CRITICAL NOTES ON TURKISH RUBIACEAE

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The present contribution to our knowledge of Turkish *Rubiaceae* is in line with continued studies on members of this family from the Near and Middle East:

1948: Rubiaceae. In K. H. Rechinger: Ergebnisse einer botanischen Reise nach dem Iran, 1937. V Teil. *Annal. Naturhist. Mus. Wien*, lvi, 212–244.
1951: Rassengliederung, Variabilitätszentren und geographische Merkmalsprogressionen als Ausdruck der raum-zeitlichen Entfaltung des Formenkreises Galium incanum S.S.—Eine Monographie. (Zur Phylogenie der Gattung Galium, II.) *Österr. Bot. Zeitschr.* xcviii, 427–490.
1952a: Revision der Subsect. Ceratocarpa Boiss., Sect. Orienti-Galium Ehrendf. der Gattung Galium Tournef. (Rubiaceae–Stellatae). *Österr. Bot. Zeitschr.* xcix, 164–167.
1952b: Rubiaceae. In K. H. Rechinger: Zur Flora von Palästina und Transjordanien. (Reliquiae Samuelssonianae, V.) *Ark. f. Bot.*, Ser. 2, ii(5), 428–432.
1953: Rubiaceae. In P. H. Davis: Notes on the Summer Flora of the Aegean. *Notes R.B.G. Edinb.*, xxi, 121.
1954: Rubia chitralensis Ehrendf., spec. nov. In P. Wendelbo: Three new species from Chitral, N.W. Pakistan. *Nytt Mag. Bot.* (*Oslo*), iii, 228–231.
1955: Rubiaceae. In M. Köie & K. H. Rechinger: Beitrag zur Flora von Südwest-Iran, II. *Dansk Bot. Ark.*, xv, 40–41.
1958a: Rubiaceae. In M. Köie & K. H. Rechinger: Symbolae Afghanicae. *Kongl. Danske Vidensk. Selsk., Biol. Skr.* (*Copenhagen*) (in press)
1958b: Rubiaceae. In K. H. Rechinger: Zur Flora von Syrien. (Reliquiae Samuelssonianae ...) *Ark. f. Bot.*, Ser. 2 . . . (in press)
1958c: Sect. nova Jubo-Galium (Rubiaceae: Galium), ein alter, aufgesplitterter Sippen-Komplex mit Zentrum im südöstlichen Mediterrangebiet. (Zur Phylogenie der Gattung Galium, V.) *Österr. Bot. Zeitschr.* . . . . (in press)
1958d: Ein Variabilitätszentrum als "fossiler" Hybrid-Komplex: Der ost-mediterrane Galium graecum L. - G. canum Req.-Formenkreiz. (Zur Phylogenie der Gattung Galium, VI.) *Österr. Bot. Zeitschr.* . . . . (in press)

The basis for my work on Turkish *Rubiaceae* has been the rich collections which Dr. P. H. Davis has brought back from his Anatolian expeditions for 1947, 1949, 1950, 1952 and 1954. I have seen duplicates or sheets from the Edinburgh herbarium (E) of all his *Rubiaceae* numbers. Other sets (not seen) are at Kew (K), the British Museum (BM) and Ankara

University (ANK). The duplicate material at my disposal (of numbers represented at Edinburgh) is at the Naturhistorisches Museum, Wien (W). All the material of Davis has been determined and is enumerated in this paper, together with smaller collections from the same general area, which I have studied during the last few years (especially those of Haradjian from the N. Syrian-Anatolian border area). Unless otherwise indicated, all records cited fall within the limits of modern Turkey.

The main purpose of the present paper is the communication of numerous critical notes on the inter- and intra-generic grouping of the *Rubiaceae-Galieae* (i.e. the *Asperula-Galium* problem!) from Anatolia and adjacent areas, and surveys and revisions of various critical and polymorphic groups with full citation of all material seen, accompanied by keys, distributional maps and figures. Fourteen new species and combinations and various new intraspecific entities have been described and discussed. A full register of all names cited should make possible the use of all these data for quick reference. The maps—I hope—will prove of value for future phytogeographical analyses of the Near and Middle East.

For much help and advice in the completion of the manuscript I have to thank Dr. P. H. Davis, as well as for generous gifts of duplicate material. My thanks are also due to the Directors and Curators of various herbaria who put plant material at my disposal.

PUTORIA Pers., Ench. i, 524 (1805)

Putoria calabrica (Linn.f.) Pers., Ench. i, 524 (1805).

TURKEY. Aintab, *Haradjian* 1314 (G). Amanus, Kusliji Dagh, *Haradjian* 2446 (G). Amanus, pr.vic.Harounié, 3–400 m., *Haradjian* 3596 (G).

SYRIA. Djebel Ansarieh pr.Massiaf, 650–850 m., *Haradjian* 3390 (G).

RUBIA L., Sp.Pl. 109 (1753)

Rubia davisiana Ehrendf., **spec. nov.** (fig. 1).

Suffrutex, 1–1·5 m. altus; rami lignosi, cortice albo-brunneo fibroso secedente, basales ± 10 mm. diam., superiores tenuiores, hornotini virides, pruinosi, glaberrimi laevesque, internodiis elongatis 4–8 cm. longis; folia (et stipulae foliaceae) coriacea, siccitate virescentia, pruinosa, ± recurva, marginibus irregulariter denticulatis, nervis primariis 3–5, ovato-lanceolata acuminata, usque 5 cm. longa et 1·5 cm. lata, long./lat. ± 3·3; inflorescentiae elongatae, interruptae, foliosae, e ramis axillaribus ramificatione cymosa compositae; flores luteoli, parvi, 2–3 mm. diam., rotati; lobi corollae conniventes 5, apiculati; styli 2 discreti, stigmatibus claviformibus instructi; fructus baccati, nigrescentes, 3–4 mm. diam.

Typus: Prov. Antalya (Lycia): Soğut yayla near Sivri Dağ, cliff crevice, 16 July 1949, *Davis* 15369 (holo. E; iso. K, W).

This beautiful new species—clearly belonging to *Rubia* by its pentamerous flowers—is most closely related to *R. laurae* (Holmboe) Airy-Shaw from Cyprus. The main differences are found in the much larger and relatively broader leaves which remain greenish when dried and have 3–5 main nerves. The strongly woody basal branches have a characteristically white-brownish fibrous and defoliating bark and make *R. davisiana* one of the very rare examples of a definitely shrubby species of *Galieae*.

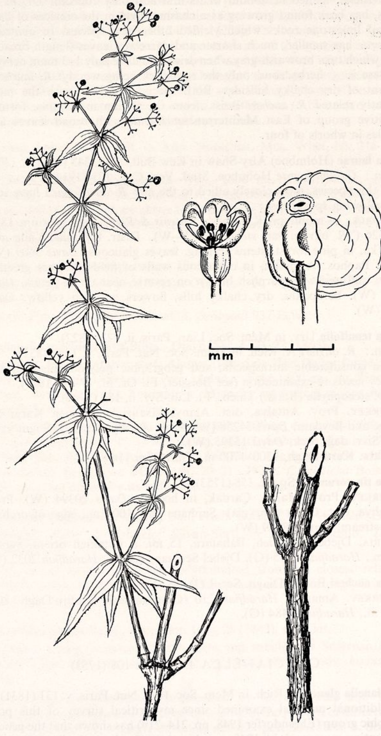

FIG. 1. *Rubia davisiana* Ehrendf., spec. nov.; habit ($\times \frac{1}{2}$), flower and fruit (enlarged).

R. davisiana, named in honour of its first and only collector Dr. P. H. Davis, has been found growing as a chasmophyte in the crevices of hard vertical limestone rocks which yielded other new species. In contrast, *R. laurae* has smaller, much shorter and narrower leaves (length/breadth ± 5) which turn brownish-grey when dried and have only 1–3 main nerves; the base is ± herbaceous, only the rootstock being woody. *R. laurae* is a plant of dry chalky hillsides. Both species, together with the more distantly related *R. aucheri* Boiss. from the Syrian mountains, form a primitive group of East Mediterranean *Rubiae* with broad leaves and stipules in whorls of four.

Rubia laurae (Holmboe) Airy-Shaw in Kew Bull. 1937, 343 (1937).

Syn.: *Galium laurae* Holmboe, Stud. Veg. Cyp. 171 (1914).

Of this species, most closely allied to the new *R. davisiana*, I have seen the following specimens:

CYPRUS. In mont. pr. Kythraea, *Sintenis & Rigo*, Iter Cyprium 1880, no. 526 ("*R. olivieri* var. *stenophylla*"—W). Distr. Kyrenia: Yaila near Halefka, in pine forest, stems trailing, leaves glaucous, *Davis* 3609 (W). Distr. Paphos: Arminou, in calcareous walls of fields, flowers greenish yellow suffused with purplish brown on reverse near tip of petals, *Davis* 3423 (W). Perapedhi, dry chalky hills, flowers greenish yellow, *Davis* 1845 (W).

Rubia tenuifolia Urv. in Mém. Soc. Linn. Paris, ii, 223 (1822).

Syn.: *R. olivieri* A. Rich. in Mém. Soc. Nat. Paris, v, 132 (1831).

The considerable intraspecific and geographic polymorphism of this species needs re-examination (see Boissier, Fl. Or. iii, 17–18: 1875).

var. **stenophylla** (Boiss.) Thiéb., Fl. Lib.-Syr. ii, 186 (1940).

TURKEY. Prov. Antalya, dist. Alanya (Isauria): between Kargi çay bridge and Beydam, *Davis* 14258 (W). Prov. Antalya (Lycia): Sogut yaylâ near Sivri dağ, rock, *Davis* 15395 (W).

SYRIA. Kurd Dagh, 1300–1700 m., *Haradjian* 1144 (G).

Rubia tinctorum L., Sp. Pl. 158 (1753).

TURKEY. Prov. Maraş: Çardak, in hedges, *Davis* 20394 (W). Prov. Kutahya, dist. Gediz (Phrygia): Şaphane dağ, 1000 m., edge of orchard near stream, *Davis* 18479 (W).

SYRIA. Djebel Ansarieh, Bahamra, 15 mi. a Latakieh orient. versus, 330 m., *Haradjian* 2785 (G). Djebel Semaan, 400 m., *Haradjian* 2032 (G).

Rubia aucheri Boiss., Diagn. Ser. I (3), 54 (1843).

TURKEY. Amanus: *Haradjian* 210 (G). Amanus, Kusliji Dagh, 800–1700 m., *Haradjian* 2484 (G).

CRUCIANELLA L., Sp. Pl. 108 (1753)

Crucianella glauca A. Rich. in Mem. Soc. Hist. Nat. Paris, v, 131 (1831).

Additional material examined since my critical survey of this polymorphic group (Ehrendorfer 1948, pp. 214–219) has shown that the general conception proposed in 1948 can be maintained; only the differential character of hairiness of corolla tube has proved to be rather variable in subsp. *kotschyi*, where otherwise identical forms with glabrous and smooth flowers have been found (*Davis* 24012, 24279). The former subsp. *remota* Ehrendf. most likely contains the type material of the species according to the indications: "spicae subinterruptae" and "folia 6-na" in the original description; these would not fit subsp. *kotschyi*, the other subspecies which occurs in the zone of contact where the type locality ("inter Kermancha et Amadan") is situated. Subsp. *remota* therefore has to be named subsp. *glauca* according to the new nomenclatural rules.

Subsp. **kotschyi** Ehrendf. in Ann. Naturhist. Mus. Wien, lvi, 216–217 (1948).

Turkey. Prov. Bitlis: Tatvan—Tuğ, 1800 m., sunny banks, *Davis* 22323a (E). Prov. Hakkâri: Cilo dağ, in gorge between Cilo yaylâ and Diz deresi, 2340 m., rocky slope above torrent, *Davis* 24279 (E). Prov. Hakkâri: Cilo dağ, in Diz deresi, 1650 m., rocky slope, *Davis* 24012 (E). "Armenia", *Calvert & Zohrab* (E).

Subsp. **glauca** (=subsp. *remota* Ehrendf., l.c., 1948).

Turkey. Prov. Van, dist. Satak: Görentas, N. slopes, 2000 m., *Davis* 23166 (E, W).

Iran. Fars, Dena, Sičani-Sissakht, *Behboudi* 937 E(W).

Crucianella macrostachya Boiss., Diagn. Ser. I (3), 27 (1843).

Turkey. Prov. Antalya, dist. Alanya (Isauria): Han Boğaz forest near Geyik dağ, *Davis* 14593 (E). Prov. Adana: Feke, 600 m., in Pinetum brutiae, *Davis* 19650 (E). Tournali pr. Marache, ad radices montis Akher Dagh, 900 m., *Haradjian* 1545 (G).

Syria. Djebel Ansarieh, Aïn Halakim, 800–1000 m., *Haradjian* 3540 (G).

C. penicillata Boiss., *C. syriaca* Boiss. and *C. fimbriata* Boiss. ex Mal. (in Bull. Soc. Bot. Genève, 2 sér., ii, 14: 1910) are conspecific with *C. macrostachya* Boiss. (see Fl. Or. iii, 20–21: 1875). *C. disticha* Boiss. is quite close but differs by its indurate, ± 3-nerved bracts.

Crucianella kurdistanica Mal. in Bull. Herb. Boiss., 2 sér., viii, 623 (1908).

Turkey. Prov. Diyarbakir: Silvan-Siirt, in Quercus scrub, *Davis* 22114 (E).

This is an excellent species differentiated from its closest relative *C. macrostachya* by linear, pectinate-ciliate bracts and the strongly knotted appearance of the dried flower tubes.

Crucianella graeca Boiss., Diag. Ser. I (3), 25 (1843), sens. lat.

Turkey. Lydia, in montis Karatscham, reg. subalp., dit. Smyrnae, 800–900 m., 6 Jun. 1906, *Bornmüller* 9565 (*C. imbricata* var. nov. *laxiuscula* —W).

The *C. graeca* complex—characterized by large flowers and hair-pointed prophyllous bracts—represents a geographic pattern of differentiation not yet clarified; strongly deviating are the specimens from S. Serbia, Macedonia and S. Bulgaria by their tall habit and little basal branching.

Crucianella exasperata Fisch. & Mey. in Ind. Sem. Hort. Petrop. iv, 8 (1837).

Syn.: *C. hispidula* Fisch. & Mey. in Ind. Sem. Hort. Petrop. i, 22 (1835) —non Decne. (1834).

TURKEY. Prov. Van: Zab valley 25 miles S. of Başkale, 2000 m., fallow field, *Davis* 23801 (E).

An excellent species with small flowers which is quite distinct from its closest relative *C. chlorostachys* Fisch. & Mey. (incl. *C. exasperata* var. *marginata* E. Korovin in Sched. ad Herb. As. Med., Fasc. x, 248b: 1926) by its thin, membranous, green to marginally hyaline, mostly hispidulous bracts and *more* than four elements in its whorls of leaves and stipules; *C. chlorostachys* has thickish, leathery, greyish green bracts with indurate margins and a few stiff ciliolae, the leaves and stipules are in whorls of four. Conspecific status has been proposed for the two taxa by Malinovski in his (quite uncritical) monograph: Les espèces du genre Crucianella L. (in Bull. Soc. Bot. Genève, 2 sér., xi, 9–16: 1910) and by Bornmüller (in Mitt. Thür. Bot. Ver., N.F., xxix, 27–36:1912).

Crucianella angustifolia L., Sp. Pl. 157 (1753).

TURKEY. Prov. Adana, dist. Feke: Sencan Dere between Görümze and Süphandere, 1000 m., *Davis* 19638 (E).

Crucianella latifolia L., Sp. Pl. 158 (1753).

TURKEY. Prov. Isparta, dist. Sütçüler (Pisidia): above Kuzdere (in Kozlu dere), N. of Bozburun dağ, *Davis* 15850 (W). Antalya, dist. Kemer; Gönük, *Davis* 15013 (W).

SYRIA. Djebel Ansarieh, Aïn Halakim, 800–1000 m., *Haradjian* 3540 (G). Jab el Ahmar, *Post* 212 (BM).

The hyaline membrane which connects the two bracts in this species is often torn and divided by the growing fruits. In this stage care has to be taken not to confound the species with *C. imbricata* Boiss. which is very similar to *C. latifolia*. *C. imbricata* has no hyaline membrane between the broader, ovate-lanceolate somewhat curved bracts and the bracts are *not* grossly inflated and are without enlarged epidermal cells at their base.

C. imbricata occurs in Crete and around Smyrna; I have seen a hairy race—*C. imbricata* var. *asperula* Sam.—from Cassius (*Wall*—S). Whether typical *C. imbricata* also occurs in Syria, as indicated by Boissier, has not yet been confirmed. I therefore prefer to make the syntype from Smyrna (*Balansa* 401—W) the lectotype of *C. imbricata*. The species seems to connect *C. latifolia* with the rest of the small-flowered *Crucianellae* like *C. exasperata*.

ASPERULA L., Sp. Pl. 103 (1753)

It has become increasingly clear in the last decade that the genus *Asperula* according to its original Linnaean conception, where separation from *Galium* is based solely on the length of the corolla tube, represents an unnatural taxonomic conglomeration of very heterogeneous plants. On the one hand there are some well-separated and quite distinctive groups which deserve generic recognition; on the other hand there are a number of single species which show very close affinities to various groups of *Galium*. Such species (like *Asperula odorata* L., *A. aparine* M. Bieb., *A. glauca* L., *A. humifusa* M. Bieb. and others) have been transferred to *Galium*, in spite of their $\pm$ long corolla tubes, on the basis of other, more important and phylogenetically correlated characters. The remaining taxa, originally described in *Asperula* and without closer affinities to *Galium*, I prefer to leave in *Asperula* while a general taxonomic reorganization of the whole *Galieae* is in preparation. From the natural and distinctive groups on which this taxonomic reorganization will be based, the following (at present still within our provisional *Asperula* conception) may be enumerated:

Sect. *Cruciana* Griseb., the *A. oppositifolia* group, Sect. *Cynanchica* DC. (p.p., including the *A. hexaphylla-A. incana* group), the *A. taurina-A. tinctoria* group, Sect. *Sherardiana* DC. (with the *A. arvensis* group and (?) Sect. *Crucianelloides* Boiss.), *A. tournefortii* (incl. *A. majori*), *A. trichodes* (which is *Leptunis trichodes* (J. Gay) Ehrendf., see Ehrendorfer 1958a), the very isolated and mostly dioecious Australian *Asperulae*, the *A. asperrima-Galium concatenatum* group, the *A. scutellaris-G. purpureum* group and the *A. platygalium* group.

Generic typification of *Asperula* has to follow Scopoli (1772) who transferred all of Linnaeus's *Asperulae* to *Galium* except for *A. arvensis* (Sect. *Sherardiana* DC.).

Asperula prostrata (Adam) C. Koch in Linnaea, xxiv, 461 (1851).

Syn.: *Crucianella prostrata* Adam in Web. & Mohr, Beitr. i, 46 (1805).
Crucianella aspera M. Bieb., Fl. Taur. Cauc. i, 107 (1808).
Asperula aspera (M. Bieb.) Boiss., Fl. Or. iii, 28 (1875).
Asperula laxiflora Boiss., Fl. Or. iii, 37 (1875).

The species is rather variable in respect to flower colour (greenish-yellowish to purplish), habit (tall to condensed, correlated with ecotypic differentiation), leaf-breadth and indumentum. There seems to exist no decisive break between *A. prostrata* and *A. kotschyana* (Boiss. & Hoh.) Boiss. Of *A. laxiflora* Boiss. I have seen the type at Geneva; it clearly belongs to *A. prostrata*, the flowers are mostly pentamerous. Boissier's placing of *A. laxiflora* into *Cynanchica-Roseae* is therefore erroneous.

TURKEY. Prov. Hakkâri: Kara dağ, 2900 m., flowers pinkish buff, *Davis* 24250 (W, E); *ibid.*, 3500 m., rocky slopes, fls. buff, *Davis* 24454 (E); Cilo Tepe, 3050 m., cliffs and ledges, *Davis* 24036 (W, E); Cilo dağ, 10 km. W. of Cilo Tepe, 3650 m., S. scree, fls. purplish buff, *Davis* 24186 (E). Prov. Van, dist. Başkale: Ispiriz dağ, 1900 m., rocky serpentine slope; fls. greenish yellow, *Davis* 23645 (E). Prov. Van, dist. Gevaş: Artos dağ, 3050 m., screes, fls. yellow-buff, *Davis* 22825 (W, E); *ibid.*, 3350 m., scree, fls. maroon, *Davis* 22837 (W, E). Prov. Bitlis: Süphan dağ, 3000 m., block scree, *Davis* 24730 (W, E); Kambos dağ above Hürmüz, 1830 m., *Davis* 23483 (W, E).

Asperula asterocephala Bornm. in Bull. Herb. Boiss. vii, 116 (1899).

