montium Lassiti Cretae, 20.5.1846", Heldreich. holo. G, iso. K!

Specimens seen:

CYPRUS:-

Limassol:- m. Troödos, Sintenis & Rigo 762, Haradjian 481 (1525-1950m.). m. Troödos: Chionistra, Davis 1858 (summit - chromium mines, 1890m.), 3512 (N. side, 1890m.), Kennedy 1192 (S. side, 1645m.), Lindberg 16.6.1939. Amiandos, 1495m., Merton 2201. Kryos Potamos, 1800m., Kennedy 1196.

Geographical distribution: Endemic.

Biology (of species): Small xerophytic annual occurring on scree and in dry river beds between 1500 and 1890m. Flowers May - June.

Discussion: The first plants of this species to be collected were Heldreich's very dwarf specimens from Crete called A. nana by Boissier (1849) and renamed A. boissieri by Pax (1893) on account of the existence of Willdenow's A. nana (1813), a member of the South American

sub-genus Dicranilla. Boissier distinguished the Cretan plant from his earlier A. macrosepala from Turkey, chiefly on account of its small size and supposedly acute not acuminate sepals. He described a third species, A. saponarioides from Phrygia, in collaboration with Balansa in 1859, but reduced it to a variety (var. minor) of A. macrosepala in "Flora Orientalis" (1867). No further specimens are known to have been collected on Crete or in Turkey since Boissier's time, but considerable confusion has existed as to the identity of the many plants gathered in the Troödos mountains in Cyprus. The larger specimens have usually been described as A. macrosepala and the more dwarfed forms as A. nana. In fact the Cyprus gatherings are very uniform, varying only in size and differing markedly from typical A. macrosepala in seed characters (cf. key). The type specimen of A. saponarioides (= A. macrosepala var. minor) was found to be identical with the Cyprus plants in this respect and in the size of the sepals. For this reason it has been decided to treat them as conspecific along with the Cretan type of A. boissieri Pax, a flowering specimen which has the same range of sepal length. The earliest legitimate name for this species is thus A. saponarioides. The Crete and Cyprus plants differ from the type, however, in having narrower more acuminate sepals and narrower petals and are treated as a separate subspecies - subsp. boissieri, based on Boissier's A. nana. This is one of the very few taxa confined to Crete and Cyprus.

32. A. macrosepala Boiss., Diagn. Fl. Orient. ser.1 1 : 52 (1842).

Type: TURKEY: Caria: "in arenosis pinguibus montis Cadmi supra Colossam" (Honaz dağ), Boissier Jun.1842. holo. G, iso. S.

Specimens seen:

TURKEY:-

Lycia:- mt. Elmalu (Elma dağ), Bourgeau 14.6.1860.

Phrygia:- Kaiagol Dere, S.S.E. of Ouchak (Uşak), Balansa 1296 (1.6.1857).

Other records: Cappadocia: m. Karamas: Balansa (cf. Boissier, 1867)?

Geographical distribution: Endemic.

Biology: A xerophytic annual of sandy places, dry river beds etc. Flowers May - June.

Discussion: A. macrosepala in the restricted sense (i.e. with Boissier's var. minor separated - see under A. saponarioides) is a very uniform species confined to a few mountains in Southern Anatolia, where it does not seem to have been re-collected since Boissier's time. It is not known to occur elsewhere, the many records from Cyprus being of A. saponarioides subsp. boissieri.

Series Saponarioides - Discussion

Essentially very similar to Series Arenaria, the Series Saponarioides

has been separated because of its extreme xerophytic development - a development paralleling that found in the series Montanae and Minuartia of the genus Minuartia. Despite their restricted distribution (only 6 localities are known) and their lack of variability, the members of the group have been taxonomically rather confused. This is probably largely because one of the most important criteria, sepal size and shape, changes very considerably as the capsule develops after flowering. The two species are readily distinguishable, however, at either stage. (cf. key).

Series Cylindricae McNeill

One species:

33. A. guicciardii Heldr. in Boiss., Diagn. Fl. Orient. ser.2 5 : 60 (1856).

Type: GREECE: Central Greece: "versus cacumen montis Parnes Atticae, Junio", Heldreich. holo. G.

Specimens seen:

GREECE:-

Central Greece:- m. Parnes (Parnethis), Heldreich 8.6.1857 (1220-1370m.), pl. exs. Graec. 2909 (5.6.1857) (W-H), Herb. Graec. Norm. 1522 (15.5.1900) (1200-1350m.), Tunta 121 (20-22.5.1909) (JE), 2-21.5.1913 (JE).

Peloponnese:- "prope Vurlaughado Zatunae" ?, Orphanides 700 (as "A. guicciardii forma giganteum").

Geographical distribution: Endemic.

Biology: A xerophytic annual collected near the summit of Mt. Parnes from 1200-1350m. Flowers May - June.

Discussion: A. guicciardii is apparently a very rare plant known from only two mountain localities in central and southern Greece. The specimen from the Peloponnese is larger in all its parts than those from the original locality on mt. Parnes and has been given the manuscript name "forma giganteum" by Orphanides, the collector. The

single plant on the sheet examined is otherwise identical with typical plants and there seems no justification on present knowledge for taxonomic recognition.

Series Cylindricae - Discussion

The solitary species of this series shows close affinity with the series Arenaria of which, like the members of the series Saponarioides, it appears to be a xerophytic derivative. It differs from both these groups, however, in having a long cylindrical capsule and very narrow long acuminate sepals. The capsule structure is so unusual, in the sub-genus Arenaria, as to seem to warrant its separation as a distinct group on its own.

Section Arenaria - Discussion

The section Arenaria is a very distinct and natural group, characterised by its members having sessile, multinerved, often triangular leaves and short petals. The juvenile foliage (the first 6 or so pairs of leaves) is of the Orientales type and the group would appear to have an affinity with that section.

The type series containing A. serpyllifolia, the type species of the genus (cf. Green in Hitchcock & Green, 1929), is apparently the basic group of the section, the other two being probably derived from it with the development of particular specialised characteristics. The plants of both series are more xerophytic, particularly the two species of Saponarioides, which seem to have originated from an A. cassia type by the development of strong leaf and sepal nervation. A. guicciardii, the single species of Series Cylindricae, is very unusual in the possession of long narrow acuminate sepals and a cylindrical capsule, its closest relative being possibly A. leptoclados.

Subgenus Eremogone Fenzl

Section Capillares McNeill

One species:

34. A. lychnidea M. Bieb., Fl. Taur. Cauc. 1 : 347 (1808).

Syn.: A. capillaris Poir. β airifolia (Fisch) Regel lusus c. brevifolia Regel in Bull. Soc. Nat. Moscou 35 :249 (1862), pro parte.

(!)Eremogone lychnidea (M.B.) Rupr., Fl. Cauc. 219 (1869).

Illustrations:

Grossheim, Fl. Kavkaza (Fl. Caucas.) ed.2 3 : 221 t.21. f.10 (1945).

Ketschoveli, Sosnovskii & Charadze, Fl. Gruzii (Fl. Georgia) 3 : 248-249. t.116 (1947).

Komarov, Fl. U.R.S.S. 6 : 523 t.29 f.3 (1936).

Type: U.S.S.R.: "in Caucaso iberico", M. Bieberstein. holo. LE (photo !)

Specimens seen:

TURKEY:-

N.E. Armenia:- Maden - Miriomana, 2620m., Balls 557.

?Kurdistan:- "Kurdistan", Brant (comm. Strangways 1840) (K).

U.S.S.R.:-

Kabardino & N. Osetia:- ?Balkariya: Kamenaya rossip. Ogari-erkhi Sukane, 2700m., Busch 30.6.1927. Digorie (Ossetie): Karaugom,

2500m., Wisniewski 86.

Georgia:- Gudaur at R. Aragon, Brotherus 179e. Ossetia: M. Tomoraset nr. Ress at R. Terek, Brotherus 179a (as Alsine pinifolia gracilis at WU, and as Alsine caucasica at S). Ossetia: M. Kasbek at R. Terek, Brotherus 179c.

Geographical distribution: Endemic.

Biology: A tufted plant of scree and rock crevices with creeping caudiculi. Recorded between 2500m. and 2700m. Flowers June - August; petals sometimes of varying shades of pink (Balls 557) otherwise white.

Discussion: A. lychnidea is a very distinctive high mountain species and would appear to be an isolated Caucasian representative of the Asian-American A. capillaris complex. Regel (1862) includes the species within A. capillaris, but it can readily be distinguished by the very weak development of staminal glands.

Section Eremogone

Sepals 4.25-5mm. long, not keeled, with a broad 3-7 nerved median herbaceous strip; staminal glands bifurcate, long (0.40-0.50mm.), prominently enlarged at the top. 35. A. graminea

Sepals 2.5-3.75mm. long, somewhat keeled, with a narrow 1-3 nerved median herbaceous strip; staminal glands bifurcate, shorter (0.20-0.35mm.), not enlarged at the top. 36. A. blepharophylla

Sepals c.3mm. long, somewhat keeled; staminal glands indistinct. 37. A. isaurica

35. A. graminea C.A. Meyer, Verz. Pfl. Cauc. 220 (1831).

Syn.: (!) Eremogone graminea (C.A.M.) Fisch. & Mey., Ind. Sem. Hort. Petrop. 1835 : 7 (1835).

A. graminea C.A.M. ∝ grandiflora Fenzl in Ledebour, Fl. Ross. 1 : 362 (1842).

!A. graminea C.A.M. var. brachypetala Grossheim in Beih. bot. Zbl. 44 (2) : 209 (1927).

Illustration: Grossheim, Fl. Kavkaza (Fl. Caucas.) ed.2 3 : 221 t.21 f.7 (1945).

Type: U.S.S.R.: Georgia: "In montibus Talusch prope pagum Swant. Locus lapidosis siccis alt. 700-800 ft.", C.A.Meyer, holo. LE (photo!)

Specimens seen:

U.S.S.R.:-

No precise locality:- "Caucasus", Ledebour (with A. cucubaloides and as Eremogone cucubaloides) (K).

Georgia:- pr. Tatuni, Hohenacker (1836) 2383.

Armenia:- "Armenia", Szowits 322 ("mt. Kara-bagh" cf. Williams 1898).

IRAN:-

Azerbaijan:- Atropotania nr. Tabris, 1500m., Grossheim & Schischkin (1928) 278 (leg. Grossheim) (type of A. graminea var. brachypetala).

Geographical distribution: Endemic.

Biology: Erect grass-leaved plant with a short stout caudex from which the leaves and stems arise in dense tufts. Recorded at 1500m. in Iran. Flowers July.

Discussion: The few specimens of this species which have been seen show little variation. Grossheim's var. brachypetala seems merely to be an immature plant with the petals not fully expanded. Fenzl in Ledebour's "Flora Rossica" included Boissier's A. steveniana (A. blepharophylla var. parviflora) as a variety of this species, calling the type variety var. grandiflora. The two species are in fact very distinct.

36. A. blepharophylla Boiss., Fl. Orient. 1 : 693 (1867).

Key to varieties

Leaf margins long ciliate, those of the stem leaves 0.3-0.6mm. long (i). var. blepharophylla

Leaf margins smooth or with short cilia, those of the stem leaves < 0.2mm. long, (a few rather longer at the base of the leaf) (ii). var. parviflora

(i). var. blepharophylla

Lectotype: TURKEY: S.W. Armenia: "Prov. Musch. In monte Bimgoell versus vallem Merga Sadk alt. 6000', 23 Aug. 1859, Kotschy 529". G!, JE!, P!

Specimens seen:

TURKEY:-

S.W.Armenia:- "Armenia", Tchichatcheff (1858) (G) (same locality as Kotschy 529 according to Boissier, 1867) (paratype).

N.E.Armenia:- "Armenia", Calvert & Zohrab 5.1867 (as "Gypsophila see collina") ("succulina", Williams, 1898).

IRAN:-

Azerbaijan:- Ser, Knapp 8.7.1884 (as & with A. gypsophiloides)(WU).

(ii). var. parviflora (Fenzl) McNeill, comb. nov.

Syn.: !A. graminea C.A.Mey. β parviflora Fenzl in Ledebour, Fl. Ross. 1 : 362 (1842).

!A. steveniana Boiss., Fl. Orient. 1 : 692 (1867).

!A. blepharophylla Boiss., var. breviflora Williams in J. Linn. Soc. 33 : 403 (1898).

A. oosepala Bordz. in Bull. Jard. bot. Kieff 12/13 : 110 (1931).

Type: U.S.S.R.: Armenia: "pr. Erivan", Steven. holo. LE, iso. K! (as A. gypsophiloides) (also syntype of A. steveniana).

Specimens seen:

TURKEY:-

N.E. Armenia:- Yağmurlu Dağ between Karaurgan & Sarikamiş, 2200m., Davis 29481. Kisir Dağ between Kars & Ardahan, Davis 29635 (2150m.), 30488 (2300m.). Ziyaret Dağ (Yalnizçam Dağlari) above Yalnizçam, 2300m., Davis 30318. Yalnizçam, 1900m., Davis 29621.

U.S.S.R.:-

Armenia:- "Armenia", Szowits 315 (as A. gypsophiloides) (S). ? Carthalinia, Lake Tabeschiez: Brotherus 184 (as Eremogone gypsophiloides) (S). Göktschal, Bunge (G) (syntype of steveniana).

Geographical distribution (of species): Endemic.

Biology: An erect grass-leaved plant with vegetative rosettes and flowering stems arising from spreading caudiculi. Recorded between 1900 and 2300m. on rocky slopes. Flowers June - July.

Discussion: In "Flora Orientalis" Boissier described two new species with small obtuse sepals and prominent bifurcate glands, A. steveniana and A. blepharophylla; he distinguished them on leaf breadth and the prominence of the marginal cilia and on sepal shape. Of these characters only the presence of rather longer cilia on the leaves of typical A. blepharophylla is in fact discriminatory and for this reason A. steveniana is reduced to a variety, following Williams (1898). Williams named this variety var. breviflora apparently 'amending' the earlier name at varietal rank - parviflora used by Fenzl under A. graminea. This name refers, of course, to the difference between A. blepharophylla and A. graminea; there is no difference in flower size between the typical var. blepharophylla and var. parviflora.

No material has been seen of the following species which is probably referable to this group:

37. A. isaurica Boiss., Fl. Orient. 1 : 695 (1867).

Type: TURKEY: Cilicia: "in pascuis alpinis montis Gheidagh Tauri Isaurici," Heldreich. holo. G.

Boissier related the species to A. graminifolia, from which he

distinguished it by the absence of sheathing leaves round the base of the stem, the indistinct staminal glands, the oblong-obovate petals and the oblong sepals with a narrow scarious margin and a darker apex.

Other features of note from the original description are the very short leaves (rosette 1.8-2.0cm.; cauline c.4.0cm.) and the few-flowered inflorescence.

Section Glomeriflorae Fenzl ex Williams

1a. Opposite cauline leaves united at the base to form a sheath 4-25mm. long; sepals more than 5mm. long:

2a. Cauline leaf sheaths long (12-25mm.); sepals ovate-lanceolate, 2-3 times as long as broad, usually glabrous; flowers usually densely compacted into a terminal head (inflorescence rarely paniculate and then the upper bracts exceeding the pedicels)

38. A. dianthoides

2b. Cauline leaf sheaths short (4-9mm.); sepals broadly ovate, 1.25-1.75 times as long as broad, glandular pubescent, usually densely so; flowers forming a lax cyme or panicle of cymes, the upper bracts (but not bracteoles) shorter than the pedicels

39. A. cucubaloides

1b. Opposite cauline leaves free to the basal node (the united membranous portion round the node < 2mm. long); sepals 3-4.5mm. long

40. A. gypsophiloides

38. A. dianthoides J.E. Smith, Ic. Pl. Ined. 16 (1789).

Key to varieties

Flowers densely compacted into a terminal head, peduncles and pedicels 0-2mm. long; petals narrowly lanceolate

(3.5-4 times as long as broad), more than twice as long as the sepals (2-2.25 times); inflorescence entirely glabrous (i). var. dianthoides

Flowers arranged in a terminal panicle of cymes, primary peduncles 10-25mm. long, ultimate pedicels 2-5mm.; petals lanceolate (2.75-3.25 times as long as broad), less than twice as long as the sepals (1.5-1.75 times); upper part of the flowering stem and peduncles densely glandular pubescent, pedicels and sepals less densely so (ii). var. paniculata

(i). var. dianthoides

Syn.: Alsinanthus dianthoides (Smith) Desvaux in J. Bot. Desv. 3 (5) : 221 (1816).

Illustrations:

J.E. Smith, Ic. Fl. Ined. t.16 (1789).

Grossheim, Fl. Kavkaza (Fl. Caucas.) ed.2 3 : 221 t.21 f.5 (1945).

Type: ?TURKEY: "Sponte nascitur in Armenia", Herb. Tournefort. holo. P (?).

Specimens seen:

TURKEY:-

N.E. Armenia:- "Armenia", Calvert & Zohrab (E). Erzeroum

(Erzerum), Zorab 131 (K). M. Tech dagh above Erzeroum, 2135-2440m., Huet du Pavillon 7.1853. Kars, S.W. side of Kisir Dağ, 2300m., Davis 30493. Kars: Ziyaret dağ (Yalnizçam dağlari) above Yalnizçam, 2250m. Davis 30313. Kars: nr. Kyrch-kilissa, Koenig 6.7.1906 (WU).

U.S.S.R.:-

Georgia:- Tiflis: Achalkalaki: nr. lake Tabitzchuri, 1830m., Grossheim & Schischkin, Fl. orient. Exs. 154 (leg. Kozlowsky).

Armenia:- "Armenia", Szowits (K). Erivan, Steven (K). Nachsrepublika: Paroga - Tiva, Karjagin & Safiev 18.6.1931 (S), Karjagin & Piterkina (K).

Azerbaijan:- Talusch, C.A.Meyer (K). Bougard, C.A.Meyer (K).

IRAN:-

Azerbaijan:- Savala, Aucher-Eloy 4258. M. Gelasa, Knapp 14.6.1884 (WU).

(ii). var. paniculata McNeill, var. nov.

Syn.: ?A. cucubaloides var. confertiflora Bordz. in Bull. Jard. bot. Kieff. 12/13 : 111 (1931).

A varietate typica inflorescentia glanduloso-pubescenti paniculata nec capitata petalis lanceolatis nec anguste lanceolatis sepalis vix duplo longioribus differt.

Inflorescentia paniculata; pedunculi infimi 10-25mm. longi; pedicelli ultimi > 2mm. longi; axis et pedunculi dense pedicelli et sepala sparsius glanduloso-pubescentes. Petala latitudine 2.75-3.5-plo longiora, sepalis 1.6-1.75-plo longiora.

Typus: TURKEY: N.E. Armenia: "Prov. Kars: Yagmurlu Dag between Sarikamis & Karaurgan. 2300m. Meadows. Perennial. Flowers white. 7.7.1957, Davis & Hedge (D.30764)." holo. E!

Geographical distribution (of species): Endemic.

Biology: Erect grass-leaved plant (to 50cm. tall) with rather short caudex and caudiculi. Recorded between 1800 & 2450 m. Flowers May - July.

Discussion: A. dianthoides is a rather common species of the Caucasus and adjacent parts of Turkey and Iran and from the specimens examined seems to be very uniform morphologically - that is with the exception of the very extraordinary plant described as var. paniculata. At first sight this Davis gathering made in 1957 was thought to be a most striking and (for an Arenaria) attractive new species, related to A. dianthoides on the one hand and A. cucubaloides on the other. On detailed examination it was found that, apart from the very obvious difference in the form of the inflorescence, only pubescence and petal shape distinguished it from typical A. dianthoides. Moreover all the flowers examined seemed to be male sterile, not only suggesting

chromosomal irregularities and perhaps hybridity but also a possible cause of the relatively shorter petals. The presence or absence of glandular pubescence in the inflorescence commonly appears to be induced in Arenaria by a small genetic difference (cf. A. gypsophiloides, A. balansae and A. cretica) and so both the correlating characters are rather suspect for delimitation at specific rank. The possibility of this being a sterile hybrid between A. dianthoides and A. cucubaloides, deriving its glandular hairs and lax inflorescence from the latter, cannot therefore be excluded. The whole gathering is, however, very uniform and Davis notes (personal communication) that the plant filled a whole meadow. In the apparently more reliable characters of sepal structure and leaf sheath, the plant is typical of A. dianthoides and for the present it would seem best to include it within that species.

In 1931 Bordzilowski described from the same area a variety of A. cucubaloides (var. confertiflora), which may well represent similar plants to this Davis gathering. There are however some discrepancies between his description (see below under A. cucubaloides) and the plants collected by Davis; in the former the flowers would appear to be smaller and the sepals always glabrous. In view of this doubt as to the application of the name confertiflora, Davis' plant is described as a new variety (var. paniculata) of A. dianthoides.

39. A. cucubaloides J.E. Smith, Ic. Pl. Ined. 17 (1789).

Syn.: Alsinanthus cucubaloides (Smith) Desvaux in J. Bot. Desv. 3 (5) : 221 (1816).

Eremogone cucubaloides (Smith) Fenzl, Versuch Verbreit. Alsin. t. ad. p. 57 (1833).

?A. cucubaloides ∝ glabra Fenzl in Ledebour, Fl. Ross. 1 : 365 (1862).

A. cucubaloides β viscida Fenzl l.c.

Illustrations:

J.E. Smith, Ic. Pl. Ined. t.16 (1789).

Grossheim, Fl. Kavkaza (Fl. Cauc.) ed.2 3 : 221 t.21 f.9 (1945).

Type: ?TURKEY: "Sponte nascitur in Armenia", Herb. Tournefort. holo. P (?).

Specimens seen:

TURKEY:-

Galatia:- Ak dagh nr. Amasia, Bornmüller (1889) 50 (1600-2000m.) (JE), (1889) 150 (1800m.).

Cappadocia:- Pinarbaşi- Gürün, 1890m., Davis 21972. Zara-Sutchehir (Suşehri ?), 1830m., Balls 1471. Hassan dagh (? Hasan dağ nr. Niğde), Whittal 153.

Cataonia:- Antitaurus: Bereketli, 2000m., Siehe (1906) 407 (as A. gypsophiloides).

S.W. Armenia:- ? Armenia Minor: Göl dagh, Bornmüller (1893) 3288

Egin : Yokardidagh, Sintenis (1890) 2498 (JE).

N.E. Armenia:- "Armenia", Calvert & Zohrab (E). Baibout (Bayburt) - Gumuschtihane (Gümüşane), Bourgeau (1862) 53. Gümüşane: Argyridagh, Sintenis (1894) 5038 (JE). Erzeroum, Zohrab (comm. 1853) (K). Erzeroum - Ispir above Ortus, 1850-1980m., Huet du Pavillon 6.1853. Erzeroum-Ispir nr. Setchank, 1830m., Huet du Pavillon 6.1853 (BM). Ortus-Setchank, Huet du Pavillon 6.1853 (JE). Erzerum: Horasan - Karaurgan, 14mls. from Horasan, 2000m., Davis 29508. Kars : Yalnizçam, 1900m., Davis 29618. Muş : nr. Egurt, Schischkin 29.5.1916 (BM).

Kurdistan:- no precise locality, Layard 92. Wan (Van), Kulzer 6.1912 (as A. gypsophilcides) (WU). Wan: Warack dagh (Erek dağ), 2700m., Kronenburg 164 (WU).

U.S.S.R.:-

Armenia:- Erivan, Steven (K).

IRAN:-

?Azerbaijan:- mts. nr. Moshaku, 2135m., Cowan & Darlington 2402, Ushun - Manibratum, 1830m., Cowan & Darlington 1467. Sivik mts., 2230m., Cowan & Darlington 1299.

Geographical distribution: Endemic.

Biology: Erect grass-leaved plant to 40cm. with a rather slender creeping caudex. Altitudinal range: 1800 - 2300 (-2700) m. Flowers June.

Discussion: A. cucubaloides is a very distinct but rather variable species. The possibility of its hybridising with A. dianthoides has been mentioned in the discussion of that species, and in that connection it is worthwhile noting that the variation observed is of a type which could well be explained by some form of gene-flow (e.g. Introgressive Hybridisation) between the three species of the section (A. dianthoides, A. cucubaloides and A. gypsophiloides). Bordzilowski's var. confertiflora may represent such a hybrid form (note the smaller flowers approaching A. gypsophiloides). No authentic material has been seen but the original publication is as follows:

A. cucubaloides var. confertiflora Bordz. in Bull. Jard. Bot. Kieff. 12/13 : 111 (1931).

Type: TURKEY: N.E. Armenia: "Provincia Kars. In prato prope oppidulum Sarykamysch 11. VII. (29.VI.) 1910 fl., T.A. Roop". holo. KW.

"...floribus confertis".

"Flores, quam in forma typica, minores, petalis calyce glabro, 4-5mm. longo subduplo longioribus"

(For further discussion of this taxon see under A. dianthoides).

40. A. gypsophiloides L., Mant. 1 : 71 (1767).

Key to varieties

Peduncles, pedicels and sepals glandular-pubescent, usually densely so. (i). var. gypsophiloides

Peduncles, pedicels and sepals glabrous (ii). var. glabra

(i). var. gypsophiloides

Syn.: !Alsinanthus gypsophiloides (L.) Desvaux in J. Bot. Desv. 3 (5) : 221 (1816).

!Eremogone gypsophiloides (L.) Fenzl, Versuch Verbreit. Alsin. t. ad. p. 57 (1833).

A. gypsophiloides L. β viscosa Fenzl in Ledebour, Fl. Ross. 1 : 365 (1842).

!A. mirdamadii Rech. f. in Bot. Jb. 75 : 342 (1951).

Illustrations:

Grossheim. Fl. Kavkaza ed.2 3 : 221 t.21 f.8 (1945).

Komarov, Fl. U.R.S.S. 6 : 523 t.29 f.4 (1936).

Type: "in Oriente", Schreber. holo. LINN! iso. M?

Specimens seen:

TURKEY:-

S.W. Armenia:- Tunceli: Munzur dağ above Ovacik, 2400m., Davis 31332, 31366. Tunceli: Pulumur, 1550m., Davis 29262.

N.E. Armenia:- "Armenia", Calvert & Zohrab (E). Erzinghan (Erzincan) : Sipikordagh nr. Orumserai, Sintenis 1283. Sipikor

Pirinbaghre, Sintenis 3966 (JE). Erzincan: Kesiş dağ above Cimin, 2300m., Davis 31836. Argyridagh, Sintenis 6288 (JE). Ispir-Baibourt, Bourgeau 52 (10.7.1862) (K) (JE), 23.7.1862 (JE). Baibourt, Bourgeau 7.1862 (JE). Baiburt: Vavurt Dagh, 1920m., Balls 1761 S. of Sogarli dag, N. of Bayburt, 1700m., Davis 31991. Erzeroum, Zorab 134 (K). M. Tech Dagh above Erzeroum, 1830-2135m., Huet du Pavillon 7.1853. Erzerum: Pasinler-Horasan, 1650m., Davis 29394. W. of Kars, 1700m., Davis 32581. Kars - Susuz, 8 km. from Kars, 1800m. Davis 30625. ?Stauri 2195m., Balls 503 (as A. blepharophylla).

Kurdistan:- "Kurdistan, Brant (comm. Strangways 1840) (K) (cf. Blakelock, 1957 p.183). Bitlis: Meleto (Meretug) Dagh, 2750m., Handel-Mazzetti 2828 (WU). Nemrut dağ, Davis 23524 (2285m.), McNeill 550 (crater, 2400m.). Karz dağ above Kotum, 1980m., Davis 22222. Wan (Van): Warak (Erek) Dagh, 2200-2500m., Kronenburg 43 (WU)(JE). Artos dağ above Gevaş, 2900m., McNeill 769 (with var. glabra). Başkale: Ispiriz Dağ, 2800m., Davis 23667.

Mesopotamia:- Suerek (Siverek) - Diarbekir (Diyarbakir) (? on Karaçali dağ), Kotschy (1841) 168 (as A. gypsophiloides var. glabra).

U.S.S.R.:-

Georgia:- nr. Tatuni, 915-1220m., Hohenacker 6-7.1836 (as A. cucubaloides).

Armenia:- "Armenia", Szowits 315. Nachsrepublic: Daragassu, Karjagin & Safiev 24.6.1931. Nachsrepublic: Mt. Chazor-yurt nr.

Yuasitsvaz, Karjagin & Safiev 19.6.1931 (S). Nachsrepublic: Mt. Ayakatach, Gadzhiev, Gurvitsch & Ulubabov 10.8.1933 (S). Nachsrepublic: Mt. Arazhin, Gadzhiev, Gurvitsch & Ulubabov 7.8.1933.

Azerbaijan:- Talusch, Herb. Mus. Petrop. (1837) (as A. cucubaloides) (K).

IRAN:-

Azerbaijan:- Meshkambar nr. Tabriz, 1460m., KAR 2237 (leg. Mirdamadi) (type of A. mirdamadii Rech.) (W).

Caspian Sea:- Elburz: R. Norion at Talkan, 2400m., Bornmüller 6411 (JE).

Tehran:- Elburz: m. Demawend above Pelur, 2600m., KAR 2226 (leg. Gauba & Esfandieri) (W). Demavend above Ask, Pichler 4.7.1882 (WU). Kazvin: Kandavan nr. Assam Varak, 3100m., KAR 2224 (leg. Gauba) (with var. glabra) (W). Kandavan, 3050m., Davis 839. Kazvin: R. Keredj nr. Azaddbar, KAR 2225 (leg. Esfandieri) (W).

(ii). var. glabra Fenzl in Ledebour, Fl. Ross. 1 : 365 (1842).

Syn.: !A. caricifolia Boiss. in Tchihatch., Asie Min. 3 (Bot.) (1) : 235 (1860).

!A. gypsophiloides β parviflora Boiss. Fl. Orient. 1 : 694 (1867).

Syntypes: 1) no locality: ex herb. Paris as A. dianthoides, 2) U.S.S.R.: Georgia: Talusch. alt 700-800 hexap., C.A.Meyer (as A.

cucubaloides (glabra)) 3) ? locality: Hohenacker 4) ? "ad locum Goktschai", Eichwald. holo. destroyed (W) iso. K! (l. only), LE?

Specimens seen:

No locality:- H.P. 8.8.1818 (as "A. dianthifolia H.P." (K). ex hort. Berol. 92 (1816) (as A. dianthoides)(S) (JE). Hort. ber. 24 (1818) (as A. longifolia altered to A. cucubaloides) (JE). cult. Valeyres (1863) (G). "ex Orient" & "ex Asia Minori", cult Valeyres 1865 (as A. caricifolia) (G).

TURKEY:-

N.E. Armenia:- ? Avzapert - Uzunbazar, Tchihatcheff 943 (type of A. caricifolia) (G). Erzerum: Ilica-Tercan, 1900m., Davis 30841. environs of Erzeroum, Calvert (JE).

Kurdistan:- Van : Erek dağ, 2440m., Davis 22905. Van : Artos dağ, 2900m., McNeill 769 (with var. gypsophiloides). Cilo dağ, 2285m., Davis 23944. Byn Ucum, 25 km. S.W. of Mukus, 1900m., Frodin 137 (as A. caricifolia) (W).

U.S.S.R. :-

No locality:- "Caucasus", Ledebour (as Eremogone cucubaloides & with A. graminea) (K).

IRAQ:-

Mosul:- ? "In deserto fl. Chabar" (Khabur), Eradris?, Haussknecht 165 (5.1867) (JE).

IRAN:-

No locality:- "Persia", anon. 1333 (as A. dianthoides) (E).

Azerbaijan:- Mishan Dagh nr. Tabriz, Gilliat-Smith 2373. Savalen, Aucher-Eloy 4259, ~~(isotype)~~. ?Tschahrik, Knapp 16.6.1884 (WU). ?Ser, Knapp 8.7.1884 (WU).

Caspian Sea:- Elburs, Totschal Scheheristanek, 2200m., Bornmüller 6409.

Kordestan & Zanjan:- Sahend Hills above Zinjinab (Zanjan?) 1830m., Cowan & Darlington 1832, 1852, Gilliat-Smith 2515 (no alt.).

Northern Zagros:- m. Elwend, Hamadan, Strauss 53. Hamadan, Ghitan, Michaux (P).

Tehran:- Kandeman pass (Kandavan?), anon. 32 (K). Kazvin: Kandavan nr. Assam Varak, 3100m., KAR 2224 (leg. Gauba) (with var. gypsophiloides) (W).

Geographical distribution (of species): Endemic.

Biology: An erect grass-leaved plant, 20-50cm. tall (-60 cm. in cultivation) with a very stout woody caudex. Recorded at c.1100m., 1460m. and throughout the range 1800-3100m.

Discussion: A. gypsophiloides is probably the most common perennial species of Arenaria to be found in the Orient. It is not, however, very widespread, being restricted to Armenia, Kurdistan, Azerbaijan and the Elburz mountains. The major variation within the species is

in the pubescence, the inflorescence being either densely glandular hairy or else entirely glabrous. With only two exceptions, individual gatherings are uniform in this respect and although there is a very wide overlap, the glabrous plant would seem to be more southerly in its distribution. For these reasons it has been recognised as a separate variety (var. glabra Fenzl). (cf. fig. 25)

Two species are here reduced to synonymy under A. gypsophiloides; the one, Boissier's A. caricifolia, is merely a luxuriant form of var. glabra, while the other, A. mirdamadii, which Rechinger described in 1951, is based on plants not in full flower and so not yet showing the characteristic cuspidate sepals.

Section Glomeriflorae - Discussion

The section Glomeriflorae appears to lie intermediate between the section Eremogone with obtuse sepals and Rigidae in which they are acute. The typical sepal structure of this section is the development, from an originally obtuse apex, of a prominent dark-coloured cuspidate tip. This is achieved by the very membranous margin in the upper part of the sepal becoming inrolled or even ruptured at maturity, while the usually black or violet herbaceous central portion elongates.

A. dianthoides, in which the cusp is never well-developed, was

formerly united with other capitate species to form the section Glomeriflorae, but in fact it forms a closely interlinked series with A. cucubaloides and A. gypsophiloides. A. dianthoides is the type species of Section Glomeriflorae Williams, and so with the revised circumscription, this becomes the correct name for the group which Fenzl and Schischkin termed Chromolemmae (Fenzl's name is invalid and Schischkin's is at Series rank and is antedated by Williams'). The difference in staminal glands between A. cucubaloides on the one hand and A. gypsophiloides and A. dianthoides on the other, is purely a matter of degree of development and Williams' (1898) separation into two subgenera on this basis is quite unrealistic. Although maintaining the capitate species as a separate group, Fenzl's (in Ledebour, 1842) treatment of the group is much more natural.

Section Rigidae Schischkin ex McNeill

Series Rigidae

Base of the flowering stems sheathed by a whorl of leaves and dead leaf bases; internodes 4-6; median stem leaves 6-7cm. long, basal rosette leaves 8-15cm. long; pedicels and peduncles glabrous 41. A. holostea

Base of the flowering stem naked or with a whorl of short scales; internodes 9-11; median stem leaves 3-4cm. long, basal rosette leaves 3-5cm. long; pedicels always and peduncles often shortly glandular pubescent 42. A. szowitsii

41. A. holostea M. Bieb., Fl. Taur. Cauc. 1 : 345 (1808).

Key to subspecies

Basal part of the flowering stem glabrous A. subsp. holostea

Basal part of the flowering stem shortly and roughly pubescent B. subsp. macrantha

A. subsp. holostea

Syn.: (!)Eremogone holostea (M.B.) Rupr., Fl. Cauc. 217 (1869).

Illustrations:

Komarov, Fl. U.R.S.S. 6 : 523 t.29 f.2 (1936).

Ruprecht, Fl. Caucas. t.6 (1869) (Mem. Acad. Sci. Petersb. ser.7 15 (2)).

Type: U.S.S.R.: "in Caucasico iberico", M. Bieberstein. holo. LE (photo!).

Specimens seen:

U.S.S.R.:-

Daghestan:- "Daghestan", Becker 74.

Geographical distribution: Endemic.

B. subsp. macrantha (Schischkin) McNeill, comb. et stat. nov.

Syn.: (!)A. macrantha Schischkin in Komarov, Fl. U.R.S.S. 6 : 886 (1936).

Type:- U.S.S.R.: Armenia: "Transcaucasia australis. Armenia, prope pag. Takjoltu 10.vi.1912", leg. G. Woronow. holo. LE (photo!)

Specimens seen:

TURKEY:-

N.E. Armenia:- Bayaza (Dogu Bayazit?), Aucher-Eloy 4259A.

Erzerum: Horasan, 1600m., Davis 29365.

Geographical distribution: Endemic.

Biology (of species): A tufted plant up to 30cm. tall, probably growing in soil rather than on scree. Caudex short or absent.

Collected at 1600m., flowering in June.

Discussion: In the Flora U.R.S.S., Schischkin and Knorring distinguish two species within Boissier's concept of A. holostea. The new species, A. macrantha, is distinguished from typical A. holostea by the basal part of the stem (at least the lowest internode) bearing sparse, short and rather rough hairs. No other discriminatory features are mentioned and none are observable in the photograph of the type specimen or on the scanty material at present available. In this restricted sense A. holostea appears to be confined to eastern Transcaucasia with Schischkin's macrantha replacing it in Western Transcaucasia and Turkish Armenia. In view of the small single character difference between the taxa, it seems at present best to treat them as geographical subspecies of the one species, A. holostea.

42. A. szowitsii Boiss., Fl. Orient. 1 : 695 (1867).

Illustration:

Grossheim, Fl. Kavkaza (Fl. Caucas.) ed.2 3 : 221 t.21 f.6 (1945).

Type: IRAN: Azerbaijan: "in collibus ad urbem Deliman distr. Khoi prov. Aderbidjan", Szowits, holo. G! iso. LE (photo!).

Specimens seen:

U.S.S.R.:-

Armenia:- "Armenia", Szowits (K). Nakhichevan: Narashenski raion Akhchga, 1240m., Herb. Inst. bot. Komarov (LE) 19.5.1947 (BM).

IRAN:-

Azerbaijan:- Urmia (Urumia), Gilliat-Smith 1533. nr. Tabriz, Gilliat-Smith 1849a. nr. Sir, 2135m., Cowan & Darlington 2218. Khasrowo, M. Karnaru ("in locus classicus"?), Knapp 10.6.1884 (WU)(JE). M. Selosa, Knapp 14.6.1884 (WU).

Geographical distribution: Endemic.

Biology: A plant, 20-25cm. tall, of scree and stony hill slopes with extensive caudex and caudiculi, the latter often rather stoloniform. Collected at 1240 and 2130m. Flowers May - June.

Discussion: cf. Discussion of Series.

Series Rigidae - Discussion

The two species of the series are very closely related, being indistinguishable on floral characters. The sepal length, used to distinguish them by Boissier (1867) is very variable both as between the different positions in the cyme (the first flower largest) and as between the flowering and fruiting stage of any one flower. The measured range for A. szowitsii is 6-9mm. and for A. holostea 6-11mm. (Boissier claimed 6.5mm. for szowitsii and 8.5-10.5 for holostea.)

There is, however, a very striking difference in habit, A. holostea being a tufted plant with short caudex and caudiculi and with a whorl of leaves and dead leaf bases at the foot of each flowering stem whereas A. szowitsii spreads apparently through scree or loose stony soil by long almost stolon-like caudiculi which give rise to sterile rosettes and flowering shoots, the latter having only a whorl of scale leaves (3mm. long) at the base. The flowering stems of A. szowitsii, unlike those of A. holostea which appear to die back completely each year, frequently have axillary whorls of leaves in the lower part and after flowering become prostrate and continue as caudiculi.

The two species appear also to be separated geographically, A. holostea occurring in Turkish Armenia, South Transcaucasia, and Daghestan, north and west of A. szowitsii which is confined to Nakhichevan and Azerbaijan.

Series Setaceae McNeill

One species:

43. A. angustisepala McNeill, sp. nov.

Species valde distincta, ab A. szowitsii et A. holostea affinis foliis brevibus setaceis non longis linearibus sepalis angustioribus planta dense caespitosa humili caulibus < 5cm. altis 1(-2)-floris praeditis facile distinguenda; ab A. armeniaca, cui in forma foliorum et sepalorum aliquantum approximat, glandulis staminorum 5 indivisis floribus plerumque solitariis nec paucis dense congestis et praesertim habitu humili caespitoso differt.

Herba perennis, dense caespitosa vel subpulvinata, humilis ad 6cm. alta. Caudex ± gracilis, 2-4mm. diam., in caudiculos numerosos intortos transiens. Caudiculi 3-10cm. longi, foliis persistentibus mortuis superne praediti, rosulas steriles paucas et caules floriferos unum vel paucos abientes. Rosulae steriles superne sparse (in typo) glanduloso-pubescentes foliis 4-7-jugis praeditae. Caules breves 3-5cm. longi, foliis 3-5-jugis breve (c. 0.75mm.) connatis ± aequaliter disjunctis praediti. Folia setacea, 5-10mm. longa et 0.3-0.6mm. lata, apiculata, breve ciliata et minute et sparse puberula (eglandulis); omnia, praeter par caulinem supremum, plerumque viridia, sed marginibus membranaceis angustis ad basim praedita; folia caulina suprema bracteis similia sed longiora et angustiora. Inflorescentia 1(-2)-flora (raro tertio rudimentario); bracteae lanceolatae longe acutae, c. 7mm. longae et 2mm. latae, carinatae, late scarioso-marginatae,

glabrae; pedicelli 5-10mm. longi dense glanduloso-puberuli. Sepala glabra, ± aequalia, lanceolata, c.7.5mm. longa et c.2.5mm. lata, carinata, acuta vel obtusa, tantum non carina scariosa; carina herbacea uninervia (vere paucinervia conjuncta) ad basim 1mm. lata supra angustiora ad apicem percurrens. Petala obovata vel spathulata truncata, 9-10mm. longa et c.4.5mm. lata. Stamina 10, exteriora basi glandulis minutis praedita; filamenta c.4.mm. longa; antherae c.0.75mm. longae. Ovarium ovoideum c.2mm. longum; styli c.2.5mm. longi; ovula c.30. Capsula vix matura c.6mm. longa, valvis 6 aequalibus dehiscens. Semina ignota.

Key to varieties

Sepals glabrous, c.7.5mm. long, all ovate lanceolate (outer and inner ± equal in size and shape); leaves eglandular-puberulent; stems glabrous or sparsely glandular-pubescent below; bracts glabrous; pedicels densely glandular-puberulent. (1). var. angustisepala

Sepals glandular-pubescent, 5.5-6mm. long, outer narrowly lanceolate and inner ovate; leaves glandular-puberulent; stems densely glandular-pubescent throughout; bracts and pedicels densely glandular-pubescent. (ii). var. glandulosa

(i). var. angustisepala

Typus: TURKEY: Kurdistan: "Prov. Bitlis/Van: mt. 10 km. S.E. of

Pelli. 8500 ft. [2590m.] 8 July 1954", Davis & O. Polunin (D.22524). holo. E! iso. K.

(ii). var. glandulosa McNeill, var. nov.

A typo puberulentia glandulosa foliorum caulibus ex toto et bracteis dense glanduloso-pubescentibus pedicellis glanduloso-pubescentibus (nec glanduloso-puberulis) sepalis brevioris (5.5-6mm.) gradatim inaequalibus glanduloso-pubescentibus differt.

Sepalum extimum anguste lanceolatum (latitudine c.4-plo longius) aliquantum anguste scarioso-marginatum ex toto glanduloso-pubescens; sepalum intimum ovatum (latitudine c. duplo longius) latissime scarioso-marginatum, tantum in carina glanduloso pubescens.

Typus: TURKEY: Kurdistan: "Prov. Van, dist. Gevaş: Artos Dağ, 10,000 ft. [3048m.] Rock crevices. Fls. white. 15 July 1954", Davis & O. Polunin (D.22818). holo. E! iso. K.

Discussion: A. angustisepala is an extremely distinctive new species which appears to form a link between the Sections Rigidae and Scariosae. It has been included in the former because of its sepal structure - usually acute with the distinct midrib running right to the apex. It possesses, however, the setaceous leaves of Section Scariosae and of the species of that group most closely resembles A. armeniaca.

The two known gatherings, from different mountains south of Lake Van in Turkish Kurdistan, are each very uniform within themselves but differ quite markedly from one another. This has prompted the recognition of one as a separate variety. (cf. fig. 26)

Section Scariosae McNeill

Series Polycnemifoliae McNeill

1a. Flowering stems with 1-2 pairs of leaves; inflorescence composed of 2-3 remote clusters each of 1-4 flowers; sepals 3.5-4.5mm. long; seeds minutely fimbriate along the ridge; plant forming dense spiny cushions 44. A. pseudacantholimon

1b. Flowering stems with 5-7 pairs of leaves; inflorescence composed of a terminal cluster of 2-8 flowers (rarely with 1 weakly developed axillary cluster below); sepals 5-8mm. long; seeds without fimbriate margin; plant arising from creeping woody caudiculi, basal leaves setaceous but not spiny :

2a. Sepals 5-6mm. long; petals ovate-lanceolate, 2-2.5 times as long as broad, abruptly contracted at the base, slightly shorter than the sepals; stamens 3-4mm. long, c. two-thirds as long as petals 45. A. polycnemifolia

2b. Sepals 6-8mm. long; petals linear-lanceolate, 3.5-5 times as long as broad, gradually narrowing to a broad base, longer than the sepals; stamens 7.5-9mm long, almost as long as the petals 46. A. zargariana

44. A. pseudacantholimon Bornm. in Mitt. thuring. bot. Ver. N.F. 27 : 22 (1910).

Syn. : Buffonia caespitosa Hausskn. ined.

Syntypes: TURKEY: S.W. Armenia: 1) "Sipikordagh: in pascuis subalpinis 28.7.1890, P. Sintenis 3100" sub "Buffonia caespitosa Hskn. n.sp." holo. JE! iso. K!, WU! 2) N.E. Armenia: "Szanschak Gumuschkhane. Argyridagh 14.7.1894, P. Sintenis 6289" sub "Buffonia caespitosa Hskn." holo. JE! iso. BM!, E!, K!

Specimens seen:

TURKEY:-

S.W. Armenia:- Erzincan: Sipikor dagh, 1525-1830m., Sintenis 1171. Erzincan: Keşiş dağ above Çimin, Davis 31631 (2700-2900m.) 31659 (2500-2600m.).

Geographical distribution: Endemic.

Biology: A spiny hummock-forming plant of stony slopes and scree, resembling Acantholimon sp. in habit. Recorded from igneous rock. Flowers July - August.

Discussion: A. pseudacantholimon is a very distinct species both in its vegetative and floral characters. It appears to be most closely related to A. polycnemifolia but it shows an approach towards the section Sclerophyllae in its sepals having only a relatively narrow scarious margin. It was first collected by Sintenis, on three occasions - in 1889, 1890, and 1891. These gatherings were mistaken by Haussknecht for a new species of the genus Buffonia (which is distinguished from Arenaria by having its floral parts in fours) and given the manuscript name "Buffonia caespitosa". Bornmüller in 1910 recognised their true taxonomic position, describing them as Arenaria

pseudacantholimon from their obvious resemblance to the Plumbaginaceous genus. The only other known gatherings are two made by Davis in 1957 from the same area.

45. A. polycnemifolia Boiss., Diagn. Fl. Orient. ser.1 1 : 48 (1842).

Lectotype: IRAN: Caspian Sea: "Demavend Kou, Aucher-Eloy 4255", BM!, K!

Specimens seen:

IRAN:-

No locality:- Persia occidentalis, Aucher-Eloy 592 (paratype).

Caspian Sea:- Getschesar-Asadbar, 2600-2700m., Bornmüller 6406. nr. Asadbar, 2195m., Kotschy 462 (as A. armeniaca). W. Elburz: Seroderre nr. Germat above Talkau, 2600-2700m., Bornmüller 6407 (BM). W. Elburz: Sihekerabad above Char, 2200m., Bornmüller 6408 (JE).

Northern Zagros:- Hamadan: m. Elwend, Strauss 8.1898 (as and with A. gypsophiloides) (JE).

Tehran:- Kuh Dasht, 2600-2800m., Parsa 272.

Central Desert:- ?Damghān/Semnān: Baschm, 2400m., Rechinger 119 (S).

Geographical distribution: Endemic.

Biology: A plant of dry stony places and scree with strong caudiculi. Recorded between 2200 and 2800m. Flowers July - August.

Discussion: This species is apparently confined to the Elburz mountains in northern Persia where it was first collected by Aucher-Eloy (nos. 592 and 4255). Boissier also cited a third gathering of Aucher-Eloy's under this species, no. 591 from Armenia, but the specimen at Kew is of a plant of A. acutisepala in the section Sclerophyllae, a species with a somewhat dense cymose inflorescence but without the flowers being clustered into heads. Boissier's description seems to refer solely to the Persian plants, but to avoid later confusion a lectotype has been chosen - Aucher-Eloy 4255 from Mt. Demavend. Another erroneous record of this species from Armenia is Sintenis 6111, a gathering of A. scariosa which was distributed under the name A. polycnemifolia.

In its floral characters the species appears to lie intermediate between A. pseudacantholimon and A. zargariana, though vegetatively and in the general form of the inflorescence it very closely resembles the latter.

46. A. zargariana Parsa in Kew Bull. 1947 : 18 (1947).

Syn.: !A. leucocephala Bornm. & Gauba in Fedde Repert. 39 : 93 (1935), non Fernald (1919).

!A. kourosii Parsa in Kew Bull. 1947 : 17 (1947).

Type: IRAN: Tehran: "Ali-abad (Ghom) 29.6.1939", A. Parsa. holo. K!

Specimens seen:

IRAN:-

Tehran:- Kazvin: Kuh-e-Dasht nr. Karaj, Gauba 2222 (type of A. leucocephala Bornm. & Gauba) (W), Parsa 670 (2300m.) (type of A. kourosii). C. Elburz: M. Pic Kuh nr. Karaj, 1600-2200m., Rechinger 567.

Geographical distribution: Endemic.

Biology: A plant of dry stony ground, possessing well-developed caudiculi. Recorded between 1600 and 2300m. Flowers June - July.

Discussion: Despite the uniformity of the four known gatherings of this species, they have been made the basis of three different species. The responsibility for this rests with Parsa who described as new species, two of his own specimens which only differ materially in the one having been collected without the basal parts (caudex, caudiculi and sterile rosettes). Moreover he appears to have ignored Rechinger's specimen (correctly identified as A. leucocephala Bornm. & Gauba) which was available to him and which differs from his two specimens only in being slightly more luxuriant and in being in an early flowering stage (the petals have not expanded).

Unfortunately Bornmüller & Gauba's A. leucocephala, the earliest name, is illegitimate being antedated by Fernald's transfer to Arenaria

sensu lato of Alsine leucocephala Boiss. (= Minuartia leucocephala (Boiss.) Mattf.). As a result one of Parsa's otherwise superfluous specific epithets must become the correct name for the species, and A. zargariana has been chosen.

Series Polycnemifoliae - Discussion

Each of the three species of this series is very distinct and has a rather restricted distribution in the mountains of Turkish Armenia and northern Iran. They appear to form a natural linear sequence which extends into the series Scariosae and the only taxonomic difficulty in the whole group is that of determining where to draw the demarcating line between the two series (cf. Discussion of the section).

Series Scariosae

Flowers aggregated into terminal clusters, pedicels 0-2mm. long (axillary clusters sometimes present, rarely reduced to a single flower); sepals with a long triangular herbaceous portion running to near the apex ($> \frac{3}{4}$ way); petals ovate-lanceolate to lanceolate (2.5-3.25 times as long as broad) 47. A. armeniaca

Flowers arranged in a panicle of cymes, pedicels 1-10mm. long (at least some 5-10mm.); sepals with short triangular herbaceous portion merging half-way into a scarious upper part; petals lanceolate to linear-lanceolate (3.5-4.5 times as long as broad) 48. A. scariosa

47. A. armeniaca Boiss., Diagn. Fl. Orient. ser.1 1 : 48 (1842).

Key to varieties

Sepals 6-8.5mm. long; staminal glands 0.30mm. long (i). var. armeniaca

Sepals 4.5-5mm. long; staminal glands 0.45mm. long (ii). var. minor

(i). var. armeniaca

Type: TURKEY: "Armenia, Aucher-Eloy 592 bis", holo. G., iso. K!

Specimens seen:

No locality:- cult. Valeyres 9.1869 (JE).

TURKEY:-

N.E. Armenia:- Gümüsane: Saida - Feke, Sintenis 6113. Erzerum, Montbret (1834). nr. Baibout (Bayburt), Bourgeau 54 (as Ar. cappadocica). Erzerum: Ilica - Tercan, 1900m., Davis 30843.

(ii). var. minor McNeill, var. nov.

A varietate typica, sepalis minoribus (4.5-5mm. longis) et glandulis staminorum longioribus (0.45mm. longis) differt.

Planta 10-20cm. alta; inflorescentia dense capitata (rachis brevis, < 5mm.).

Typus: TURKEY: S.W. Armenia: "Prov. Erzincan: Erzincan - Kelkit, c. 15 km. from Erzincan, 1650m. Dry igneous hillsides; Perennial, erect. Not spiny. 1.8.1957, Davis & Hedge (D.31885)". holo. E! iso. K.

Geographical distribution (of species): Endemic.

Biology: A plant of dry rocky slopes with well-developed caudex and caudiculi, recorded at 1650 & 1900m. Flowers July - August.

Discussion: A. armeniaca is the only member of Section Scariosae in which any appreciable variability has been detected, and even here it

is confined to the exi tence of a rather smaller and noticeably short-sepalled gathering made by Davis & Hedge in 1957 (Davis 31885). This plant, which comes from the vilayet of Erzincan (all the other localised gatherings being from Gümüşane or Erzerum), also differs in having much longer staminal glands and apparently in the inflorescence being always composed of a single dense head. In the typical plants of the species the flowers are arranged in rather elongate clusters. These are usually solitary and terminal, but sessile axillary clusters are occasionally present or else the inflorescence may be branched towards the top. While the general size of the plant and the more contracted inflorescence may be directly due to environmental factors, this does not seem likely in the case of the sepal length (there being so marked a discontinuity) or of the longer staminal glands, and accordingly the Erzincan plant has been described as a variety (var. minor).

48. A. scariosa Boiss. in Tchihatch., Asie Min. 3 (Bot.) (1) : 234 (1860).

Type: TURKEY: N.E. Armenia: "inter Gumuchkane et pagum Kerekli, Asia Minor Ost. 1858, M. de Tchihatcheff." holo. G!

Specimens seen:

TURKEY:-

N.E. Armenia:- Gümüşane: Ketschikale, Sintenis 6111 (as A. polycnemifolia). Gümüşane: "locus classicus", Sintenis 11 (JE).

Gümüşane: Korans (Bayburt-Gümüşane), 1800m., Davis 31937.

("Persia occidentalis": Aucher-Eloy (K) (as A. armeniaca)).

Geographical distribution: Endemic.

Biology: A plant of dry stony slopes with well-developed caudex and caudiculi. Recorded at 1800m. Flowers July - August.

Discussion: A. scariosa is a very distinct species, characterised as its name suggests by the very prominent scarious margins and scarious upper half (at least) of the sepals. The record from Western Iran is extremely doubtful, as the plant has never been rediscovered outside the Gümüşane region and as there is frequently confusion in the labelling of Aucher-Eloy specimens.

Series Scariosae - Discussion

The natural sequence exhibited by the series Polycnemifoliae continues through A. armeniaca to A. scariosa, species which resemble those of Polycnemifoliae in their distinctiveness and restricted distribution. A variety of A. armeniaca has been described, the only infra-specific taxon to be proposed in this taxonomically 'easy' group.

Section Scariosae - Discussion

As mentioned under the discussion of each of the two series, this section appears to form a natural sequence from A. pseudacantholimon, with its largely herbaceous sepals, its short petals abruptly contracted at the base and its indistinct staminal glands, to A. scariosa with almost entirely scarious sepals, longish petals gradually narrowing at the base and prominent staminal glands. The range between the two extremes is so great that it seems desirable from the point of view of uniformity of treatment within the genus as a whole to divide it into two series the one centred on A. polycnemifolia and the other on A. scariosa. The distinctiveness of each species causes some difficulty in determining where best to 'draw the line'; if petal characters were used, A. pseudacantholimon and A. polycnemifolia with petals shorter than the sepals and abruptly contracted at the base, would be separated from the other three species; on the other hand A. scariosa could be isolated from the rest (as Boissier has done) by virtue of its lax inflorescence. In fact the most marked discontinuity, the presence or absence of prominent staminal glands, has been chosen partly for convenience and partly because it is correlated with the most distinct (if still not very clear-cut) discontinuity in sepal strucutre in the group (cf. key to the species).

Section Sclerophyllae (Boiss.) McNeill

1a. Leaves with a very narrow scarious margin, the basal all densely imbricate, tetrastichous; bracts and bracteoles very broadly triangular, acute to obtuse; sepals obtuse, 2.5mm. long.

55. A. tetrasticha

1b. Leaves without a scarious margin, the basal spreading or some forming rather congested rosettes, not appearing tetrastichous; bracts and bracteoles subulate to triangular, acuminate; sepals acute to acuminate, or if obtuse, > 3mm. long and rosette leaves all spreading :

2a. Cauline leaves as long as or longer than the rosette leaves and 0.2-0.75 times as long as the corresponding internode; sepals ovate to lanceolate, 2-3.5 times as long as broad; petals ovate-lanceolate to lanceolate, 2.5-3.5 times as long as broad :

3a. Sepals 4.5-6.0mm. long, ovate-lanceolate to lanceolate 2.25-3.25 times as long as broad, often densely glandular pubescent; inflorescence lax 49. A. acerosa

3b. Sepals 2-4.5mm. long, glabrous :

4a. Sepals broadly ovate (1.25-2 times as long as broad), 3.5-4.5mm. long; petals 1.5-3 times as long as the sepals; plant suffruticose; cauline leaves frequently subtending axillary rosettes at flowering time; inflorescence lax

50. A. drypidea

4b. Sepals ovate to lanceolate (2-3 times as long as broad); petals usually 1-1.5 times as long as the sepals (rarely more, and then sepals < 3.5mm. or else lanceolate); plant forming spiny cushions, (occasionally suffrutescent and then sepals lanceolate); flowering stems without axillary rosettes :

5a. Inflorescence usually composed of clustered cymes appearing densely corymbose, rarely a rather lax cymose panicle; sepals 3.5-4.5mm. long, lanceolate (2.75-3 times as long as broad) 52. A. acutisepala

5b. Inflorescence a lax cymose panicle (or reduced to a single flower), never contracted; sepals 2.0-3.5(-4.0) mm. long, ovate (2-2.25 times as long as broad, rarely narrower, to 2.75 times, and then inflorescence very lax and spreading) 51. A. ledebouriana

2b. Cauline leaves absent or if present shorter than the rosette leaves and 0.1-0.2 times as long as the corresponding internode :

6a. Flowering stems 2.5-30.0cm. tall with 1-6 flowers; sepals broadly ovate 1.5-2 times as long as broad; petals suborbicular to broadly ovate, 1.25-1.75 times as long as broad

7a. Flowering stem leafless, arising from a basal rosette of leaves similar to the sterile rosettes; leaves terete or semi-circular in section, usually very pungent; plants

forming spiny cushions or tufts 52. A. persica

7b. Flowering stem with 1-3 pairs of small leaves and arising from a rosette of 1-4 pairs of green leaves much less prominent than the many-leaved sterile rosettes; leaves flattened, rather stiff and somewhat pungent; plants usually very densely pulvinate 54. A. insignis

6b. Flowering stems 1.5-2.5cm. tall with 1(-3) flowers; sepals ovate-lanceolate to lanceolate, 2.5-3 times as long as broad; petals cuneate, about twice as long as broad 56. A. davisii

49. A. acerosa Boiss., Diagn. Pl. Orient. ser.1 8 : 103 (1849).

Key to varieties

Pedicels and sepals densely glandular pubescent (i). var. acerosa

Pedicels and sepals glabrous (ii). var. glabra

(i). var. acerosa

Syntypes: TURKEY: Lycaonia: 1) "ad occ. planitiei Koniah inter hanc urbem et Beychehr sitis" ("Collines de tuffe tres arides et chaudes en descendant vers la plaine de Koniah a 5 lieue de cette ville (venant

par la chemin de Beychehr)") ("collis tophacei aridi planities Koniah"), Heldreich [843] - [9] Juin 1845." holo. G.! iso. BM!, E!, K!; 2) TURKEY: Lycia: "in m. Bereket Dagh Lyciae" (= Çalbali dağ), Pestalozza (1846), holo. G!; 3) TURKEY: Pisidia: "in reg. alp. montis Anemas, Heldreich [1252] [21 Aout 1845] " holo. G.!

Specimens seen:

TURKEY:-

Lycia:- Ak dagh (Ag Dagh), Aucher-Eloy 586, Bourgeau 4.7.1850. Tahtali dağ, 2000m., Davis 15066. Çalbali dağ, 2000-2100m., Davis 15290. Girdev dağ, 2200m., Davis 13778.

Pamphylia:- Gebiz: Bozburun dağ, N. side, 2100-2200m., Davis 15671, Bozburun dağ, Tasli yayla & Kozlu dere, Davis 15768.

Cilicia:- Durnass above Kundukbunar, 1600m., Siehe (1912) 469 (as "Alsine ledebouriana").

Phrygia:- Akscheher (Aksehir): Sultandagh above Tchai (Cay), 2000m., Bornmuller 4185.

Cappadocia:- Taurus nr. Ulukisla, Bornmüller 24.6.1927 (JE) (with A. ledebouriana).

Cataonia:- Malatya - Kjachta (Kahta): Gok Tepe, 1800-2000m., Handel-Mazzetti 2300 (WU).

S.W. Armenia:- Hasarbaba Dagh nr. lake Göldschik (Gölcuk), 2400-2430m., Handel-Mazzetti 2605 (WU).

(ii). var. glabra Boiss., Fl. Orient. 1 : 697 (1867).

Type: TURKEY: Cataonia: "in rupestribus montis Berytdagh alt. 7000' " (= 2134m.), Haussknecht [1177] [7.8.65]. holo. G!, iso. JE!

Specimens seen:-

TURKEY:-

S.W. Armenia:- Egin: Jaltibaschi, Sintenis 2329 (JE). Elazig: Kharput (Harput): Pekenik, Sintenis 538, W. of Harput, 1400m., Davis 29174.

Geographical distribution (of sp.): Endemic.

Biology: A rather spiny caespitose or spreading plant, often with long prostrate caudiculi. Found on stony slopes and screes between 1400 and 2430m. Flowers June - July.

Discussion: With its very large flowers, A. acerosa is the most readily distinguished member of the Series Sclerophyllae. Although less polymorphic than the other members of the series it shows considerable variation particularly in the size and form of the inflorescence. Plants with glabrous pedicels and sepals, instead of the usual dense glandular-pubescence, are only known from the eastern part of the range, where they appear to predominate. For this reason, Boissier's var. glabra has been maintained.

50. A. drypidea Boiss., Diagn. Fl. Orient. ser.1 1 : 49 (1842).

Type: TURKEY: Cataonia: "Cappadoc. ad Euphrat., Aucher-Eloy 587". holo. G, iso. K!

Specimens seen:-

TURKEY:-

Amanus:- "Amanus", Post 7.1891 (as A. ledebouriana) (BM), Haradjian 319 (as A. ledebouriana). m. Düldül, Haradjian 3806 (1500-2000m.), 2387 (1524-2134m.).

Cappadocia:- Ali (Ala) Dagh, 7 km. S.E. of Cesareé (Kayseri), Balansa 1057 (= 653 at G) (1400m.), (as A. ledebouriana), Zederbauer 13.7.1902 (1500-1800m.) (as A. ledebouriana) (WU). Argaeus (Erciyas dağ), 2000m., Siehe 267 (as A. ledebouriana). Masmeneu Dagh, "2 lieue" S. of Cesareé (Kayseri), Balansa 8.8.1855 (as A. ledebouriana).

Cataonia:- Eastern Taurus, Montbret (as "A. verticillata") (K). Akher Dagh (Ahir dağ) nr. Maraş, Haradjian 1515 (850m.), (Haussknecht) 18.7.(1865) (JE). Berytdagh, Haussknecht 1176 (10.8.1865) (1830-2740m.) (JE), 11.8.1865 (2740m.). Maraş: Goksun: Hobek dağ, 2000m., Davis 20180B, 20190. Malatja - Kjachta (Kahta): Ak Dagh, 1900-2400m., Handel-Mazzetti 2348 (WU). Nimrud Dagh nr. Kjachta: Mamuret-ul-Asis below Tchirik Jailasii, 1800-1900m., Handel-Mazzetti 2737 (WU).

Geographical distribution: Endemic.

Biology: A prickly suffruticose plant growing in stony places from

(850-) 1400-2750m. Flowers July - August.

Discussion: A. drypidea, as here circumscribed, includes many specimens previously referred to the highly polymorphic A. ledebouriana. It thus becomes a fairly homogeneous group of plants centred in the Anti-Taurus and characterised by the almost shrubby habit and the very broad sepals.

51. A. ledebouriana Fenzl, Illustr. Fl. Syr. Taur. 45 (1843), (reprint from Russegger, Reise 1 (2) : 931).

Key to varieties

1a. Flowering stems short, <4.0cm., with 1-2 internodes below the inflorescence; inflorescence 1-3(-5) flowered

(ii). var. pauciflora

1b. Flowering stems long, 4-25cm., with (2-)3-6 internodes below the inflorescence; inflorescence 5-50 flowered :

2a. Inflorescence many-flowered (15-50), very lax, pedicels > 5mm.; sepals ovate to ovate-lanceolate (2-2.75 times as long as broad), narrowly acute to long acuminate;

(iii). var. parviflora

2b. Inflorescence few to many-flowered (5-50), ultimate cymes

rather contracted with some pedicels < 5mm.; sepals ovate (2-2.5 times as long as broad), bluntly acute to abruptly acuminate (i). var. ledebouriana

(i). var. ledebouriana

Syn.: !"A. aculeata" Desv. in J. Bot. Desv. 5 (5) : 221 (1816), nomen nudum, non S. Wats. (1871).

!A. glutinosa Boiss. in Ann. Sci. Nat. ser.4 2 : 247 (1854), non M. Bieb. (1808).

!A. ledebouriana var. glutinosa (Boiss.) Boiss., Fl. Orient. 1 : 697 (1867) ("β").

!A. tchihatcheffii Vierh. in Penther & Zederbauer in Ann. Naturh. Hofmus. Wien 20 : 394 (1905).

Lectotype: TURKEY: Cilicia: "in rupibus alpis Maaden-tepessi circa fodina Tauri occidentalis" ("In monte Tauro") "Aestate 1836, Kotschy 61", holo. destroyed (W), lecto. K! iso. BM!, G!, S!

Specimens seen:-

No locality:- herb. Desvaux (as A. aculeata) (P).

TURKEY:-

Paphlagonia:- Kastambuli (Kastamonu): Tossia (Tosya), Kanrak Tschessne, Sintenis 4169, Tossia, Sintenis 5195 (JE).

Cilicia:- "Cilicia", leg. A. Prior (K). Cilicia trachea, Tchihatcheff 310 (type of A. glutinosa ≡ A. tchihatcheffii). Taurus

mts., Kotschy 59. Bulghar Dagh, 2440-2740m., Kotschy 216 (G), 30 74 130 216 & 358a (one sheet) (G)(K)(S)(WU). Taurus: Cilician gates, Balansa 605 (26.6.1855), (Balansa ?) 836 (26.6. -) (Gülek Boghaz) (G). Taurus: Durnas above Fundukbunar, 1700m., Siehe (1912) 503. Sara nr. Ermenek, (? Bourgeau) 325 bis (G).

Lycaonia:- Konia: nr. Fertek, 1300m., Siehe (1913) 540. W. of Bulgar Maaden, 2200m., Siehe (1912) 202.

Galatia:- Gerede - Ankara, nr. Kizilcahamam, 1200m., McNeill 283. Angora (Ankara), Wiedemann (G), Bornmüller 3013. Elma dagh nr. Ankara, 1800m., Kotte 97 (25.6.1932). Amasia (Amasya): Ak dagh, 1300m., Bornmüller 185 (13.7/8?.1889).

Cappadocia:- Niğde/Kayseri: Nevşehir-Ürgüp, 1200-1300m., Davis 19135. Nevşehir (= Niğde/Kayseri): Göreme, 10 km. W. of Ürgüp, 1000m., McNeill 402. Erciyas dağ: Ali dagh, Balls 1394 (Talas, 1585m.), Zederbauer 13.7.1902 (1500-1800m.) (WU). Kayseri: Bakir dağ above Kisge, 1400m., Davis 19290.

Cataonia:- Malatya: Gürün - Darende, 1525m., Davis 21859. Berytdagh, Haussknecht 1174 (11.8.1865) (G) (JE).

Mesopotamia:- ? "Mesopotamia", (Grisebach)(K).

? location:- nr. Kizildagh, Tchihatcheff (1854) (G).

(ii). var. pauciflora McNeill, var. nov.

Planta dense caespitosa vel pulvinata. Caules floriferi breves (1.5-4.0cm.); internodia sub inflorescentia 1-2; inflorescentia 1-3(-6)- flora. Sepala 2.5-4.0mm. longa, ovata, latitudine 1.75-2.25-plo longiora, late acuta vel abrupte acuminata.

Typus: TURKEY: Caria: "Mughla: Sandras dagh nr. Gökce ova. 1700m.? fl. white 23.7.1947, P.H. Davis 13517" holo. E! iso. K!

Specimens seen:

TURKEY:-

Caria:- Muğla: Sandras dağ, Gökce ova - summit, 2000m., Davis 13503, nr. Gökce, 1700m., Davis 13516B (K).

Cilicia:- Taurus Cilic., 1525-2740m., Kotschy 358a (K). Bulghar Maaden, 1400-2800m., Siehe (1895) 543 (as Alsine erythrosepala).

