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MATERIALS TOWARDS A FLORA OF TURKEY: XV

VALERIANACEAE: VALERIANELLA

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INTRODUCTION

There has been no revision of the genus *Valerianella* in Turkey since Boissier's account in Flora Orientalis (3: 95–113, 1875), which is based upon Krok's Monograph of the genus (Vet.-Akad. Handl. Stockholm 5, 1864). The present account is an attempt to bring up to date the work of these two botanists, to make their findings more available and easily understood, and to illustrate each of the species found in Turkey.

I had originally hoped to cover the whole of the Middle East in this study, thereafter the whole genus, but there has not been enough time. The need to finish the work quickly has meant that the following account has suffered in two obvious ways—I have been unable to see all types and all original descriptions and have left out type citations which were not available in the Royal Botanic Garden, Edinburgh; also, two species had to be inserted after the illustrations had been planned and drawn, so these are found out of order.

I have not found it necessary to describe any new species. There can be few Turkish groups of comparable size which, after reworking, have been presented so little changed since Boissier, and to which only one new species has been added. It is a tribute not only to Krok and Boissier, but also to the classical collectors—particularly perhaps Balansa; few modern collectors have found so many of the species.

The species are not difficult to identify once one has understood what one is required to see, and provided that fruiting material is available. I can recognise only half-a-dozen species in flower alone; fortunately the plants usually produce fruits fairly quickly. It follows that they should not be collected unless in fruit. The key provided below virtually ignores vegetative characters. A detached fruit is all that is really necessary for identification.

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CHARACTERS

Apart from a few leaf and bract characters clearly distinct in a handful of species, all the characters, therefore, are confined to the form of the inflorescence and fruit. (The inflorescence is cymose and has been studied by Weberling in Abh. Math.-Nat. kl. Akad. Wiss. Mainz no 5, 1961). Occasionally the peduncles below the inflorescence thicken up or inflate in late fruit.

The fruit of *Valerianella* is formed from an inferior ovary, together with what is presumably calyx. All show a single, "posterior", fertile carpel and almost all show two empty sterile carpels. The variety of forms and variations developed in the different species by calyx and ovary-wall thickening is remarkable and their study well repays the effort involved.

I make no attempt to explain these forms, although it is possible to suggest dispersal mechanisms for some. I have not had time nor facilities enough for as intensive a study of the fruit sections as they deserve, but a preliminary series of sections has shown that the cellular organisation is as bizarre as the external morphology. Blocks of spongy tissue, blocks of lignified tissue, blocks of unlignified tissue with curious walls are arranged in various ways (but with a recurring pattern) around the three loculi. In addition, the epidermal hairs, glands and papillae, the different kinds of crystal in certain cells, the pattern of the vascular tissue should all repay study and provide a better understanding of the genus.

In the final section of this paper I have tried to make sense of some of the features seen; although I have not been able to map in detail all the tissues visible even in hand-sections, the diagrams in the figures give a simplified breakdown: lignified, thickened with some lignification, thickened without lignification, unthickened; bundles are shown as a cross or line within a circle.

Somewhat arbitrarily, I have illustrated two species that have not been recorded from Turkey, partly because I should not be surprised if at least one were found in eastern Turkey, partly to assist the preparation of an account for *Flora Iranica* (they are 2 of the four non-Turkish species from that area which are unambiguous and also represented in the Herbarium at Edinburgh).

INFRA-GENERIC ARRANGEMENT

Unfortunately for most botanists, as Boissier himself complained, the discussion in Krok's Monograph is in Swedish and I have had no time to have it translated for study.

Krok has 5 Sections of which one, *Siphonella*, is only found in N. America and is often treated as a genus. Of the rest, there are species in Turkey from each. Boissier increases these 4 sections to 8, fairly easily distinguishable. The key does not follow the sectional classification but I have arranged the species mostly according to Boissier's order for the purposes of this paper, with *V. hirsutissima* placed first, not last, to make the illustration order easier (although I should not be surprised if eventually that species

is included in the *Coronatae*). The one respect in which I appear to differ from Krok, Boissier and the Flora URSS is in the placing of *V. lasiocarpa*, which, if I have defined it correctly, is clearly in the section *Coronatae*.

ILLUSTRATIONS

Because of the intricate nature of the fruit and calyx forms, it is usually easier to refer to illustrations for identification. Krok's small illustrations are surprisingly good, but the work is not generally available. Boissier, of course, is not illustrated. The best recent illustrations that I have seen of a large range of species, many of which are found also in Turkey, are in Linczewsky's account in the Flora URSS (23: t. 23, 24, 1958). Good illustrations are also to be found in Nikitin's Flora of Aschkabad (1965), Ross-Craig, Draw. Brit. Pl. 14 (1960); Hadač's paper on the Valerianaceae of Iraq is also illustrated, with diagrams of the fruit sections (Bull. Coll. Sci. Baghdad 6: 29–41, 1961); section diagrams are unfortunately omitted from the Fl. URSS account. All my drawings are to scale on each plate but the plates are not to scale between themselves. Nowhere are the Section diagrams necessarily to scale.

SPECIMEN CITATIONS

I have cited specimens on the Grid & Vilayet system used in the Flora of Turkey, but not always restricting the numbers of specimens cited as in that work (Vol. 1, 1965; see Introduction for the explanation of the system). Similarly, the *Davis et al.* numbering series is always abbreviated to *D* . . .

MAPS

I have mapped specimens I have seen of the majority of species, and have also included a few reliable records. Unfortunately the Caucasian area is badly served—most of those few specimens I have seen have had the localities in Cyrillic handwriting which I cannot decipher; neither have I had time to obtain further specimens on loan for that area.

EXPLANATION OF THE KEY

Certain terms are used as follows:

Calyx-cup: the interior of the calyx structure, only applicable to certain species.

Carpel: the entire carpel viewed from the outside.

Coronate: the calyx-lobes joined together at base and with the free lobes held erect or spreading.

Fan: a membranous or herbaceous lobe or rim on the top of the fertile carpel, sometimes growing into a $\frac{1}{2}$ or $\frac{2}{3}$ cylinder and growing forwards onto the top of the sterile carpels also.

Loculus: the cross-sectional area of the air-spaces within the carpels.

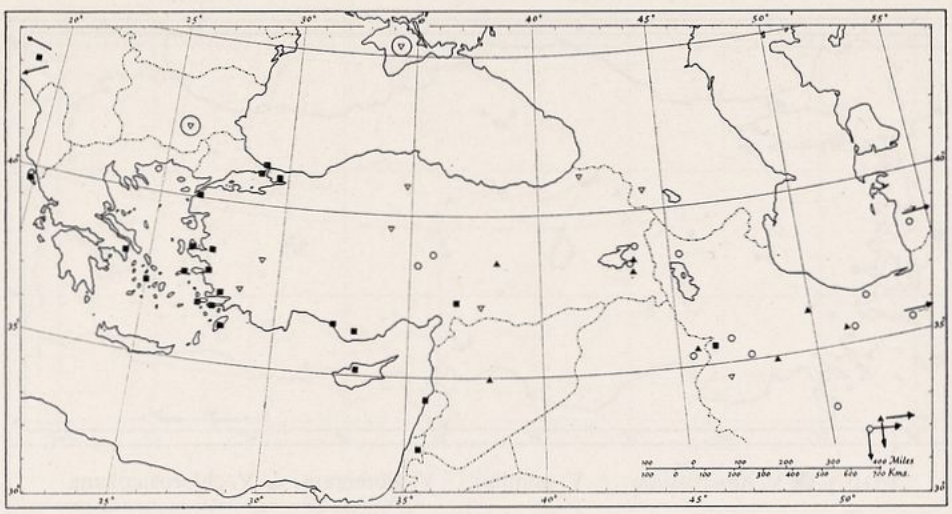
Strap: a $\pm$ linear, lateral extension of the fan.

Webbed (bracts): the membranous margins of the bracts running down and continuous with the winging of the inflorescence branches.

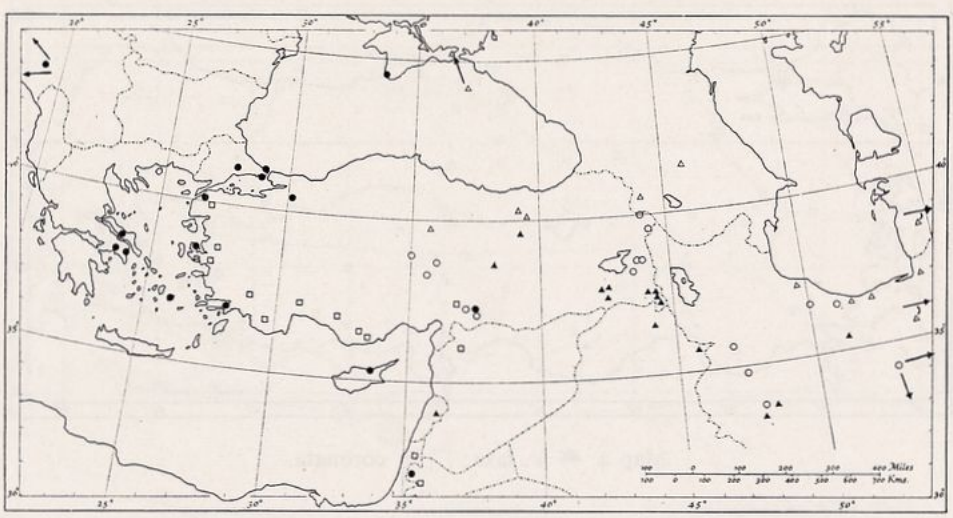
1 Fruits all of one kind, those of the lower branch-forks similar to those of the cymes or absent, never both 3-horned and with spongy tissue blocks 2
+ Fruits in the lower branch-forks thinner and often longer than those of the cymes, often abortive and 1-locular; cyme fruits 3-horned and with blocks of spongy tissue 33
2 Fruits longer than broad, incurved, covered with warts or tubercles; calyx 6–12-lobed, irregular, thickened and wide-spreading to reflexed, sometimes hooked . . . . . 2. *tuberculata*
+ Fruits various, not with the above combination of characters . 3
3 Fruiting calyx ± symmetrical and distinctly coronate, radiate or inflated 4
+ Fruiting calyx asymmetric or inconspicuous 19
4 Calyx an inflated, bladder-like vesicle with infolded teeth around the mouth . . . . . 26. *vesicaria*
+ Calyx not inflated and vesicular; teeth, if present, erect or spreading 5
5 Calyx lobes (2–)3 6
+ Calyx lobes 6 or more 9
6 Calyx lobes sub-orbicular, reticulately veined, serrate-margined 19. *dufresnia*
+ Calyx lobes ovate or reduced almost to undulations of an irregularly developed rim 7
7 Sterile loculi about equalling the fertile; sterile carpels separated by a rounded or ovoid depression, at most puberulous . . 17. *pumila*
+ Sterile loculi exceeded by the fertile; sterile carpels separated by a triangular or rectangular depression, very hairy . . . 8
8 Fruits 3–3·5 mm; back of fertile carpel flat . . 22. *chlorostephana*
+ Fruits 1·5–3 mm; back of fertile carpel rounded . 27. *lasiocarpa*
9 Calyx lobes c. 20, linear, almost obscured by setae; bracts very broad, membranous, densely ciliate, obscuring the fruit . 1. *hirsutissima*
+ Calyx lobes usually 6 (occasionally with smaller subsidiary lobes, in all not exceeding 12) lanceolate or ovate, not obscured by hairs; bracts usually narrower and not usually obscuring the fruit . . 10
10 Fruits (excluding calyx) 2 × longer than broad, sparsely glandular-hairy at most; sterile carpels expanding at base; calyx lobes lanceolate, acuminate 11
+ Fruits (excluding calyx) not much longer than broad, usually with an indumentum puberulent at least; sterile carpels not expanding below; calyx lobes ± ovate or triangular 12
11 Base of all calyx lobes with reticulate venation; leaves undivided but with pronounced, often remote, teeth . . . . 4. *dactylophylla*
+ Base of posterior 2 lobes only with reticulate venation; leaves deeply pinnately divided . . . . . 3. *uncinata*
12 Sterile loculi together much smaller than the fertile . 30. *eriocarpa*
+ Sterile loculi together ± equalling the fertile or only a little less . 13
13 Interior of calyx-cup glabrous 14
+ Interior of calyx-cup villous or at least puberulent in the centre . 17
14 Fruit 1·5–3 mm . . . . . 27. *lasiocarpa*
+ Fruit more than 3 mm 15
15 Calyx lobes 6(–12), clearly defined, hooked at apices . . 16
+ Calyx lobes often ± irregular, without hooks . 22. *chlorostephana*

16 Hooks at apex of calyx-lobes strong, with pronounced stalks; flowers packed in tight globular heads · · · · · · 20. *coronata*
\+ Hook weak, ± sessile; flowers in hemispherical heads, often in pairs and not very densely packed · · · · · · · 21. *kotschyi*
17 Calyx lobes free to base; bracts suborbicular and very thin 23. *glomerata*
\+ Calyx lobes joined at base; bracts ovate, ± herbaceous · · 18
18 Calyx lobes up to 12, the 'basic' 6 usually with smaller but clearly defined subordinate lobes; hooks present at lobe apices only · 24. *discoidea*
\+ Calyx lobes 6, rounded, with hooks on the margins as well as the lobe apices · · · · · · · · · · 25. *obtusiloba*
19 Calyx with at least one lateral strap about as long as the fruit · 31
\+ Calyx a short oblique tube or fan, reduced to a lateral or terminal tooth or inconspicuous · · · · · · · · · · 20
20 Calyx present as a distinct tube or tooth at least · · · 25
\+ Calyx absent or present only as a short continuation of the fertile carpel · · · · · · · · · · · · 21
21 Fruit longer than broad, incurved; the fertile loculus broader than (not necessarily exceeding in area) the sterile · · · · 15. *carinata*
\+ Fruit about as broad as long; fertile loculus about as broad as the sterile or much narrower · · · · · · · · · 22
22 Conspicuous blocks of spongy tissue present behind the fertile loculus 23
\+ Spongy tissue blocks absent · · · · · · · 24
23 Fruits smooth; spongy tissue mostly confined to behind the fertile carpel · · · · · · · · · · · 13. *locusta*
\+ Fruits papillose; spongy tissue present on the lateral surfaces as well as behind the fertile carpel · · · · · · · 14. *costata*
24 Sterile carpels widely separated, scarcely contiguous above; some tissue present around the fertile loculus, seen in section · · 16. *turgida*
\+ Sterile carpels evidently contiguous above, divided by a depression not exceeding the carpel width; tissue absent from around the fertile loculus 17. *pumila*
25 Section showing the sterile loculi each as big as or bigger than the fertile · · · · · · · · · · · · 26
\+ Section showing the fertile loculus much exceeding the sterile · 29
26 Fruits 2 × longer than broad, incurved, with a small lateral extension of a posterior fan · · · · · · · · 7. *plagiostephana*
\+ Fruits about as long as broad, not incurved; calyx a small irregular rim, a tube or ± trilobed · · · · · · · · · 27
27 Fruiting calyx a short tube or ½-cylinder, much narrower than the width of the fruit; fruit surface with regular polygonal papillae 18. *rimosa*
\+ Fruiting calyx not as above; fruit surface smooth, or irregularly and partially papillose at most · · · · · · · · 28
28 Sterile carpels widely separated, scarcely contiguous above; some tissue present around fertile loculus, seen in section · · · 16. *turgida*
\+ Sterile carpels evidently contiguous above, divided by a depression not exceeding the carpel width; tissue absent from around the fertile loculus 17. *pumila*
29 Fruiting calyx width not exceeding ½- the fruit width, short 28. *dentata*
\+ Fruiting calyx width ± equalling or exceeding the fruit width, often ½ as long as the fruit or more · · · · · · · · 30