In spite of only having tetramerous corollas, this isolated species definitely belongs in sect. *Cruciana* Griseb., where its affinities are especially with *A. prostrata*. In addition to the type material (Iraq: Kuh-Sefin near Schaklava) a second collection has lately turned up which has a more xerophilous aspect (smaller and thicker leaves, stouter habit) than the type collection:

IRAQ. Kurdish hills, 760 m., crevices of rock, *Low* 319 (BM).

Asperula glomerata (M. Bieb.) Griseb., Spicileg. ii, 166 (1844).

Syn.: *Crucianella glomerata* M. Bieb., Fl. Taur. Cauc. i, 107 (1808).

A critical survey of the very polymorphous group has been incorporated in my publications 1948: 220–225 and 1957a.

subsp. **glomerata**

TURKEY. Prov. Niğde/Kayseri: between Nevşehir and Ürgüp, 12–1300m., steppe, *Davis* 19118 (W, E). "Armenia", Calvert & Zohrab (E).

subsp. **condensata** Ehrendf., l.c. (1957a).

TURKEY. Prov. Van, dist. Başkale: Ispiriz dağ, 3300 m., screes, *Davis* 23716 (W, E). Prov. Van, dist. Gevaş: Artos dağ, screes, 3500 m., *Davis* 22888 (W).

Both collections, especially *Davis* 22888, show a tendency from var. *condensata* towards var. *filiformis* Bornm.

Asperula cilicica Hausskn. ex Ehrendf., **spec. nov.**

E rhizomate lignoso multicaulis; caules paulum ramosi, tetragoni, glaberrimi, 20–25 cm. alti, internodiis mediis elongatis 5–6 cm. longis; folia opposita, rarissime stipulis brevioribus 1–2 instructa, 12–18 × 1·8–3·0 mm., uninervia, glaberrima, marginibus laevibus, apice brevissimo cartilagineo; inflorescentia elongata ramis basalibus brevibus; flores 2-5-ni in dichasiis in apice ramorum ± congestis, bracteis inconspicuis lineari-lanceolatis; pedicelli 0·1–1 mm. longi; ovaria glabra, superne abrupte truncata; corollae albidae (?), infundibulares, c. 1·2–1·8 mm. longae; lobi quam tubus paulo longiores.

Typus: Cilicia, Bulghar Maaden, 1600 m., *Siehe* 1896, no. 501 (holo. WU).

TURKEY. Prov. Antalya dist. Alanya (Isauria): Kargi çay near Kozlu dere, rocky places, *Davis* 14282 (W).

This excellent species has already been recognized by Haussknecht but he never published a description. *A. cilicica* belongs to the species group of *A. oppositifolia* Reg. & Schmalh., *A. fragillima* Boiss. & Hausskn. and *A. brachyantha* Boiss. occurring from Anatolia through the northern and southern mountain chains of Iran and Afghanistan to Turkestan and the Alatau. This group is very well characterized within the conventional genus *Asperula* by its woody rootstock, by the lack or very strong reduction of stipules, the linear to narrowly ovate leaves, the pyramidal, cymose inflorescence, the pedicels without bracteoles, the infundibuliform flower tubes and the truncate ovaries. Our new species is clearly set aside by its short corolla tube, absolute glabrousness and relatively loose inflorescences. A key to species of the group and figures of habit and flowers are published in my work on the Rubiaceae of Afghanistan (1958a).

The most critical racial complex in the genus *Asperula* in its present circumscription is the *A. cynanchica* group (in its widest sense), probably to be separated together with the relatively closely allied *A. hexaphylla-A. incana* group* into a new genus. The differential characters of the *A. cynanchica* group are: Suffruticose to herbaceous perennial plants; leaves and foliaceous stipules always in whorls of four, with one nerve, narrowly lanceolate to linear; inflorescences cymose with various degrees of development or reduction of main and lateral axes; flowers hypocrateriform to infundibuliform, purple or greenish-yellow to rose or (rarely) ± whitish; ovaries ± papillose to tuberculate.

With its distributional centre in the Mediterranean and radiations into western, northern and south-eastern Europe and adjacent Asia (Anatolia,

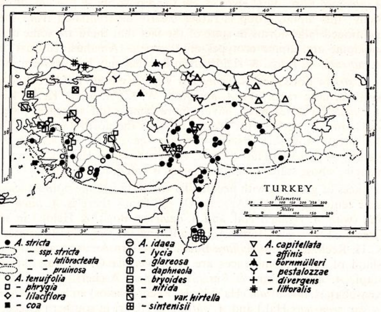

FIG. 2. Distribution of the *Asperula cynanchica*-complex in Anatolia and adjacent areas.

Transcaucasia, Caucasus, steppes of S.W. Asia) the *A. cynanchica* group is still very imperfectly known; the present account of the Anatolian (and some other Eastern Mediterranean) forms has therefore only preliminary status.

Representatives of four more closely allied racial groups, A, B, C and D, within *A. cynanchica* sens. latiss. can be recognized in Anatolia (see the map, fig. 2).

A. Flower tubes long; inflorescences with branched or unbranched main axes but very reduced lateral peduncles, flowers therefore in ± interrupted spikes or series of clusters, in alpine forms often very reduced. This group comprises the bulk of the species and is strongly differentiated, more or less "in situ", in the Eastern Mediterranean. Some developmental trends, often combined in various ways, can be recognized: the increase of ligneous elements in the leaves, the development of long hyaline points on

* These two groups are sharply separated; there are no intimate relations or even transitional forms between *A. incana* and *A. idaea* in Crete (see K. H. Rechinger in Akad. Wiss. Wien, Math.–Naturw. Kl., Denkschr. cv (2/1), 134:1943).

the leaf tips and the appearance of a glaucescent-pruinose coverage on the young leaves and stems seem to be correlated with increasing xerophytism; the differentiation of compact and condensed cushion-forming races can be related to the invasion of alpine biocenoses. Races of Group A with short pointed leaves and tall habit are *A. stricta* Boiss., *A. tenuifolia* Boiss. and closely allied forms around *A. canescens* Vis. in Dalmatia; the corresponding disjunct alpine group contains *A. idaea* Hal. (Crete, the only member of the *A. cynanchica* complex on the island), *A. lycia* Stapf, *A. capitellata* Hausskn. & Bornm., *A. affinis* Boiss. & Huet (with *A. pontica* Boiss.) in Anatolia and the glaucescent *A. suberosa* Sibth. & Sm. (Athos), *A. glareosa* Ehrendf. (Lebanon, etc.) and possibly *A. gussonei* Boiss. from Sicily; this alpine group is rather clearly differentiated from the above mentioned taller forms in spite of the fact that there are some condensed subalpine and alpine ecotypes of *A. stricta* (Amanus, Taurus) of which *A. suffruticosa* Boiss. & Heldr. from Euboea may be a western extension.

A. stricta Boiss. and *A. canescens* Vis. are closely linked in the Balkans with northern races like *A. longiflora* W. K., *A. nestia* K. H. Rech. and *A. tenella* Heuff. ex Kern. having more cymose inflorescences (lateral axes less reduced); such forms prevail towards the north and penetrate along the Greek mountain systems towards the south: *A. thessala* Boiss. & Heldr., *A. puberula* Hal. & Sint., *A. peristeriensis* Hal. ex Maire & Petitmengin, whose status and interrelation is still quite confused.

Races of group A with needle-like and long hyaline-pointed leaves have their centre around the Aegean. Of tall forms there is *A. lutea* Sibth. & Sm. (with *A. rigidula* Hal. and *A. mungieri* Boiss. & Heldr.) in southern Greece. *A. phrygia* (Bornm.) Ehrendf. and the very closely related *A. coa* K. H. Rech. and *A. lilaciflora* Boiss. in western Anatolia and the adjacent island of Kos; alpine races are *A. daphneola* O. Schwarz, *A. bryoides* Stapf, *A. nitida* Sibth. & Sm., *A. sintenisii* Aschers. ex Bornm. (N.W. Anatolia), *A. abbreviata* (Hal.) K. H. Rech. (Naxos) and *A. boissieri* Heldr. (+var. *transiens* Hal.) and *A. pulvinaris* Heldr. in southern Greece; intermediates towards the taller forms of lower altitudes, possibly also influenced by alpine forms allied to *A. longiflora* W. K., are *A. pinifolia* (Boiss.) Heldr. and *A. oetaea* (Boiss.) Hal. in the mountains of central and northern Greece.

This pattern of differentiation of the more or less xerophilous and heliophilous *Asperulae* grouped here under A in the Eastern Mediterranean shows many similarities with the differentiation of the *Galium mollugo* complex (cf. p. 377) and the *G. incanum* complex (cf. Ehrendorfer 1951). These similarities point to similar causes, the climatic and geological history of the area: the main development of the racial differentiation before the submergence of the Aegean land connections during the Pliocene/early Pleistocene (cf. affinities *A. lutea*—*A. phrygia*, *A. oetaea* *A. nitida*, *A. suffruticosa*—*A. stricta* etc.); origin of the older alpines with the contemporaneous uplift of the mountain systems "in situ" (cf. affinities *A. lutea*—*A. pulvinaris* or *A. phrygia*—*A. nitida*), their separation from the lowland forms (only in areas connected with the continent) by the extension of dense forest zones, during the pluvial periods; penetration and hybrid introgression of northern subalpine-alpine forms along the Greek mountain system during the corresponding cold times (lower timberlines!); origin of younger foot-hill-montane-subalpine(-alpine) ecoclines in the southern xeric mountain systems (Taurus, Amanus) during the postglacial "thinning" of the forest zones.

B. Flower tubes short; inflorescences with branched main axes and terminal heads of flowers subtended by conspicuous bracts. This group contains only *A. pestalozzae* Boiss. and is represented on the Crimean peninsula by a very closely allied race; it may represent an older, now disjunct circum-pontic element. There are some affinities with races of group A: *A. affinis* (with *A. pontica*) has similar terminal flower heads but longer, nevertheless $\pm$ variable corolla tubes, *A. bornmuelleri* Velen. has the inflorescence form of *A. stricta* but the corolla colour and length of *A. pestalozzae* and may be of hybrid origin.

C. Flower tubes short; inflorescences cymose, not in terminal heads; ovaries $\pm$ smooth. This is the critical group of *A. cynanchica* L.s.str., with its centre of variability in S.E. continental Europe and with *A. divergens* Boiss. as the only outpost in Anatolia; a species whose correct position and status remains to be studied thoroughly.

D. Similar to C, but ovaries verrucose-hispid. A group of psammophilous races with its centre in southern Russia and adjacent S.W. Asia, containing the often misinterpreted *A. graveolens* M. Bieb., *A. setulosa* Boiss., *A. danilewskiana* Bas. and others, and represented on the dunes of the Black Sea north of Istanbul by *A. littoralis* Sibth. & Sm.

The following key, conspectus and distributional map (fig. 2) are based on all species and specimens belonging to the *Asperula cynanchica* complex from Anatolia (and some adjacent areas) actually seen by the author.

1a. Corolla tube (1·5–) 2–4(–5) times longer than lobes; flowers intensely pink or yellowish-greenish-purplish, mostly longer than 5 mm.; ovaries never verrucose-hispid 2

1b. Corolla tube equalling the lobes or somewhat longer; flowers faintly pink or $\pm$ white, often shorter than 5 mm.; ovaries sometimes verrucose-hispid 13

2a. At least the upper leaves with a long hyaline point equalling their breadth; leaves stiff and needle-like, not more than 1 mm. broad, basal ones often densely imbricate and in fascicles; plants of N.W. and W. Anatolia, mostly forming dense cushions . . . 3

2b. Leaves without or with a shorter hyaline point, mostly less stiff; plants of S.E., S., S.W. and Central Anatolia and adjacent Syria—Lebanon (in doubtful cases compare forms of *A. phrygia* and *A. stricta* in S.W. Anatolia!) 9

3a. Plants compact and densely caespitose, of alpine localities, only (2–)3–8(–15) cm. tall; flowers sessile between the leaves or in 1–2(–3) clusters on simple inflorescence axes 4

3b. Plants less compact, of lower altitides, (15–)20–40(–50) cm. tall; flowers in (3–)4 to many intercalary and terminal clusters on branched or simple inflorescence axes 7

4a. Ovaries and corollas densely and shortly hirsute; flowers very large, 17–22 mm. long, in depauperate groups in the axils of upper leaves: (Lydia, Izmir: Nif dağ) . . . . . *A. daphneola* O. Schwarz

4b. Ovaries and corollas glabrous; flowers smaller, not more than 12 mm. long 5

5a. Flowers 10–12 mm. long; plants in very dense tufts, about 2–4 cm. tall; only upper leaves with hyaline point of c. 1 mm.; leaves scabrous to glabrescent: (Lycia: Uyuklu dağ) . . . *A. bryoides* Stapf

5b. Flowers 5–8(–10) mm. long; all leaves with a hyaline point . . 6

6a. Leaves glabrous and smooth, young ones somewhat glaucescent-pruinose, not longer than 5 mm.; inflorescences very reduced with single flowers; plants forming very low and dense tufts, about 2 cm. tall: (Trojan Ida) . . . *A. sintenisii* Aschers.ex Bornm.

6b. Leaves glabrous or ± hirsute, never glaucescent-pruinose, often blackening when dried, longest usually more than 5 mm.; inflorescences often less reduced, flowers either in groups in the axils of upper leaves or in 1–2(–3) clusters on short unbranched axes; cushions mostly taller: (Bithynia, Phrygia, Lydia; Lesbos?, Greece?) *A. nitida* Sibth. & Sm.

7a. Flowers very showy with curving corolla lobes, 2–3 mm. long and spreading, tube 4–5 mm. long; inflorescence axes ± branched: (Lydia, Phrygia, Bithynia?) . . . . . *A. lilaciflora* Boiss.

7b. Flowers less conspicuous with corolla lobes only (1–)1·5(–2) mm. long, tube 4–5 mm. long 8

8a. Flowers (4–)5–6(–8) mm. long, glabrous or ± hirsute; inflorescence axes ± branched; basal shoots usually with relatively soft leaves: (Bithynia, Caria, Phrygia, Chios) . *A. phrygia* (Bornm.) Ehrendf.

8b. Flowers smaller, only ± 4 mm. long, ± papillose; inflorescence axes simple; basal shoots with short and spreading, pungent leaves: (Kos) *A. coa* K. H. Rech.

9a. Plants with compact and caespitose basal shoots, of alpine localities, only (2–)3–10(–15) cm. tall (compare the taller, but characteristically pruinose-pubescent forms of *A. glareosa* from the Antilebanon!); flowers sessile between the upper leaves or in 1–2(–3) clusters on short and unbranched inflorescence axes 10

9b. Plants less compact and caespitose (10–)15–50(–70) cm. tall; flowers in (3–)4– many clusters on branched (or rarely unbranched) inflorescence axes (compare more condensed subalpine forms of *A. stricta* from S.W. Anatolia, the Taurus system and the Amanus which are closely linked with taller forms of lower altitudes) . . .12

10a. Leaves slightly glaucescent-pruinose, glabrous or ± pubescent, longest usually not more than 8 mm., ± adpressed towards the stem; flowers on ± elongated unbranched axes in clusters subtended by broad and short bracts hardly attaining half of the corolla length; corolla glabrous: (Lebanon, Antilebanon, E. Taurus: Masmutli dağ) *A. glareosa* Ehrendf.

10b. Leaves green, never pruinose, glabrous, scabrous or hirsute; flower clusters subtended by narrower, leaf-like bracts which are often longer than half the corolla length 11

11a. Plants in dense and very low tufts, 2–4 cm. tall, glabrous or slightly scabrous along the leaf margins, green; flowers in depauperate groups in the axils of upper leaves: (Lycia: Ak dağ) *A. lycia* Stapf

11b. Plants loosely caespitose, never with subterranean runners (2–)5–10

(–12) cm. tall, hirsute or very rarely glabrescent, never blackening when dried; flowers on ± abbreviated axes in irregular clusters: (Central Anatolia) . . *A. capitellata* Hausskn. & Bornm., emend. Ehrendf.

11c. Plants loosely caespitose, with subterranean runners, glabrous to scarcely hirsute, often blackening when dried; flowers in regular terminal heads on elongated peduncles, subtended by bracts: (Pontus, Armenia turcica, W. Transcaucasia) *A. affinis* Boiss. & Huet

12a. Inflorescences branched, with terminal and lateral spikes composed of ± continuous, depauperate groups of flowers subtended by narrowly lanceolate, leaf-like but ± hyaline-margined bracts; plants (15–)20–40(–50) cm. tall, erect, with filiform leaves of which the basal ones are usually already withered at flowering time: (Lycia, Pamphylia, Caria) . . . . *A. tenuifolia* Boiss.

12b. Inflorescences branched or rarely unbranched with interrupted series of ± dense flower clusters subtended by broadly lanceolate to ovate, mostly green bracts; plants of very variable habit but leaves usually of firmer texture and linear . . . . . *A. stricta* Boiss.

A. Outer bracts subtending the flowers ± broadly lanceolate, with elongated points, free, not denticulate; plants green, sometimes blackening when dried, often slender, smooth and glabrous; tall to ± condensed ecotypes, from lowland to subalpine (alpine) localities: (Taurus, Amanus, N. Lebanon) . . . . subsp. *stricta*

B. Similar to subsp. *stricta*, but plants always glabrous and smooth, young leaves and stems glaucescent-pruinose: (Lydia, Caria, Samos) subsp. *pruinosa* Ehrendf.

C. Outer bracts subtending the flowers ovate, abruptly acuminate, ± connate in pairs, ± denticulate; plants green or brownish when dried, often robust and scabrous to hirsute; tall to somewhat condensed ecotypes, from lowland to subalpine localities: (Central Anatolia to Eastern Taurus) . subsp. *latibracteata* (Boiss.) Ehrendf.

13a. Ovaries and fruits never verrucose-hispid; no subterranean runners 14

13b. Ovaries and fruits verrucose-hispid; flowers in cymes of broad pyramidal shape; plants with very long, subterranean runners; leaves rather densely imbricate on the lower portions of the stems: (sandy sea-shores of Black Sea, N. of Istanbul) *A. littoralis* Sibth. & Sm.

14a. Inflorescences with all flowers sessile in dense groups subtended by conspicuous oblanceolate, ± white-margined bracts, forming either terminal heads or interrupted spikes; flowers infundibuliform with broad and short hirsute tubes; leaves of rather firm texture, needle-like 15

14b. Inflorescences very loose, with flowers partially on short stalks in depauperate groups subtended by very small, inconspicuous and scale-like bracts; flowers with narrow, glabrous or very finely papillose tube; leaves of thin texture: (Phrygia, Lydia) *A. divergens* Boiss.

15a. Flowers in heads terminating the branched axes of the inflorescences (only rarely with 1(–2) intercalary flower-clusters); basal vegetative shoots forming caespitose cushions: (N. Anatolia from Paphlagonia to Armenia turcica and Artvin; Crimean peninsula?) *A. pestalozzae* Boiss.

15b. Flowers in clusters forming ± interrupted spikes along the branched axes of the inflorescences; basal vegetative shoots not conspicuously caespitose: (Paphlagonia, Galatia) . . *A. bornmuelleri* Velen.

Asperula stricta Boiss., Diagn. Ser I (3); 33 (1843).

Syn.: *A. fasciculata* Boiss., Diagn. Ser. I (10), 60 (1849) (W!) (A 1)*
A. macrantha Hausskn. ex Bornm. in Fedde, Rep. Beih. lxxxix, 296 (1941) (W!) (C2).
A. cappadocica Hausskn. ex Bornm. in Fedde, Rep. Beih. lxxxix, 296 (1941) (C).
A. elongata Stapf ex Bornm. in Fedde, Rep. Beih. lxxxix, 296 (1941) in syn. (C).
A. stricta var. *tomentosa* Boiss., Diagn. Ser. I (3), 33 (1843), p.p. (C).
—— var. *glabrescens* Boiss., Diagn. Ser. I (3), 33 (1843), p.p. (A 1).
—— var. *longifolia* Boiss., Fl. Or. iii, 35 (1875) (A 1).
—— var. *alpina* Boiss., Fl. Or. iii, 35 (1875), p.p. (A 2, 3).
—— var. *latibracteata* Boiss., Fl. Or. iii, 35 (1875) (C!).

Lectotypus: In monte Tauro, aestate 1836, *Kotschy* 241 (iso. W, BP).

A. subsp. **stricta**.

Bracteae lanceolatae, liberae, numquam denticulatae.

Hab.: In locis apertis, saxosis, glareosis, graminosis vel ± dumosis, 500–2500 m.

