TAXONOMIC STUDIES IN THE ALSINOIDEAE II. A REVISION OF THE SPECIES IN THE ORIENT

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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, the Dalmatian coast, the Crimea and Afghanistan. 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.

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).

This region comprises five main phytogeographical areas, the Hyrcano-Colchic, the European, the Mediterranean, the Irano-Turanian and the Saharo-Sindian (cf. McNeill, 1960). 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. Species of the group are normally absent from Saharo-Sindian vegetation, the only known exception being *Minuartia picta*, which, however, is essentially an Irano-Turanian species.

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 *Eremogone*), 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).

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. McNeill, 1962, pp. 79–80) but the work has been primarily based on the collections at Edinburgh and Kew. All specimens examined are cited in the thesis (McNeill, 1960) from which this paper is extracted; in this account reference to the type specimen and a brief summary of distribution only, are given.

The use of the exclamation mark (!) before 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. These are indicated by the symbol ≡. 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.

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Artificial Key to Genera and Infra-generic Groups in the Orient

1a. Styles 2; capsule globose, inflated, opening by 2 valves; leaves linear-lanceolate to ovate, rather large (>3·5 cm. long); straggling annuals . . . . . *Lepyrodiclis* p. 401

1b. Styles 3; capsule ovoid to cylindrical, never inflated, opening by 3, 4 or 6 valves or teeth; leaves frequently linear or setaceous, if broader then rather small (<1·5 cm. long); plants annual or perennial 2

2a. Leaves linear-lanceolate or linear-spathulate to orbicular . . 3

2b. Leaves narrowly linear, subulate or setaceous 6

3a. Stamens inserted at two levels, the inner whorl adnate to the petals and the outer arising below them on a very short calyx tube; petals usually pink; capsule opening by 3 valves; cotyledons accumbent *Minuartia* Subgenus *Rhodalsine* p. 323

3b. Stamens and petals inserted at one level on a hypogynous disc; petals, when present, white; cotyledons incumbent 4

4a. Leaves many-nerved, linear-lanceolate to lanceolate, sessile, rather rigid; sepals prominently and ± equally 5–7–nerved, erect or scarcely spreading at anthesis; densely caespitose or pulvinate perennials; capsule opening by 3 valves . . . . . *Minuartia* Section *Lanceolatae* p. 313, key entry 18b.

4b. Leaves various but usually flaccid, if somewhat rigid then 3–nerved; sepals obscurely nerved or with a prominent midrib and indistinct lateral nerves, usually spreading at anthesis; capsule opening by 6 valves or teeth 5

5a. Leaves ovate, 3–nerved, 1·0–2·5 cm. long; lax annual plants; petals, if present, much shorter than sepals; seeds smooth, shiny, with a white oily appendage (strophiole) . . *Moehringia* p. 309

5b. Leaves various, but <1·0 cm. long in annual plants with very short petals; seeds tuberculate to obscurely reticulate without a strophiole *Arenaria* Subgenus *Arenaria* p. 245, key entry 1a.

6a. Plants perennial bearing sterile leafy shoots in addition to flowering stems 7

6b. Plants annual, without sterile leafy shoots 11

7a. Sepals 1(–3)–nerved with prominent parallel white stripes on either side of the green median nerve; capsule opening by 3 valves *Minuartia* Subsection *Xeralsine* p. 316, key entry 36b.

7b. Sepals entirely herbaceous or with a broad scarious margin, but without white stripes 8

8a. Calyx indurate at the base, especially in fruit; sepals often strongly keeled, usually with wide scarious or coriaceous margins; capsule opening by 6 teeth; cotyledons accumbent . . .
Arenaria Subgenus *Eremogone* p. 245, key entry 1b.

8b. Calyx not at all hardened at the base; sepals entirely herbaceous except for narrow membranous or scarious margins, often with 3–many prominent nerves; cotyledons incumbent 9

9a. Sepals rounded to obtuse at apex, ± linear; calyx cylindrical; capsule opening by 3 valves . . . . . .
Minuartia Section *Spectabiles* p. 311, key entry 4a.

9b. Sepals acute to acuminate, linear-lanceolate to ovate; calyx ovoid to urceolate 10

10a. Sepals not at all keeled, prominently and ± equally 3–7–nerved; capsule opening by 3 valves . . . . . .
Minuartia Sections *Tryphane*, *Acutiflorae* and *Plurinerviae* p. 311, key entry 4b.

10b. Sepals with one rather prominent median nerve forming a keel at least on the innermost sepal, lateral nerves, if present, short and rather indistinct; capsule opening by 6 valves or teeth
Arenaria Subgenus *Arenaria* (a few spp.) p. 245, key entry 1a.

11a. Stem leaves bearing axillary fascicles of equally long leaves (the leaves superficially appearing to be whorled); petals usually pink; capsule opening by 3 valves; seeds pyriform; cotyledons accumbent
Minuartia Subgenus *Spergella* p. 311, key entry 2a.

11b. Fascicular leaves usually absent, if present, shorter than the subtending stem leaves; petals white; seeds reniform; cotyledons incumbent 12

12a. Petals about twice as long as the sepals; inflorescence lax, pedicels spreading or reflexed; capsule opening by 6 valves .
Arenaria Section *Pseudosabulina* p. 248, key entry 19a.

12b. Petals shorter than or up to $1\frac{1}{2}$ times as long as the sepals; inflorescence often congested, if lax, pedicels erect to spreading; capsule opening by 3 valves . . . . . .
Minuartia Sections *Sabulina* and *Minuartia* p. 316, key entry 36a.

ARENARIA L.

Key to Orient Species

1a. Leaves usually lanceolate to ovate, herbaceous, occasionally linear or linear-subulate and then always flaccid; sepals not or scarcely hardened at the base; seeds reniform; cotyledons incumbent; plants annual or perennial: (Subgenus *Arenaria*) 2

1b. Leaves long, linear and grass-like, or short, stiffly setaceous or pungent, never broad or flaccid; sepals markedly hardened at the base, often the receptacle and the entire lower part of the calyx becoming ligneous in fruit; seeds ± pyriform; cotyledons accumbent; plants perennial: (Subgenus *Eremogone*) 34

2a. Plants perennial, bearing sterile leafy shoots in addition to flowering stems 3

2b. Plants annual, without sterile leafy shoots 19

3a. Leaves strongly 3–nerved, the lateral nerves marginal; sepals with a prominent median nerve (Section *Grandiflorae*) . . . 4

3b. 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 . . . 5

4a. 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*

4b. 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*

5a. Leaves < 8 mm. long, ovate or obovate to orbicular with a rounded or obtuse apex; petals ovate ± abruptly contracted at the base (Section *Rotundifoliae*) 6

5b. Leaves linear to ovate, apex acute to obtuse (rarely broadly ovate to orbicular and then at least some leaves > 10 mm. long); petals usually lanceolate to obovate, cuneate at the base . . . 7

6a. Entire plant glandular-pubescent, usually densely so, or entire plant glabrous; petioles never ciliate; petals equalling or exceeding the sepals; leaves ovate or obovate, 1·5–2·5 times as long as broad 8. *A. balansae*

6b. 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 orbicular to ovate . . . . . 9. *A. rotundifolia*

7a. Sepals with a prominent median nerve (inner always keeled) and indistinct lateral nerves; petals always > 1·5 times as long as the sepals (up to twice as long); stem leaves linear to ovate, never orbicular; plants densely caespitose with woody caudex and caudiculi (Section *Rariflorae*) 8

7b. Sepals scarcely keeled, ± equally 3–7(–9)–nerved, or obscurely nerved; petals usually slightly longer than sepals (up to 1·5 times), rarely nearly twice as long and then stem leaves orbicular; plants tegetiform (Section *Orientales*) 12

8a. Dwarf caespitose plants, flowering stems < 1 cm. long; leaves very small, 1·5–4·5 mm. 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 9

8b. More robust caespitose or almost cushion-forming plants; flowering stems > 2 cm. long; leaves 5–11 mm. long 10

9a. Leaves minute, < 3 mm. long, ovate to lanceolate, 2–3(–3·5) times as long as broad; sepals c. 4·5 mm. long . 3. *A. minutissima*

9b. Leaves larger, 3–4·5 mm. long, linear-lanceolate, 3·5–4 times as long as broad; sepals 3·5 mm. long . . . 4. *A. bulica*

10a. 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, 3·5–4·5 mm. long . 11

10b. 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, 4–5 mm. long . . . . . 5. *A. cretica*

11a. 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*

11b. 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*

12a. Basal leaves linear, linear-spathulate or linear-lanceolate to lanceolate, sessile; seeds obscurely reticulate or with a fimbriate margin 13

12b. Basal leaves ovate-lanceolate to orbicular, always petiolate; seeds tuberculate or sometimes obscurely reticulate, but never with a fimbriate margin 14

13a. Stem leaves short (2–8 mm.), linear-spathulate or linear-lanceolate to lanceolate (< 8 times as long as broad); seeds with a fimbriate margin . . . . . 12. *A. libanotica*

13b. Stem leaves long (6–15 mm.), linear (c. 10 times as long as broad); seeds without any protuberances . . 13. *A. angustifolia*

14a. Stem leaves ± orbicular, abruptly contracted at the base; petals nearly twice as long as sepals; seeds obscurely reticulate without papillae . . . . . 10. *A. speluncarum*

14b. Stem leaves lanceolate to ovate, sessile or tapering at the base; petals up to 1·5 times as long as sepals 15

15a. Leaves and sepals with prominent crystalline inclusions; leaves ovate-lanceolate; plant sparsely pubescent with short hairs; seeds obscurely reticulate, the 'cells' without central papillae but with minute marginal puncta . . . . . 11. *A. sipylea*

15b. Leaves and sepals without prominent crystalline inclusions; plants often densely pubescent; seeds tuberculate, the tubercles with a central papilla 16

16a. Upper leaves sessile, lower shortly petiolate; seeds large (0·8—1·0 mm. × 0·6—0·7 mm.) (Series *Graecae*) . . 17

16b. 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. × 0·4—0·6 mm.) (Series *Deflexae*) 18

17a. 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*

17b. 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. $25 \times 10\ \mu$) centrally placed on the tubercles of the dorsal surface . . . . . 15. *A. teddii*

18a. Outer sepals 3·5–4 mm. long, acute, ovate-lanceolate, c. 2·5 times as long as broad; inflorescence few-flowered (2–5), pedicels short (< 1 cm.), stout (that of the lowest flower 0·2–0·3 mm. diam.); seeds with long papillae (60 μ) on the tubercles of the dorsal ridge . . . 17. *A. fragillima*

18b. Outer sepals acuminate, rarely acute and then usually < 3·5 mm. long; inflorescence few to many-flowered (3–15), pedicels usually long (1–2 cm.) and slender (< 0·2 mm. diam.); seeds with short papillae (< 25 μ) on the tubercles of the dorsal ridge 16. *A. deflexa*

19a. Sepals strongly 3–nerved without any subsidiary nerves; pedicels spreading or reflexed; petals about twice as long as sepals (Section *Pseudosabulina*) . . . . . 24. *A. sabulinea*

19b. Sepals with a single median nerve or with a number (> 3) of nerves varying in their degree of prominence; pedicels erect or spreading 20

20a. Leaves all petiolate with a single median nerve; petals as long as or longer than sepals (Section *Orientales* Series *Orientales*) . 21

20b. Leaves (except the first few pairs of seedling leaves) sessile, many-nerved; petals usually shorter than the sepals (Section *Arenaria*) 26

21a. Bracts subulate or setaceous with an abrupt change in size and (usually) shape between the uppermost leaf and the lowest bract 22

21b. Bracts foliaceous (upper becoming subulate) showing a gradual reduction in size from the stem leaves upwards . . . 25

22a. Sepals 2–2·5 mm. long, petals about 1·5 times as long; capsule when fully mature greatly exceeding sepals (almost twice as long) 18. *A. luschanii*

22b. Sepals 2·5 mm. 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 23

23a. 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 24

23b. 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*

24a. 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*

24b. 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*

25a. Sepals 2·25–5·5 mm. long, with 3(–5) almost parallel nerves; capsule ovoid-cylindrical more than twice as long as broad; if sepals < 3·0 mm., then much exceeded by the petals (1·3–1·5 times as long) . . . . . 22. *A. pamphylica*

25b. Sepals < 2·25 mm. 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*

26a. Capsule narrowly cylindrical (> 3 times as long as broad); sepals lanceolate (3–3·5 times as long as broad), narrowly acuminate; plants rather xerophytic (Series *Cylindricae*) 33. *A. guicciardii*

26b. 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 27

27a. Plants very xerophytic; leaves and sepals densely glandular-pubescent, prominently nerved; upper leaves spathulate, the nerves all alike (Series *Saponarioides*) 28

27b. 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 (Series *Arenaria*) 29

28a. Sepals 4·5–5·0 mm. long in flower, extending to 6·5 mm. in fruit; seeds with a smooth testa, the 'cells' not developing into raised tubercles . . . . . 31. *A. saponarioides*

28b. Sepals 6·25–7·0 mm. long in flower, extending to 9·0 mm. in fruit; seeds tuberculate . . . . . 32. *A. macrosepala*

29a. Seeds large, 0·85–1·10 mm. long, 0·70–0·85 mm. 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. 4·5 mm. long, broadly ovate, 2·5 (in flower)–1·5 (in fruit) times as long as broad, bluntly acute 30

29b. Seeds rather small, 0·40–0·70 mm. long, 0·35–0·65 mm. 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 32

30a. 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, 3–8 mm long; sepals 2·75–3·75 mm. long, slightly exceeding the petals 25. *A. conferta*

30b. Capsule ± globose, c. 1·3 times as long as broad, with thick and very hard walls, not breaking easily; seeds distinctly longer than broad, 0·95–1·10 mm. long; inflorescence few- to many-flowered (c. 3–20), with long pedicels 31

31a. Leaves linear-lanceolate, 3·5–4 times as long as broad; inflorescence a many-flowered regular dichasium; pedicels very long (15–25 mm.); sepals 3·25–3·75 mm. long, slightly exceeding the petals 30. *A. tremula*

31b. Leaves broadly ovate, 1·75–2 times as long as broad; inflorescence rather few-flowered (c. 3–10), frequently monochasial; pedicels shorter (8–10 mm.); sepals 4·5–5 mm. long, greatly exceeding the petals . . . . . 29. *A. cassia*

32a. Seeds 0·55–0·70 mm. long, (0·50–)0·55–0·65 mm. 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*

32b. Seeds 0·40–0·55 mm. long, 0·35–0·50 mm. 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 33

33a. Stem internodes usually long (10–30 mm.); leaves and bracts narrowly acute to acuminate; sepals 2·5–3·0 mm. long 27. *A. leptoclados*

33b. Stem internodes very short (2–8 mm.); leaves and bracts obtuse to broadly acute; sepals c. 4·0 mm. long . . 28. *A. aegaea*

34a. Leaves long, linear or setaceous, not spiny, the leaves of the vegetative rosettes erect, tufted (2·5–) 4–25 cm. long; sepal margins often scarious but not entire upper portion; plants erect or tufted or with creeping caudiculi, never forming cushions . . 35

34b. Leaves short (0·5–1·5 cm.), setaceous rather spiny, or if longer (to 3 cm.) ± pungent; leaves of the vegetative rosettes closely crowded together all appressed or the outer spreading, rarely all erect (and plants ± tufted) and then margin and entire upper portion of sepals scarious; plants forming spiny cushions, occasionally suffruticose and sometimes loosely tufted 43

35a. Sepals always obtuse, the median portion ± herbaceous with (1–)3 or more parallel nerves, the margins coriaceous to scarious (Section *Eremogone*) 36

35b. Sepals acute, acuminate or cuspidate, often becoming obtuse when flattened (the thin membranous margin being normally recurved) 38

36a. Staminal glands indistinct; sepals c. 3 mm. long, somewhat keeled . . . . . 37. *A. isaurica*

36b. Staminal glands prominent, bifurcate, appearing as 10 . 37

37a. Sepals 4·25–5 mm. long, not keeled, with a broad 3–7 nerved median herbaceous strip; staminal glands long (0·40–0·50 mm.), prominently enlarged at the top . . . 35. *A. graminea*

37b. Sepals 2·5–3·75 mm. long, somewhat keeled, with a narrow 1–3 nerved herbaceous strip; staminal glands shorter (0·20–0·35 mm.), not enlarged at the top . . . . 36. *A. blepharophylla*

38a. Sepals at or after anthesis appearing cuspidate by the inrolling of the thin membranous margin at the apex, obscurely nerved, the median coriaceo-herbaceous portion dark brown, purple or black at least at the tip (forming the cusp); cauline leaves linear, grass-like (Section *Glomeriflorae*) 39

38b. Sepals acute or acuminate or appearing so, never cuspidate; tip usually buff or green, if dark-coloured, cauline leaves rather short setaceous 41

39a. Opposite cauline leaves united at the base to form a sheath 4–25 mm. long; sepals more than 5 mm. long 40

39b. Opposite cauline leaves free to the basal node (the united membranous portion round the node < 2 mm. long); sepals 3–4·5 mm. long . . . . . 40. *A. gypsophiloides*

40a. Cauline leaf sheaths long (12–25 mm.); 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*

40b. Cauline leaf sheaths short (4–9 mm.); 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*

41a. Sepals broadly ovate and broadly acute, almost entirely herbaceous with a narrow ± membranous margin, often darkened at the tip; plants densely tufted from a thick caudex; rosette leaves short 4–8 cm. long (Section *Capillares*) . . . 34. *A. lychnidea*

41b. Sepals ovate to lanceolate, narrowly acute to long acuminate, mostly coriaceous to scarious with a broad scarious margin, buff or midrib green, never darkened; plants caudiculate, loosely tufted; rosette leaves (5–)8–20 cm. long (Section *Rigidae* Series *Rigidae*) 42

42a. Base of the flowering stems sheathed by a whorl of leaves and dead leaf bases; internodes 4–6; median stem leaves 6–7 cm. long, basal rosette leaves 8–15 cm. long; pedicels and peduncles glabrous 41. *A. holostea*

42b. Base of the flowering stem naked or with a whorl of short scales; internodes 9–11; median stem leaves 3–4 cm. long, basal rosette leaves 3–5 cm. long; pedicels always and peduncles often shortly glandular pubescent . . . . . 42. *A. szowitsii*

43a. Petals shorter or a little longer than sepals; sepals obscurely nerved, not or scarcely carinate, broadly acute to obtuse; flowers usually aggregated into dense clusters, if inflorescence lax, sepals almost entirely scarious (Section *Scariosae*) 44

43b. Petals always much longer than sepals; sepals distinctly nerved, often carinate; inflorescence usually lax, if congested sepals narrowly acuminate 48

44a. Flowers arranged in a panicle of cymes, pedicels 1–10 mm. long (at least some 5–10 mm.); sepals almost entirely scarious, the short triangular herbaceous portion merging below half-way into the scarious upper part; staminal glands deeply bifurcate appearing as 10 . . . . . 48. *A. scariosa*

44b. Flowers aggregated into terminal and sometimes axillary clusters (pedicels 0–2 mm. long); herbaceous portion of sepals running at least ¾ way to apex 45

45a. Staminal glands deeply bifurcate appearing as 10; herbaceous portion of sepal not extending right to the tip . . 47. *A. armeniaca*

45b. Staminal glands five, indistinct; median herbaceous strip running right to the apex of the sepal 46

46a. Flowering stems with 1–2 pairs of leaves; inflorescence composed of 2–3 remote clusters each of 1–4 flowers; sepals 3·5–4·5 mm. long; seeds minutely fimbriate along the ridge; plant forming dense spiny cushions . . . . . 44. *A. pseudacantholimon*

46b. 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 5–8 mm. long; seeds without fimbriate margin; plant arising from creeping woody caudiculi, basal leaves setaceous but not spiny 47

47a. Sepals 5–6 mm. long; petals ovate-lanceolate, 2–2·5 times as long as broad, abruptly contracted at the base, slightly shorter than the sepals; stamens 3–4 mm. long, c. two-thirds as long as petals 45. *A. polycnemifolia*

47b. Sepals 6–8 mm. long; petals linear-lanceolate, 3·5–5 times as long as broad, gradually narrowing to a broad base, longer than the sepals; stamens 7·5–9 mm. long, almost as long as the petals 46. *A. zargariana*

48a. Sepals 5–8 mm. long, lanceolate, with a broad scarious margin, only the prominent keel herbaceous; inflorescence 1(–3)-flowered; leaves setaceous not or scarcely spiny, those of the sterile rosettes ± appressed (Section *Rigidae* Series *Setaceae*) 43. *A. angustisepala*

48b. Sepals 2–6 mm. long, broadly ovate to lanceolate with a rather narrow membranous or subscarious margin; inflorescence many-flowered, rarely 1- few-flowered and then sepals ovate or obscurely nerved; rosette leaves usually spreading, spiny, occasionally appressed, not spiny, and then sepals < 5 mm. and obscurely nerved: (Section *Sclerophyllae*) 49

49a. Leaves with a very narrow scarious margin, the basal all densely imbricate, tetrastichous; bracts and bracteoles very broadly triangular, acute to obtuse; sepals obtuse, 2·5 mm. long 55. *A. tetrasticha*

49b. 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, > 3 mm. long and rosette leaves all spreading 50

50a. 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 51

50b. Cauline leaves absent or if present shorter than the rosette leaves and 0·1–0·2 times as long as the corresponding internode . . 54

51a. Sepals 4·5–6·0 mm. long, ovate-lanceolate to lanceolate 2·25–3·25 times as long as broad, often densely glandular pubescent; inflorescence lax . . . . . 49. *A. acerosa*

51b. Sepals 2–4·5 mm. long, glabrous 52

52a. Sepals broadly ovate (1·25–2 times as long as broad), 3·5–4·5 mm. 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*

52b. 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 < 3·5 mm. or else lanceolate); plant forming spiny cushions (occasionally suffrutescent and then sepals lanceolate); flowering stems without axillary rosettes 53

53a. Inflorescence usually composed of clustered cymes appearing densely corymbose, rarely a rather lax cymose panicle; sepals 3·5–4·5 mm. long, lanceolate (2·75–3 times as long as broad) 52. *A. acutisepala*

53b. 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*

54a. Flowering stems 2·5–30·0 cm. 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 55

54b. Flowering stems 1·5–2·5 cm. 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*

55a. 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 53. *A. persica*

55b. 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*

Subgenus Arenaria

Section Rariflorae Williams

1. **A. antitaurica** McNeill in Notes Roy. bot. Gard. Edin. **23**, 507 (1961).

Key to Varieties

Leaves with the marginal vasculation no more developed than the extremely faint traces anastomosing throughout the lamina; sepals 3·5–4 mm. long var. *antitaurica*

Leaves with a distinct but very weak pair of marginal veins, not visible macroscopically; sepals 4–5 mm. long var. *intermidia*

var. **antitaurica**

Type: Turkey: cataonia: maraş, distr. Göksun: Binboğa dağ in ravine above Yalak, 2200 m. Rocks. 17 July 1952. *Davis, Dodds & Cetik* (D. 20130) (holo. E!, iso. K!)

Only known from two gatherings from Binboğa dağ (type & *Davis* 20114).

var. **intermedia** McNeill in Notes Roy. bot. Gard. Edin. **23**, 508 (1961).

Type: TURKEY: CATAONIA: In monte Nimrud Dagh prope vicum Kjachta districtus Mamuret-ül-Asis, in declivitatis septentr.-occid. rupibus. Substrato calcareo: ca. 2000–2200 m. 12 vii 1910, *Handel-Mazzetti* 2060 as "*Arenaria tmolea* Boiss." (holo. WU!)

Only known from type specimen.

Distribution (of species): *A. antitaurica* is endemic to the Anti-Taurus mountains in southern Turkey.

Collected in flower and fruit in mid-July between 2000 and 2400 m.

The two Davis gatherings of this new species have the appearance of rather pulvinate variants of *A. kotschyana* while in the shape and size of the petals they resemble *A. tmolea*. However, the absence of any marginal vasculation in the leaves distinguishes them from both these species and links them with the broader leaved *A. uninervia*, another new species from the Anti-Taurus. (q.v.)

Two Handel-Mazzetti specimens from the same area, identified by him as *A. tmolea* (cf. Ann. naturh. Hofmus. Wien **26**, 149, 1912), have been found to resemble closely the Davis collections. One of these Handel-Mazzetti gatherings is typical of *A. uninervia* and the other is referable to *A. antitaurica* but differs in having larger sepals and traces of marginal vasculation in the leaves (not visible macroscopically). This plant, although best included with *A. antitaurica* in Section *Rariflorae* may show an approach to Section *Grandiflorae* (with its 3-nerved leaves) and has been made the basis of a separate variety, var. *intermedia*.

2. **A. uninervia** McNeill in Notes Roy. bot. Gard. Edin. **23**, 508 (1961).

Type: TURKEY: CATAONIA: ADANA, distr. Feke: Bakir dağ nr. top of Sencan Dere, 2200 m. 30 June 1952, *Davis, Dodds & Çetik* (D. 19413). (holo. E!, iso. K!)

Distribution: only known from Bakir dağ (type) and Ak dağ (*Handel-Mazzetti* 2336) in the Anti-Taurus mountains in southern Turkey.

The two known gatherings were in early flowering stage at the end of June at 2200 m. and mid-July at 2500–2670 m.

In habit and leaf structure *A. uninervia* closely resembles *A. cretica* from Greece; the species are, however, readily distinguished on floral characters (cf. key).

A closer affinity probably exists between *A. uninervia* and *A. antitaurica*, the other new Anti-Taurus endemic. In addition to leaf shape, *A. uninervia* appears to differ in the colour of the leaves (a yellowish-green), in the bracts being more leaf-like and in the broader, less acuminate sepals. Probably the most important difference is that found in the habit of growth.

In *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 *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.

3. **A. minutissima** Rech. f. et Esfandiari in Bot. Jahrb. **75**, 342 (1951).

Type: IRAN: FARS: Kuhé Dena Gardaneh Sieni, 1 Aug. 1949, in fissuris, *Behboudi*. (holo. W!)

Distribution: Only known from two mountains (Kuhé Dena & Kuhé Lalesar) 500 km. apart in southern Iran.

A high mountain plant growing on rocks. Flowering in August.

A. minutissima is a 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 (< 3 cm. 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 Sept. 1885, *Stapf*. (holo. K!)

Distribution: Only known from type.

A dwarf caespitose high mountain plant growing in rock cracks. In fruit in September.

A. bulica, only known from Stapf's very poor original specimen, was placed by Williams in his section *Sikkimenses* (=Subgenus *Solitaria*), 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	var. *cretica*
Entire plant densely pubescent	var. *stygia*

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*).)

Distribution (of var.): GREECE: Epirus (Papingon), Peloponnese (Taiyetos), Crete (Levka Ori). Also occurs in Albania (Nëmerçke above Permet, Delvine etc.)

Altitudinal range, 1500–2750 m.; an alpine plant growing among rocks, especially in cracks (occasionally on scree), forming loose cushions or mats. Flowers June–August.

var. **stygia** Boiss. et Heldr. in Boiss., Diagn. Pl. Orient. ser. 2, **1**, 91 (1853).

Syn.: !"*A. hirta*" Sieber ex Presl in Oken, Naturwiss. Ges. Isis **21**, 272 (1828), pro syn., non Wormsk. (1819).
!"*A. Sieberi*" Spreng. ex Presl. l. c., nom. nud.
A. ciliata sec. Sibth. & Smith, Fl. Graeca **5**, t. 438 (1825), non L. (quoad saltem planta cretica).
≡"*A. stygia*" Boiss. & Heldr. ined.
≡*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 Pl. ser. 3. sched. 71 t. 179 nos. 2, 3, 4, & 8.

Syntypes: GREECE: 1.) PELOPONNESE: Chelmos ad fontem Stygia, *Heldreich.* (G). 2.) MACEDONIA/THESSALY: Olympus Thessaliae, 31 Jul. 1851, *Heldreich* Herb. 2136. (G, K!). 3.) CENTRAL GREECE: in monte Parnasso Aug. 1852, *Heldreich* Herb. 2136. (G, K!). 4.) PELOPONNESE: in rupibus excelsis montis Ziniae (Kyllenes), 5000–6500 ft., 17–29 Jul. 1851, *Orphanides* Fl. Graec. Exs. 158. (G, JE!, K!, S!, W-H!)

Distribution (of var.): GREECE: Thessaly (Olimbos), Central Greece (Parnassos), Peloponnese (Aroania Oros, Killini Oros, Taiyetos Or.) Crete (Levki Ori). Endemic.

Altitudinal range: 1200–2700 m.; otherwise as var. *cretica*.

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). The species was first described from Crete and 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.

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 pubescent 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* and *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, pp. 195–196, Halacsy 1900, Rechinger 1943, and Graebner 1918) until there is more certain evidence of a morphological gradation between the two species.

DISCUSSION—SECT. RARIFLORAE

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 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 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

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 decliviis alpis Maaden-Tepessi circa fodinas Tauri occidentalis; aestate 1836." *Kotschy* 60. (holo. destroyed W, iso. BM!, K!, S!)

Distribution: TURKEY: Cilician Taurus, N. Amanus (Düldül), Anti-Taurus (Beryt dağ), S.W. Armenia (Egin, Munzur dağ, Keşiş dağ). Endemic.

Altitudinal range, 900–2100 m. Cliff or scree plant, often in shaded places, forming rather dense mats. Flowers June to August.

7. **A. tmolea** Boiss., Diagn. Pl. Orient. ser. 1, **1**, 50 (1842).

Key to Varieties

Mature leaves ovate-lanceolate to lanceolate, 3–4(–6) times as long as broad . . . . . var. *tmolea*
Mature leaves linear-lanceolate (5–)6–7(–8) times as long as broad var. *stenophylla*

var. **tmolea**

Type: TURKEY: LYDIA: "Tmolus supra Philadelphiam", Jun. 1842, Boissier. (holo. G, iso. E!, JE!, K!—mixed with *Minuartia saxifraga* ssp. *tmolea*).

Distribution: TURKEY: Mountains of Lydia, Caria, Lycia, Pamphylia and Pisidia. Endemic.

var. **stenophylla** (Bornm.) McNeill, **stat. nov.**

Syn.: !*A. tmolea* forma *stenophylla* Bornm., Symbolae Fl. Anatol., in Feddes Rep. Beih. **89**, 254 (1940).

Syntypes: TURKEY: 1.) Amasia, in montis Ak-dagh regione alpina, 1600–1900 m., 9 Jul. 1889, *Bornmüller* 990 (JE!, K!). 2.) in rupestr. regionis alpinae 'Sana-dagh', dist. Amasiae, 1550 m., 15 Jul. 1889, *Bornmüller* 991 (JE!)

Distribution (of var.): Only known from type specimens.

Altitudinal range of species 1800–2300 m. Plant forming rather dense mats or even cushions among rocks. Flowers June to August.

DISCUSSION—SECT. GRANDIFLORAE

The two Orient species of this section were regarded as conspecific by Boissier in "Flora Orientalis" (1867), *kotschyana* being treated as a variety of *A. 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 described from the Orient in this section is Bornmüller's forma *stenophylla*.

Boissier reduced *kotschyana* to varietal rank presumably 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. 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. 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.