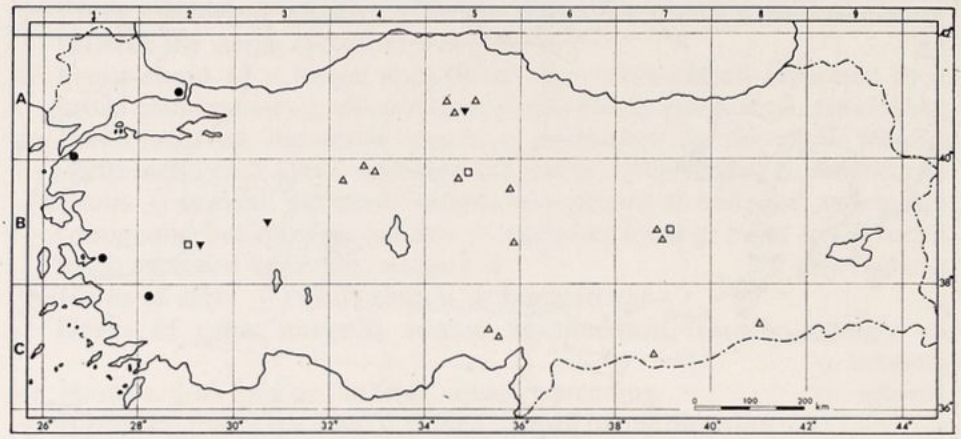
30 Fruiting calyx forming a complete tube, usually deeply toothed 30. *eriocarpa*
\+ Fruiting calyx not forming complete tube but showing a gap in anterior view, lightly toothed at most · · · · · 29. *muricata*
31 Fruits cylindrical, about 2 × longer than broad, with a narrow groove between the sterile carpels at mid-point · · · · · 32
\+ Fruits about 1½ × longer than broad; the sterile carpels separated by a broad membranous ± elliptic interval, not deeply grooved 8. *szowitsiana*
32 Fruits incurved, the sterile carpels ± equidistant for the whole length; sterile loculi each about equalling the fertile; strap single 6. *cymbicarpa*
\+ Fruits ± straight, the sterile carpels very narrow at midpoint and nearly contiguous, but splaying out into ± wing-like lobes at base; sterile loculi much exceeded by fertile; straps 1–2 · · · 5. *oxyrrhyncha*
33 Horns of calyx ± equal; section ± symmetrical · · · 34
\+ Horns of calyx unequal; section asymmetrical, usually strongly so 9. *echinata*
34 Horns c. ½ as long as the fruit, equally spreading · · 10. *triceras*
\+ Horns less than ½ the fruit, if curved then all in one direction · 35
35 Fruits incurved, usually with 2 diverging posterior spongy ridges 11. *laxa*
\+ Fruits straight, without posterior ridges · · 12. *orientalis*



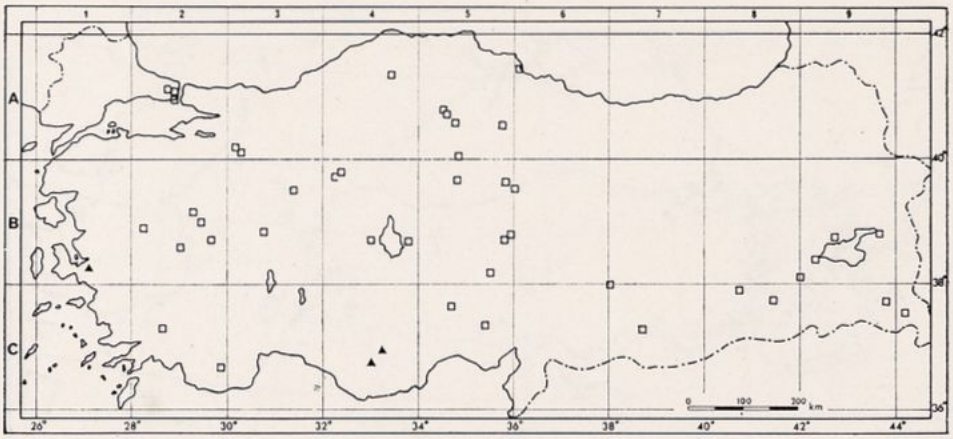
Map 1. ▲ V. tuberculata; ○ V. szowitsiana; ■ V. discoidea; ▽ V. lasiocarpa—one specimen of illegible locality in Bulgaria.



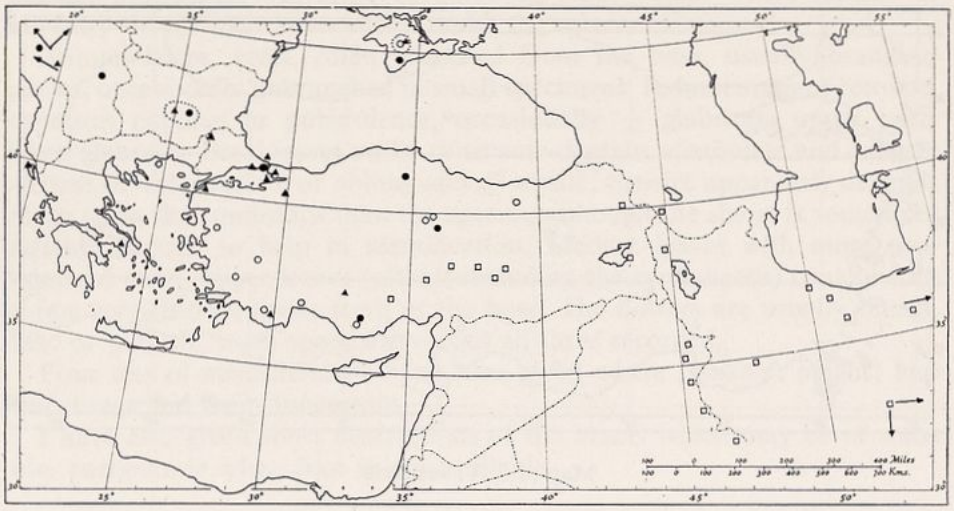
Map 2. △ V. uncinata; ▲ V. dactylophylla; ○ V. oxyrrhyncha; ● V. echinata; □ V. orientalis.



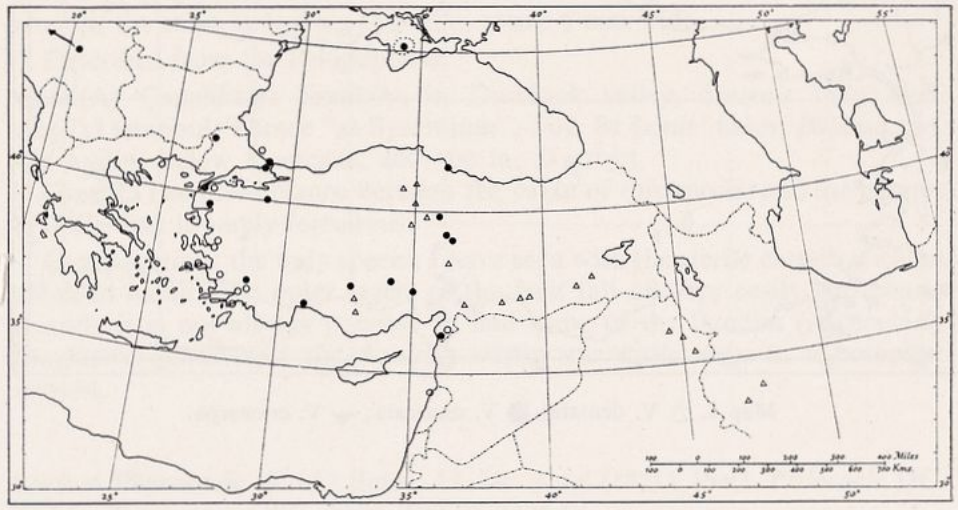
Map 3. ● V. hirsutissima; △ V. pumila; □ V. glomerata; ▼ V. chlorostephana.



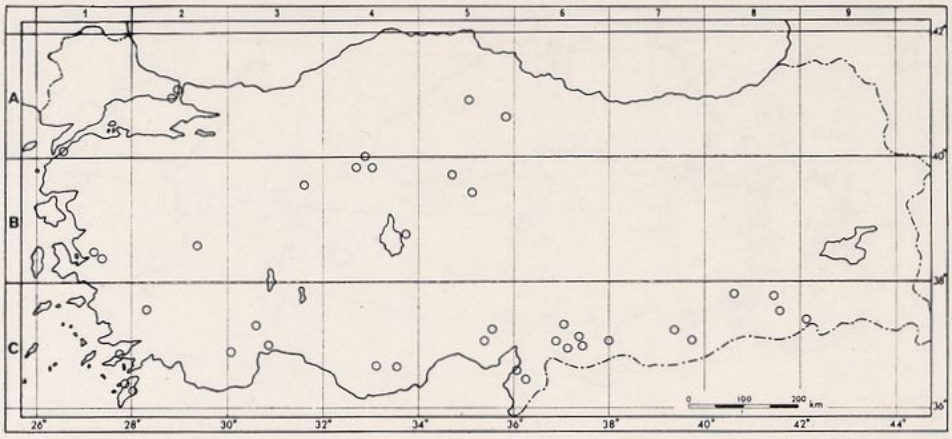
Map 4. ▲ V. laxa; □ V. coronata.



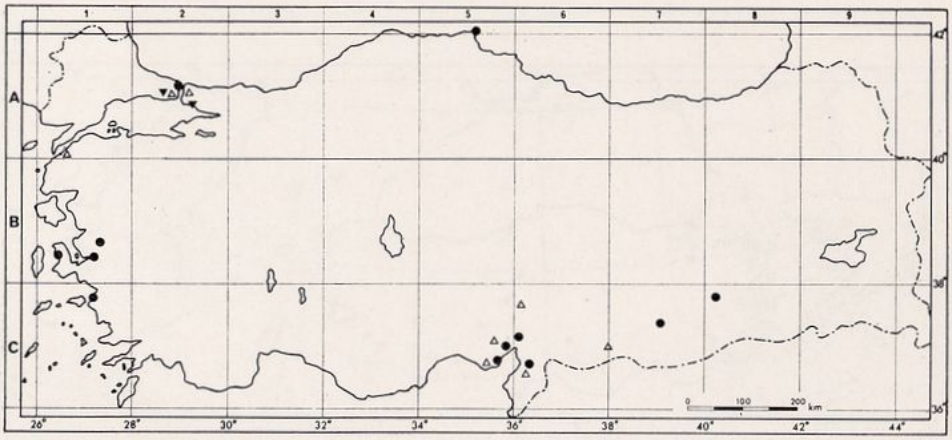
Map 5. ● V. locusta—one specimen of illegible locality in Bulgaria and one unlocalised record for Crimea (Fl. URSS); ○ V. costata—one unlocalised record for Crimea (Fl. URSS); ▲ V. turgida—one specimen of illegible locality in Bulgaria and one unlocalised record for Crimea (Fl. URSS); □ V. dufresnia.



Map 6. V. carinata—one unlocalised record for Crimea (Fl. URSS); △ V. kotschyi; ○ V. obtusiloba.



Map 7. ○ V. vesicaria.



Map 8. △ V. dentata; ● V. muricata; ▼ V. eriocarpa.

THE SPECIES DESCRIPTIONS

Since most *Valerianellas* are very similar vegetatively, the following general, partial, description will serve to cover all cases except where further or contrary details have been added under the species concerned.

Annual herbs, erect, often branched from the base, usually branched above, occasionally unbranched in small specimens. Indumentum of retrorse, asperous papillae or puberulence, occasionally ± glabrous; upper parts often glabrous. Basal leaves entire to sinuate-dentate, spathulate and cuneate at base or oblanceolate or oblong and ± sessile; the size apparently depends more upon the conditions than the species, although the shape is sometimes reliable enough to help in identification. Median leaves with more pronounced teeth, upper leaves (often subtending the cyme-heads) usually with a few very distinct linear teeth at the base. The flowers are usually bluish, lilac or pinkish; some species have had all three recorded.

Four sets of measurements have been given where possible: height; and leaf, bract and fruit dimensions.

I have also given short descriptions of the bracts which may be of some use, particularly when fruit is not available.

Section **Eriocephalae** Boiss., Fl. Or. 3: 96 (1875).

1. V. hirsutissima Link in Linnaea 9: 580 (1834). (Plate 1, f. 1–3. Map 3).

Ic: Krok, t. 1, f. 1.

6–15 cm, lower leaves present at least in early fruit. Leaves 20–35 × 2–6 mm. *Inflorescence* densely globose. *Bracts* 5–6 × 4–5 mm, broadly ovate, ± membranous, nervose, very ciliate. *Flowers* mauve. *Fruit* c. 8 mm overall, the calyx spreading to 6 mm, ovary 3 mm wide.

Described from the Peloponnese.

A1(A) Çanakkale: Erenköy, in Dumbrek valley, *Sintenis* 1883: 400. A2(E)? Istanbul: Thrace "at Byzantium", *Noë*. B1 Izmir: Izmir, *Balansa* 229. C2 Aydin: below Karacasu, 400–500 m, *D* 41653.

Greece. The resemblance between the calyx of this species and the pappus of *Valeriana* is surely fortuitous.

Ovary section: the only species I have seen with the sterile carpels without air-filled loculi. The outer layers of the fruit fall off very easily and consequently it is not always possible to find some of the bundles (particularly the lateral-sterile and the dorsal*)—these are easily seen in a complete section.

Section **Physocoele** (Krok) Boiss., Fl. Or. 3: 95 (1875). [Sect. *Psilocoele* DC. Tribus *Physocoele* Krok, Mon. Val. 30 (1864)].

2. V. tuberculata Boiss., Diagn. ser. 1(3): 59 (1843). (Plate 1, f. 4–6. Map 1.)

Ic: Krok, t. 1. f. 7; Fl. URSS 23: t. 23, f. 7; Hadac in Bull. Coll. Sci. Bagh. 6: 40, f. 12 (1961).

*For explanations of these terms see the paragraphs headed "Speculation".

Height c. 10 cm. *Leaves* ± entire, 22–35 × 6–7 mm. *Inflorescence* very lax, the branches angularly held, straight and stiff, inflating somewhat in ripe fruit. *Bracts* ± linear, free and herbaceous below, becoming obsolete above. *Flowers* lavender. *Fruit* 6 mm overall, the calyx spreading to 5 mm, the ovary 1·3 mm wide.

Type: Hab. in Persia australis montis Perezend, *Aucher* 4686.

B6 Elaziğ: Kharput, Pekenik, *Sintenis* 1889: 754. B9 Van: Van to Erçek, 1850 m, *D* 44334. *ibid.*, Kurubaş, 6 km S.E. of Van, 1850 m, *D* 44613.

Syrian Desert, N. & S. Iran, N. Iraq, C. Asia, Afghanistan. The name var. *oligodonta* has been applied to specimens with one longer tooth (Type: [Iran] pr. Teheran, Maj. 1859, *Bunge*, G).

Ovary section: in many ways the most peculiar, if not the most bizarre. The sterile carpels are almost invisible from the outside; the section shows they contain very small loculi. The vascular strands are in most cases less sharply demarcated from the surrounding tissue than in most other *Valerianellas*, especially the lateral-sterile. The unique feature of this species is the remarkable tissue surrounding the fertile loculus, apparently lignified parenchyma.

3. V. uncinata (Bieb.) Dufr., Hist. Valer. 60 (1811). (Plate 1, f. 9–10. Map 2.)

Syn.: *Valeriana uncinata* Bieb., Fl. Taur.-Cauc. 1: 26 (1808).
Valeriana pubescens Germann in Bot. Zeit. 4: 360 (1805).
Valerianella pubescens (Germann) Krok, Mon. Valer. 48 (1864) non Mérat 1812.

Ic: Krok, t. 1, f. 8 as *V. pubescens*; Fl. URSS 23: t. 23, f. 12 (1958); Fl. Aschk. t. 95, f. 5 (1965).