TURKEY. Taurus cilicicus, Güllek Boghas, 1160 m., *Kotschy*, sine no. (W) (1). "in monte Tauro", *Kotschy* 240, 241 (W, BP) (1). Konia, am Nordabhang des Taurus bei Eregli, 1850 m., *Siehe* 223 (WU) (3). Adana, Hochplateau am Gongelek-Passe bei Fundukbunar, 1800 m., *Siehe* 222 (WU) (3). Cilicien, Bulghar Magara, *Siehe* 535 (WU) (3). Cilicien, *Siehe* 330 (WU) (3). Taurus, Bulghar Dagh, in monte Gisyl Deppe, 2400 m., *Kotschy* 108, 181b, 212 (W) (3). Taurus, *Kotschy* 240 p.p. (W) (3). Prov. Isparta, dist. Sütçüler (Pisidia): Dedegöl dağ above Oruz Gaz yaylâ, *Davis* 16048 (W) (4). Prov. Antalya, dist. Kemer (Lycia): Tahtali dağ, 10 July 1949, *Davis*, sine no. (W) (4). Prov. Denizli (Caria): Boz dağ, 2100 m., *Davis* 13413 (W) (4). Prov. Antalya, dist. Gebiz (Pisidia): Bozburun dağ between Taşli yaylâ and Kozlu dere, *Davis* 15722 (W) (4); *ibid*, N. side, *Davis* 15653 (W) (4). Prov. Denizli (Caria): Badadağ, 2000 m., screes, *Davis* 18414 (W) (4). Prov. Muğla, dist. Fethiye (Lycia): Girdev dağ, 2000 m., 5 Aug. 1947, *Davis*, sine no. (W) (4). Amanus: *Haradjian* 359, 569 (G) (1); *ibid.*, *Haradjian* 385 (G) (2); *ibid.*, 915 m., *Haradjian* 492 (G) (3); *ibid.*, 1220–1830 m., *Haradjian* 561, 4599 (G) (3). Région d'Hassan Beyli, 915 m., *Haradjian* 2157, 2221, 2624 (G) (1); *ibid.*, 1220–1520 m., *Haradjian* 2255 (G) (3). Kusliji Dagh, 760–1520 m., *Haradjian* 2445 (G) (3).

* Letters and numbers refer to subspecies and numbered "minor variants" (see p. 338).

Beilan, ad Apich Kaja, 1220 m., *Kotschy* 91 (W) (2); *ibid.*, 760 m., *Kotschy* 96 (W) (1); *ibid.*, Mesgidou, 800 m., *Kotschy* 3 (W) (1). Arsou, supra Kara Kaja versus Kiserlik [=Kizil?] Dagh, *Kotschy* 121 (W) (1). Mt. de Düldül, 1500–2000 m. *Haradjian* (G) (1).

LEBANON. Libanon, Blaouza, c. 1320 m., *Samuelsson* 2356, *Hafström* (S) (1). Libanon, prope Aitou, c. 1100 m., *Samuelsson* 2389, *E. Wall* (S) (1). In declivitatibus Libani borealis occidentalibus, prope pagum Ehden, 1450 m., *Bornmüller* 11910 (W) (1).

SYRIA. Mt. Cassius, 915–1220 m., *Haradjian* 3090 (G) (1). Monts Nusairy, env. de Massiaf, 610–760 m., *Haradjian* 3372 (G) (1).

B. subsp. **pruinosa** Ehrendf., **subsp. nov.**

Differt a subsp. *stricta* caulibus follisque juvenilibus pruinosis glaucescentibus glabris.

Typus: Prov. Izmir, dist. Ödemiş (Lydia): Bozdağ, 1800 m., 16 Aug. 1950, *Davis* 18183 (holo. W, iso. K, E).

Hab.: In saxosis, 1200–1800 m.

AEGEAN. Insula Samos, in monte Kierki, c. 1200 m., *K. H. Rechinger* 2038 (W, BP).

TURKEY. Prov. Muğla, dist. Köyceğiz (Caria): Sandras dağ, 23 July 1947, *Davis*, sine no. (very condensed form—W). Sandras dağ, near Gökce ova, serpentine, *Davis* 13519 (W).

C. subsp. **latibracteata** (Boiss.) Ehrendf., **comb. nov.**

Syn.: *A. stricta* var. *latibracteata* Boiss., Fl. Or. iii, 35 (1875).

Bracteae ovatae, abrupte acuminatae, ± connatae, denticulatae.

Typus: In graminosis montis, Berytdagh Cataoniae, 2400 m., 8 Aug. 1865, *Haussknecht* (iso. W, including var. 1 and 2!).

Hab.: in locis apertis saxosis et stepposis, 1000–2800 m.

TURKEY. Armenia minor, in ditione oppidi Divriki, 1000 m., *Bornmüller* 3357 (W, WU) (1). Kurdistania, Mardin, in declivibus saxosis, *Sintenis* 879 (WU) (1). Mardin, Mts. Zennar, *Kotschy* 276 (W) (1). Cappadocia orientalis *Montbret* 2366 (W) (1). Cappadoce, ad Euphratem, *Aucher* 289, 285 bis (W) (1). Cappadoce, Ali-dagh, a 7 km. S.E. de Césarée, vers 1350 m., *Balansa* 1063 (W) (1). Abhänge bei Bereketli, Niğde, 1400 m., *Siehe* 596 (WU, BM, DP, E) (1). Erdschiasdagh, auf steinigen Abhängen des Ali-dagh, c. 1500 m., *Zederbauer* (W) (1). Prov. Elaziğ/Diyarbakir: Maden—Ergani, 1220 m., flowers dirty yellow, *Davis* 22035 (W). Prov. Malatya: Gürün—Darende, 1070 m., flowers pink, *Davis* 21946. Prov. Adana, dist. Feke: Bakir dağ, top of Sencan dere, 2000 m., flowers pink, *Davis* 19392 (1). Prov. Niğde/Kayseri: between Nevşehir and Ürgüp, 1200–1300 m., flowers greenish yellow, *Davis* 19115 (1). Prov. Niğde: Nevşehir, 1200 m., steppe, *Davis* 19095, 19161 (1). Prov. Kayseri: Bakir dağ above Kisge, 1400–1700 m., flowers pink, *Davis* 19316 (1) (W). Prov. Maraş: Akher Dagh, 1830 m., *Haradjian* 1634 (G) (1). Prov. Maraş, dist. Göksun: Binboğa dağ above Yalak, on rocks in ravine, 1500 m., flowers yellowish, *Davis* 19955 (1). Prov. Maraş dist. Çardak: Berit dağ above Arpa Çukuru Y., 1700 m., *Davis* 20288 (2) (W). Cappadocia borealis, in reg. super.

mte. Ak-dagh, 17–1900 m., *Bornmüller* 1041 (W, WU) (2). Kurdistania occidentalis, Taurus cataonicus, in monte Ak Dagh (Aryly Tash) inter urbem Malatja et vicum Kjachta, 2500–2650 m., *Handel-Mazzetti* 2333 (W, WU) (2). Armenia turcica: Kharput, Schuschnas, *Sintenis* 663 (W, WU) (3).

In the original description (1843) of *A. stricta*, Boissier included forms which are placed today under *A. lutea* Sibth. & Sm. (*A. rigidula* Hal.); his treatment in the Flora Orientalis (1875) included in var. *alpina* both *A. capitellata* Bornm. & Hausskn. emend. Ehrendf. and *A. glareosa* Ehrendf. Typified by the tall race from the Cilician Taurus (*Kotschy* 241) *A. stricta* is recognized in its present circumscription by the following differential characters: stems branched predominantly in the upper half (basal branching in *A. canescens* Vis., *A. nestia* K. H. Rech.), leaves with short hyaline-cartilaginous point (long hyaline points in *A. lutea* Sibth. & Sm., *A. phrygia* (Bornm.) Ehrendf.), inflorescences with strongly interrupted series of flower clusters (cf. *A. tenuifolia* Boiss.), if reduced in ecotypes of higher altitudes plants never hirsute (as in *A. capitellata* Bornm. & Hausskn.) or glaucescent and broadly bracteated (as in *A. glareosa* Ehrendf.).

A. stricta Boiss. is very variable in many respects. Some characters could not be used taxonomically, for example the colour of the corollas, changing from pink (predominant) to greenish-yellow (as in specimens of subsp. *latibracteata*). The use of this character to differentiate major divisions within the group (as was done in Boissier's Flora Orientalis) is quite unjustified. Similar unstable conditions of the same flower colours are found in *Galium obliquum* Vill., *G. purpureum* L., *G. apiculatum* Sibth. & Sm. and others. The intraspecific taxonomy of the species has been based on the appearance of glaucescent-pruinose forms on the S.W. margin of the area (subsp. *pruinosa*) and of broadly bracteated forms in Central Anatolia (subsp. *latibracteata*, but taken in a wider sense than in Boissier's original description). In contrast to this only inferior importance was given to variation of leaf form, flower size and ecotypic altitudinal clines in various mountain systems; this led to the recognition of numbered "minor variants" (see the indications in brackets after the citation of specimens).

subsp. **stricta**

var. 1: tall, inflorescences branched, leaves linear; montane zone; Cilician Taurus, N. Syria and Lebanon.

var. 2: condensed, leaves linear; (sub)alpine; Amanus.

var. 3: ± condensed, inflorescences ± unbranched, leaves filiform; upper montane-subalpine zone; Cilician Taurus, Amanus.

var. 4: similar to var. 3, but leaves linear, short; W. Taurus.

subsp. **latibracteata**

var. 1: tall, inflorescences branched, flowers of medium size: montane zone; Central Anatolia, E. Taurus.

var. 2: ± condensed, inflorescences unbranched; (sub)alpine zone; Cataonian Taurus.

var. 3: similar to var. 1, but flowers larger (=*A. macrantha* Hausskn. ex. Bornm.); Kharput.

Asperula tenuifolia Boiss., Diagn. Ser. I(3), 32 (1843).

Typus: In regione montana Siphyli supra Magnesiam, *Boissier*, July 1842 (holo. G; iso. W).

Hab.: In locis apertis saxosis vel dumosis regionis montanae.

TURKEY. Siphylus, partie supérieure, audessus de Magnesie, *Balansa* 142(W). "Caria," *Pinard* a. 1843 (W). Lycia, Elmalu, *Bourgeau* 137 (W, BP). Lycia, Elmalu, in mte. Alidagh, 2135 m., *Pichler* 315 (WU, BP). In Tauro pamphylico inter Marla et Adalia, 1220 m., *Heldreich* 1069 (W, WU, vergens ad *A. strictam* subsp. *strictam* var. 4!).

This species is very closely related to *A. stricta* and differs from subsp. *stricta* var. 4 (subalpine zone of S.W. Anatolian Mts.) only by its branching inflorescence axes, the depauperate flower fascicles, with ± imbricate bracts forming short terminal and lateral spikes, and by the filiform but not hyaline-pointed leaves. Whether it can be maintained as a species or not will depend on examination of further material.

Asperula phrygia (Bornm.) Ehrendf., **stat. nov.**

Syn.: *A. stricta* var. *phrygia* Bornm. in Beih. Bot. Zentralbl. xxiv, 2 Abt., 467 (1909), et in Fedde, Rep. Beih. lxxxix, 309 (1944) in adnot.
A. stricta var. *scabrida* Boiss., Diagn. Ser. I (3), 33 (1841).
A. phrygia Bornm. in Beih. Bot. Zentralbl. xxiv, 2 Abt., 467 (1909) in syn.; in Fedde, Rep., Beih. lxxxix, tab. 17 (1941) nomen tantum.

Typus: Phrygia, ad radices montis Sultandagh, in rupestribus et saxosis prope Akscheher (Wilajet Konia), 1100 m., 18 June 1899, *Bornmüller* 4540 (lecto.) et 4541 (W, WU, etc.).

Hab.: In locis saxosis et stepposis regionis collinae et montanae, 300–1200 m.

TURKEY. "Anatolia," *Wiedemann* (W, WU). Carie, Denisleh, *Boissier* a. 1842 ("*A. stricta* var. *scabrida*"—W). Karakurt bei Denisli, 350 m., *E. Wall* 239, 339 (S). Bithynia, ad Bilecik, ad fluvium Kara-su, 300–400 m., *Bornmüller* 14237. Siphylus, 1842, *Boissier* p.p. (mixed with *A. nitida* var. *hirtella*—W).

AEGEAN. Chios, in saxosis mts. Plaka supra pagum Karies, c. 900 m., *K. H. Rechinger* 5383 (W).

This species was first published as a "nomen nudum" on printed labels in Bornmüller's "Iter Anatolicum tertium, 1899," then described as a variety in 1909, published under "*A. phrygia* Bornm. sp. nov." on a photographic plate (without references) in 1941, but again reduced to varietal rank in 1944. The present occasion is thus the first on which it has been validly published as a species. Though closely related to *A. stricta* and taller forms of *A. nitida* it deserves specific recognition in my opinion as a race of lower altitudes with ± branched inflorescences, clearly hyaline-pointed leaves, interrupted series of flower heads and medium-sized flowers. Both *A. lilaciflora* Boiss. and *A. coa* K. H. Rech. are of very close affinity.

Asperula lilaciflora Boiss., Diagn. Ser. I (3), 33 (1843).

Syn.: *A. acerosa* C. Koch in Linnaea, xix, 31 (1847).
A. lilaciflora Boiss. var. *caespitosa* Boiss., Fl. Or. iii, 39 (1875) (=*A. caespitosa* Boiss. in Bal. exs. 1857, ms.).

Typus: In collibus montis Mesogis prope Derwend in via inter Laodiceam et Philadelphiam, July 1842, *Boissier* (holo. G, iso. W).

Hab.: In locis apertis regionis collinae et montanae.

TURKEY. Phrygia, Ouchak, 940 m., *Balansa* 1146 (G, W).

This rare species, differentiated by its large and showy corolla lobes, is closely linked with *A. phrygia* which already exhibits some variability in flower size tending towards *A. lilaciflora*. Var. *caespitosa* is an ecotype of more compact habit and little branching of inflorescence axes.

Asperula coa K. H. Rech. in Denkschr. Akad. Wiss. Wien, Math.-Naturw. Kl. (Fl. Aegaea), 566 (1943).

Typus: Insula Kos (Coo), in declivibus siccis tuff. ad Kephalo, 8 Jun. 1935, *K. H. Rechinger* 8081 (holo. W).

Known only from the type locality, this species is very closely approached by some forms of *A. phrygia* from the Anatolian mainland with spinescent and divaricate leaves (e.g. Denisli, *E. Wall* 239).

Asperula daphneola O. Schwarz in Fedde, Rep. xxxvi, 139–140 (1934).

Typus: Nifdagh Smyrnae, Lydia, in pascuis lapidosis cacuminis, solo calcareo, c. 1500–1800 m., *O. Schwarz* 848 (B—destroyed?—ANK).

This is—according to the description, for I have not seen specimens—the largest flowered of all *Cynanchicae* and one of the very localized East Mediterranean mountain endemics to which group belong the following four species and *A. pulvinaris* Heldr., *A. abbreviata* (Hal.) K. H. Rechinger, *A. boissieri* Heldr. and *A. suberosa* Sibth. & Sm. in Greece.

Asperula bryoides Stapf in Denkschr. Akad. Wissensch. Wien, Math.-Naturw. Kl., l, 106 (1885).

Typus: Caria, in monte Ujuklu Dagh, 14 June 1882, *Luschan* (holo. WU).

This local species is somewhat intermediate between *A. daphneola* and *A. nitida* var. *hirtella*.

Asperula nitida Sibth. & Sm., Prodr. Fl. Graec. i, 89 (1806) et Fl. Graec. ii, 19, t. 124 (1813).

Typus: In summitate montis Olympi Bithyni, *Sibthorp* (iso. W).

Hab.: In rupestribus et locis glareosis, solo calc.

TURKEY. Bithynia: Bursa, Olympus bithynicus (=Ulu dağ), *Montbret*, *Frivaldsky*, *Clementi*, *Boissier*, *Pichler* 183, *Davis* 14823 (W, WU, K, E, etc.). Cultivated specimens are found in many gardens and have sometimes escaped from cultivation, e.g. on rocks around the monastery of Athos (W).

var. **hirtella** Boiss., Fl. Or. iii, 39 (1875).

Differs by its shortly hispidulous leaves and stems.

Typus: Siphyli cacumen, July 1842, *Boissier* (iso. W).—The tall specimens from the same collection belong to *A. phrygia*!

TURKEY. Phrygia, Akscheher (Wilajet Konia), in regione alpina montis Sultandagh, in jugis supra pagum Tschai, 1700–2200 m., *Bornmüller* 4539 as "*A. lycia* var. *scabrifolia*" (W, WU). Phrygia, Prov. Kutahya; Şaphane dağ, 2000 m., *Davis* 18474 bis (together with *Galium incanum* subsp. *incanum*—W).

AEGEAN. Ins. Mytilini (Lesbos), in monte Olympos ad pagum Ajassos, in saxosis calc. cacuminis, c. 940 m., *K. H. Rechinger* 5563 (W).*

Though one of the earliest known species of the group, *A. nitida* offers some taxonomic problems. There is conspicuous variability in regard to the development of the inflorescence in the type locality, ranging from forms 15 cm. in height with slender unbranched flower axes (1–3 fascicles) above the densely caespitose basal shoots to others where the flowers are hidden between the upper basal leaves and no inflorescence axes are developed. All this seems to depend on local conditions, exposure, grazing (?) and other factors which do not affect the differential characters: leaves stiff, curved inward towards the stem, glabrous, blackening when dried. These features do not reappear in Greek specimens which, on the basis of substantial similarities in habit, have been referred to this species. I therefore prefer at present to include ± condensed forms from the Pindos (Karava, Tsumerka), Kokkino, Veluchi and Oeta (Katavothra) with straight narrowly lanceolate (not linear-subuliform), densely imbricate and glabrous leaves with long hyaline points in *A. oetaea*,† of which *A. pinifolia* §—limited to collections from Parnassus—might represent only a hirsute parallel race. All this remains to be studied more intensively in the future. *A. nitida* var. *hirtella* shows close affinities with *A. phrygia* (which has been found on the bases of Mt. Sipylos and Sultandağ) and with *A. capitellata* Hausskn. & Bornm., emend. Ehrendf.

Asperula sintenisii [Aschers. in Sint. exs. "Iter trojanum 1883", nom. nud. ex] Bornm. in Fedde, Rep. Beih. lxxxix, 299 (1941)—non *A. sintenisii* Hal. in Oesterr. Bot. Zeitschr. xi, 38 (1890), nom. nud. in syn.

Typus: In montis Idae summo "Gargaros", 1 Aug. 1889, *Sintenis* 424 (iso. BM, etc.).

This local Trojan endemic is somewhat reminiscent of *A. boissieri* Heldr. ex Boiss. (Fl. Or. Suppl. 281: 1888) from the mountains of the Peloponnesus (Chelmos, Kyllene) and Parnassus in its glaucescent-pruinose young shoots, but differs in its larger (8–10 mm.) flowers borne singly and in its more compact tufts.

Asperula lycia Stapf, Denkschr. Akad. Wiss. Wien, Math-Naturw. Kl., l, 150 (1885).

Typus: Lycia, in monte Akdagh, cacum. summ., 17 Jul. 1882, *Luschan* (holo. WU).

This local endemic bridges geographically and morphologically the gap between the group of local alpines with hyaline pointed leaves in N.W. Anatolia (and Greece), *A. capitellata* Hausskn. et Bornm. emend. Ehrendf. in the Central Anatolian Mts., *A. idaea* Hal. on Crete and *A. glareosa* Ehrendf. in the Lebanon, Anti-Lebanon and eastern Taurus (Masmutli dağ).

* This collection is only provisionally determined; it shows similarities with the Greek *A. oetaea*–*A. pinifolia* group and may represent a local taxon.

† **A. oetaea** (Boiss.) Halácsy, Consp. Fl. Graec. i, 739 (1901).
Syn.: *A. lutea* var. *oetaea* Boiss., Fl. Or. Suppl. 280 (1888).
A. lutea subsp. *oetaea* (Boiss.) Nyman, Consp. Fl. Eur. Suppl. II, i, 156 (1889).

§ **A. pinifolia** (Boiss.) Heldr., Chl. Parn. 19 (1890).
Syn.: *A. lutea* var. *pinifolia* Boiss., Fl. Or. Suppl. 280 (1888).
A. rigidula var. *pinifolia* (Boiss.) Halácsy, Consp. Fl. Graec, i, 739 (1901).

Asperula glareosa Ehrendf., **spec. nov.***

Syn.: *A. stricta* Boiss. var. *alpina* Boiss., Fl. Or. iii, 35 (1875), p.p.

Perennis, caespitosa, e rhizomatibus lignescentibus (numquam stoloniferis) multicaulis; caules floriferi (3)5–10(20) cm. alti, internodiis inferioribus abbreviatis et foliis imbricatis, superioribus magis elongatis, foliis multo longioribus; folia et stipulae foliaceae linearia, stricta, glabra vel ± puberula, juvenilia glaucescenti-pruinosa, obtusa et brevissime cartilagineo-acuminata, maxima 5–8(13) mm. longa et 0·5–0·9 mm. lata, nervis medianis prominentibus, 0·2–0·4 mm. latis; inflorescentiae ± simplices, fasciculis floriferis 1–2(3, 4); bracteae ovato-lanceolatae, integerrimae, breves, ovaria paulo superantes; flores rosei, 6–8 mm. longi, tubis quam lobis triplo longioribus, lobis obtusis; ovaria et fructus glabri et ± laeves.