(iii). var. parviflora Boiss., Fl. Orient. 1 : 697 (1867) ("γ").

Syn.: ?A. trichotoma Boiss., Diagn. Fl. Orient. ser.2 5 : 60 (1856), non Royle (1874).

Type: TURKEY: ?Cataonia/Mesopotamia: "Cappadocia ad Euphratem", Aucher-Eloy 590 bis" holo. G!, iso. K!

Specimens seen:

TURKEY:-

Cataonia:- nr. Besnie (Besni), Montbret (1834). Malatya - Kjachta (Kâhta): above Karatschar towards Kumik, 1600-1700m., Handel-Mazzetti 2260 (as A. tchihatcheffii) (WU). Malatya: below Erhenek, Doğanşehir - Pazarçik, 900m., Davis 27732.

N.E. Armenia:- Musch (Muş): m. Bimgoell (Bingol dagh) nr. Gümgüm (Warto), 1830m., Kotschy 377.

Mesopotamia:- Diarbakir - Mardin, Kotschy 289. Diyarbakir: Maden-Ergani, 1000m., Davis 29075.

Geographical distribution (of sp.): Endemic.

Biology: Spiny caespitose or cushion-forming plants growing on stony ground between 900 & 2800m. Flowers June - July.

Discussion: A. ledebouriana is a highly polymorphic species and a satisfactory taxonomic treatment of its variation is very difficult to achieve. Boissier (1867) recognised three varieties, including the type, each of which he had originally described as a distinct species. Of these, var. glutinosa (≡ A. tchihatchewii Vierh.) does not seem to merit any taxonomic recognition whatsoever, because in the species every gradation is found from the entirely glabrous condition to a dense glandular pubescence on one or two internodes of the flowering stem. The type of Boissier's var. parviflora (≡ A. trichotoma Boiss.) matches well with the other plants of the species from South-eastern Turkey but the distinguishing characters of the taxon (laxity of inflorescence and long-pointed sepals) are difficult to define and

recognition has been given only at varietal rank. One geographically isolated gathering, Kotschy 377 from Muş, has been tentatively referred to this variety but it is not typical showing an approach to A. acutisepala var. laxa. Another isolated locality for the species is Sandras dağ in Caria; the plants from this mountain are very dwarf, resembling some gatherings from the Cilician Taurus. All these may merely represent phenotypic modifications to a high alpine habitat but the fact that this is the only form known in south-western Turkey, has encouraged the recognition of a new variety - var. pauciflora.

The remaining plants of the species, forming the type variety, still show a wide range of variation, particularly in pubescence, inflorescence form and flower size. The variety is distributed throughout Central Anatolia from extreme north to south; attempts to separate it into long and short sepalled groups have not been successful, but the extremes of the former do seem to be confined to the south in Cilicia, and possibly Cataonia. These plants appear to show an approach to A. acutisepala var. laxa. The lectotype of A. ledebouriana at Kew (Kotschy 61) and the type of A. glutinosa Boiss. (≡ A. tchihatcheffii Vierh.) have both distinctly short sepals. (cf. fig. 27)

52. A. acutisepala Haussknecht ex Williams in J. Linn. Soc. 33 : 395 (1898).

Key to varieties

Inflorescence composed of clustered cymes appearing densely corymbose; pedicels 2-3(-4)mm. long (i). var. acutisepala

Inflorescence a rather lax cymose panicle; pedicels 4-7mm. long (ii). var. laxa

(i). var. acutisepala

Syn.: !A. eginensis Hausskn. ex Bornm. in Fedde Repert. Beih. 89 : 253 (1940).

!"Alsine laricioides" Hausskn. ined.

Type: TURKEY: S.W. Armenia: "Armenia turcica: Egin : Salachlu in collibus nudis 25.6.1890, Sintenis 2764". holo. K! iso. BM!, JE!, WU!

Specimens seen:

TURKEY:-

No locality:- Aucher-Eloy 591 (K) (as "A. armenia") (paratype of A. polycnemifolia Boiss.). (Kotschy) (G) (as "A. ledebouriana var. β confertiflora Fenzl").

S.W. Armenia:- Egin : Euphrates (Firat) nr. Deluklutasch, Sintenis 958. Egin: Szanduk, Sintenis 2586 (JE)(WU) (type of A. eginensis). Egin: Kyl-Maghara dagh, Sintenis 2898 (as "Als. laricioides"), Tunceli: Munzur Dağ above Ovacik, Davis 31170 (1800m., 31309 (2300m.), Munzur Dağ, in Aksu Dere above Ovacik, 1700m., Davis 31477A (with A. acutisepala var. laxa). Erzincan: Erzincan - Refahiye,

1400m., Davis 32681. Erzincan: Erzincan-Kalkit, c.15 km. from Erzincan, Davis 31887 (1650m.), 31916 (2100m.). Erzincan: Kesiş dağ above Çimin, 1900-2100m., Davis 31714.

N.E. Armenia:- Gumuschkhane (Gümüşane): Kotschikale, Sintenis 6112 (as "Als. ledebouriana"). Gumuschkhane: Karagoelldagh, Monator, Sintenis 7299 (as "Als. ledebouriana"). Gumush Kane (Gümüşane), 1370m., Balls 1711.

(ii). var. laxa McNeill, var. nov.

A varietate typica, inflorescentia laxa paniculata non dense pseudocorymbulosa differt.

Pedicelli 4-7cm. longi.

Typus: TURKEY: S.W. Armenia: "Tunceli: Munzur Dag in Aksu Dere above Ovacik, 1700m. Rocky limestone slopes 21.7.1957, Davis & Hedge (D.31477)." holo. E!

(with A. acutisepala var. acutisepala = Davis 31477A)

Specimens seen:

TURKEY:-

?Cilicia: "Taurus", Kotschy "n.5 & 7" (K) (? with Kotschy 61, type of A. ledebouriana).

S.W. Armenia:- (Erzincan) : Kurutschai (Kuruçay), Hassanova, Sintenis 1012 (JE).

Geographical distribution (of sp.): Endemic.

Biology: A cushion-forming or tufted plant of dry stony slopes often with long prostrate caudiculi occasionally suffrutescent. Recorded from igneous and limestone rocks between 1375 and 2300m. Flowers June - July.

Discussion: A. acutisepala is effectively known only from the collections of Sintenis and Davis, both of whom have made extensive gatherings of the species. Haussknecht gave new specific names (unpublished) to three of Sintenis' specimens and identified the remainder with Arenaria ledebouriana (but labelling them "Alsine ledebouriana" in error). These gatherings are in fact all fairly uniform although one (Sintenis 2898 - "A. laricioides") is a more straggling plant than the others. Williams (1898) saw a duplicate of one of these specimens (Sintenis 2764 - "A. acutisepala") at Kew and gave a validating description. This gathering does not appear to have been seen by Bornmüller (1940), who although accepting only one species, validated A. eginensis, Haussknecht's third manuscript name.

Davis' collections show that this species is rather variable, much of the variation being in the direction of A. ledebouriana. Three specimens are known which in sepal structure are clearly referable to A. acutisepala, but which have a paniculate inflorescence. These may represent an intermediate condition between A. ledebouriana and A. acutisepala, but the two localised specimens being entirely within the range of the latter, they have for the moment been described as a variety (var. laxa) of that species. (cf. fig. 27)

53. A. persica Boiss., Diagn. Pl. Orient. ser.1 1 : 49 (1842).

Syn.: A. lessertiana Fenzl, Illustr. Pl. Syr. Taur. 46 (1843), (reprint from Russegger, Reise 1 (2) 932).

!A. lessertiana Fenzl var. minor Boiss., Fl. Orient. 1 : 698 (1867) ("β "), pro parte.

!Alsine pungens Stapf in Denkschr. Akad. Wiss., Wien 51 : 20 (1886).

!Minuartia pungens (Stapf) Parsa, Fl. Iran 1 : 1160 (1952).

Lectotype: IRAN: ?: "Dalmkou, Aucher-Eloy 4253" G!, K!

Specimens seen:

IRAN:-

Lorestan:- "m. Elwend": Choremabad, Strauss 2.8.1910* (JE). Bisitun, Strauss 24.6.1903* (JE).

Northern Zagros:- "m. Elwend": Gulpaigan, Strauss 24.6.1905*. "m. Elwend": Hamadan, Strauss 6.1902 (JE). "m. Elwend (media)", Pichler (1882) (type of Alsine pungens). Sultanabad: Kuh Girru, Strauss 490 (mid June 1902)* (JE), 7.1903 (Nehawend) (JE). Sultanabad: Shuturun Kuh, Strauss 310 (28.7.1902)* (JE), 8.1903* (JE), 8.9.1906 (JE). Sultanabad: Girdu - Nesmabad, Strauss 72 (2.6.1898)* (JE).

Southern Zagros:- Isfahan - Teheran, Bunge 5.1859*(G). m. Ssou nr. Ispahan (Esfahan), Buhse (1847) 1445*(G). Bakhtiari country, Herb. G. Watt 13050, 13068 (both leg. H.A. Sawyer). Zerdakou [... S.E. of Esfahan], Aucher-Eloy 608.

Fars:- Kuh Bul, Stapf 6.9.1885*. Kuh Daena (Kuhe Dena), Kotschy 597 (syn-type of var. minor), Behboudi 1310 (Gardaneh Sieani).

Kerman & Yazd:- Shir Kuh above Dehbala nr. Yazd, 3050-3660m., Davis 796*.

??? :- No locality, Buhse (1854) 1444*(G), Aucher-Eloy 600 bis* (paratype, also syntype of var. minor). Persia occidentalis: Kuh Sefid-Khane, Strauss 15.6.1906*(JE), 6.1903(JE). P. occ.: Raswend, Strauss 4.7.1909*(JE). Kuh Abbas Ali, Stapf 3.9.1885*. Schahu - Avroman, 2745-3050m., Haussknecht 211 (6.7.1867). mt. Schahu above Juanro, Haussknecht (1867) 214a(?). Persia austro-occidentalis: Kuh Nur, 3660-2960m., Haussknecht 7.1868. P.a-o.: Mt. Sawers Nur, Haussknecht 7.1868*.

Geographical distribution: Endemic.

Biology: Plant forming dense, usually very spiny cushions, arising from a stout caudex. Altitudinal range 2750-4000m. Flowers June - July.

Discussion: Although Boissier in "Flora Orientalis" adopted Fenzl's name, A. lessertiana, for this species, his own A. persica, which was cited as a synonym, appears to antedate it by one year. The only conceivable basis for Williams' (1898 p.401) statement to the contrary is that Fenzl dates the writing of his introduction as 1842; there is no evidence that the date of publication is not 1843 as given on the title-page, whereas the relevant part of Boissier's "Diagnoses" was

published in 1842.

The species has hitherto had a wider circumscription, including plants from the Elburs mountains now referred to A. insignis Litw. A. persica, as here defined, is restricted to the Zagros mountain chain in west and south-west Iran. In his original description, Boissier cited three Aucher-Eloy specimens, one of which (no. 4253A from Mt. Demawend) is referable to A. insignis. Likewise one of the three syntypes of A. lessertiana var. minor Boiss. (Kotschy 570) belongs to A. insignis, which is very easily recognised by the presence of small leaves on the flowering stem. The type of A. lessertiana Fenzl has not been seen but as it comes from "m. Elwend Persiae", it is almost certainly referable to this species and not to A. insignis.

The status of Boissier's var. minor is open to doubt. Dwarf plants with few flowers and less rigid leaves are very common, particularly in the northern part of the range of the species. These are to some extent replaced in the south by dwarf plants in which the leaves are short but as hard and rigid as in the typical form, which occurs throughout the range. The differences between these forms are thus such as can readily be attributed to environmental factors and for this reason no infra-specific classification is attempted. An asterisk is placed, however, at each specimen in the enumeration above which has the typical very spiny habit and many-flowered inflorescence.

54. A. insignis Litwinow in Trav. Mus. bot. Acad. St. Petersb. 3 : 106 (1907).

Syn.: A. lessertiana sec Boiss., Fl. Orient. 1 : 697-698 (1867) et auctt. aliis, pro parte, non Fenzl (1842).

!A. lessertiana var. minor Boiss., Fl. Orient. 1 : 698 (1867) ("β"), pro parte.

!A. lessertiana γ tenuifolia Bornm. in Bull. Herb. Boiss. ser.2 5 : 125 (1905).

Illustration:

Komarov, Fl. U.R.S.S. 6 : 533 t.30 f.7 (1936).

Type: U.S.S.R.: "Plantae Turcomaniae. Pr. Ashabad. In aridis ad cacum. m. Bosi-kjarnow ca. 6800 ft. 9.vii.1897, D. Litwinow 1092" holo. LE; iso. E!, WU!

Specimens seen:

IRAN:-

Caspian Sea:- Elburs: in valle Lar nr. Meidan, 2200m., Bornmüller 6423 (type of A. lessertiana var. tenuifolia). W. Elburs: M. Kendevan, 3000-3100m., Bornmüller 6420. Shahrud-Bustam: Khosh-Jaila, 70 km. E. of Shahrud, 2200m., Rechinger 5498.

Tehran:- M. Totschal, Kotschy 570 (syntype of A. lessertiana var. minor Boiss.), Bornmüller 6422. m. Demawend, Aucher-Eloy, 1524m., Trott 767.

?? :- North Persia, Kotschy 571 (S), no number (S). Karos nr. Garmab, 2400m., Trott 590.

Geographical distribution: U.S.S.R.: Turkmenia: Kopet dagh (Herb. Fl. Asiae Med. 463!), & m. Bosi-kjarnow nr. Ashabad (Litwinow 1092! type).

Biology: Plant forming very dense rather spiny cushions, with densely imbricate dead leaves persisting on the lower parts of the stout woody caudex and caudiculi. Recorded between (1500-)2200-3100m. Flowers June - July.

Discussion: The plants from the Elburs mountains belonging to the section Sclerophyllae have usually been identified as A. lessertiana Fenzl (= A. persica Boiss.) but in fact prove to be distinct from that species (cf. key), which in its restricted sense is confined to west and south-west Iran. Litwinow in 1907 described as a new species (A. insignis) a very densely pulvinate plant from near Ashabad in Turkmenia. This specimen is clearly an extreme form of the rather less densely cusion-forming plants of the Elburs mountains and as there is complete gradation in habit (though all are more densely pulvinate than A. persica) they are regarded as forming the one species, for which A. insignis is the only available name.

55. A. tetrasticha Boiss., Diagn. Pl. Orient. Ser.1 1 : 51 (1842).

Syntypes: 1) IRAN: ? : "inter Ispahan et Schiraz, Aucher-Eloy 4234" holo. G; iso. K! 2) IRAN: ? : "in monte Dalinkou

Persiae borealis, Aucher-Eloy 4262" holo. G; iso. K'

Geographical distribution: Endemic.

Biology: Dense tufted or possibly cushion-forming plant.

Discussion: A. tetrasticha, only known from Aucher-Eloy's original gatherings, is a very distinct species with a similar habit to the Turkish members of the section but with a floral structure more close to that of A. persica and A. insignis.

56. A. davisii McNeill, sp. nov.

Species valde distincta; caulibus floriferis brevis non foliatis inflorescentiis glanduloso-pubescentibus plerumque unifloris et pedicellis sublongis sepalis subacutis petalis cuneatis bene notatur. Ab A. tetrasticha affinis, sepalis longioribus et angustioribus foliis non scarioso-marginatis etiam differt.

Herba perennis caespitosa vel subpulvinata. Caudex crassus, 10-15mm. diam., caudiculos numerosos lignosos contortos abiens. Caudiculi 2-9cm. longi, 1-4mm. diam., foliis persistentibus mortuis canis superne obtecti, rosulas steriles et floriferas transientes. Rosulae folia 3-6-juga dense congesta instructae, saepe caulem floriferum brevem (1.5-2.5cm.) non foliatum glanduloso-pubescentem gerentes. Folia brevia (4-10mm.), subulato-setacea triquetra, apiculata; margines minute et

sparse hispiduli. Inflorescentia ex toto dense glanduloso-pubescentia, 1(-3)-flora; bracteae 2.5-3.5mm. longae, lanceolatae, anguste acuminatae, scarioso-marginatae; pedicelli 10-15mm. longi. Sepala purpurascentia, dense glandulosa, enervia (vena mediana indistincta et venis lateralibus 1-2-jugis indistinctissimis), 3-4mm. longa; sepalum extimum lanceolatum, subacutum, anguste membranaceo-marginatum; sepalum intimum late ovatum, obtusum, latissimo membranaceo-marginatum. Petala cuneata, 6-8mm. longa et 3-4mm. lata, apice truncato vel irregulariter crenato. Stamina 10, exteriora basi glandulis minutis praedita; filamenta 3.75-4.5mm. longa; antherae 0.7mm. longae. Ovarium ovoideum, 4mm. longum, 2mm. diam.; styli (2-)3(-5), 2.0-2.25mm. longi. Capsula longe ovoideum, 5-6mm. longum, 2.5mm. diam., calycem excedens, dentibus duplo stylorum numero dehiscens; ovula c. 15-30. Semina immatura.

Typus: TURKEY: Kurdistan: "Prov. Van. dist. Baskale : Ispiriz Dag, 3400m. Rock crevices. Fls. white. 31 July 1954, Davis & O. Polunin (D. 23694)". holo. E! iso. K!

Discussion: This very distinct new species appears to have some affinity with Boissier's little-known A. tetrasticha from the mountains of Iran. It differs very markedly in the reduction of the inflorescence almost invariably to a single flower, in its larger flowers, its cuneate petals, and in the absence of the scarious leaf margins which characterise A. tetrasticha. A. davisii carries even further the tendency seen in A. tetrasticha for the base of the sepals to show hardening only in fruit, and is in general facies an atypical member

of Subgenus Eremogone. (cf. fig. 28)

It gives me great pleasure to name this not unattractive dwarf rock plant after my supervisor Dr. P. H. Davis, who collected it in 1954 from a very high alpine locality in the south-eastern corner of Turkey.

Moehringia L.

Section Latifoliae Nyman ex Graebner

Leaves with scattered hairs and ciliate margins; sepals distinctly 3-nerved; petals present, 0.3-0.7 times as long as sepals; stamens 10; seeds smooth 1. M. trinervia

Leaves with ciliate petiole, otherwise glabrous; sepals 1-nerved; petals absent; stamens 5; seeds minutely papillose 2. M. pentandra

1. M. trinervia (L.) Clairv., Man. Herb. 150 (1811).

Syn.: Arenaria trinervia L., Sp. Pl. 423 (1753).

Alsine trinervia (L.) Crantz, Inst. 2 : 406 (1766).

Arenaria nervosa Lam., Fl. Franc. 3 : 36 (1778).

Alsinanthus trinervius Desv. in J. Bot. Desv. 3 (5) : 221 (1816) ("trinervis").

Alsinella trinervia S.F. Gray, Nat. Arr. Br. Pl. 2 : 655 (1821) ("trinervis").

Strophium trinervium Dulac, Fl. Hautes-Pyren. 248 (1867).

?M. thasia Stoyanoff & Kitanoff in Annu. Univ. Sofia Phys.-Math. 41 (3) (Sci. Nat.) : 293 (1945).

Illustrations:

Grossheim, Fl. Kavkaza (Fl. Caucas.) ed.2 3 : 229 t.22 f.1 (1945).

Reichenbach, Ic. Fl. Germ. 5 t.216 (1841).

Willkomm, Ic. Pl. Eur. aust.-occ. Hispan. 1 t.58 (1852).

Original citation:

"... Hort. cliff. 173, Fl. Suec. 374[ed] Roy lugdb. 471"

"Alsine plantaginis folio Bauh. hist. 3 p.364"

"Habitat in Europae sylvis glareosis ⊙"

(No specimen in Herb. Cliff.).

Specimens seen:

GREECE:-

Macedonia:- Armensko, 975m., Alston & Sandwith 617. Kozani: M. Pieria above Kataphygian, 1600-1900m., Rechinger 17905 (W). M. Pangaeon (Purnar Dagh), 1200m., Rechinger 10270 (W-R). Drama: Boz Dagh above Granitis (Guricik), 1000m., Rechinger 6363 (W-R).

Central Greece:- Euboia (Evvia): M. Xerowuni: Steni, 800m., Rechinger 2640 (W-R).

TURKEY:-

Pontus:- Çoruh (Artvin): Kardevan Dağ (Yalnizçam Dağlari) nr. Kutul Yayla, 2100m., Davis 30197. mts. above Artvin, 1800m., Davis 29780. near Rhize (Rize), Balansa (1866) 1424.

Thracia:- Constantinople (Istanbul), Aucher-Eloy 647 (as Stellaria media).

IRAN:-

Caspian Sea:- Lahijan: Guilan, Lindsay 950.

Geographical distribution: Throughout Central Europe, north to about 62°N. (absent from the Hebrides, Orkney and Shetland), rare in the

Mediterranean area but extending to Central Spain and Sicily. Extends across Northern Asia to Eastern Siberia.

Biology: An erect annual growing in forests in the Orient (recorded from Picea, Fagus and Castanea) between 800 and 2100m. Apparently a weed of tea plantations in northern Iran. Flowers (in Orient) June - July.

Chromosome number: n = 12, Rohweder (1939); 2n = 24, de Litardiere (1948), Blackburn & Morton (1957).

Discussion: M. trinervia is typically a Central European and North Asian mesophytic plant and only extends into the wetter parts of the Orient at the southern extremity of its range. Its distribution in the region largely Hyrcano-Colchic, being confined to Northern Greece and the coasts of the Black and Caspian Seas.

For discussion of M. thasia see under M. pentandra.

2. M. pentandra J. Gay in Ann. Sci. Nat. ser.2 26 : 230 (1832).

Syn.: Arenaria trinervia L. var. divaricata Salis. in Flora 17 Beibl. 2 : 71 (1834).

M. trinervia (L.) Clairv. β pentandra (Gay) Webb & Berth., Phyt. Canar. 1 : 150. (= Hist. Nat. Canar. 3 (2) Sect. 1 : 150) (1840).

Arenaria pentandra (Gay) Ardoino, Fl. Alp. Marit. 67 (1867), non Dufour (1820), nec Wallr. (1822), nec Turcz. (1834) nom. nud., nec Maxim. (1880).

M. trinervia (L.) Clairv. subsp. pentandra (Gay) Arcangeli. Fl. Ital. 102 (1882), ("β pentandra" cf. Intro. vi lines 27-29).

?M. thasia Stoyanoff & Kitanoff in Annu. Univ. Sofia Phys.-Math. 41 (3) (Sci. Nat.) : 293 (1945).

Illustration:

Willkomm, Ic. Fl. Eur. aust.-occ. Hispan. t.58 f.A (1852).

Syntypes: 1) "Gallia austr.: Fort-Sarral nr. Perpiniano", Petit; 2) "m. Tessone supra Vindomagnum", Cambessedes; 3) "de l'Est inter Forum Julii et Cannas", Pereymond; 4) "Corsica c. Bonifatium", Pougois; holo. P?

Specimen seen:

GREECE:-

Macedonia:- Thasos: Limenas, Sintenis & Bornmüller 375 (as M. trinervia).

Geographical distribution: Canary Islands and Western Mediterranean (S. France, Corsica, Spain, Balearic Is., Portugal, Morocco, Algeria, Italy, Sicily).

Biology: An erect annual more slender than M. trinervia, growing among bushes. Flowers May - June.

Chromosome number: 2n = 48, de Litardiere (1948), Blackburn & Morton (1957).

Discussion: M. pentandra is only known from one locality in the Orient (the island of Thasos), being primarily a plant of the Western Mediterranean where as a tetraploid species it largely displaces the closely related diploid M. trinervia. This situation, in which the diploid is much more widespread and northerly in its distribution than its tetraploid counterpart, is thus the reverse of the usual relationship.

The type of M. thasia, also from the island of Thasos, has not been seen; "M. pentandra Bornm. in Fedde Repert. xvi, 1919, p.183, non Gay" is cited as a synonym, but the Sintenis & Bornmüller specimen, which Bornmüller was discussing, does not agree with Stoyanoff and Kitanoff's description, but is typical of M. pentandra.

The diagnosis and type of M. thasia are as follows:-

"A Moehringia trinervia Clairv. recedit sepalis uninervis petalis reductis et staminibus paucioribus, a M. pentandra Gay foliorum marginibus tote longitudine ciliatis, sepalis inaequalibus seminibus levibus, nec punctulatis."

Syntypes: Thasos: "Planta florenda et fructifera legi 3 Junio 1942, in graminosis saxosis cacum. Isparion, ad cca 1100m. s.m.; 16 Julio 1943 in arenosis maritimis ad Makriamo prope urbem Limena holo. SO?

Minuartia L.

Subgenus Rhodalsine (J. Gay) Graebner

One species:

1. M. geniculata (Poir.) Thellung, Fl. Adv. Montpellier 232 (1912).

Syn.: Arenaria geniculata Poir., Voy. Barb. 2 : 166 (1789).

!Arenaria procumbens Vahl, Symb. Bot. 2 : 50 (1791).

!Alsine procumbens (Vahl) Fenzl, Versuch Verbreit. Vertheil. Alsin. 57 (1833).

!Rhodalsine procumbens (Vahl) J. Gay in Ann. Sci. Nat. ser.3 4 : 25 (1845).

Rhodalsine geniculata (Poir.) Williams in Bull. Herb. Boiss. 6 : 7 (1898).

Cherleria geniculata (Poir.) Sampaio, Lista Herb. Portug. 82 (1913).

(for fuller list of extra Orient synonyms cf. Williams, 1898a)

Illustrations:

Vahl, l.c. t.33 (1791).

Willkomm, Ic. Descr. Fl. Eur. austr.-occ. Hisp. t.67 f.A (1852).

Type: Algeria, Poiret holo. P?

Specimens seen:

GREECE:-

Central Greece:- Phaleron (nr. Piraeus), Heldreich 5.1848, Fl. Graec. Exs. 15.4.1855, Herb. Graec. Norm. 205 (26.4.1856). nr. Piraeus, Haussknecht 5.1885 (BM). Cape Sunion, Haussknecht (BM).

Peloponnese:- Aegina island, Heldreich Fl. Hellen. (leg. Heldreich & Holzmann) 18-26.4.1881, Salzmann 472.

CYPRUS:-

Kyrenia:- Kyrenia, Syngrassides 12, Atherton 13, 110, 1341.

LIBYA:-

Cyrenaica:- Derna, Taubert 213. Benghazi, Ruhmer 49.

EGYPT:-

Lower Egypt:- No locality, Bolland 38, Delisle (1803) (BM), Kotschy 660 (Aegypto inferiore) (as Ar. muralis). Mersa Matruh, Ball (1904), Hughes (pre 1906). Mariut: Burg el Arab, Davis 6434B (K). Abakir, Kralik 28.3.1847 (Aboukir), Gilbert 516 (Moascar Abakir) (BM). ?Taulah, Müschler 2.1906. nr. Alexandria, Ehrenberg 3.1824, Tomard 7.1824, Martius, Kralik 9.3.1847, Schweinfurth 5.1902 (BM). Müschler 395a (PRC). Marmarica: Ramleh, Gauba 126a (W). Marmarica: Aschebel Chaschm-el-Aisch, Gauba 126 (W).

Geographical distribution: Canary Islands, Portugal and throughout the West Mediterranean coasts, but absent from France, N. Italy and the Adriatic.

Biology: A perennial plant with a stout caudex, growing on coastal rocks and cliffs. Flowers March - May.

Discussion: The characters used by Williams (1898a) to discriminate between M. geniculata and M. procumbens were not found to be valid

even in some of his cited specimens. While local races may exist especially in the Western Mediterranean, the European, Orient and North African plants are clearly conspecific (cf. Jackson 1933). The plants from the Orient are fairly uniform, often having smaller more crowded leaves than some West Mediterranean plants.

Subgenus Spergella (Fenzl) McNeill

Sepals rounded at the apex, ovate-orbicular (1.25-1.75 times as long as broad), 2-2.5mm. long: pedicels often reflexed in fruit.

3. M. picta

Sepals acuminate, ovate (c. twice as long as broad), 3.25-4mm. long; pedicels erect or spreading in fruit 2. M. formosa

2. M. formosa (Fenzl) Mattf. in Bot. Jb. 57 Beibl. 126 : 33 (1921).

Key to varieties

Leaves, stems and pedicels sparsely glandular-pubescent

(i). var. formosa

Entire plant glabrous (ii). var. glabra

(i). var. formosa

Syn.: !Alsine formosa Fenzl in Flora 26 (1) : 403 (1843).

Type: TURKEY: Mesopotamia: "inter Severek et Diyarbakir, 1841" (? Karacali dağ), Kotschy 168. holo. W (destroyed), iso. K!

(ii). var. glabra Oppenheimer in Bull. Soc. bot. Geneve ser.2 22 : 294 (Reliquiae Aaronsohnianae p.169) (1931).

Illustrations:

Bouloumoy, Fl. Syrie Liban t. 56 f. 3 (1930).

Oppenheimer, l. c. p. 293 (1931).

Type: JORDAN: Gilead: Djisr er-Roûkkâd, Aaronsohn 9. 5. 1906 holo. G, iso. AAR.

Specimens seen:

SYRIA:-

Latakia:- Nusairy Mts., Husn Musyad, Post 9. 4. 1885 (BM).

Jebel Druz:- Soueida-Saleh, 1550m., Samuelsson 4175 (S). nr. Kafer, 1350m., Samuelsson 6185 (S).

? locality:- Tell Kalakh, 610m., Trench 4. 4. 1945 (as M. picta) (BM).

LEBANON:-

North Lebanon:- Tripoli - Homs : Akkari - Tell Kelah, 170m., Samuelsson 3323 (S).

South Lebanon/ISRAEL: Galilee:- Safed - Tyre, Hayne (1873).

JORDAN:-

Gilead:- Khushniyah, 820m., Meyers & Dinsmore G 411 (as Als. picta).

Other records: SYRIA: Latakia: "mont. reg. Chara ad fluv. Eleutherum" (Nahr-el-Kebir), Blanche (in Boissier, 1867); LEBANON: North Lebanon: Tripoli - Akkar, Post (in Post & Dinsmore, 1932).

Geographical distribution (of species): Endemic.

Biology: An annual plant of fields and stony places very similar in

habit to M. picta but usually more robust. Recorded between 170 & 1550m. Flowers April - May.

Discussion: M. formosa is rather unique among the non-alpine members of the genus in that it is very local in its distribution. Its few known localities stretch from the region of Karacali dağ near Diyarbakir in Turkey to the northern parts of Jordan and Israel; it is thus well within the range of M. picta which it closely resembles in habit, but from which it is very readily distinguished by its larger flowers and acuminate sepals.

The geographically rather more isolated type specimen from Turkey is sparsely glandular pubescent on the leaves, stems and pedicels, while all the Levant plants are entirely glabrous; the latter have been recognised as a separate variety - var. glabra.

3. M. picta (Sibth. & Sm.) Bornm. in Beih. bot. Zbl. 28 (2) : 148 (1911).

Syn.: !Arenaria picta Sibth. et Smith, Fl. Graec. Prodr. 1 : 304 (1806).

Ar. filiformis Labill, Ic. Fl. Syr. 4 : 8 (1812).

!"Alsinanthus fasciculatus" Desv. in J. Bot. Desv. 3 : 221 (1816), nomen.

Ar. cerignensis Sibth. ex Walpole, Memoirs "I 18" (1818) (cf. Holmboe, Stud. Veg. Cypr. 70, 1914).

Ar. pharnaceoides Ser. in D.C., Prodr. 1 : 408 (1824).

!Alsine picta (Sibth. & Sm.) Fenzl, Versuch Verbreit. Vertheil. Alsin. tab. ad p. 57 (1833).

Als. pharnaceoides (Ser.) Fenzl l.c. (1833).

!Ar. nudiuscula Bertol., Misc. Bot. 2 : 8 (1842).

Als. filiformis (Labill.) Fenzl ex Heynh., Nomencl. 2 : 27 (1846).

!Als. sinaica Boiss., Daign. Fl. Orient. ser.1 8 : 100 (1849).

!Als. picta var. sinaica (Boiss.) Boiss., Fl. Orient. 1 : 688 (1867). (" γ ").

!Als. picta var. brachypetala Boiss., Fl. Orient. 1 : 688 (1867) (" β ").

Als. picta var. albiflora Eig in Inst. Agric. Nat. Hist. Bull. 6 : 5 (1927).

Illustrations:

Bertoloni, Misc. Bot. 2 t.1 f.1 (1843) (as Ar. nudiuscula) (colour).

Bertoloni in Novi Comm. Acad. Sci. Bonon. 6 t.8 (1844) (as Ar. nudiuscula) (colour).

Bouloumoy, Fl. Liban Syrie t.56 f.4 (1930).

Labillardiere, Ic. Pl. Syr. 4 : t.3 f.2 (1812).

Sibthorp & Smith, Fl. Graeca 5 : t.440 (1825).

Type: CYPRUS: "In insulae Cypri campestribus", Sibthorp. holo. OXF. iso. BM!

Specimens seen:

TURKEY:-

No locality:- "Asia Minor", Grisebach.

Pamphylia:- nr. Adalia (Antalya), Heldreich 3.1845. East of Antalya, 40m., Tengwall 103.

Amanus:- ? Alexandretta (Iskenderun) - Aintab (Gaziantep), 915m., Haradjian 3965.

?Kurdistan:- "mountains of Kurdistan", Layard (93).

Mesopotamia:- Biredjik (Birecik) : Djebel Taken, Sintenis (1888) 141. Yonasprin on Euphrates, 25 km. E. of Gaziantep, 610m., Haradjian 1782. Urfa : Suruc - Urfa, 20 km. from Suruc turning, 600m., Davis 27990.

CYPRUS:-

Kyrenia:- nr. Kythraea, Sintenis & Rigo 232. Agios Ilarion Castle, Mavromoustakis 32. Nicosia Road, sea-level, Atherton 1130.

Famagusta:- Famagusta, 10m., Syngrassides 878. ?Mactares Forest, Mandres Kambiou, 365m., Probyn 10.

Nicosia:- Nicosia, Davis 2168. Syrianokhari - Ayia Irini, S. of Aloupos R., Davis 2604. nr. Philani, 760m., Reid 13.5.1908, Mavrovouni Tefka, 150m., Huddle 23. Kokkina Trimithia - Kafkalou, Syngrassides 317. Ayios Demetrianos, Kythres, 215m., Chapman 164. Malounda, 305m., Chapman 297.

Larnaka:- Skarinou, Davis 2680.

Limassol:- Kato Platres, 885-1005m., Kennedy 382A.

? ? :- Parahuru (?), Druce 92.

SYRIA:-

Aleppo:- Aleppo, Montbret (1834), ?Aucher-Eloy 663 ("Alep, Mesopot.,

Sinai"), Kotschy 17.3.1841, Russel (BM).

Deir ez Zor:- ? Bal Kuz, R. Euphrates, 400m., Haradjian 960 (W).

Hama:- nr. Hama, 500m., Haradjian 1894 (W).

Homs:- Qaryatein, Davis 5724, 5684 (Rat Tush). ?Jab. Darn, 970m., Dinsmore (Fl. Syr. Desertae) 18411.

Damascus:- Djebel el Khaihe, Laknaya (?) nr. Damascus, Gaillardot 1655 (?1699) (type of var. brachypetala).

ISRAEL:-

Galilee:- ? Tell Fara, Harding 222.

Central Israel:- Jerusalem, Meyers & Dinsmore 411 (800m.), Roth 3.1858 ("Hierosolyma"), Hooker & Hanbury 9-10.1860 ("Syria"), HUJ (Fl. Pal. Exs.) 118 (Mt. Scopus).

Negev:- Beersheba, Lowne (1863-4). Yutta Judean desert, Gabrieleth 76.

JORDAN:-

Cisjordania:- Jericho, Ghar-es-Safieh, Dead Sea, Hart 10.1883-2.1884. Mt. Olivet nr. Jerusalem (Hierosolyma), Ball 19.4.1877.

Moab:- Maris Mortui, Wadi Kefrein, 200m., Meyers & Dinsmore 4411, Wadi Hesban, 200m., Meyers & Dinsmore 1644, 411b. Medaba, 770m., Meyers & Dinsmore M1644. Dhiban - Wadi Themed, Davis 9174, 9626. Wadi Shu'eib (Shaghab), Post 27.4.1886. Mt. Nebo (Nibbeh) Fox 3.1872. Amman, 760m., Burton 31. Jebel Laghoh, Post 27.4.1886 (BM).

Edom:- Shobek Aneizi, Davis 9155. Wadi Ram, Davis 9011.

Eastern Desert:- East of Sohrab, 600m., Dinsmore 14411.
?Amman - Baghdad (?'Iraq), Durham 12.2.1926.

? ? :- Shajaret - Taiyar, Hunting Aero Survey 181 (leg. Poore).

'IRAQ:-

no locality:- "Mesopotamia", Rolland (93) (ex herb Ball).
"Euphrates", Chesney 126 (K) (BM) (type of nudiuscula).

Mosul:- Ain Ghazal, 365m., BAG 4075 (leg. Guest). Balad Singar - Tal Afar, 335m., BAG 4147, 4159 (both leg. Guest). Ain-al-Husan, nr. Sinjar, 320m., BAG 4219 (leg. Guest). Quaiydrah, 195m., Bayliss 34 (17.3.1939 & 20.3.1939). Jazira, S. of Sinjar nr. Balaj, 300m., BAG 13373 (leg. Guest). "Mosul & elsewhere", 215-305m., Law 31 (BM).

Erbil:- Erbil, BAG 626 (leg Guest).

Kirkuk & Sulaimaniya:- nr. Kerkuk (Kirkuk), 400m., Bornmüller 959. Sulaimani, Graham 717 (4.1920). Jarmo, Helbaek 335.

Western Desert:- Baghdad - Syrian Desert, Jackson H2401.

? ? :- Shaijot, leg. Rao 4.1920 (comm. Graham). Dohuk, 460m., BAG 1319 (leg. Guest). nr. Rutba Wells, Dickson XII (4.1933).

IRAN:-

no locality:- in Persia (?), Herb. Desvaux (P) ("type of "Alsinanthus fasciculatus", nomen nudum).

Lorestan:- 1 km. E. of Khuramurabad (Korramabad), 1250m., Cowan & Darlington 1016. "Loristan", Olguin 5.1852 (BM). Chah- Bazan, 500m., Koie 405 (W). Tang-e Malavi nr. Khorramabad, KAR 2207 (leg. Gauba & Sabeti) (W).

Tehran:- Tehran - Kom (Ghom), Aliabad, 1100m., Bornmüller 3331.

Southern Zagros:- nr. Ispahan, 1800m., Bornmüller 3332.

Fars:- Shiras, Koelz 14529. Shiraz - Firuzabad, 1600m., KAR 2208 (leg. Gauba & Sabeti).

Fars/Kerman & Yazd:- between Čah Čoghuk (Čafut) ridge and Tarum, 1400m., Rechinger 3205.

Persian Gulf:- Mian Kutal nr. Bushire (Bushehr), Hower 177.

? ? :- nr. Khaniqui, 60m., Cowan & Darlington 219, 232. Dalmkou, Aucher-Eloy 4260 (syntype of sinaica).

EGYPT:-

Lower Egypt:- N. Galala, Davis s.n. (Spring 1944). Tanlah, Muschler 2.1906. Wadi Ghisli south of Galala, 1000m., Schweinfurth 7-10.5.1887 (BM).

Sinai:- ?"Arabia petraea", McDonald (1849). "Sinai", Boissier 3.1846 (syntype of sinaica), Schimper 220 (syntype of sinaica). M. St. Catherine, Shabetai 16.6.1937, Meinertzhagen 3.1938 (monastery, 1490m.) (BM). Jebel Serbal, Post 6.3.1882. (BM).

Geographical distribution: Afghanistan, E. Pakistan (Baluchistan).

Biology: An annual plant of fields, steppe lands and desert; recorded between sea-level and 1800m. Flowers February - April (- May).

Discussion: M. picta is a widespread, rather variable annual plant chiefly of Irano-Turanian vegetation but occurring in Saharo-Sindian regions (unique in the genus) and extending into the Mediterranean region (Pamphylia, Cyprus, etc.). The variation is mainly in stature (var. sinaica Boiss.) and flower size (var. brachypetala Boiss.). The former seems to be largely environmental in origin, while a complete gradation exists in flower size and relative petal length. Although it is difficult to determine this from herbarium specimens, it seems that varying degrees of pigmentation are present in the petals from white to pink (e.g. Davis 2680 has "white fls. often pink on outside") - cf. var. albiflora Eig.

Subgenus Minuartia

Section Spectabiles (Fenzl) Hayek Subsection Spectabiles

Series Laricinae Mattf.

(Key to species translated from Grossheim, 1949).

1a. Sepals dark red; styles 5 (4-6); capsule 5-valved (rarely 4-6); petals 1.3 times as long as calyx; habit loosely caespitose 4. M. rhodocalyx

1b. Sepals green; styles 3; capsule 3 valved :

2a. Habit densely pulvinate; leaves small, 2-3mm. long, ovate-elliptical; flowers solitary; sepals ovate, 3-5mm. long 5. M. trautvetteriana (M. brotherana sec Grossheim)

2b. Not forming cushions, more or less caespitose plants :

3a. Petals equalling or scarcely exceeding the calyx; entire plant softly lanuginose 6. M. inamoena

3b. Petals 1.5 to 2.5 times as long as the calyx :

4a. Nerves of the leaves and sepals obscure; leaves obtuse, 3-7mm. long; stems woody at the base 7. M. brotherana (M. ruprechtiana sec Grossheim)

4b. Leaves with 1-3 nerves; sepals 3-nerved; stems not woody :

5a. Leaves shiny, with projecting nerves; capsule conical expanded at the base; petals 1.5 times as long as

calyx 8. M. colchica

5b. Leaves not shiny with a ± clear single nerve; capsule cylindrico-conical, with an unexpanded base; petals twice as long as calyx 9. M. imbricata

4. M. rhodocalyx (N. Albow) Woronow in Fomin & Woronow, Opredelitel' rast. Kavk. Krim. 2 : 180 (1914).

Syn.: (!)Alsine rhodocalyx Albow in Bull. Herb. Boiss. 2 : 255 (1894).

Type: U.S.S.R.: Georgia: "Prov. Maris Nigri: m. Fisht c. 2700m." N. Albow (1893) ? holo./iso. LE photo!

Records: West Caucasus and northern part of West Transcaucasia - Grossheim (1949).

Geographical distribution: Endemic.

Biology: On limestone in alpine zone. Flowers June - July.

Discussion: see end of section.

5. M. trautvetteriana Sosnowsky & Kharadze in Trav. Inst. bot. Tbilissi 2 : 210 (1938).

Syn.: !Arenaria brotherana Trautv., Increm. Fl. Ross. 1 : 127 (1882); in Acta Hort. Petrop. 8 : 151 (1883).

Alsine brotherana sec Akinfiew, Fl. tsentr. Kavk. 1 : 96 (1894), non (Trautv.) Boiss. (1888).

M. brotherana sec Grossheim, Fl. Kavk. ed.1 2 :394 (1930) p.p.; ed.2 3 : 214 (1945), non (Trautv.) Woronow (1914).

Type: U.S.S.R. (Caucasus): "Ad fontes fl. Rion, prope Gurschevi, alt. 10,000 ped.", A.H. & V.F. Brotherus holo. LE?, iso. K!

Specimens seen:

U.S.S.R.:-

? ? :- Imeretia: Mamisson, springs of R. Rion, 3050m., Brotherus 7.1877 (G).

Records: Central Caucasus, West Transcaucasia and the northern part of Central Transcaucasia - Grossheim (1949).

Geographical distribution: Endemic.

Biology: In rocky places in alpine zone. Flowers June - July.

Discussion: The correct name for this plant appears to be M. trautvetteriana proposed by Kharadze (1938) as a new name with the basionym Arenaria brotherana Trautv. M. brotherana (Trautv.) Woronow appears to be based on Stellaria brotherana (the original publication of the combination has not been seen), and so on the basis of his own taxonomic treatment, Grossheim's use of M. brotherana for the densely pulvinate M. trautvetteriana is incorrect.

6. M. inamoena (C.A. Meyer) Woronow in Fomin & Woronow, Opredelitel' rast. Kavk. Krim 2 : 180 (1914).

Syn.: Alsine inamoena C.A. Meyer, Verz. Pfl. Cauc. 218 (1831).

Als. macrocarpa forma inamoena (C.A. Mey.) Regel in Bull. Soc. Nat. Moscou 35 (1) : 241 (1862) ("ε").

Als. imbricata var. inamoena (C.A. Mey.) Boiss., Fl. Orient. 1 : 673 (1867). ("β").

Als. imbricata formae hirsuta Rupr. et inamoena (C.A. Mey.) Rupr., Fl. Cauc. 1 : 207 (1869).

M. inamoena var. hirsuta (Rupr.) Kharadze in Trav. Inst. bot. Tbilissi 2 : 205 (1938).

Type: U.S.S.R.: "in reg. alp. Cauc. occ.", C.A. Meyer, holo. LE (photo!), iso. G.

Specimens seen:

U.S.S.R.:-

Daghestan:- Djulti Tschai, 460m., Ruprecht 16.7.1860 (nr. Kufour, R. Samuri) (K), (confluence of Samuri) (JE).

Records: West Caucasus, East Caucasus, Daghestan, West Transcaucasia and Koshkar dagh in Karabakh. - Grossheim, 1949.

Geographical distribution: Endemic.

Biology: On gravelly slopes in alpine zone. Flowers June - July.

Discussion: see end of section.

7. M. brotherana (Trautv.) Woronow in Fomin & Woronow, Opredelitel' rast. Kavk. Krim 2 : 179 (1914), non sec Grossheim, Fl. Kavkaza ed. 1 2 : 394 (1930) p.p.: ed.2 3 : 214 (1945).

Syn.: Alsine imbricata forma obtusifolia Rupr., Fl. Cauc. 1 : 207 (1869).

Stellaria brotherana Trautv., Incr. Fl. Ross. 1 : 129 (1882); in Acta Hort. Petrop. 8 : 153 (1883).

Alsine Brotherana (Trautv.) Boiss., Fl. Orient. Suppl. 112 (1888).

M. imbricata var. obtusifolia (Rupr.) Grossheim, Fl. Kavkaza ed.1 2 : 394 (1930).

M. ruprechtiana Kharadze in Trav. Inst. bot. Tbilissi 2 : 210 (1938).

Type: U.S.S.R.: "Ossetia: alpe Kadlasan, ad fl. Didi Liachva, specimen solitarium legerunt A.H. et V.F. Brotherus" holo. LE? iso. G.

Records: Central Caucasus and northern part of Central Transcaucasia - Grossheim (1949).

Geographical distribution: Endemic.

Biology: In stony places in alpine zone. Flowers June - July.

Discussion: Because of the confusion in the application of the name M. brotherana (depending on whether it was thought to be based on Stellaria brotherana Trautv. or Arenaria brotherana Trautv.) Kharadze (1938) proposed a new name for this species as well as the one now accepted as M. trautvetteriana. It appears, however, that the original combination M. brotherana was based on Stellaria brotherana and so the name must be retained for this plant.

8. M. colchica Kharadze in Trav. Inst. bot. Tbilissi 2 : 206 (1938).

Syn.: Alsine imbricata forma ruprechtii Somm. et Lev., Enum. Fl. Cauc. in Acta Hort. Petrop. 16 : 80 (1900).

M. imbricata var. ruprechtii (Somm. & Lev.) Grossh., Fl. Kavk. 2 : 394 (1930).

M. colchica var. ruprechtii (Somm. & Lev.) Kharadze l.c. 207 (1938).

Type: Not designated: 36 specimens cited from West Caucasus & Transcaucasia.

Records: West Caucasus and West Transcaucasia - Grossheim (1949).

Geographical distribution: Endemic.

Biology: On rocky and stony slopes in alpine zone. Flowers June - July.

Discussion: see end of section.

9. M. imbricata (M.B.) Woronow in Fomin & Woronow, Opredelitel' rast. Kavk. Krim. 2 : 179 (1914); Mattf. in Fedde Rep. Beih. 15 : 196 (1922).

Syn.: Arenaria imbricata M. Bieb., Fl. Taur. Cauc. 1 : 344 (1808).

Alsine imbricata (M.B.) C.A. Meyer, Verz. Pfl. Cauc. 217 (1831).

Als. imbricata β denudata Fenzl in Ledeb., Fl. Ross. 1 : 353 (1842).

Als. macrocarpa forma imbricata (M.B.) Regel in Bull. Soc. Nat. Moscou 35 (1) : 239 (1862) ("γ").

Als. imbricata formae sylvatica Rupr., steveni Rupr., denudata (Fenzl) Rupr., glandulosa Rupr., alpina Rupr., Fl. Cauc. 1 : 206-207 (1869).

Als. ciliata Schmalh. in Ber. deutsch. bot. Ges. 10 : 287 (1892), pro parte, non (L.) Crantz (1766).

M. imbricata vars. alpina (Rupr.) Kharadze, sylvatica (Rupr.) Kharadze, denudata (Fenzl) Kharadze, glandulosa (Rupr.) Kharadze, svanica Kharadze in Trav. Inst. bot. Tbilissi 2 : 199-201 (1938).

Type: U.S.S.R.: Caucasus circa Kobi, M. Bieberstein (?). holo. LE (photo.!).

Specimens seen:

TURKEY:-

Pontus:- Rize: Ikizdere: Cermanin Tepe above Cimil, 3200m., Davis 21101. Lazistan: below Djimil (Cimil), 2500m., Balansa 8.1866. Çoruh (Artvin): Savval Tepe above Murgul, 2800m., Davis 32311.

N.E. Armenia:- Maden Dagh, Balls 439 (2.8.1933) (as Als. aizoides) (cf. also M. aizoides). Erzerum - Ispir, Huet du Pavillon 6.1853 (nr. Haho, 1830-1980m.) (K), (above Haho) (JE).

U.S.S.R.:-

No locality:- "Caucasus", Imp. Acad. Petrop. (1835), 31, 32, 58, (Cauc. orientalis), 65, (all K), Radde (K).

Kabardino & N. Osetia:- ? Balkharie: above L. Takhala-Stanat,

3000m., Wisniewski 76, nr. Shtulu, 2500m., Wisniewski 77.

Daghestan:- no locality, Becker 99.

Georgia:- ? Ossetia: Kasbek Terek, Brotherus 182. Kutais: Swanethia Soc. Čubechewi, Utwir ridge, reg. alp., Sosnowsky 1.8.19-- (WU). Abkhasia: Kliutsch valley below Kluchar ridge, Sommier & Levier 191 (WU). Kaischur & Lumiskele, Hohenacker 9.1842.

Armenia:- no locality, Szovits.

? ? ?:- Ascholis Mts., Radde 35 (28.6.1878). Azunta, Radde (WU).

Records: Throughout the Caucasus and Transcaucasia except the Shekinsko Highlands, East Transcaucasia, Karabakh, Talysch etc. - cf. Grossheim (1949).

Geographical distribution: Endemic.

Biology: A mat-forming plant on rocky and stony slopes; recorded between 1830 and 3200m. ("subalpine and alpine zones"). Flowers July - August ("June - July" - Grossheim).

Discussion: see Discussion of Series.

Series Laricinae - Discussion

The Orient representatives of Series Laricinae are a highly polymorphic group centred in the Caucasus. In addition to the fairly common and rather variable M. imbricata, there appear to be a number of

more restricted high mountain taxa, five of which Kharadze (1938) and Grossheim (1945)(1949) recognise at specific level.

Although some doubt must attach to the validity of all these species this treatment has had to be followed in the present account because of the inadequacy of the available material. The two taxa of which specimens have been seen (M. brotherana and M. inamoena) certainly seem distinctive and probably deserve specific rank.

Kharadze (1938) gives a descriptive key to the species she recognises in the group and a translation of this is appended:

1. Sepals dark red, broadly elliptical, rounded at the apex; pistil with 5 (rarely 4-6) styles; capsule 5 (rarely 4-6) valved, 1.5 times longer than the calyx; leaves subulate, long ciliate at the base; peduncles, calyx and bracts glandular-pubescent M. rhodocalyx

- Sepals green; capsule 3 or rarely 4 valved 2.

2. Plants forming dense cushions; stems numerous clothed from the base with densely imbricate leaves; leaves small (2-3mm. long), concave, obtuse, ciliate on margin; flower & fruit immersed in cushion; capsule conical, swollen at the base M. trautvetteriana

- Plants not forming dense cushions, ± densely caespitose 3.

3. Petals equal to the calyx or a little exceeding it; capsule equal to the sepals or scarcely longer than them; sepals concave at

apex, narrowly linear or linear-lanceolate, obtuse, 3-nerved; leaves narrow, linear-subulate; entire plant ± lanuginose

M. inamoena

- Petals longer than sepals (1.3-2.5 times); capsule exceeding calyx (1.3 to 2 times longer); sepals flat at apex; sepals & pedicels pubescent, leaves glabrous or ciliate 4.

4. Leaves and sepals inconspicuously nerved; leaves blunt at apex, linear-subulate or linear-oblong, thickish, convex below, flat above, glabrous or shortly hairy on margin; sepals blunt, ovate-oblong or spathulate; capsule ovoid, obtuse at apex, valves up to 1.5 times longer than calyx; stems woody in lower part

M. ruprechtiana (M. brotherana)

- Leaves 1-nerved or obscurely 3-nerved, linear-subulate or lanceolate, acutish, long-ciliate or glabrous on margin; sepals 3-nerved; stems not woody 5.

5. Leaves ± clearly 1-nerved, linear-subulate or linear, acutish, long-ciliate or glabrous on margin; sepals lanceolate, narrowed upwards, blunt, narrowly scarious; flowers tubular; capsule cylindrico-conical or oblong-ovoid constricted at the base about 1.5 times longer than the calyx; plants for the most part with erect (?) shoots and hardened stems and leaves M. imbricata

- Leaves shining with projecting nerves, lanceolate, long-lanceolate

or ovate-lanceolate, acute, shortly ciliate; sepals ovate or oblong-spathulate, very obtuse, broadly scarious; flowers infundibular; capsule conical wide at the base constricted towards the apex, 2-2.5 times longer than calyx; plants with creeping shoots M. colchica

Subsection Laricifoliae (Mattf.) McNeill

Series Caucasicae Mattf.

Leaves linear-subulate; leaf base 5-nerved, 1.0-1.5mm. broad, glabrous or long ciliate; sepals 2.5-3.0 (-4.0) mm. long; petals 5-6mm. long 10. M. aizoides

Leaves narrowly linear, 3-nerved and 0.5-1.0mm. broad at the base, margin scabrid particularly towards the base; sepals 4.25-5.25mm. long; petals 10-13mm. long 11. M. circassica

10. M. aizoides (Boiss.) Bornm. in Beih. bot. Zbl. 31 (2) : 193 (1914).

Syn.: !Alsine aizoides Boiss., Diagn. Pl. Orient. ser.1 1 : 47 (1842).

!Arenaria aizoides (Boiss.) Fernald in Rhodora 21 : 6 (1919) (= Contr. Gray Herb. Harv. 57 : 6).

Type: TURKEY: "in alpibus Armeniae", Aucher-Eloy 589. holo. G, iso. K!

Specimens seen:

TURKEY:

Pontus:- Rize: Ikizdere, Cermanin Tepe above Cimil, 3100m., Davis 21056. Çoruh! Ardanuç: Ziyaret Dağ (Yalnizçam Dağlari), Artvin-Ardahan, 2500m., Davis 30338. Baibourt - Trapezuntum (Trabzon), Webb (herb.) (1824). Trapezunt (Trabzon): Zigana dağ, nr. Zigana

Karduni, 1900m., Schischkin 5.7.1917 (BM). ?Pontus: Sumila, Karakaban, Sintenis 1577 (3.8.1889) (as Als. imbricata) (JE)(WU), Haussknecht 3.8.1889 (K).

Cappadocia:- Niğde: Hasan dağ above Taspinar Yayla, 2700-2600m., Davis 18969. Erciyas dag (Argaeus), Siehe 225 (3000m.), Balansa 1059 (2200m.), Bornmüller 1627 (2200m.), Zederbauer 25.5.1902 (above Hadsdyrlar ?, 2200m.) (WU).

N.E. Armenia:- "Armenia", Calvert & Zohrab 1230. Gümüşane: Karagoelldagh, Sintenis 7278 (Tschadirla - JE). Erzerum, Zohrab 133. M. Palauteutheu (?), nr. Erzerum, 1830-2135m., Huet du Pavillon 6.1853. Muş: Warto: Bimgoell dagh nr. Gümgüm, 2745m., Kotschy (1859) 528. Kars: Kisir Dağ, 3000m., Davis 30555.

Kurdistan:- Bitlis: Nemrut dağ, 2350m., Davis 23558; Suphan dağ, Davis 24643 (above Adilcevaz, 3200-3660m.), 24752 (3300m.) (with M. recurva subsp. oreina). Van : Şatak. Kavussahap Dağ, 3200m., Davis 23091.

? ? :- Kuzitashi Mesourach, 2500m., Balls 439 (2.7.1933) (as Als. aizoides) (cf. also M. imbricata).

U.S.S.R.:-

Georgia:- Adjaria: Batum - Akhalzikh, Khanli ridge above Danais-Paraul, Sommier & Levier 190 (WU). ?Carthalinia: L. Tabisijchuz, Brotherus 174 (6.1881) (BM). Kasbek: Terek, Brotherus 8.1881.

Armenia:- "Armenia", Szowits.

Geographical distribution: Endemic.

Biology: A ± prostrate turf-forming plant with erect flowering shoots. Recorded from (1830-) 2200-3200m. Flowers June - August.

Discussion: M. aizoides appears to occur more widely and commonly in the Caucasus than Mattfeld (1922) supposed (cf. Grossheim 1945).

11. M. circassica (Albow) Woronow in Fomin & Woronow, Opredelitel' rast. Kavkaza (Keys Pl. Cauc.) 2 : 181 (1914); Grossheim, Fl. Kavkaza ed.1 2 : 393 (1930).

Syn.: Arenaria laricifolia sec M. Bieb., Fl. Taur. Cauc. 1 : 347 (1808), non L. (1753).

Ar. stellarioides Willd. ex Schlecht. in Mag. Ges. Naturf. Fr. 7 : 209 (1816), pro parte (fide Mattfeld), non Pers. (1805).

Alsine laricifolia sec C.A. Mey., Verz. Pfl. Cauc. 218 (1831), non (L.) Crantz (1766).

Als. pinifolia auctt. mult. (Fenzl, Versuch Verbreit. Vertheil. Alsin. tab. ad p. 46 (1833); Boissier, Fl. Orient. 1 : 671 (1867)), non Ar. pinifolia M.B. (1808), nec Als. pinifolia (M.B.) Fenzl (1833) quoad basionom.

(!)Als. pinifolia β robusta Fenzl in Ledeb., Fl. Ross. 1 : 354 (1842).

Als. pinifolia γ gracilis Fenzl in Ledeb. l.c. (1842).

Als. pinifolia δ pumila Fenzl in Ledeb. l.c. (1842).

(!)"Ar. caucasica" Adams ex Fenzl in Ledeb. l.c. (1842), pro syn.

(!)Als. caucasica Adams ex Rupr., Fl. Cauc. 1 : 203 (1869) non Boiss. (1853).

Als. ciliata Schmalh. in Ber. deutsch. bot. Ges. 10 : 287 (1892), pro parte (fide Grossheim), non (L.) Crantz (1766).

Als. circassica Albow in Bull. Herb. Boiss. 2 : 449 (1894).

? Als. laricifolia var. pontica Albow in Trav. Jard. bot. Tiflis 1 Suppl: 34 (1895).

M. pinifolia Hand.-Mzt. in Ann. Naturh. Mus. Wien 23 : 153 (1909), quoad plant. cit., nec quoad basionom.

M. ciliata (Schmalh.) Woronow, in Fomin & Woronow, Opred. rast. Kavkaza 2 : 181 (1914), pro parte (fide Grossheim).

(!)M. caucasica (Adams ex Rupr.) Mattf. in Ascherson & Graebner, Syn. Mitt.-Eur. Fl. 5 (1) : 941 (1919) (basionom. illeg.).

M. caucasica var. circassica (Albow) Grossheim, Fl. Kavkaza ed. 2 3 : 211 (1945).

Type: U.S.S.R.: Caucasus: "Circassie: M. Ochten. 8000 ped." (2440m.), Alboff (1893) 298. holo. G?, iso. LE?, TGM?

Specimens seen:

TURKEY:-

Pontus:- Çoruh (Artvin): Savval tepe above Murgul, 2700m., Davis 32273, Djimil (Cimil), 2000m., Balansa (1866) 1426. Trabzon (Trapesuntum, Trebizond), Aucher-Eloy 588, Montbret (1834) (Webb herb. 2560). Trabzon: Zigana Dagh, 2040m., Balls 1685; Sigana Pass, 2300m., Frodin 19.7.1930 (W); N. side of Soğanli dagh above Çaykara, 2000-2200m., Davis 32136. Trapezuntum (Trabzon) - Baibout (Bayburt): nr. Tachtheupru (?),

Huet du Pavillon 8.1853. Sumila: Hanschuka, Sintenis 1583. Giresun: Balabondağlari above Tamdere, 2300m., Davis 20517. ? Hamsereiu, 2285m., Balls 497.

U.S.S.R.:-

No locality:- Steven (Alp. Cauc. orient.) (as Ar. imbricata).

Daghestan:- Kurusch, Becker 74.

Georgia:- Tiflis: Borcalo, Besobdal ridge, 1980m., Schelkovnikov 15.7.1920 (BM). °Balkharie: Lake Tauhala - Hanat, 3000m., Wisniewski 87.

Armenia:- "Armenia" Szovits.

? ? :- Dargar, Frier (1892). Digoriya, Chefanzar, 2300m., Busch 20.8.1927. Kudarskii, M. Morakh, 2400m., Busch 31.7.1928.

Geographical distribution: Endemic.

Biology: Similar in habit to M. aizoides but rather more tufted. Recorded from 1980-3800m. Flowers July - August.

Discussion: The nomenclature of this species has been extremely confused; no fewer than six different epithets have been applied to it and the one which must now be adopted was the last to be published (1894). The species was first of all misidentified as the Central European M. (Ar.) laricifolia, and then when its distinctiveness was noted was termed Ar. (Als.) pinifolia. According to Mattfeld (1922 p.184) the specimen on which this name is based is of the European M. capillacea and so cannot be adopted for the Caucasian and Pontic plant.

Unfortunately Mattfeld (1919, 1922), followed by all later authors (e.g. Grossheim, 1930, 1945 and Schischkin, 1936), chose to adopt the epithet caucasica for the species, a name published in synonymy in 1842 and not validated (in Alsine) until 1869 by which time it was antedated by Boissier's Als. caucasica (= M. montana subsp. wiesneri). There is an earlier name Ar. stellarioides Willd. ex Schlecht. but according to Mattfeld the type is a mixture of elements referable to this species and to M. biebersteinii (Section Acutiflorae), and in any case is a later homonym of Ar. stellarioides Pers. (≡ M. biflora). The next earliest name referable to the species is Alsine ciliata Schmalh. which according to Grossheim (1930, 1945) and Schischkin (1936) also in part represents M. imbricata; this name is, however, antedated by Als. ciliata (L.) Crantz (1766) (≡ Arenaria ciliata L.). The first available name is therefore Albow's Als. circassica, the combination in Minuartia having been made (according to Grossheim) by Woronow l.c. (1914).

Series Laricifoliae

1a. Leaves straight, rigid, semi-terete, with a large single nerve (not prominent); sepals 2.5-3.5mm. long; capsule longer than calyx:

2a. Petals rose-pink; inflorescence densely glandular-pubescent; sepals rather narrowly oblong, 2.5-3 times as long as broad; capsule slightly longer than calyx (c. 1.2 times); seeds rugulose, without papillae 14. M. labillardierei

2b. Petals white; entire plant glabrous (basal margins of the leaves minutely scabrid); sepals broadly oblong c. twice as long as broad; capsule much longer than calyx (almost twice as long); seeds with a prominent dorsal papillose crest 15. M. wettsteinii

1b. Leaves recurved, rather flaccid, ± flattened, rarely ± semi-terete and then fleshy and distinctly 3-nerved at the base; sepals 4-7.5mm. long; capsule usually (always?) shorter than the calyx; petals white, seeds rugulose without papillae :

3a. Petals about 1.5 times as long as sepals; sepals 4-5mm. long, very densely glandular pubescent obscuring the nerves, lateral nerves often becoming inconspicuous towards the apex; leaves often rather fleshy; densely caespitose or almost pulvinate plants with the sterile shoots usually short 12. M. garckeana

3b. Petals 1.7-2.0 times as long as sepals; sepals (4.5-)5.5-7.5mm. long rather densely glandular pubescent but 3 nerves always prominent throughout; leaves ± setaceous; plants caespitose

with long creeping sterile shoots 13. M. baldaccii

12. M. garckeana (Aschers. & Sint.) Mattf. in Bot. Jb. 57 Beibl. 126 : 33 (1921).

Syn.: Alsine garckeana Ascherson & Sint. in Boiss., Fl. Orient. Suppl. 112 (1888).

Als. skorpilii Velen. in S.B. bohm. Ges. Wiss. 5 : 31 (1890) ("Skorpili").

Als. bauhinorum sec Velen. in S.B. bohm. Ges. Wiss. 8 : 7 (1892), non Gay.

Als. serrulata Formanek, Verh. Naturf. Ver. Brunn 34 : 335 (1895).

Als. recurva var. ciliata Formanek l.c.

M. skorpilii (Velen.) Graebner in Aschers. & Graebn., Syn. Mitt.-Eur. Fl. 5 (1) : 764 (1918).

Type: TURKEY: Mysia: "M. Ida prope Kareikas, 4.VII. 1883", Sintenis 457. holo. B? (destroyed), iso. BM!, JE!, K!, WU!

Specimens seen:

GREECE:-

Epirus:- Joanina: M. Pindus, Katara ridge above Metsova, 1600-1800m., Rechinger 18342 (as M. baldaccii) (W).

Macedonia:- Kozani: M. Vourinan, E. slopes, 1200-1600m., Rechinger 17381 (as M. baldaccii) (W). S. Macedonia: Mikra, Rycroft 12.9.1918 (as Als. baldaccii) (BM).

Thrace:- M. Rhodope above Iasmos (Jasi-Köy), Rechinger 9521 (600m.), Tedd 1799 ("Yassikeuy", 1200m.). Kartol dagh, 915m., Tedd 1856.

Geographical distribution: Bulgaria and Yugoslav Macedonia.

Biology: Rather dense tufted or almost turf or cushion-forming plant; leaves often rather flaccid. Recorded between 600 and 1800m., on serpentine and mica schist (Tedd 1856). Flowers June - July.

13. M. baldaccii (Hal.) Mattf. in Aschers. & Graebn., Syn. Mitt.-Eur. Fl. 5 (1) : 940 (1919).

Key to subspecies

1a. Sepals 4.5-5.0mm. long; flowers solitary or in pairs; low growing, rather densely caespitose plants, 4-10cm. tall; leaves short 4-10mm., semi-terete, rather fleshy, sometimes falcate; turions short, with leaves rather dense; petals obovate, 2-2.5 times as long as broad

(Albania) (C. subsp. dorfleri)

1b. Sepals 5.0-7.5mm. long; inflorescence (1-)2-10-flowered; plant forming a loose mat with erect stems, 7-20cm. tall :

2a. Petals obovate, 2-2.5 times as long as broad; leaves rather rigid, setaceous (4-15mm. long), densely clustered on the ±

erect turions; sepals 5.0-6.0mm. long (N. Albania)

(B. subsp. skutariensis)

2b. Petals oblanceolate, 3-4 times as long as broad; leaves flat flaccid, (5-)10-20mm. long; turions long, creeping with spreading to falcate leaves loosely arranged; sepals 5.5-7.5mm. long A. subsp. baldaccii

A. subsp. baldaccii

Syn.: Alsine liniflora sec Baldacci in Nuovo G. bot. ital. ser.2 6 : 34 (1899), non L.

Als. baldaccii Halacsy, Consp. Fl. Graec. 1 : 237 (1901).

Type: GREECE: Epirus: "in reg. Abiet. m. Smolika supra Paleoseli, distr. Konitza, 19.7.1896, Baldacci Iter Albanicum Quartum 223." holo. W-H! iso. K!, WU!

Specimens seen:

GREECE:-

Epirus:- M. Smolika, Guiseppi 53 (1960m.), Balls 3524 (Djou - Samarina, 1830m.), Atchley 977 (1675m.), Guiol 1927 (above Samarina) (BM).

Geographical distribution: Albania.

(B. subsp. skutariensis Hayek, Prodr. Fl. Balc. 1 : 193 (1924) (= Fedde Rep. Beih. 30 (1)).

Syn.: !Als. liniflora var. glandulosissima Hayek in Denkschr. Akad. Wiss. Wien 94 : 135 (1918).

Type: Albania: "Nord-Albanien: Umgebung van Shkodra. Auf dem Grossen Bardanjolt, Serpentin, 12 Juni 1916", Erwin Janchen. holo. WU!

Geographical distribution: Only known from type gathering.)

(C. subsp. dorfleri (Hay.) Hayek, Prodr. Fl. Balc. 1 : 193 (1924) (= Fedde Rep. Beih. 30 (1)).

Syn.: M. dorfleri Hayek in Öst. bot. Z. 70 : 12 (1921).

Type: Albania: "Nord-Albanien: Distrikt Luma. Hauptgipfel des Koritnik, auf felsigen Boden, 2383m., 6.VIII.1918", Dorfler 961 holo. WU!

Geographical distribution: Endemic to Albania.)

Biology (of species): Habit - cf. key to subspecies. Recorded from (300m. : subsp. baldaccii, Albania : -) 1675m.-1980m. (-2380m., subsp. dorfleri). Flowers July - August.