(6–)13–35 cm. *Leaves* entire below, becoming very deeply toothed to divided pinnately to almost pinnate above, the pinnae occasionally dentate. *Inflorescence* ± dense and hemispherical. Lowermost bracts divided like the upper leaves, the upper linear or linear-lanceolate, entire, glabrous, 3–6 × 0·3–0·7 mm. *Flowers* only recorded as white. *Fruit* c. 6 mm, the calyx spreading to 6 mm, the ovary 1·5–2 mm wide.

Type: [Crimea] in Tauriae collibus apricis; ad Bosphoram frequento, Floret Majo, *Bieberstein*.

A7 Gümüşane: Gümüşane, 1100 m, *Görz* 493. *ibid.* Charavak, *Sintenis* 1894: 5630. B5 Yozgat: Sorgun to Çekerek, 1200 m, *Coode & Jones* 1584.

N. Iran, Soviet Armenia, Georgia, Caucasus, Crimea, C. Asia, Afghanistan. The leaves resemble those of *Centranthus calcitrapa* and are quite different from the leaves of all other *Valerianellas* in Turkey, excepting *V. amblyotis*, see Appendix 1. This species, together with *V. dactylophylla*, seem consistently to be taller than other species, although individuals may rival them.

4. V. dactylophylla Boiss. & Hohenacker in Boiss., Diagn. ser. 1(10): 75 (1849). (Plate 1, f. 7–8. Map 2.)

Ic: Krok, t. 1, f. 9: Fl. URSS 23: t. 23, f. 2 (1958); Hadač in Bull. Coll. Sci. Bagh. 6: 40, f. 11 (1961).

30–40 cm, basal leaves ± withered in fruit. *Leaves* elliptic or linear-elliptic, 30–40 × 5–10 mm, teeth at base of upper leaves large, up to 22 × 2 mm. *Inflorescence* ± dense and hemispherical; some fruits present in lower axils. *Bracts* stiff, linear-lanceolate, evenly tapering to a sharp point, with a narrow membranous margin and thick central nerve; weakly ciliate, 2·5–0·2–0·3 mm, free. *Fruits* 5–6 mm overall, the calyx spreading to 3–4 mm, the ovary c. 1 mm wide.

Syntypes: [Iran] in lapidosis montis Elbrus, *Kotschy* 91A and 193; [Lebanon] ad radices Antilibani, *Boissier*.

B7 Tunceli: Pertek to Tunceli, 1400 m, *D* 29137. Elaziğ: Angüsü near Kharput, *Sintenis* 1889: 642. C9 Siirt: Daharakol Dağ, E. of Şat, *Frödin* 122. Mardin: Cudi Dağ above Hessana (distr. Silopi) 1500 m, *D* 42846. C10 Hakkari: near junction of Van-Hakkari/Yüksekova roads, 1700 m, *D* 44720.

W. & N. Iran, N. Iraq, Antilebanon, Lebanon, Palestine, C. Asia. Occasionally this species has the sterile carpels splaying out below as in *V. oxyrrhyncha*. I have seen no specimens from the Palestine/Lebanon area; on the face of it, the recorded distribution is very peculiar.

Ovary section: I have been unable to cut the fruit satisfactorily; consequently I have not seen all the bundles that I am confident will be found in a good section.

5. V. oxyrrhyncha Fischer & Meyer, Ind. Sem. Hort. Petrop. 3: 51 (1837). (Plate 2, f. 1–5. Map 2.)

Syn.: *V. diodon* Boiss., Diagn. ser. 1 (3): 57 (1843); *V. diplusodon* Boiss., Diagn. ser. 1(10): 74(1849); *V. stocksii* Boiss., Fl. Or. 3: 99 (1875).

Ic: Krok, t. 2, f. 12; Fl. URSS 23: t. 23, f. 10 and 14 (1958); Hadač, Bull. Sci. Bagh. 40, f. 13 (1961); Fl. Aschk. t. 95, f. 8 (1965).

6–12(–18) cm, lower leaves withered in fruit, 11–35 × 1–8 mm, less toothed than average. *Inflorescence* loose, much branched, corymbose; in fruit the branches persistent and sometimes resembling basketry. *Bracts* herbaceous, 3–6 × 0·5–1 mm below; smaller, ± webbed and more membranous above. *Flowers* pale lilac. *Fruits* c. 4 mm overall, straps up to 3 mm, the ovary c. 1 mm wide.

Described from Armenia and the Mountains of the Talysch.

A9 Ḳars: 16 km from Iğdir to Tuzluca, 920 m, *D* 43560A. B5 Yozgat: Himmetdede to Boğazliyan, 1200 m, *Coode & Jones* 1454. B5 Kayseri: nr. Incesu, 1200 m, *Coode & Jones* 1295. *ibid.*, 18 m from Kayseri to Gemerek, 1300 m, *Coode & Jones* 1331. B9 Van: Özalp to Van, 2130 m, *D* 44350. B10 Ağri: 35 km E. of Doğubayazit nr. Iran border, 1600 m, *D* 43978. C6 Gaziantep: Kizilhisar Dere, 25 km from Gaziantep to Kilis, 750 m, *D* 28033. *ibid.*, Nisib to Birecik, 450 m, *D* 27914. (Armenia Turcica, *Szowits*; Cappadocia, at Karahisar, 3600′, *Balansa*).

N., W. & C. Iran, W. Pakistan, Baluchistan, Afghanistan, Caucasus, C. Asia, Palestine, Iraq. Specimens with 2 lateral straps have usually been called var. *diodon* or *V. diodon*. Although many specimens do fall into one or other category fairly easily, there are specimens with both sorts on one individual. However, the illustration of *V. diodon* in Fl. Aschkabad (t. 95,

f. 9) is of a more "extreme" form, with toothed, broad straps and broad fan; it is possible that I have been too hasty in consigning *V. diodon* to synonymy—but I have seen nothing in Turkey resembling the published figure in Fl. Aschkabad. (See also the paragraphs headed "Speculation").

Specimens with some much larger fruits in the lower forkings of the inflorescence, bulbous and with less surface detail than those of normal *V. oxyrrhyncha*, have been named *V. stocksii* (Type: Beloutschistan, 1851, *E. Stocks* (W.); N. Iran, Elburs, *Rechinger* 1937: 157). These plants seem to me to be diseased or galled, since the large fruits are extremely variable and peculiar; it would be interesting to try to grow them.

Section **Sclerocarpae** Boiss., Fl. Or. 3: 95 (1875).

6. V. cymbicarpa C. A. Meyer, Verzeichn. Pfl. Cauc. 49 (1831). (Plate 2, f. 6–8.)

Syn.: *V. monodon* Koch in Linnaea 17: 34 (1843); *V. huetii* Boiss., Fl. Or. 3: 101 (1875).

Ic: Krok, t. 2, f. 18; Fl. URSS 23: t. 23, f. 9 (1958); Fl. Aschk. t. 95, f. 12 (1965).

7–14 cm, the basal leaves withered in fruit. *Leaves* 20(–60) × 1·5(–5) mm. *Inflorescence* loose, spreading, with ± distinct ultimate cymes, some lower forks with fruits, the branches persistent. *Bracts* oblong, 2–3 × c. 0·4 mm, ± free and herbaceous below, becoming more webbed, smaller and membranous above, shortly puberulous at most. *Fruit* 3–3·5 mm overall, the straps c. 2 mm, the ovary 0·5–1 mm wide.

Type: (Georgia) In arena rivulorum pluvialium ex siccatorum ditionis Swant, Georg. Caucas., *Hohenacker* (iso. K.).

B6 Sivas: Gürün, 1400 m, *Stainton & Henderson* 5421. "Armenia", *Calvert & Zohrab* 42. B8 Erzurum: Erzurum, June 1843, *Huet.* (Type of *V. huetii.*)

Iran, Afghanistan, Baluchistan; Caucasus, eastwards to C. Asia. The collections from Armenia and Erzurum resemble each other in having the base of the fruits swollen, those of Huet's collection being more pronounced and almost certainly monstrous or diseased—these variants have been named *V. huetii.*

Boissier and Krok disagreed over the relationship of *V. cymbicarpa* and over the relative sizes of the fertile and sterile loculi. I have been unable to see any *V. sclerocarpa* (recorded from NW. Iran near Khoi, but not yet found in Turkey) and cannot therefore assess the similarities between it and *V. cymbaecarpa.*

7. V. plagiostephana Fischer & Meyer, Ind. Sem. Hort. Petrop. 2: 52 (1835). (Plate 2, f. 9–11.)

Syn.: *V. carinata* var. *navicularis* Krok, Mon. Val. 63, t. 2, f. 20 (1864).

Ic: Krok, t. 2, f. 19; Fl. URSS 23: t. 23, f. 8 (1958); Fl. Aschk. t. 95, f. 13 (1965).

14–18 cm. *Leaves* often entire, 25–27 × 5–6 mm. *Inflorescence* lax, obconic, the fruits deciduous leaving the persistent inflorescence branches. *Bracts* 3–5 × 0·5 mm, the lower herbaceous and free, the upper webbed, smaller, membranous. *Flowers* lilac. *Fruit* 3·5 × c. 1 mm.

Type: Hab. in campis altiorum montium Talüsch.

A8 Erzurum: Pasinler to Horasan, 1650 m, *D* 29393. B10 Kars: N.E. slope of Ağri Dağ, below Serdar Bulak, 1500 m, *D* 43705.

Caucasus, Soviet Armenia, Afghanistan, C. Asia. One specimen from Afghanistan has a few fruits with short lateral straps; these fruits are very similar to those of *V. cymbicarpa* (see "Speculations").

8. V. szowitsiana Fischer & Meyer, Ind. Sem. Hort. Petrop. 3: 48 (1837). (Plate 2, 12–14. Map 1.)

Syn.: *V. aucheri* Boiss., Diagn. ser. 1 (3): 58 (1843); *V. persica* Boiss., loc. cit.

Ic: Krok, t. 2, f. 17; Fl. URSS 23: t. 23, f. 11 (1958); Hadac, Bull. Sci. Bagh. 39, f. 4 (1961); Fl. Aschk. t. 95, f. 10 (1965).

4–18 cm. *Leaves* mostly entire, 17–45 × 1–6 mm. *Inflorescence* at first dense, later lax, obconic, the branches and bracts stiff, persistent, resembling basketry. *Bracts* 2·5–3 × 0·5–0·8 mm below, ± free and herbaceous, smaller and webbed above. *Flowers* pale lilac. *Fruit* 3·2–4 mm overall, the strap 2–2·1 mm, the ovary 1·2–2 mm wide.

B5 Kayseri: 18 m from Kayseri towards Gemerek, 1300 m, *Coode & Jones* 1330A. *ibid.*, nr. Incesu, c. 1200 m, *Coode & Jones* 1298. B9 Van: Van to Erçek, 1850 m, *D* 44298.

Iran, Afghanistan, Syria, W. Pakistan, Caucasus, C. Asia. The size of the fruit varies between the collections and some of the older fruits become bluish. Occasionally a second, shorter lateral strap is produced or the strap becomes bifid or very deeply toothed.

The name *V. persica* (Type: Ispahan, *Aucher* 4687 (G)—the only specimen I have seen) has been applied to plants lacking the straps on the fruit. Since I have seen fruits with and without straps on the same plant, I consider *V. persica* to be synonymous with *V. szowitsiana.*

Section **Cornigerae** Soy.-Willem. in Gren. & Godr., Fl. Fr. 2: 61 (1850) emend. Krok, Mon. Val. 33 (1864).

9. V. echinata (L.) DC., Fl. Fr. 4: 242 (1805). (Plate 3, f. 1–3. Map 2.)

Syn.: *Valeriana echinata* L., Syst. Nat. ed. 10, 2: 861 (1759).
Valerianella soyeri Buch. in Boiss., Diagn. ser. 1 (10): 74 (1849)?

Ic: Krok, t. 4, f. 43; Fl. URSS 23: t. 23, f. 5 (1958); Hadač, Bull. Coll. Sci. Bagh. 6: 40, f. 10 (1961), as *V. soyeri.*

5–20(–30) cm, basal leaves usually withered in fruit. *Leaves* 15–35 × 5–8 mm. *Inflorescence* ± capitate, the upper branches and peduncles often becoming inflated in fruit, sometimes detaching complete with peduncle.

Bracts herbaceous, 2–3 × 0·5 mm, linear, the upper bracts inconspicuous and obscured by the flowers. *Flowers* few (3–8) per inflorescence, lilac. *Fruits* persistent, 4–6 mm overall, the hooks spreading to 2–3 mm.

A1 (A) Çanakkale: Thymbra, in Scamandra valley, *Sintenis* 183: 197. A2 (E) Istanbul: Istanbul, 1847, *Noë* 6. *ibid.*, Halkali to Yeni Bostan, 4 v 1939, *B.V.D. Post.* A2 Bilecik, 300 m, *D* S135/1962—grown from seed. B1 Izmir: Dyo-Adelphia in the gulf of Izmir, 8–900 m, *Bornmüller* 1906: 9621. C2 Muğla: Marmaris to Gökova, 50–100 m, *D* 41079. (?C6 Urfa): Rum Kala'a, *Sintenis* 1888: 289.

Palestine, Cyprus, Crimea, Iraq, Lebanon. Boissier and Krok disagree over their treatment of *V. soyeri.* There is variation, as Boissier indicated, in the development of blocks of spongy tissue on the fruit and in the extent of inflation of the fruiting branches, but the two are not correlated (especially not in the *Sintenis* specimens from Thymbra).

10. V. triceras Bornm. in Mitt. Thür. Bot. Verein. 34: 66 (1908). (Plate 8, f. 1–2).

Differs from *V. echinata* in having 3 long horns on the fruit and from *V. laxa* in having the horns spreading in 3 directions, and in having a more slender fruit.

Type: [Turkey B1 Izmir] Lydia, Sinus Smyrnaeus in mont "Dyo-Adelphia" (Iki-Kardasch), 8–900 m, 15 v 1906, *Bornmüller* 9623.

Known only from the type, although 2 collections from Cyprus seem to resemble it very closely (Papoutsa, 4000 ft, *R. D. Meikle* 2932: Paputsa, 4200 ft, *Davis* 3110). However, the specimens I have seen of the latter have been younger than *Bornmüller's* collection, so there must remain some doubt. If they are all conspecific, the distribution is very peculiar, and the species can be expected in S. Turkey. I am grateful to R. D. Meikle for specimens of his collection and for his advice.

11. V. laxa Boiss. & Bal., in Boiss. Diagn. ser. 2 (2): 121 (1856). (Plate 3, f. 4–6. Map 4.)

Ic: Krok, t. 4, f. 44.

(6–)9–35 cm, most leaves withered in ripe fruit. *Stems* branched or not. *Leaves* 12–35 × 2–7 mm. *Inflorescence* few-flowered, condensed, the branches thickening and not all fruits ripening perfectly. *Bracts* 3(–12) × 0·5 mm, smaller above and becoming obscured; ± herbaceous and linear. *Flowers* blue. *Fruit* 5 × 2–3 mm.

Type: [Turkey B1 Izmir] Hab. in collibus Koukouloudja prope Smyrne, *Balansa.*

B1 Izmir: Yamanlar Dağ, 1000 m, *Dudley*, D 34887A. C4 Içel: district Mut, Mağras Dağ, 1300 m, *Coode & Jones* 763. *ibid.*, Adras Dağ, 1300 m, *Coode & Jones* 951.

Both the fruit shape and the ovary section are intermediate between those of *V. echinata* and *V. orientalis.* Possibly *D* 27491 (from C6 Maraş: Ahir Dağ above Maraş, 1100 m) belongs here, but the fruit is very young.

12. V. orientalis (Schlechtd.) Boiss. & Bal. in Boiss. Diagn. ser. 2 (2): 120 (1856). (Plate 3, f. 7–9. Map 2.)

Syn.: *Fedia orientalis* Schlechtd. in Linnaea 17: 126 (1843).

Ic: Krok, t. 4, f. 45.