Typus: In Libani borealis in declivitatibus alpis Dschebel Makmal, 2500–2600 m., *Bornmüller* 11907: "*Asperula stricta* var. *alpina*" (holo. W).

Hab.: In glareosis regionis alpinae, 1800–2600 m.

LEBANON. In Libano ad Bscherre et circa Cedretum, versus jugum Baalbek, 1830 m., *Kotschy* 349 (W). In Libani alpini declivitatibus occidentalibus, in monte Dschebel Keneise (=Kenissé), 2100–2200 m., *Bornmüller* 11908 (WU); *ibid.*, 1950–1980 m., *Samuelsson* 5721, *Wall* (S). Libani in regione alpina jugi Sannine, 2000 m., *Bornmüller* 746 (W, WU). Circa Zebdaine prope Damascum, in jugis supra Bludan versus Palmyram, 1980 m., *Kotschy* 145 (W: tall and pubescent form).

TURKEY. Cappadocia: Anti-Taurus, Masmutli Dagh, a. 1908, *Siehe* (W). This is a very distinct alpine endemic of the Lebanon and Anti-Lebanon ranges with a characteristic disjunction towards the Anti-Taurus. It is sharply separated from *A. stricta* and its subalpine forms in the Amanus and Taurus, as well as from the rest of the alpines in Anatolia, by its small, glaucescent-pruinose, glabrous or puberulent leaves, the reduced inflorescences, the short involucral bracts of the flower fascicles and a characteristic habit; it comes closest to *A. lycia* and especially to *A. idaea* Hal. var. *lassitica* K. H. Rech. from the mountains of Crete and to *A. suberosa* Sibth. & Sm. from the Athos, where the glaucescent character re-appears, mostly correlated with the pubescent indumentum. Differentiation from *A. glareosa* is possible on the basis of the shorter flowers (not longer than 5 mm.) of *A. idaea* and the longer and more leaf-like involucral bracts of *A. suberosa*. The three species—eventually together with the more distantly related *A. gussonei* Boiss. from Sicily—might represent remnants of an older phylogenetic expansion of the East Mediterranean *Cynanchicae* which have preserved some primitive characters in common.

Asperula capitellata [Hausskn. & Bornm., in sched. et in Mitt. Thür. Bot. Ver. xx, 13–14, 1904/5, nom. nud. ex] Bornm. in Fedde, Rep., Beih. lxxxix, 296–297 (1941), emend. Ehrendf.

Typus (*Lectotypus*): Cappadocia, in excelsis montis Argaei, 2200–2600 m., 16 Jun. 1889, *Bornmüller* 2389 (JE, not seen).

Hab.: In locis apertis, saxosis et lapidosis regionis (sub)alpinae, 1200–2500 m.

TURKEY. Vilajet Sivas, Gipfel des Akdagh, 2500 m., N. vom Halys bei Schcharkischla, *Siehe* 345 (W). Erdschias dağ (Argaeus): Tekir jaila,

* A habit figure will be published in "Reliquiae Samuelssonianae" (Ehrendorfer, 1958*b*).

2300 m., 23 June 1902, *Zederbauer* (W); oberhalb Hadschilar, 2150 m., 26 May 1902, *Zederbauer* (W); supra Everik, 1980 m., *Kotschy* 1073 (W). Niğde, auf Hügeln, 1200 m., May 1902, *Zederbauer* (WU). Vilajet Konia, Utschkapu dağ, Passhöhe zwischen Berektetli und Niğde, 200 m., *Siehe* 586 (W, BM, BP, E). Prov. Niğde: Hasan dağ near Taşpinar yayla, 2300 m., *Davis* 18946. Kayseri-Bunyan, *Davis* 21842, ±vergens ad *A. strictam* Boiss. (W).

The history of this taxon is rather confused: it was first mentioned as a new species *in schedis*, then in 1905 reduced to a synonym of *A. nitida* var. *hirtella* and finally definitely published in 1941; the original description contains citations of many specimens which belong, according to the classification accepted here, to *A. nitida* var. *hirtella*, *A. affinis* (incl. *A. pontica*) and a third entity not described before. All this has made it necessary to choose a lectotype and to redefine the name to fit the above mentioned "third entity": a group of subalpine races remaining green when dried, characterized by lack of subterranean runners, hirsute (rarely glabrescent) indumentum, hyaline points on the leaves short or lacking, and irregular terminal, sometimes intercalary clusters of flowers. Morphologically and geographically this entity is intermediate between *A. nitida* var. *hirtella* (of which the collections from Sultan dağ show already some similarities to *A. capitellata*) and the following *A. affinis* from the Armenian and Pontic mountains. There seem to be no direct connections with the races of *A. stricta* which occur in lower altitudes in the same general area. Though I have not seen the lectotype of *A. capitellata*, its characters seem to be definitely ascertained by rich collections from the type-locality cited above.

Asperula affinis Boiss. & Huet, Diagn. Ser. II (2), 110 (1856).

Syn.: *A. pontica* Boiss., Fl. Or. iii, 39 (1875)

A. cynanchica L. var. *affinis* (Boiss. & Huet) Boiss., l.c. 41 (1875).

Typus: In alpinis Armeniae Turcicae prope Palanteuken (=Erzeroum), 7000–8000 m. (in glareosis ad cacumen mont. Tech-Dagh), Jul. 1853, *Huet du Pavillon* (iso. W).

Hab.: In pascuis et locis apertis regionis alpinae, 1800–3000 m.

TURKEY. Pontus, Hanschuka, *Sintenis* 1573 (W, WU). Armenia turcica, Erzinghan, Sipikordag, 1830 m., *Sintenis* 1106 (W, WU). Gümüschkhane, Karagvelldagh, *Sintenis* 7045 (W, WU). Pontus galaticus, in alpinis montis Ak-dagh, Amasia, 1800–1900 m., *Bornmüller* 1847 (W: vergens ad *A. pestalozzae*!). Bousdouandagh, Ponti Lazici, supra Khaba Khar, 2400 m., *Balansa* 397 (typus *A. ponticae*—G). Prov. Giresun: Balabandaglari (Kilinç Tepe), above Tamdere, 2900 m., *Davis* 20548 (W).

According to Grossheim (Flora Kavk. iv, 27: 1934), N.E. to the regions of Batum and Kutais.

A close comparison between the type of *A. affinis* and representative specimens of *A. pontica* did not reveal any differences other than a slightly more condensed habit and somewhat firmer leaf texture in *A. affinis*; in contrast to the treatment in the Flora Orientalis and the second edition of Flora Kavkaza I am therefore compelled to reduce the more recent *A. pontica* to synonymy as long as there are not more collections at hand to validate separation. The area of *A. affinis* seems to extend towards western Transcaucasia whence both this species and *A. pontica* are indicated by Grossheim in his Flora Kavkaza. *A. affinis* is quite close on the one hand to northern forms of *A. capitellata*, on the other to *A. pestalozzae* Boiss. of which it might represent an alpine parallel race. The main differential characters distinguishing it from *A. pestalozzae*, which shares with *A. affinis* the characteristic terminal flower heads, are the larger and more intensely pink flowers with longer corolla tubes, the much more condensed habit, the softer, usually blackening leaves and the subterranean runners.

Asperula bornmuelleri Velen., Fl. Bulg. Suppl. i, 143 (1898); Bornm. in Mag. Bot. Lap. xxx, 65 (1931), non Hausskn. in sched. et in syn. ex Bornm. in Fedde, Rep., Beih. lxxxix, 298 (1941).

Syn.: *A. refracta* Czecz. in Acta Soc. Bot. Polon. ix, 39 (1932) et in Fedde, Rep., Beih. cvii, 191 (1939).
A. bornmuelleri var. *galatica* Bornm. in Fedde, Rep., Beih. lxxxix, 298 et 309 in adnot. et tab. 18 (1941).
A. bornmuelleri var. *paphlagonica* Bornm., l.c. 298 et 309 in adnot. (1941) (=subsp. *paphlagonica* Bornm., l.c., tab. 19 (1941) nom. nud.).

Typus: Ad Angoram Galatiae, *Bornmüller* 3160, "*A. graveolens*" (W, WU, etc.: isotypi).

Hab.: In collibus stepposis aridis, 700–900 m.

TURKEY. Paphlagonia austr., ditionis opp. Cankri, 800–900 m., *Bornmüller* 14234 (W); ad opp. Cankri, in vallis Cakmakli-dere, c. 800 m., *Bornmüller* 14235 (W). Paphlagonia, Kastambuli, Tossia, *Sintenis* 4608 (W, p.p., vergens ad *A. pestalozzae*).

In contrast to the treatment in Bornmüller's "Symbolae ad Floram Anatolicam" (in Fedde, Rep., Beih. lxxxix, 198: 1941) *A. bornmuelleri* is here limited to strongly branched forms with short corolla tubes and terminal as well as intercalary flower fascicles. This puts *A. bornmuelleri* subsp. *cappadocica* and some of the specimens cited by Bornmüller under var. *paphlagonica* (e.g. his no. 1036) definitely into the following species. According to the material I have seen, the delimitation of forms with intercalary and others with predominantly terminal flower fascicles seems quite natural. In the light of the facts available at present the hypothesis may be advanced that *A. bornmuelleri* represents hybrid derivatives between *A. stricta* subsp. *latibracteata* bordering towards the S. and S.E. (habit, form of inflorescences!) and the widely distributed northern *A. pestalozzae* Boiss. (short corolla tubes, flower colour, tendency towards terminal glomeration of flowers). It will depend on the study of more material to decide the question how broad the zone of intermixture of the original species is, and whether *A. bornmuelleri* can be maintained as a species or not.

Asperula pestalozzae Boiss., Diagn. ser. II (2), 112 (1856).

Syn.: *A. graveolens* var. *pestalozzae* (Boiss.) Boiss., Fl. Or. iii, 41 (1875).
A. bornmuelleri Velen. subsp. *cappadocica* Bornm. in Fedde, Rep., Beih. lxxxix, 298 (1941).
A. graveolens M.B. var. *majoriflora* Bornm., l.c. 299 (1941).
"*A. graveolens* M.B." auct. mult. Fl. Anatol.
A. woronowii Krecz. in Grossh., Fl. Kavkaza, iv, 25 (1934).

Typus: Bithynia, prope Bolu, *Pestalozza* as *A. cynanchica* var. *supina* (iso. W).

Hab.: In locis apertis, graminosis et saxosis (0–)500–1500(–2300) m.

TURKEY. Pontus: Amasia, Ak-dagh, in catena montium septentrionali supra Ladik, 1500 m., 15 Jul. 1890, *Bornmüller* 1858 as "*A. divergens*" (W). "Anatolia", *Wiedemann* (W). Pontus austr., in monte Kirklar, Amasia, *Bornmüller* 3000 (W). Cappadocia borealis, in reg. alp. montis Ak-dagh, in jugo Karababa, 2300 m., *Bornmüller* 1036 (WU). Amasia, supra arcem, 500–600 m., *Bornmüller* 498 (W, WU). Armenia turcica: Gümüschkane, Kurdomer, in pascuis subalpinis, *Sintenis* 6238 (W, WU). Paphlagonia: Kastambuli, Tossia, *Sintenis* 4608 p.p. (WU, vergens ad *A. bornmuelleri*).

If the synonym *A. woronowii* is correct, the area of *A. pestalozzae* extends eastwards to the Artwin region.

Specimens belonging to this widely distributed and rather variable race in northern Anatolia (varying in habit, size of flower heads, size of flowers, indumentum, etc.) have previously been determined mainly as *A. graveolens* M. Bieb.; but this is a very different plant with verrucose ovaries and fruits, and cymose, never terminally glomerulated and bracteated, flowers; it grows in sandy localities in S. Russia: Tanais (R. Don). Search for a more appropriate name led to *A. pestalozzae* Boiss. *A. pestalozzae* Boiss. reappears on the Crimean Peninsula in identical or only slightly different forms, recently described as *A. caespitans* Juz. (in Not. Syst. Herb. Inst. Bot. Ac. Sc. URSS Leningrad, xiv, 35–37: 1951—widely distributed exsiccata *Pareys* 14, *Callier* 108, 272, 622?, 793, 3944, mostly as *A. cretacea* Willd. ap. R. & S., Syst. iii, 529: 1818, which is an earlier name for the different *A. taurica* Pacz., Descr. Pl. Gubern. Sherson, 20: 1889).

The racial differentiation of this interesting species around the Black Sea still needs more critical study. In respect to the relations of *A. pestalozzae* Boiss. with *A. affinis* and *A. bornmuelleri* see p. 344.

Asperula divergens Boiss., Diagn. Ser. II (6), 90 (1859).

Syn.: *A. graveolens* var. *glabriflora* Boiss., Fl. Or. iii, 41 (1875).

Typus (*Lectotypus*): Ouchak (Phrygie), vers 940 m., coteaux calcaires, *Balansa* 1147 (iso. W).

TURKEY. Prov. Izmir, dist. Ödemiş (Lydia): Bozdağ, 1200 m., *Davis* 18170 (W).

A very isolated species in Anatolia (cf. p. 331) belonging to a critical group of species around *A. cynanchica* L., characterized by very small, glabrous flowers in loose cymes.

Asperula littoralis Sibth. & Sm., Prodr. Fl. Graec. i, 88 (1806) et Fl. Graec. ii, 18, t. 122 (1813).

Typus: Ad maris Euxini littora, *Sibthorp* (holo. Oxf.—not seen).

Hab.: In arenosis maritimis.

TURKEY. Environs de Constantinople, Kilia, 4 Jul. 1897, *Nemetz* (WU), *Aznavour*, Herb. Norm. 3945 (WU). Ponti anatolica prope pagum Riva, 13 Jun. 1890, *Degen* (WU).

There is some variability in the height of the stems, which are quite low and reduced in the specimens from Riva but tall and strongly branched in those from Kilia. About the relationship of the species cf. p. 333.

A further series within the genus *Asperula* in its original circumscription consists of a sequence from *A. taurina* via *A. libanotica*, *A. involucrata*, *A. laevigata* to *A. tinctoria*, mentioning only the more important species of this group. The "extreme" members of this series are very different, but altogether form a rather continuous "chain" of related taxa. Their common key characters are: perennial habit; whorls of two leaves and two (in *A. tinctoria*, rarely also in *A. laevigata*, up to four) leaf-like stipules; flowers in heads subtended by numerous involucral leaves or in more loose grouping with small but nevertheless very characteristic blunt, elongate-ovate floral bracts; flowers white (rarely pale pink), odorous, trumpet-shaped with four (three) lobes and long to short tubes, ovaries and fruits glabrous and smooth, ovate. The whole group is set aside from other *Galieae* rather clearly. Affinities might exist between *A. taurina* and the annual *A. arvensis* group, further on between *A. laevigata* and the East Asiatic complex around *A. platygalium* Kom. with broadly cupshaped flowers. As there are no closer relations with species of *Galium* I cannot accept the transference of *A. tinctoria* to the latter genus as *G. triandrum* Hylander (Nomenkl. Syst. Stud. Nord. Gefässpfl. 298: 1945).

As the *Asperula taurina—A. tinctoria* group seems to have its centre in the Eastern Mediterranean I include a key to all the species:

1a. Flowers in dense heads subtended by numerous floral leaves of which the inner ones are bordered by long cilia; leaves and stipules (2+2) broadly ovate: (W. Alps through the Italian Peninsula and the Balkans to northern Anatolia, the Crimean Peninsula, Caucasus, Transcaucasus and N.W. Iran)
A. taurina L. (incl. *A. leucanthera* (Beck) Wettst.)

1b. Flowers in loose groups with single glabrous floral bracts; middle stem regions with whorls of two leaves and four smaller leaf-like stipules, all linear; flowers trimerous: (middle, southern, N., E. and S.E. Europe)
A. tinctoria L. (incl. *A. ciliata* Rochel)

1c. Floral leaves never with long cilia (sometimes ciliolate); hardly ever more than two stipules present in each whorl 2

2a. Inflorescences loose, elongate-pyramidal; flowers not glomerulate, with corollas small, about three times the length of the ovaries: (western Mediterranean, E. to Balkans) . . *A. laevigata* L.*

2b. Inflorescences cymose; flowers ± glomerulate, with corollas usually longer than four times the length of the ovaries 3

3a. Leaves mostly with glabrous and smooth margins (sometimes whole plant puberulent in *A. xylorrhiza*), lanceolate to elongate, two or more times longer than broad 4

3b. Leaves mostly with short, papillose hairs directed forward along the margins, rough, broadly ovate, rarely twice as long as broad . 6

4a. Leaves thin, oblanceolate and blunt, broadest in the upper half; flowers strongly glomerulate: (northern Anatolia from Bursa and Istanbul to Rize) . . . . . . *A involucrata* Wahlenb.

4b. Leaves slightly leathery, narrowly lanceolate, pointed, broadest in the middle; inflorescences loose 5

* About nomenclatural confusions with *Galium rotundifolium* L., see Ehrendorfer in Oesterr. Bot. Zeitschr. xcix, 625–631 (1952).

5a. Leaves linear-lanceolate, 10–15 mm. long; flowers very small, about 2–3 mm. long; plant mostly strongly virgate from the base: (northern Central Anatolia, from Amasya to Gümüşane) *A. petrophila* Bornm.

5b. Very similar, but leaves often longer, up to 25 mm. long; flowers larger, about 3–4 mm. long; plant less strongly virgate from the base: (Central Anatolia, from Gümüşane to Sivas and Maraş) *A. suavis* Fisch. & Mey.

5c. Leaves lanceolate, 15–25 mm. long; only with relatively short branches in the upper stem portion; flowers about 3–4 mm. long; sometimes whole plant puberulent but mostly glabrous (Central Taurus from Maraş to Bitlis) . . . . . . *A. xylorrhiza* Nab.

6a. Nigrescent when dried; low, caespitose plant with prostrate-ascending, rooting stems, abbreviated internodes and depauperate flower groups: (High mountains, from Caucasus to Transcaucasus and adjacent northern Turkish Armenia) *A. gracilis* C. A. Mey (=*Galium pseudopolycarpon* Som. & Lev.)

6b. Never nigrescent; stems taller, erect or ascending; flower groups mostly with more than ten flowers 7

7a. Only 20–30 cm. tall with ascending-erect stems; leaves broadly elliptic, obtuse, broadest around the middle, with margins sometimes glabrescent; flowers in somewhat irregular heads: (Amanus) *A. cymulosa* Post

7b. Mostly taller than 30 cm., erect; leaves ovate, acute, broadest below the middle, with margins always strongly ciliolate; flowers capitate . 8

8a. Stems mostly more than 45 cm. tall, strongly branched with numerous (usually more than ten), relatively small flower heads: (North Syrian mountains: Cassius and Nusairy Mts.) *A. pseudolibanotica* Ehrendf. ined.*

8b. Stems about 30–40 cm. tall, not or only somewhat branched with fewer (mostly up to five), relatively large and many-flowered heads: (Lebanon) . . . . . . *A. libanotica* Boiss.

The following enumeration contains *all* specimens I have seen of the very well isolated *A. involucrata*, of *A. suavis*, *A. petrophila* and *A. xylorrhiza*, a very closely allied triangle, and of *A. cymulosa*. Bornmüller's treatment (in "Symbolae ad Floram Anatolicam, in Fedde Rep. Bh. lxxxix, 300: 1941) is inadequate in certain respects and contains some misidentifications and misinterpretations which are corrected here. The typification of *A. suavis* published on cultivated material is not yet definitely settled; in contrast to the interpretation adopted by Bornmüller and in the present provisional treatment, the type of *A. suavis* might very well be identical with the small flowered racial entity called here *A. petrophila* Bornm., leaving the large flowered southern racial equivalent—which has been named *A. suavis* here—without a name. Another uncertainty concerns the taxonomic status of the three taxa *A. suavis*, *A. petrophila* and *A. xylorrhiza*; these are very closely related, connected by some intermediate forms,

* Description and figures of this new species will be published in "Reliquiae Samuelssonianae" (Ehrendorfer, 1958b).

and may eventually have to be treated as geographic-ecological subspecies of *A. suavis*. *A. xylorrhiza* cannot be restricted to hairy forms as they are represented by the type, but must cover also otherwise identical glabrous parallel forms which occur in the same general area. A complete list of specimens belonging to *A. pseudolibanotica* and *A. libanotica*, the group members from Syria and the Lebanon, will be published in the forthcoming treatment of Rubiaceae in "Reliquiae Samuelssonianae" (1958b).