Discussion: The type subspecies appears to be the commonest form of the species and the only one which occurs within the area. Subsp.

dorfleri, a dwarf densely tufted high alpine plant, and the M. capillacea like subsp. skutariensis have only been seen from their type gatherings; other Albanian specimens labelled as subsp. dorfleri are in fact typical subsp. baldaccii.

14. M. labillardierei Briquet in Ann. Conserv. Jard. bot. Geneve 13/14 : 385 (1911).

Syn.: !Arenaria rupestris Labill., Ic. Pl. Syr. 4 : 8 (1812), non Stellaria rupestris Scopoli (1772), nec M. rupestris (Scop.) Schinz & Thell. (1907).

!Alsine rupestris (Labill.) Fenzl, Versuch Verbreit. Vertheil. Alsin. tab. ad p. 57 (1833), non Druce (1907), nec Muschler (1911).

Illustrations:

Bouloumoy, Fl. Liban Syrie t.56 f.3 (1930).

Labillardiere, Ic. Pl. Syr. 4 : t.4 f.1 (1812).

Type: LEBANON: North Lebanon: "in Libano", Labillardiere. holo. FI?, iso. K!

Specimens seen:

LEBANON:-

North Lebanon:- "Syria", Hooker & Hanbury 1.10.1860. "Lebanon", Aucher-Eloy 582. above Cedars, Boissier 7.1846, Post 734 (BM), Kotschy 350 (Bscherre, 1830m.). Hasroun, Blanche (Summer 1866).

Djebel Makmel, Dahr el Kodib, Blanche 7.9.1869 (JE), Bornmüller 11462a (2600-3000m.) (JE). Yamouny a Dimum (?), Blanche 18.9.1864 (JE).

Geographical distribution: Endemic.

Biology: A densely caespitose to pulvinate plant of mountain slopes. Flowers July - September.

Discussion: M. labillardierei is placed by Mattfeld in a monotypic series but differs essentially from Series Laricifoliae only in flower colour. Although white flowers are not recorded in M. labillardierei, they are known in the typically pink-flowered M. picta, and the character seems scarcely important enough to warrant the separation from the closely related M. wettsteinii.

15. M. wettsteinii Dörfler ex Mattf. in Bot. Jb. 57 Beibl. 127 : 62 (1922), (in Bot. Jb. 57 Beibl. 126 : 33 (1921), nomen).

Type: GREECE: Crete: "Hierapetra: In Felsritzen in der Gipfelregion des Aphendi Kavusi; ca. 1400m. 2.8.1904, Dörfler Iter Creticum 1048". holo. B? (destroyed), iso. WU!

Specimens seen:

GREECE:-

Crete:- M. Aphendi Kavutsi, 1220m., Ripley & Barneby 1960. Lassithi, 1250m., Lemperg 1150.

Geographical distribution: Endemic.

Biology: An almost spiny, rather densely caespitose plant of stony places on the Cretan mountains; only recorded substratum - calcareous. Flowers August.

Section Plurinerviae McNeill

1a. Petals narrowly lanceolate, truncate to subcordate (and then very shortly clawed) at the base; sepals with a broad hyaline margin; bracts c. 5-nerved with a broad hyaline margin; entire plant glabrous or very sparsely pubescent 17. M. eurytanica

1b. Petals oblong-ovate, cuneate or long-clawed at the base; plants usually glandular-hairy, at least on pedicels (and there densely so) (very rarely glabrous) :

2a. Bracts 3-5 nerved (ultimate always 3); inner sepals with only 3 prominent nerves, outer rarely with more than 5; plants densely caespitose or pulvinate 19. M. recurva

2b. Bracts 5-7 nerved (ultimate usually at least 5, rarely only 3 nerves prominent but then lower bracts with 7 or more prominent nerves running throughout); inner sepals rarely with less than 5 nerves, outer always more :

3a. Bracts with a broad hyaline margin; sepals usually 3-4 or 5-6mm. long; plants frequently densely caespitose 18. M. juressi

3b. Bracts without a hyaline margin or with a very narrow one; sepals often 4-5mm. long; plants always loosely caespitose 16. M. hirsuta

16. M. hirsuta (M.B.) Hand.-Mzt. in Ann. Naturh. Hofmus. Wien 23 : 152 (1909).

Key to subspecies

1a. Leaf fascicles long erect, leaves straight, very fine, crowded together; sepals with a broad white margin, the outer nerves inconspicuous (Hungary, Romania) (C. subsp. frutescens)

1b. Leaf fascicles short often curved, leaves often falcate, rather thick; sepals with 5-7 prominent nerves running throughout.

2a. Plants densely glandular hirsute throughout; seeds echinate on the dorsal ridge (Crimea) (B. subsp. hirsuta)

2b. Plants glandular-pubescent in the inflorescence, otherwise glabrous or sparsely hairy; seeds obscurely tuberculate throughout. A. subsp. falcata

A. subsp. falcata (Griseb.) Mattf. in Bot. Jb. 57 Beibl. 126 : 30 (1921).

Syn.: Alsine hirsuta α Fenzl in Ledeb., Fl. Ross. 1 : 347 (1842).

!Alsine falcata Griseb., Spicil. Fl. Rumel. Byth. 1 : 200 (1843).

!Alsine recurva var. nivalis Boiss., Fl. Orient. 1 : 674 (1867), pro parte ("α ").

!Als. hirsuta var. falcata (Griseb.) Aschers. & Kanitz, Cat. Corm. Serb. 83 (1877).

!Als. frutescens β falcata (Griseb.) Beck in Glasn. zem. Mus. Bosn. Herc. 18 : 490 (1906).

!M. falcata (Griseb.) Tuzson in Ung. bot. Bl. (Mag. bot. Lap.)

8 : 357 (1909).

M. hirsuta subsp. vestita sec Hand.-Mzt. in Ann. Naturh. Hofmus. Wien 23 : 152 (1909), pro parte excl. vestita Fenzl.

M. hirsuta subsp. frutescens sec Hand.-Mzt. l.c., pro parte excl. frutescens Kit.

M. hirsuta subsp. vestita II denudata sec Graebn. in Aschers. & Graebn., Syn. Mitt.-Eur. Fl. 5 (1) : 731 (1918), non denudata Fenzl.

!M. hirsuta subsp. frutescens II falcata (Griseb.) Graebn. l.c. 732 (1918).

M. hirsuta subsp. falcata var. denudata sec Mattf. in Fedde Rep. Beih. 15 : 117 (1922), non denudata Fenzl.

Lectotype: TURKEY: Bithynia: Olympus (Ulu dağ), Aucher-Eloy 595 holo. W (destroyed), iso. G!, K!

Specimens seen:

GREECE:-

Epirus:- Zagorion: M. Gamila (Vrideton), Baldacci (1896) 162 (PRC). Konitza: M. Smolika above Karasova, 2574m., Baldacci (1896) 225 (PRC) (densely caespitose).

Macedonia:- N.W. Macedonia: Pisoderion, 1340m., Alston & Sandwith 536. Lailia nr. Serres 1370m., Tedd 1594. Salonika, Dimonie 4.1908 (PRC), 5.1908 (PRC), 38 (4.1909) (PRC), Tosci (PRC).

Thrace:- Kula Dagh, 1525m., Tedd 1155. W. Thrace: M. Karlikdagh nr. Komotini (Gümüldschina), 400m., Rechinger 10442b. ?"Turquii

d'Europe", Thirke (1845) (G).

TURKEY:-

Paphlagonia:- Kastamonu: Tossia, Tchech-dere, Sintenis 3669, Tossia, Karkun, Elmalu dagh, Sintenis 3941. Kastamonu - Kure, 1220m., Davis 21701. ? Kara-dagh ("Pontus"), 800m., Bornmüller (1889) 41b. Ilkas dagh (M. Olgassys) above Karakol on summit between Çankiri and Kastamonu, 2000-2150m., Bornmüller 13904.

Bithynia:- Ulu dağ (Keşiş dağ; Keschisch dagh; Olympus), Herb. J.S. Mill (6.1862) (K), Pichler 178, 192 (G), Bornmüller 4201 (1000-1200m.), Clementi 8.1850 (G), Wiedemann (G), Boissier (G), Moore 7307 (below hotel, 1600-1800m.). "Colles Bithyniae", Pestalozza (1846) (G).

Phrygia:- Eskişehir: Vustahlia, Kotte 1047.

Galatia:- Ankara, Elma dagh, 1700m., Kotte 96. Ankara - Tahis dağı, Eski yayla, 1500m., Bilger 222. Gerede - Ankara, nr. Kizilca-hamam, 1200m., McNeill 282. Amasya, Akdagh, 1600-2000m., Bornmüller (1889) 41, Amasya, Manissadjian 432.

Cappadocia:- Sivas: Çamlibel dağ (Tschamli bel), 1700m., Bornmüller 2043 (PRC). Niğde - Bereketli: Kapu dagh, 1800m., Siehe 377 (? approaches M. recurva subsp. oreina).

N.E. Armenia:- nr. Baibourt, Bourgeau 61 (10.7.1862). "Armenia", Calvert & Zohrab, Calvert 113 (G) (leg. Tchihatcheff), Tchihatcheff 340 (G). Gümüşane, Argyri dagh, Sintenis 5937. Erzerum: Ilica - Tercan, 1900m., Davis 30890.

Geographical distribution: Bulgaria, ? Yugoslavia, ? Albania.

Biology: Loosely caespitose plants with ± prostrate caudiculi, growing in stony places on mountains from 400 to 2150m. Flowers June - July.

(B. subsp. hirsuta

Syn.: Arenaria hirsuta M. Bieb., Fl. Taur.-Cauc. 1 : 349 (1808).

Alsine hirsuta (M.B.) Fenzl, Versuch Verbreit. Vertheil. Alsin. tab. ad p.46 (1833).

Alsine hirsuta vestita Fenzl in Ledeb., Fl. Ross. 1 : 347 (1842).

Alsine recurva var. hirsuta (M.B.) Boiss., Fl. Orient. 1 : 675 (1867) (" "), pro parte minore sed basionom. incl.

M. hirsuta subsp. vestita (Fenzl) Hand.-Mzt. in Ann. naturh. Hofmus. Wien 23 : 152 (1909), pro parte.

Alsine recurva subsp. hirsuta (M.B.) Tuzson in Bot. Koslem 8 : 263 (1910).

M. hirsuta subsp. falcata var. vestita (Fenzl) Mattf. in Bot. Jb. 57 Beibl. 126 : 30 (1921); in Fedde Rep. Beih. 15 : 119 (1922).

Type: U.S.S.R.: Crimea: "in Tauriae, summo M. Tschatur dağ", M. Bieberstein. holo. LE?

Geographical distribution: Endemic to Crimea (records from Balkans erroneous, cf. Mattfeld, 1922).).

(C. subsp. frutescens (Kit.) Hand.-Mzt. in Ann. naturh. Hofmus. Wien. 23 : 152 (1909), pro parte.

Syn.: Arenaria frutescens Kit. in Schultes, Öst. Fl. ed.2. 1 : 664 (1814).

Alsine frutescens (Kit.) Kern. in Öst. bot. Z. 18 : 182 (1868).

Sabulina frutescens (Kit.) Schur in Verh. naturf. Ver. Brunn 15 : 2 (1876).

M. frutescens (Kit.) Tuzson in Ung. bot. Bl. (Mag. bot. Lap.) 8 : 356 (1909).

Alsine recurva subsp. frutescens (Kit.) Tuzson in Bot. Kozlem 8 263 (1910).

Type: Hungary: "auf Felsen Ungarn", Kitaibel. holo. W (destroyed)?

Geographical distribution: Hungary, Romania.)

Discussion (of species): The first satisfactory classification of Section Plurinerviae (Tryphane sec Mattf.) is that proposed by Handel-Mazzetti in 1909; this provided the basis for Mattfeld's treatment and is also followed in the present account. The species is here confined to those plants with many-nerved bracts and sepals without a hyaline margin (cf. key) thus returning to Handel-Mazzetti's circumscription and excluding Mattfeld's subsp. oreina which is referred to M. recurva.

Mattfeld's delimitation of subspp. frutescens and falcata is followed in preference to that of Handel-Mazzetti but his two varieties of subsp. falcata have been raised to subspecific rank. M. hirsuta, as here defined, comprises, therefore, three geographical subspecies - subsp. hirsuta (= subsp. falcata var. vestita) in the Crimea, subsp.

frutescens in Hungary and Romania and subsp. falcata (subsp. falcata var. denudata) in Bulgaria, Northern Greece and Northern Turkey, east to Erzerum. The plants from Western Turkey (Mysia - Lycia) which Mattfeld identified as M. hirsuta subsp. falcata var. denudata, are referable to M. juressi subsp. asiatica, as are most of the plants included by Boissier in his var. hirsuta (under Alsine recurva). (cf. fig. 29).

17. M. eurytanica (Boiss. & Heldr.) Hand.-Mzt. in Ann. naturh. Hofmus. Wien 23 : 153 (1909).

Syn.: !Alsine eurytanica Boiss. et Heldr. in Boiss., Diagn. Fl. Orient. ser.2 6 : 35 (1859).

!"Alsine tempskyana" Hausskn. et Sint. ined.

Type: GREECE: Central Greece: "alp. Megarheuma m. Veluchi Eurytaniae (Aetoliae)" ("In m. Veluchi Eurytaniae pascuis alpinis (Megarheuma), alt. 5000' [1525m.] d. 5 Aug. 1857"), De Heldreich Herbarium Graecum normale 607, leg. Samaritani et Guicciardi, holo. G, iso. K!, PRC!

Specimens seen:

GREECE:-

Thessaly:- Kalampaka (Kalabaka), nr. Saraskina, Sintenis (1896) 250 (as Als. tempskyana)(PRC). Pindus Tymphaeus: Dokimi, Sintenis (1896) 944 (as Als. recurva).

Central Greece:- Aetolia: Vardhousia Ori (Korax), Dörfler Fl.

Graeca 273 (leg. Leonis), Atchley 2161 (2135m.). M. Oeta (Katavothra), Phthiotidis, 1675m.-1920m., Heldreich 12.7.1879 (G).

Geographical distribution: Endemic.

Biology: A loosely caespitose plant with ± prostrate caudiculi, growing among rocks and recorded at 1525 and 2135m. Flowers June - August.

Discussion: Intermediate forms between typical M. eurytanica and M. hirsuta subsp. falcata appear to occur in Thessaly and Epirus (Northern Pindus) (cf. Mattfeld, 1922). These include plants identified under the manuscript name "Als. tempskyana" and although sparsely hairy seem best included under M. eurytanica. (cf. fig. 29)

18. M. juressi (Willd. ex Schlecht.) Lacaita in Cavanillesia 3 : 32 (1930).

Key to subspecies and varieties

1a. Sepals 4.5-6mm. long; plants loosely caespitose, few (4-8) flowered, occasionally densely caespitoes 1(-few) flowered; leaves flat or setaceous with a broad base, not at all fleshy

A. subsp. asiatica

2a. Plants with rather tall (5-20cm.), ± erect, few (4-8) flowered inflorescences arising from ± prostrate caudiculi;

A. (i). var. asiatica

2b. Plants densely caespitose; inflorescence 1(-few) flowered, scarcely arising above leaf fascicles;

A. (ii). var. caespitosa

1b. Sepals 3-4mm. long; plants ± densely caespitose or sometimes pulvinate; inflorescence 1-4 flowered; leaves rather thick or fleshy, triangular or sometimes terete in section

B. subsp. juressi

A. subsp. asiatica McNeill subsp. nov. (i). var. asiatica

Syn.: Alsine recurva var. hirsuta sec Boiss., Fl. Orient. 1 : pro parte maiore, non (M. Bieb.)

A subsp. juressi habitu laxe caespitoso sepalis longioribus foliis plerumque setaceis nunquam crassis divergit; a M. hirsuta subsp. falcata cui approximat bracteis late hyalino-marginatis sepalis longioribus differt.

Planta laxe caespitosa ex toto sparse (vel ex parte dense) glanduloso-pubescens turionibus foliatis et caulibus floriferis altis (5-20cm.) ex caudiculis ± prostratis emergentibus praedita. Folia 6-10mm. longa, ad basim lata (0.8-1.8mm.) sed sursum ± abrupte contractata et plerumque setacea 0.2-0.3mm. lata. Inflorescentia pauciflora (c. 4-8) saepe subcongesta, ± dense glanduloso-pubescenti; bracteae ovatae 5-7 nerviae late hyalino-marginatae. Sepala 5-6mm. longa, lanceolata, 5-7(-9) nervia. Petala oblongo-ovata, cuneata, calyce paulo longiora.

Typus: TURKEY: Lydia: "Sinus Smyrnaeus, in cacumine montis Yamanlar-dagh, 900m., 22.V.1906", J. Bornmüller 9174. holo. E! iso. BM!, K!

Specimens seen:

TURKEY:-

Mysia:- Kaz dağ (M. Ida), Kapu dağ, Sintenis 1065, 1065b, (both approach subsp. juressi).

Lydia:- Yamanlar dagh, N. of Gulf of Smyrna (Izmir), Balansa (1854) 114. "Lydiae montes", Boissier 6.1842. M. Bournabat, Boissier 5.1842 (G). above Smyrna (Izmir), Boissier (G). Bozdagh (Tmolus), Boissier (G).

Caria:- Cadmus (Honaz dağ) above Gheyra, Boissier 6.1842.

Lycia:- ? Katara Pass, Forbes 130.

Geographical distribution: Endemic.

Biology: A loosely caespitose plant of stony slopes on mountains. Flowers May - July.

A.(ii). var. caespitosa McNeill, var. nov.

A varietate typica planta dense caespitosa inflorescentiis 1(-3)-floris fasciculos foliorum vix excedentibus

differt; a subsp. juressi sepalis longioribus inflorescentiis humilioribus divergit.

Folia 4-8mm. longa, plana vel ± setacea, ad basim lata ad apicem sensim attenuata. Sepala 4.5-5.5mm. longa. Petala calycem subaequantia.

Typus: TURKEY: Mysia: M. Ida (Kaz dag): in jugo, 23.6.1883, Sintenis (1883) 820 (as Alsine pulvinaris Boiss.). holo. K!, iso. BM!

Geographical distribution: Endemic.

Biology: A densely caespitose high alpine plant (derivative of var. asiatica ?). Flowering in June.

B. subsp. juressi

Syn.: Arenaria juressi Willd. ex Schlecht. in Mag. Ges. Naturf. Fr. Berlin 7 : 212 (1813).

Arenaria condensata Presl, Delic, Prag 1 : 62 (1822).

Alsine juressi (Willd. ex Schlecht.) Fenzl, Versuch Verbreit, Vertheil., Alsin. tab. ad p. 57 (1833).

Alsine condensata (Presl) Fenzl l.c.

Alsine pulvinaris Boiss., Diagn. Pl. Orient. ser.1 1 : 46 (1842).

M. condensata (Presl) Hand.-Mzt., in Ann. naturh. Hofmus, Wien 23 : 152 (1909).

Arenaria pulvinaris (Boiss.) Fernald in Rhodora 21 : 6 (1919) (= Contr. Gray Herb. Harv. 57 : 6).

M. recurva subsp. juressi (Willd. ex Schlecht.) Mattf. in Bot. Jb. 57 Beibl. 126 : 31 (1921) ("juressii").

Type: Spain: M. Juressi (Serra do Gerez), Willdenow Herb. 1772. holo. B.

Specimens seen:

GREECE:-

Macedonia:- M. Kaimakcalan, Dörfler 103.

Thrace:- Samothraki: M. Phengari, 1600m., Rechinger 9871 (as M. erythrosepala var. kabirarum).

TURKEY:-

Lydia:- Izmir: Odemiş: Boz dağ (Tmolus), Balansa (1854) 113 (as Als. pulvinaris), Davis 18202 (2000-2100m.).

Geographical distribution: Mountains of Spain, S. France, Italy, Albania(?) and Yugoslav Macedonia(?).

Biology: A densely caespitose to pulvinate plant of high mountains. Flowers (in Orient) June - August.

Discussion (of species): Although very close to M. recurva in habit, M. juressi seems sufficiently distinct from that species to warrant recognition at specific rank, thus departing from Mattfeld's (1922) treatment (as subspecies) and returning to Handel-Mazzetti's (1909) evaluation.

A group of loosely caespitose plants from Western Anatolia which Mattfeld and Handel-Mazzetti included in M. hirsuta subsp. falcata (or vestita) were found to have the broad hyaline margined bracts typical of M. juressi and their true affinity would seem to be with

that species rather than with M. hirsuta. This geographically distinctive group has been described as a new subspecies - subsp. asiatica.

On the summit of Kaz dağ (M. Ida in Mysia) densely caespitose plants have been collected which seem to be high mountain derivatives of subsp. asiatica. These resemble the typical subsp. juressi in habit but retain the flower size and leaf characters of asiatica. Mattfeld's (1922) suggestion that these plants (forming a single gathering - Sintenis 820) might represent hybrids with M. erythrosepala (Section Minuartia) is scarcely conceivable from their external morphology; in view of their marked differences from typical asiatica, they have been described as a variety (var. caespitosa) but the discovery of transiftional forms from intermediate altitudes might make this distinction of little value.

Further south on Boz dağ (Tmolus), typical subsp. juressi (Boissier's Als. pulvinaris) replaces subsp. asiatica at higher altitudes. M. hirsuta is entirely absent from the area of M. juressi subsp. asiatica and only overlaps with subsp. juressi in the Northern Pindus region (Epirus, Albania and Yugoslav Macedonia), in which the whole section exhibits great complexity and confusion of form. (cf. fig. 29)

19. M. recurva (All.) Schinz et Thell. in Bull. Herb. Boiss. ser.2 7 : 404 (1907).

Key to subspecies

1a. Anthers yellow, leaves rather soft, fleshy or sometimes setaceous, not or scarcely flattened; petals longer than sepals A. subsp. recurva

1b. Anthers pink or blue :

2a. Leaves rigid, terete to ± triangular in section, obscurely nerved; petals shorter than sepals; plants very densely caespitose to densely pulvinate C. subsp. carica

2b. Leaves usually rather soft and somewhat flattened, if ± terete then very flaccid, or if rather rigid then prominently 3-nerved; plants caespitose frequently densely so B. subsp. oreina

A. subsp. recurva

Syn. : !Arenaria recurva Allioni, Fl. Pedem. 2 : 113 (1785).

!Alsine recurva (All.) Wahlb., Veg. Clim. Helvet. 87 (1813).

!Sabulina recurva (All.) Reichb., Fl. Germ. Excurs. 788 (1832).

!Tryphane recurva (All.) Reichb., Ic. Fl. Germ. 5 : 29 (1842).

!Alsine verna β recurva (All.) Fiori & Paoletti, Fl. Anal. Ital. 1 : 343 (1898).

Alsine recurva var. orbelica Velen., Fl. Bulg. Suppl. 54 (1898).

M. recurva subsp. eurecurva Mattf. in Bot. Jb. 57 Beibl. 126 : 31 (1921).

M. recurva var. orbelica (Velen.) Hayek, Prodr. Fl. Balc. 1 190 (1924).

Type: Italy: "alp. Valdensium", Allioni. holo. TO! (cf. note under discussion of species).

Specimens seen:

GREECE:-

Epirus/Thessaly:- M. Peristeri, Orphanides 338 (19/31.7.1862) (G), 1029 (2135-2285m.) (31.7.187-?) (PRC) (both approach M. juressi).

Thrace:- Kula Dagh, 1525m., Tedd 1156.

Geographical distribution (of subsp.): Alps, Transylvania, S. Yugoslavia, Bulgaria.

Biology (of subsp.): Densely caespitose plants of mountain slopes. Flowers in Orient in July.

B. subsp. oreina (Mattf.) McNeill, comb. nov.

Syn.: !M. hirsuta subsp. oreina Mattf. in Bot. Jb. 57 Beibl. 126 : 30 (1921) (nomen); in Fedde Rep. Beih. 15 : 118 (1922) (diagn. in clave).

!M. oreina (Mattf.) Schischk. in Trans. Tomsk Univ. (Ber. Tomsk Univ.; Izv. Imp. Tomsk Univ.) 81 : 443 (1928).

Lectotype: TURKEY: Kurdistan: "Taurus Armenus. In monte Meleto (Meretug) Dagh districtus Bitlis, in lapidosis circa cacumen. Substrato

calcareo; ca. 2900-3100m. 11.VIII.1910, Dr. Heinr. Frh. v. Handel-Mazzetti 2758. holo. B (destroyed), iso. WU!

Specimens seen:

TURKEY:-

Pontus:- ? Alischeri Chan, 1890m., Kotschy 771 (G). Lazistan: Djimil (Cimil), 2500m., Balansa 250 (G), 251 (G). Çoruh (Artvin): Ardanuç: Kordevan Dağ (Yalnizçam Dağlari), 2600m., Davis 30392. Kars: Kisir Dağ, Davis 30537 (28--m.), 30493B (S.W. side, 2300m.). Rize: Ikizdere: Vercinin Tepe, 3400m., Davis 21135. Trabzon: Tigana (Zingana?) dagh nr. Tigana-Korduni, Schischkin 5.7.1917 (BM).

Pamphylia:- Antalya: Gebiz (Pisidia): Bozburun Dağ, Davis 15555 (nr. Tozlu Çukur yayla, 2000m.), 15660 (N. slopes, 2200-2300m.).

Cilicia:- no locality, Siehe (1896) 543 (as Als. erythrosepala). Boulgar Maaden, Balansa 822 (18.7.1855), Siehe (1912) 600 (Kysil tepe).

Cappadocia:- Niğde: Hasan Dağ, Davis 18939 (nr. Taspinar yayla, 2400m.), 18961 (above T. yayla, 2700m.). Erciyas Dağ (Argaeus, Ergias), Balansa 1060 (3000m.), 649 (2975m.) (G), Siehe (1898) 218 (2800m.) (as Als. tchihatchewii), Balls 1420 (2440m.)

Cataonia:- Akher (Ahir) Dagh, 1830-2135m., Haradjian 1718.

S.W. Armenia:- Tunceli: Munzur Dağ above Ovaçik, 2600m., Davis 31135. Erzincan: Keşiş Dağ above Cimin, Davis 31658 (2500-2600m.), 31614 (2700-2900m.), 31762 (2550m.).

Kurdistan:- Bitlis: Karz dağ above Kotum, 2225m., Davis 22282,

Nemrut, N. slope of crater, McNeill 570 (2700m.), 593B (2600m.), Suphan Dağ above Adilcevaz, Davis 24660 (3960m.), 24752B (3300m.), Hakâri: Cilo Dağ, Davis 24049 (Cilo Tepe, 3290m.), 24169 (10 km. W. of Cilo Tepe, 3200m.); Kara Dağ, 3505m., Davis 24457.

U.S.S.R.:-

No locality:- "Caucasus" LE (1837).

Daghestan:- no locality, Becker 74.

Georgia:- S. Ossetia: Chaparuchskoe Uschele, M. Chaparucha, 2100m., Busch 21.7.1930; Sredne-Ermanskoe, Busch 12.8.1935 (2800m.), (BM), 22.8.1935 (2900m.), (BM). Swant, M. Baernaesaer, 1525m., Hohenacker 6-7.1836 (BM) (G).

Armenia:- no locality, Szovits 271. M. Karagiol, Szovits (G). Nachrespublica: M. Arazhon, 3100m., Gadzhiev, Gurvitsch & Ulubabov 5.8.1933. Nachichevan: Shahbuzskii: Baplavop (?), 2100m., LE 26.5.1947 (leg. Grossheim et al.) (BM).

? ? :- Borbalo, Radde 15.7.1876. Kurusch, Becker. Vrasbek, 2710m. Rehmann (1873) (G).

'IRAQ:-

Erbil:- Arl Cird Dagh, BAG 2840 (3050m.) (leg. Guest), 9593 (N. E. slopes, 3000m.) (leg. Gillett). Ser Kurawa, 3100m., BAG 9743 (leg. Gillett). Siah Koh, 3200m., BAG 1532 (leg. Ludlow-Hewitt).

IRAN:-

Caspian Sea:- Mazanderan: Kudjur, M. Ulodj, 3200-3400m., Rechinger

6514. M. Elbrus, Asadbar, 2440m., Kotschy 468(G), 468a, 467a (BM).

Northern Zagros:- Kuh Elwend, 3810m., Balls 107.

Geographical distribution: (of subsp.): Endemic.

Biology (of subsp.): A rather densely caespitose plant of stony mountains slopes from (1525-)1830-3960m.

C. subsp. carica McNeill, subsp. nov.

A subspeciebus aliis M. recurvae foliis rigidis enerviis petalis calyce brevioribus planta semper pulvinata divergit; a subsp. oreina solum foliis teretibus vel triangularibus et numquam flaccidis distinguenda: a subsp. recurva solum antheris puniceis vel caeruleis differt.

Planta pulvinata interdum dense, praeter inflorescentias glabra. Caudiculi numerosi suberecti dense congesti in fasciculos foliorum breves (4-8mm.) transientes. Folia 1.5-6mm. longa (4-6mm. in typo) tereta vel triangularia enervia (vere obscure nervata). Caules 1.5-6.0cm. alti ad apicem inflorescentia 1-7-flora (3-7 in typo) subcongesta glanduloso-pubescentia instructi; bracteae anguste lanceolatae, 3(-5)-nervia, anguste hyalino-marginatae. Sepala lanceolatae, 3-7 nervia; ± dense glanduloso-pubescentia. Petala calyce breviora. Antherae probaliter caeruleae (? puniceae).

Typus:- TURKEY: Caria: "Mughla: Sandras dagh, 2200m. 23.7.1947, P.H. Davis 13552" holo. E! iso. K! (mixed with Arenaria ledebouriana var. pauciflora).

Specimen seen:

TURKEY:-

Caria:- Denizli; Baba dağ above Kadiköy, 1800m., Davis 18373.

Geographical distribution (of subsp.): Endemic.

Biology (of subsp.): Pulvinate or densely pulvinate mountain plants. Flowering and fruiting July - August.

Discussion (of species): In this account a return is made to Handel-Mazzetti's circumscription of M. recurva which includes the Asiatic plants with few-nerved bracts. These Mattfeld described as a sub-species of M. hirsuta (subsp. oreina) which he distinguished from the other forms of M. hirsuta by just those characters which distinguish M. recurva subsp. recurva from M. hirsuta. Both European recurva and the Asiatic oreina are very variable and no character except anther colour has been found to distinguish absolutely, between the two groups. There can be no question of regarding them as specifically distinct for although Mattfeld may be right in suggesting that they have distinct evolutionary histories, it would be very difficult to identify with certainty, many unlocated specimens.

The typification of M. recurva presents some difficulty, the species being originally described by Allioni from "alp. Valdensium". In Allioni's original herbarium at Turin there are six sheets labelled "Arenaria recurva", two of which represent plants referable to the M. verna complex (Section Tryphane sensu stricto) while the remaining

four are of M. recurva subsp. recurva. Only two specimens are at all localised, one of M. verna being labelled "pedem." (Piedmont) and the other (M. recurva) "Col de St. Stephano loco alpino et frigido" (? in Liguria). All six are labelled in the same handwriting (presumably Allioni's) but in all but one case (a re-mounted sheet of recurva) the epithet "recurva" has been added later suggesting that at least five of the specimens were in Allioni's possession prior to the writing of Flora Pedemontana (1785). The re-mounted sheet bears only the name "Arenaria recurva" written on an attached piece of paper contemporaneous with that on which the other specimens are mounted. Both sheets of M. verna bear the synonym "Alsine petalis integris foliis sulcatis, radicalibus congestis recurvis lanceolatis. Hall. Em. I. n.73.", while that of M. recurva from San Stefano is labelled "an Varietas Alsines petalis integris ..." etc. The other two sheets of M. recurva are similarly identified but with different Haller references, viz.: "Alsine fol. sulcatis, radicalibus congestis recurvis caulinis lanceol., petalis integris. Hall. emendat. pag.21." and "Alsine fol. sulcatis, recurvis radicalib. congestis, caulinis lanceolatis. Hall. hist. no. 868".

It is proposed to regard this last plant identified from Haller's later work ("Historia stirpium ... Helvetiae...", 1768) as the lectotype of M. (Arenaria) recurva. It seems almost certain that Allioni had this sheet in his possession at the time of writing "Flora Pedemontana" and moreover that it was his most recently identified specimen. Despite the fact that its prevenance is unknown, it seems the most appropriate specimen by which to typify recurva; this choice preserves

the widely accepted usage of the name (cf. Handel-Mazzetti, 1909 and Mattfeld, 1922).

Subsp. recurva only occurs within the Orient in N. Greece and in forms showing an approach to M. juressi. Subsp. oreina is however endemic to the area but is very variable. The plants from Northern Iran, the Caucasus and parts of the Pontus and Kurdistan have more erect, rigid leaves with prominent nerves than do the typical plants of Eastern Anatolia. A further trend to very flaccid leaves and a more dense habit is seen further west in Central Anatolia. The demarcation of these three types is too obscure to warrant taxonomic recognition.

Subsp. carica may be an extreme variant of the C. Anatolian plants but the two known specimens possess much more rigid 'nerveless' leaves than any other forms of the species. This and its pulvinate habit and geographic isolation have prompted its recognition as a third subspecies. The plant from Baba Dağ is very densely pulvinate and superficially resembles those plants of M. juressi subsp. juressi from Boz Dağ (= Als. pulvinaris Boiss.). The structure of the bracts is very different however. (cf. fig. 29)

Section Lanceolatae (Fenzl) Graebn.

Series Graminifoliae Mattf.

Sepals with outer nerves curved and all the nerves narrow with broad inter-nerve regions; petals lanceolate (> 3 times as long as broad); leaves flaccid, linear to ovate-lanceolate, (7-)12-40mm. long; inflorescence 2-12cm. tall, 1-5(-7) flowered.

20. M. saxifraga

Sepals all parallel-nerved, the nerves broader than the inter-nerve strips; petals ovate (2-2.5 times as long as broad); leaves rigid, linear-triangular, 4-10mm. long; inflorescence 1-2cm. tall, 1(-4)-flowered

21. M. stellata

20. M. saxifraga (Friv.) Graebner in Ascherson & Graebner, Syn. Mitt.-Eur. Fl. 5 (1) : 756 (1918).

Key to subspecies

Cauline leaves ovate-lanceolate with the lateral nerves curved; inflorescence short to tall (2-12cm.), 3-7-flowered (Rumelia)

(A. subsp. saxifraga)

Cauline leaves linear to linear-lanceolate, all the nerves parallel; inflorescence short (2-3cm. tall), 1-3(-4)-flowered

B. subsp. tmolea

(A. subsp. saxifraga

Syn.: !Arenaria saxifraga Friv. in Flora 19 (2) : 434 (1836), non (Bertol.) Fenzl (1848).

!Alsine saxifraga (Friv.) Boiss., Diagn. Fl. Orient. ser.1 1 : 47 (1842).

!M. saxifraga subsp. rumelica Mattf. in Bot. Jb. 57 Beibl. 126 : 31 (1921) (nomen); in Fedde Rep. Beih. 15 : 132 (1922) (diagn. in clave).

Type: Bulgaria: "In Rumelia, 1835", Frivaldszky holo. BP, iso. K!

Geographical distribution (of subsp.): Confined to the Balkan Mountains of Central Bulgaria.).

B. subsp. tmolea Mattf. in Bot. Jb. 57 Beibl. 126 : 31 (1921) (nomen); in Fedde Rep. Beih. 15 : 132-133 (1922) (diagn. in clave).

Syntypes: TURKEY: Lydia: Boz dağ: 1) "rupes Tmoli supra Bozdagh, Jun. 1842", Boissier; 2) "Sommet du Tmolus, au-dessus de l'Yaila de Bozdagh, 19 Juillet 1854", Balansa 112.
holo. B (destroyed?); iso. BM!, G, JE!, K!

Specimen seen:

TURKEY:-

Lydia:- Izmir: Ödemiş: Bozdağ, 1900m., Davis 18215.

Geographical distribution (of subsp.): Endemic.

Biology: A densely caespitose or more or less pulvinate plant of cliffs. Flowers July - August.

Discussion: M. saxifraga was described from the Balkan Mountains in Bulgaria but plants collected on Boz Dağ in Lydia were referred to it by Boissier (1867). Although clearly related the plants from the two disjunct areas are very distinct and were regarded as separate subspecies by Mattfeld (1922). This treatment has been followed although the Turkish plants have some claim to recognition at specific rank. (cf. fig. 30)

21. M. stellata (Clarke) Maire & Petitm., Etude Pl. Vasc. Grece 4 : 48 (1908).

Key to subspecies

Entire plant densely glandular-puberulent; leaves linear - lanceolate, the lateral nerves curved; inflorescence 1-3(-4) flowered A. subsp. pseudosaxifraga

Stems and pedicels glandular-pubescent, rest of plant (e.g. leaves and sepals) subglabrous; leaves linear-triangular with parallel nerves; inflorescence 1(-2) flowered B. subsp. stellata

A. subsp. pseudosaxifraga Mattf. in Fedde Rep. Beih. 15 : 136 (1922).

Type: GREECE: Epirus: "in rupestribus m. Papingon, Gamila,

Cepelovan (Vradeton) distr. Zagarion 13-25 Julio 1896, Baldacci (Iter Albanicum (Epiroticum) Quartum) 161." holo. B (destroyed?), iso. W-H!

Geographical distribution: Endemic.

B. subsp. stellata

Syn.: Cherleria stellata Clarke, Travels 2 (3) : 211 (1816).

!Alsine parnassica Boiss. et Sprun. in Boiss., Diagn. Fl. Orient. ser.1 1 : 46 (1842).

Alsine stellata (Clarke) Halacsy in Denkschr. Akad. Wiss. Wien. 61 : 232 (1894).

!Alsine stellata var. epirotica Halacsy l.c. (1894).

Arenaria stellata (Clarke) Fernald in Rhodora 21 : 6 (1919) (= Contr. Gray Herb. Harv. 57 : 6).

Type: GREECE: Central Greece: M. Parnassus, (Wednesday 16th December 1801), Clarke. holo. BM?

Specimens seen:

GREECE:-

Epirus:- M. Tsumerka (Tzoumerka): Strungula, Bresani, Kakarditza, 1800-2400m., Baldacci (1895) 124 (WU). below Peristeri ridge, M. Pindos, Baldacci (1895) 214 (WU).

Thessaly:- E. slopes of Mt. Peristeri above Khaliki, 2000m.,

Halacsy 17.7.1893 (W-H) (WU) (type of var. epirotica).

Central Greece:- Aetolia: Vardhousia Ori: Mt. Korax, Heldreich Herb. Graec. norm. 4 (21.7.1879)(1830-2340m.), Heldreich Herb. Graec. norm. 1312 (leg. Tuntas & Leonis, 1-10.8.1896), Balls 3331 (1980m.), Guiseppi 35 (1220-2135m.). Pindus: Agrapha (Agrafa), Mt. Karavi, 1675-1980m., Haussknecht 1-3.7.1885. Mt. Tymphrestos (Timfristos), Karpenissi (Karpension), 2000m., Grebenchikoff 14.7.1938. Mt. Parnassus (Parnassos), Sprunner (1842) (G) (type of parnassica), Heldreich Herb. Graec. norm. 4 (leg. Guicciardi, 8.1855) (1830-2135m.), Dörfler Fl. Graeca 178 (leg. Leonis 14.7.1898) (nr. Pigadia), Atchley 2309 (2135m.). Euboia: Mt. Dirphys (Dhirfis), 1525m., Atchley 2072.

Pelopponese:- Erimanthos (Mt. Olenos), Heldreich 7.1848 (1830-2135m.), Bornmüller 219 (2000-2100m.). Mt. Kyllenes (Killini Oros), Pichler 7.1876 (1830m.), Orphanides 24 (13.7.187-) (2195m.), 24 (1-13.7.1851) (Mt. Ziriae, 2135m.), Thompson 1171 (3.7.1939) (Mt. Ziria, 1750m.), Grebenchikoff 24.7.1938 (above Trikkala, 2000m.). Aroania Oros, Chelmos, Guiseppi 53 (1830-2440m.), Grebenchikoff 29.7.1939 (Kalavryta, 2000m.).

Geographical distribution (of subsp.): S. Albania (Griba and Cikes Mountains). (Baldacci (1892) 114!, (1894) 59!)

Biology (of sp.): A pulvinate plant of rocky places between 1600 and 2400m. Flowers July.

Discussion: M. stellata is a very uniform species in the Pelopponese

and Central Greece but shows some variability further north. Halacsy described plants collected on the eastern slopes of Mt. Peristeri (Pindus) with glabrous pedicels as var. epirotica. Plants from the west side of the same mountain (Baldacci (1895) 214) have typical densely glandular pedicels while the glabrous type occurs again in the Tzoumerka range (Baldacci (1895) 124). In view of the apparently scattered occurrence of these plants with glabrous pedicels and the absence of any correlated characters, Halacsy's variety is not maintained.

The densely puberulent plant from Zagorion, which Mattfeld described as subsp. pseudosaxifraga is much more distinct, and although scarcely isolated geographically, has been maintained in this account. The two gatherings seen from Albania have longer leaves and the one which is in flower has rather longer sepals; in leaf shape and pubescence they are, however, typical of subsp. stellata. (cf. fig. 30)

Series Dianthifoliae Mattf.

1a. Sepals 6-12mm. long; petals ovate to lanceolate (2-3.5 times as long as broad), half as long as sepals; capsule half as long as calyx; leaves flat, often rigid, but not pungent, margin and median nerve only a little more prominent than the many lateral nerves, apex ± acute not sharp pointed :

2a. Sepals linear-lanceolate (c. 5 times as long as broad), long acuminate, 8-9mm. long, glandular-pubescent; petals oblong-lanceolate (> 3 times as long as broad), claw ± absent; leaves glabrous to ± glaucous, very narrowly triangular, cauline long acute; plants densely caespitose 23. M. acuminata

2b. Sepals ovate-lanceolate to lanceolate (2.5-4.5 times as long as broad), acute (rarely, subsp. kurdica, ± acuminate); petals ovate to lanceolate (2-3 times as long as broad); leaves usually broadly linear-lanceolate, rarely (subsp. kurdica) narrowly triangular and then glandular-pubescent, cauline usually shortly acute; plants laxly to ± densely caespitose (cf. also key to subspp.). 22. M. dianthifolia

1b. Sepals 15-20mm. long; petals broadly ovate (< twice as long as broad), < half as long as sepals, claw prominent c. 0.5mm. long; capsule < half as long as calyx; leaves pungent, ± channelled above, with a very prominent midrib and thickened margin, narrowly triangular, acerose 24. M. pestalozzae

22. M. dianthifolia (Boiss.) Hand.-Mzt. in Ann. Naturh. Hofmus. Wien 26 : 147 (1912).

Key to subspecies

1a. Leaves glabrous (margins sometimes minutely scabrid) broadly linear-lanceolate; sepals 6-8.5mm. long, glabrous or rather sparsely glandular-pubescent; petals little shorter than the sepals (> 0.8 times as long), ovate-lanceolate to lanceolate (c. 2.5-3 times as long as broad), claw absent; plants rather loosely caespitose A. subsp. dianthifolia

1b. Leaves ± densely glandular-pubescent; petals much shorter than the sepals (0.6-0.8 times as long) :

2a. Sepals glabrous (glandular-pubescent at junction with pedicels), 8.5-12.0mm. long; petals ovate-lanceolate (c. 2.5 times as long as broad), claw obscure (< 0.25mm. long); leaves linear-lanceolate, gradually narrowed to the apex but scarcely triangular; plants loosely to rather densely caespitose B. subsp. cataonica

2b. Sepals glandular-pubescent, 6.0-8.5(-9.0) mm. long; petals ovate (c. twice as long as broad), claw distinct (c. 0.5mm. long); leaves linear to very narrowly triangular; plants ± densely caespitose C. subsp. kurdica

A. subsp. dianthifolia

Syn.: *Alsine dianthifolia Boiss., Diagn. Pl. Orient. ser.1 8 : 99 (1849).

*Arenaria dianthifolia (Boiss.) Fernald in Rhodora 21 : 6 (1919) (Contr. Gray Herb. Harv. 57 : 6).

Type: TURKEY: Lycia: Akdagh, Pestalozza (1846). holo. G.*

Specimens seen:

TURKEY:-

Lycia:- Beidagh nr. Elmali, Pichler 1.7.1883 (WU), 121 (9.7.1883) (K) (WU). Pass between Baschibunar and Girdeff (Girdev), Luschan 19.7.1882 (WU). Summit pass above Karakioe, Luschan 2.8.1882 (WU) (sepals glandular). Girdev dagh, Davis 13773B (2300m.), 13841 (S. side).

Geographical distribution: Endemic.

Biology: Plant of stony places rather loosely tufted with creeping caudiculi. Flowers July - August.

B. subsp. cataonica McNeill, subsp. nov.

Affinis subspecie dianthifolia sed foliis glanduloso-pubescentibus sepalis longioribus petalis calyce multo brevioribus recedit; a subspecie kurdica sepalis glabris (praeter proxime pedicellum) petalis angustioribus ungue obscuro foliis non triangulis differt.

Planta ± laxe vel dense caespitosa, valde caudiculata. Caudiculi crassi (ad 2mm. diam.), suberecti, foliis mortuis praedita (saepe dense). Folia 5-12mm. longa et 1.0-2.5mm. lata, linearia vel lineari-lanceolata ad apicem anguste acuta, glanduloso-pubescentia. Caules 5-10cm. alti, ± sparse glanduloso-pubescentia vel subglabra, foliis 3-5-jugis praediti, inflorescentia 1-2(-3)-flora terminati. Pedicelli breves, 5-8mm. longi, dense glanduloso-pubescentes. Sepala glabra, 8.5-12.0mm. longa, anguste acuta. Petala ovato-lanceolata, latitudine c. 2.5-plo longiora, sepalis multo (1.25-2.5-plo) breviora, obscure unguiculata; unguis < 0.25mm. longus.

Typus: TURKEY: Cataonia: "Prov. Maraş, distr. Goksun: Binboğa dağ, in ravine above Yalak, 2000m. Rocks, rare. Fl. white. 17 July 1952", Davis, Dodds & Çetik (D.20129). holo. E!, iso. K!

Specimens seen:

TURKEY:-

Cataonia:- Berytdagh, 2745m., Haussknecht 1675(?) (10.8.1865) (G) (JE). Malatya - Kjachta (Kâhta): Ak Dagh, 2500-2670m., Handel-Mazzetti 2335 (WU). Goksun: Binboğa dağ above Yalak, 2200-2300m., Davis 20143.

Cataonia/Cappadocia:- Aslan-Dach (nr. Anti-Taurus) 12 "lieues" (? 58 km.) E.S.E. of Erciyas dağ (Argaeus), Balansa 648 (5.8.1856) (G).

Geographical distribution: Endemic.

Biology: Usually rather densely tufted plant growing among rocks. Flowers July - August. Recorded between 2000 and 2745m.

C. subsp. kurdica McNeill, subsp. nov.

A subspeciebus aliis M. dianthifoliae foliis ± anguste triangulis sepalis glanduloso-pubescentibus petalis ovatis distincte unguiculatis bene distinguit; a subsp. dianthifolia solum plantis dense caespitosis foliis glanduloso-pubescentibus petalis calyce multo brevioribus differt; affinis subsp. cataonica qua sepalis brevioribus etiam divergit. Insuper affinis M. acuminata sed sepalis latioribus petalis latioribus unguiculatis foliis pubescentibus facile distinguenda. In forma petalorum M. pestalozzae revocat, sed in foliis, sepalis et capsulis omnino differt (cf. clave).

Planta ± dense caespitosa caudiculis numerosis densis provisa. Caudiculi crassi, ad 2mm. diam., foliis mortuis dense praedita. Folia 6-18mm. longa et ad basim 1.5-2mm. lata, angustissime traingula, longe acuta, glanduloso-pubescentia. Caules 4-9cm. alti sparse glanduloso-pubescentes, foliis 3-4(-5)-jugis praediti, inflorescentia 2-3(-4)-flora congesta terminati. Pedicelli breves, 5-7mm. longi, dense glanduloso-pubescentes. Sepala glanduloso-pubescentia, 6.0-8.5(-9.0)mm. longa, lanceolata (latitudine 3-4-plo longiora) acuta vel interdum acuminata. Petala ovata (latitudine c. duplo longiora), sepalis multo (1.25-2.5-plo) breviora, distincte unguiculata; unguis c. 0.5mm. longus. Capsula calyce c. 1.5-plo breviora.

Typus: TURKEY: Kurdistan: "Prov. Van dist. Gevaş: Artos Dağ, 8500 ft. (2590m.). Fls. white. 14 July 1954", Davis & O. Polunin (D.22716). holo. E! iso. K!

Specimen seen:

TURKEY:-

Kurdistan:- Van : Artos dağ, N. slopes above Gevas, 5000m., McNeill 770.

Geographical distribution: Endemic.

Biology: A rather densely caespitose plant growing in stony places. Flowers July to August.

Other record of M. dianthifolia: U.S.S.R.: Armenia: Nakhichevan: Shikh-Jurdi, alpine zone cf. Grossheim (1945)(1949).

Discussion (of species): M. dianthifolia has a very restricted distribution, being only known from four mountain areas in Turkey and an adjacent part of the Caucasus. The type was described from Lycia where six other gatherings are known to have been made. These plants are all fairly uniform and differ from the five known gatherings from the Anti-Taurus (Cataonia) in having glabrous leaves, shorter sepals and relatively longer petals etc. Two of these more easterly specimens (those collected by Balansa and Haussknecht) were known to Boissier and in 'Flora Orientalis' were included in his Alsine dianthifolia. These two very similar groups of plants are best considered as geographical subspecies and the Anti-Taurus one has been described as new - subsp. cataonica.

A more distinctive plant occurs still further east in Turkish

Kurdistan; this has only been collected twice - by Davis in 1954 and by the writer in 1956, in both cases on the same mountain near Lake Van. In habit, leaf shape and sepal pubescence it shows an approach towards M. acuminata, only known from the type specimen from Mishou Dagh near Tabriz in Northern Iran. The Lake Van plant, described here as M. dianthifolia subsp. kurdica, is most distinctive, however, in its ovate clawed petals resembling those of M. pestalozzae. It has indeed some claim to specific recognition but in the absence of specimens from other Kurdish mountains it has been thought best to place it within M. dianthifolia.

Grossheim (1945)(1949) (and Schischkin in Komarov, 1936) record M. dianthifolia from another disjunct locality - a mountain in Nakhichevan. As no material of this has been seen and as no specimens are known to have been collected in adjacent Turkish Armenia, the taxonomic position of this plant is uncertain. It may well represent a fourth subspecies. (cf. fig. 30)

23. M. acuminata Turrill in Kew Bull. 1929 : 225 (1929).

Type: IRAN: Azerbaijan: "Mishou Dagh nr. Tabriz, 19.7.1928", B. Gilliat-Smith 2374. holo. K!

Geographical distribution: Endemic.

Discussion: M. acuminata is very closely related to M. dianthifolia, particularly the densely caespitose subsp. kurdica. The very narrow

long-pointed sepals readily distinguish it, however, from any known plants of M. dianthifolia and for this reason it is maintained at specific rank. Should the Nakhichevan plants recorded as M. dianthifolia, or new collections in Eastern Turkey and Azerbaijan, show further intermediate conditions between the two species (as is not improbable), the status of M. acuminata may have to be reconsidered.

24. M. pestalozzae (Boiss.) Bornm. in Beih. bot. Tbl. 33 (2) : 279 (1915).

Syn.: Alsine pestalozzae Boiss., Diagn. Fl. Orient. ser.1 8 : 99 (1849).

Type: TURKEY: Lycia: Bereket Dagh, 1846, Pestalozza holo. G!

Specimens seen:

TURKEY:-

Caria:- M. Cadmus (Honaz dağ), E. of Denisleh, Boissier (as Dianthus) (G).

Lycia:- Antalya: Çalbali dağ (Bereket dagh), 2000-2100m., Davis 15282.

Phrygia:- Sultandagh above Tschai (Çay), 2000-3200m., Bornmuller 4207.

Geographical distribution: Endemic.

Biology: A very striking, spiny, densely caespitose plant of rock crevices and screes. Flowers July - August.

Discussion: M. pestalozzae is probably the largest and most striking species of the genus. Its pungent leaves and dense habit of growth give it the appearance of an Acanthophyllum or an Acantholimon Despite its distinct facies it is closely related to M. dianthifolia, especially to subsp. kurdica. Like that species it is a relict mountain endemic, and is only known from three localities in south-western Anatolia. (cf. fig. 30)

Section Acutiflorae (Fenzl) Hayek

Series Acutiflorae

1a. Leaves 2-6(-8) mm. long, fleshy, yellowish-green, rather glaucous; plant densely caespitose 4-8(-10) cm. tall, inflorescence short, 2-5cm. tall; sepals c. 4mm. long 27. M. aucheriana

1b. Leaves (5-)10-20mm. long, flat and flaccid or rigid, or terete ± pungent, bright green, glabrous to glandular-pubescent; plants loosely tufted or forming loose spiny clumps, (8-)10-25cm. tall; inflorescence 6-20cm. tall:

2a. Leaves flaccid, flat; plants slender, caudiculi < 0.5mm. diam. :

3a. Sepals 4-4.5mm. long; petals c. 1.5 times as long as sepals; pedicels ± erect, 8-20mm. long 25. M. biebersteinii

3b. Sepals c. 3.5mm. long; petals slightly longer than sepals; pedicels spreading widely, 15-25mm. long. 26. M. gracilis

2b. Leaves rigid, flat or often terete; plants very robust, caudiculi c. 1.0mm. diam. :

4a. Leaves flat, not pungent, those of the sterile shoots spreading widely; nodes of the sterile shoots not swollen but sometimes bearing loose axillary fascicles at anthesis; pedicels strictly erect, often short, 5-10(-25) mm. long; sepals 4.5-5.5mm. long 28. M. lineata

4b. Leaves terete or semi-terete, those of the sterile shoots

either strongly pungent and spreading widely or if less pungent fasciculate (pointing forward); pedicels erect or spreading :

5a. Sterile shoots with swollen nodes bearing short dense axillary leaf clusters at anthesis; leaves spreading widely, strongly pungent; inflorescence usually rather dense, pedicels ± erect; plants forming spiny clumps

29. M. juniperina

5b. Sterile shoots without swollen nodes, with or without open axillary fascicles at anthesis; sterile leaves fasciculate (pointing forward) ± pungent; inflorescence lax, pedicels spreading, 10-35mm. long; plants forming rather loose tufts

30. M. glandulosa

25. M. biebersteinii (Rupr.) Schischkin in J. bot. Gdn. Nikita 10 : 38 (1928).

Syn. : (!)Alsine biebersteinii Rupr., Fl. Cauc. 1 : 215 (1869).
Alsine subuniflora Albow, Prodr. Fl. Colch. in Trav. Jard. Bot. Tiflis 1 : 35 (1895). (fide Grossheim, 1945).
M. subuniflora (Albow) Woronow in Fomin & Woronow, Opreditel' rast. Kavk. Krima (Keys Fl. Cauc. Crim.) 2 : 178 (1914).

Type: U.S.S.R.: Ossetia: Alagir, 21.5.1861, Ruprecht. holo. LE (photo!).

Specimens seen:

U.S.S.R. (Caucasus):-

? ? :- Uleti nr. R. Aragva, Brotherus 179 (1.6.1881) (BM).

Ossetia: Lars nr. R. Terek, Brotherus 179d (26.5.1881) (S).

Records: West Caucasus, East Caucasus, Daghestan, West Transcaucasia and Central Transcaucasia (only in north) - Grossheim (1949).

Geographical distribution: Endemic.

Biology: A rather slender caespitose plant, apparently growing under mesophytic conditions. Flowers May - June.

Discussion: M. biebersteinii is a member of the M. flaccida (= M. villarsii) complex, which Mattfeld treated as one species and which occurs throughout Europe and C. Asia in a series of disjunct areas. The plants from each of these areas are often treated as distinct species (notably by recent Russian botanists - cf. Schischkin in Komarov, 1936), M. biebersteinii being the Caucasian representative.

The lack of adequate material from the Caucasus and C. Asia has made it impossible to evaluate the claim of this taxon to specific rank and Grossheim's (1945, 1949) treatment is therefore followed. The species is replaced in the Southern Caucasus by M. lineata and possibly also by M. glandulosa, both more xeromorphic in habit.

26. M. gracilis McNeill, sp. nov.

Species valde distincta, inter Sectionem

Acutiflorae petalis calycem vix excedentibus (nec multo longioribus) singulare; probaliter affinis M. bieberstejnii sed sepalis brevioribus et pedicellis patentibus differt.

Planta gracilis laxe caespitosa glabra (praeter summos pedicellos). Caudiculi tenues 0.25-0.5mm. diam. in caules floriferos transientes. (Caules steriles ut videtur absentes). Caules floriferi 10-15cm. alti, jugis foliorum 3-5 turiones steriles 2-6 foliatos interdum subtendentibus praediti, inflorescentias terminales 3-5-florati nec non saepe laterales 1-2 florati gerentes. Folia anguste linearia 5-12mm. longa trinervia. Inflorescentia laxissima inaequaliter dichasialis; bracteae anguste triangulares, herbaceae, prominente trinervia; pedicelli late patentes, 15-25mm. longi, in summi sparse et minute glanduloso-puberuli. Sepala c. 2.5mm. longa, lanceolata, acuminata, prominente et ± aeque trinervia; extimum anguste lanceolatum (latitudine c. 5-plo longius) anguste membranaceo-marginatum; intimum lanceolatum (latitudine c. triplo longius) late membranaceo-marginatum. Petala lanceolata (nec oblanceolata) sepali sublongiora. Stamina 10; filamenta 1.8-2.0mm. longa; antherae flavae, 0.30-0.35mm. longae et c. 0.25mm. latae. Styli 3. Capsula anguste ovoidea calyce excedens ad apicem in valvis (?3-)4 dehiscens (capsula immatura lineis dehiscentia tantum 3 praedita). Semina (immatura) ut videtur c. 0.6 diam., obscure tuberculata, prominente papillosa vel echinata.

Typus: TURKEY: Paphlagonia: "Prov. Kastamonu: Kure - Inebolu, 2400 ft. [730m.]. Ledges of metamorphic rocks. Fl. white. 7 June 1954", Davis 21616. holo. E!, iso. K!

Geographical distribution: Endemic.

Discussion: This slender plant, known only from the type gathering, is unique in Section Acutiflorae in having petals scarcely longer than the calyx (as in Section Tryphane). In all other characters it is however clearly referable to Section Acutiflorae. Only a few capsules have ripened on Davis' specimen but each is clearly opening by four valves, apparently naturally and not because of pressure in drying. Only three styles are present, however, and in immature capsules only three lines of dehiscence can be discerned. It would appear that one of the valves is much larger than the other two and that a secondary splitting occurs in it possible due to differential contraction. It is not possible to say whether this is the normal condition in the species, an abnormality confined to this specimen, or just something associated with the drying of immature capsules.

27. M. aucheriana (Boiss.) Bornm. in Beih. bot. Zbl. 27 (2) : 318 (1910).

Syn.: ?Arenaria aucheriana Boiss., Diagn. Fl. Orient. ser.1 1 : 50 (1842).

?Alsine aucheriana (Boiss.) Fenzl in Boiss., l.c. ser.1 8 : 100 (1849).

?Alsine aucheriana var. procera Fenzl ex Boiss., Fl. Orient. 1 : 678 (1867).

M. escalarae Pau in Trab. Mus. Cienc. nat. Madr. (Bot.) 14 : 9 (1918).

Type: IRAN: (?Southern Zagros): in monte Zerde (Zerdakou), Aucher-Eloy. 606. holo. G, iso. K!

Specimens seen:

IRAN:-

Northern Zagros:- Gulpaigan (Mt. Elwend), Strauss 20.6.1909 (JE).

Southern Zagros:- "Bakhtiari Country", Watt 13068. Kuh-Daena, Kotschy 773 (type of var. procera).

? ? :- Schuturunkuh, Strauss 25.6.1905, 25.6.1905 (as var. procera) (JE), 8.9.1906 (JE), 8.9.1906 (as var. procera) (JE), 8.1903, (as var. procera) (JE). Kuh Anstichek(?), Strauss 26.6.1909 (JE) (approaches M. lineata). Kuh i Casawend, Strauss 1.7.1909 (JE) (approaches M. lineata).

Geographical distribution: Endemic. (Plants from Turkmenistan described as Als. aucheriana var. glandulosa are the basis of Schischkin's M. litwinowii - cf. Discussion of M. lineata).

Biology: A densely caespitose mountain plant. Flowers July - August.

Discussion: M. aucheriana replaces M. lineata in South-west Iran (the southern part of the Zagros range). Two Strauss specimens (whose origin could not be located) which have the dense caespitose habit of M. aucheriana resemble M. lineata closely in leaf form. The var. procera seems no more than a tall variant of the typical form and the two have been collected from the same locality. Even tall large-leaved plants of M. aucheriana have usually more fleshy leaves and shorter sepals than M. lineata. (cf. fig. 31)

28. M. lineata Bornm. in Beih. bot. Zbl. 27 (2) : 318 (1910).

Syn.: (!)"Arenaria lineata" C.A. Meyer in Ledebour, Fl. Ross. 1 : 351 (1842), pro syn.

(!)Alsine juniperina var. lineata C.A. Mey. ex Boiss., Fl. Orient. 1 : 677 (1867) (" ε ") (nom. illeg.), pro parte, "Als. heldreichiana" (≡ Als. villarsii var. stricta) excl.

Type: U.S.S.R.: Azerbaijan: ditionis Talysch, C.A. Meyer. holo. LE (photo.!).

Specimens seen:

No locality:- Bunge in Lehmann Reliq. bot. 214 (K).

TURKEY:-

N.E. Armenia:- Mt. Ararat (Agri Dağ), Lac Kup göl, Robb (?) 651 (8.8.1871) (as Als. villarsii var. villosula).

U.S.S.R.:-

Armenia:- Nachsrespublica (Nakhichevan): nr. Negram, Prilipno 24.8.1933 (as M. biebersteinii) (S); Shahbuzskii, Baplavo(?), 2100m., LE 27.5.1957 (leg. Grossheim et al.).

'IRAQ:-

Erbil:- Ser Kurawa, 3100m., BAG 9746 (leg. Gillett). Koda nr. Haji Omran, 2700m., BAG 9203 (leg. Rawi). Arl Gird Dagh, BAG 3073 (leg. Guest) (3350m.), 12366 (leg. Gillett) (3600m.). ? Chia-i-Mandali, 2740m., BAG 3060 (leg. Guest) (approaches M. aucheriana).

IRAN:-

Azerbaijan:- no locality, Aucher-Eloy 4292. ?Totschal, 3350m.,

Lindsay 505 (BM). ?Wishon Dagh, Gilliat-Smith (2374?) (seed no. K155/1928) (as Arenaria gypsophiloides) (K). ?Takhi-i-Suleiman Pass, 2440m. Trott 75.

Caspian Sea:- Mazanderan: R. Talar between Gaduk and Abbasabad Ridges, 1800m., Rechinger 1992; Kudjur: M. Ulodj, 3200-3400m., Rechinger 6534; N. slopes of Kandavan Ridge, 2600-3000m., Rechinger 6755; R. Čalus, 2400m., Rechinger 908. ?M. Totschal nr. Scheher-istanek, 2200m., Bornmüller 6415. ?W. Elbrus nr. Asadbar, 2440m., Kotschy 201 & 467 (one sheet). Mt. Elbrus, nr. Passgala, Kotschy 220 &201a (one sheet), 220 (BM), 201a (BM). ?Near Schahrud, Bunge 16.5.1858. ?Shahrud-Bustam: S. slopes of Mt. Shahvar above Nekarman (Nigarman), Rechinger 5875 (2300m.), 5995 (2700m.), Khosh-Jaila Ridge, c. 70km. E. of Shahrud, 2000-2200m., Rechinger 5424.

Northern Zagros:- Hamadan: M. Elwend, Strauss 3.5.1902 (inflorescence very lax - approaches M. aucheriana ?), Pichler (1882).

Tehran:- Mt. Demavend, Aucher-Eloy 4292, Bornmüller 6419 (3700m.)

? ? :- nr. Sivik, 2285m., Cowan & Darlington 2335.

Other records: South Transcaucasia, Nakhichevan(!), Karabakh and Zuvana (Grossheim, 1949).

Geographical distribution: Probably occurs in W. Afghanistan but replaced to the east by M. afghanica and M. kashmirica, otherwise only in the area. Records from Turkmenistan of this species or M. aucheriana are referred by Schischkin (in Komarov, 1936) to M. litwinowii. The

Crimean plants sometimes referred to M. lineata seem quite distinct (M. taurica (Stev.) Schischk.)

Biology: Robust caespitose plants of rocky mountain slopes. Recorded between 1800 and 3700m. Flowers June - July.

Discussion: M. lineata is widespread from Mt. Ararat in the eastern border of Turkey across Southern Transcaucasia and Northern Iran probably stretching into Western Afghanistan. Round it, in all directions, there is a more or less gradual replacement by other species of the series. To the west in Turkish Armenia is the endemic M. glandulosa with semi-terete more fasciculate leaves and a lax spreading inflorescence. To the south in Turkish Kurdistan direct contact is made with the more pungent-leaved M. juniperina which is widespread throughout Turkey, the Levant and Greece. In Southern Iran M. lineata appears to be replaced by M. aucheriana and in the Northern Zagros Mountains and 'Iraqi Kurdistan somewhat intermediate forms are to be found. A more abrupt separation occurs on the north-western side where M. lineata is common on the Transcaucasian Mountains whereas M. biebersteinii is confined to the Caucasus range itself. The relationships of the plants growing to the north-east in Turkmenia and to the east in Afghanistan, Tien Shan-Altai and Kashmir are very confused, and it may be that further investigation would show that M. lineata could only subspecifically be separated from "species" such as M. litwinowii, M. afghanica, M. jacutica, M. kashmirica and Arenaria foliosa. Type material of all these except M. jacutica has been seen and M. lineata in its erect compact inflorescence and rigid linear leaves is certainly taxonomically distinct, and for the present it seems best to maintain

its specific status. On the better known western side of its range there can be no doubt that it is specifically separable from its close relatives, M. aucheriana, M. juniperina and M. glandulosa. (cf. fig. 31)

The epithet lineata first appeared in synonymy in Ledebour's "Flora Rossica" (1842) where it was attributed to C.A. Meyer. The first valid publication was at varietal rank (under Als. juniperina) in Boissier's "Flora Orientalis" (1867), but was illegitimate in that "Alsine heldreichiana" (an invalid name identical with the earlier valid and legitimate Als. villarsii var. stricta) was cited as a synonym. Bornmüller's (1910) new combination in Minuartia, referring back to Boissier's brief description, is thus the first legitimate publication of the name.

29. M. juniperina (L.) Maire et Petitm., Etude Fl. Grece 4 : 48 (1908).

Syn.: Arenaria juniperina L., Mantissa 1 : 72 (1767), non sec Pursh, nec Dolophragma juniperinum (D. Don) Fenzl.

Alsine juniperina (L.) Wahlb., Fl. Lapp. 129 (1812), non Cherleria juniperina D. Don.

"Arenaria acicularis" Fisch. ex Ser. in D.C., Prodr. 1 : 403 (1824), pro syn.

Arenaria nodosa Bory et Chaub., Fl. Pelop. 28 t.15 (1838).

Als. juniperina var. tenuifolia Boiss., Fl. Orient. 1 : 677 (1867) ("δ").

Original citation: "Habitat..." ; Specimen as Arenaria juniperina in Herb. LINN!

Specimens seen:

GREECE:-

Epirus (Albanian border):- Zagorion: Mt. Gamila (Vradeton), Baldacci (1896) 105 (WU).

Peloponnese:- M. Kyllenes (Ziria), Orphanides 23 (6/18.7.1851) (2195m.), 18.7.187- (2195m.), Grebenchikoff 24.7.1938 (above Trikkala, 2200m.), Thompson 1182 (2376m.). Mt. Chelmos (Aroania), St. Lager 3.7.1896 (nr. Sudena), Dörfler Fl. Graeca 396 (leg. Leonis), Bornmüller (1926) 226 (1800m.), 226 (1900m.), Atchley 2124 (1830m.), Lemperg 488 Grebenchikoff 71 (30.6.1938) (above Kalavryta, 2100m.). Mt. Taygetus, Heldreich 8.1844. Herb. Graec. norm. 1523 (9.7.1899) (1500-2000m.), Pichler 6.1876 (Pentaplu), Atchley 2234 (2285m.), Guiseppi 45 (2440m.).

TURKEY:-

No locality:- "Turkey, Lady Liston.

Pontus:- Djimil (Cimil), 1800m., Balansa 17.8.1866. Giresun: Balabandağlari (Kilinc Tepe) above Tamdere, 2700m., Davis 20596.

Paphlagonia:- Kastambuli (Kastamonu): Tossia: Szu-utsehlin-dere, Sintenis 3670, Tossia, Buyuk Ilkaz dagh, Sintenis 3790.

Bithynia:- Olympus (Ulu Dağ), Clementi 18.8.1850, Montbret no date (as Ar. liniflora), 14.7.1833 (as Arenaria), Aucher-Eloy 583, Nöe 449, Pichler 7.1883 (BM).

Lydia:- no locality ("Lydiae montes"), Boissier 6.1842. M. Sipylos (Manisa Dağ), Aucher-Eloy 584, Montbret, Balansa (1854) 116 (above Magnesia = Manisa), Bornmüller 9172 (900-1000m.).

Caria:- No locality ("Caria"), Pinard (c.1843).

Lycia:- Elmalu, Bourgeau (1860) 33. Beidagh, Pichler 120. Muğla: Girdev Dağ above Bel yayla, 2200m., Davis 13972. Antalya: Çalbali Dağ above Tepe delen yayla, 1800m., Davis 15325; Kermen: Tahtali Dağ, 2200m., Davis 15086 (K).