Of the features which do, in fact, distinguish the species (cf. key p. 246) 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 accounts of the distribution, 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. 1)

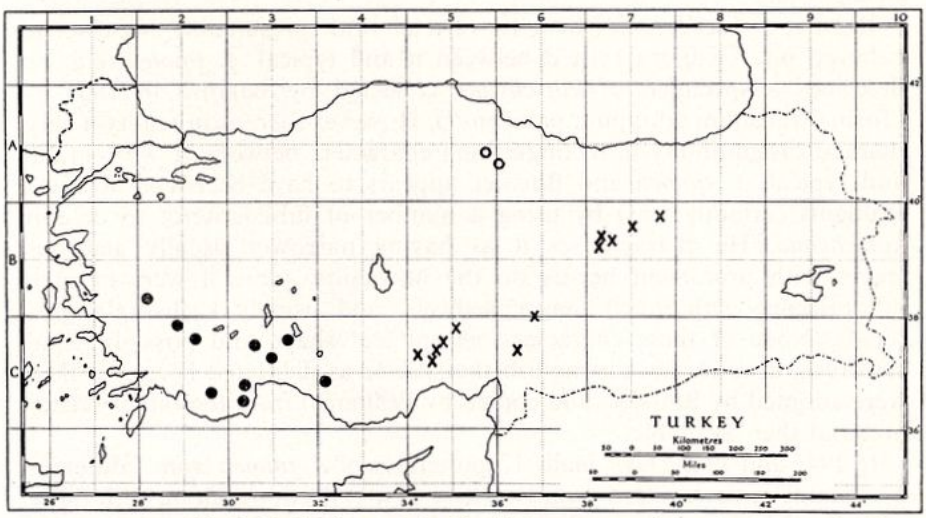

FIG. 1. Geographical distribution of the Turkish representatives of *Arenaria* Section *Grandiflorae*.

× 6. *A. kotschyana*. ● 7. *A. tmolea* var. *tmolea*. ○ 7. *A. tmolea* var. *stenophylla*

SECTION ROTUNDIFOLIAE SCHISCHKIN ex MCNEILL

8. **A. balansae** Boiss., Fl. Orient. **1**, 700 (1867).

Key to Varieties

Entire plant glandular-pubescent, usually densely so . var. *balansae*
Entire plant glabrous . . . . . var. *glaberrima*

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*, Pl. d'Orient, 1855, 602 (as *Arenaria Neelgerensis* Walk. et Arn. (sic!) var. *γ glanduloso-pubescens* Fenzl) (BM!, G, JE!, K!).

Paratypes: 1.) TURKEY: CILICIA: Bulgar Dagh, Gisyl Deppe, 2450 m., *Kotschy* 224 & 260a (one sheet) (K!, BM!). 2.) IRAN: Southern Zagros: Kuh Daena, *Kotschy* 766 (K!, BM!)

Distribution (of var.): TURKEY: Isauria (Geyik dağ), Cilicia (Bulgar dağ etc.), Kurdistan (provs. Bitlis & Hakâri). IRAN: Southern Zagros (Kuh Dena). Endemic.

Altitudinal range 2280–3500 m. 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.

var. **glaberrima** (Fenzl) McNeill, **comb. nov.**

Syn.: *A. neelgherrense* Wight & Arnott var. *α 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. 2600 m. *Kotschy* (destroyed W). 2.) reg. alp. supra Bulgarmaden. *Balansa* pl. d'Or. an. 1855 (destroyed W).

Distribution (of var.): TURKEY: Cilician Taurus (?), Kurdistan (Cilo dağ), IRAQ: Erbil (Arl Gird dagh & Ser Kurawa), IRAN: (mt. Kellal et Ssebsekuh). Endemic.

Altitudinal range of var. 2800–3700 m. 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.

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 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 1860. 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 and sepals as being "glabris vel hirtis" 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 250 km. 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
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 . . . . . subsp. *pancicii*

(Leaves ovate; petals shorter than the sepals; inflorescence many-flowered, > 10 . . . . *A. ovalifolia* (cf. discussion))

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.

≡*Euthalia 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 caucasicis—in alpe Kaischaur, Septembri florentem, *M. von Bieberstein* (holo. LE(photo!), iso. BM!?)

Distribution: GREECE: Macedonia (Athos, mt. Pangeon), Thessaly (Olimbos), Central Greece (Parnasos). TURKEY: Bithynia (Ulu dağ), Lycia (Çalbali dağ), Pisidia (Anamas dağ), Cilicia (Bulgar dağ etc.) Lycaonia (above Çay), Anti-Taurus (Bakir dağ. Berit dağ, Ak dağ), N.E. Armenia (prov. Erzincan), Pontus (provs. Artvin & Trabzon). U.S.S.R.: Georgia (Batum, Osetia). According to Williams (1898) also recorded from Afghanistan by Regel in Iter Turkestanicum 1882, but possibly a misidentification of *A. orbiculata* Royle or *A. turkestanica* Schischkin; otherwise endemic.

Altitudinal range 1200–2750 m. 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.

subsp. **pancicii** (Degen et Baldacci) McNeill, **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, 14 Jul. 1898. (BOLO?, K!, WU!). 2.) m. Planinica (et Majan) ad fines turcorum distr. Kuci, *Baldacci* 174 bis, 17 Jul. 1898. (BOLO?, iso. WU!).

Distribution: GREECE: Macedonia (Hagion Oros). Also occurs in Albania, S. Yugoslavia and Bulgaria.

Altitudinal data very incomplete, but it occurs between 1800 and 2400 m. 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.

Arenaria rotundifolia was originally described by Bieberstein from the Caucasus and his type specimen would appear (from a photograph) to be similar, in leaf shape etc., to the plants which occur in northern and central Anatolia. 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. The first two are characterised among other things by their ovate leaves and the last by its more slender habit and more acute sepals. No material of these taxa has been seen but Schischkin (1936) regards them all as synonymous with *A. rotundifolia*.

In the western part of its range two infra-specific taxa have been described; the first, var. *pauciflora* Boiss., in which the inflorescence branches were very short with only one or two flowers, was based on

plants from Thessalian Olympus and from Schar dagh in Macedonia. It would appear that this reduction of the inflorescence 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 *Bornmüller & 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. Subsp. *pancicii* closely resembles the Central and East European *A. biflora*, which is distinguishable by the narrower sepals.

DISCUSSION—SECT. ROTUNDIFOLIAE

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 seeds (cf. McNeill, 1962). 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 Table 1 has been drawn up from an examination of about 5–10 seeds in each case.

TABLE I

Taxon	Gathering	Size of Seed in microns		Size of cells on face in microns		Length/ Breadth
		Length	Breadth	Length	Breadth	
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
,,	*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 are 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. 2).

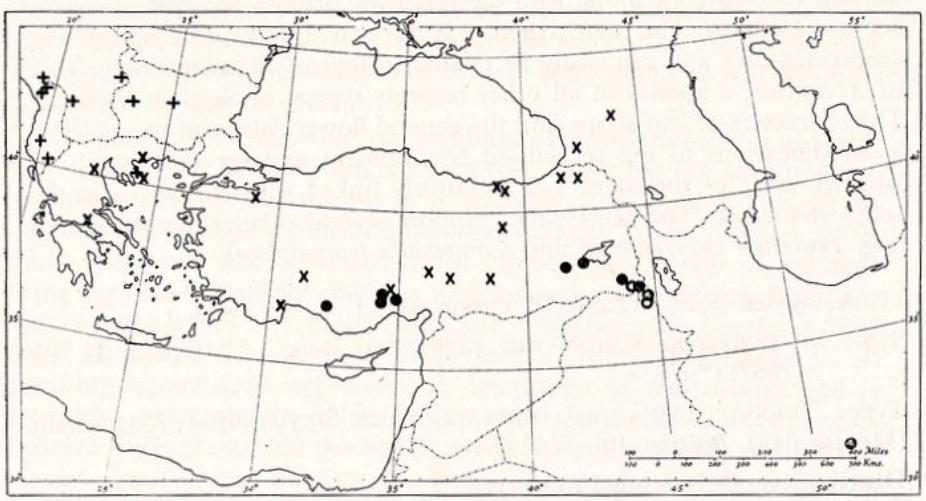

FIG. 2. Geographical distribution of the Orient representatives of *Arenaria* Section *Rotundifoliae*.

● 8. *A. balansae* var. *balansae*. ○ 8. *A. balansae* var. *glaberrima*. × 9. *A. rotundifolia* subsp. *rotundifolia*. + 9. *A. rotundifolia* subsp. *pancicii*

Section Orientales McNeill

Series Anomalae McNeill

10. **A. speluncarum** McNeill in Notes Roy. bot. Gard. Edin. **23**, 509 (1961).

Syn.: ≡ *A. graveolens* Schreb. var. *grandiflora* Boiss., Fl. Orient. **1**, 701 (1867) ("β").

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!, LIVU!).

Distribution: Only known from the one locality between Ermenek and Oyuklu dağ in the Isaurian Taurus.

A slender shade-loving plant growing on limestone rocks at the mouths of caves. Only known from one locality, at 1400–1500 m., Flowering July–August.

This species has apparently been collected only three times, on each occasion in the same place at the mouths of the caves near Ermenek. 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. speluncarum* ("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*).

11. **A. sipylea** Boiss., Diagn. Pl. 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* Jul. 1842 (holo. G!).

Distribution: Only known from type.

A densely caespitose plant of rock faces, flowering in July.

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 × 35 magnification.

12. **A. libanotica** Boiss., Fl. Orient. **1**, 699 (1867).

Syn.: *A. adonidis* Peyron ex Post, Fl. Syr. Palest. Sinai, 6 (1896).
A. libanotica var. *adonidis* (Post) Sam. ex Rech. f. in Ark. Bot. ser. 2, **5** (1), 129 (1959).
!*A. libanotica* var. *velutina* Sam. ex Rech. f. l. c. p. 130 (1959).

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* (G). 2.) in cacuminibus inter Yamouny et Dimam, *Blanche* (G.).

Distribution: LEBANON: North Lebanon (from Ehden to Nab el Hadid nr. Sannin). Endemic.

Caespitose or mat-forming plants of calcareous rocks on the western side of mt. Lebanon between 900 and 1830 m. Flowers July–August.

For a species with so restricted a geographical distribution that its most distant recorded localities (Ehden and Nab El Hadid) are only 40 km. 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 5 km. 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, 6 km. 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. libanotica* f. ad var. *adonidis* vergens". Rechinger, in his "Reliquiae Samuelssonianae VI.", has since published these varietal combinations, but in view of the variation within populations, it does not seem desirable to maintain them.

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 in Notes Roy. bot. Gard. Edin. **23**, 509 (1961).

Type: TURKEY: CILICIA: Prov. Konya, distr. Ermenek (Cilicia Trachea); Hamitsaydi boğaz between Sarivadi and Beşkuyu, 1500–1700 m., mossy rocks, perennial. 16 Aug. 1949, *P. H. Davis* 16227 (holo. E!, iso. K!).

Distribution: Only known from type gathering.

A very slender plant, vegetatively rather moss-like and found growing on mossy rocks at 1500–1700 m. Flowering and fruiting in mid-August.

This new species is very distinctive, being one of the few truly linear-leaved members of the subgenus *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 × 140 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*.

DISCUSSION—SERIES ANOMALAE

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 on the basis of their general resemblance to other members of Section *Orientales*, coupled with 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, 40 km. in extent, in the mountains of Lebanon. The others are each only known from one locality and indeed *A. sipylea* (Manisa dağ 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.

Series Graecae McNeill

14. **A. filicaulis** Fenzl in Grisebach, Spicil. Fl. Rumel. Bithyn. **1**, 203 (1843).

Key to Subspecies

1a. Pedicels long, those of the first flower 1·5 to 3 cm. 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 $\mu \times 5$–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 . . subsp. *euboica*

1b. Pedicels rather short, those of the first flower 0·5 to 1·5(–2) cm. long; seed papillae stouter (> 15 μ broad); the tubercles ('cells') of the lateral surfaces of the seed dull dark brown to black, regularly round or oval in surface view. 2

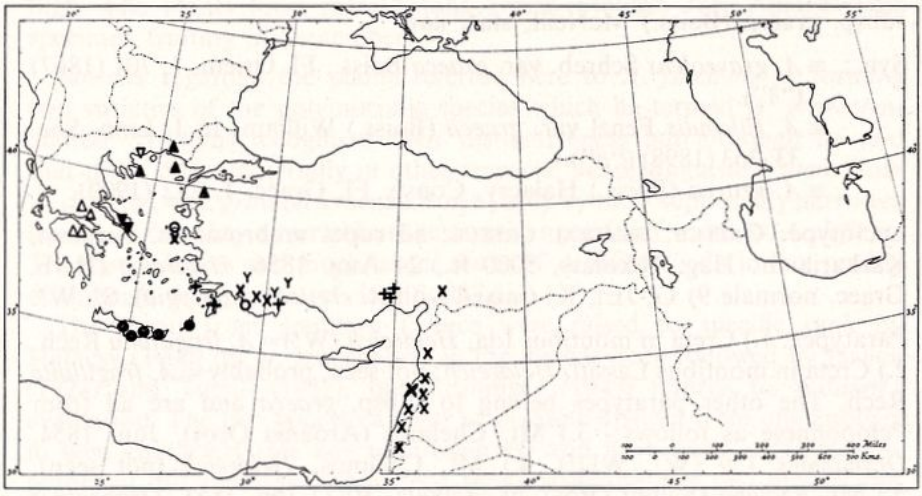

FIG. 3. Geographical distribution in the Orient of perennial members of *Arenaria* Section *Orientales*. (*A. deflexa* subsp. *deflexa* extends to Sinai).

▲ 14. *A. filicaulis* subsp. *filicaulis*. △ 14. *A. filicaulis* subsp. *graeca*. ▼ 14. *A. filicaulis* subsp. *euboica*. ▽ 15. *A. teddii*. × 16. *A. deflexa* subsp. *deflexa*. + 16. *A. deflexa* subsp. *pubescens*. ○ 16. *A. deflexa* subsp. *pseudofragillima*. Y 16. *A. deflexa* subsp. *microsepala*. ● 17. *A. fragillima*

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 subsp. *filicaulis*); seeds with longish fine papillae (c. 50–70 $\mu \times 15$ μ), centrally placed on the tubercles of the dorsal surface . . . . . 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 120–130 μ long and 20–30 μ broad at the base; seeds with longish stout papillae (c. 50–70 $\mu \times 70$ μ), often excentrally placed on the tubercles of the dorsal surface . . subsp. *filicaulis*

subsp. **filicaulis**

Syn.: !*A. graveolens* Schreb. var. *athoa* Boiss., Fl. Orient, **1**, 701 (1867) ("ε").
≡*A. graveolens* Schreb. var. *filicaulis* (Fenzl) Nyman, Consp. Fl. Eur. 114 (1878).
!*A. filicaulis* Fenzl α *rumelica* Williams in J. Linn. Soc. **33**, 363 (1898).

Type: GREECE: MACEDONIA: in reg. m. Athus pr. Panagia 4500 ft *Grisebach*. (holo destroyed W, iso. K!).

Distribution: GREECE: Macedonia (Hagion Oros-mt. Athos), Thrace (Samothrace, Karlik dagh). TURKEY: Mysia (Kaz dağ). Also occurs in Yugoslavia (S. Macedonia: Demir Kapija).

Altitudinal range 110–120 m. (Demir Kapija); 1400–2000 m. A mat-forming plant usually growing among rocks. Flowers June–July.

subsp. **graeca** (Boiss.) McNeill, **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**, 363 (1898) ("β").
≡*A. graeca* (Boiss.) Halacsy, Consp. Fl. Graec. **1**, 232 (1900).

Lectotype: GREECE: CENTRAL GREECE: ad rupes umbrosas m. Parnassi, Karkaria nr. Hag. Nikolass, 5000 ft., 24 Aug. 1856, *Heldreich* (Herb. Graec. normale 9) G, JE!, K! (mixed with *A. cretica* var. *stygia*), S!, W!.

Paratypes: 1.) Creta in montibus Ida, *Heldreich* (W!) = *A. fragillima* Rech. 2.) Creta in montibus Lassiti, *Heldreich*; not seen, probably = *A. fragillima* Rech. The other paratypes belong to subsp. *graeca* and are all from Peloponnese as follows:- 3.) Mt. Chelmos (Aroania Oros), Jun. 1854, *Orphanides* 159 (W!, WU!). 4.) Mt. Chelmos, *Heldreich* (not seen). 5.) Mt. Kyllene (Killini Oros), nr. Trikala, 10/22 Jun. 1851, *Orphanides* 159 (E!, JE!, K!, S!, W!, WU!). 6.) Mt. Kyllene, 1495 m., Jul. 1848, *Heldreich* (E!, K!).

Distribution: GREECE: Central Greece (Parnasos, Korax, Kiona), Peloponnese (Aroania, Killini). Endemic.

Altitudinal range 760–1800 m. A mat-forming plant, occasionally somewhat cushion-forming, growing among rocks on mountains. Flowers June–August.

subsp. **euboica** McNeill, **subsp. 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 glandulosorum 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 elongantes. *Sepala* 3·5–4·5 mm. longa (in typo); extimum plerumque 7 venis, intimum 3–5 venis praeditum. *Capsula* calycem subaequans sed valvae recurvantes. *Semina* 0·8–1·0 mm. longa et 0·6–0·7 mm. lata, nigerrima nitentiora; tuberculi testae parvi, ei in superficiebus lateralibus irregulariter formati, ei in jugo dorsali papilla breve subtilissima (20–40 × 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!).

Distribution (of subsp.): GREECE: Central Greece: Euboea (Dhirfis, Xerovum). Endemic.

Both known localities are in "regionis superioris" of a mountain 1743 m. high. The plants form mats among rocks. Flowers July–August (type specimen fruiting in September).

Boissier regarded the plants referred here to *A. filicaulis* as forming two varieties of the polymorphic species which he termed *A. graveolens* Schreb. Williams recognised their distinctiveness but although he said that they "differ materially in other respects" he distinguished them from *A. deflexa* (= *A. graveolens* sensu Boiss.) only by their supposedly narrower leaves; in fact they cover about the same range of leaf width as *A. deflexa*. The sessile leaves and much larger seeds of *A. filicaulis* do in fact readily distinguish the species. (cf. key p. 247.)

The plants from southern Greece were raised to specific rank by Halácsy (1900) (as *A. graeca*) and in this he 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 to subspecies) and have quite separate geographical distributions. When seed is not available the two groups can usually be separated by the size and type of hairs throughout the plant and to some extent by 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 thirty-four 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.

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 from both ssp. *filicaulis* and ssp. *graeca*. The plants have a much laxer habit and longer inflorescence, due in particular to the very long pedicels and peduncles (these are frequently indistinguishable as the inflorescence often consists of a solitary flower). The structure of the testa of the seed is also very distinctive, although its features are difficult to describe. The seed tubercles ('cells') of the Euboea plants are more irregular in outline and have much finer papillae than those of typical *filicaulis* or *graeca*. These plants from Euboea are here recognised 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) 2200 ft., rocky crevices, dry place overhung by lofty rock, fls. white, 5 Oct. 1935, *H. G. Tedd* 1249. (holo. K!).

Distribution: Only known from Mt. Pangaion (Purnar Dagh), in Greek Macedonia.

The three known gatherings were collected in July and October (fruit only) on calcareous and siliceous substrata. The plants form mats among rocks.

A. teddii was described by Turrill from a specimen collected by Tedd in 1935. Rechinger made two gatherings on the same mountain in 1936, one about the same altitude as Tedd and the other higher up at 1700 m. 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* subsp. *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 abnormally late-flowering. The most useful discriminatory feature (see key) is the cordate base of the lowest bract. Rechinger's specimen (10208), from higher up the mountain 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. Pangaion specimens. *A. teddii* is very closely related to *A. filicaulis* subsp. *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. Pangaion 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 was presumably the same plant was "described" by Halacsy & Charrel as follows: "*Arenaria nervosa* Halácsy 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. Pangaion, 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.

DISCUSSION—SERIES GRAECAE

Although Boissier (1867) included the then known plants of this series (*A. filicaulis* subsp. *filicaulis* and subsp. *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* subsp. *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*.

Series *Graecae* is almost entirely confined to Greece—*A. filicaulis* subsp. *filicaulis* being, however, recorded from one locality in N.W. Anatolia (cf. fig. 3). 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 subsp. *graeca*.

SERIES DEFLEXAE MCNEILL

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 2·5–3 mm. long, acuminate, ovate-lanceolate to lanceolate, 2·5–3·5 times as long as broad . . . subsp. *microsepala*
1b. Outer sepals 3·25–5 mm. long, rarely c. 3 mm. and then acute . . 2
2a. Outer sepals narrowly lanceolate, 3·5–4·5 times as long as broad, (3·5–)4·0–5·0 mm. long . . . . . subsp. *deflexa*
2b. Outer sepals ovate-lanceolate, 2·5–3·25 times as long as broad, 3·0–4·0(–4·5) mm. long 3
3a. Petals lanceolate, 2·5–3·5 times as long as broad; pedicels stout, that of the lowest flower 0·3 mm. diam. . . subsp. *pseudofragillima*
3b. Petals linear-lanceolate, 4–6 times as long as broad; pedicels slender, c. 0·1(–0·25) mm. diam. . . . . subsp. *pubescens*

subsp. **deflexa**

Illustrations: Bouloumoy, Fl. Liban Syrie t. 58, f. 1 (1930) (as *A. graveolens* Schreb.)—?subsp. *deflexa*.

Syntypes: EGYPT: SINAI: 1.) Entre les rochers granitiques du Sinai, Juin 1832, *N. Bove* 176 (as *A. procumbens* Vahl) (P, K!). 2.) Entre les rochers du Sinai, Juin 1832, *N. Bove* 177 (P, K!).

Distribution: GREECE: Aegean Islands (Chios); TURKEY: Lycia, Amanus (Mt. Düldül); SYRIA: Latakia (Djebel Ansarieh), Damascus; LEBANON: North Lebanon (widespread), Antilebanon (Quadi el Kam), South Lebanon (Mt. Hermon etc.); ISRAEL: Northern Israel (mts. E. of Duma); JORDAN: Cisjordan (Mt. Gerazim); EGYPT: Sinai.

Altitudinal range 400–1800 m. A straggling, sometimes rather caespitose plant of rocks, screes and cliffs. Recorded from calcareous substrata. Flowers May–July.

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–)4·0–5·0 mm. longis sat distinguenda; a subsp. *pseudofragillima* petalis lineari-lanceolatis et pedicellis tenuis (plerumque c. 0·1 mm. diam.) divergit; proxima subsp. *microsepalae* sed sepalis longioribus (sepalis plantarum Aegaearum 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 (0·5–2 cm.) tenuis c. 0·1 mm. diam. (raro ad 0·25 mm.). *Sepala* exteriora 3·0–4·0 mm. longa, ovato-lanceolata, latitudine 2·5–3·25-plo longiora, acuta vel acuminata. *Petala* 3·75–4·75 mm. longa lineari-lanceolata, latitudine 4–6-plo longiora. *Capsula* ovoidea. *Semina* brevissime papillosa vel epapillosa (papillis 0–12 μ longis).

Typus: TURKEY: LYCIA: Vil. Antalya: Takhtali Dagh (Kemer) below Chukur yaila, 5000 ft., shady rocks, perennial, 17 Aug. 1947. *P. H. Davis* 14148. (holo. E! iso. K!).

Distribution: GREECE: Aegean Islands (Kos, Rhodes); TURKEY: Lycia (Takhtali dağ), Cilicia (Cilician Gates); LEBANON?: Ain ab.

Recorded at 800, 1400 and 2400 m., and appears to flower May–August, otherwise as subsp. *deflexa*.

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 15 cm. longi, crassi, ad nodos fragiles. *Inflorescentia* ad 6 cm. longa, floribus 4–7 instructa; pedicelli longi, crassi; infimi 15 mm. longi et 0·3 mm. diam. *Sepala* extima 3·5–4·5 mm. longa, late lanceolata (latitudine 2·5–3·5-plo longiora), acuminata. *Petala* 4·25–5·25 mm. longa, lanceolata (latitudine 2·5–3·5-plo longiora). *Capsula* ovoidea. *Semina* vix matura, minute papillosa.

Typus: TURKEY: LYCIA: Prov. Antalya distr. Kemer, Teke dağ near Ovacik, 1200 m., 12 Jul. 1949 *P. H. Davis* 15333 (holo. K!).

Distribution: GREECE: Aegean Islands (Chios); TURKEY: Lycia (type).

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 1200 m. in Lycia and in mid-May in Chios.

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 10 cm. alti. *Inflorescentia* ad 5 cm. longa, floribus 3–15 instructa; pedicelli longi tenues; infimi 10–15 mm. longi et minus 0·1 mm. diam. *Sepala* 2·5–3 mm. longa, ovato-lanceolata vel lanceolata (latitudine 2·5–3 plo longiora) acuminata. *Petala* 3·5–4 mm. longa, lineari-lanceolata (latitudine c. 4-plo longiora). *Capsula* ovoidea. *Semina* in jugo dorsali breviter tuberculata (c. 40 μ longa); tubercula (=cellulae) $\pm$ quadrata, c. 60 μ lata, papillosa; papillae c. 20 μ longae.

Typus: TURKEY: CARIA: Vilajet Denizli (Caria): Boz dagh nr. Geyran yaila, 4500 ft., shady rocky places, 16 Jul. 1947. *P. H. Davis* 13352. (holo. E!, iso. K!).

Distribution: TURKEY: Caria (type), Lycia (Çalbali dağ), Pisidia (Bozburun dağ). Endemic.

A mat-forming plant with ascending flowering stems, growing among rocks, often shaded, between 1370 and 1800 m. Flowers June–July.

Unknown variety within *A. deflexa*:

A. graveolens Schreb. var. *minuta* Post, Fl. Syr. Pal. Sinai 153 (1896). Flowers ·002 m. long (=2 mm.)"Woods, Ajlun" (Ajlun—Gilead, JORDAN).

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 subspecies (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.

17. **A. fragillima** Rech. f. in Feddes Repert. **47**, 49 (1939).

Lectotype: GREECE: CRETE: Distrikt Monophatsi. Felsritzen des Kophina 5 Jul 1904, *Dörfler* (1904) 1212. (WU!) "*A. oxypetala* S. & S. det. Vierhapper", "*A. fragillima* det. Rech.".

Paratypes: All from GREECE: 1.) Crete, Mt. Ida, 1220 m., *Heldreich* 1553 (W!). 2.) Karpathos, Felsritzen am Westhang des Kalolimni, 1100 m., *Rechinger* 3184a (W—destroyed). 3.) Crete, Hierapetra, Aphendi Kavusi, *Dörfler* 1218 (W—destroyed). 4.) Crete, Borg Aph. Christos, *Dörfler* 1222a (W—destroyed).

Illustration: Rechinger Fl. Aegaea t. 2, f. 3 (1943).

Distribution: GREECE: Crete and Karpathos. Endemic.

Rather dwarf plant growing among rocks; recorded at 1200 and 1450 m. Flowers late May–July.

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 by 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*.

DISCUSSION—SERIES DEFLEXAE

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 *A. muralis*) with which imperfect specimens lacking the perennial rootstock can easily be confused. The series is intermediate

between Series *Graecae* and Series *Orientales*, but also shows an affinity with *A. sipylea* and *A. libanotica* in Series *Anomalae*.

The series is chiefly Mediterranean in distribution. It is represented in Crete, the Aegean Islands and on the mountains of the Mediterranean seaboard south to Israel and thence to Sinai; it thus replaces to the east, Series *Graecae*. (cf. fig. 3.) 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.

Series Orientales

18. **A. luschanii** McNeill in Notes Roy. bot. Gard. Edin. **24,** 115 (1962).

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!).

Distribution: Turkey: Lycia. Endemic.

An erect or ascending much-branched annual.

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 distinguished it only 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. 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).

Distribution: Greece: Central Greece (Mt. Parnes & type).

An erect annual recorded as having been collected on wet rocks.

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, and that the Cretan and Aegean material often referred to it was a distinct species (*A. muralis*) differing in 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!).

Distribution: GREECE: Aegean Islands (Samos), Central Greece (Euboea), Crete (widespread). Endemic.

An erect or prostrate annual with a much branched inflorescence, growing on dry rocks. Flowers April–June.

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, included 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 2·5–3·5 mm. long, ovate-lanceolate, < 3 times as long as broad; pollen grains 25–30 μ diam. (subsp. *rhodia*) . . 2
1b. Sepals 3·5–5·0 mm. long, lanceolate, 3–4 times as long as broad; pollen grains 31–36 μ diam. . . . . subsp. *cypria*
2a. Petals linear (5–6 times as long as broad), slightly exceeding the sepals (< 1·25 times as long) . . . *subsp. rhodia* var. *rhodia*
2b. Petals oblanceolate (c. 3 times as long as broad), nearly twice as long as the sepals . . . . *subsp. rhodia* var. *macropetala*

subsp. **rhodia** 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!).

Distribution: GREECE: Rhodes; TURKEY: Caria & Lycia (coastal localities).

subsp. **rhodia** var. **macropetala** McNeill, **var. nov.**

A varietate typica, petalis oblanceolatis (latitudine c. 3-plo longioribus) calycem valde excedentibus, circiter duplo longioribus differt.

Type: TURKEY: LYCIA: Prov. Muğla. dist. Fethiye: between Kizil dere

and Dalaman Çay, 100 m., serpentine scree, annual, fls. large, leaves purplish, 1 Apr. 1956, *Davis & O. Polunin* (D. 25543). (holo E! iso. K!). Distribution (of var. *macropetala*): TURKEY: Caria & Lycia (coastal localities). Endemic.

Subspecies *rhodia*: Erect or ascending much-branched annuals growing on serpentine rocks or scree between 30 and 200 m. 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.

subsp. **cypria** (Holmboe) McNeill, **comb.** et **stat. nov.**

Syn.: ≡*A. cypria* Holmboe, Studies Veg. Cyprus, 68 (1914) (in Bergens Mus. Skr. N.S. **1** (2).

Illustration: Holmboe l. c. (1914).

Type: CYPRUS: LIMASSOL: Rocky places in the Troödos mountains near the village of Prodromo, *Holmboe* 888. (holo. ?O, iso. ?C).

Distribution: CYPRUS: Paphos (Akamas), Limassol (Troödos Mts.). Endemic.

Habit of subsp. *cypria* resembles subsp. *rhodia*. Two specimens on serpentine rock of the Akamas have been seen but there are no data for the remaining specimens from the Troödos range; the cap of Troödos, however, is entirely serpentine (above c. 1500 m.). Some of Mrs. Kennedy's many gatherings of this subspecies have somewhat reddish leaves and are recorded as growing on "igneous rock". Grows between 1200 and 1950 m. on Mt. Troödos. Flowers April–May.

Neither *A. rhodia* nor *A. cypria* has 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' it was reduced 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. Turrill distinguished his 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 p. 248) are also found in the type specimen of *A. rhodia* and in recent gatherings by 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. Pl. Orient. ser. 1, **8**, 102 (1849).