7–14(–22) cm, leaves usually withered in ripe fruit, 12–30(–47) × 2–9 mm. *Inflorescence* ± obconic, condensed, the fruiting branches often becoming thickened and inflated. *Bracts* often obscured, the lower ± herbaceous, linear, 4–5 × 1–2 mm. *Flowers* blue to lilac. *Fruits* deciduous, 3–3·2 × 1·5–2·5 mm, sometimes going bluish when very ripe.

Type: [Syria] in lapidosis collinum prope Aleppo, 19 April, *Kotschy*.

A1 (A) Çanakkale: Dumbrek valley, *Sintenis* 1883: 395. B1 Izmir: between Menemen and Manisa, nr. Değirmen Dere, 2–300 m, *Bornmüller* 1906: 9630. *ibid.*, Yamanlar Dağ, 1000 m, *Dudley*, *D* 34888. C2 Muğla: Fethiye to Elmali, 1120 m, *Dudley*, *D* 35184. Aydin: Karacasu, 600–700 m, *D* 41605. C4 Içel: district Mut, Adras Dağ, 1300 m, *Coode & Jones* 953. *ibid.*, district Gülnar, Bozağaç to Ahirini, 700 m, *D* 26034. C6 Maraş: 10 km S. of Maraş, 550 m, *D* 27361.

Syria, Palestine. The habit and to some extent the fruiting inflorescence resemble those of *Fedia cornucopia*, which is a coarser plant.

Section **Locustae** DC., Prodr. 4: 625 (1830) emend. Krok. Mon. Val. 32 (1864).

13. V. locusta (L.) Betcke, Animadv. bot. Valer. 10 (1826). (Plate 4, f. 1–4. Map 5.)

Syn.: *Valeriana locusta* L., Sp. Pl. 33 (1753), cum var. *olitoria*; *Valerianella olitoria* (L.) Pollich, Hist. Pl. Palat. 1: 30 (1776).

Ic: Krok, t. 4, f. 40: Fl. URSS 23: t. 24 f. 1 (1958); Ross-Craig, Draw. Brit. Pl. 14: t. 30 (1960).

4·5–10 cm, leaves usually present in fruit, 8–19(–30) × 2–8 mm. *Inflorescence* ± hemispherical, often exceeded by the uppermost leaves and lower bracts. *Bracts* herbaceous, ± conspicuous, 5–10 × 1–2 mm, glabrous or shortly setose on the margins, mostly free. *Flowers* blue. *Fruit* c. 2 × 1·5 mm.

Described from Europe.

A2 (E) Istanbul: Makriköy to San Stefano, 18 iv 1923, *B.V.D. Post*. A5 Çorum: Iskilip, Kebabdere above Karmiş, 1300 m, *Coode & Jones* 1748. B5 Yozgat: Akdağmadeni to Büyük Nalbant Dağ at Köklü Deresi, 1600 m, *Coode & Jones* 2114. C4 Içel: district Mut, Mağras Dağ, 1400 m, *Coode & Jones* 772.

Differs from *V. costata* in lateral view shape of the fruit (being sharper pointed), less condensed inflorescence, larger bracts, and less spongy tissue on the sides of the fruit. In section, the thin septum between the two sterile loculi reflects the less spongy fruit. Vegetatively *V. locusta* is very like *V. carinata*; the leaves are often larger than usual for the genus, and wilt quickly.

14. V. costata (Stev.) Betcke, Animadv. Bot. Valer. 11 (1826). (Plate 4, f. 5–7. Map 5.)

Syn.: *Fedia costata* Stev. in Mém. Soc. Nat. Mosc. 5: 264 (1817).
V. capitata Boiss. & Bal. in Boiss., Diagn. ser. 2 (6): 93 (1859).

Ic: Krok, t. 4, f. 41 and 42; Fl. URSS 23: t. 24, f. 14 (1958).

7–15(–20) cm, the basal leaves usually withered in fruit. *Leaves* 1·5–3·5 × 0·1–0·7 mm, entire or sinuate-dentate at most. *Inflorescence* ± globose. Lowermost bracts herbaceous, c. 5 × 1·5 mm, oblong-elliptic, free; upper bracts much smaller, membranous and with mid-nerve, webbed. *Flowers* blue, lilac or pinkish. *Fruits* c. 2 × 1·5 mm; some axillary fruits present.

A7 Gümüşane: Wang, *Sintenis* 1894: 5629. B1 Izmir: Bergama, vi 1833, *Montbret*. B2 Uşak: Kaya Göl Dere, N.W. of Uşak, *Balansa* 1262 (type of *V. capitata*). B5 Yozgat: Sorgun to Çekerek, 1200 m, *Coode & Jones* 1577: 1585. C2 Muğla: Yatağan to Gökbel, 300 m, *D* 41471. C3 Antalya: Antalya, 17 iv 1860, *Bourgeau*. C4 Içel: district Mut, Adras Dağ, 1300 m, *Coode & Jones* 986 Lycia: Tremelley, *Forbes*.

The specimen from Adras Dağ (*Coode & Jones* 986) growing only a few miles from *Coode & Jones* 772 (*V. locusta*) has a section with a thin septum, and also resembles *V. locusta* in being more sharp-pointed above the fertile loculus than the other specimens cited here. This specimen, as well as the study of the sections, suggests that *V. locusta* and *V. costata* are not very distinct; more specimens will help to clarify the picture.

European Russia (?Bessarabia, Crimea): Greece.

Section **Platycoele** DC., Prodr. 4: 627 (1830) emend. Boiss., Fl. Or. 3: 96 (1875).

15. V. carinata Lois., Not. Fl. Fr. 149 (1810). (Plate 4, f. 8–10. Map 6.)

Ic: Krok, t. 2, f. 20; Fl. URSS 23: t. 24, f. 15 (not very informative); Ross-Craig, Draw. Brit. Pl. 14: t. 31 (1960).

5–30 cm, lower leaves often present in ripe fruit. *Leaves* 10–15 × 1–10 mm, entire or sinuate-dentate, oblong to spathulate. *Inflorescence* ± hemispherical in flower, loosely globular in fruit. *Bracts* herbaceous, conspicuous, 5–15 × 1–4 mm, linear, oblanceolate or oblong. *Flowers* white or more usually bluish, rarely lilac. *Fruit* deciduous, 2–2·7 × 0·7–1 mm.

Type: [France] champs aux environs de Paris, *Loiseleur*.

A1 (A) Çanakkale: Renkoei in Dumbrek valley, *Sintenis* 1883: 399 p.p. A2 (E) Istanbul: Rumeli Hisar, 7 iv 1919, *B.V.D. Post*. A2 Bursa: Uludağ, 15 v 1955, *Heilbronn*. A6 Samsun: 2 m N. of Samsun, 50 m, *Tobey* 35. B1 Balikesir: Kaz Dağ, Ceycis dere, 12 km from Edremit, *Dudley*, *D* 34799A. B5 Niğde: Hasan Dağ at Taşpinar Yayla, 2100 m, *D* 18984. Yozgat: Sorgun to Çekerek, 1200 m, *Coode & Jones* 1559. B6 Yozgat: Akdağmadeni to Büyük Nalbant Dağ, at Sofular Deresi, 1800 m, *Coode & Jones* 2086. C2 Aydin: d. Karacasu, Aphrodisias (Geyre), 6–700 m, *D* 41595. C4 Konya: Agios Philippos, 30 iv 1913, *B.V.D. Post* 31 p.p. C5 Niğde: Ala Dağ, Arpalik cave, 2190 m, *Parry* 161. Hatay: Antakya to Yayladağ nr. Şenköy, 1000 m, *D* 27173.

I have seen the type of *V. corymbifera* Boiss., Fl. Or. 3: 107 (1875) (C3 Antalya: Antalya, 17 iv 1860, *Bourgeau*) which has fruits resembling those of *V. carinata* but longer (up to 3·5 mm) and shiny. There is apparently good seed in the fertile loculus. However, the bracts and inflorescence look totally out of keeping with the rest of the genus and I consider that it is a diseased plant of *V. carinata*. I have seen specimens vegetatively similar to *V. carinata* but with inflorescence galled and sterile, particularly from the Istanbul area—*V. corymbifera* seems to me to be probably the result of a mild infection.

16. V. turgida (Stev.) Betcke, Animadv. Bot. Valer. 14 (1826). (Plate 4, f. 15–17. Map 5.)

Syn.: *Fedia turgida* Stev. in Mém. Soc. Nat. Mosc. 5: 345 (1817).

Ic: Krok, t. 3, f. 26; Fl. URSS 23: t. 24, f. 13 (1958).

8–18(–30) cm. *Leaves* sometimes all entire, 13–35 × 3–11 mm. *Inflorescence* ± loosely globular. *Lower bracts* 5 × 1 mm, herbaceous, sometimes exceeding the inflorescence; smaller, membranous and webbed above. *Fruit* c. 2·5 × 2–3 mm, often tenacious at least at first, later deciduous (cf. *V. pumila*).

A1 (E) Edirne: 8 km W. of Edirne, 100 m, *D* 41970. A1 (A) Çanakkale: Erenköy in Dumbrek valley, *Sintenis* 1883: 399 p.p. A2 (E) Istanbul: Rumeli Hisar, 13 v 1918, *B.V.D. Post*. A2 (A) Istanbul: Prinkipo, 3 v 1918, *Aznavour*. Kocaeli: Pendik, 6 v 1906, *Aznavour*. A3 Bilecik: 2 km S. of Bilecik, 400 m, *D* 42082. C2 Muğla: 68 miles from Fethiye to Elmali, 1120 m, *Dudley*, *D* 35187A. C4 Konya: Agios Philippos, 30 iv 1913, *B.V.D. Post* 31 p.p.

E. & C. Europe, eastwards to the Caucasus.

17. V. pumila (L.) DC., Fl. Fr. 4: 242 (1805). (Plate 4, f. 12–14. Map 3.)

Syn.: *Valeriana locusta* var. *pumila* L., Syst. Nat. ed. 12, 2: 73 (1767).
Fedia tridentata Stev. in Mém. Soc. Nat. Mosc. 2: 178 (1809) and 5: 346 (1817).
Valerianella tridentata (Stev.) Krok, Mon. Val. 73 (1864).

Ic: Krok, t. 3, f. 29 as *V. tridentata*; Fl. URSS 23: t. 24, f. 4 (1958); Hadač, Bull. Coll. Sci. Bagh. 6: 40 f. 9 (1961).

4–17 cm. *Leaves* narrower than usual, 12–36 × 1–7 mm. *Inflorescence* ± globose, dense. *Bracts* 3–5 × 0·5 mm, webbed, persistent after fruit-fall. *Flowers* white, pinkish or lilac. *Fruits* 2–2·1 × 1·5–1·8 mm, deciduous early.

A2 (E) Istanbul: Ispartakule, Kapadik çiftliği, v 1949, *Heilbronn*. A5 Çorum: 21 miles from Çorum to Iskilip, 800 m, *Coode & Jones* 1699. B4 Ankara: Ankara, Ortadoğu Universitesi Merasi, vi 1963, *Alinoğlu* (mera 4). B5 Yozgat: 20 km Yozgat to Yerköy, 1100 m, *Coode & Jones* 1525. Kayseri: 8 miles from Kayseri to Gemerek, 1300 m, *Coode & Jones* 1311. B7 Elaziğ: Gölçük, 1200 m, *E. S. Brown* 2442. C5 Adana: Kozan, 150 m, *D* 26601. C7 Urfa: Akçakale, 400 m, *D* 28107A. C8 Mardin: 2 km E. of Mardin, 1150 m, *D* 28571. Diyarbakir: Çinar to Diyarbakir, 700 m, *D* 28677.

N. Iraq, Palestine, SW., S. Iran, S. & C. Europe, European Russia, Caucasus eastwards to C. Asia, N. Africa. Krok's illustration shows a great range of variation particularly in the development of the calyx teeth. However, the Turkish material does not show this range and varies only in the size of the fruit. There is one exception: *Sintenis* 1888: 1534—from C7 Urfa: Birecik—which although not outside the range of Krok's illustration destroys the unity shown by the specimens cited above. It is also a taller plant; the fruit is drawn to scale (Plate 4, f. 11) and had it not been for Krok's illustration I would have described it as new. Specimens from the whole range of the species showing the full range of variation are needed before a satisfactory decision can be made.

18. V. rimosa Bast. in Desv. J. Bot. 3: 20 (1814). (Plate 7, 1–3.)

Syn.: *V. auriculata* DC., Fl. Fr. 5: 492 (1815).

Ic: Krok, t. 3, f. 28; Fl. URSS 23: t. 24, 11 (1958); Ross-Craig, Draw. Brit. Pl. 14: t. 32 (1960).

18–25 cm, slender. *Leaves* c. 20–30 × 2–4 mm. *Inflorescence* hemispherical ± dense. *Bracts* linear, 2–3 mm. *Fruits* deciduous, c. 2 × 2 mm.

A2 (A) Istanbul: Riva, 12 vi 1893, *Aznavour*.

Europe, Caucasia, Soviet Armenia. The only specimen from Turkey is given above; it is remarkable if it has not been found again, especially as the Istanbul area is, if anything, overcollected. The surface of the fruit is unique in Turkish *Valerianellas*, there being nothing else resembling the even, polygonal papillae.

See Appendix 1.

Section **Coronatae** Boiss., Fl. Or. 3: 96 (1875).

19. V. dufresnia Bunge ex Boiss., Fl. Or. 3: 109 (1875). (Plate 5, f. 1–3. Map 5.)

Syn.: *Dufresnia orientalis* DC., Prodr. 4: 625 (1830). *?D. leiocarpa* Koch in Linnaea 17: 34 (1843). *?D. conjugens* Binge ex Boiss., Fl. Or. 3: 109 (1875).

Ic: Fl. URSS 23: t. 24, f. 10 (1958); Hadač in Bull. Coll. Sci. Bagh. 6: 39, f. 1 (1961); Fl. Aschk. t. 95, f. 3 (1965).

3–10(–20) cm, basal leaves often present in early fruit at least. *Leaves* usually largest in the middle of the stem, entire to sinuate-dentate or occasionally sparsely toothed, ± elliptic, 15–55 × 9–15 mm. *Inflorescence* ± globose. *Bracts* ovate to elliptic, ± glabrous and herbaceous, 3–5 × c. 1 mm, free. *Flowers* white, sometimes pinkish. *Fruits* 6–10 mm overall, the calyx lobes spreading up to 10 mm, ovary width c. 3 mm.

Type: [Iraq] in Mosul et Baghdad legerunt *Olivier & Brugière* (P).

A9 Kars: Tuzluca to Kağizman (Aras valley), 950 m, *D* 43615. B5 Kayseri: 18 miles from Kayseri towards Gemerek, 1300 m, *Coode & Jones* 1372. *ibid.*, nr. Incesu, 1200 m, *Coode & Jones* 1296. B6 Sivas: Gürün, 1400 m,

Stainton & Henderson 5250. Elazig: Harputh, vi 1852, *Noë* 838. Elazig/ Diyarbakir: Argana (Ergani) to Maden, 1843, *Rochel* 14. B9 Van: Van to Erçek, 1850 m, *D* 44270; *D* 44336.

Syria: N., C., W. Iran: Soviet Armenia: W. Pakistan: Iraq: Afghanistan: C. Asia. Krok omitted this very distinct species. The fruit varies on a single plant, in size and in hairiness. For this reason I have suggested that *D. leiocarpa* and *D. conjugens*, which differ in these respects, should be reduced to synonymy, although I have not seen the types. Occasionally the fruits resemble those of *V. triplaris*, although the calyx lobes are always more membranous and net-veined and the ovary is usually hairier. The extremes of variation of *V. dufresnia* do not occur in Turkey.

20. V. coronata (L.) DC., Fl. Fr. 4: 241 (1805). (Plate 5, f. 4–5. Map 4.)

Syn.: *Valeriana locusta* var. *coronata* L., Sp. Pl. 34 (1753).