Cilicia:- Cilician Taurus, Kotschy 178, 56 (summer 1836). Karli Boghas, Siehe (1895) 280. Cilician Gates, 915m., Balls 1217. Boulgarmaden, Balansa 8.1855. Bulgar Magara, Kotschy (as Als. juniperina var. nitida - ?syntype of var. tenuifolia) (BM). Burujik, 1525m., Balls 1217a.

Amanus:- Akma Dagh, (nr. Beilan), 1830m., Kotschy 68a, Post 13.6.1884 (BM).

Phrygia:- Sultandagh, above Tschai, 2200m., Bornmüller 4205. Kutahya: Gediz: Saphane Dağ, 1900m., Davis 18452.

Pisidia:- Davros dagh, Heldreich 6.1845.

Lycaonia:- Lycaonian Taurus: nr. Derinas, 1800m., Siehe (1907) 158.

Galatia:- Ankara: Ravli - Kalecik, Davis 21443; Elma Dagh, 1800m. Kotte 94, Tahis Dağı, 1500m., Bilger 223. Amasya: Ak dagh, 1700-1900m., Bornmüller 793. ?Pontus australis: Yildis dagh, 2300m., Bornmüller 1661.

Cappadocia:- "Capp. Orient.", Aucher-Eloy 583 bis. Erciyas Dağ (Mt. Argaeus), Siehe (1898) 310 (2600m.), Bornmüller 3003 (2100m.), Kotschy (1859) 196 (above Tschomakli, 1830m.), Balansa (1856) 1056 bis, Bağda 224 (Kaya dili, 2500m.). Niğde: Hasan Dağ nr. Taspinar Yayla, 200m. (?), Davis 18998A. Kayseri: Bakir Dağ at Akolukyayla above Kisge, 2000m., Davis 19452.

Cataonia:- Maraş: Goksun: Binboğa Dağ above Yalak 2300 - 2400m., Davis 20120; Hobek Dağ, 2000m., Davis 20208. Maraş: Cardak: Berit Dağ, 2000-2100m., Davis 20369. Kayseri/Malatya: E. side of Pass, Pinarbaşi-Gürün, 1830m., Davis 21966. Malatya: Gürün-Malatya, 65 km. from Malatya, 1400m., McNeill 444. Akher (Ahir) Dagh, 1830m., Haradjian 1633. Malatya: Erkenek, 1525m., Balls 2317.

S.W. Armenia:- ?Egin: Jola, Sintenis 2499.

N.E. Armenia:- Gümüşane: Argyridagh, Sintenis 5946, Karagoel-ldagh, Shalgan, Sintenis 7279, nr. Bayburt, Bourgeau (1862) 57. ?Spikordagh, Sintenis 1170.

Kurdistan:- Bitlis: S. slopes of Kambos Dağ, above Tutu, 2200m., McNeill 623. Hakâri: Cilo Dağ in Dizderesi, 1770m., Davis 24002 (very slender plant). Van: Başkale - Van, Malanduran Dağ, 25 km. from Başkale, 3000m., McNeill 716 (male sterile, approaches, ? hybrid with, M. umbellulifrera var. kurdica).

? ? ? :- Ali Dagh, Talas, 1675m., Balls 12176. Kuru Dagh, Zeytun, 1615m., Balls 1038.

U.S.S.R.:-

Armenia:- No locality ("Armenia"), Szovits. "Armenia Rossica", Seidlitz, Bunge.

LEBANON:-

Northern Lebanon:- Hasroun, Boissier 6.18--, Blanche 30.6.1866 (labelled "Als. tenuifolia, Tripoli" at E.). J. Sanin, Bornmiller (1897) 199 (2000m.), Mooney 4525 (1800m.). M. Makmel, Boissier 7.1846, Ehrenberg 7.1822. Qornat Aruba, Davis 6272A (infected with gall insect). Qornat Sauda, 2895-3050m., Davis 9815. Cedars, Post 735 (30.8.1875)(BM). Bscherre, 1530m., Meinertzhagen 13.5.1933. Famm-ul-Mizab, Post 14.8.1865. ?"Lebanon", 2745m., Hooker & Hanbury. "Libanus", Boissier 6.1846 (as Als. juniperina var. tenuifolia - syntype ?). "Liban", Aucher-Eloy 583 ter.

Antilebanon:- W. slopes, Ain Yunun, 1800m., Bornmüller 11465. Baalbek - Talaat Musa, 1980m., Davis 6556A. Hursh Imarra between Talaat Musa and Bir Jebab, 2285m., Davis 9769. Near Zebdaine (Zebedan) 1830-2440m., Kotschy 109 & 308 (one sheet). Dschard Arascha, 2745m., Kotschy 308 (BM).

Southern Lebanon:- Mt. Hermon, Lowne (1863-64) (1220m.), (1863-64) (summit, 1830-2440m.), Post, 8.10.1865 (summit), 12.7.1890 (summit) Plantae Palaestinae 3964 (leg. Gabieleth 11.8.1929) (summit).

ISRAEL:-

Galilee:- Nazareth, Roth (1858).

'IRAQ:-

Mosul:- Natina, 1800m., BAG 8740 (leg. Rawi) (approaches close

to M. lineata).

IRAN:-

Kordestan & Zanjan:- ? M. Dalachani (near Avroman?), Haussknecht 9.1867.

Other records: GREECE: Thessaly: Kalabaka, Halacsy (1901) p.239.

Geographical distribution: Endemic (but Epirus record, Mt. Gamila, may be within Albania).

Biology: A mountain plant forming rather spiny clumps. Altitudinal range 900-3000m. Flowers June - July.

30. M. glandulosa (Boiss. et Huet) Bornm. Symb. Fl. Anatol. in Fedde Rep. Beih. 89 : 347 (1940).

Syn.: !Als. glandulosa Boiss. et Huet in Boiss., Diagn. Pl. Orient. ser.2 5 : 61 (1856), non Dulac (1867).

!Als. juniperina var. grandiflora Boiss. et Huet in Boiss., l.c. 61 (1856).

Als. juniperina var. glandulosa (Boiss. & Huet) Boiss., Fl. Orient. 1 : 677 (1867) (" β ").

M. juniperina var. glandulosa (Boiss. & Huet) Schischk. in Trans. Tomsk. Univ. (Ber. Tomsk Staats Univ.; Izv. Imp. Tomsk Univ.) 80 : 443 (1928).

Type: TURKEY: N.E. Armenia: "Gueze versus Techdagh supra Erzerum,

7-8000 ft." (2135-2440m.), Huet du Pavillon 7.1853. holo. G, iso. BM!, K!

Specimens seen:

TURKEY:-

S.W. Armenia:- Tunceli: above Pulumur, 1850m., Davis 29296 (approaches M. juniperina).

N.E. Armenia:- Erzerum, Calvert (as Als. recurva) (JE). Erzerum: Horasan - Karaurgan, Davis 29460 (1900m.), 30750 (1850m.). Khash-Khash-Dagh, Kotzsch (1934) (JE). ?Agherov Dağ, S. of Gesandasht, Frödin 1419 (24.6.1926) (JE).

Geographical distribution: Endemic.

Biology: A loosely caespitose plant with stiff but not very spiny leaves. Recorded between 1850-1900m. Flowers June - July.

Discussion: M. glandulosa parallels M. lineata in being a less spiny eastward replacement of M. juniperina. It differs, however, from that species in its semi-terete fasciculate leaves which spread forward and not horizontally and in many respects shows an approach to M. umbellulifera in Series Umbelluliferae (particularly to var. kurdica).

Boissier, in Flora Orientalis, reduced the species to a variety of juniperina and Mattfeld includes it under that species in his monograph (1922). From notes on Herb. Bornmüller specimens from Jena it appears that Mattfeld realised its distinctiveness later, proposing the new combination in a letter to Bornmüller (1925). This was later published by Bornmüller in a note in the Symbolae.

Discussion of Series *Acutiflorae*

Series *Acutiflorae* exhibits within the Orient a very marked pattern of geographical replacement. In most cases the species, although fairly uniform in the main part of their range, are not well demarcated from their relatives in adjoining regions. For an account of the distribution of the species cf. Discussion under *M. lineata.* (also fig. 31)

Series Pichleriae Mattf.

Pedicels of first flower spreading; fascicular leaves spreading widely; staminal glands prominent (0.25mm. long) forming a single narrow finger-like process with an apical nectar pit. 31. M. pichleri

Pedicels all ± erect; fascicular leaves scarcely to somewhat spreading; staminal glands obscure in the form of a broad groove at the base of the stamen 32. M. rimarum

31. M. pichleri (Boiss.) Maire et Petitm., Etude Fl. Graec. 4 : 49 (1908).
Syn.: !Alsine pichleri Boiss., Fl. Orient. Suppl. 113 (1888).

Type: GREECE: Peloponnese: "in fissuris rupium montis Kyllenes Peloponnesi 4000'" (1220m.), Pichler 7.1876 (sub Arenaria cretica). holo. G, iso. K!

Specimens seen:

GREECE:-

Peloponnese:- Mt. Taygetus, Pichler 6.5.1876 (1220m.), 6.1876 (Pentaplü).

Geographical distribution: Endemic.

Biology: A densely caespitose plant of rock cracks on mountains. In fruit May? - July.

32. M. rimarum (Boiss. & Bal.) Mattf. in Bot. Jb. 57 Beibl. 126 : 32 (1921).

Key to varieties

Inflorescence 1-2(-3) flowered; petals oblanceolate, often narrowly so (2.5-4.5 times as long as broad); leaves somewhat spreading, subglabrous to glandular-pubescent (never very densely so) (i). var. rimarum

Inflorescence (1-)3-5 flowered; petals obovate (c. twice as long as broad); leaves not or scarcely spreading, very densely glandular-pubescent (ii). var. multiflora

(i). var. rimarum

Syn.: !Alsine villarsii var. stricta Boiss. et Heldr. in Boiss., Diagn. Pl. Orient. ser.1 8 : 100 (1849).

!"Alsine heldreichiana" Boiss., l.c. (1849), pro syn.

!Alsine rimarum Boiss. et. Bal. in Boiss., Fl. Orient. 1 : 678 (1867).

!Arenaria rimarum (Boiss. & Bal.) Fernald in Rhodora 21 : 6 (1919) (Contr. Gray Herb. Harv. 57 : 6).

!M. heldreichiana Boiss. ex Mattf. in Bot. Jb. 57 Beibl. 126 : 32 (1921) (nom. illeg.), pro parte minore sed typo incl.

Type: TURKEY: Cilicia: "in fissuris rupium Tauri Cilicici supra Bulgharmaaden" 18.7.1855, Balansa. holo. G, iso. E!, K!

Specimens seen:

TURKEY:-

Pamphylia:- Antalya ("Isauria"): Geyik Dağ (Ghei Dagh), Heldreich 7.1845 (BM)(K) (type of stricta and heldreichiana), Davis 14506 (2440m.), 14573 (2590m.), Ak Dağ (S. of Geyik Dağ), 2400m., Davis 14357.

Cilicia:- no locality, Siehe (1896) 542. Gisyl Deppe (Kisil tepe), 2440m., Kotschy 130e 253b (one sheet) (as Als. villarsii var. stricta and with Arenaria kotschyana and M. erythrosepala at K).

Cataonia:- Adana: Saimbeyli: Bozoglan Dağ above Obruk Yayla, 2100m., Davis 19738. Maraş: Çardak: Berit Dağ, Davis 20291 (above Arpa Çukuru Yayla, 2700m.), 20359 (2800m.).

S.W. Armenia:- Tunceli: Munzur Dağ above Ovacik, Davis 31239 (2800m.), 31328 (2400m.). Erzincan: Keşiş Dağ above Cimin, 2800-2900m., Davis 31802.

Geographical distribution: Endemic.

(ii). var. multiflora McNeill, var. nov.

A varietate typica inflorescentiis (1-)3-5-floris petalis obovatis (latitudine duplo longiore) foliis fasciculatis non patentibus planta ex toto densissime glanduloso-pubescenti differt.

Planta nana, 4-6cm. alta, dense caespitosa, caudice lignoso crasso et caudiculibus lignosis praedita. Caules inflorescentiam terminalem et

interdum inflorescentiam lateralem gerentes. Nervi foliorum, bractearum et sepalorum valde prominentes.

Typus: TURKEY: Cataonia: "Prov. Maraş, distr. Goksun: Binboğa dağ, on Isik dag above Karli Y., 2700m. 15 July 1952", Davis, Dodds & Çetik (D.19987). holo. E!, iso. K!

Geographical distribution: Endemic.

Biology (of species): Densely caespitose plants of rock crevices on mountains. Var. rimarum has more prominent slender caudiculi giving a densely matter appearance. Recorded between 2100 and 2900m. Flowers July.

Discussion: A certain amount of confusion has existed between this species and M. umbellulifera, particularly with regard to the plants from the Isaurian Taurus, which include the type of Als. villarsii var. stricta Boiss. & Heldr. (≡ M. heldreichiana Mattf.). Although having narrower more setaceous leaves than the type of M. rimarum from Cilicia, the Isaurian plants are undoubtedly conspecific with it; intermediate conditions of leaf shape are to be found in the plants collected by Davis from Cataonia and S.W. Armenia, making M. rimarum var. rimarum fairly homogeneous.

The plants from Binboğa Dağ are more dwarf than any others seen and although distinguished by a number of characters that might suggest recognition at specific rank, the possibility that the single gathering merely represents an aberrant stunted form of M. rimarum cannot be ruled out. In the absence of any other specimens it has been though best to describe it as a variety of M. rimarum - var. multiflora.

Series Umbelluliferae McNeill

One species.

33. M. umbellulifera (Boiss.) McNeill, comb. nov.: Alsine umbellulifera Boiss., Diagn. Pl. Orient. ser.2 5 : 61 (1856).

Key to subspecies and varieties

1a. Petals narrowly oblanceolate, 3.5-5.0 times as long as broad; inflorescence never contracted into an umbellate cluster (pedicels 8-30mm. long) :

2a. Inflorescence 1(-2)-flowered, 1-2cm. tall; seeds fimbriate on the dorsal ridge (papillae c. 120 μ long); sepals lanceolate (> 3 times as long as broad) A. subsp. fimbriata

2b. Inflorescence (1-)3-6-flowered, 4-11cm. tall; seeds obscurely tuberculate throughout; sepals ovate-lanceolate (2.5-3.0 times as long as broad) B. subsp. pontica

1b. Petals obovate, 1.5-2.5(-3.0) times as long as broad:

3a. Sepals lanceolate, c. 3.5 times as long as broad; seeds echinate on the dorsal ridge (papillae c. 80 μ long); inflorescence a 1-3 flowered monochasium (pedicels 5-12mm. long) C. subsp. salbacica

3b. Sepals ovate to ovate-lanceolate, 2 to 2.5 times as long as broad; seeds obscurely tuberculate throughout (those of var. kurdica unknown) D. subsp. umbellulifera

4a. Inflorescence a (2-)3(-4) flowered umbel (rarely flowers solitary), pedicels 2-8(-10)mm. long; petals usually narrowly obovate (c. 2.5 times as long as broad); sepals frequently ovate-lanceolate (i). var. umbellulifera

4b. Inflorescence a (1-)2-4(-6) flowered monochasium, pedicels 8-15mm. long; petals broadly obovate, (c. 1.5-2.0 times as long as broad); sepals always ovate (ii). var. kurdica

A. subsp. fimbriata McNeill, subsp. nov.

Inter affines planta densissime caespitosa inflorescentiis humilis 1(-2)-floris sepalis lanceolatis petalis anguste oblanceolatis seminibus fimbriatis distinguit.

Planta densissime caespitosa ex toto sparse glanduloso-puberula. Folia subtrinervia, 3-5mm. longa. Inflorescentia 1-2cm. alta, uniflora vel rarissime biflora; bracteae ± uninerviae; pedicellus 7-12mm. longus. Sepala 4-4.5mm. longa, lanceolata (latitudine > 3-plo longiora). Petala c. 6mm. longa, anguste oblanceolata (latitudine 4-5-plo longiora), longe attenuata. Capsula calyce subaequans. Semina reniformia, c.1mm. diam., in jugo dorsali fimbriata; papillae (fimbriam formantibus) c. 120μ longae.

Typus: TURKEY: Caria: "Mughla: Sandras dagh, between Gokce ova and summit, 2000m. fls. white, 23.7.1947", P.H. Davis 13502. holo. E!, iso. K!

Geographical distribution: Endemic.

B. subsp. pontica (Bornm.) McNeill, comb. et stat. nov.

Syn.: !Alsine pontica Bornm. in Mitt. Thur. bot. Ver. ser.2 20 : 9 (1905).

!M. pontica (Bornm.) Mattf. in Bot. Jb. 57 Beibl. 126 : 32 (1921).

Syntypes: TURKEY: Galatia: 1) "Amasia: in regione alpina montis Ak-dagh, 1600-1900m., 9.VII.1889", Bornmüller 1419. 2) "Pontus Galaticus: in fissuris rupium m. Sana-dagh, 1600m., 15.V.1890", Bornmüller 2856. (sub Alsine juniperina var. glandulosa). holo. JE!, iso. BM!, K!

Specimen seen:

TURKEY:-

Galatia:- Amasya, Manisadjan 922.

Geographical distribution: Endemic.

C. subsp. salbacica McNeill, subsp. nov.

Inter affines inflorescentiis monochasialibus 1-3 floris sublonge pedicellatis sepalis lanceolatis petalis obovatis seminibus echinatis distinguit; a subsp. fimbriata cui proxima petalis obovatis inflorescentiis paucifloris (nec unifloris) et planta subtegetiformi (nec dense caespitosa) divergit.

Planta caespitosa vel subtegetiformis ex toto sparse glanduloso-puberula. Folia subtrinervia, 2-5mm. longa. Inflorescentia 3-5cm. alta, uniflora vel triflora, monochasialis; bracteae subtrinerviae; pedicelli 5-12mm. longi. Sepala lanceolata (latitudine c. 3.5-plo longiora). Petala obovata (latitudine c. 2.5-plo longiora). Capsula calycem excedens. Semina reniformia c. 1mm. diam. in jugo dorsali echinata; papillae c. 80 μ longae.

Typus: TURKEY: Caria: "Denizli: Baba dağ, 1900-2000m., fl. white, 23.8.1950", P.H. Davis 18406. holo. E!, iso. K!

Geographical distribution: Endemic.

D. subsp. umbellulifera (i). var. umbellulifera

Syn.: !Alsine umbellulifera Boiss., Diagn. Fl. Orient. ser.2 5 : 61 (1856).

M. heldreichiana Mattf. in Fedde Rep. Beih. 15 : 162 (1922), pro parte maiore, non "heldreichiana" Boiss. (nomen invalidum).

Type: TURKEY: Cilicia: "Region alpine du Taurus au dessus de Boulgarmaaden, 18 juillet 1855", Balansa. holo. G, iso. K!

Specimens seen:

TURKEY:-

Lycia:- Antalya: Çalbali Dağ, 2100-2200m., Davis 15309.

Cilicia:- (Namrun), Siehe (1895) 156. Kisyltepe above Bulghar Maaden, 2300m., Siehe 539.

Pisidia:- Isparta: Sütçüler ("Isauria"): Dedegol Dağ above Oruz Gaz yayla, 2400m., Davis 15977.

Cappadocia:- Niğde: Ulukisla: Bulgar Dağ between Alihoca and Sari tepe yayla, 2500m., Davis 16539. Sivas: Ak Dagh above Tschepni, 2400m., Siehe (1911) 266.

N.E. Armenia:- Baiburt, Kop Dagh, 2315m., Balls 1780.

Geographical distribution: Endemic.

(ii). var. kurdica McNeill, var. nov.

A var. umbellulifera inflorescentia monochasiali (nec umbellulata) (1-)2-4(-6)-flora longe pedicellata (8-15mm.) petalis late ovatis (latitudine c. 1.5-2.0-plo longiora) sepalis semper ovatis (numquam ovato-lanceolatis).

Typus: TURKEY: Kurdistan: "Bitlis: scree on north slope of crater on Nemrut Dagh, 2600m. Open community - scree rather mobile. Perennial. Fls. white. 12 Aug. 1956", McNeill 593A. holo. E!, iso. K!

Specimens seen:

TURKEY:-

Kurdistan:- Bitlis: Pelli Dağ above Pelli, 3050m., Davis 22494. Van: Şatak (Çatak): Kavuşşahap Dağ, 3200m., Davis 23101.

Geographical distribution: Endemic.

Biology (of species): Plants of rocky places; subsp. fimbriata more densely caespitose than other subspecies, all inhabitants of rock crevices or scree and slightly spreading over the rocks ('subtegetiform'). Flowers July - August (except subsp. pontica, May - June).

Altitudinal records:-

subsp. fimbriata	- 2000m.
subsp. pontica	- 1600-1900m.
subsp. salbacica	- 1900-2000m.
subsp. umbellulifera var. umbellulifera	- 2100-2500m.
subsp. umbellulifera var. kurdica	- 2400-3200m.

Discussion: M. umbellulifera is a rather polymorphic species and one in which it is difficult to assess the correct rank for the recognisably distinct forms. The plants which Mattfeld cited as M. heldreichiana (excluding the type, which represents plants of M. rimarum q.v.) form the typical subspecies and variety of M. umbellulifera. M. pontica is easily distinguished from these plants on a number of characters (cf. key) and were these the only two groups known (as they were to Mattfeld) one would not question their specific distinction. Two gatherings made by Davis, in Caria (on Baba Dağ and Sandras Dağ) show some of these 'distinguishing' characters but in different combinations; similarly plants from Kurdistan have the monochasial inflorescence of pontica along with all the floral characters of umbellulifera sensu stricto.

As a result each of the four main forms (pontica, the Sandras Dağ plant - fimbriata, that from Baba Dağ, ancient Salbacus - salbacica,

and the type) have been accorded subspecific rank. The Kurdistan plants seem closer to the typical form (itself rather variable) than are the others and have been described as a variety (var. kurdica) of subsp. umbellulifera. (Balls' specimen from Bayburt which has been referred to var. umbellulifera is in some respects intermediate). (cf. fig. 33)

Section Tryphane (Fenzl) Hayek

1a. Petals lanceolate (c. 3 times as long as broad), bluntly acute at the apex, rather longer than the sepals (c. 1.1-1.2 times); sepals acute; plant densely caespitose, low-growing (3-7cm. tall), glandular velutinous 34. M. parvulorum

1b. Petals orbicular to ovate or triangular (< twice as long as broad), shorter to slightly longer than the sepals:

2a. Petals acute, broadest near the base (± triangular above the claw), usually shorter than the sepals; sepals often acuminate; plants laxly to densely caespitose, 5-20cm. tall, glaucous to glandular-puberulent 35. M. attica

2b. Petals obtuse, broadest near the middle (usually ± orbicular), about as long as the sepals; sepals often obtuse; plants (in Orient) rather densely caespitose, glandular-puberulent 36. M. verna

34. M. parvulorum Rech. f. in Ark. Bot. 1 : 508 (1951).

Type: LEBANON: Antilebanon: (?Syria: Damascus) "dans les rochers de Maaloula, N.O. de Damas", Mouterde 24. holo. S!

Specimen seen:

LEBANON:-

Antilebanon:- Wursh Imarra between Talaat Musa and Bir Jebab.

. 2250m., Davis 9770.

Geographical distribution: Endemic.

Discussion: Rechinger relates this plant to M. aucheriana and M. rimarum but although possessing some affinity with the latter it is clear from the more copious material collected by Davis that it is best regarded as a member of the M. verna complex. The species which is geographically isolated, is however much more distinctive than most taxa in the affinity of M. verna and seems to link Sections Tryphane and Acutiflorae.

35. M. attica (Boiss. et Sprun.) Vierh. in Verh. Zool.-Bot. Ges. Wien 64 : 269 (1914).

Syn.: Alsine attica Boiss. et Sprun. in Boiss., Diagn. Fl. Orient. ser.1 5 : 84 (1844).

Als. verna var. acutipetala Boiss., Fl. Orient. 1 : 676 (1867) ("β"). (≡ attica).

Arenaria attica (Boiss. & Sprun.) Fernald in Rhodora 21 : 6 (1919) (Contr. Gray Herb. Harv. 57 : 6).

M. verna subsp. attica (Boiss. & Sprun.) Hayek in Öst. bot. Z. 71 : 112 (1922).

M. verna subsp. attica var. cretica Hayek l.c. 112 (1922).

M. idaea (Hal.) Pawlowski in Acta Soc. bot. Polon. 16 : 163 (1939).

Specimens seen:

GREECE:-

Thessaly:- Chaliki, Sintenis (1896) 713 (WU). N. Sporades: Skopelos, Leonis 27.4.-18.5.1896 (WU).

Central Greece:- M. Parnes, 915-1220m., Heldreich Herb. Graec. norm. 1219 (19.4-15.5.1896) (WU). M. Parnassos, 1830m., Heldreich Herb. Graec. norm. 403 (leg. Guicciardi 8.1855). Hymettos, nr. Pankrati, Rechinger 687 (WU). Mt. Pentelikon, nr. Kephisia, Watzl 19.4.1911 (WU).

Peloponnese:- Mt. Taygetos, Adamovic 4.1905.

Crete:- Sphakia: Mt. Gigilos, Volakia, Baldacci (1893) 57 (WU). Amari: Mt. Ida, Baldacci (1893) 177 (WU). Mt. Hag. Pneuma (Aspiorum), Baldacci (1893) 201 (WU). Lessithi: Aphendi Khristos, Dörfler 1070. (WU).

Geographical distribution: Endemic (but the taxon oxypetala from the Carpathians may be conspecific).

Biology: Rather densely caespitose plants of mountains. Flowers May - July.

Discussion: M. attica is the only representative of the M. verna complex found in Central and Southern Greece and Crete. Its acute petals readily distinguish it from all other forms (except M. oxypetala from the Carpathians - cf. Pawlowski 1939) and as a geographically

distinctive taxon it appears to have a good claim to specific recognition. In itself it is rather variable, some Cretan plants (var. cretica Hayek) being very dwarf and similar in facies to M. parvulorum.

36. M. verna (L.) Hiern. in J. Bot. Lond. 37 : 320 (1899).

Syn.: Arenaria verna L., Mantissa 1 : 72 & 514 (1767).

Alsine verna (L) Wahlb., Fl. Lapp. 129 (1812).

Sabulina verna (L.) Reichb., Fl. Germ. Excurs. 788 (1832).

Tryphane verna (L.) Reichb., Ic. Fl. Germ. 5 : 28 (1842).

Alsine thessala Halacsy in Denkr. Akad, Wiss. Wien 61 : 473 (1894).

Alsine verna var. thessala (Halacsy) Halacsy, Consp. Fl. Graec. 1 : 241.

Cherleria verna (L.) Sampaio, Lista Herb. Portug. 81 (1912).

M. verna subsp. ramosissima var. thessala (Halacsy) Hayek in Ost. bot. Z. 71 : 112 (1922).

Type: Specimens in Herb. LINN! (? type).

Specimens seen:

TURKEY:-

Pontus:- Çoruh (Artvin): Şavval Tepe above Murgul, 2750m., Davis 32303.

N.E. Armenia:- Sakarsu, N. of Baiburt, 2745m., Balls 1832.

Other records: M. verna is also recorded from Thessaly (var. thessala) (cf. Hayek, 1922), and the Caucasus (cf. Grossheim, 1949).

Geographical distribution: Widespread throughout North and Central Europe and across C. & E. Asia to N. America.

Biology: Orient plants low-growing and densely caespitose with weakly developed root system (? short-lived perennials). In flower July - August.

Discussion: M. verna is an extremely variable species which reaches the southern limit of its range in the more mesophytic parts of the Orient region. The distinctive acute-petalled M. attica, confined to Greece, has been distinguished from M. verna, but otherwise no attempt at a critical assessment of the variation has been made.

Hayek (1922) attempts to provide a natural arrangement of the group and more recently Pawlowski (1939) has investigated the taxonomy of some Balkan forms.

Section Minuartia Subsection Minuartia

Series Montanae Mattf.

1a. Flowers distinctly pedicellate (> 2mm. long); nerves of sepals and leaves plane without prominent clusters of calcium oxalate crystals (rarely with slightly prominent clusters):

2a. Sepals ovate-lanceolate, broadly acute with a mucronate tip; calyx truncate at the base; partial inflorescences of basically cincinnate clusters with the flowers erect, spreading and deflexed; seeds echinate, the 'cells' of the dorsal ridge bearing long papillae (c. 50 μ) 42. M. globulosa

2b. Sepals linear-lanceolate, narrowly acute to long acuminate; calyx usually rounded at the base, sometimes rather truncate; partial inflorescences usually of regular dichasia with flowers ± erect; seeds plane to rugulose, papillae short (< 20 μ) or lacking:

3a. Sepals 3 - 4 (- 4.5) mm. long; calyx rather truncate at the base; petals about 0.3 times as long as sepals; leaves 3-nerved with the lateral nerves marginal; seeds obscurely reticulate without papillose marking on any of the 'cells'; plants slender, low-growing (up to 5cm. tall), branching from the base; stems prostrate to ascending 41. M. sintenisii

3b. Sepals (4.5-) 5-9mm. long; leaves (3-) 5-7 nerved with a membranous margin; seeds rugulose, each of the 'cells'

('tubercles') with round or elongate markings in the centre, developed into papillose processes on the dorsal ridge; plants rather stout and relatively tall (to 15cm.) or if dwarfed, little branched and the branches all ± erect:

4a. Sepals 4.5-5.5(-6.0) mm. long; calyx rounded at the base; petals 0.4-0.6 times as long as sepals; inflorescence rather dense but with the flowers all ± equally distant; 'cells' (tubercles) of the seed with a very short central papilla (appearing as a spot marking); plant very densely glandular pubescent 37. M. multinervis

(cf. also 38. M. akinfijewii)

4b. Sepals 5.5-9.0mm. long; petals < 0.35 times as long as sepals; inflorescence with the lower flowers sometimes long-pedicelled and distinct but with at least the upper in closely overlapping cymose clusters; 'cells' (tubercles) of the seed with a central elongate marking; plant densely pubescent, some of the hairs glandular:

5a. Leaves and sepals with somewhat prominent calcium oxalate crystals; calyx rather truncate at the base; sepals subgibbous; low-growing plants (up to 3cm.) with a dense inflorescence and the facies of M. montana or intermedia 40. M. sandwithii

5b. Leaves and sepals with no visible calcium oxalate crystals; calyx rounded at the base with sepals not

enlarged; plants variable in habit (2-15cm. tall), the lower flowers often distinct. 38. M. meyeri

1b. Flowers sessile or subsessile (pedicels < 2mm.); nerves of the leaves and sepals with prominent clusters of calcium oxalate crystals (appearing as disc-like swellings, visible with a lens):

6a. Calyx rounded at the base; lower bracts almost as long as the leaves, greatly exceeding the entire inflorescence; stems short, 2-6cm., the partial inflorescences (each a dense cluster of flowers) closely crowded together; petals absent (in Orient plants) or when present (W. Mediterranean plants) < 0.1 times as long as sepals; staminal glands 5, in the form of a single groove in front of the outer stamens; seeds many (>6 per capsule), 0.65-0.80mm. long diam. 43. M. montana

6b. Calyx truncate at the base; leaves and bracts becoming gradually shorter up the stem, at least the upper flowers surmounting the bracts (rarely shorter than bracts in M. intermedia); stems frequently elongate (4-25cm. tall), the partial inflorescences in remote to crowded dichasial clusters up the stem; petals always present 0.1-0.7 times as long as sepals; seeds few (2-5 per capsule):

7a. Stems clothed with rather crisp hairs; sepals glabrous or very sparsely glandular-pubescent near the margins; petals very short, 0.1-0.25 times as long as sepals; staminal glands bifurcate appearing as 10 'finger-like' structures,

a pair lying one on each side of the outer stamens; seeds 0.70-0.85mm. long. diam. 44. M. intermedia

7b. Stems pruinose-velutinous with slender hairs; sepals very finely and densely glandular-pubescent; petals short (ssp. damascena) or more usually long (0.5-0.7 times as long as sepals); staminal glands single, appearing as a swelling at the base of each of the 5 outer stamens; seeds usually 0.90-1.00mm. long. diam. (occasionally 0.70-0.85 in ssp. damascena) 45. M. decipiens

37. M. multinervis (Boiss.) Bornm. in Beih. bot. Zbl. 33 (2) : 279 (1915).

Syn.: Alsine multinervis Boiss., Fl. Orient. 1 : 685 (1867).

Type: TURKEY: Cappadocia: "mons Alidagh Cappadociae" ("Ali Dagh a' 7 kilom. au S.E. de Césarée (Cappadoce) 16 août 1856"), Balansa. holo. G! iso. K!

Specimens seen:

TURKEY:-

Caria:- Cadmus (Honaz dağ) above Denisleh, Boissier (G).

Lycia:- Muğla: Girdev dağ, S. side, 2200m., Davis 13844. Antalya: Çalbali dağ nr. Tepe delen yayla, Davis 15317.

Phrygia:- Boulgas dagh, Balansa 336 (G).

Galatia:- Sana-dagh nr. Amasia, 900-1000m., Bornmüller 989 (JE).

S.W. Armenia:- Elazig: N. side of Hazar Göl, 1200m., Davis 28995 (& 28994B).

Other records: TURKEY: Phrygia: Sultandagh: nr. Aksehir and Yasiandagh (Bornmüller (1909) p.450).

Geographical distribution: Endemic.

Biology: Recorded between 900 & 2200m., in wooded or open ground. Flowers June - August.

Discussion: M. multinervis can as a rule be readily distinguished by the form of its inflorescence, clustered partial inflorescences which are so typical of Section Minuartia being entirely absent. Because of this and its only slightly indurate calyx it is probably the least specialised member of the section, and rather resembles a very robust member of Section Sabulina. It is, however, very closely related to M. meyeri, and some smaller plants of that species (Boissier's Alsine brevis) can easily be confused with it at first glance. Mattfeld was unable to examine material of M. multinervis and from Boissier's description suggested that it might, like brevis, be no more than a dwarf variant of M. meyeri. An examination of most of the known material has, however, made it quite clear that M. multinervis is a distinct species, the distinctive seed sculpturing and longer petals clearly demarcating it from M. meyeri which it replaces in Western Anatolia; the two species overlap in their distribution in Cappadocia

and S.W. Armenia (the record of M. multinervis from Elazig, Davis 28995, being a considerable eastward extension of its range). (cf. fig. 34)

38. M. akinfijewii (Schmalh.) Woronow in Fomin & Woronow, Opredel. Rast. Kavkaza Krima (Keys Fl. Cauc. Crim.) 2 : 176 (1914).

Syn.: Alsine akinfijewii Schmalh. in Ber. dtsch. bot. Ges. 10 : 287 (1892).

Type: "Transcaucasia, Borshom, 5500', 28 Junio, leg. Akinfijew" holo. LE (photo.!)

"Proxima A. multinervis Boiss. ... differt indumento valde glandulosa sepalis tantum acutis nec acuminatis. A. meyeri Boiss. a nostra cymis glomeratis, pedicellis brevioribus, strictis, calycibus 6-10mm. longis diversa"

From the photograph of the type specimen, this taxon appears quite distinct from M. meyeri but to resemble M. multinervis very closely.

39. M. meyeri (Boiss.) Bornm. in Beih. bot. Zbl. 27 (2) : 318 (1910).

Syn.: !Alsine globulosa β nana C.A Meyer, Verzeichn. Pfl. Cauc. 219 (1831).

!Als. meyeri Boiss., Diagn. Fl. Orient. ser.1 8 : 96 (1849).

Als. billardieri Boiss., l.c. 95, pro parte (cf. M. globulosa)

!Als. brevis Boiss., l.c. 96.

Als. meyeri var. major Boiss., Fl. Orient. 1 : 683 (1867) (" β ") (≡ Als. billardieri Boiss. p.p.).

!Arenaria meyeri (Boiss.) Edgew. & Hook. in Hooker, Fl. Brit. Ind. 1 : 236 (1874), non Fenzl (1842).

!Als. rudbarensis Stapf in Denkschr. Akad. Wiss. Wien 51 : 20 (1886), pro parte (cf. M. sclerantha).

!M. meyeri γ brevis (Boiss.) Bornm. in Beih. bot. Zbl. 28 (2) : 147 (1911).

M. meyeri δ patula Bornm. l.c.

Illustrations:

Bouloumoy, Fl. Liban Syrie t.57 (1930) (photo).

Grossheim, Fl. Kavkaza (Fl. Caucas.) ed.2 3 : 213 t.20 f.5 (1945) (very poor - rather lax).

Popov, Manual Fl. Taschkent 1-2: f.149 (1923-24) (hab.).

Syntypes: 1) U.S.S.R.: Georgia: "In aridis sabulosis lapidosis ditionis Swant Georg. Cauc. altitut. 4000-5000' [1220-1525m.] Jun.- Jul. 1836, R.F. Hohenacker" (sub "Alsine globulosa C.A. Meyer") (also type of nana C.A. Mey.). holo. G!, iso. BM!, K!, LE (photo!).

2) LEBANON: N. Lebanon: "Syria, Eden. Mai-July. 1846", Boissier. holo. G!

Specimens seen:-

TURKEY:-

Cappadocia:- Ali-dagh, 7 km. S.E. of Kayseri, 1300m., Balansa 646 (G), 1061.

Cataonia:- Soff dagh, Haussknecht 914 (G) (JE).

S.W. Armenia:- Kharput (Harput), Schusshnas, Stapf 219 (leg. Boissier 6.5.1889) (K). Elazig: above Elazig, W. of Harput, 1400m., Davis 29177. Elazig: Elazig - Kale (on Euphrates), 26 km. from Elazig, 1300m., Davis 28919.

N.E. Armenia:- Erzerum, Huet du Pavillon 6.1853 (G).

U.S.S.R.:-

Armenia:- "Armenia", Szovits (pre 1862). Azerbaidjan: Nachichevan: Duza, Grossheim, Ilinskaya & Kirpichnikov 10.5.1947 (BM).

SYRIA:-

Homs:- Syrian desert: Qaryatein, Davis 4.1943 (s.n.). Hama - Palmyra: Jebel-el-Abiad, Blanche 2961 (JE), ex herb Post (Plantae Deserti Syriaci) 28.7.1890 (above el-Meshen) (BM).

Damascus:- Jebel Khaisoun, N. of Damascus, S.W. ridge between Koubbet Siara & Koubbet el Nasr, Gaillardot 14.5.1856 (JE). Antilebanon: Menin - Seidnaya, 1350m., Samuelsson 1669 (S). Antilebanon: Bloudan, 1600m., Samuelsson 4820 (S). Antilebanon: Zebdani - El Tekieh, 1100m., Samuelsson 4870 (S). Antilebanon: Oadi el Karn, 1350m., Samuelsson 4282 (S). Antilebanon: E. of Mt. Hermon nr. Kalat Djendal, Samuelsson 4894 (1150m.) (S), 4849 (1500m.) (S).

Jebel Druz:- Soueida - Saleh, above Saleh, 1700m., Samuelsson 7685 (S).

LEBANON:-

North Lebanon:- above Sîr, 1525m., Davis 6380A. Jebel Sannin - Brumana, below the great weil, Kneucker 55 (with M. globulosa) (JE). Mrouj above Beirut, 1220m., Samuelsson 6183 (S). Djebel el Kenisseh, 1500m., Samuelsson 6184 (S). Dahr-el-Badar, 1500m., Samuelsson 1319 (S).

Antilebanon:- nr. Baalbek, 1150m., Bornmüller 11490, 11494, Samuelsson 1853 (Ain Burdai) (S). nr. Yaat, E. of Baalbek, 1050m., Wall 30.5.1932 (S). F'lita - Taalat Mousa, 1980m., Davis 6626A (? in Syria).

South Lebanon:- Coelesyria: nr. Derzenoun, 870m., Samuelsson 4228 (S). Saida, N.E. of l'Kanderoun, Gaillardot 18.3.1853 (JE).

?(Syria/Lebanon):- Kotschy Iter Syriacum (1855) (G).

JORDAN:-

Edom:- Bir Dabaghar - Shobek, 1525m., Davis 9131. above Hion Musa, 1370m., Davis 8865.

'IRAQ:-

Mosul:- Dschebel Sindschar (Jebel Sinjar) above Sinjar, 700-1300m. Handel-Mazzetti 1459.

IRAN:-

Azerbaijan:- Atropotania nr. Tabriz, 1400m., Grossheim & Schischkin (Fl. orient. exs.) 254 (leg. Grossheim). Yam nr. Tabriz. Gilliat-Smith 24.7.1929 (seed) (cult. Kew 1930 - K813). Urumia, Scher - Tschai, Knapp 2.7.1884 (JE)(WU), 4.7.1884 (WU). Tscharik, Knapp 16.6.1884 (WU), 17.6.1884 (JE)(WU).

Kordestan & Zanjan:- ? 22 mls. N. of Quiur (?), 1065m., Cowan & Darlington 2571.

Caspian Sea:- nr. Rudbar, Pichler (type of Als. rudbarensis) (with M. sclerantha at WU). R. Sefidrud, nr. Rustamabad, 100-200m., Bornmüller 6460 (JE). Shahrud-Bustam: Khosh-Jaila c. 70 km. N.E. of Shahrud, 2000-2200m., Rechinger 5440 (W). ?Shahrud-Bustam: S. of M. Shahvar above Nekarman (Nigarman), 2300m., Rechinger 5871 (W).

Lorestan:- Kermanshah, Bisitun, Strauss 24.4.1903 (JE). Kabutarahang (?) (M. Aubrutia?), Pichler (1882) (WU).

Tehran:- nr. Tehran, Kotschy 22 (syntype of Als. brevis). Keredj, Central Elburs, Rechinger 821.

Central Desert:- ? nr. Schahrud, Bunge 5.1858.

Eastern Khorasan:- Meshhed-Turbat-e-Haidari, nr. Robat-Safid, Rechinger 1544d (1700m.) (W), 7355 (1800-2000m.) (W). Kopet Dagh, between Kučan (Ghuchan) and Alamli ridge, 1600m., Rechinger 7229 (W). ? Ardak-Tolgar, M. Hazar Masdjid, 1200-1600m., Rechinger 5049 (W).

Fars:- Schiras, Baba Kuh, Stapf 1827, 1843 (?1893). Lar: Hadjiabad nr. Tarum, 1400m., Rechinger 3482 (W). ? Kerman/Fars: Čah Čoghuk (Čafut) - Tarum, 1400m., Rechinger 3517b (W); Čah Čoghuk, 1900m., Rechinger 3522 (W).

Kerman & Yazd:- Bam - Djiroft (Sabzevaran), M. Djamal Bariz above Deh Bahri, 2100m., Rechinger 3756a (W). Deh-bala, nr. Kerman, 2300m., Bornmüller 3325 (as δ patula Bornm. det. Bornm.). Kerman, M. Kuh-i-

Dschupar, 3100m., Bornmüller 3325b (as δ patula Bornm. det. Bornm.) (JE) (WU).

Baluchestan:- Khash - Iranshahr, Rechinger 7530 (W).

? ? ? :- Dalmkou, Aucher- Eloy 4261 (syntype of Als. brevis). Persia occ.: Tschehar - Katun, Strauss 6.1902 (JE). Persia media-orient.: Sser-tschah, Bunge 3.1859 (G).

EGYPT:-

Sinai:- base of M. Sinai, Schimper 416 (syntype of Als. brevis).

Geographical distribution: Turkmenia, Tadzhikistan, Afghanistan, and Pakistan (Baluchistan and N.W. Province).

Biology: A robust annual, common in dry sandy places between 100 & 3100m. Flowers April - June.

Discussion: M. meyeri is a very common species of Irano-Turanian steppe-lands but apart from its penetration to the Lebanese coast is completely absent from Mediterranean areas. It is very variable in habit and stature and in the past taxonomic recognition has been given to what seem to be mere shade forms (var. patula Bornm. and var. major Boiss.) or dwarfed plants (Als. brevis Boiss.). Mattfeld (1922) discusses these variants at length and the present studies confirm his conclusions that no infra-specific taxa are recognisable within M. meyeri as here defined. Mattfeld, however, described a new variety (var. cypricola), on the basis of Sintenis and Rigo's specimens from the Troodos Mountains. These Cyprus plants are very distinctive and in 1946 Lindberg rightly described them as a distinct species (Alsine sintenisii). (cf. fig. 34)

40. M. sandwithii Maire et Simpson in Bull. Soc. Hist. Nat. Afr.-Nord. 39 : 130 (1949).

Type: LIBYA: Cyrenaica: "altipano of Jebel Akhdar, near Maraua on flat limestone rocks on open plateau. Fls. white. c. 600m. April 3rd 1939", N.Y. Sandwith 2302 (= N.D. Simpson 39251) holo. ? iso. K!

Geographical distribution: Endemic.

Biology: A very dwarf plant, in an early flowering stage.

Discussion: Sandwith & Simpson (1941) in a preliminary note compare their plant with M. intermedia while Maire & Simpson (1949) in their description of the new species choose to distinguish it only from M. montana. It certainly shows a strong resemblance to both species not only in the general facies but also in the rather truncate calyx and the somewhat crystalline leaf and sepal nerves (cf. key). Despite its mention in the description, no account appears to have been taken of the fact that the flowers are all pedicellate, a feature which clearly distinguishes it from the montana/intermedia/decipens group; the closest relative of the plant is undoubtedly M. meyeri from which it is very difficult to distinguish it by any absolute criteria. The plant is geographically isolated, being separated from M. meyeri by some 800 miles (the nearest known locality of meyeri being Mt. Sinai) and until further material is available (especially fruiting material) it seems best to maintain it at specific rank with the note that it may prove conspecific with that species. (cf. fig. 34)

41. M. sintenisii (Lindb.) Rech. f. in Ark. Bot. ser.2 1 : 420 (1951).

Syn.: !M. meyeri var. cypricola Mattf. in Fedde Rep. Beih. 15 : 60 (1922).

!Alsine sintenisii Lindberg, Iter Cyprium in Acta Soc. Sci. fenn. N.S. B 2 (7) : 14 (1946).

Illustration: Lindberg, l.c. f.10 (1946).

Syntypes: CYPRUS: Limassol: M. Troödos 1) "Prodhromos", Lindberg. holo. H. 2) "Olympus Camp Hotel", Lindberg. holo. H, iso. K! 3) "juxta rivulum M. Chionistra" ("in terra nuda juxta rivul. exsiccat. in decliv. m. Chionistra"), Lindberg. holo. H, iso. W! 4) "in cacumine m. Chionistra", Lindberg. holo. H. 5) "m. Troödos 18.7.1880" & "18 Junio 1880", Sintenis & Rigo 760. holo. H, iso. G! (18.6.), K! (18.6. & 18.7.), WU! (18.6. & 18.7.), (also type of M. meyeri var. cypricola).

Specimens seen:

CYPRUS:-

Limassol:- Chionistra, Kennedy 39 (N. slope, 1950m.), 1202 (N. slope, 1935m.), 1203 (S. slope, 1645m.), 1206 (S.E. Slope, 1860m.). Lavaira tou Pasha (?), E. of Chionistra, 1645m., Kennedy 388. Valley of Xerokolymbos, 1770m., Kennedy 387. Platres, Kennedy 1201A.

Geographical distribution: Endemic.

Biology: A low-growing ± prostrate plant of serpentine rocks; flowering June - July.

Discussion: M. sintenisii is a very distinct species, coming in some ways between M. meyeri and M. decipiens but possessing a facies of its own; in the tendency toward reduction of the sepal nerves it shows an approach towards Series Fasciculatae. It appears to be endemic to the serpentine cone of the Troodos Mountains.

42. M. globulosa (Labill.) Schinz & Thellung in Bull. Herb. Boiss. ser.2 7 : 403 (1907).

Syn.: Arenaria fasciculata sec Sibth. & Sm., Fl. Graec. Prodr. 1 : 306 (1806), non L. (1767).

!Arenaria globulosa Labill., Ic. Pl. Syr. 4 : 6 (t.3 f.1) (1812).

!Alsine globulosa (Labill.) C.A. Mey., Verzeichn. Pfl. Cauc. 219 (1831) (excl. var. nana).

Als. smithii Fenzl, Versuch Verbreit. Vertheil. Alsin. tab. ad p.57 (1833).

Arenaria smithii (Fenzl) Steud., Nomencl. ed.2 1 : 127 (1840).

!Alsine billardieri Boiss., Diagn. Fl. Orient. ser.1 8 : 95 (1849) (quoad syn. ≡ globulosa).

(cf. also Mattfeld (1922) p.61 for fuller list of misidentifications and names published in synonymy).

Illustrations:

Bouloumoy, Fl. Liban Syrie t.56 (1930) (as Als. smithii).

Labillardiere, Ic. Pl. Syr. 4 t.3 f.1 (1812).

Sibthorp & Smith, Fl. Graeca 5 t.442 (1825) (as Ar. fasciculata) (colour).

Visiani, Fl. Dalm. 2 t.34 f.1 (1847) (as Als. fasciculata).

Type: LEBANON: North Lebanon: "in Libano juxta Tripolim Syriae", Labillardiere. holo. P?; iso. K! (Herb. Webb), S! (? "Hab. in Syria dedit Billardiere" sub "Arenaria hirsuta M.B.").

Specimens seen:

GREECE:-

Macedonia:- Litochori below Plaka, Sintenis & Bornmüller 1177 (W-H). Thasos, Tedd 989.

Thrace:- W. Thrace: R. Nestos (Mesta) nr. Toxotai (Oktschilar), 60-100m., Rechinger 9314.

Central Greece:- M. Parnassus (Parnasos), Heldreich Fl. Graec. Exs. (leg. Guicciardi 7.1885) (nr. Rachova), Heldreich Herb. Graec. norm. 609 (leg. Guicciardi & 'Samaritani' 24.7.1857) (above Rachova, 915m.). M. Hymettos (Imitos), Heldreich 3.1848, 4.1848, Halacsy 6.7.1888 (610m.) (W-H), Orphanides (1849) (W-H), 930 (10/22.5.1857) (nr. Caesariani). Attica: M. Gerania Megarae, 1000m., Tunta 802 (W-H). Attica: Peranos, Samuelsson & Zander 443 (S). Attica: Parnes above Metori, 500m., Samuelsson & Zander 464 (S). Attica: M. Lycabetti, Heldreich Herb. Graec. norm. 830.

Peloponnese:- nr. Patras, Halacsy 30.5.1893 (20m.), 5.6.1893 (Mt. Panachaicon = Voidia, 800-1200m.), Heldreich 7.6.1899 (M. Ouiplo), Herb. Grimus 5.1893 (WU). 6.1893 (M. Panachaikon) (WU). Aghion (Aiyion):

Vossitsa, Wall 17.5.1935 (S). Achaia, Valley of R. Vouraikos nr. Zachlorou, St. Lager 8.7.1896. Aegina (island), Spruner (WU). Argolis, Spruner (WU). Methana, Haussknecht 25.5.1885 (JE). Laconia: M. Malevo nr. Platanas, Orphanides 6.1856 (W-H). Reka Reuma above Segditsa (?), 700-900m., Maire & Petitmengin 675 (W-H).

Aegean Islands:- Rodi (Rhodes): Monolithos, between village and arch, Rechinger 7417b (W-R).

(?Greece):- Melissa - Nicaria, Zuccarini 469 (5.1836) (K) (as Ar. fasciculata (Sibth.).

TURKEY:-

Mysia:- Dardanelles: nr. Dardanum, Sintenis 1046.

Lydia:- Tmolus (Boz dağ), Boissier 6.1842. below Mt. Sypylos (Manisa dağ), 2-6m., Bornmüller 9161.

Lycia:- Mt. Solyma (Tahtali dağ), Heldreich 5.1845.

Pamphylia:- Konya Alti, 10m., Tengwall 440.

Cilicia:- Guzel Dere, Sedichig, N.W. of Mersina, Balansa 599. "Cilicia", leg. Prior (K).

Amanus:- Dere Bagtche below Beylan, 320m., Samuelsson 5340 (S). Antioch (Antakya), Boissier 5.1846 (JE).

CYPRUS:-

Paphos:- Trypilos (Paphos Forest), 1160m., Davis 3486. Dhrousha - Kato Arodhas, Davis 3281. Roudhkias valley (Paphos Forest), 460-610m., Davis 3379.

Limassol:- Kyperunda, 1200m., Davis 1880. Platres, 1145m., Kennedy 1197, 1201. Platres - Phini, 1065m., Kennedy 1198. Platres - Mesapotamos, 1100m., Kennedy 1200. Kryos Potamos, 915m., Kennedy 1199. nr. Omados (Omodhos), Sintenis & Rigo 761.

LEBANON:-

North Lebanon:- Well between Jebel Sannin & Brummana, Kneucker 55 (JE) (as and with M. meyeri). Beyrouth - Brummana, Blanche 16.5.1849 (JE). Mrouj above Beirut, 1220m., Samuelsson 5680 (S). Rayfour, 1200m., Samuelsson 1291 (S), 1988 (S). Bchetieh, 1600m., Samuelsson 1905 (S). Nahr-el-Kelb, near mouth, Samuelsson 1239 (S). Ras-esh-Chakka - Hamet, 100m., Samuelsson 4983 (S). Jebel el Kenisseh, 1500m., Samuelsson 5698 (S). Wadi Hammana, 1050-1100m., Bornmüller 11486 (BM).

South Lebanon:- Saida: Deir Mokhalles - Merdj Besre, Blanche 562 (14.6.1853) (JE), Gaillardot 14.6.1853 (JE).

ISRAEL:-

Central Israel:- Jerusalem, 800m., Meyers & Dinsmore B865 (as Als. brevis).

Geographical distribution: Yugoslavia: Dalmatian coast.

Biology: A plant of rocky or stony places, recorded between sea-level and 1600m. (Mt. Lebanon). Flowers May - July.

Discussion: M. globulosa is a very distinct species, sufficiently uniform for no infra-specific taxa to have been described. The nomenclatural confusion which it suffered during the nineteenth century was

brought about partly by misidentification with M. fasciculata and M. meyeri and partly by Labillardière's early name being largely ignored until 1900 when Halácsy used it in his Flora Graeca. The species is widespread along the eastern Mediterranean coastlands from Dalmatia to Palestine and replaces M. meyeri and M. multinervis in this area. Its distribution overlaps that of M. meyeri only in Lebanon and here M. meyeri is more a plant of the mountains than is M. globulosa. The only record of the two species growing together is a mixed gathering made by Kneucker, from the "grosse quelle" between Brummana and Jebel Sannin. M. globulosa has not been seen from Syria and the Antilebanon and some doubt must be attached to Post's (in Post & Dinsmore 1932) records of it from the Syrian Desert, Hauran and the Antilebanon. (cf. fig. 34)

43. M. montana L., Sp. Pl. 90 (1753), non Arenaria montana L.

Key to subspecies

Petals present, 0.7-0.9mm. long, (about 0.1 times as long as the sepals); stem in the inflorescence region rather finely and often sparsely glandular hairy, hairs sometimes confined to two rows up the stem and usually less than 50μ diam. at the base (Western Mediterranean) (A. subsp. montana)

Petals entirely absent (the staminal glands, < 0.2mm., being the

only protrusions from the disc); stem in the inflorescence region densely clothed all round with coarse crisp hairs, about 100 μ diam. at the base (Eastern Mediterranean, Caucasus and Iran) B. subsp. wiesneri

(A. subsp. montana

Syn.: Alsine montana (L.) Fenzl, Versuch Verbreit. Vertheil. Alsin. tab. ad p.46 (1833), non (L.) Crantz (1766).

Type citation: "... Loefl. epist. VIII: 43.
Habitat in Hispaniae collibus altis. 0"

Type specimens : LINN!

Geographical distribution: Eastern Spain, Algeria, Tunisia and Tripoli)

B. subsp. wiesneri (Stapf) McNeill, comb. nov. (: Als. wiesneri Stapf).

Syn.: Als. campestris sec Fenzl in Ledeb., Fl. Ross 1 : 343 (1842) non (L.) Fenzl.

!Alsine caucasica Boiss., Diagn. Pl. Orient. ser.2 1 : 87 (1853), non Adams ex Rupr. (1869), nec M. caucasica (Adams ex Rupr.) Mattf. (1919).

!Als. montana var. caucasica (Boiss.) Boiss., Fl. Orient. 1 : 685 (1867) (" β ").

!Als. wiesneri Stapf in Denkschr. Akad. Wiss. Wien 51 : 20 (1886).

!Arenaria caucasica (Boiss.) Fernald, in Rhodora 21 : 5 (1919). (= Contr. Gray Herb. Harv. 57 : 5), non Adams ex Fenzl (1842) in syn.)

!Minuartia wiesneri (Stapf) Schischkin in Komarov, Fl. U.R.S.S. 6 : 490 (1936).

Illustrations:

Grossheim, Fl. Kavkaza (Fl. Caucas.) ed.2 3 : 213 t.20 f.6 (1945) (as M. wiesneri).

Grossheim, Sosnovsky & Schischkin, Fl. Tiflis 197 (1925) (in Trav. Mus. Georgie 3).

Type: IRAN: Caspian Sea: "Rudbar, 1882, Pichler". holo. WU!

Specimens seen:

TURKEY:-

Paphlagonia:- Tossia: Sabadscha, Sintenis 4371 (JE)(WU).

Galatia:- Tokat: Tscheugelhan, 600m., Bornmüller 47a (JE).

Cataonia:- Maraş: Pazarçik: Narli - Karabyikli, 600-700m., Davis 27843. Gaziantep - Marash, 1965m., Balls & Gourlay 894A (with M. hamata and named Queria hispanica accordingly) (?Cataonia/Mesopotamia).

S.W. Armenia:- Elazig: N. side of Hazar Gölu, 1200m., Davis 28994.

Mesopotamia:- Biredjik (Bireçik): Tschiflik by Euphrates, Sintenis 626 (WU).

U.S.S.R.:-

no locality: ? Steven (K).

Georgia:- "Georgie", Wilhelms (K). ex Iberia, Wilhelms (K). Tiflis (Tbilisi), Holmberg 1283 (S), 1404 (Navtlugh) (S), Schumann 15.5.1882 (with M. hamata and as Als. sclerantha) (JE), Woronow 4.1910 (pr. Hort. bot.) (JE)(S).

Armenia:- "Armenia", Szovits. "Armen. ross.", Herb. Besser (as M. dichotoma) (K).

Azerbaijan:- Karabach (Karabakh) : nr. Schuscha castle, Hohenacker Karabagh (Karabakh), Richter (BM). Karabakh: Gadrut: nr. Dammij, Herb. Fl. S.S.S.R. (H.F.R.) 3703 (leg. Grossheim, Kirpicznikov, & Smoljaninova 31.5.1948). Elisabethpol (Kirovabad), Hohenacker 6.1834 (type of Als. caucasica).

IRAN:-

Caspian Sea:- Sefidrud nr. Rudbar, 300m., Bornmiller 6447.

Lorestan:- Kechwar, 700m., Kotschie 1390 (W).

Northern Zagros:- ?Sultanabad nr. Kastin, 1525m., Lindsay 264 (BM).

Fars:- Schiras, Koelz 14532.

? ? :- Kuh-i-Dschis, Stapf 877.

Geographical distribution (of subsp. wiesneri): Endemic.

Biology: A plant of rocky slopes, recorded between 300 & 1500m. Flowers May - June.

Discussion: Mattfeld (1922, pp. 63-65) discusses the validity of the taxon caucasica and rightly concludes that it cannot be maintained in the sense in which Boissier uses it (i.e. for plants with long recurved bracts). Mattfeld comments on the disjunct geographical distribution of M. montana but claims that no morphological distinction exists between the plants of the two regions. In fact there is at least one very clear-cut distinction, the presence of minute petals in the W. Mediterranean plants and their complete absence in plants from the Orient. A further difference in stem hairiness (cf. key) is less well marked. Schischkin in Komarov (1936) treats the Eastern Mediterranean plants as a distinct species (M. wiesneri), but the small difference between the two groups coupled with the interesting vicarious distribution seems to suggest subspecific discrimination. The epithet wiesneri has been chosen for the new subspecies to accord with its correct name as a species although caucasica would also have been available at subspecific rank. (cf. fig. 35)

44. M. intermedia (Boiss.) Hand.-Mzt. in Ann. naturh. Hofmus. Wien 26 : 148 (1912).

Syn.: !Alsine intermedia Boiss., Fl. Orient. 1 : 685 (1867).

!Arenaria intermedia (Boiss.) Fernald in Rhodora 21 : 6 (1919) (= Contr. Gray Herb. Harv. 57 : 6).

Type: TURKEY: Cilicia: "ad pylas Cilicicas" ("Defile des Portes Ciliciennes"), 23 juin 1855, Balansa 598. holo. G, iso. BM!, JE!, K!

Illustration: Grossheim, Fl. Kavkaza (Fl. Caucas.) ed.2 3 : 213 t.20 f.7 (1945).

Specimens seen:

TURKEY:-

Paphlagonia:- Tossia: nr. Sabadscha, Sintenis 4371 p.p. (with M. montana and as M. decipiens) (JE).

Bithynia:- Biledschik (Bileçik), 200m., Bornmüller 4187 (WU).

Cilicia:- "Cilicia", Aucher-Eloy 578. Adana : Misis - Ceyhan, 25m., Davis 26081. "Syria septentrionalis", Montbret (1834) (as decipiens) (K) (? Cilicia/Amanus).

Amanus:- Hatay: above Iskenderun, 100-300m., Davis 26979. Attik, 900m., Samuelsson 5464 (S). Saouk Olouk, 900m., Samuelsson 5362 (S). M. Silpius nr. Antakieh (Antakya), Samuelsson 5332 (S).

Cataonia:- Adana: Feke: Sencan dere nr. Gurumze, 1300m., Davis 19686. Maraş, 10 km. S. of Maraş, 550m., Davis 27346.

U.S.S.R.:-

Armenia:- "Armenia", Szovits 242 (mixed with M. montana at S).

SYRIA:-

Aleppo:- Dschebel Napas nr. Aleppo: Haussknecht 148 (JE) (?Syria/Turkey).

'IRAQ:-

Mosul:- Jebel Sinjar, N. of town, 900-1200m., BAG 11101A (leg. Gillett) (with 11101 = M. decipiens).

Geographical distribution: Endemic.

Biology: A plant often of sandy and gravelly places, recorded from a number of habitats - oak scrub, cultivated fields and on mountains up to 1300m. Flowers April - June.

Discussion: This is a species with a singularly appropriate name because in its general habit, in many of its technical characters and in its distribution it lies intermediate between M. montana subsp. wiesneri and M. decipiens (cf. key). The obvious question which arises is whether it is a good species or whether it is merely founded on hybrids between its two close relatives. Two things seem to point clearly to the first possibility. Firstly there is the fact that in certain characters (cf. key) there is a definite discontinuity between the species and apparently no tendency for this dividing line to become blurred; indeed M. intermedia has been found growing together both with M. montana (by Sintenis in Paphlagonia) and with M. decipiens subsp. decipiens (by Gillett on Jebel Sinjar in N. Iraq) and in neither case is any intergradation detectable; Gillett moreover recognised in the field that two elements were present. The second and more significant fact is the occurrence in M. intermedia, but in neither of the other two species, of a very characteristic and highly developed staminal gland structure. The glands are divided at the base so that instead of the typical basal swellings to the five outer stamens, such as is seen in M. montana and M. decipiens, there are 10 finger-like protrusions apparently alternating with the stamens. The glandular structure in these three species is clearly illustrated by Mattfeld (1938) in a discussion of the nature of the petals and staminal glands in the Caryophyllaceous

flower. (cf. fig. 35)

Cytogenetical studies on the species would be of great value in throwing further light on their inter-relationships. On morphological grounds it is certainly tempting to suggest an allopolyploid origin for M. intermedia.

45. M. decipiens (Fenzl) Bornm. in Beih. bot. Zbl. 31 (2) : 193 (1914).

Key to infraspecific taxa

1a. Petals prominent (2.5-4mm.), 0.5-0.7 times as long as sepals; plants often rather tall with elongate stems (up to 25 cm.) and flower cluster then rather remote; seeds 0.90-1.00mm. long diam. A. subsp. decipiens

1b. Petals very small (0.5-0.9mm.), < 0.2 times as long as sepals; plants low-growing (to 8 cm.) with flowering clusters crowded together B. subsp. damascena

2a. Sepals bearing large glandular hairs (glands 65-90 μ diam.); seeds 0.70-0.85mm. long. diam. B.(i). var. persica

2b. Sepals with fine glandular hairs (glands up to 30 μ diam.); seeds usually 0.90-1.05mm. long. diam. (rarely 0.70-0.85mm., Cyprus plants) B.(ii). var. damscena

A. subsp. decipiens

Syn.: Alsine decipiens Fenzl, Pugill. Fl. Syr. Taur. 12 (1842).

Arenaria decipiens (Fenzl) Fernald in Rhodora 21 : 6 (1919)

(= Contr. Gray Herb. Harv. 57 : 6).

Type: TURKEY: Cilicia: "in reg. inf. Taur. occ." (1836), Kotschy 60. holo. W (destroyed). iso. ? (locality and date but without number - JE!; or "Kotschy 197" - BM!, K!, S!)

Specimens seen:

TURKEY:-

Cilicia:- Taurus Mts., Kotschy of Mersina, Balansa 597. nr. Tarsus, Aucher-Eloy 575 bis.

Amanus:- ?"Syria: Amanus", 1035m., Meinertzhagen 19.5.1933 (BM). ? Tap Boghazi - Baghlama, 120m., Wall 26.4.1933 (S). ?Murad Pasha bridge nr. Boluk Göl, 50m., Haradjian 4212 (W).

Cataonia:- Maraş, Pazarçik: Narli - Karakiyikli, 600-700m., Davis 27839.

Mesopotamia:- Mardin, Post 4.1896 (BM). Urfa: Nimrud Dagh, Sintenis 826. Urfa: Suruç-Urfa, 20 km. from Suruç road, 600m., Davis 27992. Gaziantep (Aintab), Haussknecht 24.4.1865 (JE), Haradjian 10 (5.1906) (W), 1254 (6.1907), Balls 2198 (850m.).

SYRIA:-

Aleppo:- nr. Aleppo (Halep), Haussknecht 20.3.1865 (Karstiens, 365m.), Montbret (1834), Kotschy 160, Russel (as Ar. fasciculata) (BM).

?"Syr. bor.": Djebel Seman, 365m., Haradjian 2046. Aleppo - Antakieh (Antakya in Turkey), Samuelsson 3934 (Tell Akibrim, 430m.) (S), 5507 (Kasr el Benat, 320m.) (S).

Homs:- Syrian Desert: Hama - Palmyra: Snou Fadel (Puitre de Fadel), Djebel Belas, Blanche 2962 (JE).

LEBANON:-

South Lebanon:- 13 km. S. of Sour (Sur), Samuelsson 1172 (S).

ISRAEL:-

Galilee:- "Galilee", Edward 62 (K). nr. Nazareth, Bornmüller 194, Davis 4716 (el Reina), Ball 1280, Meyers 5604, Samuelsson 961 (S). ?"Pl. Jordanicae": Ain et Tabigha, 200m., Meyers & Dinsmore 1604 (4.4.1911). Tiberias - Migdal, Davis 4210. Magdala (Migdal), Lowne (1863-64). ??"Pl. Moabiticae": Merj Abu 'Aishe (?= Merj Abu Shusheh = Plain of Jezreel), 800m., Meyers & Dinsmore M1604 (28.4.1911).

Central Israel:- Judaea: Bab el Wad, 250m., Samuelsson 2634 (S).

JORDAN:-

Cisjordania:- 6 km. N. of Jiftlik, < 250m., Samuelsson 3144 (S).

Moab:- Jebel Attarus, 610-700m., Davis 8735. Jebel Sijaghah, Post 27.4.1886.

'IRAQ:-

Mosul:- Jebel Sinjar, N. of town, 900-1200m., BAG 11101 (leg. Gillett) (with 11101A = M. intermedia).

B. subsp. damascena McNeill, subsp. nov. (i). var. damascena

Syn.: M. intermedia sec Mattfeld in Fedde Rep. Beih. 15 : 67 (1922) pro parte, non (Boiss.) Bornm.

A subspecie typica petala minuta (0.5-0.9mm. longa) sepala < 0.2-plo longiora facile distinguenda.

Planta humilis 2-8 cm. alta, saepe ad radicem ramellata, ex toto pubescentia nonnumquam sparse; pili eglandulosi vel glandulosi; glandes parvae (< 30 μ diam.). Inflorescentia partiales plerumque coarctata. Semina saepe magna (long. diam. 0.90-1.05mm.) sed in plantae Cypriae minora (long. diam. 0.70-0.85mm.).

Typus: SYRIA: Damascus: "Antilebanon: ad radices orient., inter Katana et Assem Foka, in glareosis calcareis, ca 960 m.s.m. 13.5.1933, Gunnar Samuelsson 4877." (sub Minuartia decipiens) holo. S!

Specimens seen:

CYPRUS:-

Kyrenia:- Mt. near Kythrea, Sintenis & Rigo 236 (5.1880) (K)(WU). M. Pentedactylos, Sintenis & Rigo 236 (29.4.1880) (S)(WU).

SYRIA:-

Damascus:- Antilebanon: Ouadi Barada, El Djedsideh, 800m., Samuelsson 4349 (S). Summit of Djebel Khaisan, N. of Damascus, between Koubbet Sian and Koubbet el Nahr, Gaillardot 1657 (JE). M. Kasiun nr. Damascus, 700-900m., Bornmüller 11493 (as M. intermedia forma compacta) (JE).

LEBANON:-

North Lebanon:- E. side of Mt. Lebanon, Der-el-Ahmar - Aineta,

1700-1800m., Bornmüller 11491 (as M. intermedia) (JE). Jebel el Kenisseh, 1500m., Samuelsson 6153 (S).

B.(ii). var. persica McNeill, var. nov.

A plantis aliis M. decipientis sepalis glandes magnas (65-90 μ diam.) stipitatas gerentibus differt.

Characterae aliae omniae similes var. damascenae, sed semina semper aliquando parva (0.70-0.85mm. long. diam.).