Key to Infra-specific Taxa

1a. Petals much longer than sepals (1·3–1·5 times as long) (subsp. *pamphylica*) 2
1b. Petals shorter than or scarcely exceeding the petals (< 1·25 times as long) (subsp. *kyrenica*) 4
2a. Sepals 2·25–2·75 mm. long; pollen 24–27 μ diam. var. *pamphylica*
2b. Sepals 3–5 mm. long; pollen 27–32 μ diam. 3
3a. Sepals 3·0–3·75 mm. long, 3–4 times as long as broad var. *maritima*
3b. Sepals 4·25–5·0 mm. long, c. 5 times as long as broad var. *alpestris*
4a. Sepals 3·75–4·75 times as long as broad with a narrow membranous margin (about a third as broad as median herbaceous part) var. *kyrenica*
4b. Sepals 3–3·5 times as long as broad with a broad membranous margin (> half as broad as median herbaceous strip) var. *turcica*

subsp. **pamphylica** var. **pamphylica**

Type: TURKEY: PAMPHYLIA: "sur les pierres de murs de l'Amphitheatre de Perga, 19 mars. 1845, *de Heldreich* 490". (holo. G! iso. BM!, E!, JE!, K!). Only known from type.

subsp. **pamphylica** var. **maritima** McNeill, **var. nov.**

A varietate typica, sepalis maioribus (3·0–3·75 mm. 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, 3 m., white dunes. Tall specimen growing in protection of Lentisc. Annual, erect, 18 April 1956, *Davis & O. Polunin* (D. 25828). (holo. E!, iso. K.)

Distribution: TURKEY: Lycia, Pamphylia. Endemic.

subsp. **pamphylica** var. **alpestris** McNeill, **var. nov.**

A varietatibus aliis duabus, sepalis longioribus (4·25–5·0 mm. 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), 2000 m., among shady rocks (limestone). Annual, fl. white., 18. 8. 1949, *P. H. Davis* 16316". (holo. E!, iso. K!).

Distribution (of var.): TURKEY: Pisidia (Bucak), Cilicia (type). Endemic.

Subsp. *pamphylica*: Erect annual growing among rocks (often limestone), or on dunes; var. *maritima* recorded from 3–215 m., var. *pamphylica* at about 100 m., but var. *alpestris* at 915–2000 m. Var. *pamphylica* and var. *maritima* flower March–April; var. *alpestris* June–July.

subsp. **kyrenica** McNeill, **subsp. nov.**

A subspecie typica petalis sepalis brevioribus vel vix excedentibus (non multis excedentibus) differt.

Planta annua gracilis erecta vel ascendens, 5–35 cm. alta. *Inflorescentia* ad 18 cm. longa, floribus paucis vel plurimis instructa; bracteae inferiores foliaceae ad superiores bracteas subulatas sensim transientes; pedicelli ad 20 mm. longi. *Sepala* 3–4 mm. longa, lineari-lanceolata; sepalum extimum latitudine 3·75–4·75-plo longius anguste membranaceo–marginatum (margine membranaceo mediis herbaceis c. 0·7–plo angustior). *Petala* 3·0–4·5 mm. longa sepalis < 1·25-plo longiora. *Stamina* 10; filamenta 1·75–2·25 mm. longa; anthera c. 0·25 mm. longa; granula 27–36 μ diam. (plantis Cypri 31–36 μ diam.; plantis Syriae et Libani 27–31 μ diam.). *Capsula* calycem $\pm$ aequans.

Typus: CYPRUS: KYRENIA: Kornos (Kyrenia range) abundant on limestone rocks above Larnaca-tis-Lapithos, 1000–2000 ft. Annual, petals white, linear, obtuse. 3 Apr. 1941, *P. H. Davis* 2990. (holo. E!, iso. K!).

subsp. **kyrenica** var. **kyrenica.**

Distribution: CYPRUS: Kyrenia (widespread); SYRIA: Latakia (Nusairy mts.); LEBANON: North Lebanon (Cedars). Endemic.

subsp. **kyrenica** var. **turcica** McNeill, **var. nov.**

A varietate *kyrenica* sepalis latioribus et margine sepalorum latius membranaceo differt.

Sepala 2·75–3·25 mm. longa, lanceolata; sepalum extimum latitudine 3·0–3·5-plo longius, late membranaceo-marginatum (margine membranaceus mediis herbaceis < 0·5-plo-angustior). *Petala* 2·75–3·25 mm. longa calycem $\pm$ aequans. *Stamina* 10; filamenta 1·25–1·75 mm. longa, granula 27–29 μ diam. *Capsula* calycem aequans vel excedens.

Typus: TURKEY: PAMPHYLIA: Adalia, in rupestribus maritimis, 5 Maio 1860, *Bourgeau* holo. G!

Distribution of var.: TURKEY: Pamphylia (type), Cilicia. Endemic.

Subsp. *kyrenica*: Erect or ascending, usually much-branched, annual, growing among limestone rocks from sea-level to 1000 m. Flowers March–June.

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. (cf. fig. 4). 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

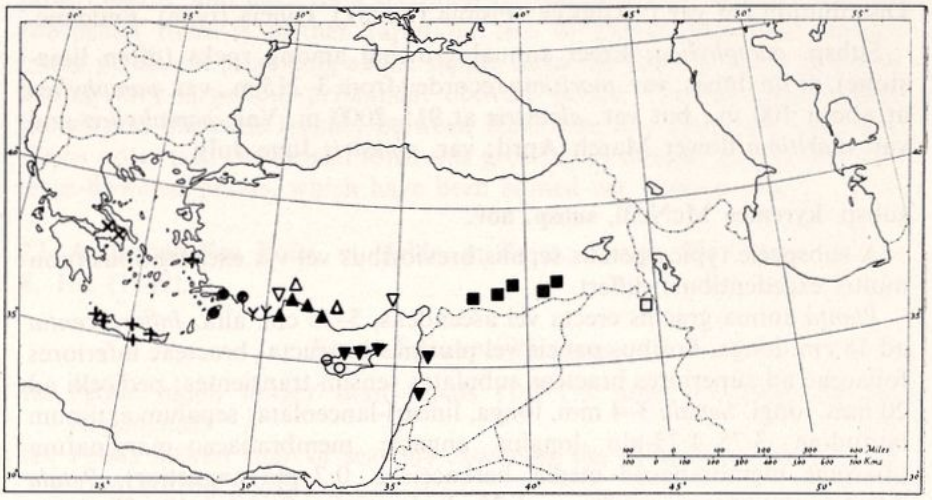

FIG. 4. Geographical distribution in the Orient of the annual members of *Arenaria* Section *Orientales* and of *A. sabulinea* (Section *Pseudosabulina*).

Y 18. *A. luschanii*. × 19. *A. oxypetala*. + 20. *A. muralis*. ● 21. *A. rhodia* subsp. *rhodia*. ○ 21. *A. rhodia* subsp. *cypria*. ▲ 22. *A. pamphylica* subsp. *pamphylica* vars. *pamphylica* and *maritima*. △ 22. *A. pamphylica* subsp. *pamphylica* var. *alpestris*. ▼ 22. *A. pamphylica* subsp. *kyrenica* var. *kyrenica*. ▽ 22. *A. pamphylica* subsp. *kyrenica* var. *turcica*. □ 23. *A. kurdica*. ■ 24. *A. sabulinea*.

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.

23. **A. kurdica** McNeill in Notes Roy. bot. Gard. Edin. **23**, 510 (1961).

Type: IRAQ: ERBIL: Sefin Dagh above Shaqlawa, 1200 m. Oak forest formation, limestone crats (sic), N. aspect. Flowers white. Frequency occasional. 9 May 1947, *J. B. Gillett*, *National Herbarium of Iraq* (*BAG*) 18076. holo. K!

Distribution: Only known from type.

A small annual plant, the only known specimen growing at 1200 m. on limestone; in an early flowering stage at the beginning of May.

In one of his enumerations of the flora of Iraq, Blakelock (1957)

commented on the distinctiveness of Gillett's plant 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 Eastern 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.

A. kurdica is the only Irano-Turanian member of a predominantly Mediterranean section.

DISCUSSION—SERIES ORIENTALES

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 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*.

DISCUSSION—SECTION ORIENTALES

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

24. **A. sabulinea** Grisebach ex Fenzl, Illustr. Pl. 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).

Type: "in Mesopotamiae sabulosis", *Grisebach.* (holo. destroyed W).

Distribution: Turkey: Mesopotamia (Birecik to Mardin); Iraq?: (see var. *brevipes* below). Endemic. (cf. fig. 4).

Slender much-branched annual of calcareous rocks between 600 and 1200 m. 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: erbil: Östlich von Erbil am Wege nach Schaklawa, am Kuh-i-Sefin, 700 m., 6 May 1893, *Bornmüller* 941. kirkuk & sulaimaniya: in der Ebene bei Kerkuk, Kalkhügel 400 m., 28 Apr. 1893 *Bornmüller* 941b. (holo. ? not traced at JE).

Discussion—Section Pseudosabulina

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. But 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.*

Section Arenaria

Series Arenaria

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!).

Distribution: GREECE: Epirus (widespread on mts.), Thessaly, Central Greece (Dhekelia). Also occurs in Albania & Montenegro.

A robust annual growing on mountain slopes between 1370 and 2700 m. Recorded from limestone and serpentine substrata. Flowers June–August.

A. conferta, as here circumscribed, can readily be distinguished from *A. serpyllifolia* 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 3–4 mm. long, ovate to ovate-lanceolate (c. 2·5–3 times as long as broad) . . . . . var. *serpyllifolia*
Sepals 4·5–5 mm. long, lanceolate (c. 3·5 times as long as broad) var. *macrosepala*

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 J. Bot. Desv. **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).

Type: ? in Herb. Linn.

Distribution: GREECE: Epirus, Macedonia, Thrace, Central Greece, Peloponnese (Aroania Oros), Crete (Mt. Ida); TURKEY: Pontus (nr. Cimil), Mysia (Kaz dağ), Bithynia (nr. Bolu), Caria, Pamphylia Lycaonia (nr. Konya), Galatia (N. of Ankara), Cappadocia (Hasan dağ), S.W. Armenia (Hazar Gölü), N.E. Armenia; U.S.S.R.: Kabardino; IRAN: Azerbaijan, Caspian Sea, Tehran, Eastern Khorasan (Kopet dagh). Common in northern Greece, local elsewhere. Also occurs throughout Europe, except Iceland and north to 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 2700 m. Introduced into N. America and possibly also Australia.

var. **macrosepala** Rech. f. in Feddes Repert. **48,** 41 (1940).

Type: IRAN: MAZANDERAN: Grasige Hange der Buschwald-zone in Čalus-Tal, etwa 2400 m., 9 Jun. 1937, *Rechinger* 901. (holo. W!).

Distribution of var.: Probably endemic and only the type known, but see discussion.

A very widely distributed annual species 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 30–100 m. and from 1000–2500 m. (Frequent below 1000 m. in Europe). Flowers May–July, automatically self-pollinated.

Chromosome number: 2n=40, Blackburn & Morton (1957), Böcher & Larsen (1958), Griesinger (1937), Rohweder (1939), Woess (1941); 2n=44, Blackburn & Morton (1957).

A. serpyllifolia is one of the most widespread species of the genus, and is found not only as a native plant throughout Eurasia from Ireland and Northern Scandinavia across to India and Japan but also established 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 thought 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 5 mm., one from the Epirus and the other from Asiatic Russia; the former has been examined (*Halacsy* 17. 7. 1893) and has been found to have the broader sepals typical of the species; also the sepal length (c. 4·5 mm.) 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*. These have been referred, on the balance of probability, 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. *leptoclados* Nyman, Consp. Fl. Eur. 112 (1878).
A. serpyllifolia subsp. *tenuior* (Mert. & Koch) Arcangeli, Comp. Fl. Ital. 101 (1882).
A. serpyllifolia subsp. *leptoclados* var. *viscidula* Rouy & Fouc. Fl. Fr. **3**, 242 (1896).
A. leptoclados β *viscidula* (Rouy & Fouc.) Williams in J. Linn. Soc. **33**, 368 (1898).
A. tenuior (Mert. & Koch) Gürke in Richter-Gürke, Pl. Eur. **2**, 273 (1899).
A. leptoclados Guss. forma *viscidula* (Rouy & Fouc.) Rech., Fl. Aegaea 141 (1943).

Original citation: "In muris, secus vias, in ruderatis, et in collibus aridis in Sicilia." ?Type *Gussone* (holo. FI? (& NAP?)).

Distribution: GREECE: Ionian Islands (Corfu), Macedonia (very common), Thrace, Thessaly (Kalabaka, Sporadhes etc.), Central Greece (widespread), Peloponnese, Cyclades, Crete; TURKEY: Bithynia (Istanbul, Ulu dağ), Thracia (Gallipoli), Mysia (Renkoei), Lycia (Armotte), Pamphylia (nr. Alanya), Amanus (Bahçe), Pisidia (Bucak), Cataonia (Pazarcik), S.W. Armenia (Hazar Gölü, Pulumar), N.E. Armenia (Horasan), Mesopotamia; U.S.S.R.: Azerbaijan (Baku); CYPRUS: Kyrenia, Famagusta, Larnaka (Skarinou), Limassol (Troödos); SYRIA: Aleppo, Homs (Palmyra), Jebel Druz; LEBANON: North Lebanon; ISRAEL: Central Israel; JORDAN: Edom (Petra, Wadi Ram); IRAQ: Mosul, Erbil, Kirkuk & Sulaimaniya, Dulaim, Central Iraq (Badra); IRAN: Azerbaijan (Sir), Caspian Sea, Lorestan, Eastern Khorasan, Southern Zagros (Bakhtiari), Fars, Kerman & Yazd, Persian Gulf (Hadjiabad); EGYPT: Lower Egypt (Dumyat). Probably widespread throughout most of cited range but under-collected except in Greece & Cyprus. Also occurs 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.

A slender annual of dry light soils, often growing among rocks, found from sea-level to 1500 m. throughout most of the region but extending to 2400 m. in southern Iran. Flowers February to June. Automatically self-pollinated.

Chromosome number: 2n=20, Blackburn & Morton (1957), Böcher & Larsen (1958), Griesinger (1937), Weiss (1941).

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 June 1939 from Cyprus, *Davis* 28998 and 29405 from Armenia and *Koelz* 15141 from the Zagros mountains in Iran.

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: Kykladen, Grabusa, *Rechinger* 5147f; Kykladen, Arhydros, *Rechinger* 5238; Dyo Adelphi, West-Insel, *Rechinger* 7766; Tria Nisia, Sud-Insel, *Rechinger* 7731; Saphrania, *Rechinger* 7661 (iso. K!); Kinaros, *Rechinger* 7801 (iso. K!). Holotypes: W destroyed.

Distribution: GREECE: Aegean Islands: Cyclades. Endemic.

A small annual plant of sea-shores, showing characteristic halophytic modifications of hairiness and rather fleshy leaves.

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 (e.g. 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, l. c) were destroyed at Vienna as a result of war damage.

29. **A. cassia** Boiss., Diagn. Pl. Orient. ser. 1, **1**, 51 (1842).

Type: TURKEY/SYRIA (AMANUS/LATAKIA): in sylvaticis regionis mediae montis Cassii Syriae borealis, *Boissier*. (holo. G.).

Distribution: TURKEY: Amanus (Saouk Oluk); SYRIA: Latakia (Djebel Ansarieh); LEBANON: North Lebanon (Mt. Lebanon), South Lebanon (J. Baruk etc.). Endemic.

A robust annual of calcareous or schistose rocks and gravel on mountains. Recorded at 800 m. in the Amanus, at 1300 m. on J. Ansarieh and between 1370 m. and 2400 m. in Lebanon. Flowers May–June.

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!).

Distribution: TURKEY: Cilicia (Kizil Dere), Amanus (Saouk Oluk, Cebel Akra etc.); SYRIA: Latakia; LEBANON: South Lebanon (Ain Zahalta); ISRAEL: Galilee (J. Jermak). Endemic.

A robust annual of calcareous or schistose rocks and gravel on the lower slopes of mountains, sometimes in pine woods. Recorded between

50 m. and 900 m. in the Amanus region and between 1100 and 1300 m. in the Lebanon. Flowers April–May.

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.

DISCUSSION—SERIES ARENARIA

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 three of 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

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
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
subsp. *boissieri*

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, *Balansa* 1297. (holo. G, iso. K!, S!).

Distribution: Only known from the type.

subsp. **boissieri** (Pax) McNeill, **comb.** et **stat. nov.**

Syn.: ≡*A. nana* Boiss., Diagn. Pl. Orient. 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 Mai 1846, *Heldreich.* (holo. G, iso. K!).

Distribution: GREECE: Crete (type); CYPRUS: Limassol (Troödos). Endemic.

Small xerophytic annual species occurring on scree and in dry river beds between 1500 and 1890 m. Flowers May–June.

The first plants of this species to be collected were Heldreich's very dwarf specimens from Crete called *A. nana* by Boissier in 1849 and renamed *A. boissieri* by Pax 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. Pl. 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!).
Distribution: TURKEY: Caria (Honaz dağ), Lycia (Elma dağ), Phrygia (S. of Uşak), Cappadocia (Karamas dağ). Endemic.

A xerophytic annual of sandy places, dry river beds etc. Flowers May–June.

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*.

DISCUSSION—SERIES SAPONARIOIDES

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

33. **A. guicciardii** Heldr. in Boiss., Diagn. Pl. Orient. ser. 2, **5**, 60 (1856).

Type: Greece: central greece: versus cacumen montis Parnes Atticae, Junio, *Heldreich.* (holo. G.)

Distribution: Greece: Central Greece (Mt. Parnes), Peloponnese. Endemic.

A xerophytic annual collected near the summit of Mt. Parnes from 1200–1350 m. Flowers May–June.

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.

Discussion—Series Cylindricae

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.

Discussion—Section Arenaria

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.

Subgenus Eremogone Fenzl

Section Capillares McNeill

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.
≡*Eremogene 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!).

Distribution: Turkey: N.E. Armenia (Maden—Miriomana), Kurdistan?; U.S.S.R.: Kabardino & Osetia, Georgia.

A tufted plant of scree and rock crevices with creeping caudiculi.

Recorded between 2500 m. and 2700 m. Flowers June–August; petals sometimes of varying shades of pink (*Balls* 557) otherwise white.

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

35. **A. graminea** C. A. Meyer, Verz. Pfl. Cauc. 220 (1831).

Syn.: ≡*Eremogone graminea* (C.A.Mey.) Fisch. & Mey., Ind. Sem. Hort. Petrop. **1835**, 7 (1835).
A. graminea C.A.Mey. α *grandiflora* Fenzl in Ledebour, Fl. Ross, **1**, 362 (1842).
!*A. graminea* C.A.Mey. 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!).

Distribution: U.S.S.R.: Georgia, Armenia; IRAN: Azerbaijan. Endemic.

Erect grass-leaved plant with a short stout caudex from which the leaves and stems arise in dense tufts. Recorded at 1500 m. in Iran. Flowers July.

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 0·3–0·6 mm. long . . . . . var. *blepharophylla*
Leaf margins smooth or with short cilia, those of the stem leaves < 0·2 mm. long (a few rather longer at the base of the leaf) . . . . . var. *parviflora*

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!

Paratype: TURKEY: "Armenia", 1858, *Tchichatcheff* (G!) (same locality as lectotype, according to Boissier, 1867).

Distribution: TURKEY: S.W. Armenia (type locality), N.E. Armenia (Erzerum?); IRAN: Azerbaijan (Ser). Endemic.

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) ("*β*").
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*).
Distribution of var.: TURKEY: N.E. Armenia (Yağmurlu dağ, Kisir dağ, Yalnizçam dağlari); U.S.S.R.: Armenia. Endemic.

An erect grass-leaved plant with vegetative rosettes and flowering stems arising from spreading caudiculi. Recorded between 1900 and 2300 m. on rocky slopes. Flowers June–July.

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 this 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 1·8–2·0 cm.; cauline c. 4·0 cm.) and the few-flowered inflorescence.

SECTION GLOMERIFLORAE FENZL EX WILLIAMS

38. **A. dianthoides** J. E. Smith, Ic. Pl. Ined. 16 (1789).

Key to Varieties

Flowers densely compacted into a terminal head, peduncles and pedicels 0–2 mm. 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 . . . . . var. *dianthoides*

Flowers arranged in a terminal panicle of cymes, primary peduncles 10–25 mm. long, ultimate pedicels 2–5 mm.; 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 . . var. *paniculata*

var. **dianthoides**

Syn.: ≡*Alsinanthus dianthoides* (Smith) Desvaux in J. Bot. Desv. **3** (5), 221 (1816).

Illustrations: J. E. Smith, Ic. Pl. 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(?).

Distribution: TURKEY: N.E. Armenia (Provs. Erzerum and Kars); U.S.S.R.: Georgia, Armenia, Azerbaijan; IRAN: Azerbaijan. Endemic.

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 10–25 mm. longi; pedicelli ultimi > 2 mm. longi; axis et pedunculi denso 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: Yağmurlu Dag between Sarikamiş & Karaurgan, 2300 m. Meadows. Perennial. Flowers white. 7 July 1957, *Davis & Hedge* (D. 30764). holo. E!

Distribution (of var.): Only known from type.

Erect grass-leaved plant (to 50 cm. tall) with rather short caudex and caudiculi. Recorded between 1800 and 2450 m. Flowers May–July.

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 these paniculate plants 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. Vertheil. Alsin. t. ad. p. 57 (1833).
?*A. cucubaloides* α *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 (?).

Distribution: TURKEY: Galàtia (Amasia), Cappadocia, Cataonia (Bereketli), S.W. Armenia (Egin etc.), N.E. Armenia (widespread), Kurdistan (Van); U.S.S.R.: Armenia; IRAN: Azerbaijan.

Erect grass-leaved plant to 40 cm. with a rather slender creeping caudex. Altitudinal range: 1800–2300(–2700) m. Flowers, June.

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. vii) 1910 fl., *T. A. Roop*". holo. KW.
". . . floribus confertis". "Flores, quam in forma typica, minores, petalis calyce glabro, 4–5 mm. longo subduplo longioribus".
(For 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 var. *gypsophiloides*

Peduncles, pedicels and sepals glabrous . . . var. *glabra*

var. **gypsophiloides**

Syn.: ≡*Alsinanthus gypsophiloides* (L.) Desvaux in J. Bot. Desv. **3** (5), 221 (1816).

≡*Eremogone gypsophiloides* (L.) Fenzl, Versuch Verbreit. Vertheil. 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?

Distribution: TURKEY: S.W. Armenia (Tunceli), N.E. Armenia (widespread—Erzincan, Bayburt, Erzerum, Kars), Kurdistan (Lake Van), Mesopotamia (Karaçali dağ?); U.S.S.R.: Georgia, Armenia (Nakhichevan), Azerbaijan; IRAN: Azerbaijan, Caspian Sea (Elburs), Tehran (Elburs etc.). Probably endemic (but 'Bulgaria, Hayek, 1924).

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.* destroyed (W), Holotypes iso. K! (1. only), LE?

Distribution of var.: TURKEY: N.E. Armenia (Erzerum), Kurdistan (Van, Hakâri); U.S.S.R.: Georgia; ?IRAQ: Mosul (R. Khabur); IRAN: Azerbaijan, Caspian Sea (Elburs), Kordestan & Zanjan, Northern Zagros, Tehran.

An erect grass-leaved plant, 20–50 cm. tall (–60 cm. in cultivation) with a very stout woody caudex. Recorded at c. 1100 m., 1460 m. and throughout the range 1800–3100 m.

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 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).

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.

DISCUSSION—SECTION GLOMERIFLORAE

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 broad 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

41. **A. holostea** M. Bieb., Fl. Taur. Cauc. **1**, 345 (1808).

Key to Subspecies

Basal part of the flowering stem glabrous . . subsp. *holostea*
Basal part of the flowering stem shortly and roughly pubescent subsp. *macrantha*

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!).

Distribution: U.S.S.R.: East Transcaucasia (Daghestan). Endemic.

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!).

Distribution: TURKEY: N.E. Armenia; U.S.S.R.: Armenia. Endemic.

A. holostea forms tufted plants up to 30 cm. tall, probably growing in soil rather than on scree. Caudex short or absent. Collected at 1600 m., flowering in June.

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!).

Distribution: U.S.S.R.: Armenia (Nakhichevan); IRAN: Azerbaijan. Endemic.

A plant, 20–25 cm. tall, of scree and stony hill slopes with extensive caudex and caudiculi, the latter often rather stoloniform. Collected at 1240 and 2130 m. Flowers May–June.

DISCUSSION—SERIES RIGIDAE

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 6–9 mm. and for *A. holostea* 6–11 mm. (Boissier claimed 6·5 mm. 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 (8 mm. 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

43. **A. angustisepala** McNeill in Notes Roy. bot. Gard. Edin. **23**, 510 (1961).

Key to Varieties

Sepals glabrous, c. 7·5 mm. 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 . . . . . var. *angustisepala*

Sepals glandular-pubescent, 5·5–6 mm. long, outer narrowly lanceolate, inner ovate; leaves glandular-puberulent; stems densely glandular pubescent throughout; bracts and pedicels densely glandular-pubescent var. *glandulosa*

var. **angustisepala**

Type: Turkey: kurdistan: Prov. Bitlis/Van: mt. 10 km. S.E. of Pelli. 8500 ft. [2590 m.] 8 July 1954, *Davis & O. Polunin* (D. 22524). holo. E!, iso. K!

var. **glandulosa** McNeill in Notes Roy. bot. Gard. Edin. **23**, 511 (1961).

Type: Turkey: kurdistan: Prov. Van, dist. Gevaş: Artos Dağ, 10,000 ft. [3048 m.] Rock crevices. Fls. white. 15 July 1954, *Davis & O. Polunin* (D. 22818). holo. E!, iso. K!

Distribution of species: Only known from type specimens.

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.

Section Scariosae McNeill

Series Polycnemifoliae McNeill

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 Jul. 1890, *P. Sintenis* 3100 sub "*Buffonia caespitosa* Hskn. n.sp." holo. JE!, iso. K!, WU!; 2.) N.E. ARMENIA: Szanschak Gumuschkhane. Argyridagh 14 Jul. 1894, *Sintenis* 6289 sub "*Buffonia caespitosa* Hskn." holo. JE!, iso. BM!, E!, K!

Distribution: TURKEY: S.W. Armenia (Erzincan), N.E. Armenia (Gümüşane). Endemic.

A spiny hummock-forming plant of stony slopes and scree, resembling *Acantholimon* spp. in habit. Recorded from igneous rock. Flowers July–August.

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* 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. Pl. Orient. ser. 1, **1**, 48 (1842).

Lectotype: IRAN: "Demavend Kou, *Aucher-Eloy* 4255". BM!, K!

Paratypes: 1.) IRAN: Persia occidentalis, *Aucher-Eloy* 592 (K!, G). 2.) TURKEY: Armenia, *Aucher-Eloy* 591 (K!) = *A. acutisepala* var. *acutisepala*.

Distribution: IRAN: Caspian Sea, Northern Zagros, Tehran, Central Desert. Endemic.

A plant of dry stony places and scree with strong caudiculi. Recorded between 2200 and 2800 m. Flowers July–August.

This species is apparently confined to the mountains in northern and western 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 in *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 Feddes Repert. **39**, 93 (1935), non Fernald (1919).
!*A. kourosii* Parsa in Kew Bull. **1947**, 17 (1947).

Type: IRAN: TEHRAN: Ali-abad (Ghom) 29 June 1939, *A. Parsa.* holo. K!

Distribution: IRAN: Tehran (Kazvin, Ghom, C. Elburs). Endemic.

A plant of dry stony ground, possessing well-developed caudiculi. Recorded between 1600 and 2300 m. Flowers June–July.

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 SCARIOSAE

47. **A. armeniaca** Boiss., Diagn. Pl. Orient. ser. 1, **1**, 48 (1842).

Key to Varieties

Sepals 6–8·5 mm. long; staminal glands 0·3 mm. long	var. *armeniaca*
Sepals 4·5–5 mm. long; staminal glands 0·45 mm. long	var. *minor*

var. **armeniaca**

Type: TURKEY: Armenia, *Aucher-Eloy* 592 bis. holo. G., iso. K!

Distribution: TURKEY: N.E. Armenia (Gümüşane, Bayburt, Erzerum). Endemic.

var. **minor** McNeill, **var. nov.**

A varietate typica, sepalis minoribus (4·5–5 mm. longis) et glandulis staminorum longioribus (0·45 mm. longis) differt. Planta 10–20 cm. alta; inflorescentia dense capitata (rachis brevis, < 5 mm.).

Typus: TURKEY: S.W. ARMENIA: Prov. Erzincan: Erzincan–Kelkit, c. 15 km. from Erzincan, 1650 m. Dry igneous hillsides; Perennial, erect. Not spiny. 1 Aug. 1957, *Davis & Hedge* (D. 31885). holo. E!, iso. K.

Distribution (of var.): Only known from type.

A plant of dry rocky slopes with well-developed caudex and caudiculi, recorded at 1650 & 1900 m. Flowers July–August.

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 existence 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 Œst. 1858, *M. de Tchihatcheff*." holo. G!

Distribution: TURKEY: N.E. Armenia (Gümüşane). (?Iran—"Persia occidentalis", *Aucher-Eloy* K!—wrong label?) Endemic.

A plant of dry stony slopes with well-developed caudex and caudiculi. Recorded at 1800 m. Flowers July–August.

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.

DISCUSSION—SECTION SCARIOSAE

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 structure in the group (cf. key to the species).

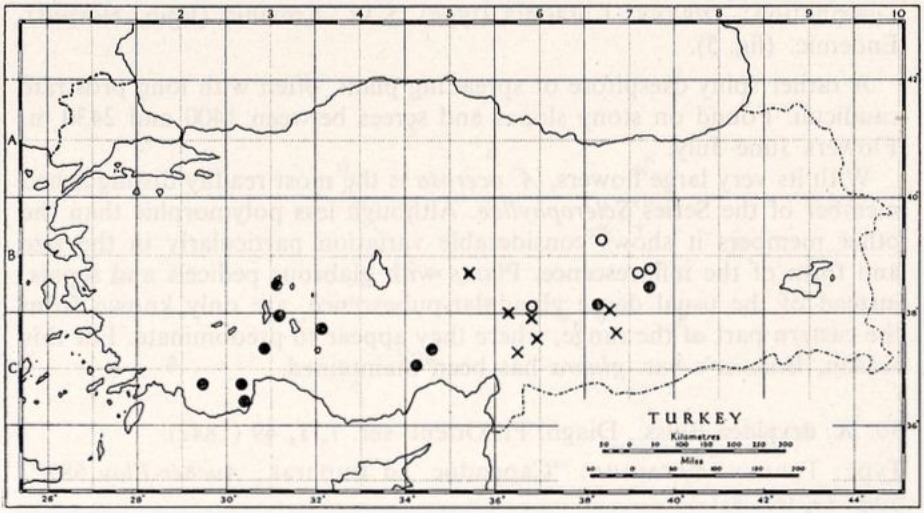

FIG. 5. Geographical distribution of Turkish representatives of *Arenaria* Section *Sclerophyllae*.

● 49. *A. acerosa* var. *acerosa*. ○ 49. *A. acerosa* var. glabra. × 50. *A. drypidea*

SECTION SCLEROPHYLLAE BOISS.

49. **A. acerosa** Boiss., Diagn. Pl. Orient. ser. 1, **8**, 103 (1849).

Key to Varieties

Pedicels and sepals densely glandular pubescent .	var. *acerosa*
Pedicels and sepals glabrous	var. *glabra*

var. **acerosa**

Syntypes: TURKEY: LYCAONIA: 1.) "ad occ. planitiei Koniah inter hanc urbem et Beychehr sitis" ("Collines de tuffe très 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!