Asperula involucrata Wahlenberg in Berggren, Res. Eur. Osterl. II., Bih. 21 (1826) et in Isis xxi, 981 (1828).

Typus: Vom thrakischen Vorgebirge und einigen anderen Stellen am Bospor um Bujukdere, *Berggren* (n.v.).

TURKEY. In agri Byzantini sylva Belgradensi, *Degen* a. 1890 (WU, W). Umgebung von Konstantinopel, Beicos, Laubwald, *Nemetz* a. 1879 (WU). In agro Byzantino, ad viarum margines silvae Belgradensis prope Bujukdere ad Bosporum, *Janka* a. 1872 (WU). Umgebung von Konstantinopel, *Mergenthaler* 55 (WU). "Anatolia", *Wiedemann* (WU, W). Flora constantinopolitana, inter frutices collis Kutschuk Tscham-lidscha Asiae, *Wimmer* 31 (W). Konstantinopel, *Noë* a. 1847 (W). Bithynia, in reg. inferiore montis Olympi supra Brussa, 200–400 m., *Bornmüller* 4638 (W. WU). Locis umbrosis sylvarum montis Olympi, *Pichler* a. 1873 (W, WU). In fruticetis umbrosis subalpinis Olympi Bithyn., *Pichler* 193 (W, WU). Olympus, Reshish dagh, *coll.*?, a. 1855 (E). Bithynischer Olymp, Ak-Dschellan Wald, *Nemetz* a. 1896 (WU). Bith. Olymp., *Tölg* (W). Prov. Kastamonu: Kure—Inebolu, 2400 m., *Davis* 21608 (W, E); Kastamonu—Kure, 1070 m., eroded shale slope, *Davis* 21693 (E). Amasia—Samsoun, in sylvaticis reg. mont., 700–1200 m., *Bornmüller* 500 (W, WU). Amasya, *Manisadjian* 172 (W). Pontus, Sumila, in saxosis prope Sta. Barbara, *Sintenis* 1471 (W. WU). Kulak Kajan Kerasun, zwischen Gebüsch, 1500 m., *Krause* 1952 (W). Prov. Giresun: Tamdere—Yavuzkemal, nr. Karinca, 1500 m., *Davis* 20728 (E). Trapezunt, in valle Kalanema Dere prope opp. Aktsche Abad (Platana), in rhododendretis humidis supra castellum Chashka, substr. erupt., 750 m., *Handel-Mazzetti* 361 (W, WU). Trapezunt, prope opp. Ordu ad viculum Tschokdam in dumetis, substr. andesitico, 600 m., *Handel-Mazzetti* 1089 (W, WU). Prope Trapezuntem, in collibus, *Sommier & Levier* a. 1890 (WU). Prov. Rize: Karadere—Güneyce, 500 m., banks, *Davis* 20840 (E, W). Gassdali (?) Mte. près Andramyli, 11 June 1833, *Montbret* (W).

Asperula petrophila Bornm. in Fedde, Rep., Beih. lxxxix, 300 (1941).

Typus: Amasia, in apricis aridis montis Kirklar, 600 m., *Bornmüller* 499 et 499b, 2 Jun. 1889 et Jul. 1890; "*A. suavis*" (iso. W).

TURKEY. Amasia, in reg. mont. Ak-dagh, Karadagh, 700–1200 m., *Bornmüller* 499 (W, WU). Pontus Galaticus, in saxosis apricis infer. montis Sana-dagh, *Bornmüller* 2871 (W). Armenia, in collibus prope Gumuschkhane, *Bourgeau* 104: "*A. mutica* Boiss." (W, WU). Armenia turcica: Gumuschkhane, Cigana in Cigandagh, in saxosis, *Sintenis* 1362 (W, WU, p.p. intermediate towards *A. suavis*). "Armenia", *Calvert & Zohrab* (E).

Asperula suavis Fisch., Mey. & Avé-Lall. in Ind. Sem. Hort. Petrop. ix, 62 (1842) et in Linnaea, xviii, 172 (1844).

Typus: In Anatolia, *Wiedemann*—cult. in Hort. Petrop. (n.v.).

TURKEY. Armenia minor, in ditione opp. Divriki, c. 1000 m., *Bornmüller* 3358: "*A. involucrata*" (WU, W). Pontus australis, in dumosis humidiusculis ad Sivas, 1200 m., *Bornmüller* 1641 (W, WU). Gümüschkhane, Stadodopi, *Sintenis* 6239 (WU). Im Gerölle der subalpinen Region des Masmutlidagh, 2700 m., Antitaurus, Konia unweit Bereketli Maaden, *Siehe* 360 (WU). Prov. Maraş, dist. Göksun: Hobek dağ, 1500 m., near stream, *Davis* 20225 (somewhat towards *A. xylorrhiza*—E, W).

A. xylorrhiza Nábělek, It. Turc.-Pers. i, 133 (1923).

Syn.: *A. involucrata* var. *rigida* Post, Fl. Syr., Pal. & Sinai, 392 (1896).

Typus: Kurdistania turcica, distr. Ramoran: Halakur-Dar ad sept. ab opp. Geziret-ibn-Omar, in fiss. rup. calc. 2300 m., 25 Jul. 1910, *Nábělek* 4317 (n.v.)

TURKEY. Berytdagh, in rupestr. calc. Cataoniae, 2100–2350 m., 8 Aug. 1865, *Haussknecht*, (W). Armenia turcica: Kharput, in fruticetis supra Pekenik, *Sintenis* 507 (WU, W). Taurus cataonicus, in convallibus subalpinis prope vicum Bekikara inter urbem Malatja et vicum Kjachta, in declivibus siccis, substr. serpentico c. 1600 m., *Handel-Mazzetti* 2451 (W, WU). Taurus cataonicus, in monte Nimrud Dagh prope vicum Kjachta distr. Mamuret-ül-Asis, locis lapidosis in valle circa Urik, substr. calc., 1200–1400 m., *Handel-Mazzetti* 2126 (W, WU). In rup. calc. mont. Achrdagh, Maraş, 19 Jul. 1865, *Haussknecht* (W). Ad radices Akhar Dagh prope Maraş, 950 m., *Haradjian* 1520 (G). "Kurdistan", cult. Hort. Bot. Vindob., Jun. 1863, *Kotschy* (W). Prov. Bitlis: Kambos dağ, above Hürmüz, 1675 m., rocky slope, *Davis* 23445 (E).

Asperula cymulosa (Post) Post, Fl. Syr. Pal. and Sinai, 391 (1896).

Syn.: *Galium cymulosum* Post in Trans. Linn. Soc. Bot. Lond. xxiv, 432 (1888).

Typus: In sphagnetis sylvaticis montis Amani, *Post* (not seen, cf. below).

TURKEY. "Syria borealis", mt. above Osmaniye, Amanus, 8 Sept. 1884, *Post* (iso. BM). Amanus prope Beilan, ad fontes aquaeducti Beilan supra pagum Kurkli, 120 m., *Kotschy* 45: "*A. libanitica*" (W). Amanus, in montibus Hassan Beyli, *Haradjian* 2175 (G). Amanus, 1650 m., *Haradjian* 215, 366, 367 (G).

Asperula arvensis L., Sp. Pl. 150 (1753).

This and the following species (or subspecies) represent a quite isolated group of annual *Asperulae* radiating from the Near and Middle East, with capitate flowers supported by mostly ciliate-pectinate involucral leaves and bracts. Other species are *A. sherardioides* Jaub. & Spach and *A. haussknechtii* Boiss.; *A. setosa* Jaub. & Spach and *A. orientalis* Boiss. & Hohen. are very close to *A. arvensis* and probably only subspecific members of the group.

TURKEY. Prov. Kayseri: Bakir Dağ above Kisge, in corn field, *Davis* 19275 (W: fls. very small). Akher Dagh, 2000–2300 m., *Haradjian* 1671 (G). Aintab, *Haradjian* 114, 1425 (G). In planitie pr. Amuk inter montes

Amanus et Kurd Dagh, *Haradjian* 956 (G). Ad montem Mourad Pascha et in pascuis ad lacum Baleuk Gol, 50 m., *Haradjian* 4201 (G). Amanus: in montibus Düldül, 1650–2300 m., *Haradjian* 2318 (G, ad *A. orientalem* verg.).

IRAQ. Kurdish hills, among rocks in the Rowanduz gorge, 760 m., fls. bright blue, *Low* 193 (BM).

Asperula setosa Jaub. & Spach, Illustr. Pl. Or. i, 152, tab. 81 (1843).

Syn.: *A. arvensis* L. subsp. *setosa* (Jaub. & Spach) Thiéb., Fl. Lib.-Syr. ii, 187 (1940).

IRAQ. Kurdish hills, 760 m., in hills, in good soil by roadside, fls. white, *Low* 317 (BM).

IRAN. "Bakhtiari country", *G. Watt* 13136 (E).

Asperula orientalis Boiss. & Hohen. in Kotschy, Pl. Kurdist. exs. (Jun. 1843) et Diagn. Ser. I (3), 30 (after 8 Nov. 1843).

Syn.: *A. azurea* Jaub. & Spach, Ill. Pl. Or. i, 151, tab. 82A (8 Nov. 1943). *A. arvensis* L. subsp. *orientalis* (Boiss. & Hohen.) Thiéb., Fl. Lib.-Syr. ii, 187 (1940).

TURKEY. Aintab, *Haradjian* 844 (G). Bal Kuz prope flumen Euphrat [in Syria?] *Haradjian* 1004 (G).

The following four Anatolian species, *Asperula brevifolia*, *A. pseudochlorantha*, *A. antalyensis* and *Galium serotinum*, belong to a primitive group of *Galieae* with a very irregular length of the corolla tube. The fact is responsible for the artificial distribution of the members of this natural group to the conventional genera *Asperula* and *Galium*. The phylogenetic relations between the relic species of this group are apparent from numerous geographical, ecological and morphological affinities: their area extends from the Balkans to Lebanon, Caucasus and Western Elburs; they are all confined to rocky slopes or rock crevices; all are perennial chamaephytes with strongly woody rootstock, lacking rooting runners, with leaf-stipule-whorls consisting of (4–)6–8(–10) elliptic to linear, one-nerved elements, with dichasial branching of the inflorescence but ± strong development of the main axis, two bracteoles on most peduncles, flowers hypocrateriform to rotate, mostly intensely coloured, yellowish-greenish-purplish; in particular, the ovaries and fruits—and this is most characteristic—are truncate, elongate when young, mostly glabrous. This natural complex consists of minor groupings with *Asperula muscosa* Boiss. & Heldr. and *A. baenitzii* Heldr. on the Greek Peninsula, *A. brevifolia* Vent. and *A. rigida* Sibth. & Sm. in S.W. Anatolia, Rhodes and Crete, *A. microphylla* Boiss. and *A. mazenderanica* Ehrendf. in the mountains from the Caucasus to Elburs (Mazanderan), *A. breviflora* Boiss. and *Galium suberosum* Sibth. & Sm. in Syria, Lebanon and Cyprus, the species pair *A. chlorantha* Boiss. & Heldr. and *A. pseudochlorantha* Ehrendf. in Greece/Albania and S.W. Anatolia, just as *A. scutellaris* Vis. (=*A. rupestris* (Vis.) Rchb.) and *A. antalyensis* Ehrendf. grow in the central to N.W. Balkans and S.W. Anatolia, and finally the purely rotate flowering *G. purpureum* L. (including *G. apiculatum* Sibth. & Sm.) in S. Europe to the Alpes

Maritimes, corresponding to *G. serotinum* Boiss. & Heldr. in Anatolia, *G. boryanum* Walp. and the isolated *G. baldaccii* Hal. in the Peloponnesus and the Central Balkans.

This species complex, falling between *Galium* and *Asperula*, will probably have to be classified as a separate genus in the future, but I have postponed its description and publication until a complete generic reclassification of the whole *Galieae* is possible.

Asperula brevifolia Vent., Descr. Plant. Jard. Cels, 63, tab. 63 (1800).

TURKEY. Prov. Antalya, Dist. Alanya (Pamphylia): between Kizil Kaya and Kizil Alan, N. of Alanya, rocks, *Davis* 14456 (W, E). Prov. Antalya, dist. Elmali (Lycia): Yuva, 1100 m., *Davis* 13426 (E, W). Prov. Antalya, dist. Kemer (Lycia): Teke dağ near Ovacik, among rocks, flowers greenish yellow, *Davis* 15197 (W); Kesme boğaz near Kemer, rocks, *Davis* 14069 (W). Prov. Denizli (Caria): Boz dağ above Geyran yayla, on ridge, 1200 m., *Davis* 13382 (E). Prov. Denizli (Caria): Petrak mahali between Acipayam and Abbas, flowers brownish green, *Davis* 13290 (W).

Asperula pseudochlorantha Ehrendf., **sp. nov.** (fig. 3a).

E basi suffrutescenti multicaulis; caules erecti, in parte superiore ramosi, c. 20–30 cm. alti, internodiis ± aequilongis c. 25–35 mm. longis, antrorsum papillosi et scabriusculi vel basi puberuli; folia et stipulae foliaceae 4–6-na verticillata, oblonga, media 8–14 mm. longa, 1·9–2·8 mm. lata, pergamenea, persistentia, superne laete viridia, lucida, versus margine antrorsum papillosa, inferne pallida, ± revoluta; inflorescentiae foliaceae, ramis basalibus divergentibus, late pyramidata, floribus plerumque singulis terminalibusque in ramulis axillaribus, pedunculis bracteis prophyllaceis glabris vel minute papillosis suffultis, brevissime pedicellatis, fructiferis ± nutantibus; flores exsiccati flavovirentes, forma *Asperulae chloranthae* sed dimidio minores, c. 1·5 mm. longi lobis lanceolatis erectis tubis brevibus duplo longioribus instructi; antherae elongatae; ovaria truncata, glabra; fructus usque 2 mm. longi.

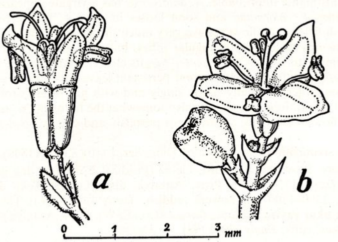

FIG. 3. Flowers of, a, *Asperula pseudochlorantha* Ehrendf., spec. nov. and, b, *Asperula antalyensis* Ehrendf., spec. nov. (enlarged).

Z

Typus: Prov. Antalya, dist. Kemer (Lycia): Kesme boğaz near Kemer, among rocks under cliffs, 60–100 m., 14 Aug. 1947, *Davis* 14053 (holo. E, iso. W*).

TURKEY. Prov. Antalya, dist. Kemer: Gönük, near sea level, *Davis* 15014 bis (W, E)*.

This new species—obviously of very local distribution and of relic nature—has a flower shape like *Asperula chlorantha*, but quite a different habit, with much broader, shining, persisting leaves, more numerous and relatively shorter internodes, more leafy and less virgate inflorescences, and much smaller flowers on longer peduncles.

Asperula antalyensis Ehrendf., **sp. nov.** (fig. 3b).

E basi multicaulis; caules adscendentes vel erecti, basi ramosi, virgati, c. 25 cm. alti, internodiis ± aequilongis 15–25 mm. longis, paulum antrorsum papillosi; folia et stipulae foliaceae (4–)6(–8)-na verticillata, mox decidua, basalia oblonga vel lineari-oblonga, usque 15 mm. longa et 2·5 mm. lata, basi petiolacea angustata, superiora minima, lineari-lanceolata, opaca viridia, inferne purpurascentia, marginibus paulum papillosis; inflorescentiae ± nudo-virgatae, late pyramidales, floribus plerumque perpaucis congestis et terminalibus in pedunculis elongatis, bracteis prophyllaceis linearibus ± papillosis suffultis, brevissime pedicellatis, fructiferis nutantibus; flores exsiccati ochroleuci, ± roseo-suffusi, tubis brevissimis, laciniis patentibus late triangularibus, c. 2·5 mm. diam.; antherae subglobosae; ovaria truncata, glabra.

Typus: Prov. Antalya, dist. Kemer (Lycia): Kesme boğaz near Kemer, among rocks under cliffs, 14 Aug. 1949, *Davis* 14053 bis (holo. W)*.

TURKEY. Prov. Antalya, dist. Kemer (Lycia): Gönük, *Davis* 15027 (E)*.

This new Lycian species has been collected *together* with *A. pseudochlorantha* in the same localities; I have checked carefully the possibility that the specimens are only modifications of one and the same taxon; but the great differences in habit, leaf shape and especially flower structure make this highly improbable. *A. antalyensis* has a virgate appearance very much like *A. chlorantha* and soon looses its narrow, dull green leaves (purplish below). Its flowers have very much the shape of those of *Galium suberosum*, with broadly triangular lobes, but with a quite short corolla tube, similar to the one in *A. scutellaris*, its closest relative in the Balkans. *A. scutellaris* differs by its narrower persistent leaves; its flowers are about 1·5 times larger, normally borne singly and with narrower corolla lobes. In habit *A. antalyensis* resembles also somewhat the following *G. serotinum*, but its flowers are twice as large, not purplish, and clearly bowl-shaped.

Galium serotinum Boiss. & Heldr., Diag. Ser. I (10), 71–72 (1849).

TURKEY. Prov. Antalya, dist. Gebiz (Pisidia): Bozburun dağ near Tasli yayla, *Davis* 15544 (W). Prov. Antalya, dist. Kemer; Teke dağ near Ovaçik, 1100–1200 m., flowers reddish, *Davis* 15177 (W); Tahtali dağ below Çukur yayla, 1525 m., *Davis* 14151 (E, W). Prov. Antalya (Pisidia); Termessus, cliffs, *Davis* 13945 (W).

* Be careful to separate specimens of *A. pseudochlorantha* and *A. antalyensis*, as they have been collected in the same localities and partly under the same numbers!

GALIUM L., Sp. Pl. 105 (1753)

Galium scabrum L., Sp. Pl. 108 (1753).

Syn.: *G. ellipticum* Willd. [Enum. Suppl. 8: 1813, *nomen*] ex Hornem., Suppl. Hort. Hafn. 17 (1819).

TURKEY. Amanus, Kusliji Dagh, 1700–2200 m., *Haradjian* 2535 (G).

Galium boreale L., Sp. Pl. 108 (1753).

"ARMENIE", *Montbret* 2597 (W).

Galium odoratum (L.) Scop., Fl. Carn., ed. 2, ii, 105 (1772).

Syn.: *Asperula odorata* L., Sp. Pl. 103 (1753).

TURKEY. Hassan Beyli, 10 Sept. 1884, *Post* (BM). Amanus; *Haradjian* 209 (G). Amanus, in montibus Dümanly, 250–400 m., *Haradjian* 3779 (G).

Galium tubiflorum Ehrendf., **spec. nov.** (fig. 4).

Habitu *Galio kurdico* Boiss. & Hoh. valde simile; perenne, e radice lignosa, dense multicaule, foliis vetustis, pro parte delapsis inter base caulium accumulatis; caules c. 15 cm. alti, fragillimi, longe pubescentes, ± simplices, internodiis inferioribus confertis, superioribus elongatis et ± aequilongis, c. 20–30 mm. longis; folia cum stipulis foliaceis 4–5-na verticillata, ovato-acuminata, media 11–17 mm. longa et 5·5–8 mm. lata, pubescentia, membranacea, vix revoluta, uninervia et reticulato-venosa, in sicco nigrescentia; inflorescentiae cymosae, ± applanatae, pauciflorae, plerumque ramis tribus trichotomis ex axillis foliorum superiorum, pedunculis elongatis, 8–15 mm. longis, pedicellis brevibus c. 2 mm. longis post anthesis erectis nec divaricatis, bracteis nullis vel perpaucis; flores rosei, tubo 2·2–2·6 mm. longo, laciniis 4, elongato-triangularibus 1·4–1·6 mm. longis; antherae oblongae; ovaria et fructus elongato-ovoidei, subtruncati, disco coronati, glabri et laeves, maturi magni, c. 3 mm. alti.

Typus: Prov. Denizli (Caria): Boz dağ above Geyran yayla, 1500–1675 m., saxatile in shady rocks, 16 July 1947, *Davis* 13428 (holo. E, iso. W).

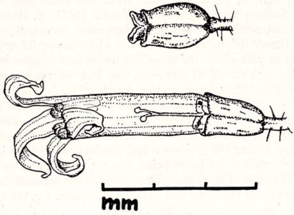

FIG. 4. Flower and young fruit of *Galium tubiflorum* Ehrendf., spec. nov. (enlarged).

This is one of the most extraordinary *Galieae* which has lately come into my hands. As the type specimens are past flower and very closely agree in habit, indumentum and leaf shape with specimens of *G. kurdicum* from more shady localities, I at first thought that the plants from Boz dağ represented an extension of range for that species. But plants cultivated from the type material in the Botanic Garden of the University of Vienna had pink, trumpet-shaped flowers, and similar flower remnants were subsequently found on the type material. Such a flower type is quite different from the one found in *G. kurdicum* and does not occur in any other *Orienti-Galia*; the fragile stems, the large elongate fruits and the smaller average number of leaf and stipule elements (only 4–5) in the whorls are further differences between *G. tubiflorum* and other *Orienti-Galia* like *G. kurdicum*.