Typus: IRAN: Fars: "Kiessteppe a Fusse des Kuh Saadi" (near Schiras) 17.6.1885., Stapf (sub Alsine intermedia). holo. K!

Geographical distribution: Endemic.

Biology: Plants of dry hills and steppe or slopes in open scrub, often on calcareous substrata. Subsp. decipiens usually (? always) growing among rocks or in stony places and subsp. damascena in sand or gravel. Subsp. decipiens recorded between 50 and 1200m., in flower April - May and subsp. damascena between 700 and 1800m., in flower May - June.

Discussion: M. decipiens has hitherto been regarded as a fairly uniform species and this was also the opinion of the present author on the basis of material in British herbaria. The examination of specimens from the herbaria at Stockholm and Jena (collected by Samuelsson, Gaillardot and Bornmüller) has revealed unexpected variation in the existence of a very small petalled race from the region of Damascus, the Antilebanon and the

eastern and southern slopes of Mt. Lebanon. These plants, apparently typical of M. decipiens in their pubescence and gland structure, show a strong resemblance in habit to some forms of M. intermedia. Indeed the Bornmüller gatherings referable to this group were accepted under the name intermedia by Mattfeld. The discovery of this race of M. decipiens from an area in which the species is otherwise absent, throws a very different light on the status of the Sintenis and Rigo plants from Cyprus and of the geographically very isolated collection made by Stapf near Schiras in Southern Iran. Both of these are regarded by Mattfeld as M. intermedia although he notes the decipiens-like pubescence of the Cyprus material. He makes no mention, however, of the fact that in both cases the staminal gland structure is essentially that of M. decipiens. (In fact in both these and the Damascus plants it is possibly more like that of M. montana, but on herbarium specimens, particularly if they are entering the fruiting stage, it is not practicable to distinguish between the rather elongate nectar groove of that species and the more cup shaped structure in M. decipiens subsp. decipiens.)

That the Cyprus, Damascus and Persian plants should be grouped together in one taxon seems certain, but its rank and closest affinity are more debatable. Just as M. intermedia lies between M. montana and M. decipiens yet seems a discreet homogeneous group, so this taxon, for which the name damascena has been chosen, would seem to lie intermediate between M. intermedia and M. decipiens. In the main distinguishing characters, pubescence, petal size, staminal gland structure and seed size, there is no evidence of any gradation or intermediate condition. The damascena group, however, is heterogenous in respect to seed size, in that the Cyprus and Persian

plants have intermedia-like seeds while in the Syrian ones they are of the large decipiens type. The association of these races with distinct and usually disjunct geographical areas, suggests that these are either isolated relicts of a once more widespread, morphologically diverse group, or else the selected products of a relatively recent hybrid complex, which have become closely adapted to specific geographical and ecological conditions. (cf. fig. 35)

For the moment it is proposed to treat this apparently intermediate group as a subspecies, which is referred to M. decipiens, because it shares with the typical form of that species, the readily observable pubescence characters and the apparently important staminal gland structure. Until more material is available the plants from Cyprus are not being distinguished taxonomically from their relatives round Damascus, but the isolated Persian plant has been described as a new variety (var. persica) because of the unusual development of large stalked glands on the calyx, reminiscent of those found in some populations of M. meyeri and its near relatives (e.g. M. sandwithii).

Series Minuartia

Bracts with a broad membranous margin at the base (c. 9.5mm. broad), narrowed abruptly toward the apex which is strongly recurved in fruit; stems and inflorescence axis sparsely to rather densely hairy, the membranous margins of the bracts glabrous; ultimate flowers sterile and imperfect; staminal glands undivided with an elongate nectar furrow in front of the outer stamens; petals about half as long as sepals, linear-subulate; capsule always 1-seeded; seeds 1.5 x 1.0mm. 46. M. hamata

Bracts with a very narrow membranous margin (< 0.25mm. broad); apex becoming somewhat incurved in fruit; stems, inflorescence axis and margins of bracts all densely lanuginose; flowers all perfect; staminal glands bifurcate, the nectaries cup-shaped at the apices of the arms, which appear to alternate with the stamens; petals completely absent; capsule 2-3 seeded; seeds c. 0.9 x 0.6mm. 47. M. sclerantha

46. M. hamata (Hausskn.) Mattf. in Bot. Jb. 57 Beibl. 126 : 29 (1921).

Syn.: Queria hispanica L., Sp. Pl. 90 (1753) ("Guerezia hispanica" L. sphalm.), non Minuartia hispanica L. ex Graebner ("M. hispanica L") (1918).

Alsine hispanica (L.) Fenzl, Versuch Verbreit. Vertheil. Alsin. tab. ad p.46 (1833).

Scleranthus hamatus Hausskn. in Mitt. thuring. bot. Ver. 9 : 17 (1890).

Illustrations:

Bouloumoy, Fl. Liban Syrie t.61 f.6 (1930).

Post & Dinsmore, Fl. Syria, Palest. Sinai ed.2 1 : 203 (1932).

Willkomm, Ic. Fl. Eur. aust.-occ. Hispan. 1 t.66 (1852) (colour).

Type: TURKEY: Galatia: "an steinigen Orten zwischen Amasia und Tokat bei Tschengelchan", Bornmüller 317 holo. JE.

Specimens seen:

GREECE:-

No locality:- Atchley (1936).

Epirus:- Yoanina: M. Mitchikeli, Baldacci 12, 289 (E. side).

Macedonia:- N.W. Macedonia: Breznitsa - Krystallopegae, 850m., Alston & Sandwith 729.

Central Greece:- M. Veluch (Tymphrestos, Ypsili Karyphi), nr. Karpenision, 1800m., Rechinger 2953. M. Parnassus (Parnasos), von Grabmayr 21.5.- (K), Herb. Mill 5.1862 (Rachova) (K), Bornmüller 237 (1600-1700m.). M. Ozia (Parnes), Orphanides 387 (1220m.), Heldreich Herb. Graec. norm. 1314 (915-1220m.).

TURKEY:-

No locality:- "Anatolia", Wiedemann (pre 9.1870) (K).

Paphlagonia:- Kastamonu, 1100m., Davis 21776.

Caria:- Cadmus (Honaz dağ), Boissier 6.1842.

Lycia:- Mt. Solyma (Tahtali dağ), Heldreich 4.1845, 5.1845, (?"Mt. Tolyma Pamphyliae") (BM).

Lycaonia:- Konya - Cihanbeyli, Davis 18616.

Galatia:- Amasia - Tokat, nr. Tschengelchan, Bornmuller 1704.

Cataonia:- (? Mesopotamia) Gaziantep - Marash, 1065m., Balls & Courley 894A (with M. montana).

S.W. Armenia:- Kharput (Harput), Sintenis 282 (Miadun), 755 (Karabasch above Tekenik).

N.E. Armenia:- nr. Ispir, Huet du Pavillon 6.1853.

Mesopotamia:- Diyarbakir: 3 km. N. of Ergani, 1000m., Davis 29058. Diarbakir, Nohuesers (1857). ?Rum - Kalaa nr. Euphrates, Sintenis 325.

U.S.S.R.:-

No locality:- "Caucasus", ex Herb. Mus. Petr. (1837) (as M. campestris Loefl.) (K), ex Imp. Acad. Petersb. (as Arenaria glomerata) (K).

Georgia:- No locality, Hohenacker (1838). Tiflis, Schumann 15.5.1882 (WU), 17.5.1882 (nr. Reinerki) (JE) (both as Als. sclerantha), Herb. Fl. SSSR (H.F.R.) 2852 (leg. Woronow) (above Hort. bot.), Brotherus 189a.

Azerbaijan:- Baku: Sangatschal, Holmberg 547.

SYRIA:-

Aleppo:- nr. Aleppo, Kotschy 155 (as Als. decipiens), Post herb.

4100 (leg. Dinsmore 9.4.1900), Aucher-Eloy 2803. Aintab (Gaziantep) - Alep, Montbret (1834) (? Turkey: Mesopotamia).

Homs:- Rat Tush (Qaryatein), Davis 5675.

Damascus:- Nebk - Deir Mar Musa, Davis 5541. Bludan - Ein-en-Sur, 1830m., Davis 6210A. (? Lebanon: Antilebanon): 'Flita - Taalat Mousa, 1980-2130m., Davis 6625A.

LEBANON:-

North Lebanon:- Hasroun, Blanche 5.1865.

'IRAQ:-

Mosul:- Kursi, Jebel Sinjar, 800m., BAG 10970 (leg. Gillett).

Erbil:- ? Palegawra, W. of Sagirrma Dagh, 15 mls. S.W. of Pir i-Mukhrun (Zagros mts.), 1000m., Helbaek 682.

Kirkuk & Sulaimaniya:- Penjwin, 1700m., BAG 12246 (leg. Rawi). Sulaimaniya - Penjwin: Mela Kowa, 1320m., BAG 22468 (leg. Rawi). Kajan mt., nr. Penjwin, 1590m., BAG 22735 (leg. Rawi).

IRAN:-

Azerbaijan:- Kuplan Kuh, 13 km. S.E. of Mianeh, 1220m., Cowan & Darlington 753. ? Ispili, Yaylah, Lindsay 1095 (1936) (BM), cult. Kew (1937) (K).

Caspian Sea:- R. Sefidrud, nr. Rudbar, 300m., Bornmüller 6457. Mazanderan: Mt. Elburs centr., Pol-e Zangule, 2200m., KAR 2216 (leg. Gauba & Sabeti) (W). Mazanderan: Hasar Djarib, IRAN 437 (leg. Sharif) (W).

Gorgan (Asterabad): M. Shahvar, N. side nr. Hadjilang, 2400-2600m.,

Rechinger 6094 (W). Shahrud-Bustam: Khosh-Jaila, 70 km. N.(E.) of Shahrud, 2000-2200m., Rechinger 5427 (W).

Lorestan:- Kechwar, 700m., Kóie 1389 (W). Durud, 1675m., Koelz 15788 (W). Kermanshah: Golan-e-Gharle, Daraabek, IRAN 187 (leg. Behbudi).

Northern Zagros:- M. Elwend (media), Pichler (1882). Hamadan: Mt. Karagan, Strauss 5.1902.

Tehran:- Mt. Elburs: nr. Keredj, R. Keredj, Wessieh, Rechinger 432 (W). Kazvin: Kuh-e-Dasht nr. Keredj, KAR 2243 (leg. Gauba) (W).

Eastern Khorasan:- M. Kopet Dagh, Kučan-Alamli ridge, 1600m., Rechinger 4823 (W). ?M. Hazar Masdjid, Ardak-Tolgar, 1200-1600m., 5783 (W).

Fars:- Shiraz, Koelz 14515. Kuh Bul, Stapf 1397.

Geographical distribution: East and Central Spain, E. Portugal, Marocco, Algeria, Tunisia, S. Yugoslavia, Bulgaria, Crimea and Turkmenia.

Biology: A plant of dry sandy soils, often on mountains, particularly in the eastern part of its range. Recorded between 300 and 2200 metres. Flowers April - June. The partial inflorescences are shed as a whole and appear to be the unit of dispersal; some seeds (those of the 'lower' flowers) will be shed as the cluster is blown about or carried about by animals, but it seems likely that some at least germinate 'in situ'; this certainly occurs when the plants are cultivated in pots.

Discussion: M. hamata, or Queria hispanica as it is otherwise known, is a very distinctive species, which, with its characteristic recurved bracts can be recognised at sight, at least as soon as fruiting has begun.

Like M. montana it shows a disjunct east-west distribution in the Mediterranean area; no morphological difference has been detected, however, between the plants of the two areas.

Its distinctive facies has probably been the major influence in persuading authors to maintain the monotypic genus Queria. As Fenzl realised in 1833 and Mattfeld clearly showed in 1922, there is no justification for separating this species from M. sclerantha and M. dichotoma (except possibly at Series level); the affinity between these three species is much closer than that which exists between them as a group and their nearest relatives, the members of Series Montanae. If Queria is to be given generic rank, it must take M. dichotoma (& sclerantha) with it - and hence take the type species of Minuartia !! Although 150 years of indiscriminate creation of new genera gives a wide range of alternative names to choose from (ranging from Cherleria L. to Alsinopsis Small), there is fortunately no need to add further to the nomenclatural burden that Minuartias already carry! It is quite unjustifiable that species such as M. montana and M. dichotoma should be placed in different genera and one could go on in this way (as Mattfeld does) showing how each group fits closely to the next, although the extremes may be widely divergent. M. hamata is one such extreme in the genus; its single-seeded capsule and synaptospermous habit may seem far removed from plants like M. hybrida or M. verna, but when one compares it with the 2-3(-4) seeded M. sclerantha and M. dichotoma, in both of which some of the seeds are never shed from their capsule, and which share with M. hamata the character, unique in the genus, of a translucent testa (giving the seeds a light straw colour instead of the usual dark brown), the close relationship is at once apparent.

The transfer of Queria hispanica to Minuartia was not made, unfortunately, until 1922 (Fenzl had transferred it to Alsine as Als. hispanica in 1833), by which times Graebner (1918) had chosen to give "Minuartia hispanica L.", a name which appears in a cancelled sheet of "Species Plantarum", priority over M. dichotoma, the name with which Linnaeus replaced it in the corrected copies. As Stearn (1956 p.142) has pointed out, "M. hispanica L." and the accompanying erroneous generic name "Guerezia" for Queria have no nomenclatural status whatsoever, not being accepted by the author who published them. Graebner (1918, pp.699 and 710), however, adopted M. hispanica for M. dichotoma, giving Linnaeus' description, and the name is thus validly though illegitimately published from these dates (p.699 - 29.3.1918; p.710 - 1.10.1918). (Mattfeld, 1921 and 1922 pp.70 & 74, also adopts the name M. hispanica for M. dichotoma). The existence of M. hispanica L. ex Graebner thus precludes the transfer of Queria hispanica to Minuartia without change of epithet. Haussknecht's erroneous description of the plant as a Scleranthus (S. hamatus) provides the only available epithet and so the species must be called M. hamata.

The name M. hispanica being in effect illegitimate when published falls into disuse - the full synonymy of the type species of the genus is therefore:-

M. dichotoma L., Sp. Pl. 89 (1753), non Arenaria dichotoma Krock (1790), nec Moench (1794).

Syn.: Alsine dichotoma (L.) Fenzl, Versuch Verbreit. Vertheil. Alsin. tab. ad. p.57 (1833).

Cherleria dichotoma (L.) Sampaio, Herb. Portugal 81 (1913).

M. hispanica L. ex Graebner, in Aschers. & Graebn., Syn. Mitt.-

Eur. Fl. 5 (1) : 699 & 710 (1918), non Arenaria hispanica Spreng. (1825), nec Alsine hispanica (L.) Fenzl (1833).

Arenaria iberica Fernald in Rhodora 21 : 5 (1919) (= Contr. Gray Herb. Harv. 57 : 5).

The species is endemic to Spain.

47. M. sclerantha (Fisch. & Mey.) Thellung in Mem. Soc. Sci. Nat. Math. Cherbourg 38 : 231 (1912).

Syn.: (!)Alsine sclerantha Fisch. & Mey. in Bull. Soc. Nat. Moscou, 33 : 400 (1838).

!Als. rudbarensis Stapf, in Denkschr. Akad, Wiss. Wien 51 : 20 (1886), pro parte (cf. M. meyeri).

Illustration:

Grossheim, Fl. Kavkaza (Fl. Caucas.) ed.2 3 : 213 t.20 f.8 (1945).

Type: U.S.S.R.: Georgia: "in tr. Suwant et prope Helenadorf, 1834-35", Hohenacker, holo. LE (photo!).

Specimens seen:

TURKEY:-

Paphlagonia:- Tossia: Sabadja, Sintenis 4370. Tossia: Szuluk Tschesme, Sintenis 3950.

Lycaonia:- Konya: Yavsan Memlehasi, nr. Tuz Gölu, Davis 18665.

Cappadocia:- Gulşehir (Arapsun) - Nevşehir, 5 km., from Gulşehir,

450m., McNeill 384.

U.S.S.R.:-

No locality:- "Cauc." (K).

Georgia:- No locality, Hohenacker (1838) (as Queria hispanica) (K).

Armenia:- "Armen. ross.", Besser (as M. dichotoma) (K).

Azerbaijan:- Nr. Elisabethpol (Kirovabad), Hohenacker 5/6.1834 (as Queria hispanica) (K).

IRAN:-

Azerbaijan:- Marand, Knapp 20.5.1884 (WU). Khasrowa, Knapp 8.6. 1884 (WU). Atropotania nr. Tabris, 1400m., Grossheim & Schischkin 227 (leg. Grossheim.).

Caspian Sea:- Nr. Rudbar, Pichler 4.5.1902 (WU) (part of type of Als. rudbarensis - with M. meyeri), Bornmüller 6450 (R. Sefidrud, 300m.) Resht - Kaswin, nr. Meddschil, 400m., Bornmüller 6451.

Geographical distribution: Endemic.

Biology: Dwarf plants growing in fine sand or clay. Recorded between 300 and 1400m. Flowers May - June.

Discussion: M. sclerantha, like the other members of this group, is a very distinct species most closely related to the Spanish M. dichotoma; indeed these may be regarded as vicariads and there are thus in Section Minuartia three examples of discontinuous distribution between the

Eastern and Western Mediterranean areas, which are of particular interest in that they show three different stages of geographical differentiation. In *M. hamata* no differences have been detected between the populations in the East and those in the West but in *M. montana*, while the plants are superficially all very alike, there are certain small differences which seem to warrant the establishment of two geographical subspecies. Finally in *M. dichotoma* and *M. sclerantha* there seems to be an example of geographical speciation; there is certainly no doubt either to their status as species or to their close affinity.

Subsection Xeralsine (Fourr.) McNeill

Series Leucocephalae Mattf.

One species.

48. M. leucocephala (Boiss.) Mattf. in Bot. Jb. 57 Beibl. 126 : 30 (1921).

Syn.: !Alsine leucocephala Boiss., Diagn. Pl. Orient. ser.1 1 : 45 (1842).

!Als. stenosepala Stapf in Denkschr. Akad. Wiss. Wien. 51 : 10 (1886).

!Arenaria leucocephala (Boiss.) Fernald in Rhodora 21 : 6 (1919) (= Contr. Gray Herb. Harv. 57 : 6).

Type: TURKEY: Caria: "m. Cadmus supra Collossam" (Honaz dağ) 6.1842, Boissier. holo. G, iso. BM!, JE!, K!

Specimens seen:

TURKEY:-

Caria:- Cadmus (Honaz dağ), Balansa (JE).

Lycia:- Ak-dagh, Bourgeau 32, Luschan 17.7.1882 (WU) (type of Als. stenosepala).

Pamphylia:- Gebiz: Bozburun dağ ('Pisidia'), Davis 15710 (2200m.) 15651 (N. side, 2200-2300m.), 15685 (N side, 2200m.), 15637 (above Torlu Çukur Yayla, 1900-2100m.) (K). Geyik dağ ('Isauria'), 2285-2440m., Davis 14579 (K).

Cilicia:- ?"Anatolia austro-orientalis", Siehe 154 (JE). Adana:

S. of Tarasch, 2200m., Siehe 321. Cilician Taurus: Burujik, Kucuk Kur, 1675m., Balls 1333.

Pisidia:- M. Davros dağ, Heldreich 6.1845. Isparta: Sutçuler, Dedegol dağ ('Isauria'), Davis 15982 (2200m., nr. Cirque Anici), 16044B (alpine).

Geographical distribution: Endemic.

Biology: A tufted perennial mountain plant of screes and stony places; recorded between 1675 and 2440m. Flowers (June-) July - August.

Discussion: As its placing in a series of its own suggests, M. leucocephala is a very distinct and readily recognisable species, a rare characteristic in perennial members of Section Mimuartia. Its taxonomic position, however, is probably less isolated than Mattfeld suggests because it is very close to some members of the Setaceae in which weak lateral nerves are present on the sepals (e.g. M. erythrosepala). However, in the absence of any fresh evidence which would suggest that this Series should be united with the Setaceae, Mattfeld's arrangement has been maintained.

It should be noted that in one of Davis' gatherings from Bozburun dağ plants range from having glabrous to the usual densely hairy leaves.

Series Setaceae Mattf. and Xeralsine

1a. Inflorescence, and often entire plant, clothed with rather long (0.15-0.25mm.) straight spreading hairs, leaf fascicles with spreading leaves at flowering time; flowers aggregated into terminal (and sometimes also axillary) clusters; petals as long as or shorter than sepals; plants annual, biennial or perennial (Series Xeralsine) 60 M. glomerata

1b. Inflorescence glabrous, or with a varied indumentum (but never long straight spreading hairs) and then leaf fascicles usually closed, with leaves tightly pressed together at flowering time (leaves spreading in M. conferta) (Series Setaceae) :

2a. Petals very much shorter than sepals (0.25-0.60 times as long):

3a. Plants densely caespitose; flowering stems short, 1-3cm., inflorescence terminal with 5-12 flowers; sepals 2.5-3.5mm. long, bluntly acute, incurved at the apex and margins 54. M. anatolica (v). var. scleranthoides

3b. Plants tall (fl. stems 5.5-12cm.) loosely tufted, or if shorter and ± densely caespitose, then sepals > 4mm., acuminate; sepals not or scarcely incurved at the apex and margins :

4a. Inflorescence few-flowered, fastigiate, axillary 'clusters' with 1-2 flowers, terminal with 2-5; sepals 3-4mm. long,

narrowly acuminate; leaves narrowly setaceous, strictly erect; bracts setaceous, lateral nerves weak, usually only visible at the base; petals about half as long as sepals 52. M. tchihatchewii

4b. Inflorescence usually many-flowered; flowers aggregated into rather dense terminal (and sometimes axillary) clusters of 5-15 flowers; sepals short (< 3.5mm.), acute, or long (4-6mm.), acuminate; leaves subulate-setaceous often falcate or almost spreading; bracts subulate to deltoid, with a broad membraneous margin at the base, and 3-nerved throughout :

5a. Leaf fascicles lax with spreading ciliate or glabrous leaves; sepals 4-6mm. long, linear-lanceolate, acuminate, often recurved at the apex; petals very short, < 0.3 times as long as sepals; plants low-growing 2-8 (-12) cm., rather densely caespitose, from a single stout caudex 59. M. confusa

5b. Leaf fascicles closed with leaves tightly pressed together; leaves and often the entire plant densely clothed with very short spreading hairs; plants rather tall, 6-20 cm., loosely tufted, the shoots arising from long slender caudiculi :

6a. Sepals 2.0-3.5mm. long, lanceolate to ovate-lanceolate, acute 57. M. corymbulosa

6b. Sepals 4-6mm. long, linear-lanceolate to lanceolate, long acuminate 58. M. leucocephaloides

2b. Petals a little shorter to much longer than sepals (0.75-1.5 times as long) :

7a. Pedicels and sepals entirely glabrous; leaves and lower part of the plant bright green, glabrous or hairy but never with long, crisped or woolly, white hairs; leaf fascicles with spreading leaves :

8a. Sepals 2.0-3.0(-3.5) mm. long, ovate-lanceolate; petals about as long as the sepals; plants usually rather strictly erect (at least in flower), 5-15 cm. tall; lower part of the plant very densely clothed with very short spreading hairs; seeds obscurely tuberculate; flowers in rather loose terminal clusters (becoming more lax in fruit) 51. M. micrantha

8b. Sepals 3.0-5.5mm. long (in Orient plants always 4mm. or more), if flowers at all clustered, sepals 4mm. or more :

9a. Inflorescence few-flowered (< 10), very lax, lowest pedicel > 12mm.; sepals 4.5-5.5mm. long, lanceolate (c. 3 times as long as broad); petals as long as or longer than the sepals; lower part of the stem rather densely clothed with very short spreading hairs 50. M. woronowii

(cf. also 50.a. M. buschiana)

9b. Inflorescence few to many flowered, rather congested (lowest pedicel 3-8mm.), or if lax then sepals 3.0-3.5(-4) mm. long

(cf. also key to varieties) 49. M. setacea

7b. Pedicels or sepals or both pubescent, usually glandular, sometimes only a few hairs at the base of the calyx, occasionally glabrous, and then plant glaucous or lower part bearing white crisped hairs (often the leaf fascicles arachnoid); leaf fascicles usually closed, with the leaves tightly pressed together, very rarely leaves spreading in lax shade plants :

10a. Lower leaves terete, small (1-4mm.), at least some tightly imbricate, tetrastichous (< 2mm. long); sepals linear-lanceolate, acuminate, > 3mm. long, slightly longer than the petals :

11a. Sepals 4-5mm. long; flowering stems short (1-4 cm.), inflorescence of few-flowered clusters (3-5); leaves ciliate, otherwise plant very sparsely and finely puberulent

56. M. libanotica

11b. Sepals c. 3mm. long; flowering stem 3-10 cm. long; inflorescence of few to many (5-15) flowered terminal and axillary clusters, the clusters mostly aggregated near the top of the stem; entire plant densely puberulent

54. M. anatolica (iv). var. tetrasticha

10b. All non-fascicular leaves setaceous or subulate > 5mm. long, or if shorter then plants rather densely caespitose, either with ovate-lanceolate acute sepals shorter than the petals, or with sepals < 3.0mm. long :

12a. Sepals < 3.0mm. long :

13a. Lower part of the stem and margins of the leaf bases densely lanuginose giving the base of the shoot an obvious white woolly appearance; upper part of the plant (incl. inflorescence) completely glabrous; calyx ± rounded at the base; petals equalling sepals; inflorescence very lax (lowest pedicels 8-12mm. long), each shoot bearing about 5-10 flowers 53. M. antilibanotica

13b. Entire plant puberulent or velutinous (rarely inflorescence glabrous), the lower part of the stem and the leaf fascicles sometimes clothed with white crisped hairs giving only a farinose appearance (if visible at all) :

14a. Flowers closely aggregated into few to many flowered (5-25) terminal, subterminal and sometimes axillary clusters; the clusters usually rather remote; plants often tall, flowering stems (5-)10-30 cm., loosely tufted from a rather stout caudex; petals shorter to a little longer than sepals 57. M. corymbulosa

14b. Flowers in lax cymes, or if rather congested, plants densely caespitose or else few-flowered (< 10) and low-growing (< 8 cm.); inflorescence never a series of remote clusters or a single dense terminal cluster :

15a. Sepals broadly acute or abruptly acuminate, ovate

to ovate-lanceolate, often red-tinted; plants low-growing (< 8cm.), densely caespitose; inflorescence glabrous or shortly glandular pubescent

55. M. erythrosepala (ii). var. orientalis

(cf. also 55a. M. granulifera)

15b. Sepals narrowly acute, lanceolate to linear-lanceolate, never red-tinted; plants loosely tufted or rarely (M. anatolica var. scleranthoides) densely caespitose (and then entire plant very densely clothed with short spreading eglandular hairs) :

16a. Entire plant sparsely clothed with very short spreading hairs (but leaves ciliate) giving a granulate appearance under a lens; inflorescence few-flowered (3-6); plants loosely tufted, low-growing (4-6cm.) 51. M. micrantha

16b. Entire plant densely velutinous (sometimes glandular in inflorescence), or with the lower part of the stem with white crisped hairs; inflorescence many-flowered (> 10); plant densely caespitose, 3-4cm., or of medium height (7-12cm.)

54. M. anatolica (ii). var. arachnoidea, (v). var. scleranthoides, & (vii). var. polymorpha

12b. Sepals > 3.0mm. long :

17a. Plants densely caespitose; petals distinctly longer than the sepals; sepals ovate to ovate-lanceolate (< 3 times as long as broad) often red-tinted and with the lateral nerves prominent at the base (occasionally sepals narrower and then petals much longer) 55. M. erythrosepala

(cf. also 55b. M. abchasica)

17b. Plants not densely caespitose (rarely rather dense and then petals very short - M. anatolica var. polymorpha); petals shorter than or as long as sepals (rarely a little longer); sepals lanceolate to linear-lanceolate (> 3 times as long as broad), rarely red-tinted and then only at maturity, always only 1-nerved :

18a. Flowers arranged in dense terminal and subterminal (and sometimes also axillary) clusters of few to many flowers (5-20) (pedicels short 0-3(-5) mm.); entire plants densely velutinous or lanuginose (rarely inflorescence glabrous); sepals 4-5.5mm. long; petals shorter than (or sometimes about as long as) sepals :

19a. Entire plant lanuginose, sometimes rather sparsely so, giving it a greyish-white appearance; plants rather low-growing, 4-10cm.; inflorescence few to many-flowered 54. M. anatolica (iii). var. lanuginosa

19b. Entire plant velutinous, or occasionally inflorescence glabrous; plants rather tall, 10-20cm.; inflorescence many-flowered (> 10) 58. M. leucocephaloides

18b. Flowers arranged in lax cymes, or if slightly congested, plants low-growing (< 8cm.) and inflorescence few-flowered (< 10); lower part of the stem usually sparsely puberulent with white crisped hairs, often glabrous or glandular in the inflorescence region, but rarely velutinous and never lanuginose throughout (occasionally entire plant densely glandular pubescent) 54. M. anatolica (i). var. anatolica, (ii). var. arachnoidea, (vi). var. phrygia & (vii). var. polymorpha

Series Setaceae:-

49. M. setacea (Thuill.) Hayek, Fl. Steierm. 1 : 271 (1908).

Key to varieties

(1a. Sepals 3.0-3.5(-4) mm. long, ovate-lanceolate to lanceolate; inflorescence lax, spreading, usually many-flowered; lower part of the stems sparsely to densely hairy (Europe) (i). var. setacea)

1b. Sepals 4.0-5.5mm. long, linear-lanceolate; ultimate inflorescences usually congested, if entirely lax, sepals > 4.5mm. :

2a. Entire plant glabrous, lower part of the stems pruinose;

leaves with faint lateral nerves; sepals narrowly linear-lanceolate (> 5 times as long as broad); inflorescence of many few-flowered fascicles on long peduncles; plant tall, 20-35cm. (ii). var. thracica

2b. Lower part of the stem rather sparsely clothed with very short spreading hairs; leaves ciliate, with prominent lateral nerves; sepals (lanceolate to) linear-lanceolate, (3-)4-5 times as long as broad; inflorescence lax to congested with few or no axillary branches; plant of moderate height, 8-20 (-25) cm. (iii). var. athoa

((i). var. setacea

Syn.: Arenaria setacea Thuill., Fl. Paris ed.2 220 (1779).

?Arenaria heteromalla Pers., Syn. 1 : 504 (1805).

Alsine setacea (Thuill.) Mert. & Koch, Deutschl. Fl. 3 : 286 (1831).

Sabulina setacea (Thuill.) Reichb., Fl. Germ. Excurs. 786 (1832).

Type: France: Paris: "a Fontainebleu rocher du Cuvier", Thuiller. holo. P?

Geographical distribution (of var.): France, C. Europe, European Russia and the Balkans south to Yugoslav Macedonia and Bulgaria.)

(ii). var. athoa (Griseb.) Hayek, Prodr. Fl. Balc. 1 : 183 (1924) (Fedde Rep. Beih. 30 : 183); Mattfeld in Fedde Rep. Beih. 15 : 98 (1922) (mentione incasa).

Syn.: *Alsine setacea var. athoa Griseb., Spicil. Fl. Rumel. 1 : 199 (1843).

Type: GREECE: Macedonia: "m. Athus frequens pr. Panajia, alt. 4500ft. [1370m.] . Fl. Jun.", Grisebach (1839). holo. GOET, iso. K!

Specimens seen:

GREECE:-

? ? :- nr. Massalia, Heldreich, 5.1849 (as Ar. tetraqueta, ? wrong label, K).

Macedonia:- Athos, Frivaldskyi (as Ar. caespitosa) (G).

E. Macedonia: Boz Dagh, nr. Drama, Volaka - Pyrgos, 1000m., Rechinger 10670 (W-R) (approaches M. glomerata subsp. macedonica and M. anatolica).

Thrace:- W. Thrace: R. Nestos (Mesta) nr. Toxotai (Oktschilar), 60-100m., Rechinger 9318.

Thessaly:- M. Olympus, Heldreich 2424 (reg. alpin.) (G), Grebenchikoff 23.7.1937 (nr. Litochoro above Ag. Dionisios, 2200m.), Goulimy 213 (S. of Alpine Club, 2200m.).

Geographical distribution (of var.): Probably endemic, though also recorded from N.W. Romania (Siebenburgen) - Mattfeld (1922) p.95.

Biology: Plant of stony places; flowering June - July.

(iii). var. thracica McNeill, var. nov.

A plantis omnibus aliis affinis, planta ex toto

glabra (praeter caulibus inferne pruinosis) facile distinguenda.

Planta procera (20-35cm. alta) gracilis. Folia subuninervia, nervis lateralibus evanescentibus. Inflorescentia laxe thyrsoidea; inflorescentiae partiales numerosae longe pedunculatae pauciflorae (1-5 florae). Sepala 4.0-5.0mm. longa, anguste lineari-lanceolata, corollam subaequantia. Capsula calyce multo breviora. Semina c. 0.90 x 0.55m., in jugo dorsali acute tuberculata.

Typus: GREECE: Thrace: "Xanthie - Shahin Rd. Km.6 Rocks. 100m. 3 July 1931, H.G. Tedd 730." (as M. bosniaca). holo. K!

Specimens seen:

GREECE:-

Thrace:- Nr. Toxotai (Oktchilar), Tedd 2053A (90m.) (as M. bosniaca), Rechinger 9283 (R. Nestos, 60-100m.) (as M. setacea var. athoa). W. Thrace: Suni Mahale nr. Xanthi, Rechinger 10540 (as M. setacea var. athoa).

Geographical distribution (of var.): Endemic.

Biology: A plant of stony places in flower June - July.

Discussion (of species): M. setacea is essentially a plant of Central and Eastern Europe and reaches its furthest extent southwards in Northern Greece, where it is represented by the two distinctive races enumerated above. The plants from the main part of its area, although by no means uniform, are much more restricted in their range of variation than those of the M. anatolica complex which replaces M. setacea in Turkey. In

Greece and N. W. Anatolia, where they meet, the two species appear to intergrade and may well hybridise; for this reason it is often difficult to distinguish between M. setacea var. athoa and some specimens better referred to M. anatolica var. polymorpha. (cf. fig. 36)

A similar relationship probably holds in the Caucasus where M. anatolica meets with setacea-like plants, but the scanty material available has prevented any well-grounded opinion being formed as to the status of the Caucasian plants. Schischkin (1936) and Grossheim (1949) recognise five species from that area apart from M. setacea, which is geographically separated, being confined to S.W. Russia and the Ukraine. Three of these, M. woronowii, M. buschiana and M. micrantha lie in the affinity of M. setacea and are discussed below.

50. M. woronowii Schischkin in Komarov. Fl. U.R.S.S. 6 : 495 (rossice), 884 (latine) (1936).

Syn.: ?Arenaria heteromalla sec M. Bieb., Fl. Taur. Cauc. 1 : 350 (1808) pro parte, non Pers.

Type: U.S.S.R.: Georgia: "Tbilissi, pr. Vake" 4.6.1917, G. Woronow. holo. LE (photo!)

Specimens seen:

U.S.S.R.:-

No locality:- "Caucasus", Herb. N.B. Ward (BM) (as Ar. heteromalla).

Georgia:- no locality, Hohenacker (BM as Ar. heteromalla, G as Als. setacea var. grandiflora).

Armenia:- no locality, Szowits (as Als. setacea var. grandiflora). Nakhichevan: M. Taideri nr. Arpa, 900m., LE 11.5.1947 (leg. Grossheim, Ilinskaya & Kirpichnikov) (BM).

Records: East Caucasus, Central Transcaucasia, Nakhichevan and Southern Karabakh - cf. Grossheim (1945, 1949).

Geographical distribution: Endemic.

Discussion: The specimens cited above seem to form a distinctive taxon and as such, agree well with Schischkin's description of M. woronowii. Whether they should be specifically separated from M. setacea is, however, open to question, and M. woronowii is only maintained here because with the inadequate material available (most of the specimens seen are fragmentary), it has not been thought advisable to make any change of rank, involving new combinations.

No material has been seen of :

50a. M. buschiana Schischkin in Komarov, Fl. U.R.S.S. 6 : 493 (rossice), 884 (latine) (1936).

Type: U.S.S.R.: Georgia: "Kuban prov. m. Baranachi, 31.5.1907", N.A. Busch. holo. LE (photo.!).

Distribution: West Caucasus, West Transcaucasia and Central Transcaucasia (in the North) - cf. Grossheim (1945, 1949).

Discussion: M. buschiana is said to differ from M. woronowii in its sharply tuberculate seeds, its shorter stature and laxer habit and to replace it in Western Transcaucasia. No authentic material has been seen and the photograph of the type specimen only confirms its relationship with M. woronowii, of which it possibly represents only a subspecies. (cf. Keys in Discussion of Series).

51. M. micrantha Schischkin in Komarov, Fl. U.R.S.S. 6 : 494 (rossice), 884 (latine) (1936).

Type: TURKEY: Pontus: "Artwin: Alvana-su prope Czarobieta", Vvedensky 29.6.1911. holo. LE (photo.').

Specimens seen:

TURKEY:-

Pontus:- Çoruh (Artvin): Çoruh gorge, Artwin-Ardanuç, 700m., Davis 30045; above Ardanuç, 800m., Davis 32437.

Paphlagonia:- Kastamonu: Tossia, Sintenis 3690 (WU). Kastamonu - Kure, 1220m., Davis 21700 (habit atypical).

N.E. Armenia:- ?"Asia Minor", Zohrab (K). Erzeroum, Zorab (sic) 110 (K).

U.S.S.R.:-

no locality:- "Caucasus", Herb. Roemer (BM) (as Ar. heteromalla).

Other records: Central and South-West Transcaucasia - Grossheim (1945, 1949).

Discussion: From the material examined the small-flowered setacea-like plants of the Pontus and Transcaucasia seem more distinct from typical European M. setacea than are their large-flowered relatives. They show a closer approach, however, to East Anatolian forms of M. anatolica and M. erythrosepala, particularly to some from the Pontus and Armenia referable to M. anatolica var. polymorpha and M. erythrosepala var. orientalis. (cf. fig. 36)

Although the specimens cited above form a fairly homogeneous group to which the name M. micrantha clearly refers, as in the case of M. woronowii there must remain some considerable doubt as to the validity of this species.

52. M. tchihatcheffii (Boiss.) Hand.-Mzt. in Ann. naturh. Hofmus. Wien 26 : 148 (1912).

Syn.: ?Alsine tchihatcheffii Boiss. in Ann. Sci. Nat. ser.4 2 : 247 (1854).
Als. setacea sec Post, Fl. Syr. Pal. ed. 150 (1896); ed.2 1 : 194 (1932), non (Thuill.) Mert. & Koch.
?Als. setacea var. puberulenta Post, Plantae Postianae in Bull. Herb. Boiss. 3 : 153 (1895).

Type: TURKEY: Cataonia: "Antitaurus in Cataonia meridionali", Tchihatcheff. holo. G!

Specimens seen:

TURKEY:-

Amanus:- Adana: Bahçe: Düldül Dağ, Davis 16392 (Baskanus yayla - Hussein Olukecesme, 1700m.), 16413 (foot of mt. nr. Gokcayir, 600m.), Haradjian 2372 (1525-2135m.). Haruniye: Dümanli Dağ, 700-1200m., Haradjian 3700.

Cataonia:- Akher (Ahir) Dagh, Haradjian 1739 (1830-2135m.), 1621 (W). Mamuret-ul Asis: Kjachta (Kâhta), Nimrud Dagh nr. Tschirik jailassi, 1950m., Handel-Mazzetti 2150 (WU). ?Ziyarat (Tiaret) Dagh, ex herb. Post 18.9.1884 (BM) (as Als. setacea).

Geographical distribution: Endemic.

Biology: In stony places on mountains; recorded between 600 and 2135m. Flowers July - August.

Discussion: M. tchihatcheffii is a very distinctive localised species confined to the mountains of the Amanus and Anti-Taurus. It represents a type related both to M. setacea and M. anatolica var. polymorpha, but unexpectedly appears closer to the former. The above list of specimens seen includes all the known records of the species. (cf. fig. 36)

Post's (1896, 1932) record of Alsine setacea from Ziyarat Dagh refers to this species and as M. tchihatcheffii is usually puberulent it is probable that his var. puberulenta does also:-

Alsine setacea var. puberulenta Post in Post & Autran, Plantae Postianae 7 in Bull. Herb. Boiss. 3 : 153 (1895).

Type: TURKEY: Amanus: "Gaiour Dagh (Amanus), 1500m.", Post holo. BEI.

53. M. antilibanotica McNeill, sp. nov.

Species valde distincta; a speciebus aliis seriei planta inferne dense tomentosa facile distinguenda; a M. anatolica var. arachnoidea, probaliter affini, planta superne omnino glabra calycibus ad basim rotundatis nec truncatis differt.

Planta humilis ad 9cm. alta. Caudex crassus, c. 5mm. diam., caudiculos numerosos coarctatos emittens. Caudiculi ad 2mm. diam., breves, in caules floriferos abientes. Caules steriles sub anthesis deficientes; caules floriferi foliis mortuis 3-5-jugis congregatis et superne foliis viridibus 2-4-jugis remotis praediti; caules inferne et margines foliorum inferiorum pilis tenuibus albis bombycinis dense vestiti. Folia subulato-setacea 2-4mm. longa; folia inferiora turiones incipientes (non comparentes) sub anthesis subtendentia. Inflorescentia ex toto glabra, laxissima, 6-10-flora; bracteae subulatae vel triangulares, ± late membranaceo marginatae; pedicelli infimi c. 10mm. longi; ultimi (flora matura) 3-5mm. longi. Sepala ovata, latitudine 2-2.5-plo longiora, longe acuta vel subacuminata, 2.5-3.0mm. longa. Petala lanceolata, latitudine c. 3.5-plo longiora, cuneata, sepala subaequilonga. Stamina fertilia; filamenta c. 2.0mm. longa; anthera c. 0.5mm. longa. Capsula ovoidea c. 2.5mm. longa; valvae 1.3-1.5mm. latae; ovula 12-18. Semina 6-10, subrotundata, c. 0.65mm. diam., obscure tuberculata, epapillosa.

Typus: SYRIA: Damascus: Antilebanon: "Sahel (Nebk). Rocks 4700ft. [1430m.] flrs. white 21.6.1943", P.H. Davis 6586A. holo. E', iso. K'

Geographical distribution: Endemic.

sparse, or crisped and not silky; upper part of plant glandular-puberulent to glabrous; plants of medium height to tall, 10-20cm. :

3a. Sepals 2.5-4.0mm. long, ovate-lanceolate to lanceolate, broadly acute to abruptly acuminate, (ii). var. arachnoidea

3b. Sepals 4.0-5.5mm. long, linear-lanceolate, narrowly acute to long acuminate (i). var. anatolica

1b. Lower part of plant glabrous, puberulent or velutinous, without white crisped or silky hairs; fascicular leaves ciliate but not arachnoid :

4a. Plants very densely caespitose, 3-4(-5) cm. tall; sepals 2.0-3.0mm. long, bluntly acute, incurved at the apex and margins (v). var. scleranthoides

4b. Plants loosely tufted, 8-25cm. tall; sepals 3.0-5.5mm. long, narrowly acute to acuminate, not incurved at the apex or margins :

5a. Lower part of plant bearing at least some tightly imbricate, ± terete, tetrastichous leaves (< 2mm. long); basal leaves (excl. fascicular leaves) all short < 5mm.; flowers arranged in terminal and subterminal clusters; petals oblong, long cuneate at base; entire plant rather densely velutinous (iv). var. tetrasticha

5b. All non-fascicular leaves setaceous or subulate, > 5mm. long; inflorescence usually lax, rarely a little congested and then petals ovate, abruptly contracted at base :

6a. Entire plant densely glandular-pubescent

(vi). var. phrygia

6b. Indumentum various, usually sparsely puberulent, only glandular in the inflorescence region :

7a. Sepals 4.0-5.5mm. long, usually glabrous

(i). var. anatolica

7b. Sepals 3.0-4.0mm. long, often finely puberulent

(vii). var. polymorpha

(i). var. anatolica

Syn. : !Alsine anatolica Boiss., Diagn. Fl. Orient ser.1 8 : 97 (1849), (excl. syn. A. setacea var. athoa Griseb.).

!Als. setacea var. anatolica (Boiss.) Boiss., Fl. Orient. 1 : 680 (1867) ("β").

!Arenaria anatolica (Boiss.) Fernald in Rhodora 21 : 6 (1919) (= Contr. Gray Herb. Harv. 57 : 6).

Lectotype: TURKEY: Caria: "Cadmus supra Denisleh, Jun. 1842", Boissier. lecto. G!

Specimens seen:

TURKEY:-

Bithynia:- Bolu, Pestalozza (1846) (paratype) (G) (atypical, approaches M. leucocephaloides and M. glomerata). M. Olympus (Ulu Dağ), Aucher-Eloy 576 (paratype) (G) (approaches M. setacea var. athoa).

Mysia:- M. Gargarus (Kaz Dağı), Aucher-Eloy 577 (paratype) (G).

Lydia:- M. Sipylos (Manisa Dağ), Boissier 7.1842 ("pars superiore") (paratype) (G) (atypical, approaches M. leucocephaloides), Balansa 6.1854 (above Magnesia = Manisa) (G), Bornmüller 9159 (reg. subalp. & alp., 900-1000m.). İzmir - Ödemiş: Boz Dağ (Tmolus), Boissier 6.1842 (above Philadelphia = Alaşehir) (paratype) (BM)(G)(K), Davis 18206 (2000m.), 18210A (1900m.).

Lycia:- ? Ujuklu Dagh, Luschan (WU). Bei dagh nr. Elmalu, Pichler 15.7.1883 (WU).

Biology: A plant of the coastal mountains of Western Anatolia, flowering June - July.

(ii). var. arachnoidea McNeill, var. nov.

Syn.: Als. setacea var. villosa Boiss., ined.

A varietatibus omnibus aliis M. anatolicae, praeter lanuginosam et interdum anatolicam, caulibus inferne et fasciculis foliorum pilis longis albis crispis vestitis differt; a var. anatolica, sepalis (2.5-)3-4.5mm. longis (nec 4.5-5.5mm. longis) lanceolatis (nec lineari-lanceolatis) divergit; a var. lanuginosa planta superne glanduloso-pubescentia vel puberulenta vel interdum glabra (nec ex toto dense lanuginosa) floribus non glomeratis facile distinguenda.

Planta 10-20cm. alta. Caules inferne pilis longis albis crispis

(interdum sparse) obtecti; margines foliorum fasciculatorum pilis similis dense vestiti (fasciculis arachnoideis). Inflorescentia glanduloso-pubescentia vel puberula vel interdum glabra, laxa, multiflora. Sepala 2.5-4.5mm. longa (2.5-3.0 in typo), ovato-lanceolata vel lanceolata, latitudine 2.5-3.0-plo longiora. Petala ovato-lanceolata, sepalis longiora (in typo) vel paulo breviora. Capsula (in typo ignota) calyce subbreviora. Semina c. 5, 0.8-1.0mm. longa x 0.6-0.8mm. lata, obscure tuberculata epapillosa.

Typus: TURKEY: Lycaonia: "Prov. Konya: Cihanbeyli. Steppe. 7 June 1952". Davis & Dodds (D. 18624). holo. E!, iso. K!

Specimens seen:

TURKEY:-

Lycia:- M. Elmalu, Bourgeau 31 (reg. alp.) (as Als. anatolica var. villosa), Pestalozza (1846) (G) (as Als. setacea var. villosa).

Phrygia:- Eskişehir: Sazova, Schwarz 1288 (leg. Scheibe) (S). (hairs very short).

Lycaonia:- Konya: Yavsan Memlehasi nr. Tuz Gölü, Davis 18673. Konia: nr. Divla, 1400m., Siehe 192.

Galatia:- Ankara: Tuz Gölü, 25 km. N. of Koçhisar, 925m., McNeill 340. Ankara (Angora), Bornmüller 3014, Kotte 1115 (19.6.1933) (Dikmen tepe). Çankiri (Tschangry, Germanicopolis), Çakmaki-dere, 800m., Bornmüller 13348 (S) (hairs sparse).

Cappadocia:- Nevşehir: Kirşehir - Gulşehir (Arapsun), c. 20 km.

from Gulşehir, 500m., McNeill 375. Erdschias (Erciyas) Dagh: Ilghim, E. of Tschawuschdschi-göl, Zederbauer 10.5.1902 (WU).

Biology: A plant of stony places in the Central Anatolian steppe, flowering June - July; the plants from Lycia appear to approach closely var. anatolica and var. polymorpha.

(iii). var. lanuginosa McNeill, var. nov.

A varietatibus omnibus aliis M. anatolicae planta ex toto lanuginosa differt; a var. arachnoidea, affini, floribus aggregatis sepala 4.5-5.5mm. longa divergit.

Planta aliquantum humilis (4-10(-14) cm.) ex toto pilis tenuis longis albis lanosis dense (in typo) vestita. Flores in corymbis terminalibus aggregati. Sepala lineari-lanceolata, 4.0-5.5mm. longa. Petala ovata, abrupte contracta, sepalis paulo breviora. Stamina fertilia 2.5-3mm. longa; sterilia 1-1.5mm. longa; antherae 0.6mm. longae. Capsula immatura calyce subbreviora; semina immatura c. 8, obscure tuberculata, epapillosa.

Typus: TURKEY: S.W. Armenia: "Prov. Tunceli: Pertek - Tunceli, 26 miles from Elazig. 1400m. Crystalline limestone ravine. Perennial, on rock outcrops. Flowers white. Erect. 6.6.1957", Davis & Hedge (D. 29132) holo. E!, iso. K.

Specimens seen:

TURKEY:-

Cappadocia:- Sivas : M. Tschamlii-bel (Çamlibel Dağı), 1200-1700m., Bornmüller 2034 (hairs less dense than type).

(iv). var. tetrasticha McNeill, var. nov.

A varietatibus omnibus aliis M. anatolicae caulibus nonnullis inferne foliis dense imbricatis tetrastichis praeditis differt: habitu var. lanuginosae similis, sed planta ex toto velutina nec lanuginosa divergit; probaliter propinquior plantae var. polymorphae sed inflorescentia contractata (et foliis tetrastichis) differt.

Planta aliquantum humilis 5-15cm. alta, laxe caespitosa, ex toto velutina. Folia caulina inferiora brevissima (< 5mm.), nonnulla crassulosa dense imbricata tetrasticha (< 2mm.). Flores in corymbulis terminalis paucifloris (4-10) aggregati. Sepala 3.5-4.5mm. longa, lineari-lanceolata, longe acuminata. Petala oblonga sepalis breviora. Stamina sterilia. Capsula ignota.

Typus: TURKEY: Cappadocia: "ad Siwas (Vilayet Siwas) c. 13-1400m., IV.1893", J. Bornmüller 3289. holo. WU! iso. JE!, K!

(v). var. scleranthoides (Boiss. & Noë) McNeill, comb. et stat. nov.

Syn.: !Alsine scleranthoides Boiss. et Noë in Boiss., Diagn. Fl. Orient ser.2 1 : 88 (1853).

!Als. setacea var. corymbulosa sec Boiss., Fl. Orient. 1 : 680 (1867) pro parte, non Boiss. et Bal. (1859).

Type: TURKEY: Cappadocia: "in subalpibus Anatoliae, Junio 1852" ("prope Sivas" cf. Boiss. l.c. 1867), Noè 953. holo. G.!

Specimens seen:

TURKEY:-

Cappadocia:- Sivas - Sarkisla, 1500m., Davis 32718.

? S.W. Armenia:- Chama: Nesskiep, Sintenis 1020 (as Als. setacea var. corymbulosa).

Biology: Very dwarf caespitose plants, with the habit of M. erythrosepala (but with the floral structure of M. anatolica). The Davis gathering is from dry gypsaceous hillside and the variety appears to flower from June - July.

(vi). var. phrygia (Bornm.) McNeill, comb. et stat. nov. (M. anatolica var. phrygia (Bornm.) Mattf. in Fedde Rep. Beih. 15 : 104 (1922), mentione incasa).

Syn.: Alsine setacea subsp. A. phrygia Bornm. in Beih. bot. Zbl. 24 (2) : 449 (1909).

M. phrygia (Bornm.) Bornm. in Beih. bot. Zbl. 33 (2) : 279 (1915) (in adnot.).

Type: TURKEY: "Phrygia: Sultandagh, in rupestribus et saxosis ad Akscheher (Wilajet Konia) 1100m. 8.VI.1899", J. Bornmüller 4195. holo. JE.! iso. E.!, K.!, WU.!

(vii). var. polymorpha McNeill, var. nov.

Syn.: M. erythrosepala subsp. cappadocica (Boiss.) sec Bornm., Symbolae Fl. Anatol. in Fedde Rep. Beih. 89 : 247 (1940), non cappadocica Boiss.

Affinis var. anatolicae et var. arachnoideae sed ab hac sepalis brevioris (3.0-4.0mm. longis) et ab illa planta glabra puberula vel velutinosa nec villosa differt.

Planta 5-15cm. alta laxe caespitosa, glabra, puberula (in typo) vel velutina, in inflorescentia glandulosa. Inflorescentia pauciflora (3-10) vel interdum multiflora (-20), laxa vel raro subcongesta. Sepala lanceolata vel lineari-lanceolata, 3.0-4.0mm. longa, viridia et alba nec erythraea. Petala saepe lanceolata, sepalis breviora vel paulo longiora (in typo).

Characteres ceteri valde variabiles.

Typus: TURKEY: Pamphylia: "Prov. Antalya, distr. Gebiz (Pisidia): Bozburun dağ between Boğaz Ağzi & Tozlu Çukur Yayli, 24.7.1949, P.H. Davis 15575". holo. E!, iso. K!

Specimens seen:

GREECE:-

Macedonia:- E. Macedonia: Drama: Boz Dagh below Granitis (Juricik), 800m., Rechinger 6383.

Thrace:- Samothrake: S. slopes, 500m., Rechinger 9788 (approaches M. setacea).

TURKEY:-

Pontus:- Lazistan: above Djimil, 2500m., Balansa 252 (G) (as Als. setacea var. genuina).

Bithynia:- Bilecik, R. Kara-su nr. station, 300-400m., Bornmüller 13349 (S).

Mysia:- M. Ida (Kaz Dağı), M. Izu Izus Dagh, Sintenis 433 (with M. erythrosepala, E. WU).

Caria:- Denizli: Bozdagh above Geyran Yayla, 1830-2135m., Davis 13363 (approaches M. erythrosepala).

Lycia:- Ali Dagh, Pichler 123 (WU).

Pamphylia:- Bozburun Dağ ("Pisidia"), N. side, 2200-2300m., Davis 15650.

Cilicia:- Sara nr. Ermenek, 1400m., (Balansa?) 326 (1872) (G) (as Als. setacea). Mersin - Eregli: Dombelak Pass, 2300m., Siehe 265. Karli Boghas, Kotschy 8a & 766 (one sheet) (Guguta Valley, 2135m.) (as Als. setacea var. trachysperma Fenzl), Siehe (1896) 279a (with M. erythrosepala at K). Bulghar dagh: Castella Gullek, 1525m., Kotschy 339 (G). Taurus, Balansa 839 (Gulek Maden) (G), Kotschy 58 (BM), 850.

Galatia:- Amasya, Manisadjian 228 (Karaman), Bornmüller 65 (400-900m.) (as Als. setacea var. genuina), 1807 (Ak Dagh, 1700m.) (JE).

Cappadocia:- Niğde: Hasan Dağ above Taspinar, 1100-1200m., Davis 18888 (K) (leaves spreading, acicular).

S.W. Armenia:- Egin, at Euphrates (Firat), Sintenis 152 (WU), 2300

(as Als. setacea var. laxa).

N.E. Armenia:- "Gummuskhane", reg. alp., Bourgeau 60 (G) (as Als. cappadocica var. glabrata).

Kurdistan:- Van : Başkale: Ispiriz Dağ, 2600m., Davis 23618 (inflorescence very lax).

U.S.S.R.:-

Georgia:- Tiflis, Rehmann (1873) (G). ? Dzovaki, Rehmann (1873) 108 (G).

Biology: A very heterogeneous assemblage of mountain plants (coastal in the west of its range). Recorded between 300 and 2600m. Flowers (May-) June - August.

Geographical distribution (of species): Endemic.

Discussion (of species): Mattfeld (1922) (pp. 104-105) said of M. anatolica that it was "so variable ... that each individual could almost be described as a separate variety". In Mattfeld's time this was certainly true, and he very wisely recognised only four taxa - all species - in Turkey. These were the rather distinctive M. leucocephaloides and M. tchihatchewii, the alpine M. erythrosepala, and M. anatolica into which he 'lumped' all the remaining steppe, montane and subalpine plants representing an extraordinary diversity of form. Most of the specimens seen by Mattfeld have been examined in the present revision, along with all those in Boissier's herbarium. New material, notably Davis' collections and my own, has amounted to about as much again as was available to Mattfeld, but many more

specimens, particularly from Northern and Eastern Turkey, will be required before any real order can be produced out of the chaos and confusion. Certain patterns of variation and potential lines of investigation have, however, been revealed that could not be deduced by Mattfeld.

In the first place, there seems definite evidence of local differentiation of distinct types and it is this that encourages the view that this is a group in which the herbarium taxonomist has still an important contribution to make. It is found that gatherings from the same area (but not the same precise locality) are often extraordinarily similar - extraordinary, that is, for Series Setaceae. The best example is probably the series made in the 150 km. between Gulşehir (Arapsun) and Pinarbaşi (McNeill 383 & 390, Balansa 652 (& 1058) and McNeill 184). These are actually specimens of M. corymbulosa var. corymbulosa but a similar uniformity can be seen in those from south of Ankara (especially round the Salt Lake) which form the basis of M. anatolica var. arachnoidea (Davis 18624 & 18673, McNeill 340, Kotte 1115 and Siehe 192). When one takes into account the restricted range of the "good" species of the series, not all of which are completely isolated (e.g. M. tchihatchewii in the Amanus and southern Anti-Taurus), there seems some reason to believe that a large number of taxa, each with a distinctive geographical and ecological range, may become recognisable within the group.

Unfortunately, this is only one aspect of the pattern of variation suggested by these studies. The other arises from the fact that very many of the specimens examined appeared to be male sterile. These male sterile plants with dwarfed stamens and rudimentary anthers very frequently appear to bear fertile seed and the possible occurrence of monoecism or

dioecism was explored. Because of the protandrous development of the flowers female sterility would not be readily detected and it is not impossible that in this species male, female and hermaphrodite plants all occur. This is supported by the fact that of the plants examined as many were hermaphrodite as were male sterile, both conditions being found in the one, otherwise more or less uniform, gathering. No individual plants were observed, moreover, with both sterile and fertile stamens, but the number of flowers examined on any one plant was necessarily few - too few to permit a generalised statement. (The sepals being erect at flowering-time makes dissection necessary for the examination of the stamens.)

Another possible explanation would seem to be genetic unbalance due to hybridisation between partially intersterile 'races' or more distinct taxa; the possibility of associated apomixis is then very strong.

Taking account of both these suggestions as to the variation pattern and breeding system of the members of the group, it was felt that while the treatment ought to be conservative until more is known of the biology of the species, some indication should be given of the more or less discreet units which can at the moment be discerned.

This has resulted in the recognition of two species within Mattfeld's concept of M. anatolica, the one, M. corymbulosa, fairly homogeneous, but the other, M. anatolica itself, extremely heterogeneous and divided into seven varieties, some of which may come to be regarded as distinct species or geographical subspecies. Although he cited Als. corymbulosa as a synonym of M. anatolica, Mattfeld did not in fact see any specimens referable to that species, which like M. leucocephaloides seems fairly distinct, without, in all probability, being completely isolated reproductively from M. anatolica.

The most distinctive race of M. anatolica is that which inhabits the central Anatolian plateau where it is the only representative of the species (although overlapping with M. corymbulosa). This has been described as a new variety (var. arachnoidea) though it is probably the strongest candidate on present knowledge, for subspecific recognition; at the periphery of its range it appears to merge with other forms of the species, mainly those referable to var. polymorpha. Of the others, three (vars. lanuginosa, tetrasticha and scleranthoides) are rather restricted, but on the other hand morphologically very distinctive. The type of M. anatolica represents another segregate, this one confined to the mountains of south-west and west Anatolia. Because of this a new variety has been described to contain the "unallocated" residue of the species. This has been appropriately named var. polymorpha and comprises an apparently homogeneous Cilician and Pisidian group (from which the type has been chosen) along with a varied assemblage of specimens mainly from Greece and Northern and Eastern Turkey which cannot be adequately discriminated. The remaining variety (var. phrygia Bornm.) is possibly nothing more than a very local pubescence form of var. polymorpha but as no similar plants are known elsewhere and as it is already provided with a name, it seems worth maintaining for the present. (cf. fig. 38)

The treatment proposed above is essentially a provisional one and no completeness is claimed for it. It does, however, seek to provide a practical and convenient classification which also represents the variation within the group as accurately as is possible at the present time.

55. M. erythrosepala (Boiss.) Hand.-Mzt. in Ann. naturh. Hofmus. Wien 26 : 148 (1912).

Key to varieties

1a. Sepals lanceolate to linear-lanceolate, > 3 times as long as broad, rarely red-tinted; petals much longer than the sepals (> 1.25 times) (iii). var. cappadocica

1b. Sepals ovate to ovate-lanceolate, < 3 times as long as broad, usually red-tinted; petals usually < 1.25 times as long as sepals :

2a. Sepals < 3mm. long, in lax rather many-flowered inflorescences (5-)19-25; petals occasionally shorter than sepals (ii). var. orientalis

2b. Sepals > 3mm. long, rarely less; inflorescence, usually few-flowered and always so if sepals < 3.5mm. long; petals always longer than sepals (i). var. erythrosepala

(i). var. erythrosepala

Syn. : !Alsine erythrosepala Boiss., Diagn. Pl. Orient. ser.1 8 : 98 (1849).

!Als. pusilla Stapf in Denkschr. Akad. Wiss. Wien 51 : 354 (1886), non Arenaria pusilla Stapf (1886), nec S. Wats (1881-2).

Als. kabirarum Degen & Halacsy in Öst. bot. Z. 41 : 331 (1891).

?M. kabirarum (Degen & Hal.) Graebner in Aschers. & Graebn., Syn. Mitt.-Eur. Fl. 5 (1) : 717 (1918).

Syntypes: TURKEY: 1) Lydia: "Tmolus supra Bozdagh Jul. 1842", Boissier. holo. G!, 2) Bithynia: "in cacumine Olympi, Aug. 1842", Boissier. holo. G!, iso. E!, JE!, K!

Specimens seen:

TURKEY:-

Paphlagonia:- Kastambuli (Kastamonu): Tossia, Buyuk Ilkaz Dağ, 2710m., Sintenis 4789.

Bithynia:- Bursa: Ulu Dağ (M. Olympus), Ball 10.(10?).1867 (reg. alp.), Pichler 193 (6.1874) (summit) (G), 176 (7.1874) (summit) (JE)(K) (WU), herb. J. Stuart Mill 6.1862 (above plateau), Bornmüller 17.9.1886 (reg. alp.) (WU), Pauli (JE), Maire 406 (reg. alp., 2300m.) (JE), Hedenborg (S), Kotte 17.8.1932 (summit reg., 2500m.), Davis 14853 (2500m.), 14831B (alpine).

Mysia:- M. Ida (Kaz Dağı), Izu Izus Dagh, Sintenis 433 (with M. anatolica var. polymorpha, E, WU).

Lydia:- İzmir: Ödemiş, Boz Dağ (Tmolus), Davis 18210A (E), 18210B (K), (1900m.) (with M. anatolica var. anatolica, D. 18210), Balansa 416 (W. of summit).

Lycia:- M. Elmalu, Bourgeau 31 (as Als. anatolica var. villosa, and with M. anatolica var. arachnoides) (K). Curova, Luschan 15.7.1882 (WU) (syntype of Als. pusilla). Geyik Dagh, 2500m., Davis 14573 (K). Ak dagh, S. of Geyik Dagh, Luschan 17.7.1882 (WU) (syntype of Als. pusilla)

(typical M. erythrosepala), Davis 14376 (fls. very small). Antalya: Tahtali Dağ nr. Kemer, Davis 14122 & 14122A (2200-2300m.) (atypical), 15083B (2300m.), 15078 (2300m.).

Cilicia:- ?"Anatolia austro-orientalis", Siehe 154 (JE) (with M. leucocephala). Osttaurus, 2500-2800m., Siehe 2 (JE). Taurus: Boulgarmaden, Balansa 18.7.1855. Karli Boghas, 1800m., Siehe (1895) 279 (WU), (1896) 279 (JE), (1895) 279a (E), (1896) 279a (K) (with M. anatolica var. polymorpha). Kisyl Tepe (Bulgar Dagh), Tolg (WU) (2500m.) (as Als. pusilla) (sepals narrow), Kotschy 130d 150a & 236b (one sheet) (2440m.) (G).

Pisidia:- Isparta: Sutçuler ("Isauria"): Dedegol Dağ above Oruz Gazi yayla, Davis 15974 (2400m.), 16050 (2200m.). ? Aglassan Dagh, Heisler (WU).

Cappadocia:- M. Argaeus (Erciyas Dag), Balansa 20.7.1856 (reg. alp.) (G), 1060 (28.8.1856) (reg. alp. sup., 3000m.) (G).

Cataonia:- Beryt Dagh, 2135-2745m., Haussknecht 10.8.1865 (G)(JE).

N.E. Armenia:- Gumuschkhane (Gümüşane): Karagoelldagh, alp., Sintenis 7301 (as Als. recurva β hirsuta) (approaches anatolica).

Kurdistan:- Van: Başkale: Ispiriz Dağ, 3500m., Davis 23757.

Biology: A caespitose high mountain plant recorded from 1800-3500m. Flowers July - August.

(ii). var. orientalis McNeill, var. nov.

Syn.: ?Alsine granulifera Fenzl in Ledebour, Fl. Ross. 1 : 346 (1842).

?Als. setacea var. granulifera (Fenzl) Boiss., Fl. Orient. 1 : 681 (1867) ("ʃ").

?M. granulifera (Fenzl) Grossheim, Fl. Kavkaza 2 : 391 (1930).

Affinis var. erythrosepala sed sepalis brevioribus (< 3mm. longis) inflorescentia fere multiflora petalis lanceolatis nec ovatis differt; a var. cappadocica sepalis ovatis nec lanceolatis petalis sepalis aequilongis vel saepe brevioribus divergit.

Planta ± dense caespitosa sed caulibus floriferis sublongis (4-12cm.) provisa. Inflorescentia laxa fere multiflora - (5-)10-25. Sepala ovata latitudine < 3.0-plo longiora. Petala lanceolata, cuneata sepalis subbreviora (in typo) vel aequilonga. Capsula calyce inclusa.

Characteres ceteri valde variabiles.

Typus: TURKEY: Kurdistan: "Prov. Van: Artos Dagh, Northern slopes above Gevaş, 3000m. Perennial. 2 Sept. 1956", McNeill 772. holo. E!, iso. K!

Specimens seen:

TURKEY:-

Cataonia:- Arabkir, Kainardagh, Sintenis 882.

S.W. Armenia:- Erzincan: Keşiş Dağ above Cimin, 2700-2900m., Davis 31624. Tunceli: Munzur Dağ above Ovacik, 2800m., Davis 31287 (atypical - petals ovate etc.). ?Sipikordagh, Sintenis 1169 (WU) (M. anatolica det. Mattf.), 3095 (JE).

Biology: High mountain plants recorded between 2700 & 3000m.; flowering June - July.

(iii). var. cappadocica (Boiss.) McNeill, comb. nov.

Syn.: ?Alsine cappadocica Boiss., Diagn. Fl. Orient. ser.2 1 : 88 (1853).

?Als. setacea var. cappadocica (Boiss.) Boiss., Fl. Orient. 1 : 680 (1867) (" γ ").

?M. erythrosepala subsp. cappadocica (Boiss.) Bornm., Symbolae Fl. Anatol. in Fedde Rep. Beih. 89 : 247 (1940), quoad basionom. nec spec. cit.

Type: TURKEY: Cataonia? : "Cappadocia ad Euphratem", Aucher-Eloy 587. holo. G.

Specimens seen:

TURKEY:-

Cilicia:- Burujik, Gilbe Kur, 1675m., Balls 1278 (atypical).

Galatia:- Amasia: Abaischidagh, 1300-1500m., Bornmüller 1423 (JE).

Cataonia:- Malatya- Kjachta (Kâhta): Ak Dagh (Aryly Tash), 2250-2670m., Handel-Mazzetti 2313 (WU). Maraş: Goksun: Binboga Dağ above Yalak, 1500m., Davis 19958.

S.W. Armenia:- ?Egin: Yokardidagh, Sintenis 2494 (JE).

Biology: A rather caespitose plant but with a relatively tall flowering stem. Grows at lower altitudes than var. erythrosepala; flowers June - July.

Geographical distribution (of species): Endemic.

Discussion: M. erythrosepala appears to be a high mountain derivative of M. anatolica and as such reflects to some extent the variability of that species. The type of the species, however, represents a fairly uniform race widely distributed from Bithynian Olympus (Ulu Dağ) to Erciyas Dağ near Kayseri (the specimens from further east tentatively referred to var. erythrosepala are atypical). A second reasonably distinctive taxon is the var. cappadocica apparently centred in Cataonia; this plant might be better referred to M. anatolica (cf. key to varieties) but its caespitose habit and long petals have determined its retention in M. erythrosepala. Bornmüller (1940) does not seem to have seen the type specimen because his concept of subsp. cappadocica refers to small-petalled North Anatolian plants, which although possessing a certain facies cannot at the moment be adequately distinguished from M. anatolica var. polymorpha (q.v.).