Distribution: TURKEY: Lycia, Pamphylia (Bozburun dağ), Cilicia, Pisidia (type), Phrygia (Sultandagh), Lycaonia (type), Cappadocia (nr. Ulukisla), Cataonia (Gok tepe), S.W. Armenia (Gölcuk). Endemic. (fig. 5).

var. **glabra** Boiss., Fl. Orient. **1**, 697 (1867).

Type: TURKEY: CATAONIA: "in rupestribus montis Berytdagh alt. 7000'" (=2134 m.), *Haussknecht* [1177] [7 Aug. 1865]. holo. G!, iso. JE!

Distribution: TURKEY: Cataonia (type), S.W. Armenia (Egin, Harput). Endemic. (fig. 5).

A rather spiny caespitose or spreading plant, often with long prostrate caudiculi. Found on stony slopes and screes between 1400 and 2430 m. Flowers June–July.

With its very large flowers, *A. acerosa* is the most readily distinguished member of the Series *Sclerophyllae*. Although less polymorphic than the other members 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. Pl. Orient. ser. 1, **1,** 49 (1842).

Type: TURKEY: CATAONIA: "Cappadoc. ad Euphrat., *Aucher-Eloy* 587". holo. G, iso. K!

Distribution: TURKEY: Amanus (Mt. Düldül etc.), Cappadocia (Erciyas dağ, Ala dağ etc.), Cataonia (mts. of Anti-Taurus). Endemic. (fig. 5).

A prickly suffruticose plant growing in stony places from (850–)1400–2750 m. Flowers July–August.

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. Pl. Syr. Taur. 45 (1843), (reprint from Russegger, Reise **1** (2), 931).

Key to Varieties

1a. Flowering stems short, < 4·0 cm., with 1–2 internodes below the inflorescence; inflorescence 1–3(–5) flowered . var. *pauciflora*
1b. Flowering stems long, 4–25 cm., with (2–)3–6 internodes below the inflorescence; inflorescence 5–50 flowered 2
2a. Inflorescence many-flowered (15–50), very lax, pedicels > 5 mm.; sepals ovate to ovate-lanceolate (2–2·75 times as long as broad), narrowly acute to long acuminate . . . var. *parviflora*
2b. Inflorescence few to many-flowered (5–50), ultimate cymes rather contracted with some pedicels < 5 mm.; sepals ovate (2–2·5 times as long as broad), bluntly acute to abruptly acuminate var. *ledebouriana*

var. **ledebouriana**

Syn.: !"*A. aculeata*" Desv. in J. Bot. Desv. **3** (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).

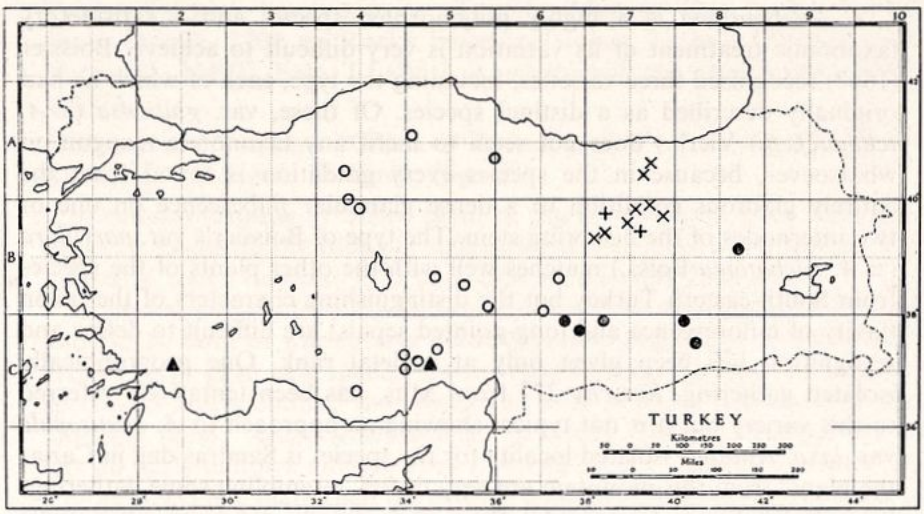

FIG. 6. Geographical distribution of Turkish representatives of *Arenaria* Section *Sclerophyllae*.

○ 51. *A. ledebouriana* var. *ledebouriana*. ▲ 51. *A. ledebouriana* var. *pauciflora*. ● 51. *A. ledebouriana* var. *parviflora* × 52. *A. acutisepala* var. *acutisepala*. + 52. *A. acutisepala* var. *laxa*.

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!

Distribution: TURKEY: Paphlagonia (Tosya), Cilicia, Lycaonia, Galatia, Cappadocia, Cataonia, ?Mesopotamia. Endemic. (fig. 6).

var. **pauciflora** McNeill, **var. nov.**

Planta dense caespitosa vel pulvinata. *Caules floriferi* breves (1·5–4·0 cm.); internodia sub inflorescentia 1–2; inflorescentia 1–3(–6)-flora. *Sepala* 2·5–4·0 mm. longa, ovata, latitudine 1·75–2·25-plo longiora, late acuta vel abrupte acuminata.

Typus: TURKEY: CARIA: "Mughla: Sandras dagh nr. Gökce ova. 1700 m.? fl. white. 23 July 1947, *P. H. Davis* 13517." holo. E!, iso. K!

Distribution: TURKEY: Caria (Sandras dağ), Cilicia (Bulgar dağ). Endemic. (fig. 6).

var. **parviflora** Boiss., Fl. Orient. **1**, 697 (1867) ("γ").

Syn.: !*A. trichotoma* Boiss., Diagn. Pl. Orient. ser. 2, **5**, 60 (1856), non Royle ex Edgeworth & Hooker (1874).

Type: TURKEY: "Cappadocia ad Euphratem", *Aucher-Eloy* 590 bis. holo. G!, iso. K!

Distribution: TURKEY: Cataonia (S. of Anti-Taurus), N.E. Armenia (Bingol dağ), Mesopotamia (Diyarbakir to Mardin). Endemic. (fig. 6).

Spiny caespitose or cushion-forming plants growing on stony ground between 900 & 2800 m. Flowers June–July.

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. tchihatcheffii* 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.

52. **A. acutisepala** Hausskn. 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 . . . . . var. *acutisepala*
Inflorescence a rather lax cymose panicle; pedicels 4–7 mm. long var. *laxa*

var. **acutisepala**

Syn.: !*A. eginensis* Hausskn. ex Bornm. in Feddes Repert. Beih. **89**, 253 (1940).
!"*Alsine laricioides*" Hausskn. ined.

Type: TURKEY: S.W. ARMENIA: Armenia turcica: Egin: Salachlu in collibus nudis, 25 Jun. 1890, *Sintenis* 2764. holo. K!, iso. BM!, JE!, WU!

Distribution: TURKEY: S.W. Armenia (widespread), N.E. Armenia (Gümüşane). Endemic. (fig. 6).

var. **laxa** McNeill, **var. nov.**

A varietate typica, inflorescentia laxa paniculata non dense pseudo-corymbulosa differt.

Pedicelli 4–7 cm. longi.

Typus: TURKEY: S.W. ARMENIA: Tunceli: Munzur Dag in Aksu Dere above Ovacik, 1700 m. Rocky limestone slopes, 21 July 1957, *Davis & Hedge* (D. 31477). holo. E! (With *A. acutisepala* var. *acutisepala* = *Davis* 31477A).

Distribution: TURKEY: ?Cilicia ("Taurus"), S.W. Armenia (Erzincan: Kuruçay, and type). Endemic. (fig. 6).

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 2300 m. Flowers June–July.

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—"*Alsine laricioides*") is a more straggling plant than the others. Williams (1898) saw a duplicate of one of those specimens (*Sintenis* 2764—"*Ar. 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 *Ar. 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.

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!

Paratypes: 1.) no locality (IRAN), *Aucher-Eloy* 600 bis (K!, G!). 2.) IRAN: Mt. Demawend, *Aucher-Eloy* 4253A (K!, G!) = *A. insignis* Litw.

Distribution: IRAN: Lorestan, Northern Zagros, Southern Zagros, Fars, Kerman & Yazd. Endemic.

Plant forming dense, usually very spiny cushions, arising from a stout caudex. Altitudinal range 2750–4000 m. Flowers June–July.

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.

54. **A. insignis** Litwinow in Trav. Mus. bot. Acad. St. Petersb. **3**, 106 (1907).

Syn.: *A. lessertiana* sec. Boiss., Fl. Orient. m̄, 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 Jul. 1897, *D. Litwinow* 1902. holo. LE, iso. E!, WU!

Distribution: IRAN: Caspian Sea (Elburs mts.), Tehran (Elburs mts.). Also occurs in U.S.S.R., Turkmenia (type & Kopet dagh).

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 (1500–)2200–3100 m. Flowers June–July.

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 p. 253), 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 Ashkhabad in Turkmenia. This specimen is clearly an extreme form of the rather less densely cushion-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!

Distribution: Only known from type specimens.

Dense tufted or possibly cushion-forming plant.

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 in Notes Roy. bot. Gard. Edin. **23**, 511 (1961).

Type: TURKEY: KURDISTAN: Prov. Van, dist. Başkale: Ispiriz Dağ, 3400 m., rock crevices, fls. white. 31 July 1954, *Davis & O. Polunin* (D. 23694). holo. E!, iso. K!.

Distribution: Only known from type.

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*.

MOEHRINGIA L.

Key to Orient Species

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*

SECTION LATIFOLIAE NYMAN EX GRAEBNER

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* (L.) Desv. in J. Bot. Desv. **3** (5), 221 (1816) ("*trinervis*").
≡*Alsinella trinervia* (L.) S.F. Gray, Nat. Arr. Br. Pl. **2**, 655 (1821) ("*trinervis*").
≡*Strophium trinervium* (L.) Dulac. Fl. Hautes-Pyren. 248 (1867).
?*M. thasia* Stojanoff & 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.* *Roy lugdb.* 471.
Alsine plantaginis folio. *Bauh. hist.* 3. *p.* 364.
Habitat in Europae *sylvis.*"

(No specimen in Herb. Cliff.).

Distribution: GREECE: Macedonia (widespread), Central Greece (Euboea); TURKEY: Pontus (prov. Artvin), Thracia (Istanbul); IRAN: Caspian Sea (Lahijan). Also occurs 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.

An erect annual growing in forests in the Orient (recorded from *Picea*, *Fagus* and *Castanea*) between 800 and 2100 m. Apparently a weed of tea plantations in northern Iran. Flowers (in Orient) June–July.

Chromosome number: n = 12, Rohweder (1939); 2n = 24, de Litardière (1948), Blackburn & Morton (1957).

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 is largely Hyrcano-Colchic, being confined to Northern Greece and the coasts of the Black and Caspian Seas.

The status of *M. thasia* is discussed 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., 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) Nyman, Consp. Fl. Eur. 117 (1878).
?*M. thasia* Stojanoff & Kitanoff in Annu. Univ. Sofia Phys.-Math. **41** (3) (Sci. Nat.), 293 (1945).

Illustration: Willkomm, Ic. Pl. 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.* Holotypes: P?

Distribution: GREECE: Macedonia: Thasos (Limenas, *Sintenis & Bornmüller* 375). CANARY ISLANDS and WESTERN MEDITERRANEAN: (S. France, Corsica, Spain, Balearic Is., Portugal, Morocco, Algeria, Italy, Sicily).

An erect annual more slender than *M. trinervia*, growing among bushes on Thasos. Flowers May–June.

Chromosome number: 2n = 48, de Litardière (1948), Blackburn & Morton (1957).

M. pentandra is only known from one locality in the Eastern Mediterranean (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. **16**, 1919, p. 183, non Gay" is cited as a synonym, but the Sintenis & Bornmüller specimen, which Bornmüller was discussing, does not agree with Stojanoff 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 ca. 1100 m. s.m.; 16 Julio 1943 in arenosis maritimis ad Makriamo prope urbem Limena. *Stoyanoff* and *Kitanoff*. holo. SO?

MINUARTIA L.

Key to Orient Species

1a. Inner whorl of stamens adnate to the petals arising at the top of a very short calyx tube (c. 1 mm.); outer whorl of stamens inserted at a lower level on the calyx tube; leaves linear to ovate, rounded or bluntly obtuse at the apex; petals frequently pink; cotyledons accumbent; plants perennial (Subgenus *Rhodalsine*) 1. *M. geniculata*

1b. Both whorls of stamens inserted at one level on a hypogynous disc; petals and stamens free to the base; leaves frequently linear-subulate, if broader then acute to acuminate 2

2a. Leaves setaceous, bearing axillary fascicles of equally long leaves (the leaves superficially appearing to be whorled); seeds pyriform with a dorsal groove; cotyledons accumbent; petals pink, rarely white; plants annual: (Subgenus *Spergella*) 3

2b. Fascicular leaves, when present, shorter than the subtending cauline leaves; seeds reniform with a flat or rounded dorsal ridge; cotyledons incumbent; petals white (very rarely pink–in a caespitose to pulvinate perennial): (Subgenus *Minuartia*) 4

3a. Sepals acuminate, ovate (c. twice as long as broad), 3·25–4 mm. long; pedicels erect or spreading in fruit . . 2. *M. formosa*

3b. Sepals rounded at the apex, ovate-orbicular (1·25–1·75 times as long as broad), 2–2·5 mm. long; pedicels often reflexed in fruit 3. *M. picta*

4a. Sepals rounded to obtuse at apex, linear; calyx cylindrical: (Section *Spectabiles*) 5

4b. Sepals acute or acuminate, rarely obtuse and then ovate; calyx ovoid or urceolate 16

5a. 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: (Subsection *Spectabiles* Series *Laricinae*) 6

5b. 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: (Subsection *Laricifoliae*) . . . 11

6a. 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*

6b. Sepals green; styles 3; capsule 3 valved 7

7a. Habit densely pulvinate; leaves small, 2–3 mm. long, ovate-elliptical; flowers solitary; sepals ovate, 3–5 mm. long 5. *M. trautvetteriana*

7b. Not forming cushions, more or less caespitose plants . . 8

8a. Petals equalling or scarcely exceeding the calyx; entire plant softly lanuginose . . . . . 6. *M. inamoena*

8b. Petals 1·5 to 2·5 times as long as the calyx 9

9a. Nerves of the leaves and sepals obscure; leaves obtuse, 3–7 mm. long; stems woody at the base 7. *M. brotherana* (*M. ruprechtiana* sec. Grossheim)

9b. Leaves with 1–3 nerves; sepals 3–nerved; stems not woody. 10

10a. Leaves shiny, with projecting nerves; capsule conical expanded at the base; petals 1·5 times as long as calyx . 8. *M. colchica*

10b. Leaves not shiny with a ± clear single nerve; capsule cylindrico-conical, with an unexpanded base; petals twice as long as calyx 9. *M. imbricata*

11a. 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 toward the apex: (Series *Caucasicae*) 12

11b. Leaves of sterile shoots ± fasciculate, never rosulate to spreading, linear-subulate or setaceous, semiterete, obscurely nerved or 1–3 nerved at the base; petals rarely pink: (Series *Laricifoliae*) . 13

12a. Leaves linear-subulate; leaf base 5–nerved, 1·0–1·5 mm. broad, glabrous or long ciliate; sepals 2·5–3·0(–4·0) mm. long; petals 5–6 mm. long . . . . . 10. *M. aizoides*

12b. Leaves narrowly linear, 3–nerved and 0·5–1·0 mm. broad at the base, margin scabrid particularly towards the base; sepals 4·25–5·25 mm. long; petals 10–13 mm. long . . . 11. *M. circassica*

13a. Leaves straight, rigid, semi-terete, with a large single nerve (not prominent); sepals 2·5–3·5 mm. long; capsule longer than calyx 14

13b. Leaves recurved, rather flaccid, ± flattened, rarely ± semi-terete and then fleshy and distinctly 3–nerved at the base; sepals 4–7·5 mm. long; capsule usually (always?) shorter than the calyx; petals white, seeds rugulose without papillae 15

14a. 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*

14b. 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*

15a. Petals about 1·5 times as long as sepals; sepals 4–5 mm. 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*

15b. Petals 1·7–2·0 times as long as sepals; sepals (4·5–)5·5–7·5 mm. long, rather densely glandular pubescent but 3 nerves always prominent throughout; leaves ± setaceous; plants caespitose with long creeping sterile shoots. . . . . 13. *M. baldaccii*

16a. Plants always perennial; sepals 3–many(5–9)–nerved with a rather narrow membranous or scarious margin; calyx not hardened at the base 17

16b. Plants perennial, sepals 1–nerved (rarely 3) with broad white scarious margins, or annual and sepals 1–3–nerved; calyx often hardened at the base (always so in perennial plants) 36

17a. Sepals 5–7(–9)–nerved 18

17b. Sepals 3–nerved 26

18a. Leaves linear-subulate or setaceous; sepals spreading at anthesis; seeds obscurely tuberculate: (Section *Plurinerviae*) . . 19

18b. Leaves lanceolate or linear-lanceolate; sepals erect or scarcely spreading at anthesis; seeds fimbriate on the dorsal ridge: (Section *Lanceolatae*) 22

19a. 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*

19b. 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) 20

20a. 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*

20b. 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 21

21a. Bracts with a broad hyaline margin; sepals usually 3–4 or 5–6 mm. long; plants frequently densely caespitose . 18. *M. juressi*

21b. Bracts without a hyaline margin or with a very narrow one; sepals often 4–5 mm. long; plants always loosely caespitose 16. *M. hirsuta*

22a. Petals longer than or rarely equalling the 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: (Series *Graminifoliae*) . . 23

22b. Petals shorter than the sepals, ovate to lanceolate, abruptly contracted at the base, clawed or sessile; stems angled, elongate, 4–20 cm. tall; bracts broader than at least the lower cauline leaves: (Series *Dianthifoliae*) 24

23a. 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–)12–40 mm. long; inflorescence 2–12 cm. tall, 1–5(–7) flowered . 20. *M. saxifraga*

23b. 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, 4–10 mm. long; inflorescence 1–2 cm. tall, 1(–4)–flowered . . . . . 21. *M. stellata*

24a. Sepals 6–12 mm. 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 25

24b. Sepals 15–20 mm. long; petals broadly ovate (< twice as long as broad), < half as long as sepals, claw prominent c. 0·5 mm. 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*

25a. Sepals linear-lanceolate (c. 5 times as long as broad), long acuminate, 8–9 mm. long, glandular-pubescent; petals oblong-lanceolate (> 3 times as long as broad), claw ± absent; leaves glabrous to ± glaucous, very narrowly triangular, cauline leaves long acute; plants densely caespitose . . . . . 23. *M. acuminata*

25b. 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*

26a. Sepals acuminate, erect at anthesis; petals obovate or oblong gradually narrowing to the base, 1·5–2 times as long as sepals rarely only slightly longer, cf. *M. gracilis*: (Section *Acutiflorae*) 27

26b. Sepals acute, spreading at anthesis; petals orbicular to ovate or triangular, abruptly contracted at the base into a claw, shorter to slightly longer than sepals: (Section *Tryphane*) . . . 35

27a. Leaves of sterile shoots spreading at anthesis (usually widely so), rather long (12–20 mm.), herbaceous flat and linear-lanceolate to hard ± terete, never subulate-setaceous (rarely leaves short, 3–10 mm., and then linear-lanceolate and rather fleshy); the median nerve of the leaves thicker than the laterals or leaves 1-nerved: (Series *Acutiflorae*) 28

27b. Leaves of sterile shoots densely fasciculate to somewhat spreading, short, 4–10 mm. long, subulate-setaceous, rarely linear. . 33

28a. Leaves 2–6(–8) mm. long, fleshy, yellowish-green, rather glaucous; plant densely caespitose 4–8(–10) cm. tall, inflorescence short, 2–5 cm. tall; sepals c. 4 mm. long . . . 27. *M. aucheriana*

28b. Leaves (5–)10–20 mm. long, flat and flaccid or rigid, or terete ± pungent, bright green, glabrous to glandular-pubescent; plants loosely tufted or forming loose spiny clumps (8–)10–25 cm. tall; inflorescence 6–20 cm. tall 29

29a. Leaves flaccid, flat; plants slender, caudiculi < 0·5 mm. diam 30

29b. Leaves rigid, flat or often terete; plants very robust, caudiculi c. 1·0 mm. diam. 31

30a. Sepals 4–4·5 mm. long; petals c. 1·5 times as long as sepals; pedicels ± erect, 8–20 mm. long . . . . 25. *M. biebersteinii*

30b. Sepals c. 3·5 mm. long; petals slightly longer than sepals; pedicels spreading widely, 15–25 mm. long . . . 26. *M. gracilis*

31a. 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 4·5–5·5 mm. long 28. *M. lineata*

31b. 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 32

32a. 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*

32b. Sterile shoots without swollen nodes, with or without open axillary fascicles at anthesis; sterile leaves fasciculate (pointing forward) ± pungent; inflorescence lax, pedicels spreading, 10–35 mm. long; plants forming rather loose tufts . . 30. *M. glandulosa*

33a. Leaves of sterile shoots usually somewhat spreading with 3 ± equal nerves, narrowly linear to subulate-setaceous; petals oblanceolate: (Series *Pichleriae*) 34

33b. Leaves of sterile shoots densely fasciculate, one-nerved or with lateral nerves present only at the base, subulate-setaceous to semi-terete; petals obovate: (Series *Umbelluliferae*) 33. *M. umbellulifera*

34a. Pedicels of first flower spreading; fascicular leaves spreading rather widely; staminal glands prominent (0·25 mm. long) forming a single narrow finger-like process with an apical nectar pit 31. *M. pichleri*

34b. 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. rimuram*

35a. Petals acute, broadest near the base (± triangular above the claw), usually shorter than the sepals; sepals often acuminate; plants laxly to densely caespitose, 3–20 cm. tall, glaucous to glandular-puberulent . . . . . 34. *M. attica*

35b. 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 . . 35. *M. verna*

36a. Plants annual; sepals 3-nerved, green except for a very narrow membranous or scarious margin (central green portion extending well beyond the lateral nerves) 37

36b. Plants usually perennial, sometimes biennial or annual; sepals 1-nerved, nerve white with two narrow green lines on either side and with broad white scarious margins (very rarely 3-nerved and then the green portion not extending beyond the lateral nerves and plant perennial): (Section *Minuartia* Subsection *Xeralsine*) . . 54

37a. Calyx not or scarcely hardened at the base; seeds small (0·25–0·70 mm. long diam.): (Section *Sabulina*) . . . 38

37b. Calyx strongly hardened at the base; seeds large (0·70–1·50 mm. long diam.): (Section *Minuartia* Subsection *Minuartia*) . 45

38a. Sepals not at all indurate, the 3 nerves ± equally prominent (rarely the laterals weak, and then sepals < 3 mm.), running to the apex (at least in outer sepals); margin of sepals narrowly membranous (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 39

38b. 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 . . 44

39a. Leaves and bracts rather fleshy; lower leaves linear-spathulate; sepals 2·5–3·5 mm. 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 (0·25–0·6 mm. long), much longer than the sepals (1·2–1·5 times as long) . . . . . 61. *M. thymifolia*

39b. Leaves and bracts linear-subulate or subulate-setaceous (rarely linear, flaccid); sepals 1·5–5·0 mm. long, ovate-lanceolate to linear-lanceolate (> twice as long as broad), acute to acuminate; petals cuneate, or if abruptly contracted with a claw usually < 0·3 mm. long, up to 1·25 times as long as sepals (very rarely longer) . 40

40a. Leaves and bracts 1-nerved (sometimes 3-nerved at the base); sepals 2–2·5 mm. 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 (10–25 mm. on lower flowers), ± spreading . . . . 63. *M. subtilis*

40b. Leaves and bracts 3-nerved; sepals strongly nerved; capsule narrowly ovoid to narrowly cylindrical (valves 2·5–5·0 times as long as broad) 41

41a. Capsule shorter than calyx; sepals 2·5–3 mm. 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*

41b. 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 1·5–5 mm. long (when < 3 mm., 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 . 42

42a. Inflorescence contracted ± fasciculate, with flowers on short stiffly erect pedicels 0·5–7·0 mm. long, the upper pedicels shorter than calyx; petals < half as long as sepals (often absent); capsule shorter than calyx; sepals 3–5 mm. long . . 66. *M. mediterranea*

42b. Inflorescence lax with flowers on long, often spreading pedicels, the lower pedicels (7–)10–20 mm. 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 < 3 mm. long 43

43a. 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, subsp. *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 < 3 mm.; inflorescence usually spreading; plant often decumbent and branching from the base . . . . . 62. *M. mesogitana*

43b. 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 > 3 mm. long (if less sepals acuminate); inflorescence ± strictly erect; plant erect or ascending . . . . . 65. *M. hybrida*

44a. Sepals 2·5–3·25 mm. 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 10–15 mm. long and only the very uppermost shorter than sepals; leaves and bracts glabrous 67. *M. regeliana*

44b. Sepals 3·25–4·0 mm. 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 10 mm.) and series of dense clusters of upper flowers (with pedicels always shorter than sepals); leaves and bracts ciliate . . . . . 68. *M. urumiensis*

45a. 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 inflorescences; seeds few to many, dark brown, obscurely tuberculate: (Series *Montanae*) 46

45b. 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: (Series *Minuartia*) 53

46a. Flowers distinctly pedicellate (pedicels > 2 mm. long); nerves of sepals and leaves plane without prominent clusters of calcium oxalate crystals (rarely with slightly prominent clusters) . . 47

46b. Flowers sessile or subsessile (pedicels < 2 mm.); nerves of the leaves and sepals with prominent clusters of calcium oxalate crystals (appearing as disc-like swellings, visible with a lens) . . 51

47a. 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) 41. *M. globulosa*

47b. 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 . 48

48a. 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 markings on any of the 'cells'; plants slender, low-growing (up to 5 cm. tall), branching from the base; stems prostrate to ascending 40. *M. sintenisii*

48b. Sepals (4·5–)5–9 mm. 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 15 cm.) or if dwarfed, little branched and the branches all ± erect . 49

49a. 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 . . 36. *M. multinervis* (cf. also 37. *M. akinfijewii*)

49b. Sepals 5·5–9·0 mm. 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 . . 50

50a. Leaves and sepals with somewhat prominent calcium oxalate crystals; calyx rather truncate at the base; sepals subgibbous; low-growing plants (up to 3 cm.) with a dense inflorescence and the facies of *M. montana* or *intermedia* . . . 39. *M. sandwithii*

50b. Leaves and sepals with no visible calcium oxalate crystals; calyx rounded at the base with sepals not enlarged; plants variable in habit (2–15 cm. tall), the lower flowers often distinct 38. *M. meyeri*

51a. Calyx rounded at the base; lower bracts almost as long as the leaves, greatly exceeding the entire inflorescence; stems short, 2–6 cm., 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), 0·65–0·80 mm. long diam. . . . . 42. *M. montana*

51b. 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 (4–25 cm. 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) . . 52

52a. 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 0·70–0·85 mm. long diam. 43. *M. intermedia*

52b. Stems pruinose-velutinous with slender hairs; sepals very finely and densely glandular-pubescent; petals short (subsp. *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 0·90–1·00 mm. long diam. (occasionally 0·70–0·85 in subsp. *damascena*) . . 44. *M. decipiens*

53a. Bracts with a broad membranous margin at the base (c. 9·5 mm. 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 1·5×1·0 mm. . . . . 45. *M. hamata*

53b. Bracts with a very narrow membranous margin (< 0·25 mm. 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. 0·9×0·6 mm. 46. *M. sclerantha*

54a. Sepals prominently 3-nerved; flowers aggregated into terminal clusters; plants perennial: (Series *Leucocephalae*) 47. *M. leucocephala*

54b. Sepals 1-nerved (or with 2 lateral nerves at the base and then flowers not clustered) 55

55a. Inflorescence, and often entire plant, clothed with rather long (0·15–0·25 mm.) 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*

55b. 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*) 56

56a. Petals very much shorter than sepals (0·25–0·60 times as long) 57

56b. Petals a little shorter to much longer than sepals (0·75–1·5 times as long) 61

57a. Plants densely caespitose; flowering stems short, 1–3 cm., inflorescence terminal with 5–12 flowers; sepals 2·5–3·5 mm. long, bluntly acute, incurved at the apex and margins 53. *M. anatolica* var. *scleranthoides*

57b. Plants tall (fl. stems 3·5–12 cm.) loosely tufted, or if shorter and ± densely caespitose, then sepals > 4 mm., acuminate; sepals not or scarcely incurved at the apex and margins 58

58a. Inflorescence few-flowered, fastigiate, axillary 'clusters' with 1–2 flowers, terminal with 2–5; sepals 3–4 mm. 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 . . . . . 51. *M. tchihatchewii*

58b. Inflorescence usually many-flowered; flowers aggregated into rather dense terminal (and sometimes axillary) clusters of 5–15 flowers; sepals short (< 3·5 mm.), acute, or long (4–6 mm.), 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 59

59a. Leaf fascicles lax with spreading ciliate or glabrous leaves; sepals 4–6 mm. 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*

59b. 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 60

60a. Sepals 2·0–3·5 mm. long, lanceolate to ovate-lanceolate, acute 57. *M. corymbulosa*

60b. Sepals 4–6 mm. long, linear-lanceolate to lanceolate, long acuminate 58. *M. leucocephaloides*

61a. 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 . 62

61b. 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 64

62a. 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) 50. *M. micrantha*

62b. Sepals 3·0–5·5 mm. long (in Orient plants always 4 mm. or more), if flowers at all clustered, sepals 4 mm. or more . . . 63

63a. Inflorescence few-flowered (< 10), very lax, lowest pedicel > 12 mm.; sepals 4·5–5·5 mm. 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 49. *M. woronowii* (cf. also 49a. *M. buschiana*)

63b. Inflorescence few to many flowered, rather congested (lowest pedicel 3–8 mm.), or if lax then sepals 3·0–3·5(–4) mm. long (cf. also key to varieties . . . . . 48. *M. setacea*

64a. Stems and leaves densely glandular-pubescent; sepals lanceolate, acuminate, with rather prominent lateral nerves; petals lanceolate, clawed, equalling or slightly exceeding the sepals 54. *M. innominata*

64b. Stems and leaves puberulent, velutinous or with short crisped hairs, only very rarely glandular-pubescent (*M. anatolica* var. *phrygia* q.v.); lateral sepal nerves often absent or indistinct, only prominent in ovate-lanceolate acute sepals; petals cuneate or if clawed, ovate longer than the sepals 65

65a. Lower leaves terete, small (1–4 mm.), at least some tightly imbricate, tetrastichous (< 2 mm. long); sepals linear-lanceolate, acuminate, > 3 mm. long, slightly longer than the petals . . . 66

65b. All non-fascicular leaves setaceous or subulate > 5 mm. long, or if shorter then plants rather densely caespitose, either with ovate-lanceolate acute sepals shorter than the petals, or with sepals < 3 mm. long 67

66a. Sepals 4–5 mm. 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*

66b. Sepals c. 3 mm. 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. . 53. *M. anatolica* var. *tetrasticha*

67a. Sepals < 3·0 mm. long 68

67b. Sepals > 3·0 mm. long 72

68a. 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 8–12 mm. long), each shoot bearing about 5–10 flowers . . . 52. *M. parvulorum*

68b. 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 hairs visible at all) 69

69a. 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*

69b. 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 70

70a. Sepals broadly acute or abruptly acuminate, ovate to ovate-lanceolate, often red-tinted; plants low-growing (< 8 cm.), densely caespitose; inflorescence glabrous or shortly glandular pubescent 55. *M. erythrosepala* var. *orientalis* (cf. also 55a. *M. granulifera*)

70b. 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) 71

71a. 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 (4–6 cm.) . . . . . 50. *M. micrantha*

71b. 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, 3–4 cm., or of medium height (7–12 cm.)
53. *M. anatolica* var. *arachnoidea*, var. *scleranthoides* & var. *polymorpha*

72a. 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*)

72b. 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 73

73a. 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 4–5·5 mm. long; petals shorter than (or sometimes about as long as) sepals 74

73b. Flowers arranged in lax cymes, or if slightly congested, plants low-growing (< 8 cm.) 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) . . . 53. *M. anatolica* var. *anatolica*, var. *arachnoidea*, var. *phrygia* & var. *polymorpha*

74a. Entire plant lanuginose, sometimes rather sparsely so, giving it a greyish-white appearance; plants rather low-growing, 4–10 cm.; inflorescence few to many-flowered 53. *M. anatolica* var. *lanuginosa*

74b. Entire plant velutinous, or occasionally inflorescence glabrous; plants rather tall, 10–20 cm.; inflorescence many-flowered (> 10) 58. *M. leucocephaloides*

Subgenus Rhodalsine (J. Gay) Graebner

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. Pl. Eur. austr.-occ. Hisp. t. 67 f. A (1852).