Ic: Krok, t. 3, f. 32; Fl. URSS 23: t. 24, f. 6 (1958); Hadač in Bull. Coll. Sci. Bagh. 6: 39, f. 6 (1961); Fl. Aschk. t. 95, f. 4 (1965).

5–25 cm, the basal leaves usually withered in fruit. *Leaves* ± linear, 20–40 × 1–3 mm. *Inflorescence* densely globular. *Bracts* ovate, membranous with a broad green midnerve, acuminate, setose on margins and nerves, slightly webbed. *Flowers* pale, bluish to lilac to pinkish, rarely white. *Fruit* overall 3–5 × 2–4 mm.

Described from Lusitania.

A2 (E) Istanbul: Halkali to Yeni Bostan, 4 v 1939, *B.V.D. Post.* A2 Bilecik: Bilecik, Karasu valley, 3–400 m, *Bornmüller* 1929: 14194. A5 Samsun: Çakalli Köy nr. Mağmur Dağ, 400 m, *Tobey* 226. B2 Kütahya: Murat Dağ above Banaz, Gürlek to Murat, 1800 m, *Coode & Jones* 2450. B3 Eskişehir: 18 miles from Polatli to Sivrihisar, 800 m, *Coode & Jones* 2269. B4 Konya: Cihanbeyli, *D* 18629. B5 Kayseri: Bakir Dağ above Kisge, 1400 m, *D* 19259. B6 Yozgat: Akdağmadeni, Yukari Çulhali, *Curtis* 160. B6/7 Malatya: Malatya to Maraş, 1400 m, *Stainton & Henderson* 6565. B8 Siirt: Siirt to Baykan, 800–900 m, *D* 43173. B9 Bitlis: Ahlat to Adilcevaz, 1750 m, *D* 44332. C2 Muğla: Muğla to Kale, 1100 m, *Dudley*, *D* 35102. C5 Niğde: Pozanti to Niğde, 1300 m, *Coode & Jones* 1246. C7 Urfa: Surug to Urfa, 300 m, 5 v 1865, *Haussknecht*. C8 Siirt: Ramana Dağ, 20 km from Hasankeyf to Batman, 730 m, *D* 42987. C9 Hakkari: 12 km from Hakkari to Van, 1250m, *D* 44862. C10 Hakkari: 9 km S. of Hakkari to Yüksekova road junction, 1500 m, *D* 44661.

Most of S. & C. Europe; SW. Asia, eastwards to Tien Shan.

Ovary section: the fruit becomes very hard and lignified and none of my handsections shows the posterior bundle; with good sections I am confident it will be found.

Very common in W. and C. Turkey.

21. V. kotschyi Boiss., Diagn. ser. 1 (3): 60 (1843). (Plate 5, f. 6–7. Map 6.)

Ic: Krok, t. 3, f. 33; Hadač in Bull. Coll. Sci. Bagh. 6: 39 f. 3 (1961).

7–25 cm, lower leaves sometimes present in fruit. *Leaves* 24–45 × 4–7 mm. *Inflorescence* ± loosely globular. *Bracts* free, herbaceous, 3–6 × 0·5–1 mm

below; smaller, more membranous and webbed above. *Flowers* pink, lilac or pale bluish. *Fruits* 3·5–5 overall, calyx spreading to 2·5–3·5(–5) mm, ovary width 1·5–2·3 mm.

Syntypes: in locis humidiusculis pr. Aleppo, 15 iv 1841, *Kotschy* 108a (G!) Hab. in Mesopotamia, *Aucher* 2077.

A5 Çorum: 15 miles from Çorum to Merzifon, 900 m, *Coode & Jones* 1871. Yozgat: 14 miles from Çekerek to Alaca, 800 m, *Coode & Jones* 1606. B5 Kayseri: 15 miles from Kayseri to Gemerek, 1300 m, *Coode & Jones* 1313. Yozgat: 20 miles from Yozgat to Yerköy, 1100 m, *Coode & Jones* 1530. C4 Konya: Konya to Çumra, Küçük Köy, 980 m, *Helbaek* 2393. C6 Gaziantep: 30 miles from Gaziantep to Kilis, 750 m, *D* 28103. Urfa: Birecik, "Tschiftlik" (Çiftlik—farm), *Sintenis* 1888: 409. C7 Urfa: Viranşehir to Ceylanpinar, 530 m, *D* 42370. C8 Mardin: c. 10 km W. of Savur, 900 m, *D* 42443. Siirt: Ramana Dağ (Hasankeyf to Batman) 730 m, *D* 42983.

Iraq. Often the fruits detach in pairs, the very flat backs of the fertile carpels allowing back-to-back pairing. Like *V. coronata*, *V. kotchyi* has proved difficult to section on account of the extreme lignification. It is probable that a large sample would show sections more resembling those of *V. coronata* than that drawn. The epidermis does not detach easily.

22. V. chlorostephana Boiss. & Bal., Diagn. ser. 2 (6): 92 (1859). (Plate 5, f. 8–9. Map 3.)

Syn.: *V. boissieri* Krok, Mon. Val. 81 (1864).

Ic: Krok, t. 3, f. 34; Hadač, Bull. Coll. Sci. Bagh. 6: 39, f. 5 (1961)—this illustration seems to me to be misleading; certainly the section bears no resemblance to what I have found.

12–15 cm, lower leaves withered in fruit. *Leaves* linear-oblong or oblanceolate, 0·8–2·7 × 0·1–0·5 mm. *Inflorescence* ± globular, loose, few (6–12)-flowered. *Bracts* ovate to broadly ovate, 2·5 × 2 mm, membranous with a broad midnerve projecting at apex; slightly webbed. *Fruit* overall 3–3·5 × 2·5 mm.

Type: [Turkey B2 Uşak] Ouchak, 910 m, *Balansa* 1263 (G K).

A5 Çorum: 5 miles S. of Iskilip to Çorum, 800 m, *Coode & Jones* 1794. B3 Afyon: 17 miles S. of Emirdağ on road to Bolvadim, 1100 m, *Coode & Jones* 2332.

Differs from *V. kotschyi* (which seems to be intermediate between *V. coronata* and *V. chlorostephana* in calyx form) in lacking hooks on the calyx lobes, by the less clearly defined hexamery, and generally less developed calyx.

Ovary section: the section drawn is from a younger fruit than that drawn for *V. kotschyi*. The difference between them is, I suspect, more a reflection of the age difference than specific. The one section of the very ripe fruits of the type that I managed to cut was more similar to that shown for *V. kotschyi*. However, it was impossible to see the bundles in the type section, and I therefore have drawn the younger section, which also will be mentioned again in the paragraphs "Speculation".

23. V. glomerata Boiss. & Bal., in Boiss. Diagn. ser. 2 (6): 93 (1859). (Plate 5, f. 10–11. Map 3.)

Ic: Krok, t. 4, f. 36.

9–16 cm, the lower leaves usually present in early fruit. *Leaves* ± oblong, 15–30 × 2–6 mm. *Inflorescence* globose. *Bracts* very broadly ovate or orbicular, 4–5 × 3–4 mm, conspicuous, membranous, nervose, ciliate at margin, ± free. *Flowers* pale lilac. *Fruit* 5 × 2·5 overall, the calyx spreading to 4 mm.

Type: [Turkey B2 Uşak] Versant du Boulgas Dagh (Phrygie), vers. 1300 m, *Balansa* 1621 (K W).

B5 Yozgat: 20 km from Yozgat to Yerköy, 1100 m, *Coode & Jones* 1527. B7 Elaziğ: Elaziğ to Kale, 1300 m, *D* 28931.

Distinctive on account of the bracts enveloping the flowers; the calyx lobes are glabrous inside, with a hairy cup—cf. *V. discoidea* with hairs on the inside of the calyx lobes.

Ovary section: the section drawn is from a young fruit, since none of the recent collections are ripe. The general shape is probably too flat; presumably the densely dotted area would in time have become entirely lignified and would have more resembled the other sections on the plate. There appear to be at least 2 vascular bundles making up the "central" strand. The corners of the fertile carpel extend laterally either fusing with the tissue on the "shoulders" of the sterile carpels, or showing lacunae developing, by tearing, internally; either way there are 2 extra "loculi" formed, small but quite distinct. It seems evident that these are in no way homologous with the sterile loculi "proper". It is possible that they tear open in older fruit, as enlargement proceeds. The epidermis (loose-fitting and very hairy) covers the "joins" as though there were nothing unusual beneath; it is difficult to see how if these false loculi do tear open in maturation, a section similar to, e.g. *V. kotschyi* could be reached, with the epidermis remaining in contact with the fruit outline throughout. It seems, therefore, that the presence of these loculi do represent a difference dividing *V. glomerata* from the rest of Section *Coronatae*.

24. V. discoidea (L.) Lois., Not. Fl. Fr. 148 (1810). (Plate 6, f. 1–2. Map 1.)

Syn.: *Valeriana locusta* var. *discoidea* L., Syst. Nat. ed. 10, 2: 860 (1759).

Ic: Krok, t. 4, f. 37.

5–20(–30) cm, basal leaves often present in fruit. *Leaves* oblanceolate or spathulate, 2–3·5 × ·5–1 cm. *Inflorescence* ± densely globose. *Bracts* lanceolate or narrowly ovate, membranous with a mid-nerve, ciliate and hairy, less than the mature fruit, generally "inconspicuous" free. *Flowers* pale lilac. *Fruits* 4–5 mm overall, the calyx spreading to c. 4 mm, the ovary c. 1·5 mm wide.

A1 (A) Çanakkale: Erenköy, in Dumbrek valley, *Sintenis* 1883: 402. A2 (E) Istanbul: Rumeli Hisar, 19 iv 1919, *B.V.D. Post*. A2 (A) Kocaeli: Pendik, 29 iv 1892, *Aznavour*. B1 Izmir: Çeşme, 10–50 m, *D* 41822. C1 Muğla: d. Bodrum, Muşgebi to Karatoprak, 50–100 m, *D* 41007. Izmir: S. of

Kuşadasi, 30 m, *D* 40717. C4 Antalya: Alanya, 100 m, *D* 25870. C4 Içel: Anamur, foot of Kaldöken Dağ, 100 m, *D* 25937. C6 Maraş: district Pazarcik, Narli to Karabiyikli, 600–700 m, *D* 27776. Is: Ikaria, *D* 40655. Rodhos, *D* 40378.

Palestine, Lebanon, Cyprus, Macadonia, Greece. A specimen (*M. Jacobs* 6470) that I cannot distinguish from *V. discoidea* has been seen from NW. Iran, which is apparently some hundreds of miles from the nearest known locality.

25. V. obtusiloba Boiss., Diagn. ser. 1 (3): 59 (1843). (Plate 6, f. 5–6. Map 6.)

Syn.: *Fedia nervata* Hochst. & Steud. in sched.

Ic: Krok, t. 4, f. 38.

7–20(–30) cm, lower leaves often present in fruit, 14–40 × 2–7 mm. *Inflorescence* globose. *Bracts* broadly ovate, membranous, nervose, the margins ciliate, 3·5 × 2·5 mm. *Flowers* pink or lilac. *Fruit* c. 6 mm overall, calyx spreading to 10 mm, ovary c. 3 mm wide.

Syntypes: Hab. in Asia Minor, *Aucher* 2070 Legi quoque ad radices Cadmi prope Denisleh. *Boisser*.

A1 (A) Çanakkale: Thymbra, in Scamandra valley, *Sintenis* 1883: 401. A2 (E) Istanbul: v 1844, *Noë* 546. B1 Izmir: Izmir, 19 iii 1827, *Fleischer*. C1 Aydin: Priene, 50–100 m, *D* 40823. C2 Muğla: Dereköy between Marmaris and Muğla, 10 m, *D* 25398. C5 Hatay: Antakya near St. Peter's Church, 150–300 m, *D* 27233. Is: Samos, *Gathorne-Hardy* 635. Ikaria, *D* 1593.

Lebanon.

Ovary section: I was unable to cut a good hand-section of the fruit of this species; part of the difficulty lies in the oblique setting of the calyx which is low on the ovary anteriorly. Thus median sections are often obscured by calyx. The diagram is therefore composite. I could not find the lateral sterile bundles, but again expect them to be found in a good section. The central and anterior bundles are represented by a dense block of tissue containing at least 2 bundles.

26. V. vesicaria (L.) Moench, Meth. Pl. 493 (1794). (Plate 6, f. 3–4. Map 7.)

Syn.: *Valeriana locusta* var. *vesicaria* L., Spl. Pl. 33 (1753).

Ic: Krok, t. 4, f. 39; Fl. URSS 23: t. 24, f. 5 (1958); Hadač, Bull. Coll. Sci. Bagh. 6: 39, f. 2 (1961).

(5–)9–20(–30) cm, lower leaves often present in fruit. *Leaves* 5–40 × 2–11 mm. *Inflorescence* ± globose. *Bracts* broadly ovate to orbicular, membranous, nervose, ciliate on margin, c. 4 × 4 mm. *Flowers* lilac to pinkish. *Fruits* 4–6 × 4–6 mm.

Described from Crete.

A1 (A) Çanakkale: Erenköy, nr. Halil Eli, *Sintenis* 1883: 395. A2 (E) Istanbul: Florya to San Stefano, 25 v 1896, *Aznavour*. A5 Amasya: 17 km from Merzifon to Havsa, 700 m, *Coode & Jones* 1958. B1 Izmir: Smyrne, 1908, *Kats*. B2 Uşak: Uşak, 910 m, *Balansa* 259. B3 Eskişehir: Polatli to Sivrihisar, 800 m, *Coode & Jones* 2270. B4 Ankara: Tuz Gölü, 10 km S. of

Şereflikoçhisar, 950 m, *Coode & Jones* 134. B5 Yozgat: 20 km from Yozgat to Yerköy, 1100 m, *Coode & Jones* 1529. C1 Muğla: Marmaris, Yarimadasi, 300 m, *D* 41383. C2 Antalya: Elmali to Korkuteli, 1200 m, *Dudley*, *D* 35224. C3 Antalya: Antalya, *Bourgeau* 124. C4 Içel: nr. summit of Adras Dağ, *Coode & Jones* 1004. C5 Adana: 10 km from Adana to Ceyhan, s.l. *Coode & Jones* 372. C6 Gaziantep: Gaziantep: 1000 m, *Balls* 2205. C7 Urfa: Birecik, Djebel Taken, *Sintenis* 1888: 292. C8 Diyarbakir: Çinar to Diyarbakir, 700 m, *D* 28675. C9 Mardin: foot of Kasrik gorge 9 km from Cizre, 350 m, *D* 42671. Is: Rodhos, *Bourgeau* 78.

Iran, N. Iraq, Palestine, Lebanon, Cyprus, Syria, Anti-Lebanon, C. Asia.

The fruits often detach in pairs, back-to-back. The calyx is set somewhat obliquely, and the ovary appears only ½-inferior. Usually there are 6 teeth around the mouth of the calyx-bladder; sometimes however there are additional, smaller teeth as well.

Ovary section: very similar to that of *V. coronata* except that an "extra" area of unthickened tissue (within the lignified block between fertile and sterile loculi) is found. Already, in this section of an only half-ripe fruit, these patches of tissue show signs of breaking up; eventually this would produce a pair of "false" loculi. This must be the explanation of the drawing of the section in Krok, where it is shown as having 4 sterile loculi. As in *V. glomerata*, it seems that this is an anomalous method of producing further sterile loculi not in any way indicating descent from e.g. a 5-locular ovary as found in some Caprifoliaceae (*Sambucus*).

27. V. lasiocarpa (Stev.) Betcke, Animadv. Bot. Valer. 26 (1826). (Plate 6, f. 7–12. Map 1.)

Syn.: *Fedia lasiocarpa* Stev. in Mém. Soc. Nat. Mosc. 5: 350 (1817).
V. microstephana Boiss. & Bal. in Boiss., Diagn. ser. 2 (6): 96 (1859).