The greatest diversity and confusion within the species lies, however, in the plants from further east; specimens have been examined from Armenia, Lazistan and Kurdistan which seem to resemble M. erythrosepala more than M. anatolica but which, if referred to the former without qualification, would destroy the homogeneity which it at present possesses. A new variety (var. orientalis) has been described to take account of these East Anatolian plants, but they may possibly be referable to M. granulifera (Fenzl) Grossh., of which no authentic material has been seen (see below). One or two specimens which are tentatively referred to here (notably the dwarf plant collected by Davis and Hedge on Munzur Dağ) may prove to merit separate taxonomic recognition. (cf. fig. 39)

It has not been possible to see type material of M. (Alsine) kabirarum from Samothrace (the Degen specimen is lacking in the Vienna University Herbarium). The Rechinger specimens from Samothrace under this name are referable to M. juressi subsp. juressi in Section Plurinerviae.

55a. M. granulifera (Fenzl) Grossheim, Fl. Kavkaza 2 : 391 (1930).

Syn.: Alsine granulifera Fenzl in Ledebour Fl. Ross. 1 : 346 (1842).

Als. setacea var. granulifera (Fenzl) Boiss., Fl. Orient. 1 : 681 (1867) (" ß ").

Type: U.S.S.R.: (Georgia?): "Transcaucas. occ." ("ad fines Turcicas" fide Boissier l.c.), Nordmann holo. W? (destroyed?), iso. LE?

cf. Discussion of M. erythrosepala (above) and Key to Caucasian species in Discussion of Series.

55b. M. abchasica Schischk. in Komarov, Fl. U.R.S.S. 6 : 495 (1936) (rossice); in Acta Inst. bot. Acad. Sci. U.R.S.S. ser.1 3 : 170 (1937) (latine).

Type: U.S.S.R.: Georgia: "Abchasia, in jugo Ertzog (Irtzych), 31.7.1902", Woronow. holo. LE (photo!).

Distribution: Abchasia (Bzibskii and Ertsog).

M. abchasica appears to represent an isolated high mountain race of the M. anatolica complex and as such to be closely related to M. erythrosepala, if not conspecific with it. (cf. Key to Caucasian species in Discussion of Series.)

56. M. libanotica (Boiss.) Bornm. in Beih. bot. Zbl. 31 (2) : 193 (1914).

Syn.: !Alsine libanotica Boiss., Diagn. Pl. Orient. ser.1 8 : 98 (1849).

!Arenaria makmelensis Fernald in Rhodora 21 : 6 (1919) (= Contr. Gray Herb. Harv. 57 : 6).

!Als. libanotica var. papillosa Post, Fl. Syr. Palest. 150 (1896) (" b ").

Illustrations:

Bouloumoy, Fl. Liban Syrie t.58 f.2 (as Arenaria libanotica) (t.57 f.2 = Arenaria libanotica).

Type: LEBANON: North Lebanon: "in cacumine Makmel", Boissier 4.1846. holo. G., iso. K!

Specimens seen:

LEBANON:-

North Lebanon:- Qurnat Aruba, 2075m., Davis 6268A. J. Makmel, Kotschy 297 (2590m.) (BM)(JE)(S), Bornmüller 11485 (2600-3000m.) (BM) (E)

(K). Dhahr el Khadhib, Herb. Post Pl. Liban. 869 (7.9.1878)(BM), Bornmüller 11485 (2900m.) (WU). Qornet Sauda, 2895-3050m., Davis 9810 (K). The Cedars, Blanche 57 (JE). above Bscherre, 1925m., Bornmüller 11485 (JE). "Syria", Hooker & Hanbury 9/10.1860, ex herb. Billardei (as "Ar. imbricata" Labill.) (K).

Other record: North Lebanon: J. Famm-ul-Mizab, Post (type of var. papillosa) cf. Post (1896).

Geographical distribution: Endemic.

Biology: A high mountain plant of gravel summits and slopes (2075-3050m.). Flowers June - August (-September).

Discussion: M. libanotica is a very distinctive, rather large-flowered species, which, taxonomically as well as geographically, lies between M. filifolia (Yemen & E. Africa) on the one hand and the typical forms of M. anatolica and M. erythrosepala on the other.

All the specimens seen are glabrous, but the locality of Post's var. papillosa (distinguished as "Papillose-glandular") is with the others on Mt. Lebanon and, provided it does represent a specimen of M. libanotica, scarcely seems worth maintaining.

57. M. corymbulosa (Boiss. et Bal.) McNeill, comb. nov.

Key to varieties

1a. Leaves very finely ciliate, stems pruinose (particularly in the lower part), pedicels finely puberulent, plants otherwise glabrous; partial inflorescences of very dense few-flowered (3-10) sub-spherical clusters terminating the main stem and long axillary branches; petals about as long as the sepals; plants tall, c. 25cm.; sepals ovate-lanceolate, acute

(ii). var. gypsophiloides

1b. Entire plant usually densely puberulent, becoming glandular in the inflorescence region (occasionally middle portion of stems glabrous); partial inflorescences densely corymbose, rather many-flowered (8-25), terminal and sub-terminal :

2a. Sepals broadly ovate, bluntly acute; petals exceeding the sepals (iii). var. breviflora

2b. Sepals lanceolate, narrowly acute; petals shorter than sepals

(i). var. corymbulosa

(i). var. corymbulosa

Syn. : !Alsine corymbulosa Boiss. et Balansa in Boiss., Diagn. Fl. Orient. ser.2 6 : 36 (1859), non Barrelier (1859).

!Als. setacea var. corymbulosa (Boiss. & Bal.) Boiss., Fl. Orient. 1 : 680 (1867) (" ε ") (pro parte).

Type: TURKEY: Cappadocia: "Ali Dagh a 7 kilom. au S.E. de Césarée (Cappadoce), 24 juillet 1856", Balansa 652. holo. G!

Specimens seen:

TURKEY:-

Cappadocia:- Gulşehir (Arapsun) - Nevşehir, 5 km. from Gulşehir, 450m., McNeill 383. Gulşehir - Nevşehir, 12 km. from Gulşehir, 500m., McNeill 390. Hills W. of Cesarée (Kayseri), 1250m., Balansa 1058 (7.1856) (E)(K). Kayseri: Pinarbaşi - Gürün, 5 km. from Pinarbaşi, 1400m., McNeill 184.

(ii). var. gypsophiloides McNeill, var. nov.

A varietatibus aliis M. corymbulosae planta procera (c. 25cm.) ex toto glabriuscula inflorescentiis partialibus paucifloris subcapitatis facile distinguenda; a var. corymbulosa solum, petalis longioris etiam differt.

Planta procera c. 25cm. alta. Caudex aliquantum gracilis, caules paucos (c. 5) subremotos emittens. Caules spadicei, pruinosi, ramosi, sub anthesis foliis mortuis 8-12-jugis praediti; rami saepe longi (4-12cm.), foliati, inflorescentia partiali terminati. Inflorescentiae partiales subglobosae, minute puberulae, flores 3-10 dense aggregatos gerentes; bracteae triangulares, 1.25-1.75mm. longae, late membranaceo-marginatae. Sepala 2.5-3.0mm. longa, ovato-lanceolata, petala subaequantia. Stamina 1.5-2.0mm. longa, fertilia; antherae 0.45-0.50mm. longae. Capsula calycem subaequilonga. Semina 3-4, 0.9-1.0mm. longa x 0.5-0.6mm. lata, in jugo dorsali acute tuberculata.

Typus: TURKEY: Cataonia: "Prov. Malatya: Gürün - Malatya, c. 65 km.

from Malatya, c. 1400m. Rocky slope. Perennial. Fls. white. 7 Aug. 1956, McNeill 443". holo. E!, iso. K!

(iii). var. breviflora (Boiss.) McNeill, comb. nov.

Syn.: !Alsine setacea var. breviflora Boiss., Fl. Orient. 1 : 680 (1867) (" δ ").

Type: TURKEY: Galatia: "prope Ancyram Galatiae" (Ankara), Wiedemann. holo. G!

Geographical distribution (of species): Endemic.

Biology (of species): Plants of dry stony places, recorded between 450 and 1400m. and flowering July - August.

Discussion: M. corymbulosa is relatively easily distinguishable by its small flowers aggregated into more or less discreet heads. It appears to be closely related to M. leucocephaloides which it replaces on the Central Anatolian plateau, and to M. anatolica var. arachnoidea the other denizen (in this Series) of these rather dry steppe lands. (cf. also Discussion of M. anatolica). (cf. fig. 36)

58. M. leucocephaloides (Bornm.) Bornm. in Beih. bot. Zbl. 33 (2) : 279 (1915) (in adnot.).

Syn.: !Alsine setacea subsp. A. leucocephaloides Bornm. in Beih. bot. Zbl. 24 (2) : 450 (1909).

Lectotype: TURKEY: Phrygia: "Sultandagh, in saxosis et rupestribus ad Akscheher (Wilajet Konia), 1100m., 18.VI.1899, J. Bornmüller 4193" (sub "Alsine corymbulosa B. et Bal. β velutina Bornm."). lecto. E!, K!, WU!

Specimens seen:

TURKEY:-

Caria:- No locality, Pinard (1843) (as Als. heteromalla).

Lycia:- Mughla/Antalya: Girdev Dagh below Bel yaila, 1600m., Davis 13736. Antalya: Çalbali Dagh, nr. Çukur Ardic yayla, 1700m., Davis 15384 (K). No locality (?"Lycia", ?"Lydia"), Pestalozza (1846) (G) (as Als. anatolica).

Cilicia:- Konya: Ermenek: Hamitseydi Boğaz, Santali Beskuyu, Davis 16242. Sara nr. Eremenek, 1400m., (Balansa ?) 482 (G) (as Als. setacea var. cappadocica). Mersin: Anamur: Beskuyu - Cumurlu yayla, 1900m., Davis 16277. Gulek Maden, Taurus, Balansa, 8.1855 (JE) (as Als. setacea var. anatolica).

Pisidia:- Isparta: Sutçuler ("Isauria"): Çimen Ova on W. side of Sarp Dag, Davis 15806.

Other record: Phrygia: Sultandagh above Tschai (Çay), 1700m., Bornmüller 4194 (paratype). cf. Bornmüller (1909) l.c.

Geographical distribution: Endemic.

Biology: A mountain plant of stony pasture. Recorded between 1100

and 1900m. Flowers June - August.

Discussion: M. leucocephaloides represents one of the many local segregates of the M. anatolica complex. Although reasonably well-marked it is much less distinct than Mattfeld, who only saw Bornmüller's type material, supposed. In the west it appears to grade into the type variety of M. anatolica, which differs chiefly in its lax spreading inflorescence, and in the east approaches M. corymbulosa which is distinguished by its shorter broader sepals. (cf. fig. 36)

50. M. confusa (Boiss.) Maire et Petitm. in Mat. Etude Fl. Geogr. Bot. Orient. 4 : 49 (1908).

Syn.: Cherleria sedoides sec Smith, Prodr. Fl. Graec. 1 : 306 (1806), non L.

!Alsine trichocalycina (Ten. & Guss.) sec Heldr. & Sart. in Boiss., Diagn. Fl. Orient. ser.2 1 : 87 (1853), non Arenaria trichocalycina Ten. & Guss. (1832).

!Alsine confusa Boiss., Fl. Orient. Suppl. 114 (1888); (Heldr. & Sart. ined. et in Boiss., Diagn. Fl. Orient. ser.2 1 : 88 (1853), pro syn.).

!M. trichocalycina (Ten. & Guss.) sec Graebner in Aschers. & Graebn., Syn. Mitt.-Eur. Fl. 5 (1) : 717 (1918), non Ar. trichocalycina Ten. & Guss. (1832).

Syntypes: GREECE: Central Greece: "in cacumine montis Parnassi" 1) Heldreich, 2) Sartori. holo. G., iso. K! (Heldreich only).

Specimens seen:

GREECE:-

Central Greece:- M. Parnassus (Parnasos), Heldreich 2663 (8.8.1852), Herb. Graec. norm. 306 (8.1855) (2195m.), Orphanides 455 (13/25.7.1854) (2375m.), 13.7.1852 (in summo) (JE), no date (2285m.) (W-H), Halacsy 16.7.1888 (1980-2195m.) (W-H)(WU).

Peloponnese:- M. Kyllenes (Ziria), 1525-2170m., Heldreich 22.6.1887 (W-H).

Geographical distribution: Endemic.

Biology: A rather densely caespitose plant of high alpine localities on the Parnasos and Kilini mountains (1525-2375m.). Flowers June - August.

Discussion: Despite its name, M. confusa is a very well-marked species with a very restricted range in Southern Greece. It appears to show affinity on the one hand with M. glomerata subsp. macedonica and on the other with M. leucocephaloides (in the inflorescence and indumentum). The resemblance to M. leucocephala, which Mattfeld notes, is probably entirely superficial. (cf. fig. 36)

Discussion of Series Setaceae

The members of the series are essentially mountain plants and as such are frequently found as restricted and isolated endemics, (e.g. M. confusa, M. libanotica and M. antilibanotica as well as M. adenotricha in the Crimea and M. kraschenimnikovii in the Urals). In those areas in which the mountains are more or less continuous - C. Europe, the Balkans, Anatolia and the Caucasus - the plants too seem to lack obvious discontinuities. Some distinct taxa can certainly be distinguished, e.g. M. rostrata (? = M. mucronata) in C. Europe, M. bosniaca in the Western Balkans and M. tchihatchewii in the Amanus and Anti-Taurus. In other cases, although the extremes are widely divergent the lines of separation are blurred and this is complicated in South-eastern Europe by the intergradation with M. glomerata in the typically biennial series Xeralsine (cf. Discussion of that species), and in the existence of apparently distinctive local races of M. setacea (var. thracica and var. athoa). The distinguishing characteristics of M. setacea and M. anatolica are largely associated with habit of growth and seem rather suspect in being probably very liable to environmental modification. Further study of Macedonian and N.W. Turkish plants is needed before a satisfactory treatment of the forms in this area can be achieved.

To West European botanists the situation in N.E. Turkey and the Caucasus is even more confused and an understanding of it is hampered by lack of material. In view of their geographical isolation Schischkin is probably right in separating the Caucasian plants from M. setacea (though possibly not at specific rank - cf. Discussion of M. woronowii), but without authentic material one can come to no definite conclusion as to

the validity of the five species which he recognises in that area. M. woronowii and M. micrantha represent clearly recognisable taxa and have been provisionally acepted at specific rank in this account. No material certainly referable to M. buschiana, M. granulifera or M. abchasica has been seen, but the first-named is very closely related to M. woronowii, while the last two are in the affinity of M. erythrosepala, M. granulifera being possibly synonymous with M. erythrosepala var. orientalis.

The following are translations of Schischkin's (1936) key to the Russian species of the series, and Grossheim's (1949) for those which occur in the Caucasus.

Schischkin in Komarov (1936) pp. 484-485:-

15. Sepals glabrous .. 16

\+ Sepals very shortly glandular-pubescent .. 20

16. Seeds sharply tuberculate on the circumference .. 17

\+ Seeds smooth or with very fine obtuse tubercles .. 18

17. Plants 5-8cm. tall: calyx 4-5mm. long (Caucasus)
M. buschiana

\+ Plants 10-25cm. tall; calyx 3.5-4mm. long (Pri-Ural)
M. krascheninnikowia

18. Calyx 2.5-3.5mm. long .. 19

\+ Calyx 4-5.5mm. long (Caucasus) M. woronowii

19. Sepals 3-3.5mm. long; plant loosely caespitose (European Russia)
M. setacea

\+ Calyx 2-2.5mm. long; plant densely caespitose (Caucasus)
M. micrantha

20. Calyx 2.5-3mm. long, with 3 small nerves (South Transcaucasia)
M. granulifera

\+ Calyx 4-5mm. long .. 21

21. Flowers closely aggregated into rather dense corymbose inflorescences. Sepals with one nerve. Plant densely caespitose (Crimea) M. adenotricha

\+ Flowers in loose cymes. Sepals with 3 nerves at the base. Plant loosely caespitose (Abkhasia) M. abchasica

Grossheim (1949) p.540:-

10. Sepals with 1 nerve, with 2 white stripes on the back, hardened at the base ... 11.

\- Sepals with 3- many nerves ... 14.

11. Sepals shortly glandular-pubescent with 3 nerves at the base, and only 1 above; inflorescence lax; height 10-15cm.; habit loosely caespitose. Fls. V-VII. Abkhasia. In alpine zone. On limestone. Endemic. M. abchasica B. Schischk.

\- Sepals glabrous ... 12.

12. Calyx 2-2.5mm. long; inflorescence 3-5-flowered; height 6-20cm.; habit densely caespitose. Fls. V-VI. Central and South-west

Transcaucasia. In middle mountain zone. In stony and gravelly places. Endemic. M. micrantha. B. Schischk.

- Calyx 4-5mm. long. Plants of other regions ... 13.

13. Plants of the western half of Greater Caucasia, usually high mountain; seeds sharply tuberculate on the circumference; height 6-8cm.; habit loosely caespitose. Fls. V-VII. West Caucasus, West Transcaucasia and Central Transcaucasia (in the north). From upper mountain to alpine zones. In gravelly places. Endemic. M. buschiana B. Schischk.

- Plants of the eastern Caucasus, south and east Transcaucasia, usually of the middle zone; seeds smooth; height 8-25cm., habit densely caespitose. Fls. VI-VII. East Caucasus, Central Transcaucasia, Nakhichevan, South Karabakh. In middle mountain zone. In gravelly places. M. woronowii B. Schischk.

14. Sepals with 4-11 nerves ... 15.

- Sepals with 3 nerves ... 16.

15. M. dianthifolia (Section Lanceolatae) & M. oreina (Section Plurinerviae)

16. Sepals hardened at the base, shortly glandular-pubescent, 2.5-3.5 mm. long; height 5-15cm.; habit densely caespitose. Fls. VI-VII. South-west Transcaucasia. In middle mountain zone. On dry slopes. Rare. M. granulifera (Fenzl) Grossh.

- Sepals not hardened at the base ... 17.

17. etc. :- Spp. of Sections Tryphane (sensu Boiss.) & Acutiflorae.

A fuller understanding of these Caucasian plants would be necessary for a satisfactory account of the forms occurring in Turkish Armenia, particularly as the greatest diversity in the series is undoubtedly that met with in Turkey as a whole. The problem is essentially that of determining the best treatment for those plants usually lumped together as M. anatolica. This is discussed under that species.

Further progress towards a workable classification of this, the most difficult group of Minuartia within the Orient, depends not only upon obtaining considerably more material particularly from Eastern Turkey and the Caucasus but also in gaining some understanding of the biology and breeding behaviour of the individual plants.

Series Setaceae

(cf. key to spp. of Series Setaceae & Xeralsine)

60. M. glomerata (M.B.) Degen in Mitt. Nat. Ver. Steierm. 46 : 319 (1910).

Key to subspecies

Stem leaves erect, ± appressed to stem; petals much shorter than sepals (about half as long); sepals 5.0-6.5mm. long; inflorescence rather dense (pedicels 0.5-4.0mm. long), many-flowered (terminal clusters with 15-50 flowers); plants usually annual or biennial A. subsp. glomerata

Stem leaves not appressed, usually falcate or sometimes recurved; petals as long as or a little shorter than sepals (> 0.7 times as long); sepals 3.0-5.5mm. long; inflorescence often lax (pedicels 1.0-10.0mm. long), rather few-flowered (terminal clusters with 5-25 flowers); plants perennial B. subsp. macedonica

A. subsp. glomerata

Syn.: Arenaria glomerata M. Bieb. Fl. Taur. Cauc. 1 : 350 (1808).

Alsine glomerata (M.B.) Fenzl, Versuch Verbreit. Vertheil. Alsin. tab. ad p.46 (1833).

M. glomerata subsp. euglomerata Mattf. in Fedde Rep. Beih. 15 : 83 (1922).

Type: U.S.S.R.: Crimea: "in Tauria" holo. LE., iso. B (Herb. Willdenow, fide Mattfeld).

Specimens seen:

GREECE:-

Macedonia:- E. Macedonia: Serrai (Seres), Rechinger 9184 (W-R). Foothills S. of Struna plain: S. of Turica, Turrill 340.

TURKEY:-

Thracia:- ?"Daradanelles", Calvert (as Als. fastigiata) (K).

U.S.S.R.:-

No locality:- "Caucas." (Herb. Boiss. as "Minuartia glomerata") (petals long) (G).

Geographical distribution (of subsp.): Crimea, Ukraine, Hungary, Eastern Balkans.

B. subsp. macedonica (Degen et Dörfler) McNeill, comb. nov.

Syn.: !Alsine velutina Boiss. & Orph. in Boiss., Diagn. Pl. Orient. ser.2 6 : 36 (1859).

!Alsine glomerata var. velutina (Boiss. & Orph.) Boiss., Fl. Orient. 1 : 682 (1867) ("β").

!Alsine anatolica subsp. A. macedonica Degen et Dörfler in Denkschr. Akad. Wiss. Wien. 64 : 715 (1897).

!M. velutina (Boiss. & Orph.) Graebner in Aschers. & Graebn. Syn. Mitt.-Eur. Fl. 5 (1) : 717 (1918).

!M. anatolica B ("Rasse") macedonica (Degen & Dörfler) Graebner l.c.

!M. glomerata subsp. velutina (Boiss. & Orph.) Mattf. in Fedde Rep. Beih. 15 : 85 (1922).

Type: YUGOSLAVIA/GREECE: Macedonia: "Macedon. centr. In rupibus pr. Allchar 30.VI.1893" (nr. border - M. Kozjak), Dörfler 107. holo. WU!, iso. JE!

Specimens seen:

GREECE:-

Macedonia:- nr. Salonika (Thessalonica), Adamović 5.1903 (2 gatherings - as Als. bosniaca & Als. rostrata). N.W. Macedonia, nr. Gornichero, W. of Lake Ostrovo, 915m., Alston & Sandwith 868. W. Macedonia: Kozani: M. Vourinan above Vara nr. Siatista, 800-900m., Rechinger 17595 (W). W. Macedonia: Edessa - Florina: Lake Ostrovo - Peterske, 700-800m., Rechinger 15712 (W). E. Macedonia: Boz Dagh nr. Serrai (Seres), 900m., Rechinger 10924. E. Macedonia: R. Angista nr. Photolivos, W. of Drama Rechinger 6164. Drama: Bozdagh nr. Granidis (Turicill), 500m., Rechinger 6382. E. Macedonia: ruins of Philippi, Rechinger 10130 (W-R). M. Corfiata (Dissoross, = Krousia), 915m., Orphanides 934 (type of velutina) (JE)(W-H)(WU).

?Yugoslavia:- Lake Doiran, Burgeff, 1904 (JE), 1268 (Nikolic)(JE). C. Macedonia: Saverni, Dörfler 106 (JE)(WU).

Thrace:- Bodona (N. of Alexandroupolis), Adamović 4.1906.

Geographical distribution (of subsp.): S. Yugoslavia (Macedonia), Bulgaria, Romania (Dobrudscha).

Biology (of species): A plant of hills and stony places; according to Mattfeld (1922), subsp. macedonica (= velutina) replaces subsp. glomerata at higher altitudes; subsp. macedonica recorded between 500 and 915m. (no data for subsp. glomerata) Both subsp. apparently flowering May - July.

Discussion: M. glomerata, as represented in the Orient, is very atypical of its series, the annual or biennial Xeralsine and appears to represent a transition to the perennial Series Setaceae. Although the two series have been maintained (cf. p.193), it has been thought best to include M. glomerata in the key to Series Setaceae, particularly as subsp. macedonica is sometimes difficult to separate from M. setacea var. athoa or M. anatolica. Eastern Macedonia and Thrace appears to be a great centre of confusion and almost certainly of hybridisation between these three species.

The Pichler specimens of velutina (now macedonica) recorded in Boissier (1888) p.114 from Buyukdere near Istanbul are of Scleranthus sp.

Although the two subspecies are very well marked in the specimens seen from the area (sufficiently so almost to demand specific recognition) this is far from being the case in Yugoslavia and Bulgaria, where they tend to merge imperceptibly into one another.

Degen and Dorfler's epithet macedonica has priority at subspecific rank over Boissier and Orphanides' velutina, used by Mattfeld.

Section Sabulina (Reichb.) Graebn.

Series Sabulina

1a. Sepals not at all indurate, the 3 nerves ± equally prominent (rarely the laterals weak, and then sepals 3mm.), running to the apex (at least in outer sepals); margin of sepals narrowly membraneous (herbaceous portion extending beyond the lateral nerves); capsule shorter to longer than calyx, but 0.75 times the length; leaves (1-) 3 nerved, margin glabrous.

2a. Leaves and bracts rather fleshy; lower leaves linear-spathulate; sepals 2.5-3.5mm. long, ovate, (1.75-) 2 (-2.5) times as long as broad, obtuse to broadly acute; petals usually broadly ovate (1.5-2 times as long as broad), abruptly contracted into a claw (0.25-0.6mm. long), much longer than the sepals (1.2-1.5 times as long) 61. M. thymifolia

2b. Leaves and bracts linear-subulate or subulate-setaceous (rarely linear, flaccid); sepals 1.5-5.0mm. long, ovate-lanceolate to linear-lanceolate (twice as long as broad), acute to acuminate; petals cuneate, or if abruptly contracted with a claw usually 0.3mm. long, up to 1.25 times as long as sepals (very rarely longer):

3a. Leaves and bracts 1-nerved (sometimes 3-nerved at the base); sepals 2-2.5mm. long, weakly nerved (especially laterals); petals shorter than sepals; capsule subglobular to ovoid (valves 1.5-2.5 times as long as broad), exceeding the calyx;

pedicels long (10-25mm. on lower flowers), ± spreading

63. M. subtilis

3b. Leaves and bracts 3-nerved; sepals strongly nerved; capsule narrowly ovoid to narrowly cylindrical (valves 2.5-5.0 times as long as broad) :

4a. Capsule shorter than calyx; sepals 2.5-3mm. long, linear-lanceolate (4.5-5 times as long as broad), narrowly acuminate; petals cuneate, 0.5-0.75 times as long as sepals; inflorescence erect to spreading, not contracted; plants glandular-pubescent 64. M. viscosa

4b. Capsule as long as or longer than the calyx, or if shorter, either inflorescence contracted and petals < 0.5 times as long as sepals or else sepals lanceolate < 4 times as long as broad; sepals 1.5-5mm. long, (when < 3mm., lanceolate < 4 times as long as broad and often with petals abruptly contracted at the base and more than 0.75 times as long as sepals); plants glabrous or glandular-pubescent :

5a. Inflorescence contracted ± fasciculate, with flowers on short stiffly erect pedicels 0.5-7.0mm. long, the upper pedicels shorter than calyx; petals < half as long as sepals (often absent); capsule shorter than calyx; sepals 3-5mm. long 66. M. mediterranea

5b. Inflorescence lax with flowers on long, often spreading

pedicels, the lower pedicels (7-) 10-20mm. long and at maturity all longer than calyx; petals more than half as long as sepals; capsule as long as or longer than calyx, very rarely shorter and then sepals < 3mm. long :

6a. Petals ovate to ovate-lanceolate, abruptly contracted at the base into a very short claw, usually as long as or longer than sepals (rarely shorter and then > 0.75 times as long), (very rarely, ssp. flaccida, petals cuneate and then longer than sepals); sepals acute, very rarely acuminate, ovate to ovate-lanceolate (2-3 times as long as broad), rarely a little narrower and then sepals < 3mm.; inflorescence usually spreading; plant often decumbent and branching from the base

62. M. mesogitana

6b. Petals usually cuneate at the base, always shorter than the sepals, (if contracted, petals very short, < 0.75 times as long as sepals, and narrowly deltoid); sepals narrowly acute to acuminate, lanceolate to linear-lanceolate, 3-4(-5) times as long as broad, usually > 3mm. long (if less sepals acuminate); inflorescence ± strictly erect; plant erect or ascending

65. M. hybrida

1b. Sepals slightly indurate at the base, with one prominent median nerve

running to the apex and two weaker lateral nerves not extending beyond two-thirds-way (to half-way in inner sepals); margin broadly scarious or subcoriaceous extending at least to the lateral nerves; capsule and petals shorter than calyx; leaves and bracts 1-nerved, or weakly 3-nerved at the base, margin often ciliate :

7a. Sepals 2.5-3.25mm. long, scarcely indurate at the base; capsule more than 0.75 times as long as calyx; petals ovate-lanceolate (< 3 times as long as broad); inflorescence lax to narrowly constricted, the lower pedicels 10-15mm. long and only the very uppermost shorter than sepals; leaves and bracts glabrous

67. M. regeliana

7b. Sepals 3.25-4.0mm. long, somewhat indurate at the base; capsule 0.5-0.75 times as long as calyx; petals narrowly lanceolate (> 3 times as long as broad); inflorescence composed of a few solitary lower flowers (with pedicels up to 10mm.) and series of dense clusters of upper flowers (with pedicels always shorter than sepals); leaves and bracts ciliate 68. M. urumiensis

61. M. thymifolia (Sibth. & Sm.) Bornm. in Beih. bot. Zbl. 31 (2) : 193 (1914).

Key to varieties

Petals much longer than sepals (1.25-1.5 times), claw 0.35-0.6mm. long; sepals often glabrous and broadly acute

(i) var. thymifolia

Petals a little longer than sepals (1-1.25 times), claw 0.25-0.35mm. long; sepals often glandular-pubescent, obtuse and broadly ovate (ii) var. syriaca

(i) var. thymifolia

Syn.: Arenaria thymifolia Sibth. & Sm., Fl. Graec. Prodr. 1 : 305 (1809), non Pursh (1814).

Alsine thymifolia (Sibth. & Sm.) Fenzl, Versuch Verbreit. Alsin. t. ad p. 57 (1833).

Illustration: Sibthorp & Smith, Fl. Graec. 5 t. 441 (1825).

Type: GREECE: "in insula Creta", Sibthorp, holo. OXF.

Specimens seen:

GREECE:-

Aegean Islands:- Rhodes seashore, Heldreich 3.1845, Bourgeau (1870) 10, Cremasto 460 (Villanova) (G).

?TURKEY:-

No precise locality:- "Asia Minor", Grabmayr (K).

CYPRUS:-

Kyrenia:- Liveras, 2m., Merton 2510. Orga-Vasilia, sea-shore, Davis 2116. Kyrenia, sea-level, Atherton 882. Hartcha (Kharcha), 3m., Chapman 262.

Famagusta:- Yalusa, sea-shore, Sintenis & Rigo 228. Chelones nr.

Rhizokarpas, sea-shore, Davis 2303. Agios Philon nr. Rhizokarpas, banks nr. sea-level, Davis 2262. Rhizocarpas, Druce 89. Apost. Andreas, Druce 88. Ap. Andreas forest, 45m., Merton 2472.

(ii). var. syriaca (Boiss.) McNeill, comb. nov.

Syn.: Alsine thymifolia var. syriaca Boiss., Fl. Orient 1 : 687 (1867) ("β").

Type: LEBANON: South Lebanon: "ad Raz Beyrouth, 12 Avril 1850 Blanche 799 (Herbier Em. Desvaux)" ("in maritimis Syriae ad Ras Beyrout") holo. G.

Specimens seen:

LEBANON:-

North Lebanon:- Beyrouth: Nahr-el-Kelb, Bornmüller 5.5.1910 (JE).

South Lebanon:- Beyrouth: Raz Beyrouth, Gaillardot (small bay to the south) (JE), Mouterde 31.3.1935 (S).

Geographical distribution (of sp.): Endemic.

Biology: A prostrate or decumbent plant usually on sea-shores but recorded also from "banks between cultivated fields near sea-level" (Davis 2262), and in Ap. Andreas Forest at 50m. (Merton 2472); these plants have rather fleshy leaves but are otherwise typical. Flowers January to May.

Discussion: Although characteristically a very distinct species, M. thymifolia shows an approach towards M. mesogitana in the habit of the non-maritime Cyprus plants and in the petal structure of var. syriaca. (cf. fig. 40)

62. M. mesogitana (Boiss.) Hand.-Mzt. in Ann. naturh. Hofmus. Wien 27 : 148 (1912).

Key to infraspecific taxa

1a. Petals cuneate at the base, longer than the sepals; seeds shortly echinate (c. 30 μ), 0.60-0.70mm. long; sepals 2-2.5mm. long; capsule subcylindrical much longer than calyx (1.25-1.5 times as long) F. subsp. flaccida

1b. Petals contracted at the base into a claw, shorter to longer than sepals; seeds ± smooth to faintly rugulose; capsule as long as or longer than calyx, if much longer (> 1.25 times) then ovoid :

2a. Sepals 2.0-4.0mm. long; petals shorter to longer than sepals :

3a. Capsule ovoid, considerably exceeding calyx (1.25-1.75 times as long); leaves recurved, rather short and thick (4-8mm. long); petals distinctly shorter than sepals (0.75-0.85 times as long); sepals 2 - 3 (-3.5) mm. long; seeds 0.55-0.70mm. long x 0.50-0.60mm. broad; inflorescence rather lax and spreading; plants diffuse often branching from the base C. subsp. velenovskyi

4a. Petals broadly ovate (1.5-2 times as long as broad); capsule ovoid (valves 1.75-2 times as long as broad); seeds 0.55-0.65mm. long C (ii). var. orphanidis

(4b. Petals suborbicular (< 1.5 times as long as broad); capsule broadly ovoid (valves < 1.75 times as long as broad); seeds 0.60-0.70mm. long (Montenegro) C (i). var. velenovskyi)

3b. Capsule ovoid to ± cylindrical, equalling or slightly exceeding calyx (usually < 1.25 times as long); leaves usually spreading or suberect, (5-) 7-20mm. long, finely setaceous to relatively broad (1.0mm.) and flat; petals almost as long to longer than the sepals (0.9-1.3 times); sepals 2.0-4.0mm. long; seeds 0.30-0.65mm. long x 0.25-0.60mm. broad; plants sometimes rather erect :

5a. Sepals < 3mm. long, or if about 3mm. (or longer in a few older flowers) not exceeded by the capsule; seeds usually < 0.50mm. long; plant usually very small and slender, often ± erect (but cf. var. turcomanica) B subsp. lydia

6a. Sepals long acuminate, always < 3mm. long; bracts finely setaceous B (i). var. lydia

6b. Sepals acute or very abruptly acuminate; bracts subulate to triangular :

7a. Capsule not or scarcely exceeding calyx; sepals up to c. 3mm. long; plants diffuse often branching from base B (iii). var. turcomanica

7b. Capsule longer than calyx in most flowers; sepals < 3mm. long; plant usually ± erect

B (ii). var. kotschyana

5b. Sepals > 3mm. long, occasionally less in uppermost flowers or in late flowering specimens; capsule in most flowers exceeding calyx; seeds (0.45-) 0.50-0.65mm. long; plant usually decumbent and branching from the base

A. subsp. mesogitana

2b. Sepals 1.5-2.0mm. long; petals always longer than sepals

8a. Capsule subglobose (valves < 1.5 times as long as broad) not exceeding calyx; petals slightly exceeding sepals (c. 1.1 times as long); seeds 0.45-0.55mm. long D. subsp. brachycarpa

8b. Capsule ± cylindrical (valves c. 3 times as long as broad), about 1.5 times as long as calyx; petals more than 1.5 times as long as sepals; seeds 0.25-0.40mm. long E. subsp. macrocarpa

(2c. Sepals 1.5mm. long: petals as long as or a little shorter than sepals; capsule ovoid-globose up to 2mm. long

M. tenuifolia (L.) Hiern var. elachistantha Mattf.)

A. subsp. mesogitana

Syn.: *Alsine mesogitana Boiss., Diagn. Fl. Orient ser.1 1 : 45 (1842).

!Als. tenuifolia var. grandiflora Fenzl in Ledeb., Fl. Ross. 1 : 342 (Oct. 1842), saltem pro parte.

!Als. tenuifolia var. macropetala Boiss., Fl. Orient 1 : 686 (1867) ("β") (≡ mesogitana).

!Als. tenuifolia var. mesogitana (Boiss.) Gürke, Pl. Europ. 2 : 250 (1899).

!M. tenuifolia (var.?) mesogitana (Boiss.) Graebner in Aschers. & Graebn., Syn. Mitt.-Eur. Fl. 5 (1) : 704 (1918).

!M. tenuifolia subsp. mesogitana (Boiss.) Bornm., Symbolae Fl. Anatol. in Fedde Rep. Beih. 89 : 251 (1940).

Type: TURKEY: Caria: "Mesogis pars media in glareosis schistosis Jun." 1842, Boissier. ("Mons Mesogis supra Tralles") holo. G!, iso. BM!, E!, JE!, K!, S!

Specimens seen:

TURKEY:-

No locality:- cult. Geneva, seed from Boissier "Asia Minor", Reuter 3.1848 (G).

Caria:- Muğla: Marmaris - Emecik, 200m., Davis 25339.

Pamphylia:- Adalia (Antalya), sea-level, Heldreich 3.1845, 515 (28.3.1845) (E. of Antalya) (G), 4.1845. Antalya - Alanya, 50m., Davis 25873. Manavgat - Akseki, above Fersinuluni, 700m., Davis 25772. Karamanlik Sokak, 150m., Tengwall 82.

Cilicia:- Mersina, sea-level, Balansa 611. Adana : Kojan, 150m., Davis 26600. Giosna, 1000m., Siehe 82.

Amanus:- Adana : Bahçe : Dumanli dağ above Haruniye, 700-900m., Davis 26858. ? M. Cassius (Akra dağı), 1000-1300m., Haradjian 3079 (W), Boissier 5.6.1846 (reg. med.) (G). ? Top Boghazi - Baglama, 120m., Wall 26.4.1933 (S). Attik, 900m., Samuelsson 5441 (S). Cassius: Beit el Mal - Cheik Keui, 500m., Samuelsson 4074 (S). Cassius: Ouadi Kandil, 100m., Samuelsson 5024. ? Djebel Ansarieh, Samuelsson 5196 (Slenfe, 1000m.) (S), 5819 (toward Nebi Younes above Slenfe, 1400m.) (S). Alexandretta (Iskenderun), Sintenis 80 (WU). Hatay: Antakya - Yayladağ nr. Şenköy, 1000m., Davis 27172. Hatay : Belen : Karlik tepe above Soğuk Oluk, 900m., Davis 27062. ? Iskenderun - Halep: nr. Kyryk Han, E. foot of M. Amanus, 180m., Handel-Mazzetti 157 (WU).

Cataonia:- M. Berytdagh, 1830m., Haussknecht 8.8.1865 (JE). (? confusion in labelling).

SYRIA:-

Aleppo:- nr. Aleppo, Kotschy 137 (nr. Ain el Omberek). R. Afrin rd. to Aleppo, 250m., Haradjian 4286 (W). Djebel Seman, 400m., Haradjian 2058 (W) (approaches M. hybrida ssp. turcica). ? Aleppo - Antakya, Samuelsson 3949 (Tell Akibrin, 430m.) (S), 3883 (Purim el Soughra - Zerib, 330m.) (S). Aleppo - Hama : Khan Cheikhour - Maaret en Naman, 500m., Samuelsson 3682 (S). Aleppo - Dschebel Nahar, (Haussknecht) 147 (JE). Dana, ex herb. Post (with M. hybrida ssp. turcica).

Latakia:- Nusairy mts., Post 9.4.1886 (Husn Musyah) (BM), Haradjian 3418 (Massiaa, 700-800m.) (W). Tartous, Wall 16.5.1933 (S). ? Tripoli - Homs, Wall 14.4.1933 (Tell Kalah Basalskei) (S), Samuelsson 3330 (3 km. W. of Haddidi, 320m.) (S).

Hama:- nr. Hammah, 460m., Haradjian 1897. ? Hama - Bserine, 260m., Samuelsson 3678 (S).

Damascus:- Damascus, Gaillardot 35, 1662 (3) (both 13.3.1866 - W. at the Merdj), 1661 (27.4.1857) (W., Boustan el Donaida) (JE), 1663 (25.5.1855) (N.W., gorge of Barrada) (G)(JE), 1660 (20.3.1857) (Boustan el Nasle - Boustan Seidene) (with M. hybrida ssp. hybrida) (JE). W. of Damascus, road to Mezze, Gaillardot 1662 (4) (20.3.1857) (Boustan Seidone) (JE)(G), 1662 (bis) (3.4.1856) (between Schakra & Zeitoun Mills (JE), 1662 ("in front of last garden on the left") (JE). Environs of Damascus, Gaillardot 1662 (5) 22, (JE)(G). Mt. Hermon, Banias, Lowne (1863-4) (as Arenaria sp. no. 4) (approaches M. hybrida var. palaestina).

LEBANON:-

North Lebanon:- Tripoli, Blanche (1866), 2.3.1867 (Ile de Bellam) (JE), Post 10.3.1865. Mt. Lebanon, Beit Kachbo, Gaillardot 2483 (20.4.1859) (G)(JE), 5.4.1860 (S), Jebel Akar (Tabour Baynu), Davis 5894. Nahr el Kelb, Lowne (1863-4). Antelias, Davis 5237. Brommana, Haström 28.4.1933 (S).

South Lebanon:- Beyrouth, Samuelsson 2251 (Nabi el Alosay) (S), Gaillardot 1658 (28.2.1855) (S., Mesatbe' quarter - 'at house of French consul') (G)(JE), 905 (23.3.1856) (San Dimitri - summit) (G)(JE), 906 (25.2.1854) (between the dunes and the pines) (G)(JE), Trott 2001 (airport, 0-15m.), Post 21.1.1865) (S. of town), Blanche 314 (5.1859) (Ras Beyrouth) (G). Coelosyria : Chtaura, 900m., Samuelsson 7225 (S). Saida, Blanche 25.4.18-- (E), 19.2.1853 (Reliqu. Mailleanae 921), 66 (bis) (29.1.1853) (Nubi Yahia) (G), 67 (Reliqu Mailleanae 922) (22.2.1853) (mouth of Nahr

Aoule), Gaillardot 15/22.2.1853 (nr. mouth of Nahr Aoule) (G)(JE), 25.3.1862 (E. of town) (G). Saida, mouth of Nahr Litani, Zefteh, 320m., Samuelsson 7162 (S). Nahr Hasbani (? Israel : Galilee), Post 406 (7.4.1877) (BM).

ISRAEL:-

Galilee:- nr. Magdala, 200m., Wall 11.4.1933 (S) (approaches M. thymifolia).

? ? :- "in muris veteribus Meliando, Majo, Mazziari 29 (S). "Plants of the Holy Land", Hayne leg. Fox 10.1873 (K).

Geographical distribution: Romania : Dobrogea : Babadağ (Sintenis 945!): probably elsewhere on the Black Sea coast, otherwise endemic to the area.

Biology: Typically a decumbent plant of rather moist habitats along the Mediterranean seaboard. Altitudinal range sea-level - 1000 (-1500) m. Flowers January to May (-June above 1000m.)

For list of putative hybrids between M. mesogitana ssp. mesogitana and M. hybrida ssp. hybrida see pp.674-675 under that species.

B. subsp. lydia (Boiss.) McNeill, comb. nov., (i). var. lydia.

Syn.: !Alsine lydia Boiss., Diagn., Fl. Orient. ser.2 1 : 86 (1853).

!Als. tenuifolia var. lydia (Boiss.) Boiss., Fl. Orient. 1 : 686 (1867) (" δ ").

!M. lydia (Boiss.) Bornm. in Beih. bot. Zbl. 27 (2) : 318 (1910).

'M. tenuifolia subsp. lydia (Boiss.) Mattf. in Bot. Jb. 57 Beibl. 126 : 29 (1921).

Lectotype: TURKEY: Lydia: "montes supra Bournabat prope Smyrna Boissier Mai 1842" ("montes colles Bournabat, montes Smyrne") holo. G.!

(N.B. Heldreich 1056, Mt. Solyma, Lycia (G!) (paratype) = M. hybrida var. parviflora).

Specimens seen:

TURKEY:-

Lydia:- Menemen - Magnesia (Manisa) nr. "Deirman-dere", 200-300m., Bornmüller 9169. Sinus Smyrnae : m. Yamanlar-dagh, 900m., Bornmüller 9168.

Caria:- Cadmus (Honaz dağ) above Denisleh (Denizli), Boissier 6.1842 (paratype) (G).

Geographical distribution: Endemic.

Biology: Small suberect plants with very spreading inflorescence. Collected in flower, May - June.

B.(ii). var. kotschyana (Boiss.) McNeill, comb. nov.

Syn.: 'Alsine lydia var. kotschyana Boiss., Diagn. Pl. Orient. ser.2 1 : 86 (1853).

'Als. tenuifolia var. kotschyana (Boiss.) Bornm. in Verh. zool.-bot. Ges. Wien 60 : 87 (1910) (quoad basionom.), nom. altern.

'Als. tenuifolia subsp. kotschyana (Boiss.) Holmboe, Stud. Veg. Cypr. 70 (1914) (quoad basionom., nec quoad descr., nec quoad spec. cit.).

Type: TURKEY: Cilicia: "in Tauro Ciliciae, Kotschy 57" ("In monte Tauro Aestate 1836"). holo. G! iso. BM!, K!, WU!

Specimens seen:

GREECE:-

Thessaly:- Kampake nr. R. Saraskina, Sintenis 1370 (with M. hybrida var. hybrida) (JE).

Central Greece:- M. Parnes, Hag. Trias, 1000m., Samuelsson & Zander 780 (S). M. Hymetto, Haussknecht 5.1858 (JE). Euboea : m. Dirphye (Delphi), Heldreich 1/13.5.1876 (W-H), Leonis 15.7.1901 (W-H).

Aegean Islands:- Samos : M. Karki, 1000-2000m., Rechinger 4117 (W-R). Rhodes: M. Attairo, 800-1000m., Rechinger 7358 (approaches ssp. mesogitana) (W-R).

TURKEY:-

Mysia:- Renkoi, M. Karajun, Sintenis 144 (with M. hybrida var. hybrida), Renkoi, Ulu dagh, Sintenis 144b (with M. hybrida var. hybrida) (? approach to var. turcomanica).

Lydia:- Ile de Chustan, Gulf of Smyrna (Izmir), Balansa 115 (atypical plant - but not var. lydia).

Pamphylia:- Adalia (Antalya), Bourgeau 5.5.1860.

Cilicia:- ? "Anatolia austro-orientalis" Siehe 166 (JE). "Cilicia",

leg. Prior 134 (K). Bulghar dagh, Kotschy 357 (Cydni, 1525m.) (G),45 (Karli Boghas, 1705m.), Balansa 851 (18.7.1855) (above Boulgarmaaden) (G) (approaches M. subtilis). Kagiraki, Siehe 39. Mersina : Dorf Turuurch (?), 600m., Siehe 463. Mersina, Balansa 850 (6.4.1855), 30.4.1855 (Bouloukli). Mersin : Tarsus : Ulaş - Şamlar, 350m., Davis 26424. Mersin : Adana : Misis, Nur dağ above Kizildere, 200m., Davis 26739.

Amanus:- Hatay : Iskenderum : 7 mls. N. of Iskenderun, nr. sea-level, Davis 26943. M. Amanus, reg. Duldul, 1700-2330m., Haradjian 2404.

Pisidia:- Bucak, 915m., Truman 157.

Galatia:- Amasia, 360-600m., Bornmüller 45 (JE)(WU) (approaches M. hybrida var. parviflora).

Cataonia:- 10 km. S. of Maraş, 550m., Davis 27362. Adana : Feke : Goksu gorge, 700-800m., Davis 19845.

? ? :- "Iter cilicico-kurdicum" : in planitie Arazarba pr. Tumla Gala, Kotschy 36 (5.5.1859).

Geographical distribution: Probably endemic but may possibly be found in S.E. Balkans (e.g. Bulgarian Thrace).

Biology: Usually more or less erect plants, not or slightly branching below, but with a spreading inflorescence. Altitudinal range (Sea-level ?, 200-) 500-1800m. Flowers April - July.

B. (iii). var. turcomanica (Schischk.) McNeill, comb et stat. nov.

Syn.: M. turcomanica Schischk. in Acta Inst. bot. Acad. Sci. U.R.S.S. ser.1 3 : 168 (1937).

Illustration: Komarov Fl. U.R.S.S. 6 : 497 t.27 f.1 (1936).

Type: U.S.S.R.: Turkmenistan: "Aschabad : in apricis prope Makrowa Fl. et fr. 12.V.1900, P. Sintenis Iter transcaspico-persicum 1900-1901 no.289" (sub "Alsine tenuifolia Whlbg. var. subtilis Boiss. determ. J. Freyn.") holo. LE iso. JE!, WU!

Specimens seen:

SYRIA:-

Deir ez Zor:- Meskene - Der es Sar (Dier ez Zor) : El Huli, between Sabcha and Tibre (on Euphrates), 250-350m., Handel-Mazzetti 541 (WU).

'IRAQ:-

Mosul:- Qdiydrah, Mosul, 200m., Bayliss 92.

Erbil:- M. Kuh-Sefin, nr. Schaklava, 700m., Bornmüller 941 (JE).

IRAN:-

Northern Zagros:- Elwend, Aucher-Eloy 602. ? distr. Silachar, Strauss (1902) (JE).

Geographical distribution: Turkmenistan, Afghanistan (Fareh - Shin-Dand, Koie 4106 (W!)

Biology: A rather decumbent or sub-erect spreading plant, branching from the base (approaching spp. mesogitana in habit). Recorded between 200 & 900m. Flowers April - May.

C. subsp. velenovskyi (Rohlena) McNeill, comb. nov. (i). var. velenovskyi

Syn.: Alsine tenuifolia var. velenovskyi Rohlena in S.B. boh. Ges. Wiss. 32 : 11 (1902).

Als. tenuifolia subsp. A. velenovskyi (Rohlena) Rohlena l.c. 38 : 32 (1905).

M. velenovskyi (Rohlena) Hayek in Denkschr. Akad. Wiss. Wien 94 : 9 (t. II f.1.; t. IV f.5, 6) (1917).

M. tenuifolia velenovskyi (Rohlena) Graebner in Aschers. & Graebn. Syn. Mitt.-Eur. Fl. 5 (1) : 705 (1918).

Illustration: Hayek in Denkschr. Akad. Wiss. Wien 94 : t.2 f.1 : t.5 f.5 - 7 (1918).

Type: Yugoslavia: Montenegro: "In calcareis supra Godinje prope Vir (c. 200m.)", Rohlena. holo. FR?

Geographical distribution (of var. velenovskyi): Confined to Montenegro and the Montenegro/Albanian border country (Vir Pazar, Rohlena!: Malcija : Skala Rapss above Hani Grabom, Dörfler 120!, Klemeni : above Hani Grabom, Dörfler 157!).

C.(ii). var. orphanidis (Boiss.) McNeill, comb. nov.

Syn.: !Alsine orphanidis Boiss., Diagn. Fl. Orient. ser.2 5 : 62 (1856).

!Als. tenuifolia var. orphanidis (Boiss.) Boiss., Fl. Orient. 1 : 686 (1867) (" δ ").

!M. tenuifolia orphanidis (Boiss.) Graebn. in Aschers. & Graebn., Syn. Mitt.-Eur. Fl. 5 (1) : 704 (1918) (?"Form").

!M. tenuifolia ssp. lydia forma orphanidis (Boiss.) Hayek, Prodr.

Fl. Balc. 1 : 185 (1924) (Fedde Rep. Beih. 30).

Type: GREECE: Peloponnese: "ad Vostitza 26 Apr./8 Maji 1854", Orphanides 2840. holo. G!

Specimens seen:

GREECE:-

Crete:- Hierapetra : M. Aphendi Kavusi, 1000-1200m., Rechinger 13211.

Geographical distribution (of var. orphanidis): Endemic.

Biology (of ssp.): An open spreading plant with rather stout stiff stems often branching from near the base. A mountain plant, flowering April - May.

D. subsp. brachycarpa (Boiss. & Bal.) McNeill, comb. et stat. nov.

Syn.: Alsine brachycarpa Boiss. et Balansa in Boiss., Diagn. Fl. Orient. ser.2 6 : 37 (1859).

Als. tenuifolia var. brachycarpa (Boiss. & Bal.) Boiss. Fl. Orient. 1 : 687 (1867) ("ɣ").

Type: TURKEY: ? : "Kamechly Tchai pr. Bereketly in Cappadocia" ("Collines situees sur la rive droite du Kamechly-Tchai, pres de Bereketly (Cappadoce) a 1300 metr. d'alt. 15 Juin 1856"), Balansa 647. holo. G!, iso. K!

Geographical distribution: Endemic.

Biology: A more or less erect plant up to 10cm. high, branching from near the base. Anthers violet.

E. subsp. macrocarpa McNeill, subsp. nov.

A ssp. brachycarpa, cui in sepalis brevissimis simili capsula subcylindrica calyce multo longiore petala sepalis multo longiora semina parviora differt; a taxis aliis Sabulinae (i.e. praeter subsp. brachycarpam) sepalis brevissimis (< 2.0mm. longis) facile distinguenda.

Planta gracilis et humilis, 4-6cm. altis, extra inflorescentiam glabra. Caules erecti, simplices vel inferne ramosi (ramis erectis vel patentibus), foliis 5-8 jugis praediti. Folia subulato-setacea, 2-4mm. longa. Inflorescentia diffusa, ad 3cm. longa, partim sparse glanduloso-pubescentia (bracteis, sepalis et partis vicinis pedunculorum pedicellorumque), floribus 8-18 (ramis lateralibus floribus 3-9) instructa; bracteae triangulares, infimae 1.0mm. longae et 0.75mm. latae; pedicelli 3-7mm. longi. Sepala ovata, 1.5-1.9mm. longa, acuta. Petala ovata vel ovato-lanceolata, 2.8-3.4mm. longa, sepalis multo longiora (1.7-2.0-plo), brevissime ungulata (0.15-0.20mm.). Filamenta c. 2.2mm. longa; antherae 0.4mm. longa, violaceae; grana c. 30μ diam. Capsula subcylindrica, calyce multo longior (1.5-2-plo). Semina minutissima 0.25-0.40mm. longa, obscure reticulata ("cellulis" non prominentibus).

Typus: TURKEY: Pamphylia: "Prov. Antalya. Kumköy, between Antalya and Serik, 5m. Fixed dunes in open Pinus Pinea - Myrtus forest.

Annual. Fls. white. 6 April 1956", Davis & C. Polunin (D.25710). holo. E! iso. K!

Geographical distribution: Endemic.

F. subsp. flaccida McNeill, subsp. nov.

A subspeciebus aliis, petalis cuneatis non ungulatis, seminibus echinatis non minute rugulosis differt. A M. hybrida var. turcica, cui approximat, sepalis ovato-lanceolatis late acutis, petalis calyce longioribus capsulis calycibus multo longioribus facile distinguenda.

Planta flaccida diffusa, ad 25cm. alta, ex toto sparse glanduloso-pubescens. Caules ad basim intertexentes, foliis 4-15-jugis praediti. Folia linearia ad 1.5cm. lata, trinervia. Inflorescentia valde diffusa, ramosa, floribus c.10-25 instructa; pedicelli longi (10-35mm.). Sepala 2-2.5mm. longa, ovato-lanceolata, latitudine 2.25-2.75-plo longiora, late acuta. Petala ovato-lanceolata, sepalis longiora (c. 1.1-plo), cuneata. Filamenta c. 1.5-1.8mm. longa; antherae 0.2mm. longae; grana c.28 μ diam. Capsula 3-3.25mm. longa, subcylindrica, calyce multo longior (c. 1.4-plo); valvae latitudine 2.5-3.0-plo longiorae. Semina 0.60-0.70mm. longa, echinata; spinae c. 30 μ longae.

Typus: TURKEY: Paphlagonia: "Wilajet Kastambuli (Kastamonu) : Kure Nahas; in saxos. ad rivum prope Enzislen Kajasi 25.8.1892", P. Sintenis 5049, (sub "Alsine flaccida sp.n." - ined.) holo. JE!

Geographical distribution: Endemic.

Discussion (of species) : see end of Section. For geographical distribution of subspp. etc., fig. 40.

63. M. subtilis (Fenzl) Hand.-Mzt. in Ann. naturh. Hofmus. Wien 26 : 148 (1912).

Key to subspecies

Sepals ovate-lanceolate to lanceolate (2.5-4 times as long as broad); capsule ovoid (valves 2-2.5 times as long as broad); seeds acutely papillose on dorsal ridge — A subsp. subtilis

Sepals ovate (c. twice as long as broad); capsule subglobular (valves < 1.75 times as long as broad); seeds obtusely verrucose on dorsal ridge — B subsp. filicaulis

A. subsp. subtilis

Syn. : !"Alsine subtilis" Fenzl in sched. ad Kotschy Pl. Pers. austr. (1842) no. 501 & 272 (nom. nud.).

!Alsine tenuifolia var. γ subtilis Fenzl, Diagn. Pl. Orient. 9 (1860) (Reprint of Fenzl in Tchihatch., Asie Min. 3 (Bot.) (1) : 226).

!Als. lydia var. kotschyana sec Mattf. in Fedde Rep. Beih. 15 : 36 (1922) et auctt. aliis, non Boiss.

!M. tenuifolia subsp. subtilis (Fenzl) Bornm., Symbolae Fl. Anatol. in Fedde Rep. Beih. 89 : 251 (1940).

Type: IRAN: ? : "In l. humidis reg. super. m. Kuh-Delu Pers. austr." 12.6.1842, Kotschy 501. holo. W (destroyed) iso. G!, K!, PRC!, WU!

Specimens seen:

TURKEY:-

Pamphylia:- Çalbali dağ nr. Tepe, 1900m., Davis 15316.

Galatia:- Amasia, Ak dagh, 900-1000m., Bornmüller 44 (JE).

Cappadocia:- Sivas : M. Tchamly-bel (Çamlibel), 1500-1600m., Bornmüller 1716.

Cataonia:- Maraş - Albistan (Elbistan), R. Dschihan, Haussknecht 18.8.1865 (JE). Arabkir, Demüslübaschi., Sintenis 857.

N.E. Armenia:- Baibout (Bayburt), Bourgeau 71 (2.7.1862). Karagoelldagh nr. Artabir, Sintenis 7280 (JE)(PRC).

Kurdistan:- Bitlis: Meleto (Meretug) Dağ, 2750m., Handel-Mazzetti (WU).

IRAN:-

Azerbaijan:- Urumia, R. Ser Tschai, Knapp 2.7.1884 (JE)(WU). Tam Maleh, R. Tschagatai, Knapp 13.8.1884 (WU). Tameschli, Knapp 7.7.1884 (WU).

Caspian Sea/Tehran:- M. Elburs : Kotschy 272 (Dudera), Rechinger 1120 (S. slopes of M. Točal, Pasgaleh nr. Darband, 1500-2000m.)

Northern Zagros:- Elwend, Aucher-Eloy 602 (BM) (with M. hybrida var. hybrida).

Kerman & Yazd:- Kerman : Schirinek, foot of M. Lalesar, Bornmüller 3327 (JE).

Geographical distribution: Afghanistan (Pulalam, Koelz 11841; Sirotai, Koelz 11967!; Lal-i-Zanjangel, Köie 2971!; Koh i Baba, Griffith 1658!).

Biology: A slender low-growing annual with a very diffuse inflorescence (flowers with long sub-erect pedicels). Growing on stony mountain slopes from 900-2750m. Flowers June - August.

B. subsp. filicaulis (Lindb.) McNeill, comb. et stat. nov.

Syn.: !Als. tenuifolia subsp. kotschyana Holmboe, Stud. Veg. Cypr. 70 (1914), quoad descr. et spec. cit., nec quoad basionom. (: Als. lydia var. kotschyana Boiss.).

!Alsine filicaulis Lindberg, Iter Cyprium in Acta Soc. Sci. fenn. N.S. ser. B. 2 : 14 (1946).

!M. filicaulis (Lindb.) Rech. f. in Ark. Bot. ser.2 1 : 420 (1951).

Illustration: Lindberg l.c. f.9 (1946).

Type: CYPRUS: Limassol: "M. Troödos in terra nuda humidiuscule juxta fontem 'Kannoures Spring'" 22.6.1939, H. Lindberg. holo. H, iso. K!

Specimens seen:

CYPRUS:-

Limassol:- "M. Troödos", Sintenis & Rigo 765, Haradjian 982 (?782) (1220-1675m.) (S). Chionistra, Davis 1863 (1900m.), Kennedy 384 (S. slope

1615m.), 1211A (N. slope, 1860m.), 1213 (N. slope, 1800m.), Lindberg 17.6.1939 (W), Kannoures Spring, E. of Chionistra, Lindberg 22.6.1939 (as Als. filicaulis f. subglabra), Kennedy 1211 (1615m.). Kryos Potamos, Kennedy 386 (1705m.), 1212 (1645m.). Kerokolymbos, 1495m., Kennedy 385.

Geographical distribution: Endemic.

Biology: Habit similar to subsp. subtilis but inflorescence more spreading, the pedicels often horizontal or deflexed. Recorded between 1400 & 1900m. Flowering May - July.

Discussion (of species): Minuartia subtilis is as a rule readily distinguishable from the other small-flowered members of the series by its 1-nerved leaves and bracts, and its much weaker sepal nervation. Only one doubtful specimen has been seen (Balansa 851 from Cilicia - regarded as comprising very dwarf depauperate plants of M. mesogitana ssp. lydia var. kotschyana). For this reason it is confidently maintained as a distinct species, in contrast to Mattfeld's revised opinion in Bornmüller (1940).

The Cyprus plants, all from the Troödos mountains, have a very distinctive facies, derived partly from the apparently more globular flowers and partly from the often horizontal or deflexed pedicels. Lindberg (1946) was the first to recognise their distinctiveness and an examination of Mrs. Kennedy's extensive material has proved the validity of the criteria he employed to distinguish it from M. subtilis sensu stricto. Although there is not suggestion of intermediate forms existing, the degree of difference between the taxa is so small that,

viewing it in the light of the current assessment of the whole series, it appears better to treat it at sub-specific level. (cf. fig. 40)

M. subtilis shows the first stage in the trend of reduction in leaf, bract and sepal nervation which leads on to M. regeliana and M. urumiensis and ultimately to species of Subsection Xeralsine in Section Minuartia.

64. M. viscosa (Schreber) Schinz et Thell. in Bull. Herb. Boiss. ser.2 7 : 404 (1907).

Syn.: Alsine viscosa Schreber, Spicil. Fl. Lips. 30 (1771).

Alsinella viscosa (Schreber) Hartm., Fl. Dan. fasc. 30 t.1754 (1823).

Arenaria viscosa (Schreber) Fries, Novit. Fl. Suec. ed.2 120 (1828).

Als. tenuifolia β viscosa (Schreber) Mert. & Koch, Deutschl. Fl. ed.3 290 (1831).

Sabulina viscosa (Schreber) Reichb., Fl. Germ. Excurs. 786 (1832).

Als. tenuifolia β tenella Fenzl in Ledebour, Fl. Ross. 1 : 342 (1842) (≡ viscosa).

M. tenuifolia subsp. viscosa (Schreber) Briquet. Prodr. Fl. Cors. 1 : 551 (1910).

Illustration: Thome, Fl. Deutschl. 2 : 82 t.217 (1886) ?

Type: Germany: Leipzig: "In colle ad templum S. Theclae primo vere", Schreber ? holo. LZ? (destroyed ?).

Specimens seen:

GREECE:-

Macedonia:- Armensko, Alston & Sandwith 632 (975m.), 612 (1375m.). S. of Lake Doiran, Rechinger 9017 (W-R). Thasos: S.W. of Limena, 975m., Tedd 1751.

Thrace:- Karlik-Dagh nr. Komotini (Gümüldschina), 400m., Rechinger 10395 (W-R).

Other records: U.S.S.R.: Ciscaucasia (Tamruk) (Komarov. 1936).

Geographical distribution: Central and Eastern Europe, north to Southern Sweden and west to Eastern France. In C. Europe restricted to the north of the Alps but common in the Eastern Balkans and Southern Russia (east to the Don and Northern Volga).

Biology: An erect low-growing plant with a strict to spreading inflorescence. Recorded in Greece between 400 and 1375m.; flowering June - July.

Discussion: M. viscosa, in the restricted sense of Graebner (1918) and Mattfeld (1922) which is adopted here, is a very distinct species, characterised by its small flowers, very short capsule and narrow acuminate sepals. As Mattfeld (1922, p.38) has pointed out, the inclusion within M. viscosa of all the glandular pubescent plants of the "tenuifolia" aggregate (as was done by Boissier (1867) and followed by most Orient authors for the next 50 years) is quite unjustified. Most of the plants so identified are referable to M. hybrida ssp. hybrida, as are most of the illustrations purporting to represent M. viscosa. (cf. fig. 40)

65. M. hybrida (Vill.) Schischk., in Komarov, Fl. U.R.S.S. 6 : 488 (1936).

Syn.: Arenaria tenuifolia L., Sp. Pl. 424 (1753).

Alsine tenuifolia (L.) Crantz, Instit. 2 : 407 (1766).

Ar. hybrida Vill., Prosp. Pl. Dauph. 48 (1779).

?Als. aristata Banks & Soland. in Russell, Pl. Aleppo ed. 2 2 : 249 (1794).

?Ar. triandra Schrank, Hort Monac. t. 31 (1819) (ex tab.).

Sabulina tenuifolia (L.) Reichb., Fl. Germ. Excurs. 785 (1832).

Als. tenuifolia var. β vulgaris Fenzl, Diagn. Pl. Orient. 9 (1860) (reprint of Fenzl in Tchihatch., Asie Min. 3 (Bot.) (1) 226).

M. tenuifolia (L.) Hiern in J. Bot. Lond. 37 : 321 (1899), non Nees ex Mart. (1814).

Cherleria tenuifolia (L.) Sampaio, Herb. Portugal 82 (1913).

(cf. also under var. hybrida etc.).

Key to infra-specific taxa

1a. Sepals lanceolate (3-3.5 times as long as broad), narrowly acute, usually 3-4mm. long (rarely less); petals > 0.7 times the length of the sepals, cuneate; capsule somewhat ovoid, broadest valve 3 times as long as broad B. subsp. turcica

1b. Sepals linear-lanceolate (< 3.5 times as long as broad), acuminate, 2-5mm. long; petals 0.50-0.75 times as long as sepals, cuneate; capsule somewhat ovoid, broadest valve c. 3 times as long as broad A. subsp. hybrida

2a. Sepals < 3mm. long; plants slender, 2-6(-15) cm. tall; seeds 0.3-0.4mm. diam. A. (ii). var. parviflora

2b. Sepals 3-5mm. long; plants rather more robust, 6-25cm. tall; seeds 0.4-0.6mm. diam. :

3a. Petals ovate-lanceolate, cuneate; plants moderately robust, usually with a single main stem not branching at the base A. (i). var. hybrida

3b. Petals narrowly deltoid, abruptly contracted at the base into a very short claw; plants usually very robust, strongly branching from the base A. (iii). var. palaestina

A. subsp. hybrida (i). var. hybrida.

Syn.: Arenaria hybrida Vill., Prosp. Fl. Dauph. 48 (1779).

Ar. tenuifolia var. hybrida (Vill.) Vill., Hist. Fl. Dauph. 3 : 634 (1789) ("C" - cf. p. 635 top).

Als. hybrida (Vill.) Jord., Pugill. 33 (1852).

Als. tenuifolia γ hybrida (Vill.) Willk., Ic. Descr. Fl. Hisp. 1 : 106 (1856).

Als. viscosa auctt. Orient. (Als. tenuifolia var. viscosa sec Boiss., Fl. Orient. 1 : 686, 1867), non Schreber.

Sabulina hybrida (Vill.) Fourr. in Ann. Soc. Linn. Lyon N.S. 16 : 347 (1868).

Als. viscosa Schreb. var. hybrida (Vill.) St. Lager in Cariot, Etude Fl. ed. 8 2 : 129 (1889).

M. tenuifolia subsp. eu-tenuifolia β var. hybrida (Vill.) Briq., Prodr. Fl. Corse 1 : 531 (1910).

M. tenuifolia subsp. hybrida (Vill.) Mattf. in Bot. Jb. 57 Beibl. 126 : 29 (1921).

Illustrations:

Hegi, Ill. Fl. Mitt.-Eur. 3 t.106 (1909) (as Alsine viscosa) (colour).
Flora Danica 10 t.1754 (as Alsinella viscosa) (colour).
Willkomm, Ic. Fl. Eur. aust.-occ. Hispan. t.69 f.B (as Als. tenuifolia var. laxa) (colour).

Type: France: Dauphine: "Sortant par la porte de la Graille, suivant l'Ilfere jusqu'a sa jonction avec le Drac, remontant ce torrent pour revenir par la Rondeau. Pres le chemin de la Butte", Villars. holo. P? (GR?).

Specimens seen:

GREECE:-

Macedonia:- Athos peninsula, Hill, Sandwith & Turrill 2673 (nr. Chilandari), 2499 (above the Roumanian Prodromos, Skate). W. Macedonia: M. Vermion nr. Naussa, 300m., Rechinger 8637 (W-R). E. Macedonia: Boz-dagh nr. Serrai, 500m., Rechinger 10949a (W-R). E. Macedonia: M. Pangaeon (Purnar Dagh), 600m., Rechinger 10298 (W-R).

Thrace:- Samothrake: M. Phengari, 1000m., Rechinger 9774, Samothrake: Kamariotissa - Chorio, Rechinger 9732 (W-R). nr. Ana Gheul, 30m., Tedd 2223. W. Thrace: M. Rhodope above Tasmos (Tasi-köi), 600m., Rechinger 6.1936 (W-R). (approaches var. parviflora). "Thracica", (Grisebach?) (K) (as Alsine tenuifolia W. & brachypetala Fzl.').

Thessaly:- M. Olympus, nr. Hagios Dionysios, 800m., Chaworth Masters 3.5.1931 (BM). Sophades, Leonis 23.7.1893 (W-H).