Type: Algeria: *Poiret*. holo. P?

Distribution: Greece: Central Greece (Piraeus etc.), Peloponnese (Aegina); Cyprus: Kyrenia; Libya: Cyrenaica; Egypt: Lower Egypt (widespread along coast). Also occurs in the Canary Islands, Portugal and throughout the West Mediterranean coasts, but absent from France, N. Italy and the Adriatic.

A perennial plant with a stout caudex, growing on coastal rocks and cliffs. Flowers March–May.

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

2. **M. formosa** (Fenzl) Mattf. in Bot. Jb. **57** Beibl. **126**, 33 (1921).

Key to Varieties

Leaves, stems and pedicels sparsely glandular-pubescent — var. *formosa*
Entire plant glabrous . . . . . — var. *glabra*

var. **formosa**

Syn.: !*Alsine formosa* Fenzl in Flora **26** (1), 403 (1843).

Type: TURKEY: MESOPOTAMIA: inter Severek et Diyarbakir (?Karacali dağ), 1841, *Kotschy* 168. holo. W (destroyed), iso. K!

Distribution: Only known from type.

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 May 1906. holo. G, iso. AAR.

Distribution (of var.): SYRIA: Latakia, Jebel Druz; LEBANON: North Lebanon (Tripoli–Homs); ?ISRAEL: Galilee (Safed–Tyre) (?S. Lebanon); JORDAN: Gilead.

An annual plant of fields and stony places very similar in habit to *M. picta* but usually more robust. Recorded between 170 and 1550 m. Flowers April–May.

M. formosa is rather unique among the non-alpine members of the genus in that it is very local in 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. Pl. 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 DC., 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., Diagn. Pl. 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). Labillardiére, 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!

Distribution: TURKEY: Pamphylia (Antalya), Amanus, ?Kurdistan, Mesopotamia; CYPRUS: Kyrenia, Famagusta, Nicosia, Larnaka, Limassol; SYRIA: Aleppo, Deir ez Zor, Hama, Homs, Damascus; ISRAEL: Galilee, Central Israel, Negev; JORDAN: Cisjordania, Moab, Edom, Eastern Desert; IRAQ: Mosul, Erbil, Kirkuk & Sulaimanya, Western Desert; IRAN: Lorestan, Tehran, Southern Zagros, Fars, Kerman & Yazd, Persian Gulf; EGYPT: Lower Egypt, Sinai. Also occurs in Afghanistan & E. Pakistan (Baluchistan).

An annual plant of fields, steppe lands and desert; recorded between sea-level and 1800 m. Flowers February–April(–May).

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 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.

4. **M. rhodocalyx** (N. Albow) Woronow in Fomin & Woronow, Opredelitel' rast. Kavk. Krima **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. 2700 m., *N. Albow* (1893). ?holo./iso. LE photo!

Distribution: U.S.S.R.: West Caucasus and northern part of West Transcaucasia—cf. Grossheim (1949). Endemic.

On limestone in alpine zone. Flowers June–July.

This species is discussed at the end of the 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!

Distribution: U.S.S.R.: Central Caucasus, West Transcaucasia and the northern part of Central Transcaucasia cf. Grossheim (1949). Endemic.

In rocky places in alpine zone. Flowers June–July.

The correct name for this plant appears to be *M. trautvetteriana* proposed by Kharadze (1938) as a new name for *Arenaria brotherana* Trautv. According to Kharadze *M. brotherana* (Trautv.) Woronow is 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. Krima **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.

Distribution: U.S.S.R.: West Caucasus, East Caucasus, Daghestan, West Transcaucasia and Koshkar dagh in Karabakh. cf. Grossheim, 1949. Endemic.

On gravelly slopes in alpine zone. Flowers June–July.

For discussion of the species see end of section.

7. **M. brotherana** (Trautv.) Woronow in Fomin & Woronow, Opredelitel' rast. Kavk. Krima **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), non *Arenaria brotherana* Trautv.
≡ *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.

Distribution: U.S.S.R.: Central Caucasus and northern part of Central Transcaucasia cf. Grossheim (1949). Endemic.

In stony places in alpine zone. Flowers June–July.

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. Pl. 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.

Distribution: U.S.S.R.: West Caucasus and West Transcaucasia cf. Grossheim (1949).

On rocky and stony slopes in alpine zone. Flowers June–July.

The species is discussed at the end of the section.

9. **M. imbricata** (M.B.) Woronow in Fomin & Woronow, Opredelitel' rast. Kavk. Krima **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!)

Distribution: TURKEY: Pontus, N.E. Armenia; U.S.S.R.: throughout the Caucasus and Transcaucasia except the Shekinsko Highlands, East Transcaucasia, Karabakh, Talysch etc.–cf. Grossheim (1949).

A mat-forming plant on rocky and stony slopes; recorded between 1830 and 3200 m. ("subalpine and alpine zones"). Flowers July–August ("June–July"–Grossheim).

The species is discussed below.

DISCUSSION—SERIES LARICINAE

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:

1a. 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*

1b. Sepals green; capsule 3 or rarely 4 valved. 2

2a. Plants forming dense cushions; stems numerous clothed from the base with densely imbricate leaves; leaves small (2–3 mm. long), concave, obtuse, ciliate on margin; flower & fruit immersed in cushion; capsule conical, swollen at the base *M. trautvetteriana*

2b. Plants not forming dense cushions, ± densely caespitose . . 3

3a. 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*

3b. 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

4a. 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*)

4b. 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

5a. 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*

5b. Leaves shining with projecting nerves, lanceolate, long-lanceolate or ovate-lanceolate, acute, shortly ciliate; sepals ovate or oblong-spathulate, very obtuse, broadly scarious; flowers infundbular; 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.

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!

Distribution: Turkey: Pontus, Cappadocia (Hasan dağ, Erciyas dağ), N.E. Armenia, Kurdistan; U.S.S.R.: Georgia, Armenia. Endemic.

A ± prostrate turf-forming plant with erect flowering shoots. Recorded from (1830–)2200–3200 m. Flowers June–August.

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. Kavk. Krima (Keys Pl. Cauc. Crim.) **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.Bieb. (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. 1. c. (1842).
Als. pinifolia δ pumila Fenzl in Ledeb. 1. c. (1842).
(!)"*Ar. caucasica*" Adams ex Fenzl in Ledeb. 1. 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**, 237 (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. Kavk. Krima **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. (2440 m.), *Alboff* (1893) 298. holo. G?, iso. LE?, TGM?

Distribution: TURKEY: Pontus (widespread); U.S.S.R.: Daghestan, Georgia, Armenia. Endemic.

Similar in habit to *M. aizoides* but rather more tufted. Recorded from 1980–3800 m. Flowers July–August.

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 the name 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

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. böhn. Ges. Wiss. **5**, 31 (1890) ("*Skorpili*").

Als. bauhinorum sec. Velen. in S.B. böhn. 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!

Distribution: GREECE: Epirus (Katara ridge), Macedonia, Thrace; TURKEY: Mysia (type). Also occurs in Bulgaria and Yugoslav Macedonia.

Rather dense tufted or almost turf- or cushion-forming plant; leaves often rather flaccid. Recorded between 600 and 1800 m., on serpentine and mica schist. Flowers June–July.

13. **M. baldaccii** (Hal.) Mattf. in Aschers & Graebn., Syn. Mitt.-Eur. Fl. **5** (1), 940 (1919).

Key to Subspecies

1a. Sepals 4·5–5·0 mm. long; flowers solitary or in pairs; low growing, rather densely caespitose plants, 4–10 cm. tall; leaves short 4–10 mm., semi-terete, rather fleshy, sometimes falcate; turions short, with leaves rather densely crowded; petals obovate, 2–2·5 times as long as broad . . . . (Albania) (subsp. *doerfleri*)

1b. Sepals 5·0–7·5 mm. long; inflorescence (1–)2–10-flowered; plant forming a loose mat with erect stems, 7–20 cm. tall . . . 2

2a. Petals obovate, 2–2·5 times as long as broad; leaves rather rigid setaceous (4–15 mm. long), densely clustered on the ± erect turions; sepals 5·0–6·0 mm. long (N. Albania) . (subsp. *skutariensis*)

2b. Petals oblanceolate, 3–4 times as long as broad; leaves flat flaccid, (5–)10–20 mm. long; turions long, creeping with spreading to falcate leaves loosely arranged; sepals 5·5–7·5 mm. long subsp. *baldaccii*

subsp. **baldaccii**

Syn.: *Alsine liniflora* sec. Baldacci in Nuovo G. bot. ital. ser. 2, **6**, 34 (1899), non L.
≡ *Als. baldaccii* Halácsy, Consp. Fl. Graec. **1**, 237 (1901).

Type: GREECE: EPIRUS: in reg. abiet. m. Smolika supra Paleoseli, distr. Konitza, 19 Jul. 1896, *Baldacci* Iter Albanicum Quartum 223. holo. W-H!, iso. K!, WU!

Distribution: GREECE: Epirus (Mt. Smolika). Also occurs in Albania.

subsp. **skutariensis** Hayek, Prodr. Fl. Balc. **1**, 193 (1924) (= Feddes Rep. Beih. **30** (1)).

Syn.: ≡ *Als. liniflora* var. *glandulosissima* Hayek in Denkschr. Akad. Wiss. Wien **94**, 135 (1918).

Type: ALBANIA: Nord-Albanien: Umgebung von Shkodra. Auf dem Grossen Bardanjolt, Serpentin, 12 Juni 1916, *Erwin Janchen*. holo. WU!

Distribution: Only known from type gathering.

subsp. **doerfleri** (Hay.) Hayek, Prodr. Fl. Balc. **1**, 193 (1924) (=Feddes Rep. Beih. **30** (1)).

Syn.: ≡*M. doerfleri* Hayek in Öst. bot. Z. **70**, 12 (1921).

Type: ALBANIA: Nord-Albanien: Distrikt Luma. Hauptgipfel des Koritnik, auf felsigen Boden, 2383 m., 6 Aug. 1918, *Döerfler* 961. holo. WU!

Distribution: Endemic to Albania.

Species is recorded from (300 m., subsp. *baldaccii*, Albania,–) 1675 m.–1980 m. (–2380 m., subsp. *dorfleri*). Flowers July–August.

The type subspecies appears to be the commonest form of the species and the only one which occurs within the area. Subsp. *doerfleri*, 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. *doerfleri* 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). Labillardière, Ic. Pl. Syr. **4**, t. 4 f. 1 (1812).

Type: LEBANON: NORTH LEBANON: in Libano, *Labillardière*. holo. FI?, iso. K!

Distribution: LEBANON: North Lebanon (Les Cedres, Hasroun, Djebel Makmel). Endemic.

A densely caespitose to pulvinate plant of mountain slopes. Flowers July–September.

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. 1400 m. 2 Aug. 1904, *Dörfler* Iter Creticum 1048. holo. B? (destroyed), iso. WU!

Distribution: GREECE: Crete (Mt. Aphendi Kavusi). Endemic.

An almost spiny, rather densely caespitose plant of stony places on the Cretan mountains; only recorded substratum – calcareous. Flowers August.

SECTION PLURINERVIAE MCNEILL

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) . . . . (subsp. *frutescens*)

1b. Leaf fascicles short often curved, leaves often falcate, rather thick; sepals with 5–7 prominent nerves running throughout . . 2

2a. Plants densely glandular hirsute throughout; seeds echinate on the dorsal ridge (Crimea) . . . . . (subsp. *hirsuta*)

2b. Plants glandular-pubescent in the inflorescence, otherwise glabrous or sparsely hairy; seeds obscurely tuberculate throughout subsp. *falcata*

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. 1. 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. 1. c. 732 (1918).
M. hirsuta subsp. *falcata* var. *denudata* sec. Mattf. in Feddes Rep. Beih. **15**, 117 (1922), non *denudata* Fenzl.

Lectotype: BULGARIA: Rhodopes prope Carlova, *Frivaldsky*. holo. W (destroyed), iso. G!

Paratype: GREECE: THESSALY: Olympus, *Aucher-Eloy*.

Distribution: GREECE: Epirus, Macedonia, Thessaly, Thrace; TURKEY: Paphlagonia, Bithynia (Ulu dağ), Phrygia (Vustahlia), Galatia, Cappadocia (Çamlibel dağ), N.E. Armenia (Bayburt, Gümüşane). Also occurs in Bulgaria, and possibly Yugoslavia and Albania.

Loosely caespitose plants with ± prostrate caudiculi, growing in stony places on mountains from 400 to 2150 m. Flowers June–July.

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 β *vestita* Fenzl in Ledeb., Fl. Ross. **1**, 347 (1842).

≡ *Alsine recurva* var. *hirsuta* (M.B.) Boiss., Fl. Orient. **1**, 675 (1867) ("β"), 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. Kozlem **8**, 263 (1910).

M. hirsuta subsp. *falcata* var. *vestita* (Fenzl) Mattf. in Bot. Jb. **57** Beibl. **126**, 30 (1921); in Feddes Rep. Beih. **15**, 119 (1922).

Type: U.S.S.R.: CRIMEA: in Tauriae, summo M. Tschatur dağ, *M. Bieberstein*. holo. LE?

Distribution: Endemic to Crimea (records from Balkans erroneous, cf. Mattfeld, 1922).

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)?

Distribution: Hungary, Romania.

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. *M. hirsuta* 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. 7).

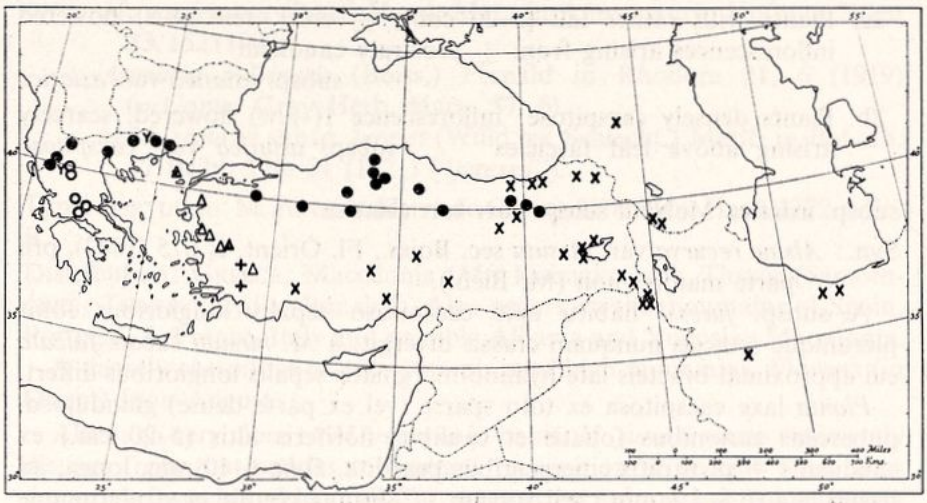

FIG. 7. Geographical distribution of the Orient representatives of *Minuartia* Section *Plurinerviae*.

● 16. *M. hirsuta* subsp. *falcata*. ○ 17. *M. eurytanica*. △ 18. *M. juressi* subsp. *asiatica*. ▲ 18. *M. juressi* subsp. *juressi*. Y 19. *M. recurva* subsp. *recurva*. × 19. *M. recurva* subsp. *oreina*. + 19. *M. recurva* subsp. *carica*.

17. **M. eurytanica** (Boiss. & Heldr.) Hand.-Mzt. in Ann. naturh. Hofmus. Wien **23**, 153 (1909).

Syn.: ≡ *Alsine eurytanica* Boiss. et Heldr. in Boiss., Diagn. Pl. 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), Heldreich Herbarium Graecum normale 607, leg. *Samaritani* et *Guicciardi*. holo. G, iso. K!, PRC!

Distribution: GREECE: Thessaly, Central Greece. Endemic.

A loosely caespitose plant with ± prostrate caudiculi, growing among rocks and recorded at 1525 and 2135 m. Flowers June–August.

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*.

18. **M. juressi** (Willd. ex Schlecht.) Lacaita in Cavanillesia **3**, 32 (1930).

Key to Subspecies and Varieties

1a. Sepals 4·5–6 mm. long; plants loosely caespitose, few (4–8) flowered, occasionally densely caespitose 1(–few) flowered; leaves flat or setaceous with a broad base, not at all fleshy (subsp. *asiatica*) . 2

1b. Sepals 3–4 mm. long; plants ± densely caespitose or sometimes pulvinate; inflorescence 1–4 flowered; leaves rather thick or fleshy, triangular or sometimes terete in section . . subsp. *juressi*

2a. Plants with rather tall (5–20 cm.), ± erect, few (4–8) flowered inflorescences arising from ± prostrate caudiculi
subsp. *asiatica* var. *asiatica*

2b. Plants densely caespitose; inflorescence 1(–few) flowered, scarcely arising above leaf fascicles subsp. *asiatica* var. *caespitosa*

subsp. **asiatica** McNeill **subsp. nov.** var. **asiatica**

Syn.: *Alsine recurva* var. *hirsuta* sec. Boiss., Fl. Orient, **1**, 675 (1867), 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 (5–20 cm.) ex caudiculis ± prostratis emergentibus praedita. *Folia* 6–10 mm. longa, ad basim lata (0·8–1·8 mm.) sed sursum ± abrupte contracta et plerumque setacea 0·2–0·3 mm. lata. *Inflorescentia* pauciflora (c. 4–8) saepe subcongesta, ± dense glanduloso-pubescenti; bracteae ovatae 5–7 nerviae late hyalino-marginatae. *Sepala* 5–6 mm. longa, lanceolata, 5–7(–9) nervia. *Petala* oblongo-ovata, cuneata, calyce paulo longiora.

Typus: TURKEY: LYDIA: Sinus Smyrnaeus, in cacumine montis Yamanlar-dagh, 900 m., 22 Mai. 1906, *J. Bornmuller* 9174. holo. E!, iso. BM!, K!

Distribution: TURKEY: Mysia (Kaz dağ), Lydia (Yamanlar dağ, Boz dağ etc.), Caria (Honaz dağ), Lycia (Katara Pass). Endemic.

A loosely caespitose plant of stony slopes on mountains. Flowers May–July.

subsp. **asiatica** 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 4–8 mm. longa, plana vel ± setacea, ad basim lata ad apicem sensim attenuata. *Sepala* 4·5–5·5 mm. longa. *Petala* calycem subaequantia.

Typus: TURKEY: MYSIA: M. Ida (Kaz dag): in jugo, 23 Jun. 1883, *Sintenis* (1883) 820 (as *Alsine pulvinaris* Boiss.). holo. K!, iso. BM!

Distribution: Only known from type.

A densely caespitose high alpine plant (derivative of var. *asiatica*?). Flowering in June.

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).
Alsine recurva subsp. *condensata* (Presl) Nyman, Consp. Fl. Eur. 119 (1878).

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: PORTUGAL: M. Juressus (Serra do Gerez), *Willdenow* Herb. 1772. holo. B.

Distribution: GREECE: Macedonia (Mt. Kaimakcalan), Thrace (Samothrace); TURKEY: Lydia (Boz dağ). Also occurs on the mountains of Spain, Portugal, S. France, Italy and possibly Albania and Yugoslav Macedonia.

A densely caespitose to pulvinate plant of high mountains. Flowers (in Orient) June–August.

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*. (fig. 7).

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 transistional 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. 7).

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 subsp. *recurva*

1b. Anthers pink or blue 2

2a. Leaves rigid, terete to ± triangular in section, obscurely nerved; petals shorter than sepals; plants very densely caespitose to densely pulvinate . . . . . subsp. *carica*

2b. Leaves usually rather soft and somewhat flattened, if ± terete then very flaccid, or if rather rigid then prominently 3-nerved; petals longer than sepals; plants caespitose, frequently densely so subsp. *oreina*

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).

Distribution: GREECE: Epirus/Thessaly (Mt. Peristeri), Thrace (Kula Dagh). Also occurs in the Alps, Transsylvania, S. Yugoslavia and Bulgaria.

Densely caespitose plants of mountain slopes. Flowers in Orient in July.

subsp. **oreina** (Mattf.) McNeill, **comb. nov.**

Syn.: ≡*M. hirsuta* subsp. *oreina* Mattf. in Bot. Jb. **57** Beibl. **126**, 30 (1921) (nomen); in Feddes 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. 2900–3100 m. 11 Aug. 1910, *Handel-Mazzetti* 2758. holo. B (destroyed), iso. WU!

Paratype: TURKEY: PONTUS: Karakaban, 1889, *Sintenis* 1576.

Distribution: TURKEY: Pontus (widespread), Pisidia (Bozburun dağ), Cilicia, Cappadocia (Hasan dağ, Erciyas dağ), Cataonia (Ahir dağ), S.W. Armenia (Munzur dağ, Keşiş dağ), Kurdistan (widespread); U.S.S.R.: Daghestan, Kabardino, Georgia, Armenia; IRAQ: Erbil; IRAN: Caspian Sea (Elburs), Northern Zagros.

A rather densely caespitose plant of stony mountain slopes from (1525–)1830–3960 m.

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 (4–8 mm.) transientes. *Folia* 1·5–8 mm. longa (4–6 mm. in typo) tereta vel

triangularia enervia (vere obscure nervata). *Caules* 1·5–6·0 cm. 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* lanceolata, 3–7 nervia; ± dense glanduloso-pubescentia. *Petala* calyce breviora. *Antherae* probabiliter caeruleae (? puniceae).

Typus: TURKEY: CARIA: Mughla: Sandras dagh, 2200 m. 23 Jul. 1947, *P. H. Davis* 13552. holo. E!, iso. K! (mixed with *Arenaria ledebouriana* var. *pauciflora*).

Distribution: TURKEY: Caria (Sandras dağ, Baba dağ). Endemic.

Pulvinate or densely pulvinate mountain plants. Flowering and fruiting July–August.

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 subspecies 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 Stan 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 provenance 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 Central 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.

Section Lanceolatae (Fenzl) Graebn.

Series Graminifoliae Mattf.

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 (2–12 cm.), 3–7–flowered (Rumelia) (subsp. *saxifraga*)
Cauline leaves linear to linear-lanceolate, all the nerves parallel; inflorescence short (2–3 cm. tall), 1–3(–4)–flowered subsp. *tmolea*

subsp. **saxifraga**

Syn.: ≡ *Arenaria saxifraga* Friv. in Flora **19** (2), 434 (1836), non (Bertol.) Fenzl (1848).
≡ *Alsine saxifraga* (Friv.) Boiss., Diagn. Pl. Orient. ser. 1, **1**, 47 (1842).
≡ *Alsine graminifolia* subsp. *saxifraga* (Friv.) Nyman, Consp. Fl. Eur. 117 (1878).
!*M. saxifraga* subsp. *rumelica* Mattf. in Bot. Jb. **57** Beibl. **126**, 31 (1921) (nomen); in Feddes Rep. Beih. **15**, 132 (1922) (diagn. in clave).

Type: Bulgaria: In Rumelia, 1835, *Frivaldszky*. holo. BP, iso. K!
Distribution (of subsp.): Confined to the Balkan Mountains of Central Bulgaria.

subsp. **tmolea** Mattf. in Bot. Jb. **57** Beibl. **126**, 31 (1921) (nomen); in Feddes 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!

Distribution (of subsp.): Only known from Boz dağ.

A densely caespitose or more or less pulvinate plant of cliffs. Flowers July–August.

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.

21. **M. stellata** (Clarke) Maire et Petitm., Étude Pl. Vasc. Grèce **4**, 48 (1908).

Key to Subspecies

Entire plant densely glandular-puberulent; leaves linear-lanceolate, the lateral nerves curved; inflorescence 1–3(–4) flowered 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. . . . . subsp. *stellata*

subsp. **pseudosaxifraga** Mattf. in Feddes Rep. Beih. **15**, 136 (1922).

Type: GREECE: EPIRUS: in rupestribus m. Papingon, Gamila, Cepelovan

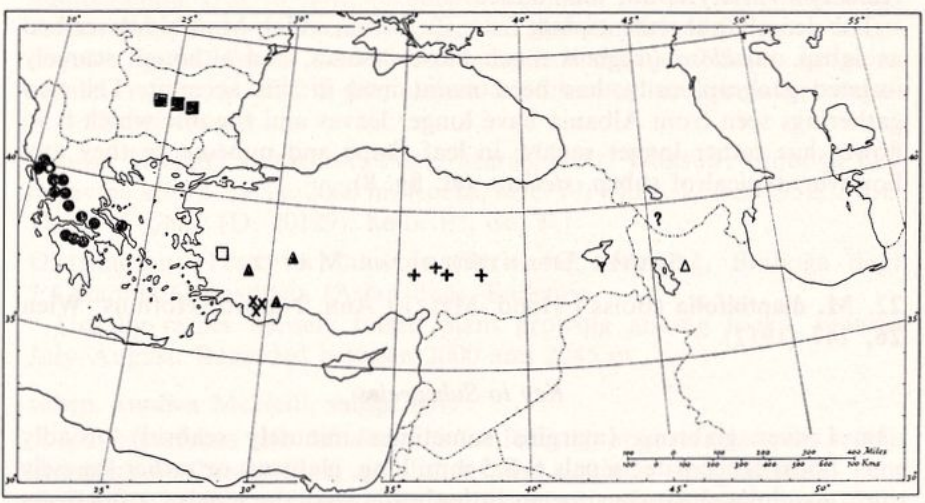

FIG. 8. Geographical distribution of the Orient representatives of *Minuartia* Section *Lanceolatae*.

■ 20. *M. saxifraga* subsp. *saxifraga*. □ 20. *M. saxifraga* subsp. *tmolea*. ○ 21. *M. stellata* subsp. *pseudosaxifraga*. ● 21. *M. stellata* subsp. *stellata*. × 22. *M. dianthifolia* subsp. *dianthifolia*. + 22. *M. dianthifolia* subsp. *cataonica*. Y 22. *M. dianthifolia* subsp. *kurdica*. ? 22. *M. dianthifolia* (record-?subsp.). △ 23. *M. acuminata*. ▲ 24. *M. pestalozzae*.

(Vradeton) distr. Zagarion 13–25 Julio 1896, *Baldacci* (Iter Albanicum (Epiroticum) Quartum) 161. holo. B (destroyed?), iso. W-H!

Distribution: Only known from type.

subsp. **stellata**

Syn.: ≡ *Cherleria stellata* Clarke, Travels, **2** (3), 211 (1816).
!*Alsine parnassica* Boiss. et Sprun. in Boiss., Diagn. Pl. Orient. ser. 1 **1**, 46 (1842).
≡ *Alsine stellata* (Clarke) Halàcsy in Denkschr. Akad. Wiss. Wien. **61**, 232 (1894).
!*Alsine stellata* var. *epirotica* Halàcsy l. c. (1894).
≡ *Arenaria stellata* (Clarke) Fernald in Rhodora **21**, 6 (1919) (= Contr. Gray Herb. Harv. **57**, 6).

Type: GREECE: M. Parnassus, [16 Dec. 1801], *Clarke*. holo. BM?

Distribution: GREECE: Epirus, Thessaly (Mt. Peristeri), Central Greece (widespread), Peloponnese (Olenos, Killini & Aroania Ori). Also occurs in S. Albania (Griba & Cikes mountains).

A pulvinate plant of rocky places between 1600 and 2400 m. Flowers July.

M. stellata is a very uniform species in the Peloponnese and Central Greece but shows some variability further north. Halàcsy 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, Halàcsy'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. 8).

SERIES DIANTHIFOLIAE MATTF.

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 6–8·5 mm. 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
subsp. *dianthifolia*

1b. Leaves ± densely glandular-pubescent; petals much shorter than the sepals (0·6–0·8 times as long) 2

2a. Sepals glabrous (glandular-pubescent at junction with pedicels), 8·5–12·0 mm. long; petals ovate-lanceolate (c. 2·5 times as long as broad), claw obscure (< 0·25 mm. long); leaves linear-lanceolate, gradually narrowed to the apex but scarcely triangular; plants loosely to rather densely caespitose . . . 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. 0·5 mm. long); leaves linear to very narrowly triangular; plants ± densely caespitose subsp. *kurdica*

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!

Distribution: TURKEY: Lycia (Bey dağ, Girdev dağ, Ak dağ etc.). Endemic.

Plant of stony places rather loosely tufted with creeping caudiculi. Flowers July—August.

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 2 mm. diam.), suberecti, foliis mortuis praedita (saepe dense). *Folia* 5–12 mm. longa et 1·0–2·5 mm. lata, linearia vel lineari-lanceolata ad apicem anguste acuta, glanduloso-pubescentia. *Caules* 5–10 cm. alti, ± sparse glanduloso-pubescentes vel subglabri, foliis 3–5–jugis praediti, inflorescentia 1–2(–3)–flora terminati. *Pedicelli* breves, 5–8 mm. longi, dense glanduloso-pubescentes. *Sepala* glabra, 8·5–12·0 mm. longa, anguste acuta. *Petala* ovato-lanceolata, latitudine c. 2·5–plo longiora, sepalis multo (1·25–2·5–plo) breviora, obscure unguiculata; unguis < 0·25 mm. longus.

Typus: TURKEY: CATAONIA: Prov. Maraş, distr. Goksun: Binboğa dağ, in ravine above Yalak, 2000 m. Rocks, rare. Fl. white. 17 Jul. 1952, *Davis, Dodds & Çetik* (D. 20129). holo. E!, iso. K!

Distribution: TURKEY: Cataonia (Berit dağ, Ak dağ, Binboğa dağ), ? Cataonia/Cappadocia (Aslan dağ). Endemic.

Usually rather densely tufted plant growing among rocks. Flowers July–August. Recorded between 2000 and 2745 m.

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 2 mm. diam., foliis mortuis dense praediti. *Folia* 6–18 mm. longa et ad basim 1·5–2 mm. lata, angustissime triangula, longe acuta, glanduloso-pubescentia. *Caules* 4–9 cm. alti sparse glanduloso-pubescentes, foliis 3–4(–5)–jugis praediti, inflorescentia 2–3(–4)–flora congesta terminati. *Pedicelli* breves, 5–7 mm. 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. 0·5 mm. longus. *Capsula* calyce c. 1·5–plo breviora.