Ic: Krok, t. 1, f. 2; Fl. URSS 23: t. 23, f. 7 (1958).

(4–)11–19 cm, lower leaves ± withered in fruit. *Leaves* 17–35 × 1–3 mm, linear to oblanceolate. *Inflorescence* ± hemispherical. *Bracts* ovate, membranous, with a green nerve, margins ciliate, ± free. *Flowers* ?whitish. *Fruits* 1·5–3 mm overall, the calyx spreading to up to 1·5 mm, ovary 0·8–1 mm wide.

A5 Çorum: 21 miles from Çorum to Iskilip, 800 m, *Coode & Jones* 1698. A9 Çoruh: Artvin, "Czoroch river near Tzria", *Woronow*. B2 Uşak: Boulgas Keui (Phrygie), 910 m, *Balansa* 180 (type of *V. microstephana*). B5 Yozgat: 20 km from Yozgat to Yerköy, 1100 m, *Coode & Jones* 1526. C2 Aydin: below Karacasu, 400–500 m, *D* 41656. C6 Urfa: Birecik, *Sintenis* 1888: 350.

Iraq, Soviet Armenia, Georgia, European Russia, Caucasus. The specimens, particularly those from outside Turkey, show variability in the calyx cup from apparently ± symmetrical and lobed to asymmetrical to approximately bilabiate—the fruits vary on a single plant, although I have not seen the full range on any one specimen. It seems to me that the bilabiate state (*D* 41656 is the best Turkish example) probably represents the original conception of the species—and it probably explains also why the species was not placed by Krok and Fl. URSS in the section *Coronatae*, where, on

the evidence of the section of the ovary, it must be placed. Certainly the variation within the species is very great, and one specimen (illustrated on Plate 6, f. 12) seems intermediate between *V. lasiocarpa* and *V. coronata*— the tips of the calyx-lobes are weakly uncinate, but the fruit is much smaller than in *V. coronata*.

Section **Siphonocoele** Soy.-Willem. in Gren. et Godr., Fl. Fr. 2: 62 (1850) emend. Krok, Mon. Val. 36 (1864).

The section *Siphonocoele* is in considerable confusion. Boissier recognised 4 species, 2 with varieties, from the Orient; I cannot find more than 3, at best recognisable, at worst completely intergrading, taxa to which it is difficult to apply names. Until a monographic revision of the group is made both the taxonomy and the nomenclature remain in doubt. I have more or less followed Fl. URSS as being most realistic, but have had to include more synonymy. There is discussion also (Fl. URSS 23: 669–670 (1958)) which I have not been able to translate and study.

28. V. dentata (L.) Poll., Hist. Pl. Palat. 1: 30 (1776) p.p. (Plate 7, f. 4–7. Map 8.)

Syn.: *Valeriana locusta* var. *dentata* L., Sp. Pl. 34 (1753); *Valerianella morisonii* DC., Prodr. 4: 627 (1830); ?*V. microcarpa* Lois., Not. Fl. Fr. 151 (1810)?

Ic: Krok, t. 1, f. 6; Fl. URSS 23: t. 24, f. 9 (1958); Fl. Aschk. t. 95, f. 14 (1965) as *V. muricata*; Ross-Craig, Draw. Brit. Pl. 14: t. 33 (1960).

(6–)10–25 cm. *Leaves* 12–40 × 2–5(–7) mm. *Inflorescence* ± obconic or obpyramidal. *Bracts* lanceolate, membranous margins broad below, tapering to apex, not usually ciliate, 1–3 × 0·5 mm. *Flowers* pale blue to lilac. *Fruit* 1·5–2 × 0·7–1 mm.

Described from S. Europe.

A1 (A) Çanakkale: Erenköy, Ulu-dagh, *Sintenis* 1883: 398. A2 (E) İstanbul: Istanbul area, vi 1859, *Noë* 683. A2 (A) Istanbul: Çatalca to Erenköy, 5 vi 1892, *Aznavour*. C5 Adana: between Misis and Ceyhan, *D* 26087. 5 km N. of Tuzla, *Coode & Jones* 311. C6 Maraş: 8 miles S. of Andirin, 800 m, *Coode & Jones* 1168a. Urfa: Birecik, *Sintenis* 1888: 618. Hatay: Amanus nr. Egbez, *Haradjian* 788.

C. & NW. Iran, N. Iraq, Europe, European Russia, Caucasus, C. Asia.

Ovary section: the epidermis is very papillose-hairy and apparently suberised; it does not resemble any other seen in *Valerianella* except *V. muricata* and perhaps *V. costata*.

29. V. muricata (Stev.) Baxt. in Loud. Hort. Brit. Suppl. 3: 654 (1839). (Plate 7, f. 8–9. Map 8.)

Syn.: *Fedia muricata* Stev. in Roem. & Schultes, Syst. 1: 366 (1817); *V. truncata* Betcke, Animadv. Bot. Valer. 22 (1826); *V. truncata* var. *muricata* (Stev.) Boiss., Fl. Or. 3: 106 (1875).

Ic: Krok, t. 1, f. 4; Fl. URSS 23: t. 24, f. 2 (1958); Fl. Aschk. t. 95, f. 15 (1965) as *V. dentata*.

6–30 cm, lower leaves present or not in fruit, 12–35 × 3–8 mm. *Inflorescence* ob-pyramidal or ± capitate, the branches sometimes thickening and inflating in fruit, and obscuring the bracts. *Bracts* 5–6 × 0·5–2 mm, ± herbaceous, smaller to ± inconspicuous and webbed in the centre of the cymes. *Flowers* pale bluish to lilac. *Fruit* 2–2·2 × 0·8–1·1 mm.

A2 (E) Istanbul: Rumeli Hisar, 1 vi 1906, *B.V.D. Post. ibid.* Yedikule, 29 v 1904, *Aznavour*. A5 Sinop: promontory at Sinop, *Tobey* 86. B1 Izmir: Çeşme, 10–50 m, *D* 41817. C1 Aydin: Samsun Dağ, 40 km from Davutlar, 400 m, *Dudley*, D 34953. C5 Adana: Yumurtalik, *Coode & Jones* 704. C6 Adana: Osmaniye, Toprakkale, 80 m, *D* 26901. C7 Urfa: Viranşehir to Ceylanpinar, 500 m, *D* 42361. C8 Diyarbakir: Diyarbakir, 650 m, *D* 28792.

Iran, N. Iraq, European Russia, Caucasus, C. Asia, Palestine: W. Pakistan. There is variation in the size of the bracts—occasionally the lower bracts completely enclose the fruit.

30. V. eriocarpa Desv., J. Bot. 2: 314 (1809). (Plate 7, f. 10–11. Map 8.)

Ic: Krok, t. 1, f. 5—the upper row only; Ross-Craig, Draw. Brit. Pl. 14: t. 34 (1960).

Differs from *V. muricata* apparently only in having a completely tubular calyx.

A2 (E) Istanbul: nr. Makriköy, 18 vi 1893, *Aznavour*. A2 (A) Kocaeli: Tuzla, 28 v 1893, *Aznavour*.

I have simply placed here those two specimens which have unambiguously complete tubular calyces.

SPECULATION

1. Calyx Lobe Reduction.

It seems to me that one can usefully arrange some species of *Valerianella* in the following manner, the effect being to produce a series of "Lines of reduction" (or lines of elaboration?).

ELABORATION ←——————→ REDUCTION

V. tuberculata ←——→ *V. tuberculata* var. oligodonta

(V. diodon)←——→ *V. oxyrrhyncha* ←——→ V. anodon

V. cymbicarpa ←——→ *V. plagiostephana*

V. szowitsiana ←——→ (V. persica)

V. dufresnia ←——→ V. conjugens
V. leiocarpa

(*V. coronata?*) ←——→ *V. kotschyi* ←——→ *V. chlorostephana*

V. platycarpa ←——→ V. lipskyi

V. triplaris also shows fruits with 3, 2, 1 or no calyx lobes.

Species in italics are those accepted in this account and seen by me; those in roman type I have not to my knowledge seen and are therefore, even more speculative. Synonyms are in parenthesis.

It is possible that, considered in this way, some problems of relationship and simple taxonomy may be soluble.

2. On the Origins of the fruit.

The following suggestions about the development/descent of the fruit of *Valerianella* are based on the hand-sections as shown in the plates.

I have termed the bundles as follows (see Plate 7, f. 17): 1. dorsal; 2. lateral fertile; 3. lateral sterile; 4. anterior; 5. central. All the fruit sections I have seen agree in the disposition of the vascular bundles, and any discrepancy in the numbers of bundles visible in the sections can be explained as (i) the lignification or enlargement of the fruit obscuring or crowding out one or more of those bundles, or (ii) the merging of 2 of the bundles to form one; this I have only seen in 4 and 5—the anterior and central bundles.

It seems very likely that *Valerianella* developed from a group having a 3-locular ovary already, perhaps, with but a single ovule per loculus and/or with 2 loculi sterile (see Plate 7, f. 16–18).

From this scheme it is not difficult to speculate the development of the whole range of *Valerianella* ovary-sections (with one possible exception) provided one can extrapolate particularly from the evidence of sections of *V. glomerata* (Plate 5, f. 11), *V. discoidea*, *V. obtusiloba*, *V. lasiocarpa* (Plate 6, f. 2, 6, 9, 10) which all show the anterior bundle and central bundle distinct but very close or contiguous. That the central and anterior bundles do exist separately can be seen from *V. locusta*, *V. costata* and *V. turgida* (Plate 4, f. 4, 7, 17) and less convincingly perhaps in *V. echinata*, *V. laxa* and *V. orientalis* (Plate 3, f. 3, 6, 9).

I visualise therefore the flattening of the fruit and the approximation of the central and anterior bundles as being one of the main "tendencies" to be found in *Valerianella* fruits.

At the corners of the fertile loculi of very many of the sections, it is possible to see a difference, a discontinuity, in the lignified tissue surrounding the loculi. At first I considered this to be an abscission layer, with some function in the release of seed—although I have never yet seen a *Valerianella* fruit dehisced in this way. I am now convinced that this discontinuity is a reflection of the development of the lignified tissue, beginning as simple strips visualised in Plate 7, f. 17–18, and seen in *V. chlorostephana* particularly (Plate 5, f. 9).

The one possible exception to this general scheme is *V. turgida* (Plate 4, f. 17); although from the disposition of its bundles it is well suited with the other species, the arrangement of the lignification around the fertile loculus is somewhat out of keeping. However, the sections are poor, the fruit being difficult to section by hand, and good sections may resolve this difficulty. *V. turgida*, in passing, resembles *Fedia cornucopia* (L.) DC in its section (Plate 7, f. 12).

The ovary and fruit of *Valerianella*, while showing great variability, always retains the 3-locular pattern, even allowing for *V. hirsutissima* having no spaces in the sterile carpels. *Centranthus* and *Valeriana* have 1-locular ovaries with what could be interpreted as erstwhile sterile loculi reduced to

ribs down the outside of the fruit. In this respect therefore, *Valerianella*, with *Fedia*, seems to have diverged less from the ancestral stock than *Valeriana* and *Centranthus*, assuming all have descended from plants with 3-locular ovaries.

APPENDIX I

Since this paper was prepared, Dr. P. H. Davis has sent fragments of *Valerianella* for identification from the East of Turkey where he is at present (vii 1966) collecting. These have been included in the account, but 3 are certainly members of a species not catered for here. The fruits key out to *V. rimosa* or *V. pumila*; we do not have comparable material here in Edinburgh from the Middle East or Caucasia, but I am fairly confident that they belong to *V. amblyotis* Fischer & Meyer, placed by Fl. URSS in Section *Platycoele*, and figured in 23: t. 24, f. 12 (1958); my drawing is on Plate 8, f. 7–9, with but a sketchy diagram for the section. The specimens are: B9 Van: Özalp to Van, 2130 m, *D* 44351. Bitlis: Ahlat to Adilcevaz, 1750 m, *D* 44331. B10 Ağri: E. of Doğubayazit, 1750 m, *D* 43905.

The fruits differ from those of *V. rimosa* and *V. pumila* in being flatter and distinctly (if only a little) incurved. The leaves are very similar to those of *V. uncinata* in C. Asian specimens I have seen—being deeply divided to almost pinnate. Whether the 3 specimens cited above are the same in this respect must wait until the bulk of Davis' collection arrives in Britain.

APPENDIX II

Iranian species not yet found in Turkey:

(1) **V. platycarpa** Trautv. Plate 8, figures 3–4. Recorded from Caucasia, N. Iran and C. Asia. Plants can be seen both with and without straps on the fruit; it is possible that it is the strapless forms that have been named *V. lipskyi* (and have been recorded from Iran). I have been unable to cut a good section of *V. platycarpa* so much detail is missing from the figure.

(2) **V. triplaris** Buhse. Recorded from Iran, Afghanistan and C. Asia. Plate 8 figures 5–6. Usually the fruits have 3 arms, but some specimens that I have seen have 2, 1 or even no arms at all—as far as I am aware these variants have not been named. (See "speculations"). The section is very peculiar.

(3) **V. sclerocarpa** Fischer & Meyer. I have seen no authentic material of this species and have always redetermined specimens labelled *sclerocarpa*. It is reported from Khoi in NW. Iran, very close to Turkey, from parts of Caucasia and from C. Asia.

(4) **V. turkestanica** Rgl. & Schmalh. Fl. URSS suggests that this species is found in Iran (23: 652, 1958). I have seen no material.

(5) **V. corniculata** C. A. Meyer; possibly from Iran.

(6) **V. lipskyi** Lincz.; see *V. platycarpa* above.

ACKNOWLEDGEMENTS

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To Dr. B. M. G. Jones I am grateful for assistance and encouragement in the field in 1965. To Miss H. Prentice I am very grateful for her help in embedding and cutting some of the more obstinate fruits and for advice on techniques, etc. In this respect I also thank Mr. B. Prijanto.

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The work was done while I was a D.S.I.R. (S.R.C.) Research Assistant on the *Flora of Turkey*.