Central Greece:- Attica: nr. Liosia & Podoniphti, Heldreich Herb. Graec. normale 1018 (26.4./16.5.1889). nr. Athens, Pichler 4.1876. M. Parnassus, nr. Bayna, Heldreich Fl. Graec. exs. 3309 (23.6.1857). M. Korydallos, 275m., Atchley 753. Mt. Pentelikon, Haussknecht (1885) (JE), Atchley 5.1936 (305-915m.), Vierhapper 19.4.1911 (Kephisia) (WU). Mt. Kerata above Eleusis, Haussknecht 4.1885 (JE). Eleusine plain, nr. Stephani, Heldreich 15.4.1878 (W-H). Attica: nr. Buliasmene, Heldreich 9.5.1875 (W-H); M. Parnes, Guiol 1480 (BM); Mt. Helicon, Guiol (1930) (BM). Phokis: Delphi, ? Arolfolaptrum 28.4.1931 (S) (approaches var. parviflora). Euboeia: Mt. Xerobuno nr. Stenni, Pichler 5.1876 (W-H).

Peloponnese:- Achaia: Patras, Mt. Panachaikon (Voidia), Bornmüller (1926) 232 (nr. Kastritzi, 600m.), Halacsy 5.6.1893 (800-1200m.) (W-H) (WU). Kynuria nr. Monast. Luku, Orphanides 3313 (G). M. Molevo Lareniae nr. Hagos Petros, Orphanides 3411 (G). Nauplia, Haussknecht 28.4.1885 (JE).

Aegean Islands:- Cyclades: Amoryos: Longadha, Davis 1447. Chios: M. Plaka above Karies, 700m., Rechinger 5399 (W-R). Samos: Prophet Elias nr. Vathy, 500m., Rechinger 3544 (W-R) (some plants very close to var. parviflora); Samos: nr. Monast. Zoodochous Pigi, 300m., Rechinger 3669 (W-R), Samos: Vatly - Mytilini village, Rechinger 3736 (W-R). Phurni: M. Selada, island Thimena, Rechinger 4666 (W-R). Rhodes: M. Prophet Elias (monte Profeta), Rechinger 8414b (nr. Archangelos, 400m.) (W-R), 7172 (nr. Salakos, 600m.); "Rhodes", Knizek 3.5.1902 (PRC),

Bourgeau 5-6.1870 (G). Kos: M. Dikaio (Dicheo), 800m., Rechinger (with no.8050b) (6.1935) (W-R).

Crete:- La Canée, Reverchon 189 (19.5.1883). Kissamos, Reverchon 189 (17.5.1884) (K), 189 (10.5.1884) (W-H). Mt. Aphendi Khristos, Neukirch 4.1911 (W-H) (as M. mediterranea det. Mattf.). M. Ida, Nidha, Dörfler 718 (WU), 718a (WU). Hag. Vasilis: Kedros, Dörfler 932 (WU). Rethymno: Karstboden nr. Rettimo, Dörfler 1209 (WU). Lassithi: M. Aloida, Gandoger 2351; Lassithi, nr. Kattaro, 915m., (Heldreich) 8.5.1846.

TURKEY:-

Bithynia:- nr. Mudaria, Bornmüller 4197 (WU).

Thracia:- 'Constantinopel' (Istanbul), Noë 387 (5.1845).

Mysia:- Renkoi, M. Karajun, Sintenis 144 (with and mostly M. mesogitana ssp. lydia var. kotschyana) (BM)(E)(K), Renkoi, M. Ulu Dagh, Sintenis 144b (with M. mesogitana var. kotschyana but mostly hybrida) (BM)(E)(JE)(K).

Lydia:- below Taktali, (Boissier) 5.1842 (G)(JE).

Lycia:- ? Katara Pass, Forbes (K). ? Xanthus, Forbes 131 (K). Muğla: Fethiye: Kalkan, 30m., Davis 25477. M. Solyma, Heldreich 5.1845 (G). Elmalu, (? Boissier, ? Bourgeau) 17.5.-- (G).

Pamphylia:- Aglassau, Heider (WU). ? Golbaschi, Luschan 19.5.1882 (WU) (approaches parviflora). Alanya promentory, 100m., Davis 25851. Akropolis of Haulhos, Luschan 23.4.1882 (WU).

Galatia:- Amasia, 500m., Bornmüller 2052 (JE).

Mesopotamia:- Aintab (Gaziantep), Haussknecht 5.1865 (JE) (mixed with ssp. turcica - 1 plant). Mardin: Rişmil between Mardin & Savur, 7-8 mls. from Mardin, 900m., Davis 28523 (approaches ssp. turcica), 2 km. E. of Mardin, 1550m., Davis 28438, 28569.

U.S.S.R.:-

Azerbaijan:- Baku: Akhmedlu, Holmberg 930; Baku: Sangatschal, Holmberg 544 (S); Baku: Sikh, Holmberg 475 (S).

CYPRUS:-

Kyrenia:- above Kharcha, 305m., Davis 2150.

Famagusta:- Sina Oros, 725m., Davis 2464.

Nicosia:- Kakopetria, rd. to Mt. Troödos, Lindberg 23.6.1939.

Larnaka:- Skarinou, Davis 2687.

Limassol:- Platres, Kennedy 1207 (1145m.), 1208 (1020m.), 1830 (S. flank of M. Troödos, 1065m.). Manona - Platres, 945m., Kennedy 1210. Kryos Potamos, 884m., Kennedy 1209. M. Pentedactylos, Sintenis & Rigo 231 (with M. mediterranea).

SYRIA:-

Aleppo:- c. Aleppo. Haussknecht 20.3.1865.

Damascus:- Banias, Mt. Hermon, Lowne (1863-64) (very lax plant - ? shade form), 'Damas', Gaillardot 1660 (20.3.1857) (with M. mesogitana) (G)(JE).

LEBANON:-

North Lebanon:- Tripoli, S. of the town, Gaillardot ser. II, 86 (JE), Blanche 86 (18.4.1855 : ?1866) (JE). Brumanna - Jebel Sannin: Kneucker 84 (foot of J. Sannin) (JE), 56 (Spring), 83 (Spring). ? locality, Gaillardot 15.3.1866 (JE).

Antilebanon:- Baalbek, among ruins, Kneucker 268 (JE).

South Lebanon:- S. of Saida, Blanche (Reliqu. Mailleanae 921) 19.2.1853 (JE), Saida, Sainik, Gaillardot 20.3.1853 (JE). ? Mt. de Balbouk, Saidan, Bourgeau 17.6.-- (G).

ISRAEL:-

? ? :- "Iter Syriacum 1855 Palaestina", Kotschy 857 (G).

Galilee:- ?? (Naz)ereth, Palestinae, Roth (K).

JORDAN:-

Cisjordania:- Solomons Pools nr. Bethlehem, Meyers 4596 (15.4.1913).

Gilead:- Suf, 830m., Meyers & Dinsmore 6459 (4.5.1911). ?"Plantae Jordanicae", Jbl. es Soki, Post 239 (12.4.1877).

Moab:- Madaba, 770m., Meyers & Dinsmore M 459. ?"Jerusalem & Kerek" (Kerek), (Boissier ??) 51 (3.57) (G).

Edom:- Wadi Ram, 915m., Davis 9022. Petra in the Sik, Davis 9312, 8762, Dinsmore 10459 (1000m.) (last two very lax plants - ? shade forms).

'IRAQ:-

Mosul:- Eski Kirkuk, 250m., BAG 10395 (leg. Gillett & Rawi). Kursi, Jebel Sinjar, 700m., BAG 10905 (leg. Gillett). Aqra, BAG 11306A (leg. Rawi).

Erbil:- Great Zab nr. Kau Gossik, 250m., BAG 10534 (leg. Gillett & Rawi). Rowandez gorge, BAG 2136 (leg. Guest) (455m.), BAG 8328 (leg. Gillett) (500m.). M. Kuh-Sefin, Schaklava, 900m., Bornmüller 988 (JE) 940 (both 9.5.1893) (JE), 9896 (7.5.1893) (JE) (approaches ssp. turcica).

Kirkuk & Sulaimaniya:- Palegawra, W. of Sagirrma Dagh, 15 mls. S.W. of Pir i' Mukhrun, 1000m., Helbaek 683, 684. Jarmo, Helbaek 355. Quaranjir, Kirkuk - Chemchemal, 700m., BAG 7544 (leg. Gillett & Rawi). Kari Dolman hills, Kirkuk, 395m., BAG 4315 (leg. Guest).

IRAN:-

Azerbaijan:- ? nr. Enzeli (Enseli), Pichler (1882) (K)(WU), Bornmüller 6438 (sea-level) (JE).

Lorestan:- Chah - Bazan, 60 km. N.E. of Dizful, 500m., Køie 1379 (as M. subtilis).

Fars:- Schiras, KAR 2234 (leg. Gauba & Sabeti) (approaches var. parviflora), Stapf 1760 (Dauermmauern) (as Ar. leptoclados).

? ? :- "Persia", Prenot (1828). Persia austr.: Persepolis, Kotschy 831.

Geographical distribution: South and West France, Spain, Portugal and throughout the Mediterranean coastlands (except Cyrenaica & Egypt), Southern Russia, Afghanistan (1600m.).

Biology: Rather slender strictly erect annual weeds and plants of stony slopes. Flowering February to May. Recorded between sea-level and 1200m.

A. (ii). var. parviflora McNeill, var. nov.

Syn.: Alsine lydia Boiss., Diagn. Pl. Orient. ser.2 1 : 86 (1853), pro parte (excl. lectotyp.).

M. tenuifolia ssp. lydia sec. Mattf. in Fedde Rep. Beih. 15 : 42 (1922), pro parte.

A varietate typica sepalis parvioribus (< 3mm.) et plantis gracilioribus differt.

Planta gracilis et humilis, 2-6 (-15) cm. alta, glabra vel glanduloso-pubescentia. Inflorescentia ± stricte erecta, floribus c. 6-15 instructa. Sepala 2.5-3.0mm. longa, lanceolata, latitudine 3-4-plo longiora, acuminata. Petala cuneata, sepalis 2.0-1.5(-1.3)-plo breviora. Capsula anguste cylindrica calyce aequans vel longior, rarius brevior. Semina 0.3-0.4mm. diam. minute rugulosa et minutissime papillosa.

Typus:- TURKEY: Galatia: "Amasia: in siccis regionis calidae alt 4-600m. 20.V.1889, J. Bornmüller, pl. exs. Anatoliae oriental. a. 1889. No.43" (sub "Alsine tenuifolia viscosa Boiss.). holo. WU!

Specimens seen:

GREECE:-

Macedonia:- ? Trudova, 100m., Bornmüller 3556 (JE) (? Yugoslavia).

Thrace:- ?"Turquie d'Europe Thracia", Grisebach (1842) (G).

Aegean Islands:- Mytilini (Lesbos) : M. Lepetymnos above Ypsilometopon, 500m., Rechinger 5795b. (W-R).

TURKEY:-

Lycia:- M. Solyma (Tahtali dağ), 915m., Heldreich 1056 (2.3.1845) (G) (paratype of Als. lydia).

Cappadocia:- Erdschias-dagh (Erciyas dağ): above Tschowakly, 2000m., Zederbauer 24.6.1902 (WU). Erdschias-dagh: nr. Gereme (Göreme?), 1900m., Zederbauer 13.6.1902 (WU).

LEBANON:-

North Lebanon:- Jebel Akar, Davis 5975 (unusually large plant).

'IRAQ:-

Erbil:- Rowanduz gorge, 500m., BAG 8327 (leg. Gillett).

IRAN:-

Fars:- Jahrum, Koelz 14599 (W). Takht-i-Jamshed, Koelz 14449 (W). Shirza, Koelz 14533.

Geographical distribution: ? Yugoslavia: Macedonia (Trudova - cf. above), ? Afghanistan, Otipore (Griffith).

Biology: A usually dwarf erect ± unbranched annual of dry sandy or calcerous habitats. Recorded between 100 & 2000m., flowering March - June.

A.(iii). var. palaestina McNeill, var. nov.

A taxis infraspecificis aliis M. hybridae, petalis anguste deltoidibus ad basim in ungue brevissime abrupte contractis distinguenda. A var. hybrida Orientis et a var. parviflora planta saepe robustior differt.

Planta erecta, 8-25cm. alta, a basi ramosa ex toto glabra vel pedicellis et sepalis glanduloso-pubescentibus. Inflorescentia ramosa vel simplex, floribus, c. 8-40 praedita. Sepala 3-4.5mm. longa. Petala anguste

deltoidea 2-2.5mm. longa, sepalis 0.5-0.75-plo longiora, ad basim in ungue brevissime abrupte contracta. Capsula calycem excedens. Semina 0.5-0.6mm. diam. minute rugulosa et minutissima papillosa.

Typus: JORDAN: Cisjordania: nr. Nablus: "Palestine, Mt. Ebal (Har Eival). Fallow fields. Flowers white. 19.4.1942, P.H. Davis 4487". holo. E!, iso. K!

Specimens seen:

? locality:- "Palaestina", Boissier 4-5.1846 (G). "Mediae Palaestinae: Kolonish", 200-800m., Dinsmore 4459.

ISRAEL:-

Galilee:- nr. Nazareth, Ball 5.1877.

Central Israel:- Karmel, 200m., Bojko 1.3.1934 (WU). Aujeh River, Saronae (Hayarqon nr. Tel Aviv), 15m., Dinsmore B6459. Ramath-Gan nr. Tel Aviv, Fl. Palaest. Exs. 39 (leg. Zohary). Jerusalem, 800m., Meyers & Dinsmore 5502. ? Convent of the Crop nr. Jerusalem, Ball 4.1877.

JORDAN:-

Cisjordania:- nr. Bireh (Bira), Ball 5.1877. el Kafr Kibbish nr. Deir Ballut, 35°E. 32°N., Ogilvie (c. 1918) (K). Nablus: Geragim (Har Gerizim), Davis 5185.

Geographical distribution: Endemic.

Biology: A rather robust field weed and plant of stony slopes. Recorded from 15-800m. Flowers (February -) March - April.

B. subsp. turcica McNeill, subsp. nov.

Syn.: M. mesogitana sec Mattf. in Fedde Rep. Beih. 15 : 35 (1922) pro parte min., non mesogitana Boiss.

M. tenuifolia ssp. hybrida sec Mattf. l.c. pro parte min., non hybrida Vill.

A ssp. hybrida sepalis lanceolatis anguste acutis petalis longioribus (sepalis 0.7-1.0-plo longioribus) capsula subovoidea (valva latissima latitudine < 3-plo longior) differt. A M. mesogitana ssp. mesogitana, cui approximat, sepalis plerumque angustioribus petalis cuneatis numquam unguicularibus saepe brevioribus habitu erecto vel ascendente distinguenda.

Planta robusta erecta vel ascendens, saepe prope basim ramosa, ex toto glanduloso-pubescentia. Inflorescentia simplex vel plerumque ramosa, floribus 8-50 praedita. Sepala (2.75-) 3-4mm. longa, lanceolata, latitudine 3.0-3.5-plo longiora, anguste acuta. Petala ovato-lanceolata, 2-3.5mm. longa, sepalis c. 0.7-0.9-plo longiora, cuneata. Capsula subovoidea calyce excedens; valva latissima latitudine c. 2.5-2.75-plo longior. Semina 0.45-0.55mm. diam., rugulosa fere epapillosa.

Typus: TURKEY: Cappadocia: "Prov. Kayseri: Kisge at W. foot of Bakir Dağ, 1300m. Rocks. Annual. 27. June 1952", Davis, Dodds & Cetik (D.19216). holo. E!, iso. K!

Specimens seen:

GREECE:-

Central Greece:- M. Parnes, Nosokomeion, 1000m., Samuelsson & Zander 478 (S).

TURKEY:-

Amanus:- M. Dumanly, 700-1200m., Haradjian 3709.

Phrygia:- Boulgas-Keiu, 950m., Balansa 335 (G).

Galatia:- Mt. Togman, Amasia, 600m., Bornmüller 2059 (? approaches ssp. hybrida var. parviflora).

Cataonia:- Berytdagh, 1220m., Haussknecht 5.8.1865 (fls. small, approaches parviflora). ? M. Singarne, (Haussknecht) 5.1867.

S.W. Armenia:- Tunceli: Tunceli-Pulumur, 6 mls. from Pulumur, 1000m., Davis 29200B. Kharput, Uelbe, Sintenis 537 (JE)(WU). Egin, Euphrates, Sintenis 2298.

N.E. Armenia:- Gümüşane: Chromdere nr. Godonando, Sintenis 5873.

Kurdistan:- Van: Gevaş - Van, 200m., McNeill 164. 5 km. E. of Siirt, 1150m., Frödin 40 (W).

Mesopotamia:- Biredjik (Bireçik): Djebel Taken, Sintenis 459. Above Urfa, 700m., Davis 27998. Urfa, rocks of castle, 600m., Davis 28040B (intermediate to hybrida s.s.). Aintab (Gaziantep), Hausskencht (1865) (mixed with M. mesogitana s.s. - accident?) (JE), 24.4.1865 (JE), 5.1865 (1 plant with var. hybrida) (JE), Haradjian 1324 (1000m.) (W).

U.S.S.R:-

Azerbaijan:- ? ? , 1770m., Herb. Inst. bot. Komarov (leg. Grossheim, Ilinskaya & Kirpichnikov 8.6.1947 (BM).

SYRIA:-

Damascus:- Damas: Djebel Khaisoun, Koubbet Siara et Koubbet

el Nasr, Gaillardot 1659 (26.3.1856) (G)(JE).

LEBANON:-

North Lebanon:- above Sir, 1220m., Davis 6391A.

'IRAQ:-

Mosul:- Jebel Sinjar, N. of town, 1000m., BAG 11120 (leg. Gillett.)

IRAN:-

Lorestan:- Bisitun, Karmanshah, Strauss 24.4.1903 (intermediate to hybrida s.s.) (JE).

Geographical distribution (of ssp. turcica): U.S.S.R.: Crimea (Callier 42!) (elsewhere in S. Russia ?).

Biology: A rather robust erect or ascending plant of fields and stony places. recorded between 600 & 2000m. Flowers April - June.

Geographical distribution (of sp.): As that of ssp. hybrida but extending (as ssp. vaillantiana) into N.E. France, Switzerland, W. Germany & S. E. England.

Biology (of sp.): Chromosome no. (Portugal): 2n = 46 Blackburn & Morton (1957).

List of putative hybrids between M. hybrida var. hybrida and M. mesogitana ssp. mesogitana. (Specimens seen) :-

LEBANON:-

South Lebanon:- Beyrouth, between dunes and pine, Gaillardot (JE).

East of Saida, Gaillardot 29.3.1862 (JE). Saida, 'Mier Elior' (??), Nubi Yahia, Blanche 66 (22.1.1853).

ISRAEL:-

Galilee:- Jebel Jermak, Fl. Terr. Israel. Exs. 425 (? M. hybrida ssp. turcica) (as & with Arenaria tremula).

Discussion (of M. hybrida): see end of section.

66. M. mediterranea (Ledeb.) Maly in Glasnik Muz. Bosn. Herceg. 20 : 363 (1908).

Syn.: ?M. tenuifolia Nees ex Mart., Hort. Erlang. 44 (1814), non (L.) Hiern (1899).

Arenaria mediterranea Ledeb. in Link, Enum. Hort. Berol. 1 : 431 (1821).

!Ar. arvatica Presl. Fl. Sicul. 163 (1826).

Sabulina mediterranea (Ledeb.) Reichb., Ic. Fl. Germ. 5 : 27 (t.205 f.4918b) (1842).

Alsine tenuifolia δ brachypetala Fenzl in Ledeb., Fl. Ross. 1 : 342 (1842) (pro parte ≡ mediterranea).

Als. mediterranea (Ledeb.) Maly, Enum. Fl. Austr. 296 (1848).

!Als. tenuifolia var. maritima Boiss. & Heldr. in Boiss., Diagn. Fl. Orient. ser.1 8 : 95 (1849).

!Als. conferta Jord. Pugill. 35 (1852) (pro parte ≡ maritima).

Als. tenuifolia var. confertiflora Fenzl ex Willk., Ic. Descr.

Fl. 1 : 107 (1856) (A.t. γ confertiflora Fenzl in Ledeb., Fl. Ross. 1 : 342 (1842) nom. nud.).

!Als. tenuifolia § stenocarpa Fenzl Diagn. Pl. Orient. 11 (1860) (reprint from Tchihatch., Asie Min. 3 (Bot.) (1) : 228) quoad syn. (≡ brachypetala), non spec. cit.

!Als. tenuifolia var. mucronata Boiss., Fl. Orient. 1 : 686 (1867) (" γ ") (nom. illeg. ≡ maritima), non Arenaria (Alsine) mucronata L.

!Sabulina conferta (Jord.) Fourr. in Ann. Soc. Linn. Lyon N.S. 17 : 195 (1869).

M. tenuifolia (L.) Hiern subsp. mediterranea (Ledeb.) Briquet, Prodr. Fl. Corse 1 : 532 (1910).

!M. tenuifolia (L.) Hiern. subsp. conferta (Jord.) Thell., Fl. Adv. Montp. 230 (1912).

Illustrations:

Javorka & Csapody, Iconogr. Fl. Hungar. 137 t.1085 (as M. densiflora).

Willkomm, Ic. Fl. Eur. aust.-occ. Hispan. t.69 f.c (as Als. tenuifolia var. confertiflora).

Type: ? ex hort. Berol. holo. B? (destroyed).

Specimens seen:

GREECE:-

Ionian Islands:- Stadt Korfu, Wille 19.4.1905 (W-H).

Macedonia:- nr. Salonika, Adamović (1905) 208 (WU). W. Macedonia : M. Vermion nr. Naussa, 300m., Rechinger 8647 (W-R).

Thrace:- W. Thrace: R. Nestos (Mesta) nr. Toxotai (Oktschilar), 60-100m., Rechinger 9336 (W-R).

Central Greece:- M. Hymetti, Heldreich 1951 (29.4.1848), Vestergren 14.4.1921 (S). M. Petelicon, Heldreich Fl. Graec. Exs. 1951 (22.4.1855) (G)(WU), Herb. Graec. Normale 1019 (15.5.1888) (Thalos, 365m.). Athens: Akropolis, Parthenon, Pallas Athenas statue, Vestergren 19.3.1921 (S). Athens: Lykabettos, Samuelsson & Zander 36 (18.4.1931) (S). M. Corydalis, Heldreich 27.3.1884 (W-H). Phocis: Chisson, Samuelsson & Zander 314 (1.5.1931 (S).

Peloponnese:- Elis : Olympia, Watzl 12.4.1911 (WU). Argolis, Spruner (1841) (G).

Aegean Islands:- Cyclades: Cythnos (Thermia), Heldreich Pl. Exs. (leg. Tuntas) 4.1900 (W-H). Sporades: Phurni: M. Selada, Thimena island, Rechinger 4689 (W-R).

Crete:- Sphakia: Gaudos Island nr. Kastri, Dörfler 1138 (WU). nr. Canea, (Heldreich) 1356 (26.3.1846) (G). Cydonia, Heldreich 3.1846 (type of maritima & conferta).

?TURKEY:-

? Cataonia:- Berytdagh, 2135m., Haussknecht 9.8.1865 (G) (error in labelling ?).

CYPRUS:-

Nicosia:- Nicosia - Famagusta, ml. 3, 150m., Chapman 397. Ayia Irini (Morphou), Davis 2537.

Larnaka:- Stavrovouni, Druce (K).

Paphos:- Paphos, Druce (K).

Limassol:- M. Pentedactylos, Sintenis & Rigo 231 (29.3.1880).

LEBANON:-

South Lebanon:- Saida, Gaillardot (Reliqu. Mailleanae 920) 15.3.1853, Blanche 69 bis (7.3.1853) (G), 69 (22.2.1853) (Nahr Aoule) (G), 68 (29.2.1853) (G). Phoenicia: Ras el Kantara, Samuelsson 1159 (S). Beyrouth, Gaillardot 904 (G). Blanche 778 (1.3.1850) (Herb. Desvaux) (Raz Beyrouth) (G), 777 (6.2.1850) (edge of road) (G).

ISRAEL:-

Central Israel:- Jaffa, Bornmüller (1897) 197, Wall 18.4.1932 (Sarona) (S).

LIBYA:-

Cyrenaica:- Baciara nr. Berta, 600m., Sandwith 2556 (= Simpson 39517).

Geographical distribution: Southern France, Spain, Portugal and throughout the Mediterranean region (absent from Egypt).

Biology: A decumbent to erect annual of sandy places often near the sea. Recorded between 0-600m. (? - 2135m.)

Chromosome number : (Portugal) 2n = 20 Blackburn & Morton (1957).

Discussion: M. mediterranea is usually very easily recognised by its contracted ultimate inflorescences (the lowermost flowers are usually long-pedicelled) and its long cylindrical calyx and capsule. A few plants do occur, however, in which the whole inflorescence is rather lax, and

such specimens can readily be confused with M. hybrida var. hybrida. The very short petals and short capsules distinguish M. mediterranea as here defined. This variation in inflorescence structure makes the species appear rather heterogeneous and many named taxa have been recognised mostly in the European part of its range. Most of this variation is probably attributable to environmental effects but some may possibly arise from introgression with M. hybrida.

The nomenclature of the species has been rather confused and it has not been possible to see type material of mediterranea or of the two possible older names, triandra Schrank and M. tenuifolia Nees ex Mart. Graebner (1918) tentatively attaches triandra to this species but an examination of the illustration in 'Hort. Monac.' suggests that it is more likely to refer to M. hybrida. The identification of M. tenuifolia Nees ex Mart. is even more difficult, but from the description the name would certainly seem to belong either to M. mediterranea or M. hybrida. (If it should prove to be the latter, one would have the rather odd situation of a name being illegitimised by an earlier homonym with which it was conspecific - i.e. Arenaria tenuifolia L. (1753) (≡ M. tenuifolia (L.) Hiern, 1899) is the earliest name for M. hybrida, but M. tenuifolia Nees ex Mart. (1814) being intended as a new species is based on a totally different type, and so renders Hiern's combination illegitimate; Ar. hybrida Vill. is the next earliest name for the species). Another source of confusion in the nomenclature of M. mediterranea lies in the disputed identity of Arenaria mucronata L. (cf. Graebner, 1918 p.724). For the moment it seems best to follow Graebner and Mattfeld in regarding this as an ambiguous name. The earliest name about whose application there is

no doubt is Arenaria arvatica Presl. Here the type specimen from Prague has been examined and although some of the plants have a rather lax inflorescence, they are clearly referable to this species. However, although probably no type material of mediterranea is extant, it seems reasonably certain from the original description that the current application of the name is a correct one and this practice has been followed.

67. M. regeliana (Trautv.) Mattf. in Bot. Jb. 57 Beibl. 126 : 29 (1921).
Syn.: !Alsine tenuifolia var. regeliana Trautv. in Bull. Soc. Nat. Moscou 33 : 156 (1860).

Illustration: Fedtschenko, Flora Yugo Vostoka (Fl. Ross. Austro-Orient.) in Acta Hort. Petrop. 43 : 262 (1930).

Syntypes: U.S.S.R.: West Kazakhstan ("Songaria") : 1) "prope Ajagus" 2) "ad ripes fl. Karatal 13.6.1840-43" 3) "in desertis salsis ad fl. Tersaken, 30.6.1840-43" 4) "in vallibus herbidis montium Ulutau 30.5.1840-43", Schrenk. holo. LE, iso. G.!, K.! (? "Songaria. Schrenk" - no date).

Record (from region):
U.S.S.R.: Azerbaijan: "Eastern Transcaucasia", Komarov (1936). (not included in Grossheim, 1949 - ? erroneous).

Geographical distribution: Lower Volga, Kazakhstan to Tien Shan and southwards into Afghanistan (Aitchison 1025.!).

Discussion: A rather distinct species (cf. key), resembling M. viscosa on the one hand and approaching the following species, M. urumiensis, on the other.

68. M. urumiensis (Bornm.) Bornm. in Beih. bot. Zbl. 33 (2) : 279 (1915).

Syn.: Alsine urumiensis Bornm. in Verh. zool-bot. Ges. Wien 60 : 85 (1910).

Type: IRAN: Azerbaijan: "Khoi in pratorum siccis 23.5.1884", J.A. Knapp. holo. JE!, iso. WU!

Specimens seen:

TURKEY:-

Lycaonia:- Konya: Tuz Golu: Yavsan Memlehasi, Davis 18684.

Cappadocia:- Erdschias-dagh nr. Soisaly, 1100m., Zederbauer 7.6.1902 (WU).

Geographical distribution: Endemic.

Biology: Small erect or spreading annuals apparently of saline soils. Flowering May - June.

Discussion: The three known gatherings of this species are fairly uniform and very distinctive. The annual habit, the small seeds and the relatively large petals have been the deciding factors in transferring this species from Section Minuartia Series Xeralsine, where Mattfeld placed it, to its present position. Its resemblance to Xeralsine is, however,

undoubtedly one of close affinity and this species represents the nearest that is known to a transitional type between the Sections Sabulina and Minuartia.

Sabulina - Discussion.

The Orient forms of Section Sabulina are taxonomically very much more complex than those of Europe and the Western Mediterranean which are themselves by no means easy to classify (cf. Graebner 1918). This greater complexity shows itself in two main directions, namely the existence of small-flowered types like lydia and subtilis and the presence of large-petalled mesophytic plants such as mesogitana sensu stricto and thymifolia.

Within the area four rather distinct species can be recognised, namely M. regeliana and M. urumiensis which present no taxonomic problems, and M. viscosa and M. subtilis which, while often confused in the past, seem as defined here to be more or less discreet entities. (A few Anatolian specimens of M. hybrida var. parviflora show an approach to M. viscosa and one sheet of depauperate lydia var. kotschyana from Cilicia might be mistaken for M. subtilis.) Two further species, M. thymifolia and M. mediterranea, while undoubtedly deserving their status, do show a close approach to other members of the group. Although very distinctive in its typical strand form, M. thymifolia can prove difficult to separate from M. mesogitana subsp. mesogitana, while the more lax plants of M. mediterranea seem genetically influenced by M. hybrida var. hybrida.

The great complex of forms, however, lies within what has often been treated as a single aggregate species (M. tenuifolia (L.) Hiern = M. hybrida (Vill.) Schischk. s.l.) (e.g. by Mattfeld in Bornmuller 1940) but which is here regarded as comprising two polymorphic and somewhat intergrading species : M. mesogitana and M. hybrida. The former is made up in the main of more spreading mesophytic plants of lower altitudes with broad sepals and large petals, the latter conspicuously contracted into a very short claw at the base. The plants which are included in M. hybrida, on the other hand, are all erect or at most ascending plants growing either as field weeds or else in dry stony places on mountains. This stress on petal and sepal shape seems to give a more natural separation into two major groups than does Mattfeld's additional use of flower size as a primary character. This latter, as measured by sepal length, seems to show almost continuous variation over the range of 2mm. to 4mm., both in hybrida-like plants and in those with mesogitana characteristics. The low-growing small-flowered plants which Mattfeld called subsp. lydia seem therefore to form an unnatural assemblage and the main difference between his excellent pioneer treatment and the current evaluation is the transference of most, but not all, of these from what is now called M. hybrida to M. mesogitana where they find a place along with some small-flowered plants which he retained in that species because of their more obviously decumbent habit. The remainder of his subsp. lydia, mostly plants of the Turkish and Iranian plateau, have for convenience been distinguished as a variety (var. parviflora) of M. hybrida subsp. hybrida. These show very strong intergradation with typical hybrida and the dividing line of sepals 3mm. long as been selected rather arbitrarily.

Although intermediate plants do occur, the small-flowered relatives of mesogitana are more distinct and seem largely to replace the typical plant at higher altitudes along the southern coast of Turkey and in the eastern part of its range (Iraq & Iran). This is reflected in their being here maintained at subspecific rank (subsp. lydia). (- the small flower-size is retained in cultivation). The lectotype of lydia (one of the three original syntypes = M. hybrida var. parviflora) represents a distinctive race with acuminate bracts and sepals, confined to Lydia and Caria. The more common form of the subspecies - in Greece and eastward to the Cilician Taurus, includes the type of Boissier's var. kotschyana, which he later (1867) erroneously equated with M. subtilis - a mistake followed by all later authors (Mattfeld, 1922, gave Als. lydia var. kotschyana as a synonym of subtilis but cited the type specimen under lydia!). Further east (from the Syrian desert to Turkmenia and Afghanistan) small-flowered plants occur which in habit more closely resemble mesogitana s.s. These were included by Mattfeld in M. mesogitana but are further distinguished by the capsule not exceeding the sepals - an unusual feature in this species. Schischkin (1937) described one of these plants as a new species (M. turcomanica) and this name is adopted here at varietal rank.

Mattfeld recognised that the taxon velenovskyi, confined to Albania and Montenegro, had a certain distinctiveness, but rightly decided that it could not be specifically distinguished from lydia. He had no material available of Boissier's var. orphanidis from the Peloponnese (though he suggested itsaffinity might be with lydia) and hence he was unable to recognise either its link with velenovskyi or their common diagnostic features of large seeds and a large ovoid capsule. Subsp.

velenovskyi, with its typical variety in the north and var. orphanidis in Greece and Crete, is the only representative of the species west of the Aegean coastlands (ssp. lydia var. kotschyana occurs on Euboea and in Attica).

In addition to the above and to the well-known type subspecies, three other subspecies have been included in M. mesogitana. Each is very distinct but is only known from a single gathering. One of these, subsp. flaccida from Paphlagonia, described here for the first time, might, with its large but cuneate petals and its echinate seeds, be raised to specific rank were more and better material available. Haussknecht had already noted its distinctiveness and proposed for it the manuscript name "Alsine flaccida". The other two subspecies, one new (subsp. macrocarpa) and one based on Boissier and Balansa's Alsine brachycarpa, have both very small flowers, with sepals 1.5-2.0mm. long. They show very marked differences from one another (cf. key) and are widely separated geographically, the former having been found among fixed dunes on the coast of Pamphylia and the latter at 1300m. in Cappadocia. No material of another very small-flowered taxon, Mattfeld's M. tenuifolia var. elachistantha, has been seen, but from the description it cannot be equated with either macrocarpa or brachycarpa; it was described from Sivas.

The type subspecies is probably the most common, being widely distributed along the Mediterranean coastlands of Lebanon, Syria and Turkey and occurring also on the west coast of the Black Sea. Although the majority of specimens are very distinct, a number, mostly from northern Syria, the Amanus and Commagene, approach M. hybrida, usually

in its subsp. turcica. Indeed, subsp. turcica is in many respects intermediate between mesogitana and hybrida s.s., but seems to merit taxonomic recognition, if only because of its distinctive geographical distribution outwith the range of the other two taxa. Among the very copious material of Blanche and Gaillardot from the Lebanon coast, most of which is clearly mesogitana or hybrida, are three aberrant gatherings which combine the characteristics of the two taxa in unusual ways (i.e. they do not resemble turcica). The plants on the sheets show considerable variation and these gatherings have all the appearance of hybrids between the two species. These specimens (listed at the end of the account of M. hybrida) and those already referred to from further north (mesogitana approaching M. hybrida subsp. turcica) are, however, very much the exception, and do not seem sufficient to warrant the two species being united.

One further variant in the group has been recognised for the first times (so far as is known). This is a race of M. hybrida subsp. hybrida which has a rather more robust ascending habit than is usual in Orient plants of the subspecies, and which combines this with small narrowly triangular petals which are abruptly contracted at the base into a very short claw. One can only speculate as to whether this character has been derived from gene flow with M. mesogitana, but the fact that this race replaces normal hybrida throughout Palestine (but not Transjordania) seems to warrant its taxonomic recognition (var. palaestina).

Banks and Solander's Alsine aristata from Aleppo may refer to a plant of M. hybrida but no specimen could be traced at the British Museum either by the present writer or by Eig (1937).

No satisfactory account of such a variable group of self-pollinated

annuals can be made solely on the basis of herbarium material (and a few cultivated specimens) but the present account is an attempt to describe the general pattern of variation within the section, basing it on as copious material as possible and always building on the solid foundation of Mattfeld's treatment in 1922.

Lepyrodiclis Fenzl

Petals obovate to cuneiform, entire or shallowly indented at the apex; sepals somewhat spreading, soon after flowering; calyx infundibular to campanulate; pedicels at flowering time about 1.5 to 2 times as long as the calyx 1. L. holosteoides

Petals narrowly linear, sharply toothed at the apex; sepals connivent soon after flowering; calyx cylindrical; pedicels at flowering time about 0.5-1 times as long as the calyx, rarely longer (fruiting pedicels, however, sometimes much longer) 2. L. stellarioides

1. L. holosteoides (C.A. Mey.) Fenzl ex Fisch. et Mey., Enum. Pl. Nov. Schrenk 1 : 110 & 93 (1841).

Syn.: Gouffeia holosteoides C.A. Mey., Verz. Pfl. Cauc. 217 (1831).

Gouffeia crassiuscula Cambess. in Jacquem., Voyage l'Inde 4 (4) 28 t.30 (1844).

Arenaria holosteoides (C.A. Mey.) Edgew. in Hook., Fl. Brit. Ind. 1 : 241 (1874).

Illustrations:

Grossheim, Fl. Kavkaza (Fl. Caucas.) ed.2 3 : t.20 f.1 (1945).

Jacquemont, Voyage l'Inde 4 t.30 (1844).

Komarov, Fl. U.R.S.S. 6 t.26 f.3 (1936).

Type: "in montibus Talusch prope pagum Swant", C.A. Meyer. holo. LE, iso. GOET (Wagenitz vidit).

Specimens seen:

No locality:- Ledebour (as Gouffeia holosteoides).

TURKEY:-

Pontus:- Rize: Djimil (Cimil) Valley, 2032m., Balansa (1866) 1427. Rize, 100-200m., Davis 20780.

N.E. Armenia:- Muş: Warto (Varto): Gestamert nr. Gumgum, S. of M. Bimgoell (Bingöll dağ), 1585m., Kotschy (1859) 294. Erzerum, Huet du Pavillon 6.1853. Gümüşane: Baibourt, Bourgeau 20.6.1862. Kars - Susuz, 1750m., Davis 29574.

Kurdistan:- Van: Hoşap: Kepir dağ, 2700m., Davis 23362 (as - Stellaria).

Mesopotamia:- Diyarbakir - Ergani, 20 km. from Diyarbakir, 750m., Davis 28813.

U.S.S.R.:-

Georgia:- Swant, Hohenacker (1838) (as "Gouffeia Holostea C.A. Meyer") Bougard (as Gouffeia holosteoides).

Armenia:- "Armenia", Szowits 160. "Armenia rossica": Herb. W. Besser (K) (as Gouffeia holosteoides).

IRAN:-

? locality:- "E. Iran" to 1675m., Daly 6.

Azerbaijan:- nr. Tabris. Gilliat-Smith 1511.

Kordestan & Zanjan:- Zanjan (Zinjan), Gilliat-Smith 2637 (Zindjan-abad), Cowan & Darlington 1826 ("Saheud Hills above Zunjinab" 1830m.).

Caspian Sea:- Elburs: N. of M. Totschal nr. Scheristanek, 2200m., Bornmiller (1902) 6400.

Northern Zagros:- Ecbatana (Hamadan), Pichler (1882).

Southern Zagros:- nr. Isfahan, Iliff 15, 20.

Fars:- Persepolis (S. of Sivand), Kotschy (1842) 259. foot of Kuh Bul, Stapf 29.5.1885.

Kerman & Yazd:- nr. Kerman, 1900m., Bornmüller 2290, 2290a (both as L. stellarioides), 2291, 2292.

Geographical distribution: Afghanistan, Baluchistan, W. Himalaya, Turkmenia, Turkestan, Pamir-Altai, Tien-Shan and W. Tibet.

Biology: Robust, much-branched annual with large broadly lanceolate leaves; growing in fields. Flowers April - July. Recorded between 1900 and 2700m.

Discussion: cf. Discussion of genus.

2. L. stellarioides Schrenk ex Fisch. et Mey., Enum. Pl. Nov. Schrenk 1 : 93 (1841).

Syn.: !L. cerastioides Kar. & Kir. in Bull. Soc. Nat. Moscou 15 : 167 (1842).

!L. cerastioides Stapf in Denkschr. Akad. Wiss., Wien 51 : 287 (1886).

Arenaria holosteoides β stellarioides (Fisch. & Mey.) Williams in J. Linn. Soc. 33 : 427 (1898).

Arenaria holosteoides γ cerastioides (Kar. & Kir.) Williams l.c. : 427 (1898).

Illustrations:

Grossheim, Fl. Kavkaza (Fl. Caucas.) ed.2 5 : 213 t.20 f.2 (1945).

Komarov, Fl. U.R.S.S. 6 t.26 f.2 (1936).

Type: "in collibus Kuguldyr subfinem Majii", Schrenk. holo. LE ?

Specimens seen:

IRAN:-

Azerbaijan:- 'John Wilesley' village nr. Urumia, 1370m., Cowan & Darlington 18.5.1929 (as L. holosteoides).

Caspian Sea:- M. Elburs nr. Passgala, Kotschy (1843) 185 (as L. cerastioides Kar. & Kir.).

Northern Zagros:- Ecbatana (= Hamadan), Pichler (1882) (as and type of L. cerasticides Stapf.).

Lorestan:- Durud, 1675m., Koelz 15635 (as L. holosteoides).

Other records: IRAN: Mt. Kerman, Bunge. Ispahan - Teheran, Bunge. (cf. Boissier 1867).

Geographical distribution: Afghanistan, Turkmenia, Turkestan, Pamir Altai and Tien-Shan.

Biology: Habit as L. holosteoides but less robust. Recorded at 1350m. growing in fields.

Discussion: cf. Discussion of genus.

Lepyrodiclis - Discussion

L. holosteoides and L. stellarioides - the two more westerly species of the genus are very closely related to one another, and together are very distinct from the third species, L. tenera Boiss. from Afghanistan and India. The two species have always been very much confused, and this confusion was only satisfactorily resolved by Wagenitz' revision of the genus in 1957. The present account follows his treatment.

Williams (1898) recognised at specific rank only holosteoides and tenera (under Arenaria) but within the former he included a variety, δ paniculata, based on Lepyrodiclis paniculata Stapf. Stapf's plant is in fact a specimen of Stellaria kotschyana Fenzl ex Boiss. (cf. p.198).

IV. BIBLIOGRAPHY.

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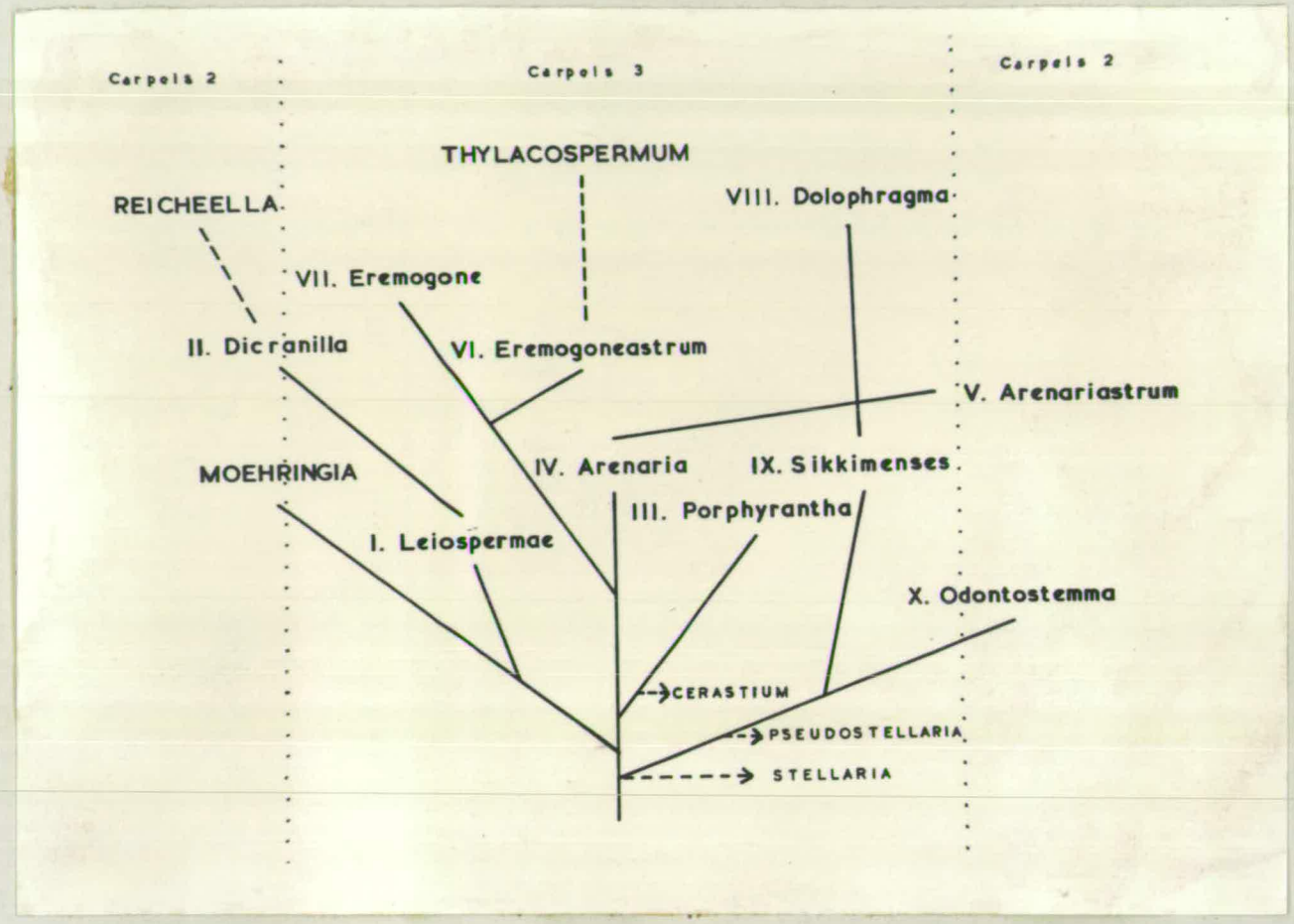


Fig. 1 Diagram of the probable inter-relationships and evolution of the subgenera of Arenaria.

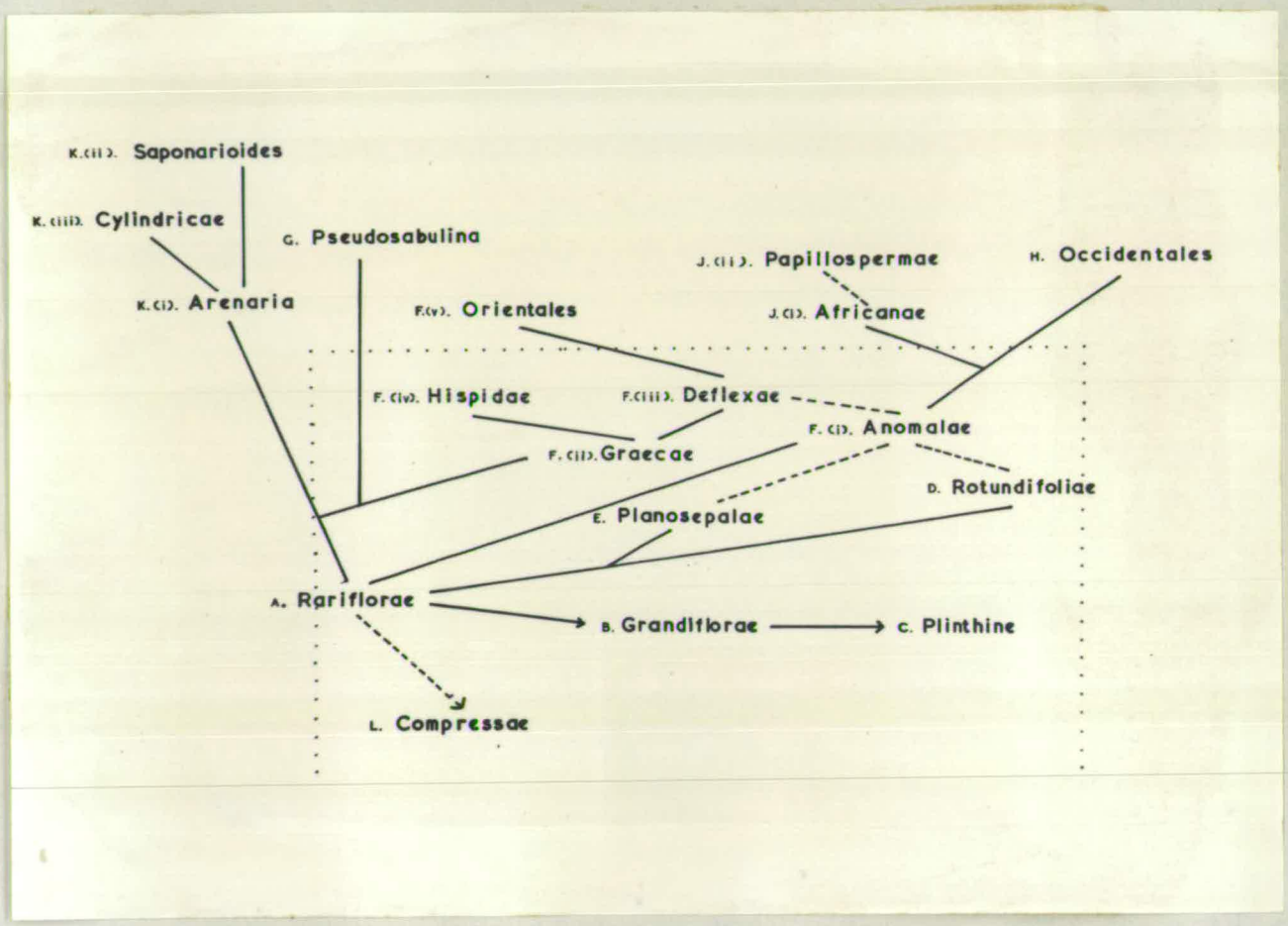


Fig. 2 Diagram of the probable inter-relationships and evolution of the sections and series of Arenaria Subgenus Arenaria.

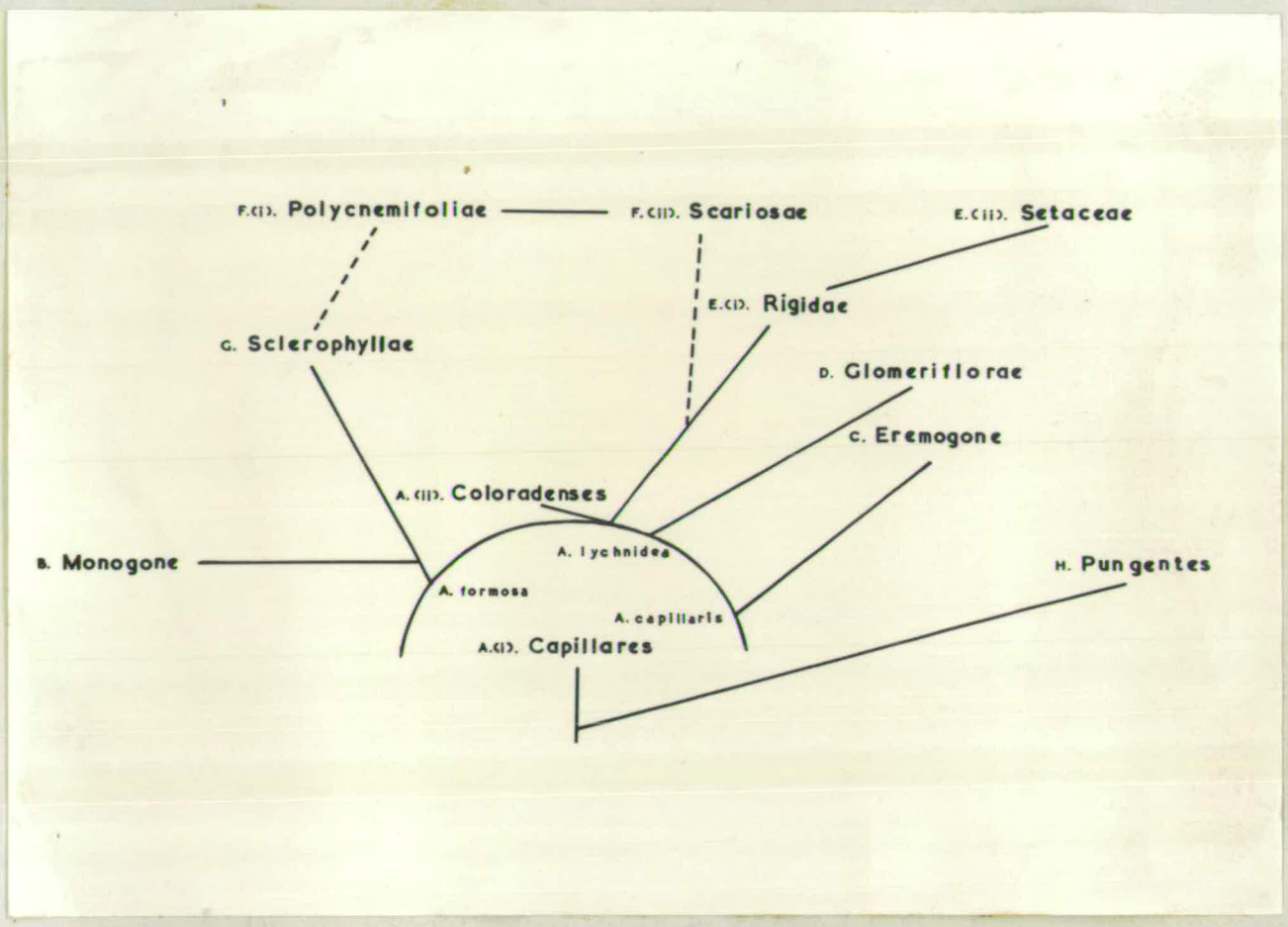


Fig. 3 Diagram of the probable inter-relationships and evolution of the sections and series of Arenaria Subgenus Eremogone.

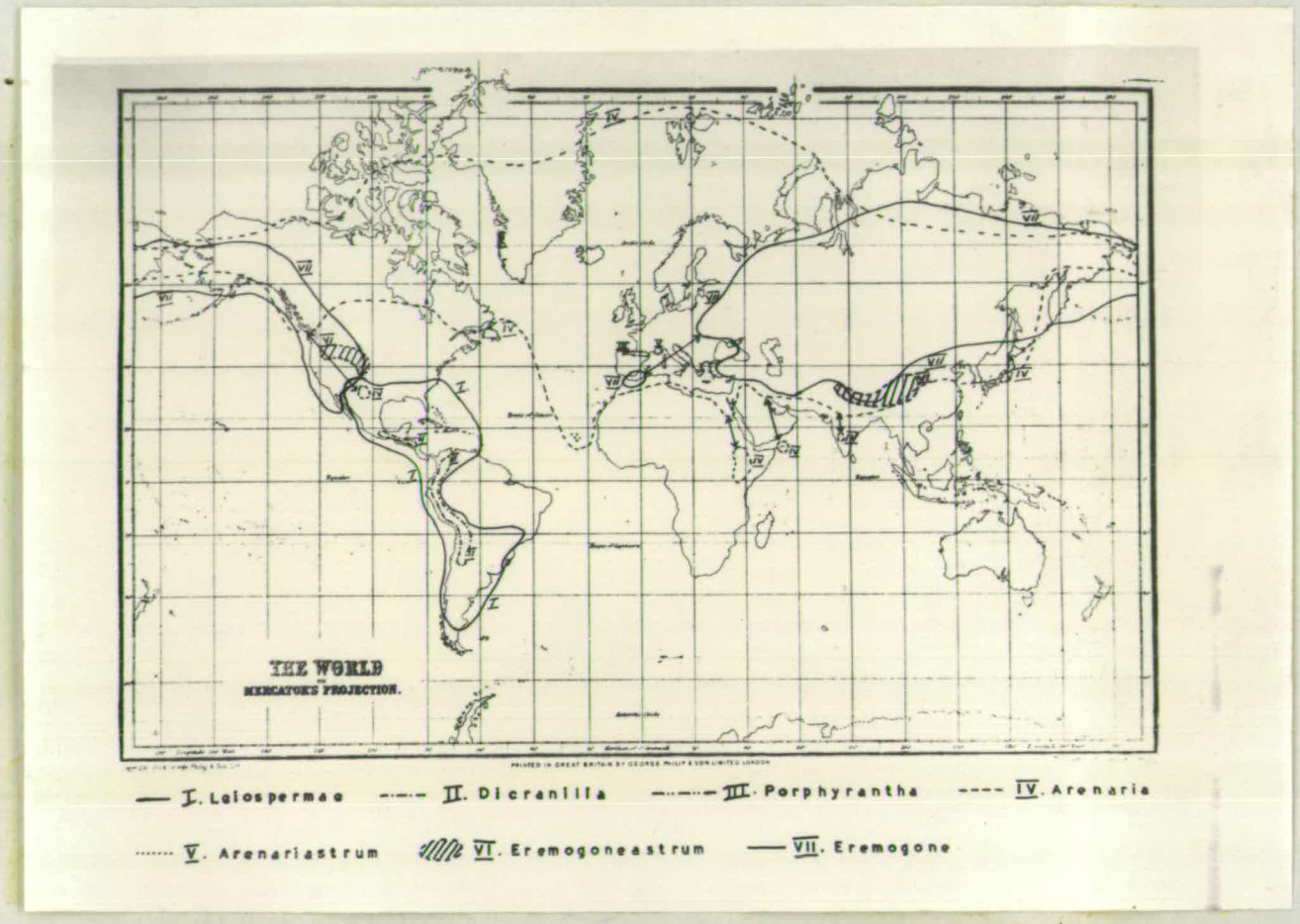


Fig. 4 Geographical distribution of the subgenera of Arenaria (excl. Sikkimenses, Dolophragma and Odontostemma).

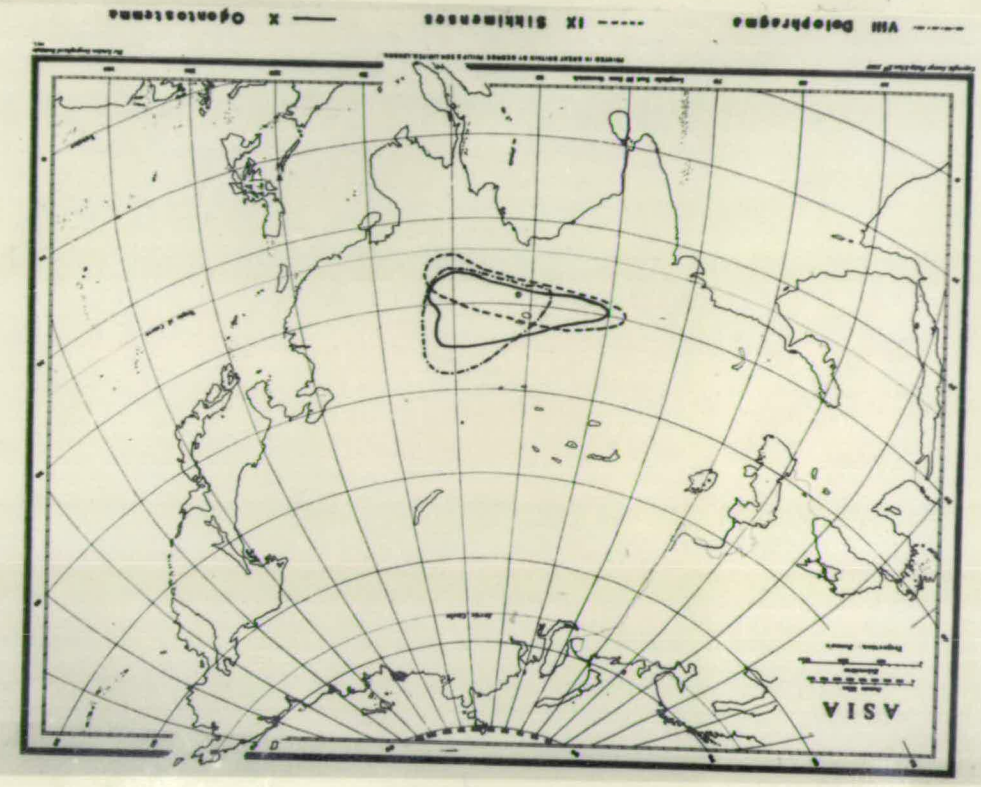


Fig. 5 Geographical distribution of Arenaria Subgenera Sikkimenses, Dolophragma and Odontostemma.

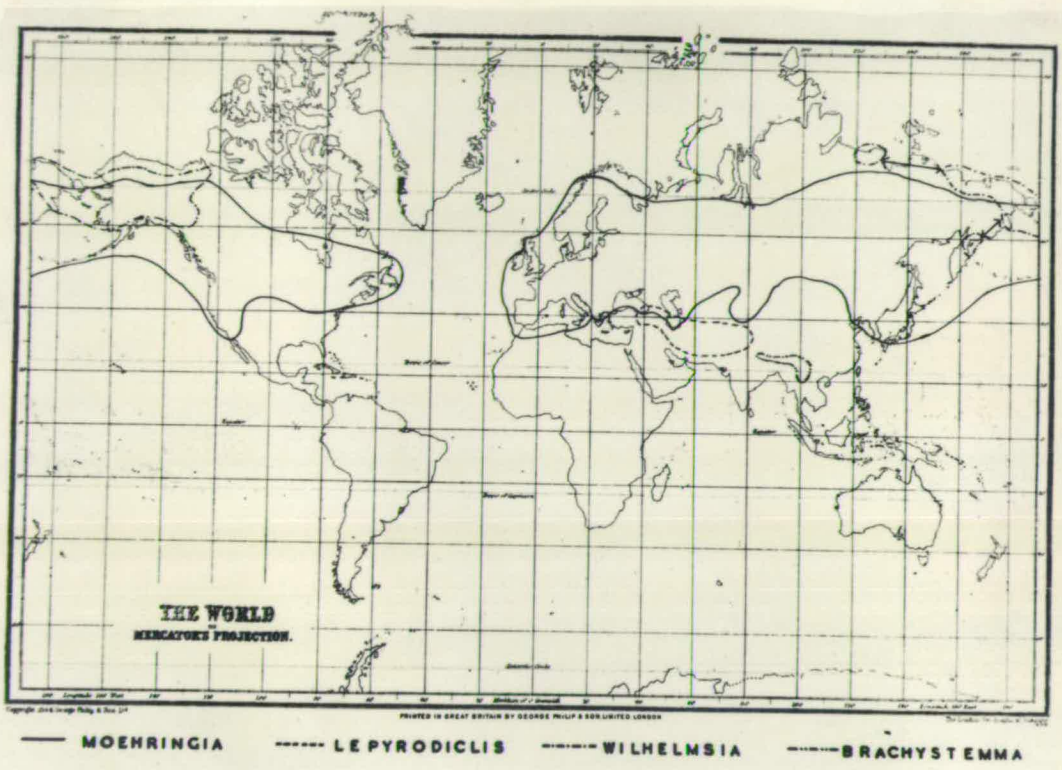


Fig. 6 Geographical distribution of Brachystemma, Wilhelmsia and Lepyrodiclis.

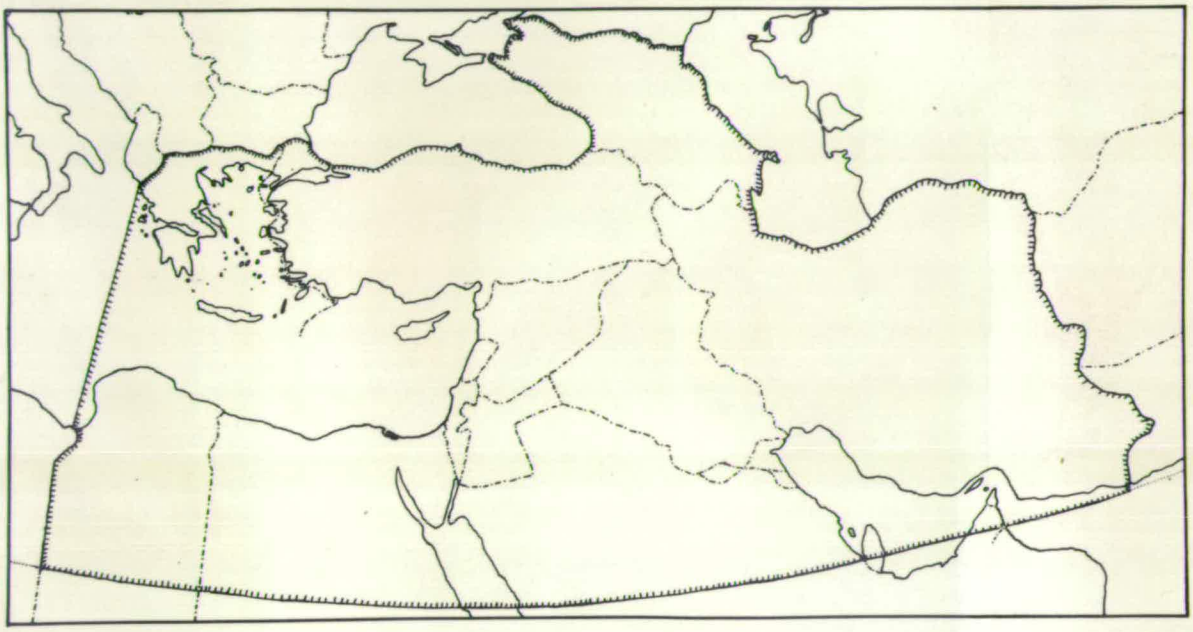


Fig. 7 Limits of the Orient as defined for the revision of species.



1. Ionian Islands
2. Epirus
3. Macedonia
4. Thrace
5. Thessaly
6. Central Greece
7. Peloponnese
8. Aegean Islands
9. Crete

Fig. 8 Administrative provinces of Greece used in citation of specimens.



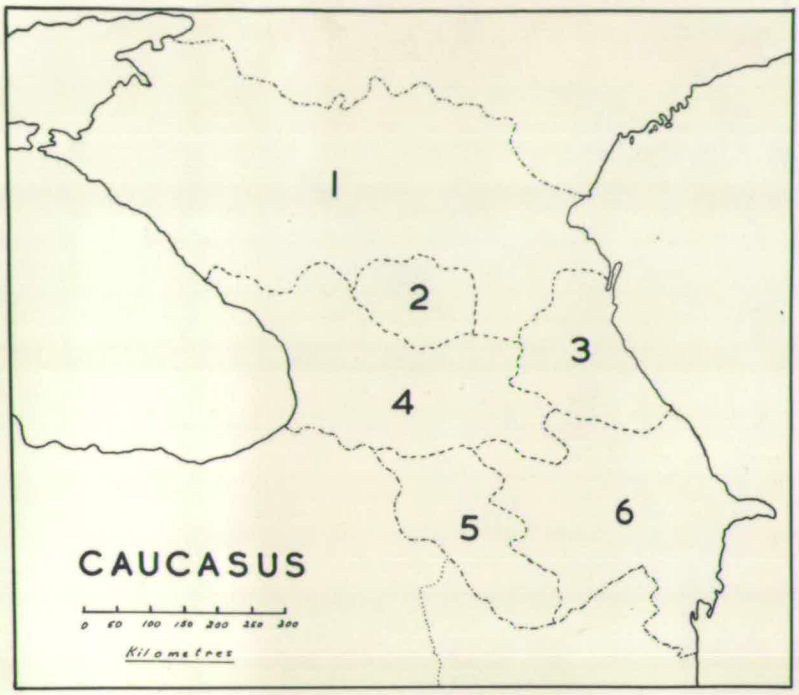
1. Pontus
2. Paphlagonia
3. Bithynia
4. Thracia
5. Mysia
6. Lydia
7. Caria
8. Lycia
9. Pamphylia
10. Cilicia
11. Amanus
12. Phrygia
13. Pisidia
14. Lycaonia
15. Galatia
16. Cappadocia
17. Cataonia
18. South-west Armenia
19. North-east Armenia
20. Kurdistan
21. Mesorotamia

Fig. 9 Roman provinces etc. of Turkey used in citation of specimens.



1. Pontus
2. Paphlagonia
3. Bithynia
4. Thracia
5. Mysia
6. Lydia
7. Caria
8. Lycia
9. Pamphylia
10. Cilicia
11. Amanus
12. Phrygia
13. Pisidia
14. Lycaonia
15. Galatia
16. Cappadocia
17. Cataonia
18. South-west Armenia
19. North-east Armenia
20. Kurdistan
21. Mesopotamia

Fig. 9 Roman provinces etc. of Turkey used in citation of specimens.



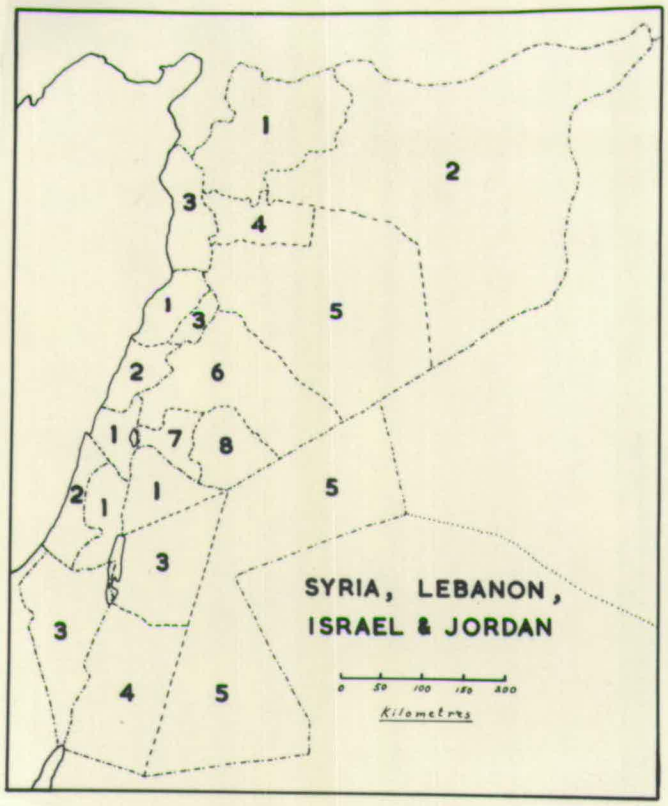
1. Ciscaucasia
2. Kabardino
3. Daghestan
4. Georgia
5. Armenia
6. Azerbaijan

Fig. 10 Divisions of the Caucasus used in citation of specimens.