Typus: TURKEY: KURDISTAN: Prov. Van, distr. Gevaş: Artos dağ, 8500 ft. (2590 m.). Fls. white. 14 July 1954, *Davis & O. Polunin* (D. 22716). holo. E!, iso. K!

Distribution: Only known from Artos dağ.

A rather densely caespitose plant growing in stony places. Flowers July to August.

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 (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.

23. **M. acuminata** Turrill in Kew Bull. **1929,** 225 (1929).

Type: IRAN: AZERBAIJAN: Mishou Dagh nr. Tabriz, 19 Jul. 1928, *B. Gilliat-Smith* 2374. holo. K!

Distribution: Only known from type.

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. Zbl. **33** (2), 279 (1915).

Syn.: ≡ *Alsine pestalozzae* Boiss., Diagn. Pl. Orient. ser. 1 **8**, 99 (1849).

Type: TURKEY: LYCIA: Bereket Dagh, 1846, *Pestalozza*. holo. G!

Distribution: TURKEY: Caria (Honaz dağ), Lycia (Çalbali dağ), Phrygia (Sultan dağ). Endemic.

A very striking, spiny, densely caespitose plant of rock crevices and screes. Flowers July–August.

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.

SECTION ACUTIFLORAE (FENZL) HAYEK

SERIES ACUTIFLORAE

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, Opredelitel' rast. Kavk. Krima (Keys Fl. Cauc. Crim.) **2**, 178 (1914).

Type: U.S.S.R.: OSETIA: Alagir, 21 May 1861, *Ruprecht*. holo. LE (photo!).

Distribution: West Caucasus, East Caucasus, Daghestan, West Transcaucasia and Central Transcaucasia (only in north)—Grossheim (1949). Endemic.

A rather slender caespitose plant, apparently growing under mesophytic conditions. Flowers May–June.

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, 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 in Notes Roy. bot. Gard. Edin. **23**, 512 (1961).

Type: TURKEY: PAPHLAGONIA: Prov. Kastamonu: Küre–Inebolu, 2400 ft. (730 m.). Ledges of metamorphic rocks. Fls. white. 7 June 1954, *Davis* 21616. holo. E!, iso. K!

Distribution: Only known from type.

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 possibly 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. Pl. 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!

Distribution: IRAN: Northern Zagros, Southern Zagros. Endemic. (Plants from Turkmenistan described as *Als. aucheriana* var. *glandulosa* Litw. are the basis of Schischkin's *M. litwinowii*—cf. Discussion of *M. lineata*).

A densely caespitose mountain plant. Flowers July—August.

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. 9).

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!).

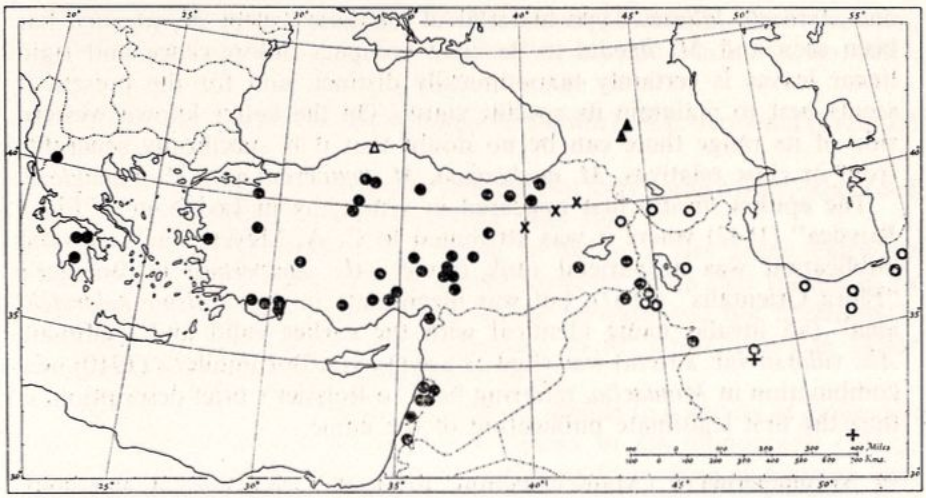

FIG. 9. Geographical distribution of the Orient representatives of *Minuartia* Section *Acutiflorae* Series *Acutiflorae*. (*M. aucheriana* extends to southern Iran and *M. lineata* to eastern Iran).

▲ 25. *M. biebersteinii*. △ 26. *M. gracilis*. + 27. *M. aucheriana*. ○ 28. *M. lineata*. ● 29. *M. juniperina*. × 30. *M. glandulosa*.

Distribution: TURKEY: N.E. Armenia (Agri dağ); U.S.S.R.: Nakhichevan; IRAQ: Erbil; IRAN: Azerbaijan, Caspian Sea (widespread), Northern Zagros, Tehran. Also recorded (not seen) from South Transcaucasia, Karabakh and Zuvana (Grossheim, 1949). Probably also 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 (1936) to *M. litwinowii*. The Crimean plants sometimes referred to *M. lineata* seem quite distinct (*M. taurica* (Stev.) Schischk.).

Robust caespitose plants of rocky mountain slopes. Recorded between 1800 and 3700 m. Flowers June–July.

M. lineata is widespread from Mt. Ararat on 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 be separated only subspecifically 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*.

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., Étude Pl. Grèce Vasc. **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 DC., 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!

Distribution: GREECE: Epirus (Vradeton), Thessaly (Kalabaka), Peloponnese (Killini, Aroania, Taiyetos); TURKEY: Pontus (Cimil, Balaban dağlari), Paphlagonia (Tossia), Bithynia (Ulu dağ), Lydia (Manisa dağ), Caria, Lycia, Cilicia (Bulgar dağ), Amanus (Akma dağ), Phrygia, Pisidia (Davros dağ), Lycaonia (Taurus), Galatia, Cappadocia (Erciyas dağ, Hasan dağ, Bakir dağ), Cataonia (widespread), S.W. Armenia (Egin), N.E. Armenia, Kurdistan; U.S.S.R.: Armenia; LEBANON: North Lebanon (widespread), Antilebanon, South Lebanon (Hermon); ISRAEL: Galilee (Nazareth); IRAQ: Mosul (Natina). Endemic (but Epirus record, "Mt. Gamila", may be within Albania).

A mountain plant forming rather spiny clumps. Altitudinal range 900–3000 m. Flowers June–July.

30. **M. glandulosa** (Boiss. et Huet.) Bornm., Symb. Fl. Anatol. in Feddes 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. (2135–2440 m.), *Huet du Pavillon* Jul. 1853. holo. G, iso. BM!, K!

Distribution: TURKEY: S. W. Armenia (Pülümür), N.E. Armenia (Erzerum etc.). Endemic.

A loosely caespitose plant with stiff but not very spiny leaves. Recorded between 1850–1900(–2440) m. Flowers June–July.

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 (1940).

DISCUSSION—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. The distribution of the species is discussed under *M. lineata* (cf. also fig. 9).

SERIES PICHLERIAE MATTF.

31. **M. pichleri** (Boiss.) Maire et Petitm., Étude Pl. Grèc. **4**, 49 (1908).

Syn.: ≡ *Alsine pichleri* Boiss., Fl. Orient. Suppl. 113 (1888).

Type: GREECE: PELOPONNESE: in fissuris rupium montis Kyllenes Peloponnesi 4000′ (1220 m.), *Pichler* Jul. 1876 (sub *Arenaria cretica*). holo. G, iso. K!

Distribution: GREECE: Peloponnese (Killini, Taiyetos). Endemic.

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) var. *rimarum*

Inflorescence (1–)3–5 flowered; petals obovate (c. twice as long as broad); leaves not or scarcely spreading, very densely glandular-pubescent var. *multiflora*

var. **rimarum**

Syn.: !*Alsine villarsii* var. *stricta* Boiss. et Heldr. in Boiss., Diagn. Pl. Orient. ser. 1, **8**, 100 (1849).
!"*Alsine heldreichiana*" Boiss., 1. 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 Jul. 1855, *Balansa*. holo. G, iso. E!, K!

Distribution: TURKEY: Isauria (Geyik dağ etc.), Cilicia (Kisil tepe), Cataonia (Bozoglan dağ, Berit dağ), S.W. Armenia (Munzur dağ, Keşiş dağ). Endemic.

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, 4–6 cm. 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 dağ above Karli Y., 2700 m. 15 July 1952, *Davis, Dodds & Çetik* (D. 19987). holo. E!, iso. K!

Distribution: Only known from type.

Densely caespitose species of rock crevices on mountains. Var. *rimarum* has more prominent slender caudiculi giving a densely matted appearance. Recorded between 2100 and 2900 m. Flowers July.

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 thought best to describe it as a variety of *M. rimarum*—var. *multiflora*.

SERIES UMBELLULIFERAE MCNEILL

33. **M. umbellulifera** (Boiss.) McNeill, **comb. nov.**
Alsine umbellulifera Boiss., Diagn. Pl. Orient. ser. 2, **5**, 61 (1856).

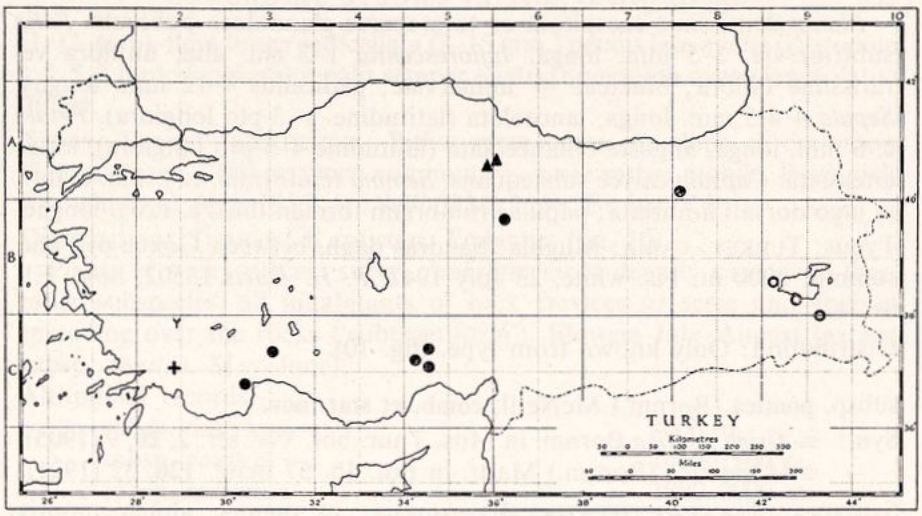

FIG. 10. Geographical distribution of the infraspecific taxa of *Minuartia umbellulifera*. + subsp. *fimbriata*. ▲ subsp. *pontica*. Y subsp. *salbacica*. ● subsp. *umbellulifera* var *umbellulifera*. ○ subsp. *umbellulifera* var. *kurdica*.

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 8–30 mm. long) 2

1b. Petals obovate, 1·5–2·5(–3·0) times as long as broad . . 3

2a. Inflorescence 1(–2)–flowered, 1–2 cm. tall; seeds fimbriate on the dorsal ridge (papillae c. 120 μ long); sepals lanceolate (> 3 times as long as broad) . . . . . subsp. *fimbriata*

2b. Inflorescence (1–)3–6–flowered, 4–11 cm. tall; seeds obscurely tuberculate throughout; sepals ovate-lanceolate (2·5–3·0 times as long as broad) . . . . . subsp. *pontica*

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 5–12 mm. long) . . 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) (subsp. *umbellulifera*) 4

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 subsp. *umbellulifera* var. *umbellulifera*

4b. Inflorescence a (1–)2–4(–6) flowered monochasium, pedicels 8–15 mm. long; petals broadly obovate (c. 1·5–2·0 times as long as broad); sepals always ovate subsp. *umbellulifera* var. *kurdica*

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, 3–5 mm. longa. *Inflorescentia* 1–2 cm. alta, uniflora vel rarissime biflora; bracteae ± uninerviae; pedicellus 7–12 mm. longus. *Sepala* 4–4·5 mm. longa, lanceolata (latitudine > 3-plo longiora). *Petala* c. 6 mm. longa, anguste oblanceolata (latitudine 4–5-plo longiora), longe attenuata. *Capsula* calyce subaequans. *Semina* reniformia, c. 1 mm. diam., in jugo dorsali fimbriata; papillae (fimbriam formantibus) c. 120 μ longae.

Typus: TURKEY: CARIA: Mughla: Sandras dagh, between Gokce ova and summit, 2000 m. Fls. white, 23 July 1947, *P. H. Davis* 13502. holo. E!, iso. K!

Distribution: Only known from type. (fig. 10).

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, 1600–1900 m., 9 Jul. 1889, *Bornmüller* 1419. 2.) Pontus Galaticus: in fissuris rupium m. Sana-dagh, 1600 m., 15 Mai. 1890, *Bornmüller* 2856. (sub *Alsine juniperina* var. *glandulosa*). holo. JE!, iso. BM!, K!

Distribution: TURKEY: Galatia. Endemic.

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, 2–5 mm. longa. *Inflorescentia* 3–5 cm. alta, uniflora vel triflora, monochasialis; bracteae subtrinerviae; pedicelli 5–12 mm. longi. *Sepala* lanceolata (latitudine c. 3·5-plo longiora). *Petala* obovata (latitudine c. 2·5-plo longiora). *Capsula* calycem excedens. *Semina* reniformia c. 1 mm. diam. in jugo dorsali echinata; papillae c. 80 μ longae.

Typus: TURKEY: CARIA: Denizli: Baba dağ, 1900–2000 m., fl. white, 23 Aug. 1950, *P. H. Davis* 18406. holo. E!, iso. K!

Distribution: Only known from type. (fig. 10).

subsp. **umbellulifera** var. **umbellulifera**

Syn.: ≡ *Alsine umbellulifera* Boiss., Diagn. Pl. Orient. ser. 2, **5**, 61 (1856).
M. heldreichiana Mattf. in Feddes Rep. Beih. **15**, 162 (1922), pro parte maiore sed typo excl., non "*heldreichiana*" Boiss. (nomen invalidum).

Type: TURKEY: CILICIA: Region alpine du Taurus au dessus de Boulgarmaaden, 18 juillet 1855, *Balansa*. holo. G, iso. K!

Distribution: TURKEY: Lycia (Çalbali dağ), Cilicia, Isauria (Dedegol dağ), Cappadocia, N.E. Armenia (Bayburt). Endemic. (fig. 10).

ubsp. **umbellulifera** var. **kurdica** McNeill, **var. nov.**

A var. *umbellulifera* inflorescentia monochasiali (nec umbellulata)

(1–)2–4(–6)–flora longe pedicellata (8–15 mm.) petalis late ovatis (latitudine c. 1·5–2·0-plo longiora) sepalis semper ovatis (numquam ovato-lanceolatis) differt.

Typus: TURKEY: KURDISTAN: Bitlis: scree on north slope of crater on Nemrut Dagh, 2600 m. Open community—scree rather mobile. Perennial. Fls. white. 12 Aug. 1956, *McNeill* 593A. holo. E!, iso. K!

Distribution: TURKEY: Kurdistan. Endemic. (fig. 10).

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*	2000 m.
subsp. *pontica*	1600–1900 m.
subsp. *salbacica*	1900–2000 m.
subsp. *umbellulifera* var. *umbellulifera*	2100–2500 m.
subsp. *umbellulifera* var. *kurdica*	2400–3200 m.

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).

SECTION TRYPHANE (FENZL) HAYEK

34. **M. attica** (Boiss. et Sprun.) Vierb. in Verh. Zool.-Bot. Ges. Wien **64**, 269 (1914).

Syn.: ≡ *Arsine attica* Boiss. et Sprun. in Boiss., Diagn. Pl. Orient. ser. 1 **5**, 84 (1844).
≡ *Als. verna* var. *acutipetala* Boiss., Fl. Orient. **1**, 676 (1867) ("β").
≡ *Als. verna* subsp. *attica* (Boiss. & Sprun.) Nyman, Consp. Fl. Eur. 119 (1878).
Als. verna var. *idaea* Halácsy, Consp. Fl. Graec. **1**, 241 (1900).
≡ *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. verna subsp. *idaea* Hayek l.c. 115 (1922).
M. idaea (Hal.) Pawlowski in Acta Soc. bot. Polon. **16**, 163 (1939).

Syntypes: GREECE: ATTICA: Mt. Parnes et Pentelicon, *Boissier*, *Spruner*. holo. G.

Distribution: GREECE: Thessaly, Central Greece, Peloponnese, Crete. Endemic (but the taxon *oxypetala* from the Carpathians may be conspecific).

Rather densely caespitose plants of mountains. Flowers May–July.

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. innominata*.

35. **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* (Halácsy) Halácsy, Consp. Fl. Graec. **1**, 241 (1900).
≡*Cherleria verna* (L.) Sampaio, Lista Herb. Portug. 81 (1912).
M. verna subsp. *ramosissima* var. *thessala* (Halácsy) Hayek in öst. bot. Z. **71**, 112 (1922).
?*M. verna* var. *thasia* Stojan. et Kitan. in Annu. Univ. Sofia Phys.-Math. **41** (3–Sci. Nat.), 291 (1945).

Type: Specimens in Herb. LINN! (?type).

Distribution: GREECE: Macedonia (Athos), ?Thessaly (not seen); TURKEY: Pontus (Şavval tepe), N.E. Armenia (N. of Bayburt); U.S.S.R.: Caucasus (cf. Grossheim, 1949). Widespread throughout North and Central Europe and across C. & E. Asia to N. America.

Orient plants low-growing and densely caespitose with weakly developed root system (? short-lived perennials). In flower, July–August.

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.

36. **M. multinervis** (Boiss.) Bornm. in Beih. bot. Zbl. **33** (2), 279 (1915).

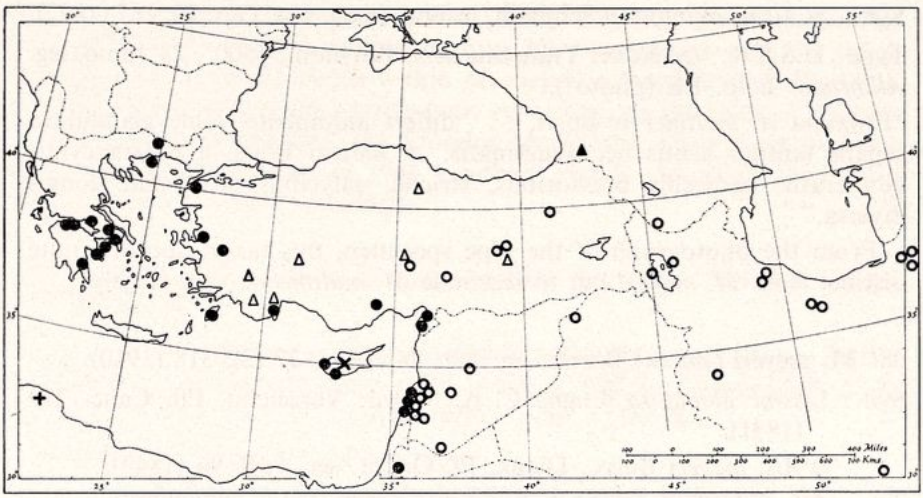

FIG. 11. Geographical distribution in the Orient of the pedicellate members of *Minuartia* Section *Minuartia* Series *Montanae*. (*M. meyeri* extends to Sinai and southern and eastern Iran),

△ 36. *M. multinervis*. ▲ 37. *M. akinfijewii*. ○ 38. *M. meyeri*. + 39. *M. sandwithii*. × 40. *M. sintenisii*. ● 41. *M. globulosa*.

Syn.: ≡*Alsine multinervis* Boiss., Fl. Orient. **1**, 683 (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!

Distribution: TURKEY: Caria (Honaz dağ), Lycia (Girdev dağ, Çalbali dağ), Phrygia (Bulgas dağ, Sultan dağ), Galatia (Sana dağ), S.W. Armenia (Hazar Gölü). Endemic.

Recorded between 900 & 2200 m., in wooded or open ground. Flowers June–August.

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. 11).

37. **M. akinfijewii** (Schmalh.) Woronow in Fomin & Woronow, Opredelitel' rast. Kavk. Krima (Keys Pl. Cauc. Crim.) **2**, 176 (1914).

Syn.: ≡ *Alsine akinfijewii* Schmalh. in Ber. dtsch. bot. Ges. **10**, 287 (1892).

Type: U.S.S.R.: GEORGIA: 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 6–10 mm. longis diversa."

From the photograph of the type specimen, this taxon appears quite distinct from *M. meyeri* but to resemble *M. multinervis* very closely.

38. **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. Pl. 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′ (1220–1525 m.) Jun.–Jul. 1836, *R. F. Hohenacker* (sub "*Alsine globulosa* C. A. Meyer") (also type of *nana* C. A. Mey.). G!, BM!, K!, LE (photo!). 2.) LEBANON: N. LEBANON: Syria, Eden. Mai–July, 1846, *Boissier*. G!

Distribution: TURKEY: Cappadocia (Erciyas dağ), Cataonia (Soff Dagh), S.W. Armenia, N.E. Armenia (Erzerum); U.S.S.R.: Armenia, Nakhichevan; SYRIA: Homs, Damascus, Jebel Druz; LEBANON: North Lebanon, Antilebanon, South Lebanon; JORDAN: Edom: IRAQ: Mosul (Jebel Sinjar); IRAN: Azerbaijan (widespread), Kordestan & Zanjan, Caspian Sea, Lorestan, Tehran, Central Desert, Eastern Khorasan, Fars, Kerman & Yazd, Baluchestan; EGYPT: Sinai. Also occurs in Turkmenia, Tadzhakistan, Afghanistan and Pakistan (Baluchistan & N.W. Province).

A robust annual, common in dry sandy places between 100 & 3100 m. Flowers April–June.

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*).

39. **M. sandwithii** Maire et Simpson in Bull. Soc. Hist. Nat. Afr.-Nord. **39**, 130 (1949).

Type: LIBYA: CYRENAICA: altiplano of Jebel Akhdar, near Maraua on flat limestone rocks on open plateau. Fls. white. c. 600 m. 3 April 1939, *N. Y. Sandwith* 2302 (= *N. D. Simpson* 39251). holo. ?, iso. K!

Distribution: Only known from type.

A very dwarf plant, in an early flowering stage in April.

Sandwith & Simpson (1941) in a preliminary note compare their plant with *M. intermedia* while Maire & Simpson l.c. (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.

40. **M. sintenisii** (Lindb.) Rech. f. in Ark. Bot. ser. 2, **1**, 420 (1951).

Syn.: !*M. meyeri* var. *cypricola* Mattf. in Feddes 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*. H. 2.) Olympus Camp Hotel, *Lindberg*. H, K! 3.) juxta rivulum M. Chionistra (in terra nuda juxta rivul. exsiccat. in decliv. m. Chionistra), *Lindberg*. H, W! 4.) in cacumine m. Chionistra, *Lindberg*. H. 5.) m. Troödos 18 Jul. 1880 & 18 Junio 1880, *Sintenis & Rigo* 760. H, G!, K!, WU! (also type of *M. meyeri* var. *cypricola*).

Distribution: CYPRUS: Limassol (Troödos Mts.). Endemic.

A low-growing ± prostrate plant of serpentine rocks; flowering June–July.

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 *Xeralsine*. It appears to be endemic to the serpentine cone of the Troödos Mountains.

41. **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. Pl. 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*). Labillardière, 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: in Libano juxta Tripolim Syriae, *Labillardière*. holo. P?; iso. K! (Herb. Webb), S! (? "Hab. in Syria dedit Billardière" sub *Arenaria hirsuta* M.B.).

Distribution: GREECE: Macedonia, Thrace, Central Greece (Attica etc.), Peloponnese (widespread), Aegean Islands (Rhodes); TURKEY: Mysia, Lydia, Lycia, Pamphylia, Cilicia, Amanus; CYPRUS: Paphos, Limassol; LEBANON: North Lebanon (widespread), South Lebanon (Saida); ISRAEL: Central Israel (Jerusalem). Also occurs on the Dalmatian coast of Yugoslavia.

A plant of rocky or stony places, recorded between sea-level and 1600 m. (Mt. Lebanon). Flowers May–July.

M. globulosa is a very distinct species, sufficiently uniform for no infraspecific 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 Dinsmore, 1932) records of it from the Syrian Desert, Hauran and the Antilebanon.

42. **M. montana** L., Sp. Pl. 90 (1753), non *Arenaria montana* L.

Key to Subspecies

Petals present, 0·7–0·9 mm. 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 50 μ diam. at the base (Western Mediterranean) (subsp. *montana*)

Petals entirely absent (the staminal glands, < 0·2 mm., 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) . subsp. *wiesneri*

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."
Type specimens: LINN!

Distribution: Eastern Spain, Algeria, Tunisia and Tripoli.

subsp. **wiesneri** (Stapf) McNeill, **comb. et stat. 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: Rudbar, 1882, *Pichler*. holo. WU!
Distribution: TURKEY: Paphlagonia, Galatia, Cataonia, S.W. Armenia, Mesopotamia; U.S.S.R.: Georgia, Armenia, Azerbaijan; IRAN: Caspian Sea, Lorestan, Northern Zagros, Fars. (fig. 12).

A plant of rocky slopes, recorded between 300 & 1500 m. Flowers May–June.

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

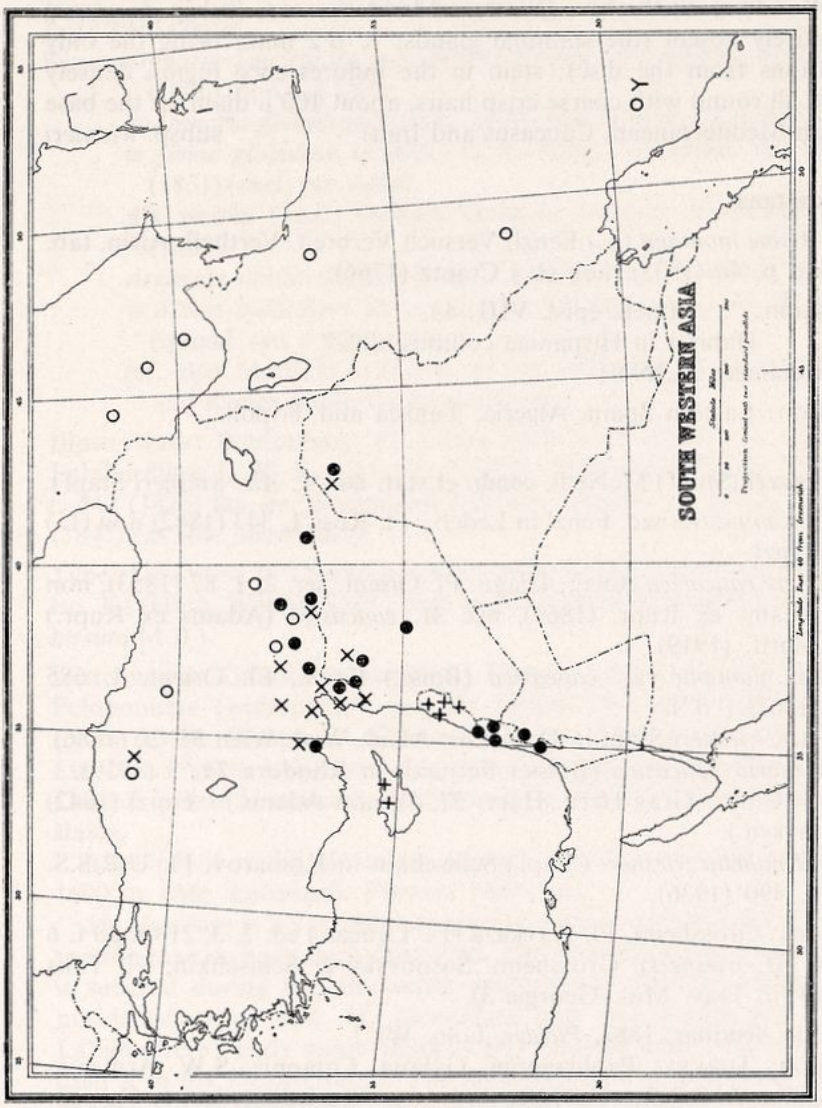

FIG. 12. Geographical distribution in the Orient of the sessile-flowered members of *Minuartia* Section *Minuartia* Series *Montanae*.

○ 42. *M. montana* subsp. *wiesneri*. × 43. *M. intermedia*. ● 44. *M. decipiens* subsp. *decipiens*. + 44. *M. decipiens* subsp. *damascena* var. *damascena*. ❚ 44. *M. decipiens* subsp. *damascena* var. *persica*.

complete absence in plants from the Orient. A further difference in stem hairiness (cf. key) is less well marked. Schischkin (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.

43. **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).

Distribution: TURKEY: Paphlagonia, Bithynia, Galatia, Cilicia, Amanus, Cataonia; U.S.S.R.: Armenia; SYRIA: Aleppo; IRAQ: Mosul (fig. 12).

A plant often of sandy and gravelly places, recorded from a number of habitats—oak scrub, cultivated fields and on mountains up to 1300 m. Flowers April–June.

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.

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*.

44. **M. decipiens** (Fenzl) Bornm. in Beih. bot. Zbl. **31** (2), 193 (1914).

Key to Subspecies and Varieties

1a. Petals prominent (2·5–4 mm.), 0·5–0·7 times as long as sepals; plants often rather tall with elongate stems (up to 25 cm.) and flower clusters then rather remote; seeds 0·90–1·00 mm. long diam. subsp. *decipiens*

1b. Petals very small (0·5–0·9 mm.), < 0·2 times as long as sepals; plants low-growing (to 8 cm.) with flowering clusters crowded together (subsp. *damascena*) 2

2a. Sepals bearing large glandular hairs (glands 65–90 μ diam.); seeds 0·70–0·85 mm. long diam. subsp. *damascena* var. *persica*

2b. Sepals with fine glandular hairs (glands up to 30 μ diam.); seeds usually 0·90–1·05 mm. long diam. (rarely 0·70–0·85 mm., Cyprus plants) . . . subsp. *damascena* var. *damascena*

subsp. **decipiens**

Syn.: ≡ *Alsine decipiens* Fenzl, Pugill. Pl. 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 as *Kotschy* 197—BM!, K!, S!).

Distribution: TURKEY: Cilicia, Amanus, Cataonia, Mesopotamia; SYRIA: Aleppo, Homs; LEBANON: North Lebanon; ISRAEL: Galilee, Central Israel; JORDAN: Cisjordania, Moab; IRAQ: Mosul (fig. 12).

subsp. **damascena** McNeill, **subsp. nov.** var. **damascena**

Syn.: *M. intermedia* sec. Mattfeld in Feddes Rep. Beih. **15**, 67 (1922) pro parte, non (Boiss.) Bornm.

A subspecie typica petala minuta (0·5–0·9 mm. 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. 0·90–1·05 mm.) sed in plantae Cypriae minora (long. diam. 0·70–0·85 mm.).

Typus: SYRIA: DAMASCUS: Antilebanon: ad radices orient., inter Katana et Assem Foka, in glareosis calcareis, ca 960 m.s.m. 13 Mai. 1933, *Gunnar Samuelsson* 4877. (sub *Minuartia decipiens*). holo. S!

Distribution: CYPRUS: Kyrenia; SYRIA: Damascus; LEBANON: North Lebanon (fig. 12).

subsp. **damascena** 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 (0·70–0·85 mm. long. diam.).