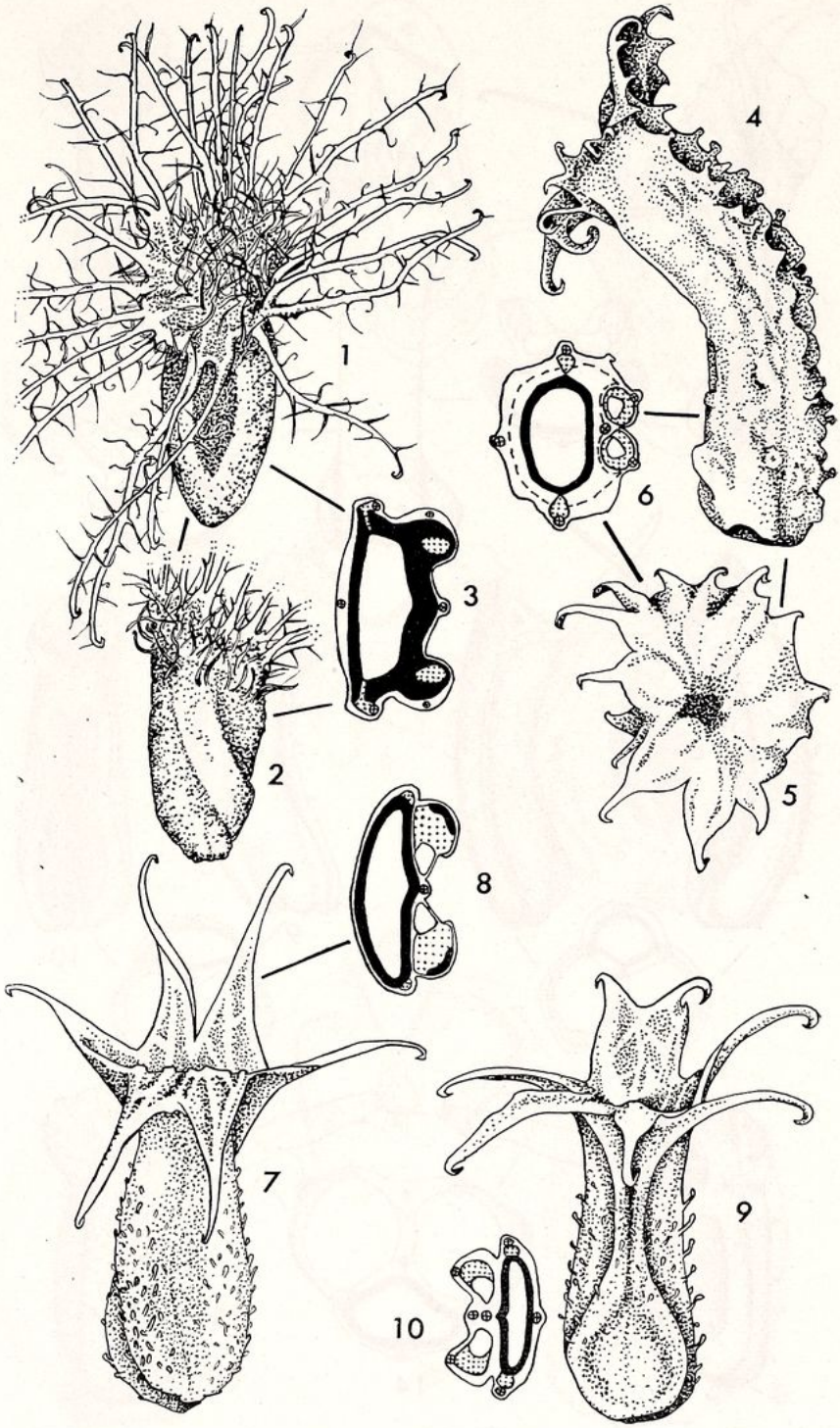

FIG. 1. 1–3 *hirsutissima:* 1, calyx lobes spread out to display insertion; 2, lateral view of ovary; 3, section. 4–6 *tuberculata:* 4, lateral view; 5, calyx cup from above; 6, section. 7–8 *dactylophylla:* 7, posterior view; 8, section. 9–10 *uncinate:* 9, anterior view; 10, section.

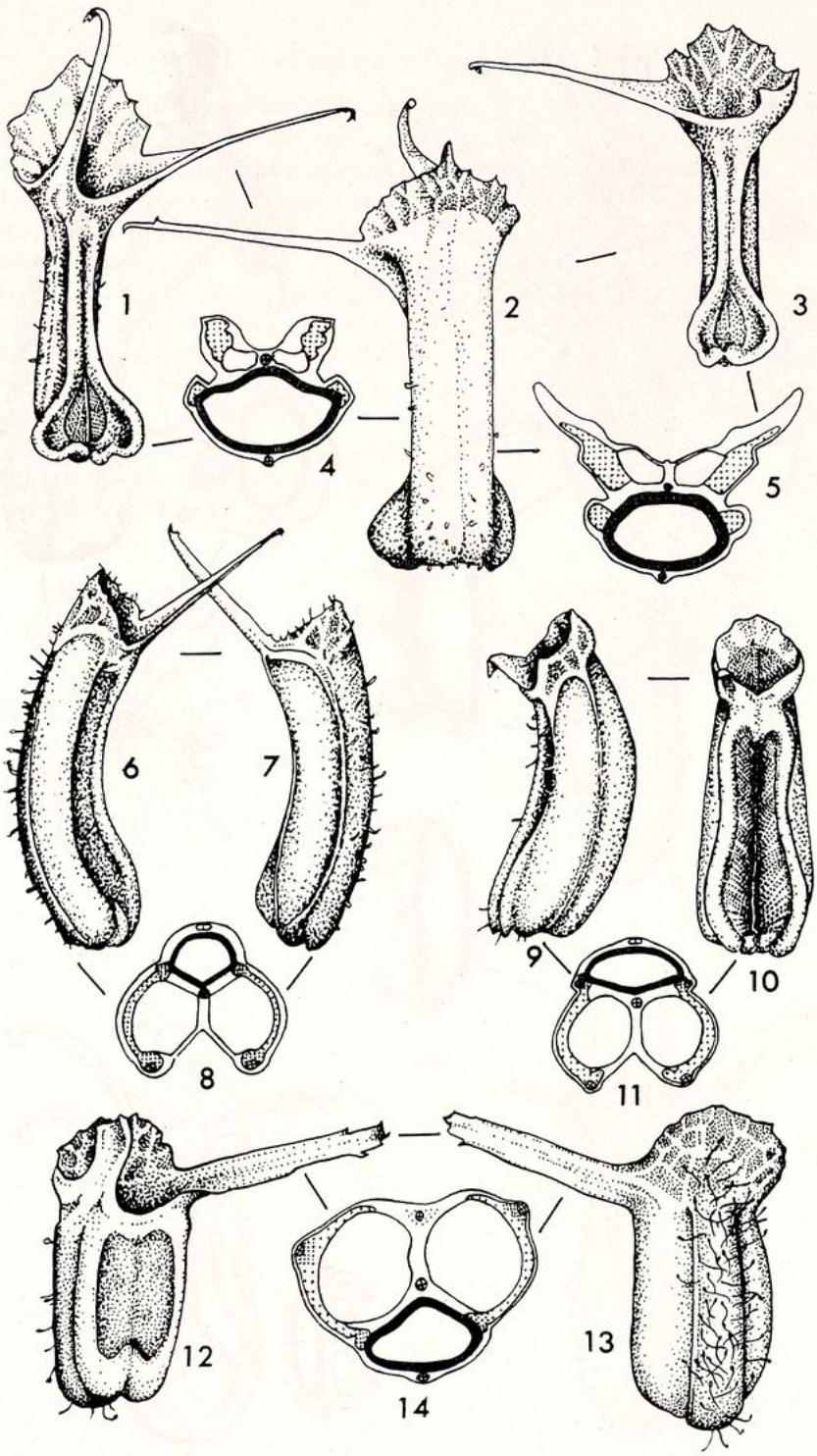

FIG. 2. 1–5 *oxyrrhyncha:* 1, 3, anterior and 2, posterior view, 4, section ± at midpoint; 5, section near base. 6–8 *cymbaecarpa:* 6, anterior-lateral view; 7, lateral view; 8, section. 9–11 *plagiostephanae:* 9, ± lateral and 10, anterior view; 11, section. 12–14 *szowitsiana:* 12, lateral and 13, posterior view; 14, section.

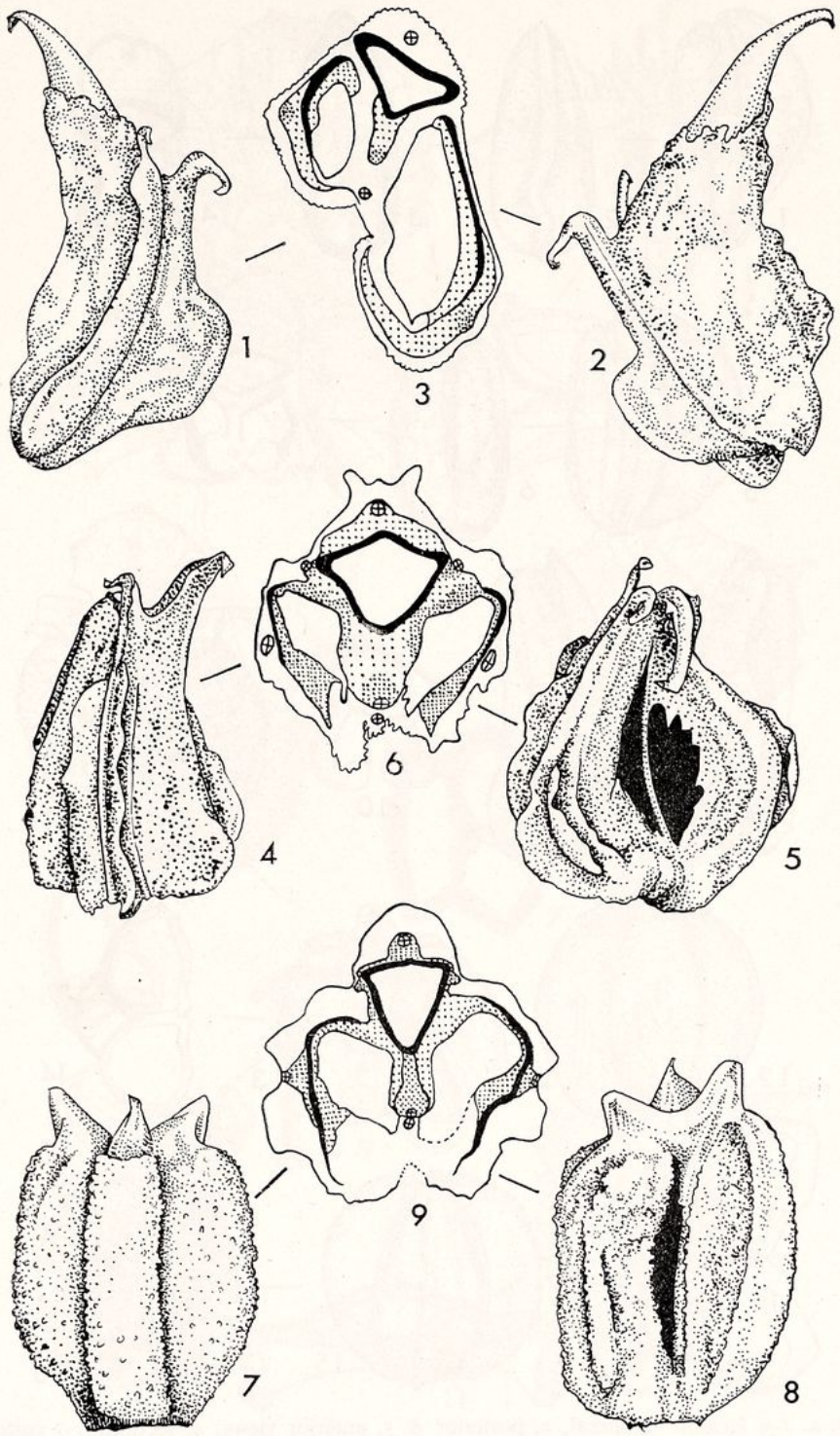

FIG. 3. 1–3 *echinata:* 1, 2, lateral views; 3, section. 4–6 *laxa:* 4, posterior & 5 ± anterior view; 6, section. 7–9 *orientalis:* 7 posterior & 6 anterior view; 9, section.

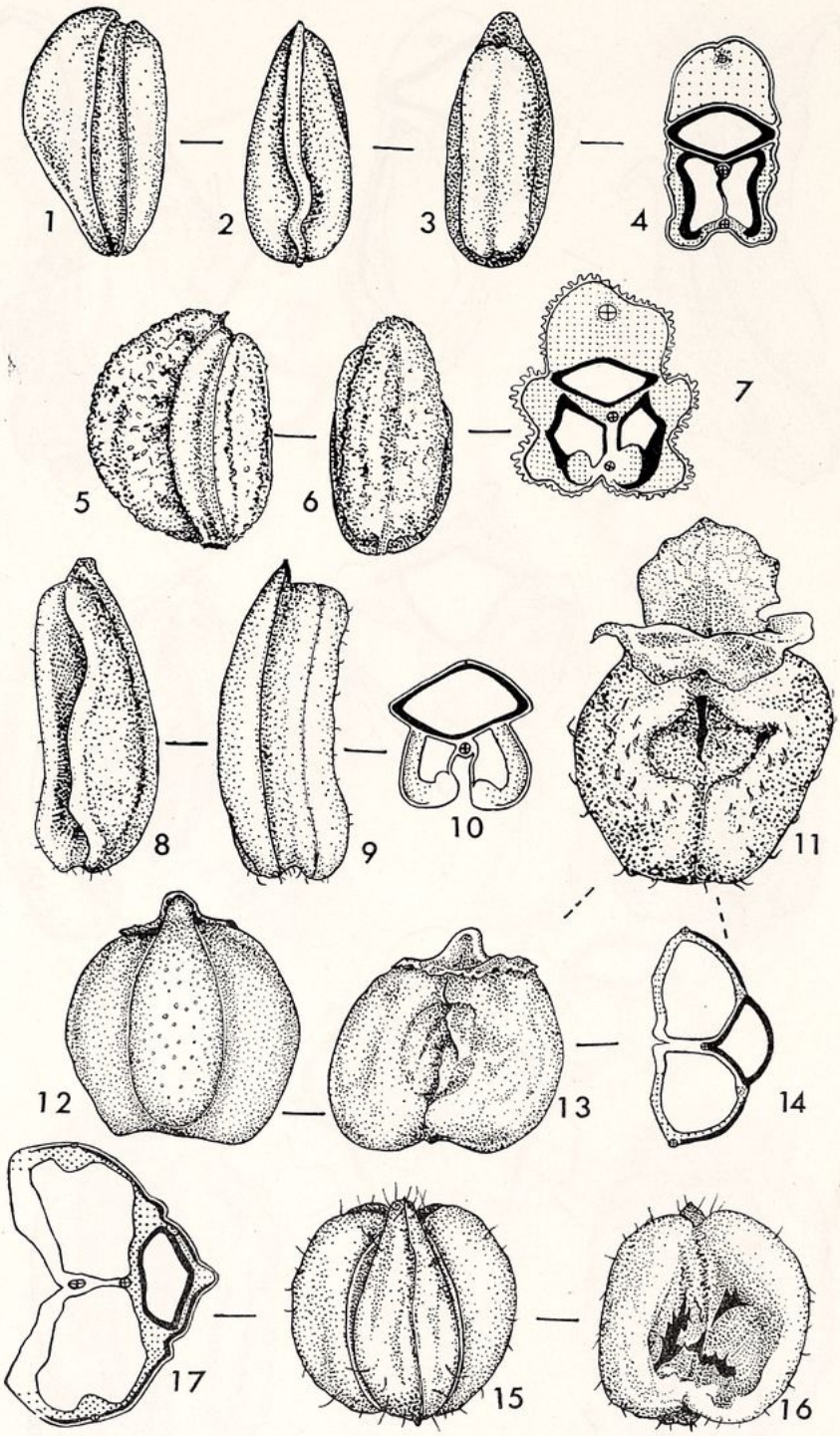

FIG. 4. 1–4 *locusta:* 1, lateral, 2, posterior & 3, anterior views; 4, section. 5–7 *costata:* 5, lateral & 6 posterior view; 7, section. 8–10 *carinata:* 8, anterior-lateral & 9 lateral view; 10, section. 11–14 *pumila:* 11, anterior view of variant (cf. discussion under the species); 12, posterior and 13 anterior view; 14, section. 15–17 *turgida:* 15, posterior and 16, anterior view; 17, section.