In spite of all these differences I believe *G. tubiflorum* to be—if not a member of the section *Orienti-Galium*—at least relatively closely related to its remote ancestors, still with an asperuloid flower. There are certain relic features of original longer corolla tubes preserved in this section, not only in the generally widely crateriform corolla shape but even more apparent in some large flowering forms of *G. subvelutinum* subsp. *megalanthum* and in *G. galiopsis*, originally described as an *Asperula*. To these tendencies we have to add all the other important similarities of habit, inflorescence, indumentum and leaf shape between *G. tubiflorum* and the *Orienti-Galia*, furthermore the generally recognized instability of corolla tube length in many other groups of *Galieae*, and finally the absolute lack of closer affinities of *G. tubiflorum* with any other group still provisionally treated under *Asperula*. All this is to defend the placing of the new taxon in *Galium* and not in *Asperula* which will—of that I am sure—arouse some critical voices, especially in the face of the treatment of forms with much more rotate flowers, like *A. antalyensis*, under *Asperula* (see fig. 3b). But we have to be aware that the forthcoming new and more natural treatment of *Galieae* cannot be based on the character of corolla tube length alone, but more correctly on many other characters too, as is already indicated in other instances of this publication.

The main bulk of perennial *Galia* from the Near and Middle East belongs to Section *Orienti-Galium* Ehrendf. (1951, p. 435). The chief differential characters are the stout perennial rootstock, the slightly crateriform (never strictly rotate) corollas, which are white or pinkish (but never purple or yellowish), the whorls of leaves and stipules in the middle stem regions with (5–)6(–8) elements, the lack of glaucousness on the lower leaf surface (exception: certain forms of *G. incanum*), the normal absence of papillae directed forward along the leaf margins (exceptions: *G. tolosianum* p.p., *G. pestalozzae* p.p., *G. shepardii*, *G. tmoleum* p.p.), the peduncles and pedicels without bracteoles or conspicuous bracts and not divaricate during the fruiting stage, the lack of hamate indumentum on stems and ovaries, the latter being ovate, rounded and never truncate at the top. The sum of these characters allows us to separate Sect. *Orienti-Galium* quite clearly from the rest of perennial *Galia*, e.g. the *G. silvaticum* group, the *G. mollugo* complex, Sect. *Lepto-Galium*, the *G. palustre* group, the species complex around *G. verum* and *G. humifusum*, etc.

To facilitate the determination of the taxa of Section *Orienti-Galium*—many belonging to very critical and polymorphic complexes—I have worked out a key to all species and subspecies belonging here and occurring in Anatolia, Syria and the adjacent Transcaucasian and Persian regions with footnotes to the few members of the section from other countries. This key and the following enumeration with critical remarks is the result of rather intensive revisional work on the group and contains many new taxonomic suggestions. I have therefore cited *all* the specimens of the respective taxa of *Orienti-Galium* which I have seen. As a whole the present treatment continues earlier studies (cf. Ehrendorfer 1948, pp. 225–236 for the *G. subvelutinum* alliance, 1952 for the subsect. *Ceratocarpa* and 1951 for the *G. incanum* complex) with additions and improvements to bring our knowledge of the section up to date.

1a. Leaves broadly ovate to linear with short hyaline point never equalling the leaf breadth; flowers mostly in well developed inflorescences (but cf. alpine forms of *G. incanum* and *G. subvelutinum* ssp. *subvelutinum*) on peduncles usually exceeding an average length of 1·5 mm.; calyx teeth rudimentary 2*

1b. Leaves lanceolate to linear, sometimes needlelike and with long hyaline point; flowers in depauperate to strongly reduced inflorescences; calyx teeth at least partly persisting and enlarged during the ripening of the fruits: ovaries and fruits nearly always hairy (Subsect. *Ceratocarpa* Boiss.) 20*

1c. Leaves linear, stiff and needlelike with a long hyaline point equalling the leaf breadth (broader and with short hyaline point only in the S.W. Anatolian *G. aretioides* Boiss.); flowers in strongly reduced inflorescences, on peduncles shorter than 1·5 mm. (cf. *G. cyllenium*); calyx teeth rudimentary; densely leafy, cushion-forming plants of high elevations 24

2a. Leaves on vegetative shoots and on the base of flowering shoots neither densely imbricate nor of distinctly different form . 3

2b. Leaves on vegetative shoots and on the base of flowering shoots densely imbricate, much abbreviated and relatively broader than the average stem leaves which are narrowly lanceolate to linear and not longer than 15(–20) mm.; inflorescences narrowly ovate to elongate 19

3a. Leaves glabrous or ciliolate along the margins, shining, obovate, length: breadth about 4–10: 2–3·5 mm., shortly acuminate, with stipules in whorls of 4–6(7), attenuated towards the base, lower internodes abbreviated and rather dense, upper ones quite elongated; mat-forming plants, usually not taller than 20 cm.: (Amanus, Giaur dağ, Cilician Taurus) . . *G. tolosianum* Boiss. & Kotschy

3b. Leaves linear to lanceolate, when broader never shining and plants $\pm$ hairy 4

4a. Leaves at least somewhat ciliolate, with short papillose hyaline hairs directed forward along the margins (sometimes lacking in 6b and 7b), of membranous texture, shining and slightly revolute when dried, lanceolate to obovate; plants—stem nodes and leaf margins excepted—glabrous 5

* In critical cases compare the transitional forms between *G. incanum* subsp. *pseudocornigerum* and *G. cornigerum* (cf. p. 375) or *G. cilicicum* (cf. p. 376).

4b. Leaves not ciliolate (very rarely so in *G. subvelutinum* subsp. *leiophyllum*), of more leathery texture, dried usually dull and not revolute, linear to ovate; plants nearly always at least somewhat hairy on leaves or axes (inflorescence, stem, base!) . 8

5a. Stems about 10–15 cm. tall, ascending from a weak filiform base; inflorescences relatively pauciflorous 6

5b. Stems about 25–45 cm. tall, ± erect from a more stout base; inflorescences relatively multiflorous 7

6a. Internodes in the middle of flowering stems up to two times longer than the leaves, upper internodes not elongated; leaves ± strongly ciliolate, mostly broadly lanceolate, upper ones subtending the peduncles not bract-like: (Lebanon)
G. pestalozzae Boiss. (f. *pestalozzae*)

6b. Internodes in the middle of flowering stems 3–4 times longer than the leaves, upper internodes elongated; leaves weakly ciliolate, sometimes absolutely smooth, mostly (ob)lanceolate, upper ones bract-like: (S.W. Anatolia) . . . *G. tmoleum* Boiss.

7a. Leaves narrowly lanceolate, largest 1·5–2·5(–4) mm. broad, weakly ciliolate, sometimes absolutely smooth; stems mostly branched from the base: (Cilician Taurus, Anti-Taurus)
G. membranaceum Ehrendf.

7b. Leaves broadly lanceolate, largest 3–5 mm. broad, strongly ciliolate; stems mostly branched only from the upper half upwards: (Amanus: Giaur dağ) . . . . . . *G. shepardii* Post

8a. Flowers shortly campanulate with tubes about 0·5 mm. and lobes about 1 mm. long; ultimate branching of inflorescence mostly monochasial; stiff habit of *G. subvelutinum* subsp. *mite*, about 45 cm. tall, erect from woody rootstock with pyramidal inflorescences elongated internodes and small leathery linear leaves, about 12: 1·2 mm. (Kurdistan: Geuljik Lake)
G. galiopsis (Hand.-Maz.) Ehrendf.

8b. Flowers with tubes shorter than 1/3 of corolla length; ultimate branching of inflorescence predominantly dichasial . . 9

9a. Leaves filiform, about 30–50 mm. long and 1 mm. broad, leathery with obsolete nerve; plants absolutely glabrous, 50–60 cm. tall with ample pyramidal inflorescences: (Turkish Armenia: Egin)
G. angustissimum Ehrendf.

9b. Leaves always shorter and mostly broader . . . 10

10a. Leaves (and stems) pubescent, broadly lanceolate to ovate, broadest around the middle; stems ascending from a filiform base, usually not taller than 15 cm.; inflorescences relatively pauciflorous, cymose and flattened 11

10b. Leaves (and stems) ± glabrous, or if pubescent, leaves broadest above the middle of stems and inflorescences different: (E. Anatolia, N.W. and S.W. Iran, Transcaucasia)
G. subvelutinum (DC.) C. Koch sens. lat. . . 12*

11a. Leaves broadly lanceolate, acute; flowers large, 4–5 mm. diam. (Lebanon) . . *G. pestalozzae* f. *ehrenbergii* (Boiss.) Ehrendf.

* *G. saxosum* (Chaix) Breistr. (=*G. megalospermum* Vill. non al.) from the south-western Alps and *G. cometerrhizon* Lap. from the Pyrenees and Corsica would have to be inserted in this section of the key.

11b. Leaves ovate, acuminate; flowers small to medium size, 2–3 mm. diam. (Kurdistan) . . . *G. kurdicum* Boiss. & Hoh.

12a. Inflorescence axes, leaves and stems absolutely glabrous; leaves linear, stiff, not broader than 2 mm., usually attaining only half the length of the rather elongated internodes; stems tall, mostly 30–60 cm., erect from woody base; ample pyramidal inflorescences; flowers small, 2–2·5 mm. diam. (Cilician Taurus, Kurdistan to S.W. Iran) . *G. subvelutinum* ssp. *mite* (Boiss. & Hoh.) Ehrendf.

12b. Plants at least somewhat hairy; leaves mostly broader, internodes relatively shorter, inflorescences less ample 13

13a. Similar to subsp. *mite* in the tall and erect stems but inflorescence axes ± hairy, leaves less stiff, usually glabrous, lanceolate (2–)2·5–4·5 (–6) mm. broad, up to (15–)25–30(–50) mm. long, broadest in or above the middle, usually longer than half the length of the more numerous and more abbreviated internodes; inflorescences less ample with more leafy bracts; flowers larger; mericarps large, up to 2·5–3 mm. long, 3–4 mm. diam. (Kurdistan to Armenia, Transcaucasia and W. Iran) . subsp. *leiophyllum* (Boiss.) Ehrendf.

13b. Plants not taller than 30 cm.; leaves pubescent or glabrous, mostly shorter than 15 mm., broadest ± in the upper third . . 14

14a. Leaves linear to oblanceolate, largest mostly longer than 10 mm., index length: breadth above 4·5; plants often of lower elevations with more robust, ascending-erect stems, usually taller than 15 cm. 15

14b. Leaves broadly oblanceolate to narrowly obovate, not longer than 10(–15) mm., index length: breadth mostly below 4·5: plants often of high elevations with filiform ascending stems, not taller than 10(–15) cm. and often pubescent 18

15a. Leaves glabrous, only rarely pubescent, but then flowers very large, about 5 mm. diam. 16

15b. Leaves at least somewhat pubescent, flowers small to medium size, not more than 4·5 mm. diam. 17

16a. Stems ± geniculate-ascending with few and quite elongated internodes, often lax and ± flexuose, without prominent angles; forks of inflorescences with some hairs; flowers large (4)5–6(7) mm. diam.; mericarps large, up to 2·5–3 mm. long, shining: (S.W. Iran, Elburz) subsp. *megalanthum* (Boiss.) Ehrendf.

16b. Stems ± erect with more numerous and somewhat abbreviated internodes, ± straight; forks of inflorescences often without hairs; flowers small to medium size, about 2–4 mm. diam.; mericarps smaller, about 1·5–2·5 mm. long, ± dull: (E. Turkish and adjacent Russian Armenia, N. W. Iran) . subsp. *problematicum* Ehrendf.

17a. Very similar to subsp. *problematicum* but with relatively dense pubescent indumentum of leaves and stems; leaves mostly broadly linear, with obsolete nerve, dull; stems without prominent angles; alpine ecotypes often very condensed: (W. and N.W. Iran, adjacent Turkish Armenia) . . . . subsp. *subvelutinum*

17b. Indumentum sparse and loose; leaves oblanceolate and cuneate with prominent nerve, shining, stems with prominent whitish angles: (Transcaucasia, adjacent N.W. Iran) subsp. *hyrcanicum* (C. A. Mey.) Ehrendf.

18a. Internodes of inflorescences not elongated; plants pubescent or glabrous; pedicels longer than 2 mm., partial inflorescences therefore relatively loose; corolla lobes acute to acuminate: (Elburz)
subsp. *decumbens* Ehrendf.

18b. Very similar to subsp. *decumbens* but always pubescent, corolla lobes clearly apiculate: (Elburz: Demawend)
subsp. *delicatulum* (Boiss. & Hoh.) Ehrendf.

18c. Internodes of inflorescences elongated; plants pubescent or rarely $\pm$ glabrous; pedicels not longer than 2 mm., partial inflorescences therefore congested; corolla lobes acuminate: (Mts. of S. Iran)
subsp. *pseudokurdicum* Ehrendf.

19a. Glabrous; leaves narrowly oblanceolate, up to 2 mm. broad with obsolete nerve and without hyaline tip; inflorescences cymose, with relatively long basal branches, flattened at the top: (Anti-Taurus: Masmutli dağ) . . . . . . *G. sieheanum* Ehrendf.

19b. Hairy, only rarely glabrous; leaves narrowly to broadly linear, usually not broader than 1·2 mm., with prominent nerve and hyaline tip; inflorescences narrow and elongated or reduced, always with short basal branches, never flattened at the top: (from the mts. of Greece and Crete through Anatolia to the Lebanon and E. Trancaucasia) . . . . . *G. incanum* Sibth. & Sm. sens. lat*

20a. Largest leaves broader than 1 mm., narrowly lanceolate . 21

20b. All leaves linear, never more than 1 mm. broad . . 22

21a. Stems about 5–15 cm. tall, with patent or reflexed leaves which are 6–9 mm. long; indumentum puberulent, hairs very short, not longer than 0·1 mm.; inflorescences cymose, depauperate, ultimate ramifications leafless, pedicels 2–5 mm. long: (E. Cappadocia)
G. ceratocarpum Boiss.

21b. Stems up to 5 cm. tall, densely caespitose, with imbricate leaves, 6–10 mm. long; indumentum hirsute, hairs longer than 0·1 mm.; inflorescences very reduced, involucrated by the upper leaves, pedicels 1–3 mm. long: (Malatya: Ak dağ) . *G. lasiocarpum* Boiss.

22a. Indumentum very short puberulent, with hairs of about 0·05 mm.; flowers single and in groups of 2–3 on peduncles, with pedicels of (1–)1·5–3(–4·5) mm.; leaves linear with short and $\pm$ puberulent hyaline point of about 0·3 mm.; plants densely leafy, about 5 cm. tall: (Maraş: Zeitun, Göksun, Yarpuz) . *G. cornigerum* Boiss

22b. Indumentum loosely hirsute, with hairs of about 0·1 mm.; flowers single in the axils of upper leaves, sessile or with very short pedicels, up to 1(–1·5) mm. long; plants with densely imbricate, erect leaves, hardly 5 cm. tall 23

23a. Leaves only 2·5–3 mm. long and about 0·5 mm. broad, dull, with $\pm$ hairy, short hyaline point (about 0·3 mm.); flowers $\pm$ single, practically sessile: (Amanus: Akma dağ)
G. cerato-amanianum Ehrendf.†

* For a key to the 7 subspecies see Ehrendorfer, 1951.

† *G. cyllenium* Boiss. & Heldr. from Mt. Kyllene on the Greek Peloponnese is nigrescent when dried, has short, forwardly directed hairs on the leaf margins and flowers on clearly marked peduncles and pedicels.

23b. Leaves up to 5–8 mm. long, about 0·8 mm. broad, shining, needlelike, with glabrous long hyaline point (about 0·5 mm. long); flowers mostly in small groups in the axils of upper leaves on short pedicels; ovaries and fruits sometimes glabrous: (Kayseri: Bakir dağ) *G. antitauricum* Ehrendf.

24a. Leaves oblanceolate, about 3·5 mm. long and 0·8 mm. broad, acute but without elongated hyaline point, with obsolete nerve, softly ciliate along the margins and midrib or glabrescent; flowers on very short pedicels, ± single in the upper leaf axils; ovaries pubescent or glabrous: (mts. of Lydia and Caria) . *G. aretioides* Boiss.

24b. Leaves linear with hyaline point ± equalling the leaf breadth with prominent nerve, very stiff and needlelike, scabrous along the margins or glabrous; flowers mostly in small groups, on very short pedicels or sessile; ovaries always glabrous 25

25a. Stems pubescent; inflorescences ± elongated, spiciform with (1–)2–5(–7) dense whorls of flowers: (W. Cilician Taurus to S.W. Anti-Taurus) . . . . . . *G. cilicicum* Boiss.

25b. Stems glabrous; inflorescences reduced to a single terminal group of 1–3 flowers: (Bithynia: Olympus=Ulu dağ) *G. olympicum* Boiss.*

A phylogenetic grouping of the taxa of the section in a single linear series is impossible due to the multidimensional relations between the various entities obviously due to polyploidization and hyrbidization in the past. Least specialized seems the "Formenkreis" around *G. subvelutinum*. It consists of the very polymorphic complex of *G. subvelutinum* with nine subspecies as understood here, and an array of seven species around it which are more clearly separated and show various relations with the subspecific entities within *G. subvelutinum*. Beginning with broad leaved, hirsute taxa (*G. kurdicum*, *G. pestalozzae* f. *ehrenbergii*; with possible affinities to *G. tubiflorum*, cf. p. 353), we find close relations with *G. subvelutinum* subsp. *delicatulum*, subsp. *hyrcanicum* and subsp. *decumbens*. In the typical form of *G. pestalozzae* we find the derived character of marginal papillae along the leaf margins, a character which reappears in the following: *G. tolosianum*, *G. shepardii*, G. *membranaceum*† and *G. tmoleum*‡; from *G. membranaceum* there exist close connections with *G. subvelutinum* subsp. *leiophyllum*. Very narrow, linear leaves are found in *G. angustissimum*, specialized ± monochasial inflorescences in *G. galiopsis*.§ both are quite close to *G. subvelutinum* subsp. *mite*. *G. saxosum* and *G. cometerrhizon* represent far western outposts of the *G. subvelutinum* alliance in the S.W. Mediterranean mountain systems (S.W. Alps, Pyrenees and Corsica).

* Closely related to *G. palaeo-italicum* Ehrendf. ined. (Mte. Pollino and Alpi Apuane, Italian peninsula) and *G. pyrenaicum* Gou. (Sierra Nevada and Pyrenees).

† Outside Sect. *Orienti-Galium* these taxa partly show similarities with the *G. silvaticum* group.

‡ Outside Sect. *Orienti-Galium* this taxon shows similarities with forms of *Lepto-Galium* Lange.

§ Outside Sect. *Orienti-Galium* these taxa show superficial similarities with East Mediterranean forms of the *G. mollugo* group (e.g. *G. scabrifolium*).

Galium kurdicum Boiss. & Hoh. in Boiss., Diagn. Ser. I (3), 37 (1843), non Ronn. (1921).

Syn.: *G. subvelutinum* (DC.) C. Koch subsp. *kurdicum* Bornm. in Beih. Bot. Centralbl. xxviii, Abt. 2, 242 (1911).

G. subvelutinum (DC.) C. Koch var. *kurdicum* Bornm. in Beih. Bot. Centralbl. lviii, 294 (1938) (f. *velutinum* et f. *glabrum*).

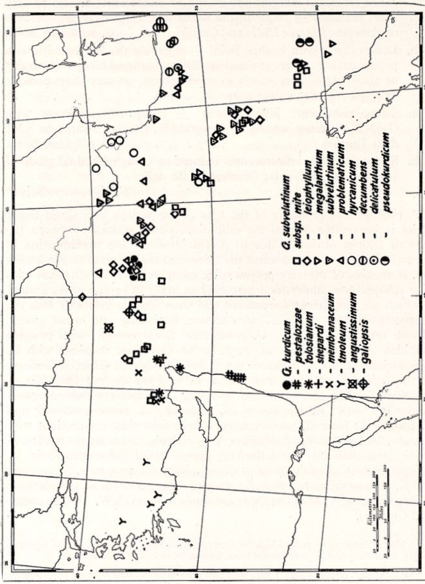

FIG. 5. Distribution of the *Galium subvelutinum*-complex.

Typus: Iraq, in cacumine montis Gara Kurdistaniae in rupibus, *Kotschy* 306b (not 506B!) (iso. W).