Typus: IRAN: FARS: Kiessteppe à Fusse des Kuh Saadi (near Schiras) 17 Jun. 1885, *Stapf* (sub *Alsine intermedia*). holo. K!

Distribution: Only known from type (fig. 12).

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 1200 m., in flower April–May and subsp. *damascena* between 700 and 1800 m., in flower May–June.

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.

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 dis-

tinguished 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

45. **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. Pl. 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.

Distribution: Greece: Epirus, Macedonia, Central Greece; Turkey: Paphlagonia, Caria, Lycia, Lycaonia, Galatia, Cataonia, S.W. Armenia, N.E. Armenia, Mesopotamia; U.S.S.R.: Georgia, Azerbaijan; Syria: Aleppo, Homs, Damascus; Lebanon: North Lebanon; Iraq: Mosul, Erbil, Kirkuk & Sulaimanya: Iran: Azerbaijan, Caspian Sea, Lorestan, Northern Zagros, Tehran, Eastern Khorasan, Fars. Also occurs in East and Central Spain, E. Portugal, Morocco, Algeria, Tunisia, S. Yugoslavia, Bulgaria, Crimea and Turkmenia.

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.

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 (1957 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. (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*.

46. **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 Helenendorf, 1834–35, *Hohenacker*. holo. LE (photo!).

Distribution: TURKEY: Paphlagonia, Lycaonia, Cappadocia; U.S.S.R.: Georgia, Armenia, Azerbaijan; IRAN: Azerbaijan, Caspian Sea. Also occurs in Turkmenia.

Dwarf plants growing in fine sand or clay. Recorded between 300 and 1400 m. Flowers May–June.

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.

47. **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) Jun. 1842, *Boissier*. holo. G, iso. BM!, JE!, K!

Distribution: Turkey: Caria (Honaz dağ), Lycia (Ak dağ), Pisidia (Bozburun dağ, Davros dağ), Isauria (Geyik dağ, Dedegol dağ), Cilicia. Endemic.

A tufted perennial mountain plant of screes and stony places; recorded between 1675 and 2440 m. Flowers (June–) July–August.

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 *Minuartia*. 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 being glabrous to having the usual densely hairy leaves.

Series Setaceae

48. **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) (var. *setacea*)

1b. Sepals 4·0–5·5 mm. long, linear-lanceolate; ultimate inflorescences usually congested, if entirely lax, sepals > 4·5 mm. 2

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, 20–35 cm. . . . 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. . . var. *athoa*

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: à Fontainebleu rocher du Cuvier, *Thuiller*. holo. P?

Distribution (of var.): France, C. Europe, European Russia and the Balkans south to Yugoslav Macedonia and Bulgaria.

var. **athoa** (Griseb.) Hayek, Prodr. Fl. Balc. **1**, 183 (1924) (Feddes Rep. Beih. **30**, 183); Mattfeld in Feddes 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. 4500 ft. (1370 m.). Fl. Jun., *Grisebach* (1839). holo. GOET, iso. K!

Distribution: GREECE: Macedonia (Athos, Boz dagh), Thrace (Toxotai), Thessaly (Olimbos) (fig. 13). Probably endemic, although also recorded from N.W. Romania (Siebenburgen)—Mattfeld (1922) p. 95.

Plant of stony places; flowering June–July.

var. **thracica** McNeill, **var. nov.**

A plantis omnibus aliis affinis, planta ex toto glabra (praeter caulibus inferne pruinosis) facile distinguenda.

Planta procera (20–35 cm. alta) gracilis. *Folia* subuninervia, nervis lateralibus evanescentibus. *Inflorescentia* laxe thyrsoidea; inflorescentiae partiales numerosae longe pedunculatae pauciflorae (1–5 florae). *Sepala* 4·0–5·0 mm. longa, anguste lineari-lanceolata, corollam subaequantia. *Capsula* calyce multo breviora. *Semina* c. 0·90×0·55 m., in jugo dorsali acute tuberculata.

Typus: GREECE: THRACE: Xanthie–Shahin Rd. Km. 6, rocks. 100 m. 3 July 1931, *H. G. Tedd* 730. (as *M. bosniaca*). holo. K!

Distribution: GREECE: Thrace (Toxotai, Xanthi, etc.). Endemic (fig. 13).

A plant of stony places in flower June–July.

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*

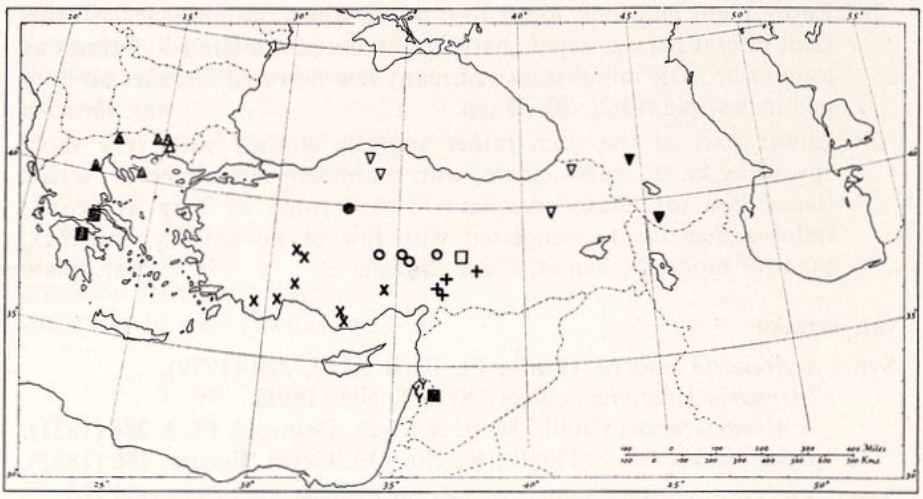

FIG. 13. Geographical distribution of the Orient representatives of *Minuartia* Section *Minuartia* Series *Setaceae*, excluding *M. anatolica* and *M. erythrosepala*.

▲ 48. *M. setacea* var. *athoa*. △ 48. *M. setacea* var. *thracica*. ▼ 49. *M. woronowii*. ▽ 50. *M. micrantha*. + 51. *M. tchihatchewii*. ■ 52. *M. parvulorum*. Y 56. *M. libanotica*. ○ 57. *M. corymbulosa* var. *corymbulosa*. □ 57. *M. corymbulosa* var. *gypsophiloides*. ● 57. *M. corymbulosa* var. *breviflora*. × 58. *M. leucocephaloides*. ■ 59. *M. confusa*.

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*.

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.

49. **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 Jun. 1917, *G. Woronow*. holo. LE (photo!).

Distribution: East Caucasus, Central Transcaucasia, Nakhichevan and Southern Karabakh—cf. Grossheim (1945, 1949). Endemic (fig. 13).

The Caucasian specimens seen, 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:

49a. **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 May 1907, *N. A. Busch.* holo. LE (photo!).

Distribution: West Caucasus, West Transcaucasia and Central Transcaucasia (in the North)—cf. Grossheim (1945, 1949).

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).

50. **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 Jun. 1911. holo. LE (photo!).

Distribution: TURKEY: Pontus (Artvin), Paphlagonia (Kastamonu), N.E. Armenia (Erzerum); U.S.S.R.: Central and South-West Transcaucasia. Endemic (fig. 13).

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*.

Although the specimens seen 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.

51. **M. tchihatchewii** (Boiss.) Hand.-Mzt. in Ann. naturh. Hofmus. Wien **26**, 148 (1912).

Syn.: ≡*Alsine tchihatchewii* Boiss. in Ann. Sci. Nat. ser. 4, **2**, 247 (1854).
Als. setacea sec. Post, Fl. Syr. Pal. ed. 1 150 (1896); ed. 2, **1**, 194 (1932), non (Thuill.) Mert. & Koch.
?*Als. setacea* var. *puberulenta* Post in Post & Autran, Plantae Postianae 7 in Bull. Herb. Boiss. **3**, 153 (1895).

Type: TURKEY: CATAONIA: Antitaurus in Cataonia meridionali, *Tchihatchew.* holo. G!

Distribution: TURKEY: Amanus, Cataonia. Endemic (fig. 13).

In stony places on mountains; recorded between 600 and 2135 m. Flowers July–August.

M. tchihatchewii 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.

Post's (1896, 1932) record of *Alsine setacea* from Ziyarat Dagh refers to this species and as *M. tchihatchewii* is usually puberulent it is probable that his var. *puberulenta* does also. The type is:- Gaiour Dagh (Amanus), 1500 m., *Post.* holo. BEI.

52. **M. parvulorum** Rech. f. in Ark. Bot. **1**, 508 (1951).

Syn.: *M. antilibanotica* McNeill in Notes Roy. bot. Gard. Edin. **23**, 513 (1961).

Type: LEBANON: ANTILEBANON: (?Syria: Damascus) dans les rochers de Maaloula, N.O. de Damas, *Mouterde* 24. holo. S!

Distribution: LEBANON: Antilebanon (type and Sahel above Nebk). Endemic.

This species is probably the most distinctive in the whole series. Its closest affinities are difficult to determine; it is certainly far removed, taxonomically, from *M. libanotica* and *M. innominata*, the geographically neighbouring species. The hairiness of the lower part of the stem of *M. parvulorum* is more silky than that usually met with in *M. anatolica* but there is possibly some relationship with the var. *arachnoidea* from Central Anatolia. In its calyx structure *M. parvulorum* resembles Central European specimens of *M. setacea* more than any Orient species.

In the original description based only on Mouterde's fragmentary specimen, Rechinger related the species to *M. aucheriana* and *M. rimarum* in Section *Acutiflorae*. However the copious material collected by Davis (and erroneously published by me as a new species, *M. antilibanotica*, in 1961) shows without doubt that *M. parvulorum* should be included in Section *Minuartia* Series *Setaceae* (cf. McNeill, 1962a).

53. **M. anatolica** (Boiss.) Woronow in Woronow & Schelkownikow, Sched. Herb. Fl. Cauc. **4**, 92 (1914); Graebner in Ascherson & Graebn., Syn. Mitt.-Eur. Fl. **5** (1), 717 (1918).

Key to Varieties

1a. Lower part of plant clothed with long white crisped or silky hairs, the leaf fascicles often appearing arachnoid 2

1b. Lower part of plant glabrous, puberulent or velutinous, without white crisped or silky hairs; fascicular leaves ciliate but not arachnoid 4

2a. Flowers aggregated into terminal clusters; entire plant lanuginose giving it a greyish-white appearance; sepals 4·0–5·5 mm. long; plants rather low-growing 4–10(–14) cm. . . . . var. *lanuginosa*

2b. Flowers in lax cymes; hairs on lower part of plant either sparse, or crisped and not silky; upper part of plant glandular-puberulent to glabrous; plants of medium height to tall, 10–20 cm. 3

3a. Sepals 2·5–4·0 mm. long, ovate-lanceolate to lanceolate, broadly acute to abruptly acuminate . . . . var. *arachnoidea*

3b. Sepals 4·0–5·5 mm. long, linear-lanceolate, narrowly acute to long acuminate . . . . . var. *anatolica*

4a. Plants very densely caespitose, 3–4(–5) cm. tall; sepals 2·0–3·0 mm. long, bluntly acute, incurved at the apex and margins var. *scleranthoides*

4b. Plants loosely tufted, 8–25 cm. tall; sepals 3·0–5·5 mm. long, narrowly acute to acuminate, not incurved at the apex or margins . 5

5a. Lower part of plant bearing at least some tightly imbricate, ± terete, tetrastichous leaves (< 2 mm. long); basal leaves (excl. fascicular leaves) all short < 5 mm.; flowers arranged in terminal and subterminal clusters; petals oblong, long cuneate at base; entire plant rather densely velutinous . . var. *tetrasticha*

5b. All non-fascicular leaves setaceous or subulate, > 5 mm. long; inflorescence usually lax, rarely a little congested and then petals ovate, abruptly contracted at base 6

6a. Entire plant densely glandular-pubescent . var. *phrygia*

6b. Indumentum various, usually sparsely puberulent, only glandular in the inflorescence region 7

7a. Sepals 4·0–5·5 mm. long, usually glabrous . var. *anatolica*

7b. Sepals 3·0–4·0 mm. long, often finely puberulent var. *polymorpha*

var. **anatolica**

Syn.: ≡*Alsine anatolica* Boiss., Diagn. Pl. 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. **87**, 6).

Lectotype: TURKEY: CARIA: Cadmus supra Denisleh, Jun. 1842, *Boissier*. lecto. G!

Paratypes: TURKEY: 1.) BITHYNIA: Bolu, 1846, *Pestalozza* (G!); 2.) BITHYNIA: Mt. Olympus, *Aucher-Eloy* 576 (G!); 3.) MYSIA: Mt. Gargarus, *Aucher-Eloy* 577 (G!); 4.) LYDIA: Mt. Sipylos, July 1842, *Boissier* (G!); 5.) LYDIA: Tmolus supra Philadelphiam, June 1842, *Boissier* (BM!, G!, K!).

Distribution: TURKEY: Bithynia, Mysia, Lydia, Caria, Lycia. Endemic.
A plant of the coastal mountains of Western Anatolia, flowering June–July.

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 4·5–5·5 mm. longis) lanceolatis (nec lineari-lanceolatis) divergit; a var. *lanuginosa* planta superne glanduloso-pubescens vel puberula vel interdum glabra (nec ex toto dense lanuginosa) floribus non glomeratis facile distinguenda.

Planta 10–20 cm. 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* 2·5–4·5 mm. 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, 0·8–1·0 mm. longa × 0·6–0·8 mm. lata, obscure tuberculata epapillosa.
Typus: TURKEY: LYCAONIA: Prov. Konya: Cihanbeyli. Steppe. 7 June 1952. *Davis & Dodds* (D. 18624). holo. E!, iso. K!

Distribution: TURKEY: Lycia, Phrygia, Lycaonia, Galatia, Cappadocia. Endemic.

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*.

var. **lanuginosa** McNeill, **var. nov.**

A varietatibus omnibus aliis *M. anatolicae* planta ex toto lanuginosa differt; a var. *arachnoidea*, affini, floribus aggregatis sepala 4·5–5·5 mm. 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, 4·0–5·5 mm. longa. *Petala* ovata, abrupte contracta, sepalis paulo breviora. *Stamina* fertilia 2·5–3 mm. longa; sterilia 1–1·5 mm. longa; antherae 0·6 mm. 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. 1400 m. Crystalline limestone ravine. Perennial, on rock outcrops. Flowers white. Erect. 6 June 1957, *Davis & Hedge* (D. 29132). holo. E!, iso. K.

Distribution: TURKEY: S.W. Armenia (type), Cappadocia (Çamlibel dağ). Endemic.

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; probabiliter propinquior plantae var. *polymorphae* sed inflorescentia contracta (et foliis tetrastichis) differt.

Planta aliquantum humilis 5–15 cm. alta, laxe caespitosa, ex toto velutina. *Folia* caulina inferiora brevissima (< 5 mm.), nonnulla crassulosa dense imbricata tetrasticha (< 2 mm.). *Flores* in corymbulis terminalis paucifloris (4–10) aggregati. *Sepala* 3·5–4·5 mm. longa, lineari-lanceolata, longe acuminata. *Petala* oblonga sepalis breviora. *Stamina* sterilia. *Capsula* ignota.

Typus: TURKEY: CAPPADOCIA: ad Siwas (Vilayet Siwas) c. 1300–1400 m.

Apr. 1893, *J. Bornmüller* 3289. holo. WU!, iso. JE!, K!

Distribution: Only known from type.

var. **scleranthoides** (Boiss. & Noë) McNeill, **comb.** et **stat. nov.**

Syn.: ≡ *Alsine scleranthoides* Boiss. et Noë in Boiss., Diagn. Pl. 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. 1. c. 1867), *Noë* 953. holo. G!

Distribution: TURKEY: Cappadocia, ? S.W. Armenia (Chama). Endemic.

Very dwarf caespitose plants, with the habit of *M. erythrosepala* (but with the floral structure of *M. anatolica*). Davis has collected plants from a dry gypsaceous hillside and the variety appears to flower from June–July.

var. **phrygia** (Bornm.) McNeill, **comb.** et **stat. nov.** (*M. anatolica* var. *phrygia* (Bornm.) Mattf. in Feddes 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) 1100 m. 8 Jun. 1899, *J. Bornmüller* 4195. holo. JE! iso. E!, K!, WU!

var. **polymorpha** McNeill, **var. nov.**

Syn.: *M. erythrosepala* subsp. *cappadocica* (Boiss.) sec. Bornm., Symbolae Fl. Anatol. in Feddes Rep. Beih. **89**, 247 (1940), non *cappadocica* Boiss.

Affinis var. *anatolicae* et var. *arachnoideae* sed ab hac sepalis brevioribus (3·0–4·0 mm. longis) et ab illa planta glabra puberula vel velutinosa nec villosa differt.

Planta 5–15 cm. 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, 3·0–4·0 mm. 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 July 1949, *P. H. Davis* 15575. holo. E!, iso. K!

Distribution: GREECE: Macedonia, Thrace, Aegean Islands; TURKEY: Pontus, Bithynia, Mysia, Caria, Lycia, Pamphylia, Cilicia, Galatia, Cappadocia, S.W. Armenia, N.E. Armenia, Kurdistan; U.S.S.R.: Georgia? Endemic.

A very heterogeneous assemblage of mountain plants (coastal in the west of its range). Recorded between 300 and 2600 m. Flowers (May–) June–August.

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).

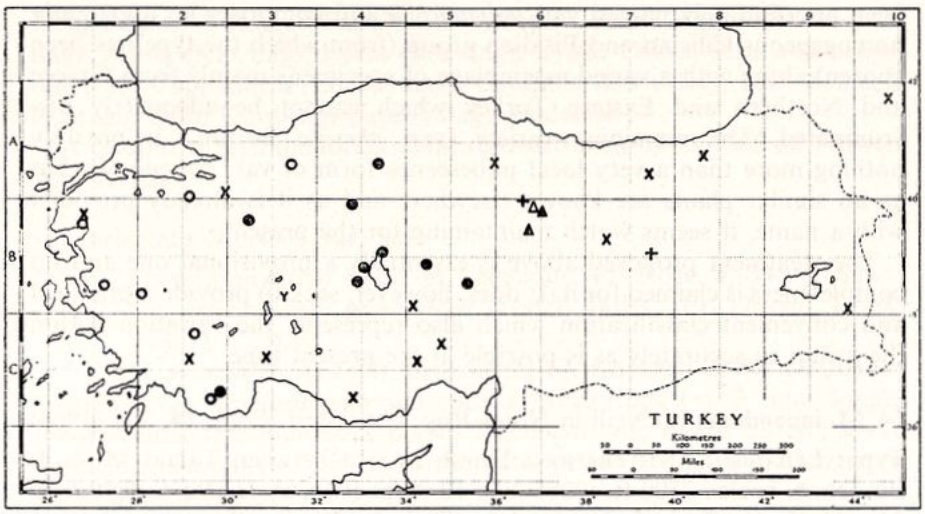

FIG. 14. Geographical distribution in Turkey of the infraspecific taxa of *Minuartia anatolica*.

○ var. *anatolica*. ● var. *arachnoidea*. + var. *lanuginosa*. △ var. *tetrasticha*. ▲ var. *scleranthoides*. Y var. *phrygia*. × var. *polymorpha*.

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*) (cf. fig. 13 & 14). 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.

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.

54. **M. innominata** McNeill in Notes Roy. bot. Gard. Edin. **24,** 237 (1963)

Type: LEBANON: ANTILEBANON: Hursh Imarra between Talaat Musa & Bir Jebab, rocks, 7500 ft. (2286 m.), 12 Aug. 1945, *P. H. Davis* 9770 (sub *M. parvulorum* Rech. f. det. J. McNeill). holo. E!, iso. K!

Although this new species is related to *M. anatolica* and *M. erythrosepala*, it shows, at least in the fruiting stage, a strong resemblance to *M. verna* (Section *Tryphane*) and to species of Section *Acutiflorae*. This resemblance is probably superficial but further collections of the species (including flowering specimens) are needed to establish its affinities more precisely (cf. McNeill, 1962a).

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) . . . . . 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 . 2

2a. Sepals < 3 mm. long, in lax rather many-flowered inflorescences (5–)19–25; petals occasionally shorter than sepals var. *orientalis*

2b. Sepals > 3 mm. long, rarely less; inflorescence, usually few-flowered and always so if sepals < 3·5 mm. long; petals always longer than sepals . . . . . var. *erythrosepala*

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 & Halàcsy 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*. G!; 2.) BITHYNIA: in cacumine Olympi, Aug. 1842, *Boissier*. G!, E!, JE!, K!

Distribution: TURKEY: Paphlagonia (Buyuk Ilkaz dağ), Bithynia (Ulu dağ), Mysia (Kaz dağ), Lydia (Boz dağ), Lycia, Cilicia, Pisidia (Dedegol dağ etc.), Cappadocia (Erciyas dağ), Cataonia (Berit dağ), N.E. Armenia (Karagol dağ), Kurdistan (Ispiriz dağ). Endemic.

A caespitose high mountain plant recorded from 1800–3500 m. Flowers July–August.

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) ("ζ").
?*M. granulifera* (Fenzl) Grossheim, Fl. Kavkaza **2**, 391 (1930).

Affinis var. *erythrosepala* sed sepalis brevioribus (< 3 mm. 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 (4–12 cm.) 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, 3000 m. Perennial. 2 Sept. 1956, *McNeill* 772. holo. E!, iso. K!

Distribution: TURKEY: Cataonia, S.W. Armenia, N.E. Armenia. Endemic.

High mountain plants recorded between 2700 & 3000 m.; flowering June–July.

var. **cappadocica** (Boiss.) McNeill, **comb. nov.**

Syn.: !*Alsine cappadocica* Boiss., Diagn. Pl. 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 Feddes Rep. Beih. **89**, 247 (1940), quoad basionom. nec spec. cit.

Type: TURKEY: CATAONIA?: Cappadocia ad Euphratem, *Aucher-Eloy* 587. holo. G!

Distribution: TURKEY: Cilicia, Galatia, Cataonia, S.W. Armenia. Endemic.

A rather caespitose plant but with a relatively tall flowering stem. Grows at lower altitudes than var. *erythrosepala*; flowers June–July.

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 farther 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 farther 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 here (notably the dwarf plant collected by Davis and Hedge on Munzur Dağ) may prove to merit separate taxonomic recognition.

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) ("ζ").

Type: U.S.S.R.: (GEORGIA?): Transcaucus. 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 Jul. 1902, *Woronow.* holo. LE (photo!).

Distribution: U.S.S.R.: 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, Apr. 1846, *Boissier*. holo. G., iso. K!

Distribution: LEBANON: North Lebanon. Endemic.

A high mountain plant of gravel summits and slopes (2075–3050 m.). Flowers June–August(–September).

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 in Notes Roy. bot. Gard. Edin. **24**, 149 (1962).

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) subspherical clusters terminating the main stem and long axillary branches; petals about as long as the sepals; plants tall, c. 25 cm.; sepals ovate-lanceolate, acute . . . . . 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 2

2a. Sepals broadly ovate, bluntly acute; petals exceeding the sepals var. *breviflora*

2b. Sepals lanceolate, narrowly acute; petals shorter than sepals var. *corymbulosa*

var. **corymbulosa**

Syn.: ≡ *Alsine corymbulosa* Boiss. et Balansa in Boiss., Diagn. Pl. Orient. ser. 2, **6**, 36 (1859), non Barrelier (1859) nom. provis.
≡ *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!

Distribution: TURKEY: Cappadocia (Gulşehir to Kayseri). Endemic.

var. **gypsophiloides** McNeill, **var. nov.**

A varietatibus aliis *M. corymbulosae* planta procera (c. 25 cm.) ex toto glabriuscula inflorescentiis partialibus paucifloris subcapitatis facile distinguenda; a var. *corymbulosa* solum, petalis longioris etiam differt.

Planta procera c. 25 cm. 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 (4–12 cm.), foliati, inflorescentia partiali terminati. *Inflorescentiae* partiales sub-

globosae, minute puberulae, flores 3–10 dense aggregatos gerentes; bracteae triangulares, 1·25–1·75 mm. longae, late membranaceo-marginatae. *Sepala* 2·5–3·0 mm. longa, ovato-lanceolata, petala subaequantia. *Stamina* 1·5–2·0 mm. longa, fertilia; antherae 0·45–0·50 mm. longae. *Capsula* calyci subaequilonga. *Semina* 3–4, 0·9–1·0 mm. longa × 0·5–0·6 mm. lata, in jugo dorsali acute tuberculata.

Typus: TURKEY: CATAONIA: Prov. Malatya: Gürün–Malatya, c. 65 km. from Malatya, c. 1400 m. Rocky slope. Perennial. Fls. white. 7 Aug. 1956, *McNeill* 443. holo. E!, iso. K!

Distribution: Only known from type.

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!

Distribution: Only known from type.

A species of dry stony places, recorded between 450 and 1400 m. and flowering July–August.

M. corymbulosa is relatively easily distinguishable by its small flowers aggregated into more or less discrete 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*)

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), 1100 m., 18 Jun. 1899, *J. Bornmüller* 4193 (sub "*Alsine corymbulosa* B. et Bal. *β velutina* Bornm."). lecto. E!, K!, WU!

Paratype: TURKEY: PHRYGIA: Sultandagh above Tschai (Çay), 1700 m., *Bornmüller* 4194 (not seen).

Distribution: TURKEY: Caria?, Lycia, Cilicia, Isauria. Endemic.

A mountain plant of stony pasture. Recorded between 1100 and 1900 m. Flowers June–August.

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.

59. **M. confusa** (Boiss.) Maire et Petitm, Étude Pl. Vasc. Grèce in Mat. Étude 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. Pl. 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. Pl. 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*. G., K! (*Heldreich* only).

Distribution: GREECE: Central Greece (Parnasos), Peloponnese (Killini Oros). Endemic.

A rather densely caespitose plant of high alpine localities on the Parnassos and Killini mountains (1525–2375 m.). Flowers June–August.

Despite its name, *M. confusa* is a very well-marked species with a 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.

DISCUSSION—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*, *M. innominata* and *M. parvulorum* as well as *M. adenotricha* in the Crimea and *M. krascheninnikovii* 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 accepted 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 (1936) pp. 484–485:-

15a. Sepals glabrous 16
15b. Sepals very shortly glandular-pubescent 20
16a. Seeds sharply tuberculate on the circumference . . .17
16b. Seeds smooth or with very fine obtuse tubercles . . .18
17a. Plants 5–8 cm. tall; calyx 4–5 mm. long (Caucasus) *M. buschiana*
17b. Plants 10–25 cm. tall; calyx 3·5–4 mm. long (Pri-Ural) *M. krascheninnikowia*
18a. Calyx 2·5–3·5 mm. long 19
18b. Calyx 4–5·5 mm. long (Caucasus) . . . *M. woronowii*
19a. Sepals 3–3·5 mm. long; plant loosely caespitose (European Russia) *M. setacea*
19b. Calyx 2–2·5 mm. long; plant densely caespitose (Caucasus) *M. micrantha*
20a. Calyx 2·5–3 mm. long, with 3 small nerves (South Transcaucasia) *M. granulifera*
20b. Calyx 4–5 mm. long 21
21a. Flowers closely aggregated into rather dense corymbose inflorescences. Sepals with one nerve. Plant densely caespitose (Crimea) *M. adenotricha*
21b. Flowers in loose cymes. Sepals with 3 nerves at the base. Plant loosely caespitose (Abkhasia) . . . *M. abchasica*

Grossheim (1949) p. 540:-

10a. Sepals with 1 nerve, with 2 white stripes on the back, hardened at the base 11
10b. Sepals with 3– many nerves 14
11a. Sepals shortly glandular-pubescent with 3 nerves at the base, and only 1 above; inflorescence lax; height 10–15 cm.; habit loosely caespitose. Fls. V-VII. Abkhasia. In alpine zone. On limestone. Endemic . . . . . *M. abchasica* B. Schischk.
11b. Sepals glabrous 12
12a. Calyx 2–2·5 mm. long; inflorescence 3–5-flowered; height 6–20 cm.; habit densely caespitose. Fls. V-VI. Central and South-west Trans-

caucasia. In middle mountain zone. In stony and gravelly places. Endemic . . . . . *M. micrantha* B. Schischk.

12b. Calyx 4–5 mm. long. Plants of other regions 13

13a. Plants of the western half of Greater Caucasia, usually high mountain; seeds sharply tuberculate on the circumference; height 6–8 cm.; 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.

13b. Plants of the eastern Caucasus, south and east Transcaucasia, usually of the middle zone; seeds smooth; height 8–25 cm., habit densely caespitose. Fls. VI-VII. East Caucasus, Central Transcaucasia, Nakhichevan, South Karabakh. In middle mountain zone. In gravelly places . . . . *M. woronowii* B. Schischk.

14a. Sepals with 4–11 nerves 15

14b. Sepals with 3 nerves 16

15a. *M. dianthifolia* (Section *Lanceolatae*) & *M. oreina* (Section *Plurinerviae*)

16a. Sepals hardened at the base, shortly glandular-pubescent, 2·5–3·5 mm. long; height 5–15 cm.; habit densely caespitose. Fls. VI-VII. South-west Transcaucasia. In middle mountain zone. On dry slopes. Rare . . . . . *M. granulifera* (Fenzl) Grossh.

16b. Sepals not hardened at the base 17

17a. 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 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 5·0–6·5 mm. long; inflorescence rather dense (pedicels 0·5–4 mm. long), many-flowered (terminal clusters with 15–50 flowers); plants usually annual or biennial 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

3·0–5·5 mm. long; inflorescence often lax (pedicels 1·0–10·0 mm. long), rather few-flowered (terminal clusters with 5–25 flowers); plants perennial . . . . . subsp. *macedonica*

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 Feddes Rep. Beih. **15**, 83 (1922).

Type: U.S.S.R.: CRIMEA: in Tauria, ?*M. Bieberstein.* holo. LE., iso. B (Herb. Willdenow, fide Mattfeld).

Distribution: GREECE: Macedonia; TURKEY: Thracia (Dardanelles); U.S.S.R.: "Caucasus". Also occurs in Crimea, Ukraine, Hungary and Eastern Balkans.

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 Feddes Rep. Beih. **15**, 85 (1922).

Type: YUGOSLAVIA/GREECE: MACEDONIA: Macedon. centr. In rupibus pr. Allchar 30 Jun. 1893 (nr. border–M. Kozjak), *Dörfler* 107. holo. WU!, iso JE!

Distribution: GREECE: Macedonia (widespread), Thrace (Bodona). Also occurs in Yugoslav Macedonia, Bulgaria and Romania (Dobrudscha).

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 915 m. (no data for subsp. *glomerata*). Both subsp. apparently flowering May–July.

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, *M. glomerata* 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. The record of subsp. *glomerata* from the Caucasus is doubtful and may represent a confusion in labelling.