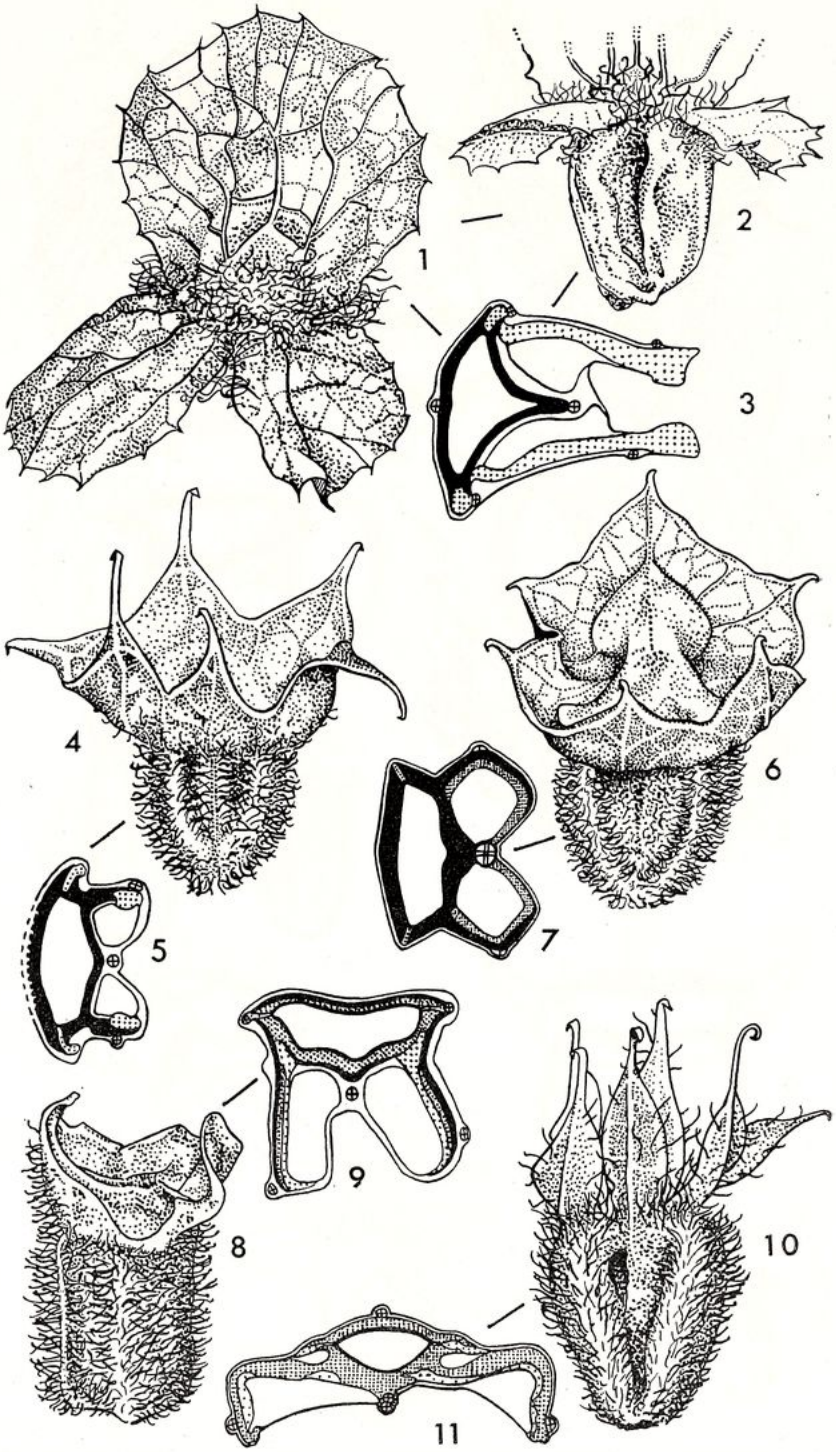

FIG. 5. 1–3 *dufresnia:* 1, vertical view of calyx cup; 2, anterior view of ovary; 3, section. 4–5 *coronata:* 4, anterior view; 5, section. 6–7 *kotschyi:* 6, anterior-vertical view; 7, section. 8–9 *chlorostephana:* 8, lateral view; 9, section. 10–11 *glomerata:* 10, anterior view; 11, section.

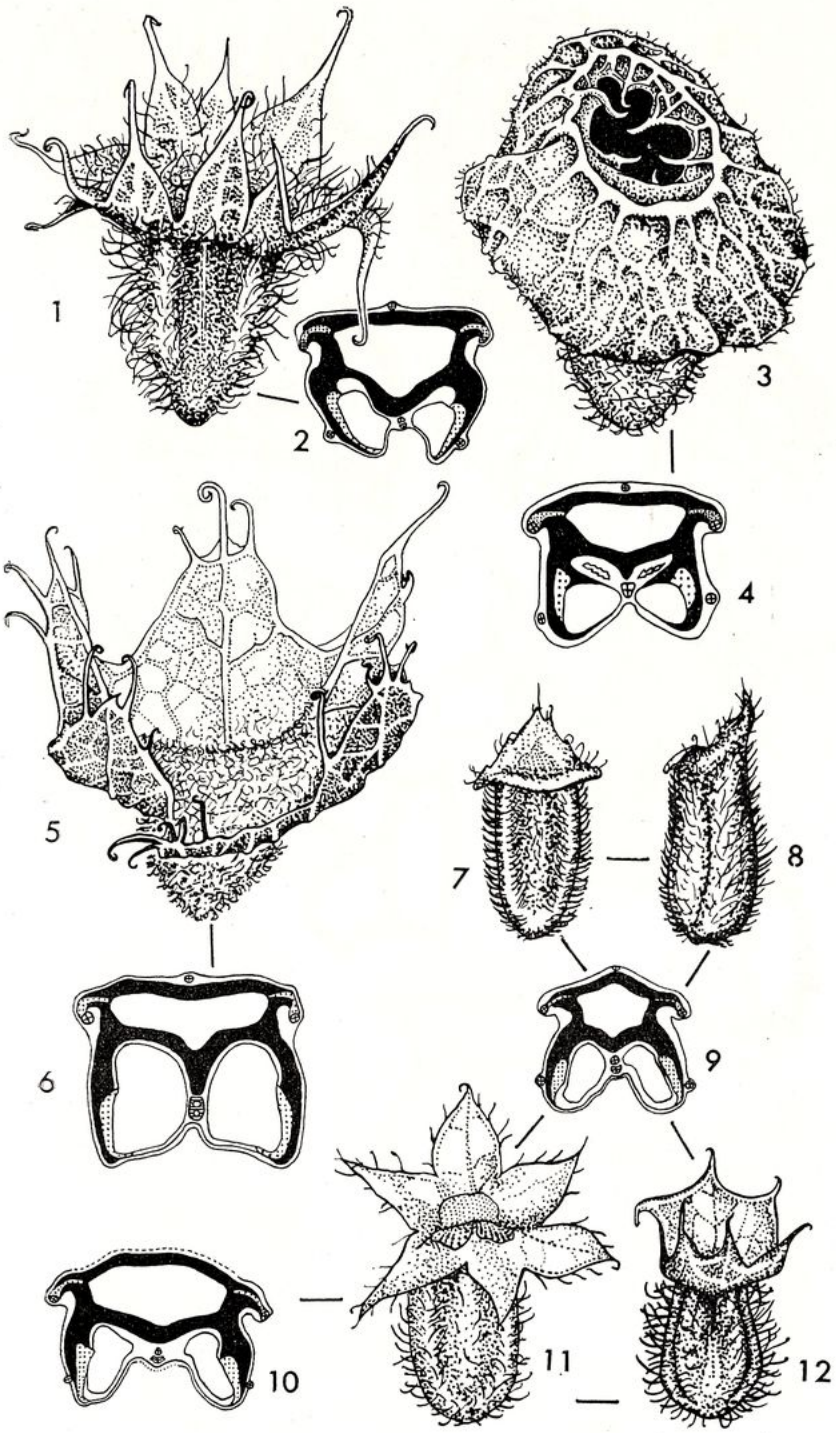

FIG. 6. 1–2 *discoidea:* 1, anterior view; 2, section. 3–4 *vesicaria:* 3, vertical-anterior view; 4, section. 5–6 *obtusiloba:* 5, vertical-posterior view; 6, section. 7–12 *lasiocarpa:* 7, anterior and 8 lateral view of same fruit (*D* 41656), 9 and 10, sections at different levels of no. 12 (Coode & Jones 1698A); 11 and 12, anterior views of different fruits (Coode & Jones 1526, 1698A).

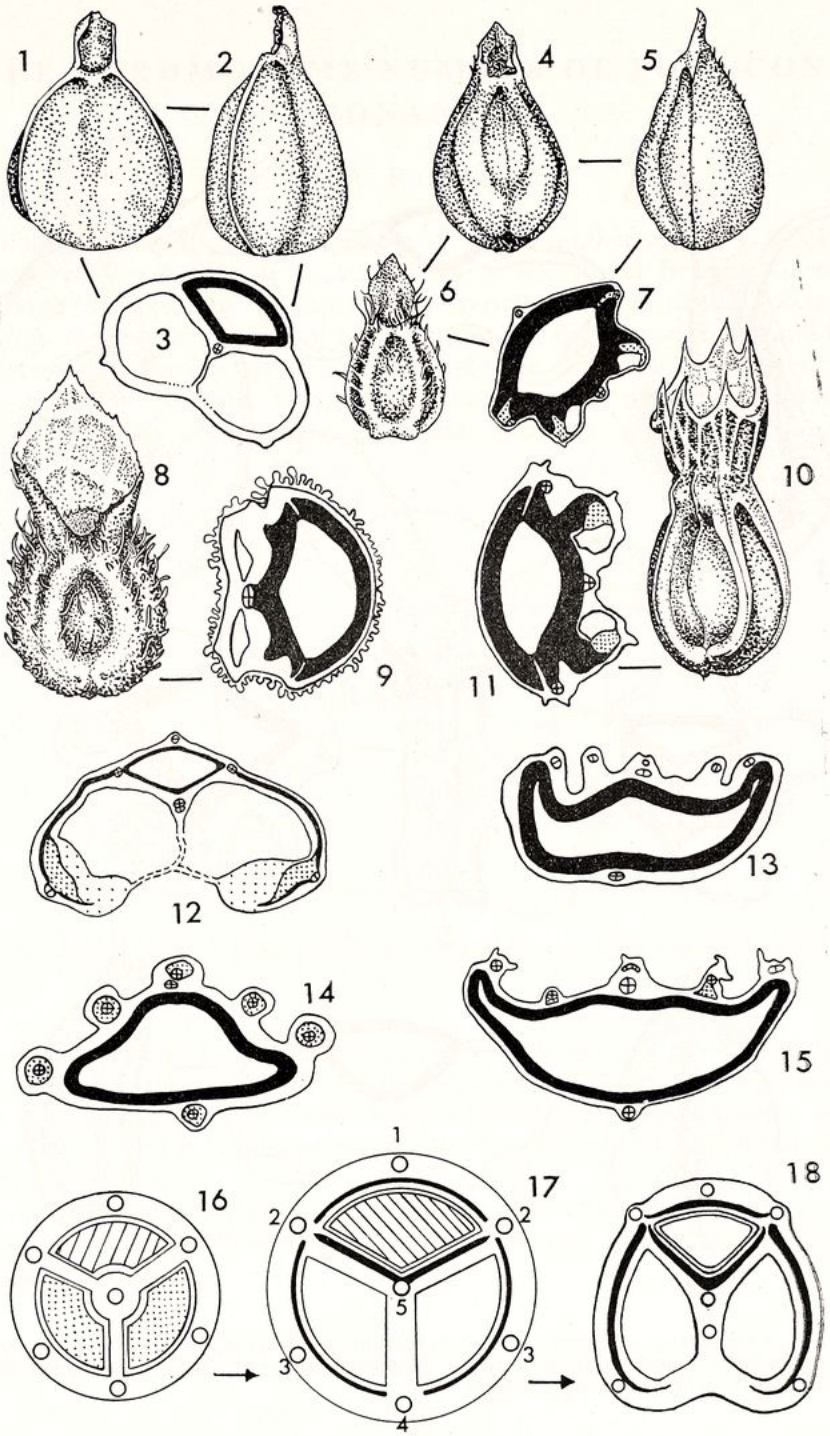

FIG. 7. 1–3 *rimosa:* 1, anterior and 2 lateral view; 3, section. 4–7 *dentata:* 4, anterior and 5 lateral view of one fruit; 6, anterior view of hairy form; 7, section. 8–9 *muricata:* 8, anterior view; 9, section. 10–11 *eriocarpa:* 10, anterior view (slightly lateral); 11, section. 12, Section of *Fedia cornucopia.* 13, Section of *Centranthus calcitrapa.* 14, Section of *Valeriana* cf. *dioscoridis.* 15, Section of *Centranthus ruber.* 16, hypothetical and ± regular ancestor of *Valerianella;* 2 loculi possibly sterile; 17, intermediate stage; the numbers refer to vascular strands discussed under "Speculation"; the thicker black lines suggest possible "primary lignification bands". 18, generalised *Valerianella* ovary section of today with lignification shown in black.

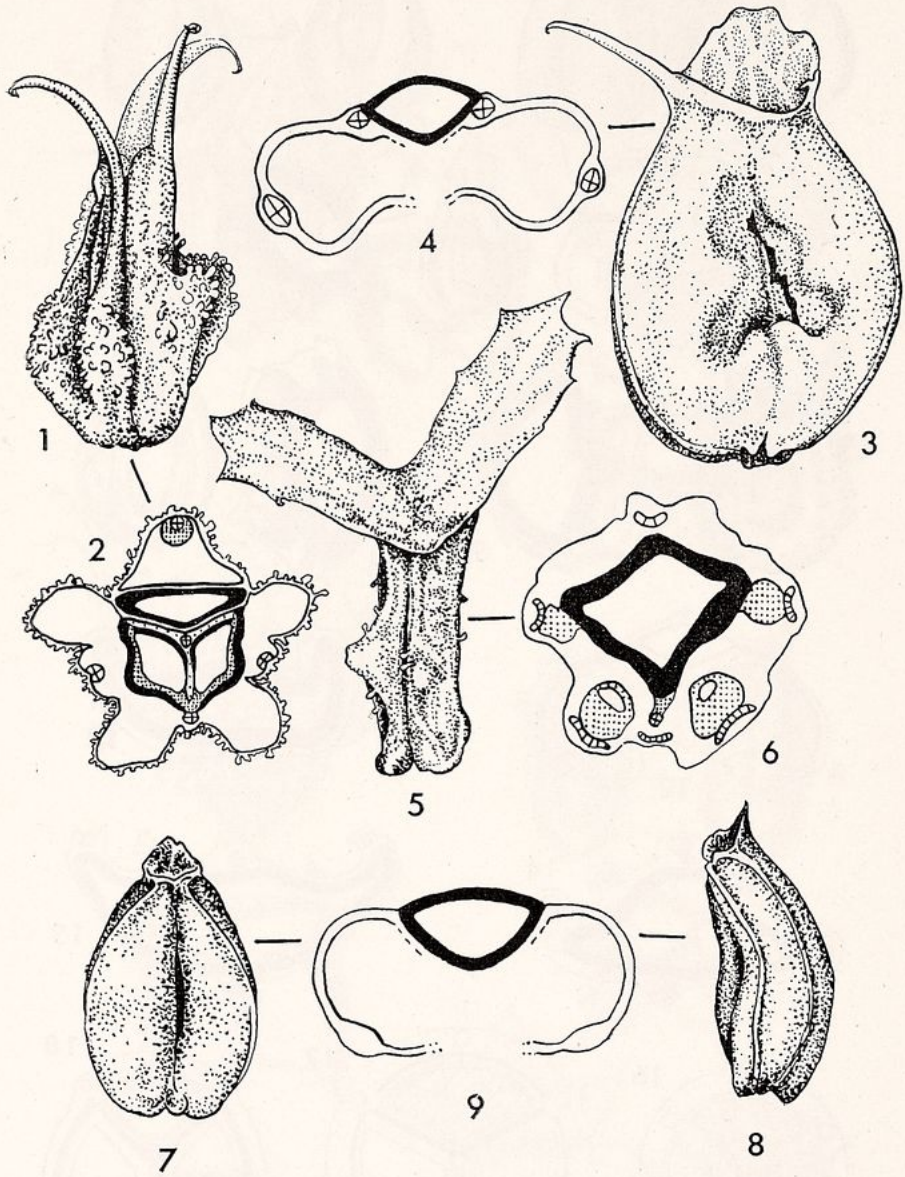

FIG. 8. 1–2 *triceras:* 1 ± posterior view; 2, section. 3–4 *platycarpa:* 3, anterior; 4, section. 5–6 *triplaris:* 5, anterior lateral view of 2—armed form—6, section. 7–9 *amblystis:* 7, anterior and 8 ± lateral view; 9, section.