TURKEY. In rupibus Beregig [Birecik ?] ad ripas Euphrat, *Kotschy* 1841 (W). Kurdistania media, Taurus armenius, in mte. Meleto (Meretug) Dagh, distr. Bitlis, Natopa, ad rupes humidas, substr. calc., 1800 m., *Handel-Mazzetti* 2700 (W, WU). Bitlis, Sa' id Ova, 1350 m., 10 Jun. 1939, *Frödin* (W). Prov. Bitlis: Kambos Dağ above Hürmüz, 1830 m., in limestone rocks, *Davis* 23487 (forma ovariis pilosis—E, W).

IRAQ/IRAN. In montibus calcareis Avroman et Schahu, in rupibus, 1830–2130 m., *Haussknecht* 1867 (W).

This entity is well characterized by its ovate, acuminate leaves, the rather loose pubescent indumentum, the cymose inflorescence and the small flowers. It grows in limestone crevices. According to my opinion all later authors (Boissier, Fl. Or. iii, 52, Bornmüller in Beih. Bot. Centralbl. xxviii, Abt. 2, 242; xxxii, 394; lviii, 294; Pau & Vicioso in Trab. Mus. Nac. xiv, 35; Blakelock in Kew Bull. 1948, 439) have widened the circumscription of *G. kurdicum* too much, including various forms which are put under *G. subvelutinum* subsp. *pseudokurdicum*, subsp. *megalanthum* and subsp. *subvelutinum* in the present treatment; only thus does separation become possible. So far I have not seen clearly intermediate forms, and therefore have retained *G. kurdicum* as a proper species. The recently collected form from Kambos dağ, together with a form of *G. subvelutinum* subsp. *megalanthum* from Pir Omar Gudrun, are the only representatives of the *G. subvelutinum* alliance with hairy ovaries.

G. kurdicum, especially the Kambos dağ form, looks very much like the new *G. davisii* (cf. p. 383); it has similar habit, similar leaf form and indumentum of stems and ovaries. Only a closer inspection reveals important differences in flower shape, colour and inflorescence form, which make it quite unlikely that *G. davisii* belongs to the affinity of *G. kurdicum* or even to sect. *Orienti-Galium*.

Galium pestalozzae Boiss., Diagn. Ser I (10), 65 (1849).

Syn.: *G. grandiflorum* Ehrenbg. ex Boiss., Fl. Or. iii, 52 (1875) non al., nom. nud. in syn.

Typus: In regione subalpina Libani inter Berytum et Damascum supra Khan Hussein in herbidis humidis, Maio 1846, *Boissier* (G, not seen).

LEBANON. Libani in regione subalpina jugi Sannine, 1500 m., *Bornmüller* 752 (W, WU). Syria, *Pinard* 1846 (W). Libanon, Raïfoun, in rupibus calcareis, c. 1200 m., *Samuelsson* 1252, *E. Wall* (S). Libanon, Faraya, 6 June 1932, *Hafström* (S). Libanon, Mairouba, 5 June 1932, *Hafström* (S) (small microphyllous form). Libanon, Gebaïl, ruines d'Afka, *coll.* ? 76 (G).

f. **ehrenbergii** (Boiss.) Ehrendf., **stat. nov.**

Syn.: *G. ehrenbergii* Boiss., Fl. Or. iii, 53 (1875).

G. pestalozzae Boiss. subsp. *ehrenbergii* Thiéb., Fl. Lib.-Syr. ii, 193 (1940).

Typus: In Syria libanotica ad Gisr el Hajar, *Ehrenberg* 311* (G).

LEBANON. Libanon, Natural Bridge, Dog river, *Post* 698 (BM); *ibid.*, *Peyron* 26 (G). Libanon, Raifoun, in rupibus calcareis, c. 1200 m., *Samuelsson* 2017, 1251; 14 May 1942, 4 June 1932, *Hafström*; 14 May 1932, *E. Wall* (S). Libanon, Gisr el Hajar, *Peyron* (G).

* Not 372 as indicated in the original description.

G. pestalozzae is endemic to the Lebanon and easily recognized by its acute, lanceolate, ciliolate or pubescent leaves, the flattened and rather depauperate inflorescence and the large flowers. There are no intimate connections with any of the other *Orienti-Galia*. *G. ehrenbergii* cannot be maintained as a species because the differential characters cited by Boissier (leaf breadth and length of corolla base) are too variable and the difference in indumentum is obviously of simple genetic basis so that hairy and glabrous forms appear side by side in the same populations.

Galium tolosianum Boiss. & Kotschy in Boiss., Fl. Or. iii, 53 (1875).

Syn.: *G. dieckii* Bornm. in Fedde, Rep. iv, 267 (1907).

Typus: Syria borealis, Amanus occidentalis supra Arsus, in umbrosis faucium porphyriticorum montis Tolos inter Medyk et Magara, 610 m., *Kotschy* 142 (iso. W).

TURKEY. Cilician Taurus, Ovadjik, *Siehe* (GB). Amanus, mont. de Düldül, 1500–2000 m., *Haradjian* 3842, 3906 (G).

In spite of the odd appearance of this species with very reduced whorls of spathulate leaves, there seem to be rather close affinities with *G. shepardii*; both species occur in the Düldül mountains but, while the specimens of *G. tolosianum* from the type locality are very condensed, glabrous and smooth, the ones from the Düldül mountains are taller and ciliolate along the leaf margins just as in *G. shepardii*. This fact might be due to hybridization.

Though I have not seen type material of *G. dieckii* there seems to be little doubt that it is conspecific with *G. tolosianum*; the indication of relationship ("*Chromo-Galia*") in the original description is misleading.

Galium shepardii Post, Fl. Syr. Palest. & Sinai, 15 (1896).

Typus: Amanus, Gaiour Dagh (=Giaur dağ), *Post* (BEI, not seen).

TURKEY. Amanus, mts. de Doumanly, 700–1200 m., *Haradjian* 3706, 3679 (G). Amanus, region de Düldül, 1500–2100 m., *Haradjian* 2413 (G). Monts Amanus, 1500–1800 m., *Haradjian* 4709 (G). Prov. Adana, distr. Bahçe (Amanus): Düldül dağ, 1800 m., between Başkonus Y. and Huseyin Oluk Çeşmesi, steep gully, *Davis* 16381 (E, W).

G. shepardii approaches in habit and other characters (leaf shape, ciliolate leaf margins, cup-formed flowers, inflorescence branching) entities of the *G. silvaticum* alliance (with *G. longifolium* Sibth. & Sm. in Anatolia). The main reason for maintaining it as a member of the *Orienti-Galia* is the lack of glaucousness on stems and lower leaf surfaces, blackish decoloration in drying and the close affinities with *G. tolosianum* and with *G. membranaceum* which replaces it towards the N. in the central Taurus chain. Differential characters are the broader leaves and the stem branching in the upper half in *G. shepardii*.

Galium membranaceum Ehrendf. in Ann. Naturhist. Mus. Wien, lvi, 229 (1948).

Syn.: "*G. leiophyllum* Boiss," auct. div.

Typus: Cilicien, Giosna, Felsengerölle, 1000 m., 1895, *Siehe* 155 ("*G. incurvum*"—holo. WU).

TURKEY. Taurus, *Kotschy* 231, 499, 502 (W). Bulgar Dagh, Güllek Boghas, 1150 m., *Kotschy* 353 k (W). Prov. Adana, distr. Feke: Sencan dere between Belanköy and Süphandere, 1000 m., in scrub on metamorphic slopes, flowers white, *Davis* 19581 (W, E).

Galium membranaceum connects *G. shepardii* with *G. subvelutinum* subsp. *leiophyllum*. From the first it differs by its narrowly lanceolate leaves, sometimes with marginal ciliolae sparse or lacking, and in the basal branching; but some less branched or somewhat more broadly leaved forms (like *Kotschy* 353k or *Davis* 19581 p.p.) come quite close to *G. shepardii*. From *G. subvelutinum* subsp. *leiophyllum*, where some rare specimens with slightly ciliolate leaf margins have been observed (*Kotschy* 359a p.p. and *Handel-Mazzetti* 2792 p.p.) differentiation is possible because of the much thinner, membranous, shining and marginally revolute leaves of *G. membranaceum*.

Galium tmoleum Boiss., Diagn. Ser. I (3), 39 (1843).

Syn.: *G. pulchellum* Stapf in Denkschr. Math.-Naturw. Kl. Akad. Wiss. Wien, l, 106 (1885), non Salisb. (1796).
G. stapfianum Ehrendf. in Ann. Naturhist. Mus. Wien, lvi, 226 (1948).

Typus: Ad rivulos alpinos montis Tmoli ad Bozdagh, Jul. 1842, *Boissier* (holo. G).

TURKEY. Prov. Isparta, distr. Sütçüler (Pisidia): Dedegöl dağ, on N. cliff by the tarn, 2300 m., flowers white, *Davis* 16025 (E, W). Prov. Muğla, distr. Koyceğiz (Caria): Sandras dağ near Gökce ova, *Davis* 13507a (W, E) and between Gökce ova and summit, *Davis* 13507b (W, E). Lycia: Nif dağ, 5 Jun. 1882, *Luschan* (WU, holo. *G. pulchelli* Stapf).

G. tmoleum seems to represent an array of isolated but closely related microraces, probably relics of an older westward migration from the centre of the *G. subvelutinum* alliance. Between the different populations exist differences in leaf shape and texture as well as in indumentum of leaf margins and stems (Tmolus: oblanceolate, thin, glabrous leaves, stems somewhat retrorsely puberulous; Dedegöl dağ: leaves broadly oblanceolate, thin, weakly ciliolate, stems glabrous; Sandras dağ: leaves oblanceolate, thicker, smooth, stems glabrous; Nif dağ: leaves narrowly oblanceolate, thicker, smooth, stems glabrous); but they are too small to deserve taxonomic recognition. Due to its weak, procumbent and filiform stem bases, habit and inflorescence *G. tmoleum* shows affinities with the sect. *Lepto-Galium*. In *Orienti-Galium* forms of *G. subvelutinum* subsp. *hyrcanicum* and subsp. *decumbens* are closest, from which *G. tmoleum* deviates by the absolute lack of stem indumentum, the more strongly marked leaf nerve and the elongated upper stem internodes.

Galium angustissimum (Hausskn. ex Bornm.) Ehrendf. in Ann. Naturhist. Mus. Wien, lvi, 229–230 (1948).

Syn.: *G. mite* Boiss. & Hoh. var. *angustissimum* Hausskn. ex Bornm. in Beih. Bot. Centralbl. lviii, Abt. 2, 295 (1938), *nomen seminudum*.

Typus: Armenia turcica, Egin, Szanduk, in declivibus saxosis, *Sintenis* 2573 "*G. leiophyllum* var. *stenophyllum*=*G. xylorrhizum*" (holo. W, iso. WU).

This species is only known from the type collection. Differing from its closest relative *G. subvelutinum* subsp. *mite* by extremely narrow and long linear leaves, reduced leaf-stipule-whorls (only 4–6 elements) and tall habit, it seems to represent a "frozen" outpost of the *G. subvelutinum* alliance.

Galium galiopsis (Hand.-Mazz.) Ehrendf., **comb. nov.**

Syn.: *Asperula galiopsis* Hand.-Mazz. in Ann. Naturhist. Mus. Wien, xxvii, 426 (1913).

Typus: Kurdistania occidentalis, Taurus Armenius, in monte Hasarbaba dagh ad lacum Göldschik (fontes Tigridis occ.), locis lapidosis, substr. serpentinico, 1800–2450 m., *Handel-Mazzetti* 2578 (holo. W).

In spite of recent collecting by Davis and O. Polunin in the species area, *G. galiopsis* has not been collected again. Like the foregoing, it is undoubtedly closest to *G. subvelutinum* subsp. *mite* from which it differs mainly in its more strongly cup-shaped flowers and the decidedly monochasial ultimate inflorescence branchings. With these close affinities to other *Orienti-Galia* and the absolute lack of any relations to groups still united under *Asperula*, it does not seem tenable to leave the species in that genus any longer; nevertheless I regret the nonsensical name which results from the transference.

Galium subvelutinum (DC.) C. Koch in Linnaea, xxiv, 465 (1851), sens. lat.

As already indicated in my provisional treatment in 1948, more intensive study of rich herbarium material of this highly polymorphic complex has made necessary the application of a wide species concept and consequent merging of many entities earlier regarded as species. The general taxonomic treatment has not been changed very much since 1948 (cf. new conception of *G. xylorrhizum*, merging of the "Zentrumsformen" with subsp. *megalanthum*, the new subsp. *decumbens*).

The general pattern of differentiation of *G. subvelutinum* sens. lat. is geographical and ecological, different races substituting each other in different geographical areas and different altitudinal belts; this is partially apparent from the distributional map of the group in fig. 5. Considering first the extreme intraspecific entities, there is on the one hand subsp. *mite*, a tall, ± woody xerophytic chamaephyte from lower elevations in the south, on the other hand there is a group of low, herbaceous hemicryptophytes in the N. and N.E. with subsp. *hyrcanicum* at lower elevations, subsp. *decumbens* and subsp. *delicatulum* at high elevations (Elburz). Between these extremes extends a series of ± conventionally circumscribed races of intermediate ecological status, with subsp. *leiophyllum* at higher elevations of the S. and W., subsp. *subvelutinum*, subsp. *problematicum* and subsp. *megalanthum* at still higher altitudes in the centre, S.E. and N.E. and finally subsp. *pseudokurdicum* as ecologically equivalent to the high alpine races of the N.E. in the high mountains of the S.E.

In the light of very detailed knowledge of the immensely complicated polyploid structure of related European *Galia* of Sect. *Lepto-Galium*, it becomes nevertheless quite clear that we are still very far from a complete understanding and definite treatment of this complex. Due to new data, the hypothesis of a primary radial differentiation of the *G. subvelutinum* alliance from a "Centre of variability" expressed in 1948 seems less likely today than an interpretation as a hybrid complex to which old "marginal" forms similar to *G. kurdicum*, *G. membranaceum*, *G. angustissimum*, *G. galiopsis*, *G. subvelutinum* subsp. *mite*, subsp. *hyrcanicum*, subsp. *decumbens* and subsp. *delicatulum* might have contributed during the climatic changes and migrations of Pleistocene and postglacial periods.

A. subsp. **mite** (Boiss. & Hoh.) Ehrendf., **comb. nov.**

Syn.: *G. mite* Boiss. & Hoh. in Boiss., Diagn. Ser. I (3), 37 (1843).

Typi: Iraq, in monte Gara Kurdistaniae, *Kotschy* 506a, 559b (306a, 359b)* (G—Boiss.; 559b=lectotypus; iso. W).

TURKEY. Cilicien, Bulghar Maaden, *Siehe* 503 (W, WU). Konia, Lycaonischer Taurus, Eregli, beim Dorfe Perinde, 1700 m., trockene Felsschlucht, bildet meterhohe Gebüsche, *Siehe* 569 (W, WU). Prov. Diyarbakir, Elaziğ: Maden-Ergani, hillsides, fl. white, *Davis* 22034 (W, E). Kurdistania occidentalis, Taurus cataonicus, in monte Nimrud Dagh prope vicum Kjachta districtus Mamuret-ül-Asis, in declivitatibus sept.–occ., rupes, substr. calc., 2000–2200 m., *Handel-Mazzetti* 2061 (W). In rupestribus montis Berytdagh Cataoniae, 2340 m., *Haussknecht* (W, WU). Armenia turcica, Kharput, in declivibus supra Pekenik, *Sintenis* 505(W). Kurdistania, Mardin, in declivibus montium, *Sintenis* 880 (Prag, W, WU). Mesopotamia, inter Beredschig et Orpha, *Kotschy* 309 (W, G—Boiss.). Prov. Maraş, distr. Göksun: Binboğa dağ, in ravine on N.E. side of Işik dağ, 1900 m., shady rocks, base woody, fl. white, *Davis* 20038 (W, E). Base de l'Akher Dagh près de Marash, 850 m., *Haradjian* 1501 (G); Akher Dagh, 1800 m., *Haradjian* 1623 (G).

IRAQ. Jebel Baradost near Diana Rowandiz, *Field & Lazar* 887 (W). Kurdistania, Riwandous (ad fines Persiae), *Bornmüller* 1342 (W, WU).

Towards the south these typical forms of subsp. *mite* are replaced by others with more lax habit and larger flowers, reminding one of subsp. *megalanthum* but absolutely glabrous:

IRAN. Kharon, 1300 m., *Koie* 746 (W). Luristan, Durud, 1675 m., in clumps, 2 ft. high, fl. white, *Koelz* 15516 (W). Fars, Sisakht—Dena, *Behboudi* 944 E (W). Luristan, Teng Nalli, 2440 m., *Haussknecht* (W). Luristan, Kuh Nur, 2740 m., *Haussknecht* (W).

IRAQ. Pir Omar Gudrun, 1525 et 1830 m., *Haussknecht* (W, BM).

On the basis of absolute glabrousness, narrow leaves, elongated internodes, pyramidal inflorescences and $\pm$ woody stem bases, subsp. *mite* is one of the best circumscribed subspecific entities of the *G. subvelutinum* complex and I was hesitant to include it under this collective species. But the existence of forms geographically, as well as morphologically and ecologically, closely "adjacent" and leading towards subsp. *leiophyllum*, subsp. *problematicum* (N.W. Persian forms have now been included here) and subsp. *megalanthum* have left no other alternative than the treatment adopted here.

* In respect to numbers of Kotschy collections from Gara some confusion exists; in the original description as well as on labels in the Boissier herbarium the numbers 506a and 559b are cited; other labels there and the sheets in Vienna have 306a and 359b. Some specimens on the sheets in Vienna show slight contamination with characters of subsp. *leiophyllum* and have to be excluded from the type material.

Forms of *G. scabrifolium* (Boiss.) Hausskn., belonging to the *G. mollugo* group and overlapping with subsp. *mite* geographically, differ by their rough stems, etc.

B. subsp. **leiophyllum** Ehrendf., **nom. et stat. nov.**

Syn.: *G. leiophyllum* Boiss., Diagn. Ser. I (3), 36 (1843), nomen illegit.

G. subvelutinum var. *leiophyllum* (Boiss.) Bornm. in Bull. Herb. Boiss. Ser. 2, vi, 774 (1906).

G. leiophyllum var. *glabrum* Boiss., Diagn. Ser. I (3), 36 (1843).

G. subvelutinum var. *glabrum* (Boiss.) Bornm. in Beih. Bot. Centralbl. lviii, Abt. 2, 23 (1938).

G. kotschyanum Boiss. in exs. et Fl. Or. iii, 51 (1875), nom. nud. in syn.

G. bullatum Lipsky in Acta Horti Petrop. xiii, 300 (1894).

G. leiophyllum var. *obtusifolium* Bornm. in Beih. Bot. Centralbl. xix, Abt. 2, 266 (1905) et in Bull. Herb. Boiss. Ser. 2, vi, 775 (1906) (f.=*latifolium* Bornm.).

G. mite var. *velutinum* Bornm. in Beih. Bot. Centralbl. lviii, Abt. 2, 295 (1938).

Typus: Iraq, in rupestribus med. reg. m. Gara Kurdistaniae, *Kotschy* 559a (359a), "*G. kotschyanum* Boiss. et Hoh." (G. Boiss. W). Iran, Mt. Elwind, *Aucher* 745 (lectotypus, G—Boiss.).

Turkey. Prov. Hakkari: Kara dağ, 2900 m., sheltered rock crevices and gulleys, fl. white, *Davis* 24396 (W. E). Prov. Hakkari; Cilo dağ at bottom of Diz deresi nr. Dezi, 1600 m., rocky slope, *Davis* 24024 (E) (forma foliis caulibusque velutinis). Prov. Hakkari: Cilo Tepe, 3050 m., cliffs, fl. white, *Davis* 24029 (W, E). Prov. Maraş, distr. Göksun: Binboga dağ above Yalak, 2200–2300 m., rocky slopes, fl. white, *Davis* 20132 (E). Prov. Van: Erek dağ, 2300 m., rocky slope, leaves hairy or glabrous, flowers white, *Davis* 22916 (W, E). Armenia, *Calvert & Zohrab*, a. 1876 (E). Kurdistania media, Taurus armenius, in monte Meleto (Meretug) Dagh districtus Bitlis, ad rupes, substr. calc., 2200–3100 m., *Handel-Mazzetti* 2792 (W, WU—p.p. formae lati- et obtusi-foliae vel ciliolatae, ad *G. membranaceum* vergentes). Kurdistania occidentalis, Taurus cataonicus, in monte Nimrud Dagh prope vicum Kjachta distr. Mamuret-ül-Asis, locis lapidosis, substr. calc. 1600–2250 m., *Handel-Mazzetti* 2097 (W, WU—ad subsp. A. verg.). Prov. Musch, ad radices australes Bimgoell montis ad Gumgum in distr. Warto, per devexa vallis Merga Sauk, 2130 m., *Kotschy* 402 (W).

Iraq. Kurdistania, Riwandous, in monte Sakri-Sakran, 2100 m., *Bornmüller* 1343 (W, WU).