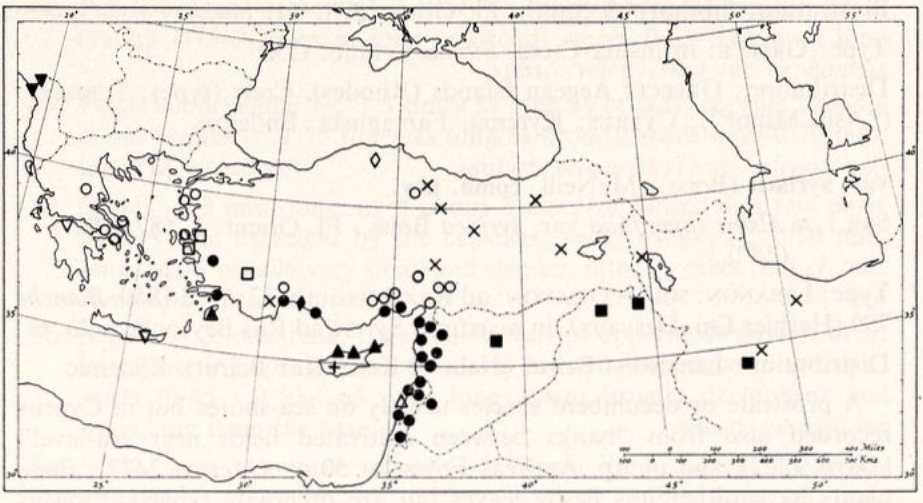

FIG. 15. Geographical distribution in the Orient of *Minuartia thymifolia*, *M. mesogitana*, *M. subtilis* and *M. viscosa* (Section *Sabulina*), including their constituent taxa.

▲ 61. *M. thymifolia* var. *thymifolia*. △ 61. *M. thymifolia* var. *syriaca*. ● 62. *M. mesogitana* subsp. *mesogitana*. □ 62. *M. mesogitana* subsp. *lydia* var. *lydia*. ○ 62. *M. mesogitana* subsp. *lydia* var. *kotschyana*. ■ 62. *M. mesogitana* subsp. *lydia* var. *turcomanica*. ▼ 62. *M. mesogitana* subsp. *velenovskyi* var. *velenovskyi*. ▽ 62. *M. mesogitana* subsp. *velenovskyi* var. *orphanidis*. ◆ 62. *M. mesogitana* subsp. *macrocarpa*. ◇ 62. *M. mesogitana* subsp. *flaccida*. × 63. *M. subtilis* subsp. *subtilis*. + 63. *M. subtilis* subsp. *filicaulis*.

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 Dörfler's epithet *macedonica* has priority at subspecific rank over Boissier and Orphanides' *velutina*, used by Mattfeld.

SECTION SABULINA (REICHB.) GRAEBN.

SERIES SABULINA

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 0·35–0·6 mm. long; sepals often glabrous and broadly acute . . var. *thymifolia*

Petals a little longer than sepals (1–1·25 times), claw 0·25–0·35 mm. long; sepals often glandular-pubescent, obtuse and broadly ovate var. *syriaca*

var. **thymifolia**

Syn.: ≡ *Arenaria thymifolia* Sibth. & Sm., Fl. Graec. Prodr. **1**, 305 (1809), non Pursh (1814).

≡ *Alsine thymifolia* (Sibth. & Sm.) Fenzl, Versuch Verbreit. Vertheil. Alsin. t. ad p. 57 (1833).

Illustration: Sibthorp & Smith, Fl. Graec. **5**, t. 441 (1825).

Type: GREECE: in insula Creta, *Sibthorp.* holo. OXF.

Distribution: GREECE: Aegean Islands (Rhodes), Crete (type); TURKEY?: ("Asia Minor"); CYPRUS: Kyrenia, Famagusta. Endemic.

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!

Distribution: LEBANON: Beirut (Nahr el Kelb, Raz Beirut). Endemic.

A prostrate or decumbent species usually on sea-shores but in Cyprus recorded also from "banks between cultivated fields near sea-level" (*Davis* 2262), and in Ap. Andreas Forest at 50 m. (*Merton* 2472); these plants have rather less fleshy leaves but are otherwise typical. Flowers January to May.

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.*

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 (spines c. 30 μ), 0·60–0·70 mm. long; sepals 2–2·5 mm. long; capsule subcylindrical much longer than calyx (1·25–1·5 times as long) . . . . . 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 a little longer than calyx, if much longer (> 1·25 times) then ovoid 1

2a. Sepals 2·0–4·0 mm. long; petals shorter to longer than sepals 2

2b. Sepals 1·5–2·0 mm. long; petals always longer than sepals . 8

2c. Sepals 1·5 mm. long; petals as long as or a little shorter than sepals; capsule ovoid-globose up to 2 mm. long (*M. tenuifolia* var. *elachistantha* Mattf.)

3a. Capsule ovoid, considerably exceeding calyx (1·25–1·75 times as long); leaves recurved, rather short and thick (4–8 mm. long); petals distinctly shorter than sepals (0·75–0·85 times as long); sepals 2–3(–3·5) mm. long; seeds 0·55–0·70 mm. long × 0·50–0·60 mm. broad; inflorescence rather lax and spreading; plants diffuse often branching from the base (subsp. *velenovskyi*) . . . 4

3b. Capsule ovoid to ± cylindrical, equalling or slightly exceeding calyx (usually < 1·25 times as long); leaves usually spreading or suberect, (5–)7–20 mm. long, finely setaceous to relatively broad (1·0 mm.) and flat; petals almost as long to longer than the sepals (0·9–1·3 times); sepals 2·0–4·0 mm. long; seeds 0·30–0·65 mm. long × 0·25–0·60 mm. broad; plants sometimes rather erect. . . 5

4a. Petals broadly ovate (1·5–2 times as long as broad); capsule ovoid (valves 1·75–2 times as long as broad); seeds 0·55–0·65 mm. long subsp. *velenovskyi* var. *orphanidis*

4b. Petals suborbicular (< 1·5 times as long as broad); capsule broadly ovoid (valves < 1·75 times as long as broad); seeds 0·60–0·70 mm. long (Montenegro) . (subsp. *velenovskyi* var. *velenovskyi*)

5a. Sepals < 3 mm. long, or if about 3 mm. (or longer in a few older flowers) not exceeded by the capsules; seeds usually < 0·50 mm. long; plant usually very small and slender, often ± erect (but cf. var. *turcomanica*) (subsp. *lydia*) 6

5b. Sepals > 3 mm. long, occasionally less in uppermost flowers or in late flowering specimens; capsule in most flowers exceeding calyx; seeds (0·45–) 0·50–0·65 mm. long; plant usually decumbent and branching from the base. . . . subsp. *mesogitana*

6a. Sepals long acuminate, always < 3 mm. long; bracts finely setaceous . . . . . subsp. *lydia* var. *lydia*

6b. Sepals acute or very abruptly acuminate; bracts subulate to triangular 7

7a. Capsule not or scarcely exceeding calyx; sepals up to c. 3 mm. long; plants diffuse often branching from base. subsp *lydia* var. *turcomanica*

7b. Capsule longer than calyx in most flowers; sepals < 3 mm. long; plant usually ± erect . . . subsp. *lydia* var. *kotschyana*

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 0·45–0·55 mm. long . . 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 0·25–0·40 mm. long . . subsp. *macrocarpa*

subsp. **mesogitana**

Syn.: ≡*Alsine mesogitana* Boiss., Diagn. Pl. 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*").
≡*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 Feddes Rep. Beih. **89**, 251 (1940).
≡*M. viscosa* subsp. *mesogitana* (Boiss.) Breistr. in Bull. Soc. sci. Dauph. **61**, 612 (1947).

Type: TURKEY: CARIA: Mesogis pars media in glareosis schistosis Jun. 1842, *Boissier*. (Mons Mesogis supra Tralles). holo. G!, iso. BM!, E!, JE!, K!, S!

Distribution: TURKEY: Caria, Pamphylia, Cilicia, Amanus (widespread), Cataonia (? error in labelling); SYRIA: Aleppo (widespread), Latakia,

Hama, Damascus; LEBANON: North Lebanon, South Lebanon (widespread); ISRAEL: Galilee (nr. Magdala). Also occurs in Romania (Dobrogea: Babadağ).

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 1000 m.).

subsp. **lydia** (Boiss.) McNeill, **comb. nov.** var. **lydia.**

Syn.: ≡ *Alsine lydia* Boiss., Diagn. Pl. Orient. ser. 2, **1**, 86 (1853).
≡ *Als. tenuifolia* var. *lydia* (Boiss.) Boiss., Fl. Orient. **1**, 686 (1867) ("ζ").
≡ *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).
≡ *M. viscosa* subsp. *lydia* (Boiss.) Breistr. in Bull. Soc. sci. Dauph. **61**, 611 (1947).
≡ *M. hybrida* subsp. *lydia* (Boiss.) Rech. f. in Bot. Jb. **80**, 315 (1961).

Lectotype: TURKEY: LYDIA: montes supra Bournabat prope Smyrna, Mai 1842, *Boissier* (montes colles Bournabat, montes Smyrne). holo. G!

Paratypes: 1.) TURKEY: Caria: Cadmus supra Denisleh, June 1842, *Boissier* (G!); 2.) TURKEY: Lycia: Mt. Solyma, *Heldreich* 1056 (G!) = *M. hybrida* var. *parviflora.*

Distribution: TURKEY: Lycia, Caria. Endemic.

Small suberect plants with very spreading inflorescence. Collected in flower, May–June.

subsp. **lydia** 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.).
≡ *M. viscosa* subsp. *subtilis* var. *kotschyana* (Boiss.) Breistr. in Bull. Soc. sci. Dauph. **61**, 611 (1947).

Type: TURKEY: CILICIA: in Tauro Ciliciae, *Kotschy* 57 (In monte Tauro aestate 1836). holo. G!, iso. BM!, K!, WU!

Distribution: GREECE: Thessaly, Central Greece, Aegean Islands (Samos, Rhodes); TURKEY: Mysia, Lydia, Pamphylia, Cilicia (widespread), Amanus, Pisidia, Galatia (Amasya), Cataonia. Probably endemic but may possibly be found in the S.E. Balkans (e.g. Bulgarian Thrace).

Usually more or less erect plants, not or slightly branching below, but with a spreading inflorescence. Altitudinal range (Sea-level ?, 200–) 500–1800 m. Flowers April–July.

subsp. **lydia** 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 May 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!

Distribution: SYRIA: Deir ez Zor; IRAQ: Mosul, Erbil; IRAN: Northern Zagros. Also occurs in Turkmenistan and Afghanistan.

A rather decumbent or sub-erect spreading plant, branching from the base (approaching spp. *mesogitana* in habit). Recorded between 200 & 900 m. Flowers April–May.

subsp. **velenovskyi** (Rohlena) McNeill, **comb. nov.** 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).
≡*M. viscosa* subsp. *velenovskyi* (Rohlena) Breistr. in Bull. Soc. sci. Dauph. **61**, 611 (1947).

Illustration: Hayek in Denkschr. Akad. Wiss. Wien **94**, t. 2 f. 1; t. 5 f. 5–7 (1917).

Type: YUGOSLAVIA: MONTENEGRO: In calcareis supra Godinje prope Vir (c. 200 m.), *Rohlena*. holo. PR?

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!).

subsp. **velenovskyi** var. **orphanidis** (Boiss.) McNeill, **comb. nov.**

Syn.: ≡*Alsine orphanidis* Boiss., Diagn. Pl. 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) (Feddes Rep. Beih. **30**).
≡*M. viscosa* subsp. *lydia* var. *orphanidis* (Boiss.) Breistr. in Bull. Soc. sci. Dauph. **61**, 611 (1947).

Type: GREECE: PELOPONNESE: ad Vostitza 26 Apr./8 Maji 1854, *Orphanides* 2840. holo. G!

Distribution (of var. *orphanidis*): GREECE: Peloponnese, Crete. Endemic.

Subsp. *velenovskyi*: An open spreading plant with rather stout stiff

stems often branching from near the base. A mountain plant, flowering April–May.

subsp. **brachycarpa** (Boiss. & Bal.) McNeill, **comb. et stat. nov.**

Syn.: ≡ *Alsine brachycarpa* Boiss. et Balansa in Boiss., Diagn. Pl. Orient. ser. 2, **6**, 37 (1859).
≡ *Als. tenuifolia* var. *brachycarpa* (Boiss. & Bal.) Boiss. Fl. Orient. **1**, 687 (1867) ("θ").
≡ *M. viscosa* subsp. *brachycarpa* (Boiss. & Bal.) Breistr. in Bull. Soc. sci. Dauph. **61**, 611 (1947) (? validly published).
≡ *M. viscosa* subsp. *brachycarpa* var. *brachycarpa* (Boiss. & Bal.) Breistr. 1. c. 612 (1947).

Type: TURKEY: Kamechly Tchai pr. Bereketly in Cappadocia (Collines situées sur la rive droite du Kamechly-Tchai, près de Bereketly (Cappadoce) à 1300 metr. d'alt. 15 Juin 1856), *Balansa* 647. holo. G!, iso. K!

Distribution: Only known from type.

A more or less erect plant up to 10 cm. high, branching from near the base. Anthers violet.

subsp. **macrocarpa** McNeill, **subsp. nov.**

A subsp. *brachycarpa*, cui in sepalis brevissimis similis capsula subcylindrica calyce multo longiore petala sepalis multo longiora semina parviora differt; a taxis aliis *Sabulinae* (i.e. praeter subsp. *brachycarpam*) sepalis brevissimis (< 2·0 mm. longis) facile distinguenda.

Planta gracilis et humilis, 4–6 cm. altis, extra inflorescentiam glabra. *Caules* erecti, simplices vel inferne ramosi (ramis erectis vel patentibus), foliis 5–8 jugis praediti. *Folia* subulato-setacea, 2–4 mm. longa. *Inflorescentia* diffusa, ad 3 cm. longa, partim sparsim glanduloso-pubescens (bracteis, sepalis et partis vicinis pedunculorum pedicellorumque), floribus 8–18 (ramis lateralibus floribus 3–9) instructa; bracteae triangulares, infimae 1·0 mm. longae et 0·75 mm. latae; pedicelli 3–7 mm. longi. *Sepala* ovata, 1·5–1·9 mm. longa, acuta. *Petala* ovata vel ovato-lanceolata, 2·8–3·4 mm. longa, sepalis multo longiora (1·7–2·0-plo), brevissime ungulata (0·15–0·20 mm.). *Filamenta* c. 2·2 mm. longa; antherae 0·4 mm. longae, violaceae; grana c. 30 μ diam. *Capsula* subcylindrica, calyce multo longior (1·5–2-plo). *Semina* minutissima 0·25–0·40 mm. longa, obscure reticulata ("cellulis" non prominentibus).

Typus: TURKEY: PAMPHYLIA: Prov. Antalya. Kumköy, between Antalya and Serik, 5 m. Fixed dunes in open *Pinus pinea–Myrtus* forest. Annual. Fls. white. 6 April 1956, *Davis & O. Polunin* (D. 25710). holo. E!, iso. K!

Distribution: Only known from type.

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 capsula calyce multo longior facile distinguenda.

Planta flaccida diffusa, ad 25 cm. alta, ex toto sparse glanduloso-pubescens. *Caules* ad basim intertexentes, foliis 4–15-jugis praediti. *Folia*

linearia ad 1·5 cm. lata, trinervia. *Inflorescentia* valde diffusa, ramosa, floribus c. 10–25 instructa; pedicelli longi (10–35 mm.). *Sepala* 2–2·5 mm. longa, ovato-lanceolata, latitudine 2·25–2·75-plo longiora, late acuta. *Petala* ovato-lanceolata, sepalis longiora (c. 1·1-plo), cuneata. *Filamenta* c. 1·5–1·8 mm. longa; antherae 0·2 mm. longae; grana c. 28 μ diam. *Capsula* 3–3·25 mm. longa, subcylindrica, calyce multo longior (c. 1·4-plo); valvae latitudine 2·5–3·0-plo longiorae. *Semina* 0·60–0·70 mm. longa, echinata; spinae c. 30 μ longae.

Typus: TURKEY: PAPHLAGONIA: Wilajet Kastambuli (Kastamonu): Kure Nahas; in saxos. ad rivum prope Enzislen Kajasi 25 August 1892, *P. Sintenis* 5049. (sub "*Alsine flaccida* sp.n."–ined.). holo. JE!

Distribution: Only known from type.

Discussion (of species): see end of Section. For geographical distribution of subspecies see fig. 15.

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 . . . . . 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 . . . . . subsp. *filicaulis*

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 Feddes Rep. Beih. **15**, 36 (1922) et auctt. aliis, non Boiss.
≡ *M. tenuifolia* subsp. *subtilis* (Fenzl) Bornm., Symbolae Fl. Anatol. in Feddes Rep. Beih. **89**, 251 (1940).
≡ *M. viscosa* subsp. *subtilis* (Fenzl) Breistr. in Bull. Soc. sci. Dauph. **61**, 611 (1947).

Type: IRAN: In 1. humidis reg. super. m. Kuh-Delu Pers. austr. 12 Jun. 1842, *Kotschy* 501. holo. W (destroyed). iso. G!, K!, PRC!, WU!

Distribution: TURKEY: Lycia (Çalbali dağ), Galatia (Ak dağ), Cappadocia (Çamlibel dağ), Cataonia, N.E. Armenia, Kurdistan (Meretug dağ); IRAN: Azerbaijan, Caspian Sea/Tehran (Elburs), Northern Zagros (Elwend), Kerman & Yazd (Mt. Lalesar). Also occurs in Afghanistan.

A slender low-growing annual with a very diffuse inflorescence (flowers with long sub-erect pedicels). Growing on stony mountain slopes from 900–2750 m. Flowers June–August.

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 Jun. 1939, *H. Lindberg*. holo. H, iso. K!

Distribution: CYPRUS: Limassol (Troödos mts.) Endemic.

Habit similar to subsp. *subtilis* but inflorescence more spreading, the pedicels often horizontal or deflexed. Recorded between 1400 & 1900 m. Flowering May–July.

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 l.c. (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 no suggestion of intermediate forms 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 subspecific level.

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*).
≡ *Als. tenuifolia* var. *viscosa* (Schreber) Boiss., Fl. Orient. **1**, 686 (1867) ("ε").

≡ *Als. tenuifolia* subsp. *viscosa* (Schreber) Nyman, Consp. Fl. Eur. 117 (1878).

≡ *M. tenuifolia* subsp. *viscosa* (Schreber) Briquet, Prodr. Fl. Cors. **1**, 531 (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?).

Distribution: GREECE: Macedonia, Thrace; U.S.S.R.: Ciscaucasia (Tamruk). Also occurs in 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).

An erect low-growing plant with a strict to spreading inflorescence. Recorded in Greece between 400 and 1375 m.; flowering June–July.

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 (1932, 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*.

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 3–4 mm. long (rarely less); petals > 0·7 times the length of the sepals, cuneate; capsule somewhat ovoid, broadest valve 3 times as long as broad . . . . . subsp. *turcica*

1b. Sepals linear-lanceolate (< 3·5 times as long as broad), acuminate, 2–5 mm. long; petals 0·50–0·75 times as long as sepals, cuneate; capsule somewhat ovoid, broadest valve c. 3 times as long as broad (subsp. *hybrida*) 2

2a. Sepals < 3 mm. long; plants slender, 2–6(–15) cm. tall; seeds 0·3–0·4 mm. diam. . . . subsp. *hybrida* var. *parviflora*

2b. Sepals 3–5 mm. long; plants rather more robust, 6–25 cm. tall; seeds 0·4–0·6 mm. diam. 3

3a. Petals ovate-lanceolate, cuneate; plants moderately robust, usually with a single main stem not branching at the base subsp. *hybrida* 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 . . . . . subsp. *hybrida* var. *palaestina*

subsp. **hybrida** var. **hybrida**

Syn.: ≡*Arenaria hybrida* Vill., Prosp. Pl. Dauph. 48 (1779).
≡*Ar. tenuifolia* var. *hybrida* (Vill.) Vill., Hist. Pl. Dauph. **3**, 634 (1789) ("C"—cf. p. 635 top).
≡*Als. hybrida* (Vill.) Jord., Pugill. 33 (1852).
≡*Als. tenuifolia* γ *hybrida* (Vill.) Willk., Ic. Descr. Pl. Hisp. **1**, 106 (1858).
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).
≡*M. viscosa* subsp. *hybrida* (Vill.) Breistr. in Bull. Soc. sci. Dauph. **61**, 611 (1947).

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. Pl. Eur. aust.-occ. Hispan. t. 69 f. B (as *Als. tenuifolia* var. *laxa*) (colour).

Type: FRANCE: DAUPHNE: Sortant par la porte de la Graille, suivant l'Ilfere jusqu'à sa jonction avec le Drac, remontant ce torrent pour revenir par la Rondeau. Prés le chemin de la Butte, *Villars*. holo. P?, GR?.

Distribution: GREECE: Macedonia, Thrace, Thessaly (Olimbos, Sophades), Central Greece, Peloponnese, Aegean Islands, Crete (widespread everywhere except Thessaly); TURKEY: Bithynia, Thracia, Mysia, Lydia, Lycia, Pamphylia, Galatia, Mesopotamia; U.S.S.R.: Azerbaijan; CYPRUS: Kyrenia, Famagusta, Nicosia, Larnaka, Limassol; SYRIA: Aleppo, Damascus; LEBANON: North Lebanon, Antilebanon, South Lebanon; ISRAEL: Galilee; JORDAN: Cisjordania, Gilead, Moab, Edom; IRAQ: Mosul, Erbil, Kirkuk & Sulaimanya; IRAN: Azerbaijan, Lorestan, Fars. Also occurs in South and West France, Spain, Portugal and throughout the Mediterranean coastlands (except Cyrenaica & Egypt), Southern Russia, Afghanistan (1600 m.).

Rather slender strictly erect annual weeds and plants of stony slopes. Flowering February to May. Recorded between sea-level and 1200 m.

subsp. **hybrida** var. **parviflora** McNeill, **var. nov.**

Syn.: *Alsine lydia* Boiss., Diagn. Pl. Orient. ser. 2, **1**, 86 (1853), pro parte (excl. lectotyp.).
M. tenuifolia subsp. *lydia* sec. Mattf. in Feddes Rep. Beih. **15**, 42 (1922), pro parte.

A varietate typica sepalis parvioribus (< 3 mm.) et plantis gracilioribus differt.

Planta gracilis et humilis, 2–6(–15) cm. alta, glabra vel glanduloso-pubescens. *Inflorescentia* ± stricte erecta, floribus c. 6–15 instructa. *Sepala* 2·5–3·0 mm. longa, lanceolata, latitudine 3–4-plo longiora, acuminata. *Petala* cuneata, sepalis 2·0–1·5(–1·3)-plo breviora. *Capsula* anguste cylindrica calycem aequans vel longior, rarius brevior. *Semina* 0·3–0·4 mm. diam. minute rugulosa et minutissime papillosa.

Typus: TURKEY: GALATIA: Amasia: in siccis regionis calidae alt 4–600 m. 20 May 1889, *J. Bornmüller*, pl. exs. Anatoliae oriental. a. 1889. No. 43 (sub *Alsine tenuifolia* ε *viscosa* Boiss.). holo. WU!

Distribution: GREECE: Macedonia, Thrace, Aegean Islands (Mytilini); TURKEY: Lycia, Galatia, Cappadocia; LEBANON: North Lebanon (Jebel Akar); IRAQ: Erbil (Rowanduz gorge); IRAN: Fars. Also occurs in Afghanistan and possibly in Yugoslav Macedonia.

A usually dwarf erect ± unbranched annual of dry, sandy or calcareous habitats. Recorded between 100 & 2000 m., flowering March–June.

subsp. **hybrida** 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, 8–25 cm. alta, a basi ramosa ex toto glabra vel pedicellis et sepalis glanduloso-pubescentibus. *Inflorescentia* ramosa vel simplex, floribus, c. 8–40 praedita. *Sepala* 3–4·5 mm. longa. *Petala* anguste deltoidea 2–2·5 mm. longa, sepalis 0·5–0·75-plo longiora, ad basim in ungue brevissime abrupte contracta. *Capsula* calycem excedens. *Semina* 0·5–0·6 mm. diam. minute rugulosa et minutissime papillosa.

Typus: JORDAN: CISJORDANIA: Palestine, Mt. Ebal (Har Eival). Fallow fields. Flowers white. 19 Apr. 1942, *P. H. Davis* 4487. holo. E!, iso. K!

Distribution: ISRAEL: Galilee, Central Israel; JORDAN: Cisjordania. Endemic.

A rather robust field weed and plant of stony slopes. Recorded from 15–800 m. Flowers (February–) March–April.

subsp. **turcica** McNeill, **subsp. nov.**

Syn.: *M. mesogitana* sec. Mattf. in Feddes Rep. Beih. **15**, 35 (1922) pro parte min., non *mesogitana* Boiss.
M. tenuifolia ssp. *hybrida* sec. Mattf. 1. c. pro parte min., non *hybrida* Vill.

A subsp. *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* subsp. *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-pubescens. *Inflorescentia* simplex vel plerumque ramosa, floribus 8–50 praedita. *Sepala* (2·75–) 3–4 mm. longa, lanceolata, latitudine 3·0–3·5-plo longiora, anguste acuta. *Petala* ovato-lanceolata, 2–3·5 mm. 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* 0·45–0·55 mm. diam., rugulosa fere epapillosa.

Typus: TURKEY: CAPPADOCIA: Prov. Kayseri: Kisge at W. foot of Bakir Dağ, 1300 m. Rocks. Annual. 27 June 1952, *Davis, Dodds & Çetik* (D. 19216). holo. E!, iso. K!

Distribution: GREECE: Central Greece (Mt. Parnes); TURKEY: Amanus, Phrygia, Galatia, Cataonia, S.W. Armenia, N.E. Armenia, Kurdistan, Mesopotamia; U.S.S.R.: Azerbaijan; SYRIA: Damascus; LEBANON: North Lebanon (Sir); IRAQ: Mosul; IRAN: Lorestan. Also occurs in Crimea and possibly elsewhere in S. Russia.

A rather robust erect or ascending plant of fields and stony places. Recorded between 600 & 2000 m. Flowers April–June.

Distribution (of species): As that of var. *hybrida* but extending (as subsp. *vaillantiana*) into N.E. France, Switzerland, W. Germany & S.E. England.
Chromosome no.: 2n = 46 (Portugal), Blackburn & Morton (1957).
Putative hybrids between *M. hybrida* var. *hybrida* and *M. mesogitana* subsp. *mesogitana* have been seen from: LEBANON: South Lebanon (Beirut, Saida); ISRAEL: Galilee (Jebel Jermak).
Discussion (of *M. hybrida*): see end of section.

66. **M. mediterranea** (Ledeb.) K. Maly in Glasnik Muz. Bosn. Herceg. **20**, 363 (1908).

Syn.: ?*M. tenuifolia* Nees ex Mart., Hort. Erlang. 44 (1814), non (L.) Hiern (1899).
?*Arenaria triandra* Schrank, Hort. Monac. t. 31 (1819).
≡ *A. 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.) J. Maly, Enum. Pl. Austr. 296 (1848).
!*Als. tenuifolia* var. *maritima* Boiss. & Heldr. in Boiss., Diagn. Pl. Orient. ser. 1, **8**, 95 (1849).
!*Als. conferta* Jord. Pugill. 35 (1852) (pro parte ≡ *maritima*).
Als. tenuifolia var. *confertiflora* Fenzl ex Willk., Ic. Descr. Pl. **1**, 107 (1856) (*A.t.* γ *confertiflora* Fenzl in Ledeb., Fl. Ross. **1**, 342 (1842) nom. nud.).
!*Als. tenuifolia* ζ *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).

!*Als. mucronata* subsp. *conferta* (Jord.) Nyman, Consp. Fl. Eur. 117 (1878).

Als. mucronata var. *arvatica* (Presl) Nyman, l.c. 117 (1878).

Als. tenuifolia subsp. *confertiflora* (Bourg.) Murb. in Lund Univ. Ark. **33,** 37 (1897).

≡ *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).

M. viscosa subsp. *confertiflora* (Bourg.) Breistr. in Proc.-Verb. Soc. sci. Dauph. **22,** 10–12 (1943).

M. viscosa subsp. *confertiflora* var. *arvatica* (Presl) Breistr. l.c. (1943).

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).

Distribution: GREECE: Ionian Islands, Macedonia, Thrace, Central Greece, Peloponnese, Aegean Islands, Crete; CYPRUS: Nicosia, Larnaka, Paphos, Limassol; LEBANON: South Lebanon; ISRAEL: Central Israel; LIBYA: Cyrenaica. Also occurs in Southern France, Spain, Portugal and throughout the Mediterranean region (absent from Egypt).

A decumbent to erect annual of sandy places often near the sea. Recorded between 0–600 m.

Chromosome number: 2n = 20, Blackburn & Morton (1957).

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 (1916) tentatively attaches *triandra* to this species but an examination of the illustration in 'Plantae horti Monacensis' 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 KAZAKHISTAN: ("Songaria"): 1.) prope Ajagus; 2.) ad ripes fl. Karatal 13 Jun. 1840–43; 3.) in desertis salsis ad fl. Tersaken, 30 Jun. 1840–43; 4.) in vallibus herbidis montium Ulutau 30 May 1840–43, *Schrenk*. LE, G!, K! (?"Songaria. *Schrenk*"—no date).

Distribution: U.S.S.R.: Eastern Transcaucasia—not seen, cf. Schischkin (1936), not included in Grossheim, 1949 and so possibly erroneous. Certainly occurs in the Lower Volga region and from Kazakhistan to Tien Shan and southwards into Afghanistan (*Aitchison* 1025!).

A rather distinct species (cf. key), resembling *M. viscosa* on the one hand and approaching the following species, *M. urumiensis*, on the other. Its occurrence in the region covered by this account is doubtful.

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 Mai. 1884, *J. A. Knapp*. holo. JE!, iso. WU!

Distribution: TURKEY: Lycaonia (Tuz Gölü), Cappadocia (Erciyas dağ); IRAN: Azerbaijan (type). Endemic.

Small erect or spreading annuals apparently of saline soils. Flowering May–June.

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* (=*Fasciculatae*), 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*.

DISCUSSION—SECTION SABULINA

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 discrete 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 Bornmüller, 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 2 mm. to 4 mm., 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 3 mm. 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 and 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 its affinity 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 1·5–2·0 mm. 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 1300 m. 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 inter-

mediate 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 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 time (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

Key to Orient Species

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: U.S.S.R.: GEORGIA: in montibus Talusch prope pagum Swant, *C. A. Meyer*. holo. LE, iso. GOET.

Distribution: TURKEY: Pontus (Rize), N.E. Armenia, Kurdistan (Kepir dağ), Mesopotamia; U.S.S.R.: Georgia, Armenia; IRAN: Azerbaijan (Tabriz), Caspian Sea, Northern Zagros, Southern Zagros (nr. Isfahan), Fars, Kerman & Yazd (nr. Kerman). Also occurs in Afghanistan, Baluchistan, W. Himalaya, Turkmenia, Turkestan, Pamir-Altai, Tien-Shan and W. Tibet.

Robust, much-branched annual with large broadly lanceolate leaves; growing in fields. Flowers April–July. Recorded between 1900 and 2700 m.

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, **3**, 213 t. 20 f. 2 (1945). Komarov, Fl. U.R.S.S. **6**, t. 26 f. 2 (1936).

Type: U.S.S.R.: TURKMENIA: in collibus Kuguldyr subfinem Majii, *Schrenk*. holo. LE?

Distribution: IRAN: Azerbaijan, Caspian Sea, Northern Zagros, Lorestan, Kerman. Also occurs in Afghanistan, Turkmenia, Turkestan, Pamir Altai and Tien-Shan.

Habit as *L. holosteoides* but less robust. Recorded at 1350 m. growing in fields.

DISCUSSION—LEPYRODICLIS

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.

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