1. Kyrenia
2. Famagusta
3. Nicosia
4. Larnaka
5. Paphos
6. Limassol

Fig. 11 Administrative divisions of Cyprus used in citation of specimens.



SYRIA

1. Aleppo
2. Deir ez Zor
3. Latakia
4. Hama
5. Homs
6. Damascus
7. Hauran
8. Jebel Druz

JORDAN

1. Cisjordania
2. Gilead
3. Moab
4. Edom
5. Eastern Desert

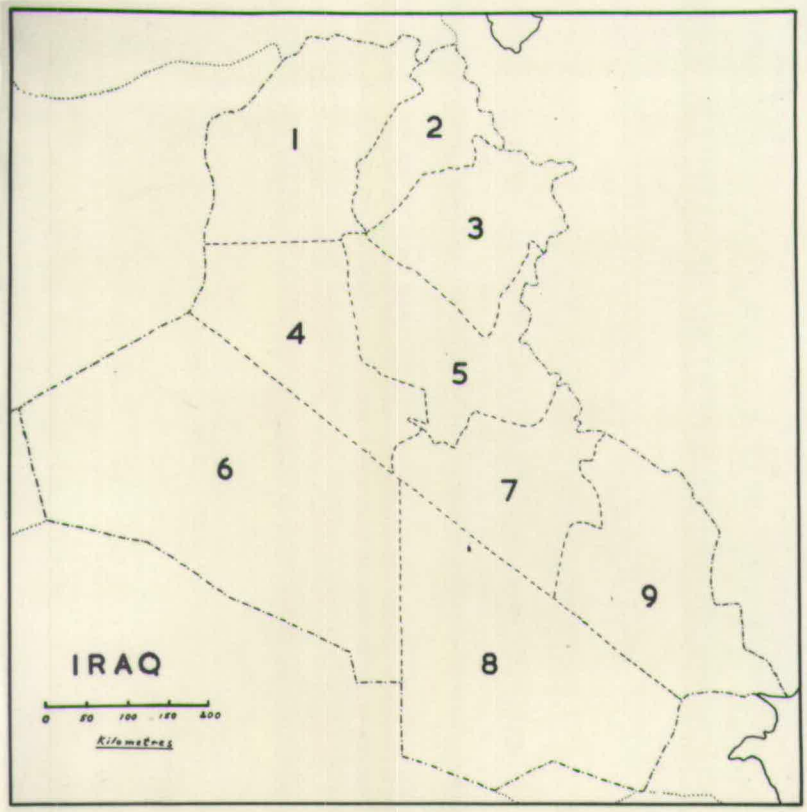
LEBANON

1. North Lebanon
2. Antilebanon
3. South Lebanon

ISRAEL

1. Galilee
2. Central Israel
3. Negev

Fig. 12 Divisions of the Levant States (Syria, Lebanon, Israel & Jordan) used in citation of specimens.



1. Mosul
2. Erbil
3. Kirkuk & Sulaimaniya
4. Dulaim
5. Baghdad & Diyala
6. Western Desert
7. Central Iraq
8. Southern Desert
9. Estuary

Fig. 13 Divisions of 'Iraq used in citation of specimens.



1. Azerbaijan
2. Kordestan & Zanjan
3. Caspian Sea
4. Lorestan
5. Northern Zagros
6. Tehran
7. Central Desert
8. Eastern Khorasan
9. Ahwaz
10. Southern Zagros
11. Fars
12. Kerman & Yazd
13. Baluchestan
14. Persian Gulf

Fig. 14 Divisions of Iran used in citation of specimens.



Fig. 15 Arenaria antitaurica McNeill - type specimen (Davis 20130).

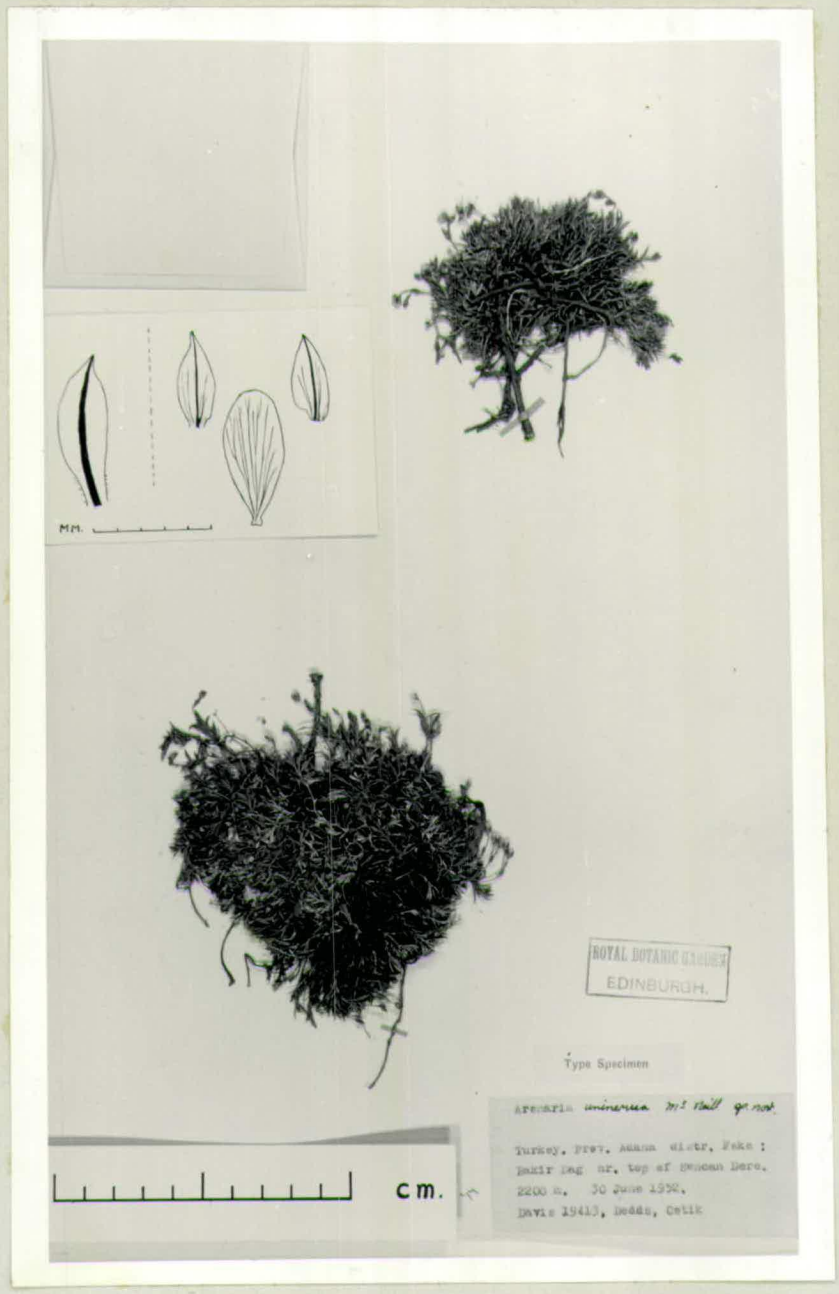
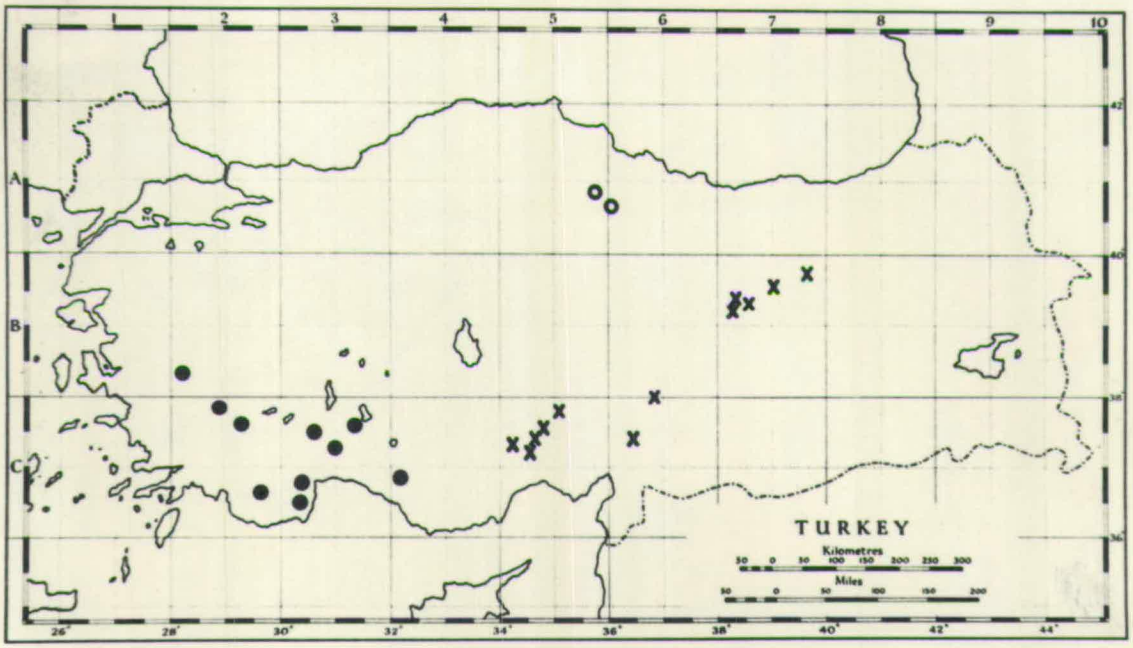
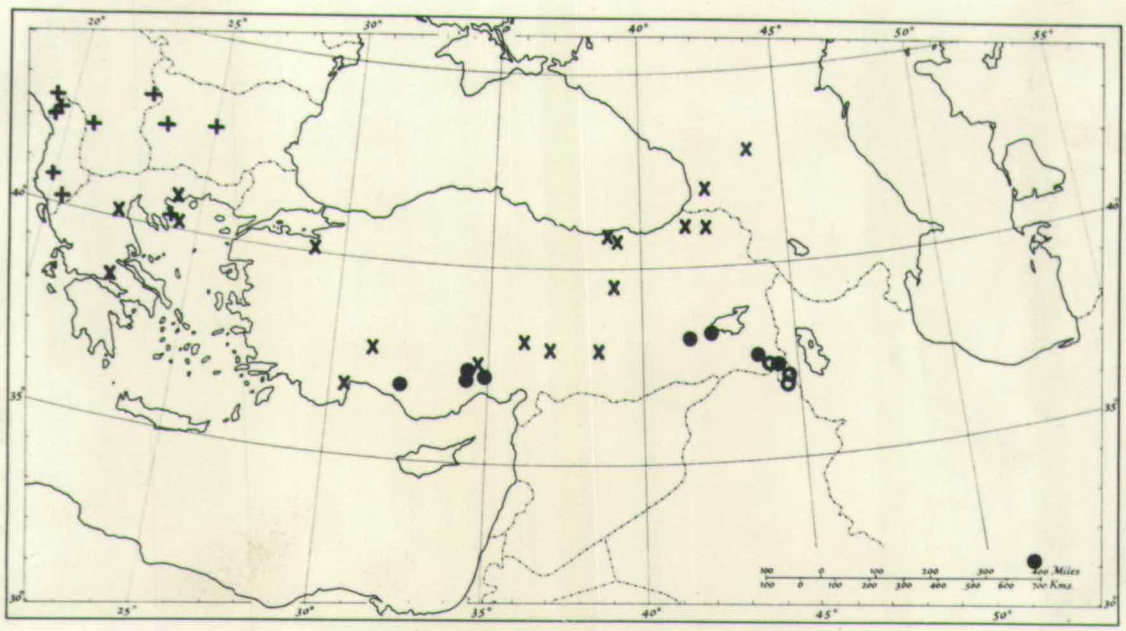


Fig. 16 Arenaria uninervia McNeill - type specimen (Davis 19413).



× 6. A. kotschyana ● 7. (i). A. tmolea var. tmolea ○ 7. (ii). A. tmolea var. stenophylla

Fig. 17 Geographical distribution of the Turkish representatives of Arenaria Section Grandiflorae.



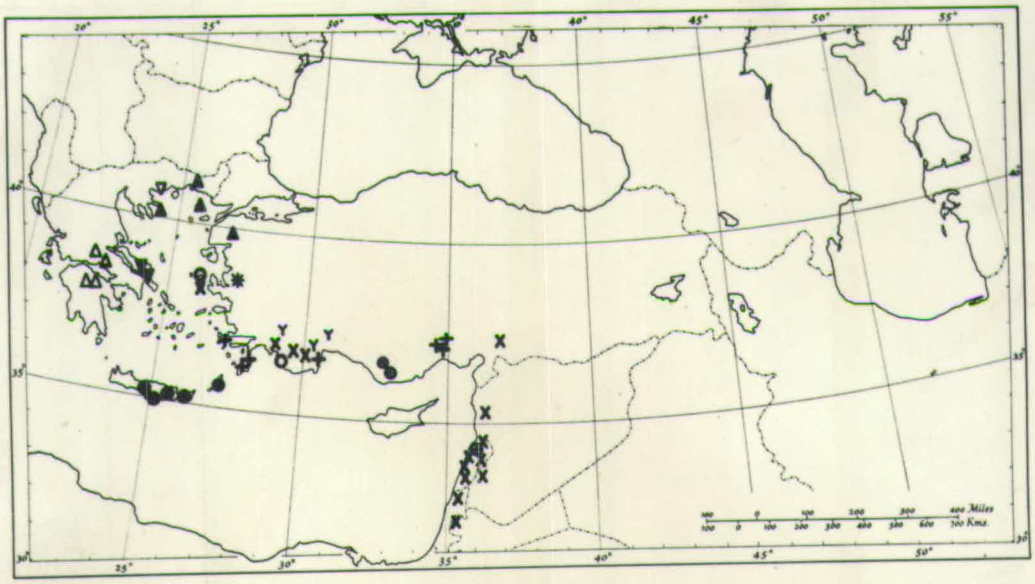
● 8.(i). A. balansae var. balansae

○ 8.(ii). A. balansae var. glaberrima

✕ 9.A. A. rotundifolia subsp. rotundifolia

\+ 9.B. A. rotundifolia subsp. pancicii

Fig. 18 Geographical distribution of the Orient representatives of Arenaria Section Rotundifoliae.



● 10. A. speluncarum

✱ 11. A. sicylea

● 12. A. libanotica

⊙ 13. A. angustifolia

▲ 14 A. A. filicaulis subsp filicaulis

Δ 14 B. A. filicaulis subsp. graeca

▼ 14 C. A. filicaulis subsp. suboica

▽ 15. A. teddii

✖ 16 A. A. deflexa subsp. deflexa

✚ 16 B. A. deflexa subsp pubescens

○ 16 C. A. deflexa subsp. pseudofragillima

Y 16 D. A. deflexa subsp. microsepala

● 17. A. fragillima

Fig. 19 Geographical distribution in the Orient of the perennial members of Arenaria Section Orientales. (A. deflexa subsp. deflexa extends to Sinai.)

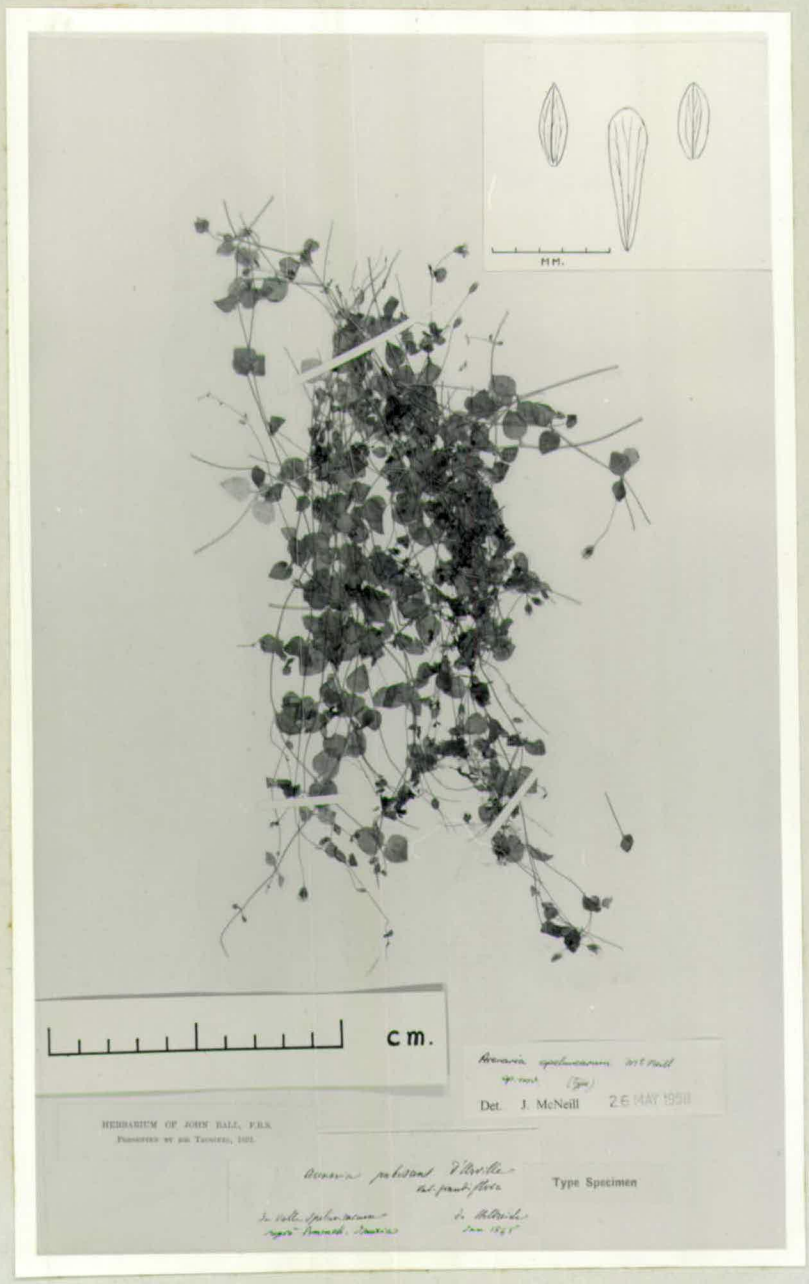


Fig. 20 Arenaria speluncarum McNeill - type specimen (Heldreich 6.1845).

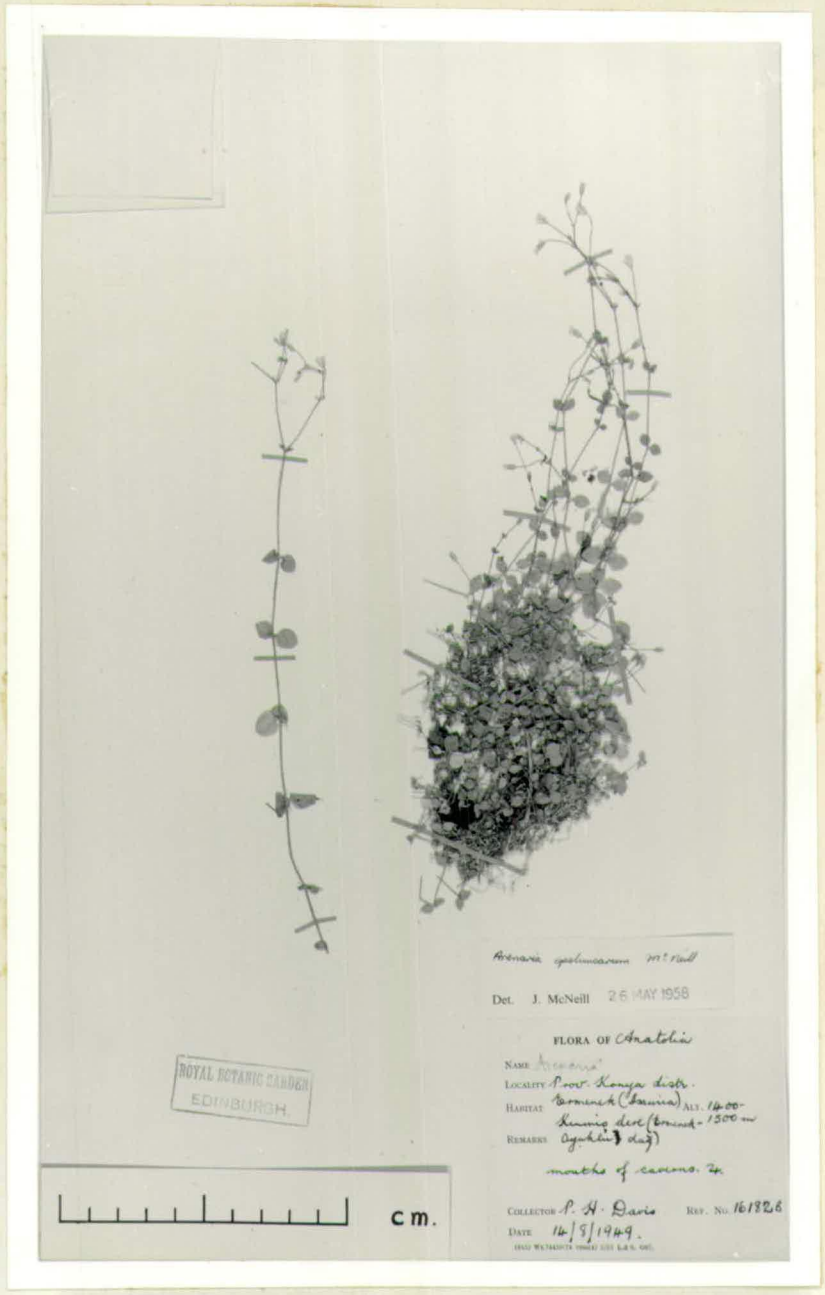


Fig. 21 Arenaria speluncarum McNeill, showing habit (Davis 16182 B).

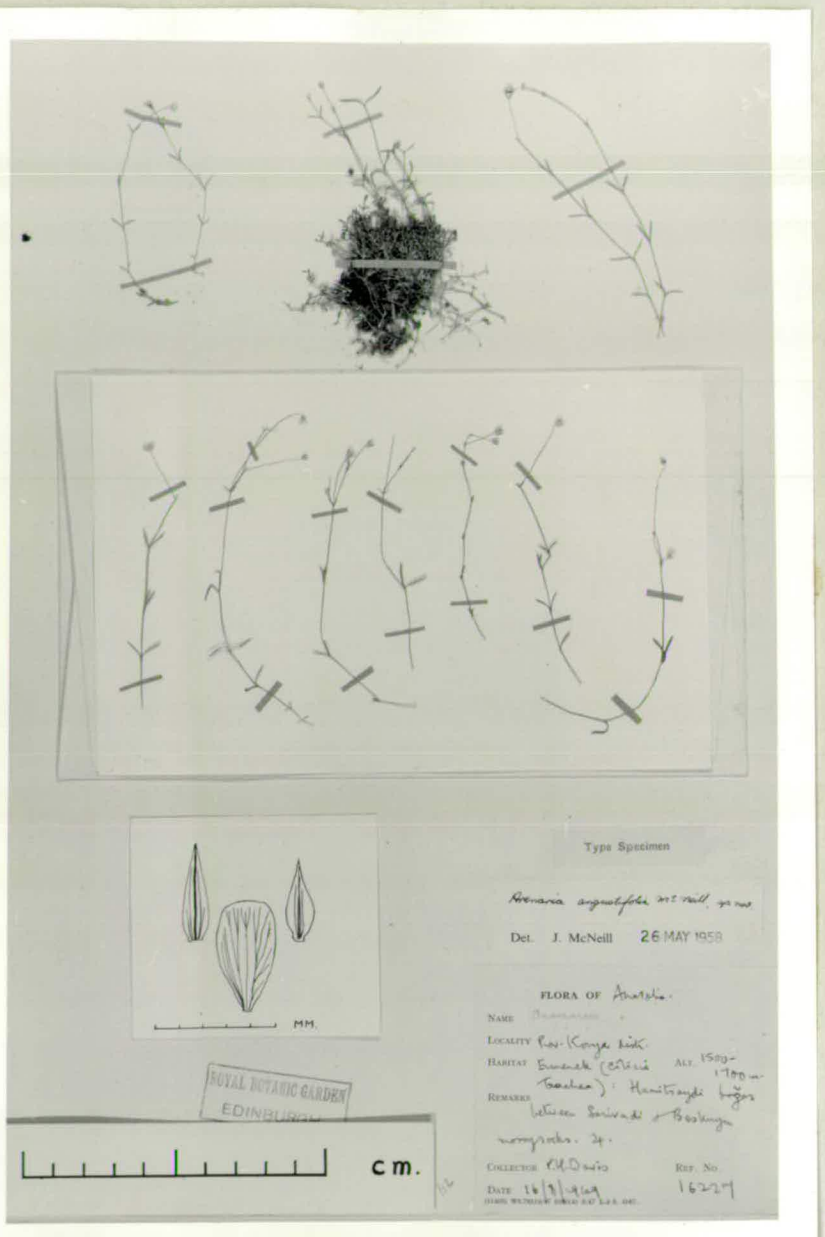
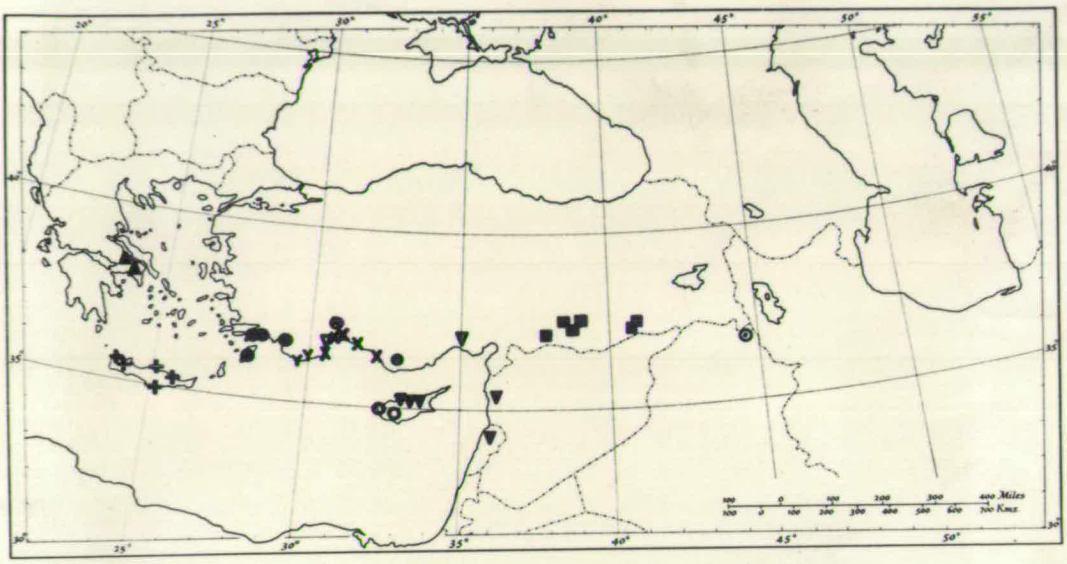


Fig. 22 Arenaria angustifolia McNeill - type specimen (Davis 16227).



▼ 18. A. luschanii

● 21 A. A. rhodia subsp. rhodia

● 22 A. (iii). A. pamphylica subsp. pamphylica var. alpestris

⊙ 23. A. kurdica

▲ 19. A. oxypetala

⊙ 21 B. A. rhodia subsp. cypria

▼ 22 B. (i). A. pamphylica subsp. kyrenica var. kyrenica

■ 24. A. sabulinea

✚ 20. A. muralis

✕ 22 A. (i) & (ii). A. pamphylica subsp. pamphylica vars. pamphylica & maritima

▽ 22 B. (ii). A. pamphylica subsp. kyrenica var. turcica

Fig. 23 Geographical distribution in the Orient of the annual members of Arenaria Section Orientales and of A. sabulinea (Section Pseudosabulina).

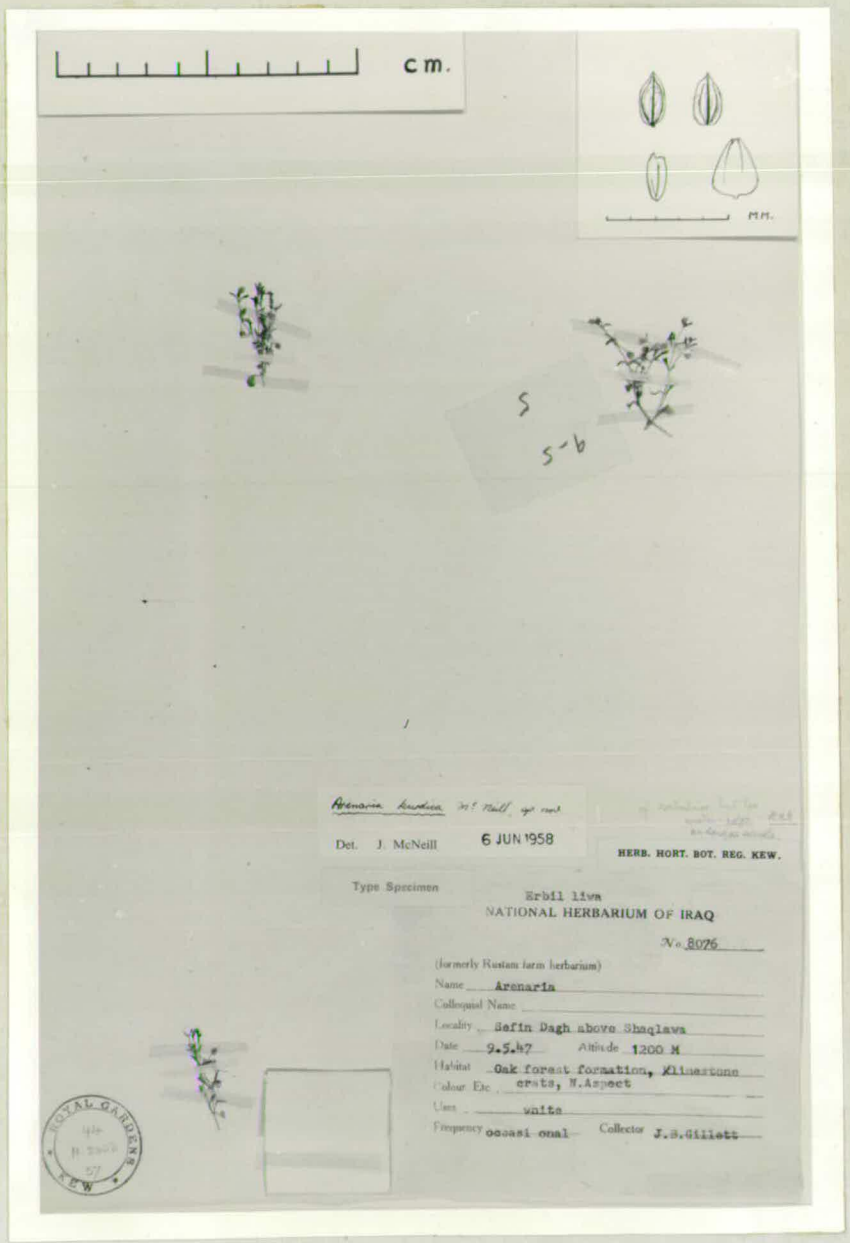
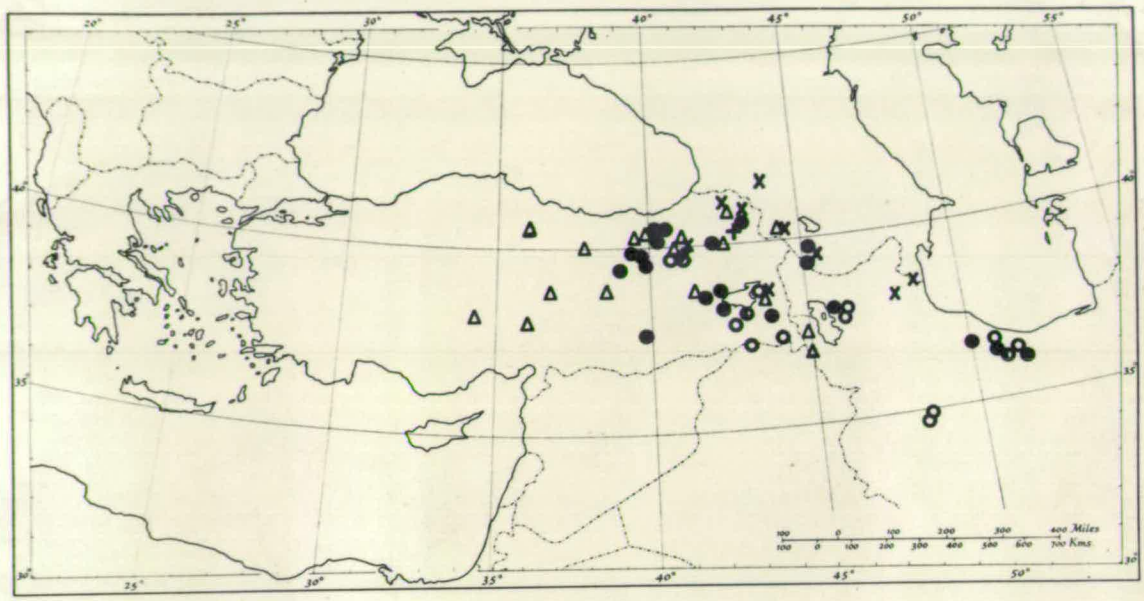


Fig. 24 Arenaria kurdica McNeill - type specimen (BAG 8076, leg. Gillett).



X 38. (i). A. dianthoides var. dianthoides

✚ 38. (ii). A. dianthoides var. paniculata

Δ 39. A. cucubaloides

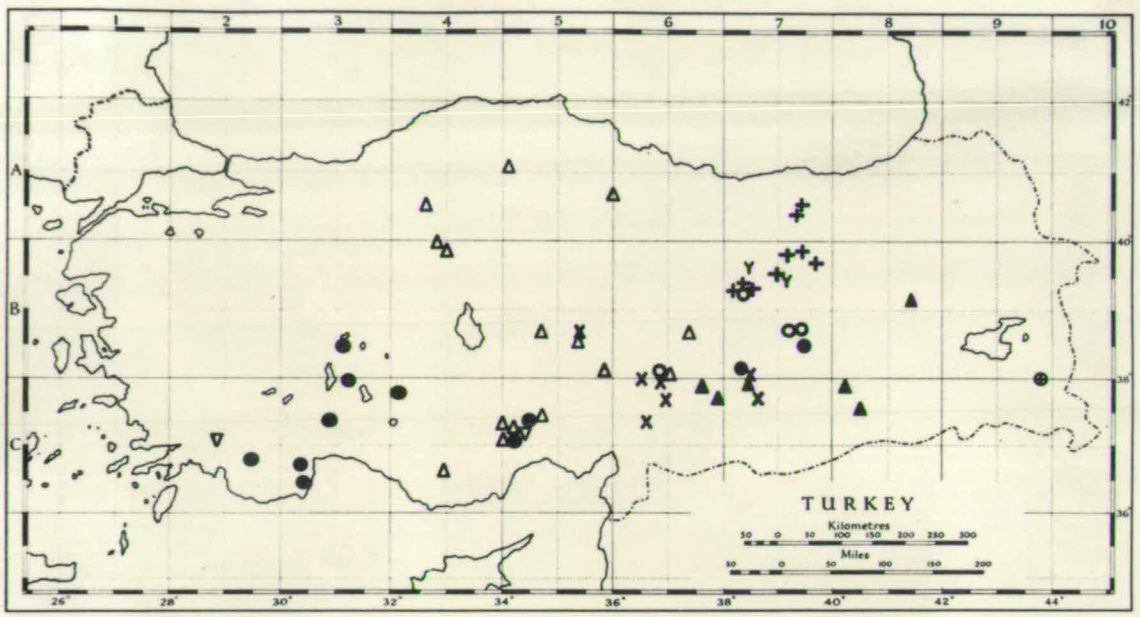
● 40. (i). A. gypsophiloides var. gypsophiloides

O 40. (ii). A. gypsophiloides var. glabra

Fig. 25 Geographical distribution of the Orient representatives of Arenaria Section Glomeriflorae.



Fig. 26 Arenaria angustisepala McNeill - type specimen (Davis 22524).



● 49.(i). A. acerosa var. acerosa

○ 49. (ii). A. acerosa var. glabra

✕ 50. A. drypidea

△ 51.(i). A. ledebouriana var. ledebouriana

▽ 51. (ii). A. ledebouriana var. pauciflora

▲ 51.(iii). A. ledebouriana var. parviflora

✚ 52.(i). A. acutisepala var. acutisepala

Y 52. (ii). A. acutisepala var. laxa

⊕ 56. A. davisii

Fig. 27 Geographical distribution of the Turkish representatives of Arenaria Section Sclerophyllae.

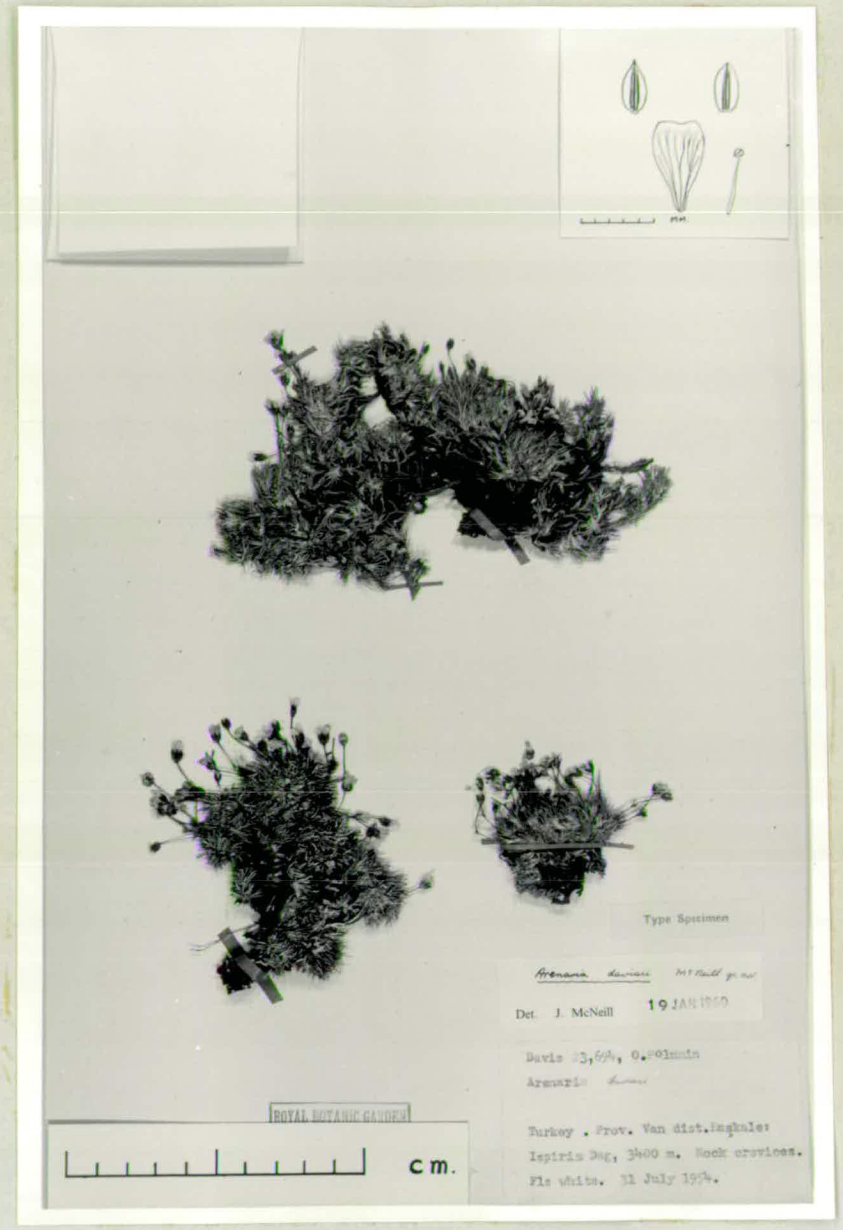
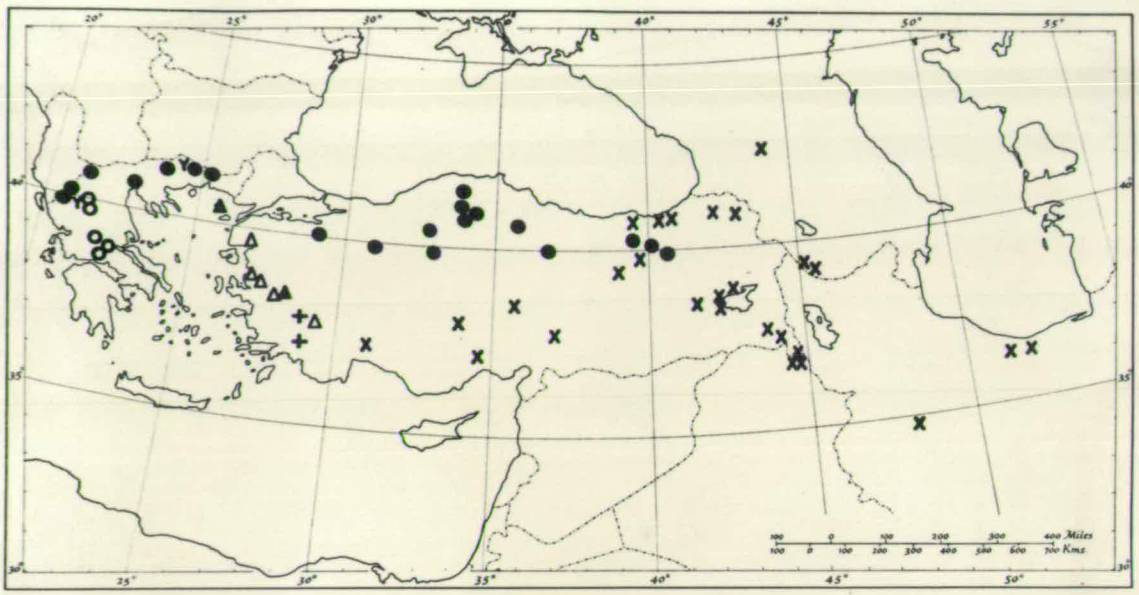


Fig. 28 Arenaria davisii McNeill - type specimen (Davis 23694).



● 16 A. M. hirsuta subsp. falcata

▲ 18 B. M. juressi subsp. juressi

O 17. M. curytanica

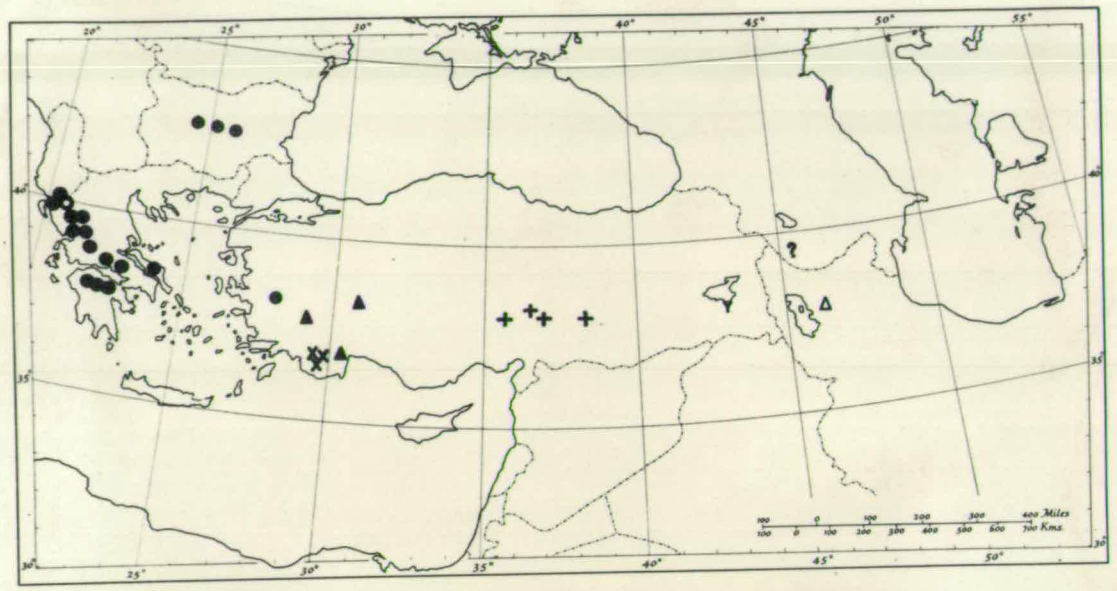
Y 19 A. M. recurva subsp. recurva

✚ 19 C. M. recurva subsp. carica

Δ 18 A. M. juressi subsp. asiatica

X 19 B. M. recurva subsp. orcina

Fig. 29 Geographical distribution of the Orient representatives of Minuartia Section Plurinerviae.



● 20 A. M. saxifraga subsp. saxifraga

● 21 B. M. stellata subsp. stellata

Y 22 C. M. dianthifolia subsp. kurdica

● 20 B. M. saxifraga subsp. tmolea

X 22 A. M. dianthifolia subsp. dianthifolia

? 22. M. dianthifolia (record – ? subsp.)

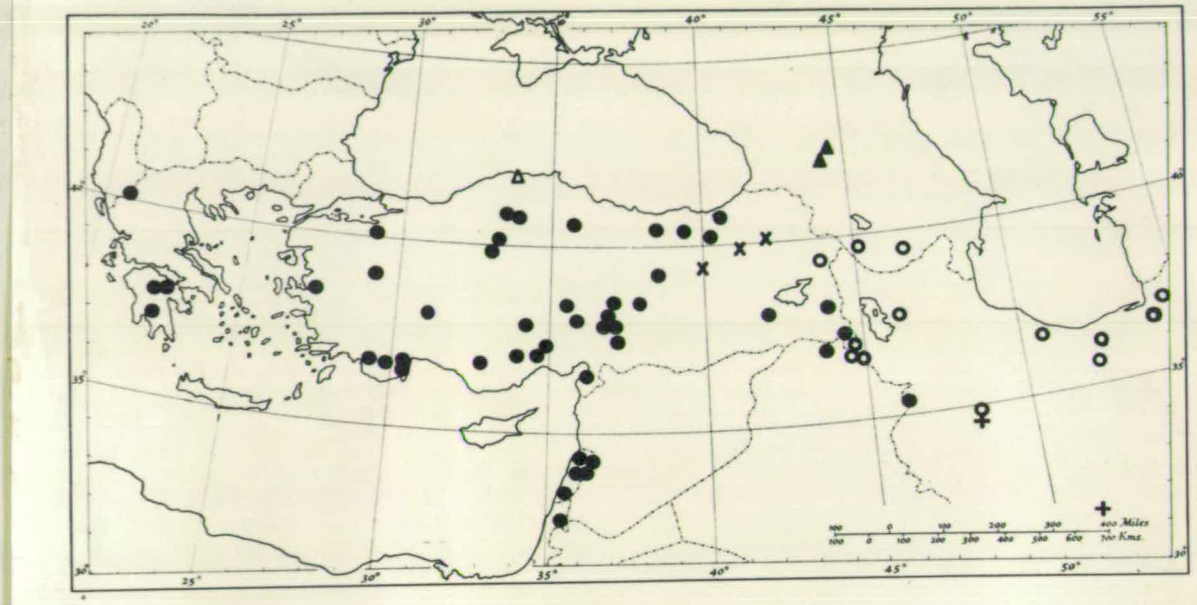
▲ 24. M. pestalozzae

O 21 A. M. stellata subsp. pseudosaxifraga

✚ 22 B. M. dianthifolia subsp. cataonica

Δ 23. M. acuminata

Fig. 30 Geographical distribution of the Orient representatives of Minuartia Section Lanceolatae.



▲ 25. M. biebersteinii

△ 26. M. gracilis

✚ 27. M. aucheriana

○ 28. M. lineata

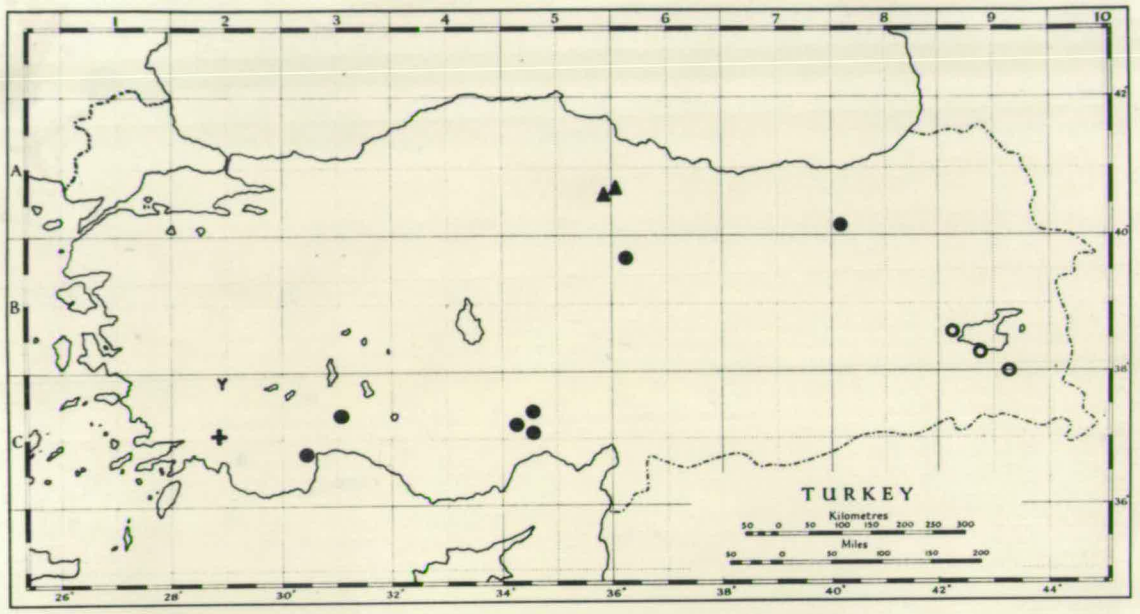
● 29. M. juniperina

✖ 30. M. glandulosa

Fig. 31 Geographical distribution of the Orient representatives of Mimuartia Section Acutiflorae Series Acutiflorae. (M. aucheriana extends to southern Iran and M. lineata to eastern Iran).



Fig. 32 Minuartia gracilis McNeill - type specimen (Davis 21616).



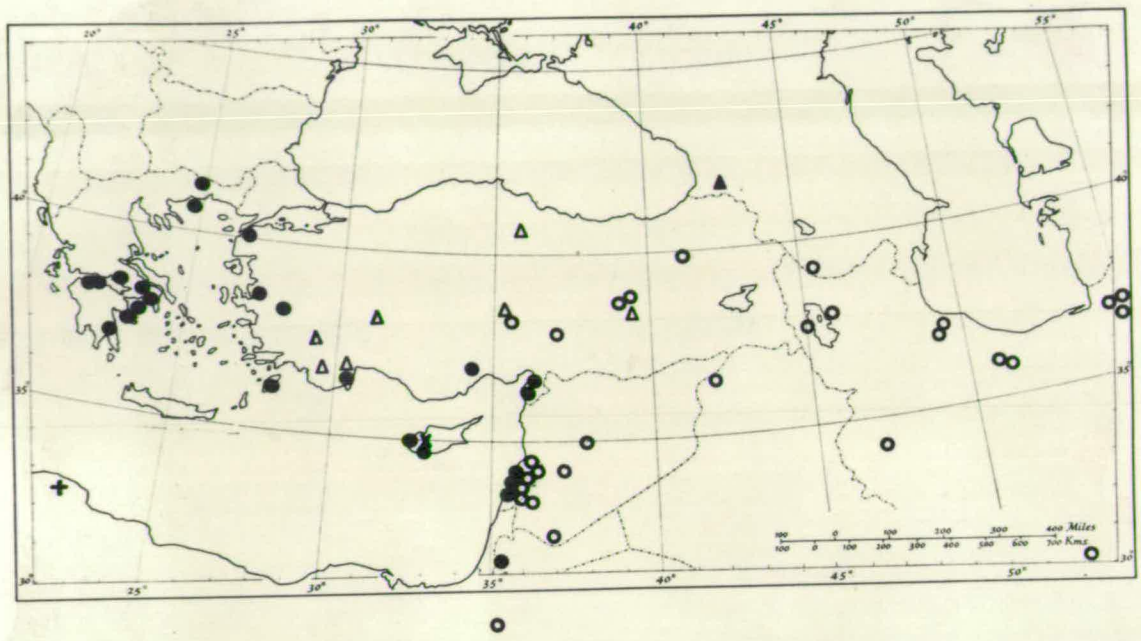
33. M. umbellulifera

✚ A. subsp. fimbriata ▲ B. subsp. pontica Y C. subsp. salbacica

● D.(i). subsp. umbellulifera var. umbellulifera ○ D.(ii). subsp. umbellulifera var. kurdica

10

Fig. 33 Geographical distribution of the infraspecific taxa of Minuartia umbellulifera. (Section Acutiflorae Series Umbelluliferae).



▲ 37. M. multinervis

▲ 38. M. skinfijewii

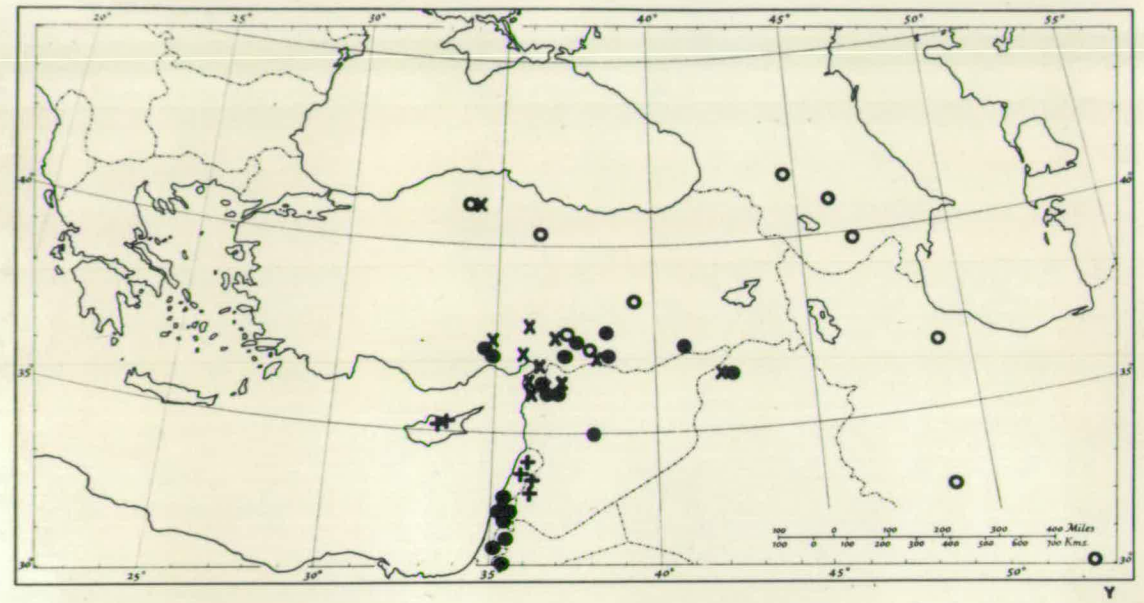
○ 39. M. meyeri

✚ 40. M. sandwithii

✕ 41. M. sintenisii

● 42. M. globulosa

Fig. 34 Geographical distribution in the Orient of the pedicellate members of Minuartia Section Minuartia Series Montanae. (M. meyeri extends to Sinai and southern & eastern Iran.)



O 43 B. M. montana subsp. wiesneri

X 44. M. intermedia

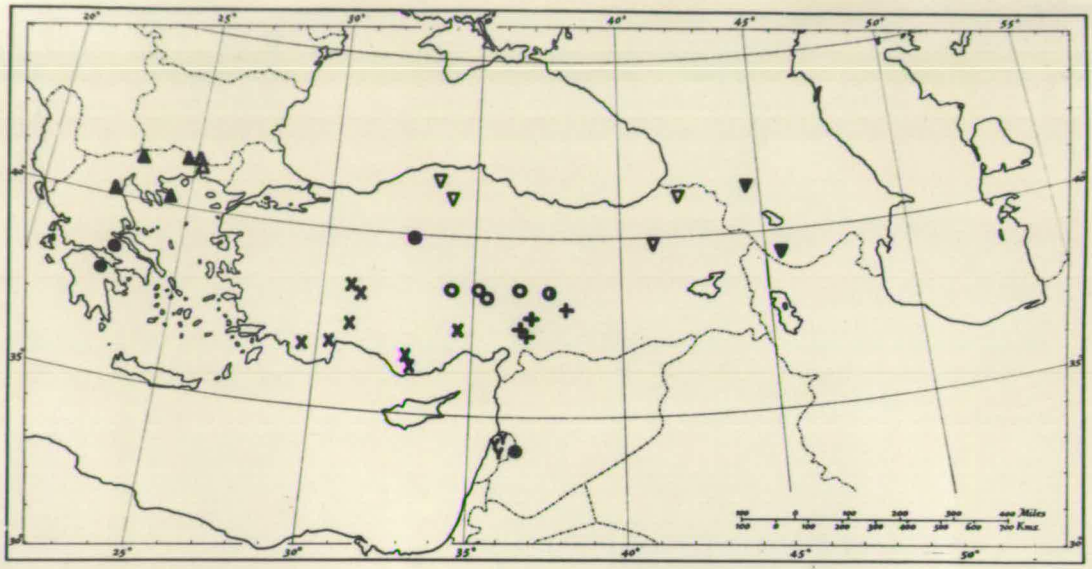
● 45 A. M. decipiens subsp. decipiens

✚ 45 B. (i). M. decipiens subsp. damascena var. damascena

Y 45 B. (ii). M. decipiens subsp. damascena var. persica

12

Fig. 35 Geographical distribution in the Orient of the sessile-flowered members of Minuartia Section Minuartia Series Montanae.



▲ 49.(ii). M. setacea var. athoa

△ 49.(iii). M. setacea var. thracica

▼ 50. M. woronowii

▽ 51. M. micrantha

✚ 52. M. tchihatchewii

● 53. M. antilibanotica

▼ 56. M. libanotica

○ 57.(i). M. corymbulosa var. corymbulosa

● 57.(ii). M. corymbulosa var. gypsophiloides

● 57.(iii). M. corymbulosa var. breviflora

✖ 58. M. leucocephaloides

○ 59. M. confusa

Fig. 36 Geographical distribution of the Orient representatives of Minuartia Section Minuartia Series Setaceae, excluding M. anatolica and M. erythrosepala.

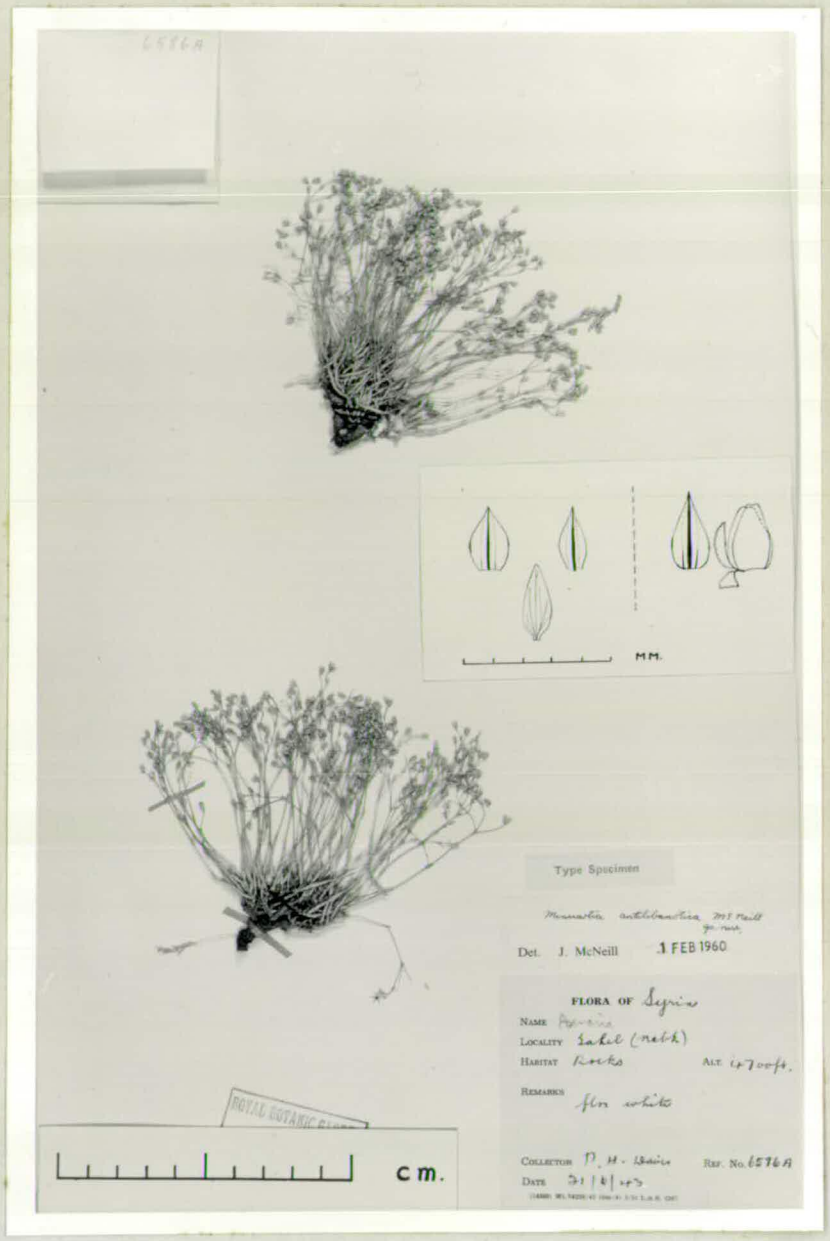
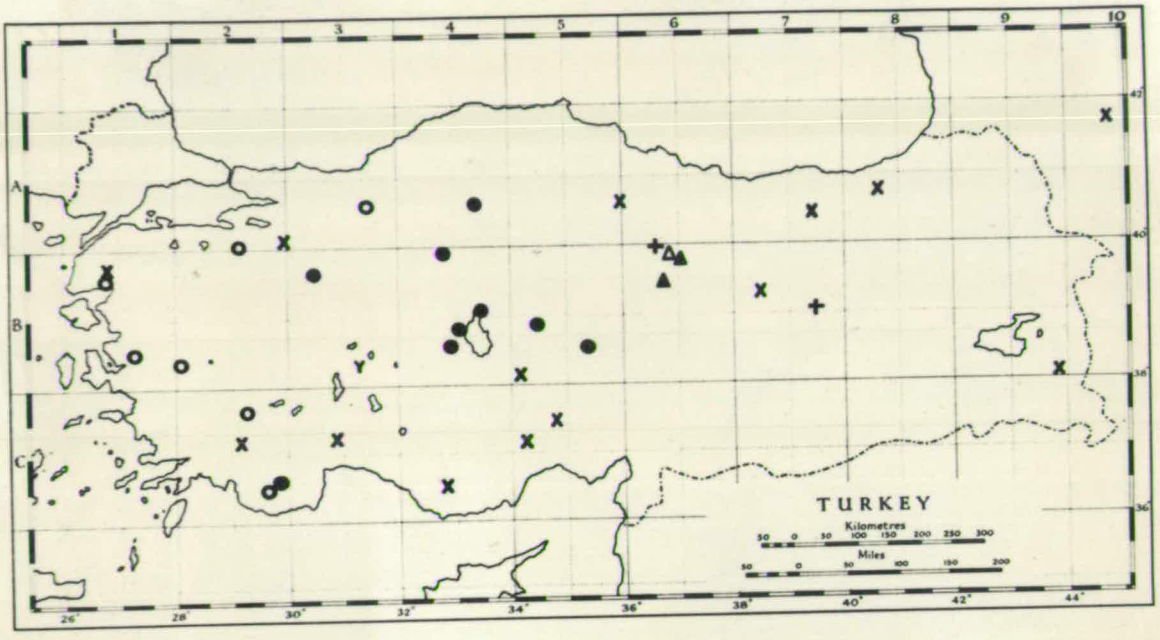


Fig. 37 Mimuartia antilibanotica McNeill - type specimen (Davis 6596 A).



54. M. anatolica

O (i). var. anatolica

● (ii). var. arachnoidea

✚ (iii). var. lanuginosa

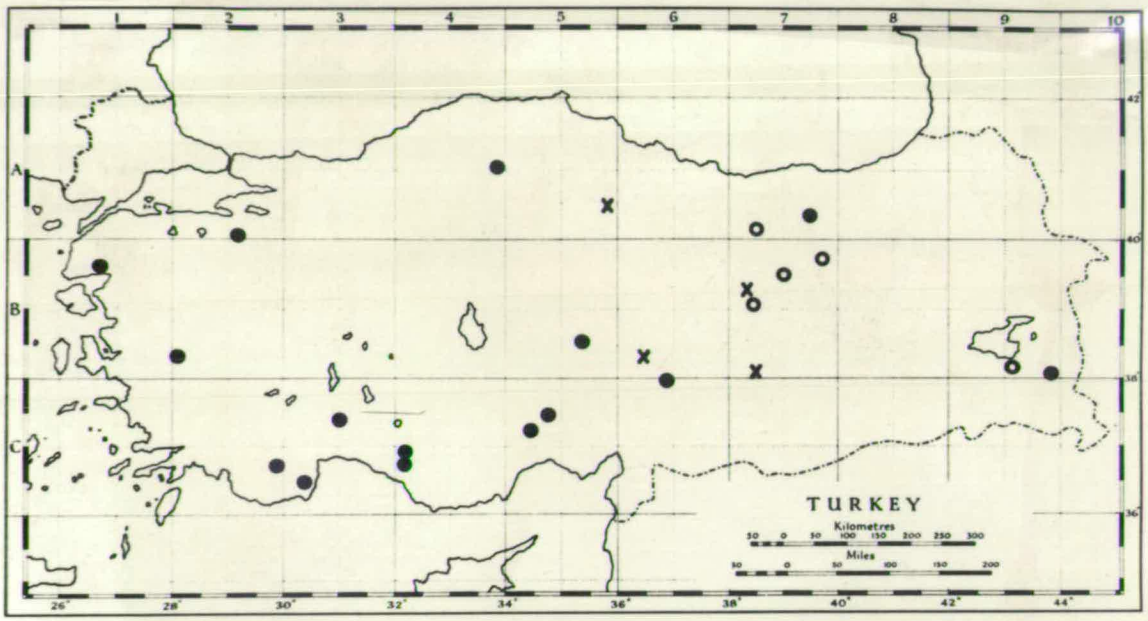
Δ (iv). var. tetrasticha

▲ (v). var. scleranthoides

Y (vi). var phrygia

X (vii). var. polymorpha

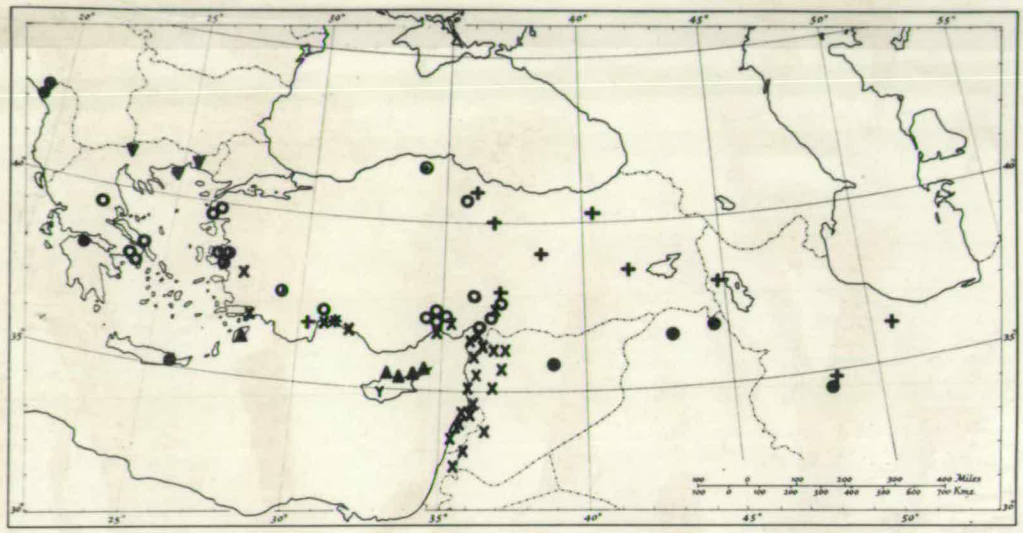
Fig. 38 Geographical distribution in Turkey of the infraspecific taxa of Minuartia anatolica.



55. M. erythrosepala

● (i). var. erythrosepala ○ (ii). var. orientalis ✕ (iii). var. cappadocica

Fig. 39 Geographical distribution in Turkey of the infraspecific taxa of Minuartia erythrosepala.



▲ 61.(i). M. thymifolia var. thymifolia

△ 61.(ii). M. thymifolia var. syriaca

✕ 62 A. M. mesogitana subsp. mesogitana

● 62 B.(i). M. mesogitana subsp. lydia var. lydia

○ 62 B.(ii). M. mesogitana subsp. lydia var. kotschyana

● 62 B.(iii). M. mesogitana subsp. lydia var. turcomanica

● 62 C.(i). M. mesogitana subsp. velenovskyi var. velenovskyi

● 62 C.(ii). M. mesogitana subsp. velenovskyi var. orphanidis

✱ 62 E. M. mesogitana subsp. macrocarpa

⊘ 62 F. M. mesogitana subsp. flaccida

✚ 63 A. M. subtilis subsp subtilis

Y 63 B. M. subtilis subsp. filicaulis

▼ 64. M. viscosa

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Fig. 40 Geographical distribution in the Orient of Minuartia thymifolia, M. mesogitana, M. subtilis and M. viscosa (Section Sabulina), including their constituent taxa.