Iran. "Bakhtiari country", *Sawyer* 13020a (BM). Shuturun Kuh, 2/5 Jul. 1890, *Strauss* (W). In monte Elwend supra Haideri Hamaden, *Pichler* a. 1882 (W, p.p. verg. ad subsp. A). Arak (=Sultanabad), in monte Raswend, 2200 m., *Mirdamadi* 1220 (W). Ser, in montium argillosis, 8 Jul. 1884, *Knapp* (W). Persia borealis, *Szovits* (W—vergens ad subsp. E).

The following specimens partly have a rather simple, little branched inflorescence and many, relatively abbreviated stem internodes; in 1948 they were provisionally designated as "*G. xylorrhizum*" which is—according to type material—subsp. *problematicum*; as the differences do not seem to be significant enough to create another subspecific entity I enumerate these collections under subsp. *leiophyllum*:

TURKEY. In alpibus prope Musch, in rupestribus Teng dictis, 1830 m., *Kotschy* 452, 505a (W). Prov. Musch, ad radices australes Bimgoell montis ad Gumgum in distr. Warto, in sax.-rupestr. ad Goschkar, 1700 m., *Kotschy* 336 (W, G—Boiss). Pontus, inter Trapezunt et Baiburt, in alpibus Alischeri, 1950 m., *Kotschy* 505 (W).

For the typification of subsp. *leiophyllum* I have chosen the very characteristic *Aucher* 745 because some of the specimens of *Kotschy* 559a (359a) have very slightly ciliolate leaves and therefore approach *G. membranaceum*.

Subsp. *leiophyllum*, due to its central position within the complex, can be circumscribed only with some difficulty. The main differential characters are the narrowly to broadly lanceolate, rather long (average 25–35 mm.) leaves, the tall, erect habit, the very reduced indumentum (leaves nearly always glabrous but the forks of the inflorescence axes mostly hairy) and the rather large flowers. Transitional forms towards subsp. *mite* occur in the south and in lower altitudes, towards subsp. *megalanthum* and subsp. *subvelutinum* (rarely) in the S.W. Iranian mountain systems, towards subsp. *problematicum* towards the N. and N.E. and at higher altitudes.

C. subsp. **megalanthum** (Boiss.) Ehrendf., **comb. nov.**

Syn.: *G. megalanthum* Boiss., Diagn. Pl. Or. Ser. I (6), 67 (1845).
G. iranicum Hausskn. ex Bornm. in Beih. Bot. Centralbl. xix, Abt. 2, 266 (1905) (subsp. B or C).
G. handelii Nab., It. Turc.-Pers. i, 134 (1923), non Cuf. (1940), nom. superfl. (subsp. C & I!).

Typus: Iran, in declivibus septentrionalibus alpis Kuh-Delu, *Kotschy* 479 (iso. W).

IRAQ. Kurdistania, Pir Omar Gudrun, *Haussknecht* (W) (partly forms with broader and hairy leaves, or with hairy ovaries).

IRAN. Kurdistania, in montibus calcareis Avroman et Schahu [borders of Iraq], *Haussknecht* 432 (W). Persia australis, M. Kellal, *Haussknecht* (W). Fars, Dena, Bigean pass, *Behboudi* 935 E(W). Persia australis, Daeschtaerdschen, Kuh Disehg, *Stapf* 1510 (WU). Persia borealis, in glareosis prope Passgala in viciniis Teheran, *Kotschy* 116 (W). Persia bor., in declivibus inter Derbent et Passgala, *Kotschy* 86 (W). Persia bor., jugi Elbursensis in subalpinis ad basin sept. alpium Totschal, prope Scheheristanek, 2200–2600 m., *Bornmüller* 7105 (W, WU), 7125 (W, WU—vergens ad subsp. E). In deserto prope Elburz *Pravitz* 129 (S). Zentral-Elburs, Südabhang des Totschal im Tal Hafthous, N.W. Teheran, Bergsteppe, 1300–1500 m., *Aellen* 160, 190 (Basel).

Subsp. *megalanthum* is characterized by rather low, lax, ascending stems with few internodes of which the upper ones are quite elongated, by shorter (average 12–20 mm.) nearly always glabrous leaves, loose inflorescences, very large flowers and large fruits. The forms from the "centre of variability" in the S.W. Iranian and Kurdish mountains which were not designated as a definite taxon in 1948 (p. 234) are now for the most part incorporated in subsp. *megalanthum* on the basis of their low stature, relatively broad leaves (never linear) and very large flowers.

D. subsp. **subvelutinum**.

Syn.: *Asperula subvelutina* DC., Prodr. iv, 505 (1830).
G. leiophyllum var. *subvelutinum* (DC.) Boiss., Diagn. Ser. I (3), 36 (1843).
Galium subvelutinum (DC.) Koch in Linnaea, xxiv, 465 (1851).
? *G. mite* var. *melandrum* E. Bordz. (cf. Grossheim, Fl. Kavk. iv, 33: 1934).

Typus: In Persia ad montem Elwind, *Olivier & Bruguière* (holo. P).

IRAQ. Arl Gird Dagh, 2700 m., *Guld* 2967 (K,S—ad subsp. I verg.).

IRAN. Mowdere bei Sultanabad, 20 May 1890, *Strauss* (WU). Sultanabad, 27 Apr. 1890, *Strauss* (WU). Luristan, Khorramabad, *Gauba & Sabeti* 1242 (W). S. W. Persia, Bakhtiari country, *Sawyer* 13020b, 13069 (BM). In monte Kuh-i-Gäsawend, 1 Jul. 1909, *Strauss* (W). Kurdistania, in montibus calcareis Avroman et Schahu, *Haussknecht* 432 (BM: together with subsp. *megalanthum*). Jalpan, 25 May 1882, *Pichler* (WU). Elwind, *Aucher* 747 (G—Boiss.). In agro Ecbatanensi (Media), *Pichler* 1882 (WU). Tacht-i-Balkis, 18 Aug. 1884, *Knapp* (W). Mazanderan, in valle fluvii Çalus, c. 2400 m., *K. H. Rechinger* 927 (W). Ghilan, *Aucher* 4690 (W).

The following specimens from southern Transcaucasia approach subsp. *hyrcanicum* in their loose indumentum, but have broadly linear leaves and stouter, erect stems like subsp. *subvelutinum*: Transcaucasia, Nachrespublica, in mte. Ljakatach, in subalpinis, 11 Aug. 1933, *J. Gadzhiev et al.* (W). Nachitschewan, *Buhse* 1847 (W). Transcaucasia, republica Nachitshevan, distr. Shach-buz, in schistoso-lapidosis, 2 Jun. 1934, *A. Grossheim et al.* (PR).

In the high mountains of the S.E. Anatolian province of Van, Dr. Davis has collected a series of forms from high to extremely high altitudes which range from a low to extremely dense mat-forming habit with progressive reduction of the inflorescences. This differentiation is analogous to quite similar forms of *G. incanum* subsp. *centrale*, but is obviously not an expression of any really close affinity. Because of the very gradual connections of the specimens from Van with typical subsp. *subvelutinum* and because of the general uncertainties as regards the taxonomic treatment of the group, I have not given a special name to these forms though the more extreme ones (e.g. *Davis* 22887) look quite distinct:

Prov. Van, distr. Başkale: Ispiriz dağ, 2600 m., limestone screes, fl. white, *Davis* 23624 (E); *ibid.*, 3200 m., *Davis* 23778 (E); *ibid.*, summit scree, 3500 m., *Davis* 23751 (E). Prov. Van, distr. Gevaş: Artos dağ, 3500 m., flowers white or pale pinkish, *Davis* 22887 and 22888 (admixed) (E, W).

The main key characters of subsp. *subvelutinum* are the puberulent indumentum (which is "thinning" in transitional forms towards subsp. *hyrcanicum*), the narrow and relatively short leaves, the erect habit (but cf. the forms from high altitudes) and the medium sized flowers. Very close is subsp. *problematicum*; it differs practically only by the lack of indumentum and the more strongly angled stems.

E. subsp. **problematicum** Ehrendf. in Ann. Naturhist. Mus. Wien, lvi, 235 (1948).

Syn.: *G. xylorrhizum* Boiss. & Huet in Boiss., Diagn. Ser II (2), 115 (1856).

G. subvelutinum var. *xylorrhizum* (Boiss. & Huet) Bornm. in Bull. Herb. Boiss. Ser. 2, vi, 775 (1906).
G. leiophyllum var. *stenophyllum* Boiss., Fl. Or. iii, 51 (1875), nom. nov. pro *G. xylorrhizo*.
G. subvelutinum var. *stenophyllum* (Boiss.) Bornm. in Bull. Herb. Boiss. Ser. 2, viii, 927 (1908).
G. vartani Grossh. in Trans. Geobot. Invest. Pasturelands, Azerbaijan, Ser. B, i, 78, tab. vii (1929).
G. achurense Grossh. in Notulae Syst. Herb. Inst. Bot. Ac. Sc. URSS, xiii, 25–26 (1950) (probably this subspecies).

Typus: Iran, Montes Elburs centr., in dit. oppidi Keredj: in montibus Kuh-e Dasht, *K. H. Rechinger*, Iter Iranicum 1937, 281 (W).

TURKEY. In alpibus prope Musch, in rupestribus Teng devexis soli orienti obversis, 1500 m., *Kotschy* 507 (W—ad subsp. B. verg.). In declivibus glareosis ad radices montis Tech Dagh Armeniae prope Erzeroum, a. 1853, *Huet de Pavillon* (G, GH—typus *G. xylorrhizi*). Armenia, *Calvert & Zohrab* (E). Prov. Van, distr. Çatak: Kavuşşahap Dağ, 3100 m., rocky ridge, flowers white, *Davis* 23139 (E). Prov. Van. distr. Gevaş: Artos Dağ, 3050 m., scree, flowers white, *Davis* 22823 (E, W). Prov. Bitlis/Van: mountain 10 km. S.E. of Pelli, 2600 m., rocky slope, flowers white, *Davis* 22515 (E, W: ad subsp. B. vergens).

IRAN. In mte. Karnaru saxosis, 10 & 12 Jun. 1884, *Knapp* (WU, p.p. ad subsp. B verg.). Koshadara, *Szovitz* 375 (G—Boiss.). Ser, in lapidosis, 8 Jul. 1884, *Knapp* (WU). Isperechan, in graminosis, 30 Jul. 1884, *Knapp* (WU). Sari Caman, Azerbaidjan, *Mirdamadi* 1249 (W). Kazvin, Pic-Kuh prope Keredj, c. 2200 m., *Gauba* 1248 (W). Zentral-Elburs, am Südabhang des Totschal im Tal Hafthouse N.W. Teheran, Bergsteppe, 1300–1500 m., *Aellen* 161, 187 (Basel). Zentral-Elburs, Gatch i Sar, 2600 m., *Remaudière* 72 (i–744) (W).

Subsp. *problematicum* is indeed one of the most problematical entities within *G. subvelutinum* s.l.; when originally described in 1948 its identity with some "species" was still quite uncertain, but it is evident now that at least *G. xylorrhizum* and *G. vartanii*, probably also *G. achurense* and *G. bullatum* (interpreted as a form linking subsp. B and E) fall within its present circumscription. This circumscription is based on the key characters of broadly linear (not broadly oblanceolate to obovate or oblong!) leaves of medium length, about 12–18 mm. long, glabrous like the stems, the latter somewhat quadrangular, erect, never weakly filiform-ascending nor woody at base, usually not taller than 25 cm., and the medium sized flowers and fruits (2–4 mm. diam. resp. 1·5–2·5 mm. long). According to its ecological and geographical position within the *G. subvelutinum* complex subsp. *problematicum* is linked "vertically" with subsp. *leiophyllum* in the lower zones of Turkish Armenia and N.W. Iran, with subsp. *megalanthum* (extensive contacts in the Elburs!) and subsp. *decumbens* in the higher zones of the Elburs mountains, and "horizontally" with subsp. *hyrcanicum* towards the N.W., but especially with subsp. *subvelutinum* (with which it is very closely affiliated) towards the S. and S.W. of its area.

F. subsp. **hyrcanicum** (C. A. Mey.) Ehrendf., **comb. nov.**
Syn.: *G. hyrcanicum* C. A. Mey., Enum. 53 (1831).

G. hyrcanicum var. *puberulum* Trautv. in Acta Hort. Petrop. vii, 461 (1881).

G. hyrcanicum var. *glabrum* Trautv. in Acta Horti Petrop. vii, 461 (1881) (G, F—E?).

Typus: In rupestribus et locis lapidosis siccis montibus Talüsch, alt. 800–1100 hexap., *C. A. Meyer* (iso. W).

U.S.S.R. In arenosis, saxosis, aridis montium prope Tatuni et Raęsgow, Georg. cauc., *Hohenacker* a. 1836 (W). Armenia orientalis, prov. Karabach *Hohenacker* (W). "Caucasus", *Hohenacker* (W—verg. ad subsp. E). Transcaucasia Nachrespublica, in rupibus calcareis inter Ordubad et fl. Arax, 20 May 1933, *Grossheim et al.* (W).

IRAN. Azerbaidjan, montes Savalan, c. 2500 m., *Mirdamadi* 1250 (W).

The delimitation of subsp. *hyrcanicum* in the present treatment is, just as in 1948, narrower than the usual conception: forms with stronger indumentum are included in subsp. *subvelutinum*, ± glabrous forms with broadly linear leaves in subsp. *problematicum*. With the differential characters of low ± albo-quadrangulate stems, cuneate or shortly oblanceolate somewhat shining leaves, prominent nerve, the loose indumentum and the not-too-many-flowered cymose and ± flattened inflorescence, subsp. *hyrcanicum* obviously represents, together with the closely allied high alpine subsp. *decumbens* and subsp. *delicatulum*, another morphological extreme (and phylogenetic corner-stone?) of the *G. subvelutinum* complex opposite to subsp. *mite*. Subsp. *hyrcanicum* seems to be confined to calcareous soils along the openings of the mountain zone of the eastern Transcaucasian and northernmost Iranian mountain chains towards the basin of the Caspian Sea.

G. subsp. **decumbens** Ehrendf., **subsp. nov.**

Laxe repente-caespitosum et multicaule e rhizomate ± lignoso; caules adscendentes et filiformes e basi procumbente et radicante, vix 10(–25) cm. superantes, glabri vel puberuli, paulum ramosi, internodiis mediis 1–2(–3) cm. longis, superioribus paulum elongatis; folia oblonga vel late oblanceolata, maiora 6–9(–12): 1·8–2·2(–2·8) mm., long.: lat.=4·5, opaca, obsolete uninervia, acutiuscula, non revoluta, margine numquam papilloso vel denticulato; inflorescentiae reductae, pauciflorae, cymosae, laxae, pedicellis 2·5–4·5 mm. longis; flores explanato-subcrateriformes, mediocres c. 3–4 mm. diam.; ovaria glabra; fructus c. 2·5–3·5 mm. longi.

Typus: Iran, Prov. Sharud-Bustam, in declivibus australibus montium Shahvar, in saxosis calc., 3500–3900 m., *K. H. Rechinger* (Iter Iranicum II) 5983 (W).

IRAN. Mazanderan, Kuhikakashan, 3050 m., on dry slope, fl. greenish, *Koelz* 16373a (W); *ibid.*, under rock in shade, fl. white, *Koelz* 16356 (W); *ibid.*, on dry slopes, fl. pale brown-madder, *Koelz* 16354a (W). Mazanderan, distr. Kudjur, in monte Ulodj, substr. calc., 3200–3400 m., *K. H. Rechinger* 6457 a+b (W—p.p. ad subsp. E verg.). Prov. Damghan-Semnan, Zentral-Elburs, im Gebiet des Kuh-i-Nizwa, Berg ca. 8 km. N. Djaschm (Tschafte), Felschutt, 2900 m., *Behboudi & Aellen* 172, 173, 171, 124, 168, 169 (Basel). Sharud-Bustam, in declivibus australibus montium Shahvar supra Nekarman (Nigarman), in glarea rivuli, 2300 m., *K. H. Rechinger* 5865 (W). Prov. Gorgan (Asterabad), in declivibus borealibus montium Shahvar prope Ostamaidan, in sax. calc., 3500 m., *K. H. Rechinger* 6018a (W).

The new subsp. *decumbens* is a race from high to very high elevations in the Elburz range and obviously limited to calcareous soils. It is most closely allied to subsp. *delicatulum*—a local endemic of the Demawend region in the Elburs—from which it differs by its narrower leaves, non-apiculate corolla lobes and the great variability in indumentum (including glabrous forms). Other affinities are with subsp. *hyrcanicum* (with narrower, ± shining leaves, stronger leaf nerves, etc.) and subsp. *pseudokurdicum* (with much shorter flower stalks, somewhat glomerulate flowers, more elongated upper stem nodes, etc.). Altitudinal contacts closely connect subsp. *decumbens* in the Elburs with subsp. *problematicum* (and rarely with subsp. *subvelutinum* or subsp. *megalanthum*); separation is based on the different stature and leaf shape of the respective entities.

Reference should be made here to *G. elbursense* Bornm. & Gauba (in Fedde, Rep. xlix, 258: 1940). This is—according to a collection from Gilan, Harsevil prope Mendjil, 1700 m., *Gauba & Sabeti* 1244 (W)—an excellent species but neither related to the *subvelutinum* alliance nor to *G. saxatile* L. (sect. *Lepto-Galium*) but to the *G. diploprion*—*G. aucheri* group of which it represents a taxon with smooth leaf margins.

H. subsp. **delicatulum** (Boiss. & Hoh.) Ehrendf., **comb. nov.**

Syn.: *G. delicatulum* Boiss. & Hoh. in Boiss., Diagn. Ser. I (10), 65 (1849).

Typus: Iran, in rupestribus montis Demawend, *Aucher* 4662 (syntypus, W); *ibid.*, *Kotschy* 362 (lecto. W).

IRAN. Known only from the type locality. In monte Demawend, *Buhse* a. 1848 (W).

The subspecies seems to be limited to the Demawend in the Elburz and is closely related to the foregoing, from which it has probably originated. According to indications from Bornmüller (in Bull. Herb. Boiss. vi, 775: 1906), the delimitation from other forms of the *subvelutinum* complex is quite clear in its region.

I. subsp. **pseudokurdicum** Ehrendf. in Ann. Naturhist. Mus. Wien, lvi, 233, fig. 7 (1948).

Syn.: "*G. kurdicum* Boiss. & Hoh." auct. div.

Typus: Persia australis, in rupestribus altioribus alpis Kuh-Daena;* *Kotschy* 598 "*G. hyrcanicum*" (holo. & iso., W—some specimens approach subsp. C, others represent a glabrous form).

S. IRAN. Höchster Gipfel des Kuh Abbas Ali, 3650 m., *Stapf* 1505 (WU). Gipfel des Kuh-Bul, *Stapf* 1506 (WU). Prope Persepolin, *Kotschy* 980 (W).

This is a southern counterpart of subsp. *decumbens* and subsp. *delicatulum* in the Elburz which it resembles in habit and ecology. The most important differential character is the ± glomerulate arrangement of the flowers; but there exist transitional forms towards subsp. *megalanthum*, and relations to the variable forms in the E. Kurdish mountains, for example the Mt. Kellal collection of Haussknecht.

With *G. sieheanum* begins another series of Sect. *Orienti-Galium* which is characterized by the development of densely leafy brachycladous basal

* The indication from Kuh-Delu, *Kotschy* 598 (W) is probably a mistake for Kuh-Daena.

shoots: the extremely polymorphic complex of *G. incanum*, with seven subspecies. Its alpine subsp. *centrale* shows affinities with more eastern alpine forms of *G. subvelutinum* subsp. *subvelutinum*; *G. incanum* subsp. *pseudocornigerum** is closely linked with the *Ceratocarpa* group, characterized by persistent calyx teeth and a compact, mat-forming habit (*G. ceratocarpum* to *G. cerato-amanianum*). This group in turn leads with *G. antitauricum* to a final series of relic species representing a maximum of derived characters (needle leaves, extremely reduced inflorences, compact alpine habit) with *G. aretioides*, *G. cilicicum**, *G. olympicum* and the west Mediterranean *G. palaeo-italicum* Ehrendf. ined. ("*G. pyrenaicum*" of the Italian Peninsula) and *G. pyrenaicum* (Iberian Peninsula). The latter species is linked by a hybrid complex to *G. caespitosum* (Sect. *Lepto-Galium*) in the Pyrenees.

Galium sieheanum Ehrendf., **spec. nov.** (Sect. *Orienti-Galium* Ehrendf.).

Multicaule et dense caespitosum, rhizomate lignoso, in sicco nigrescens; caules c. 12 cm. alti, glaberrimi, nodis papillosis exceptis laeves, supra medium ramosi, internodiis basalibus valde abbreviatis, superioribus elongatis usque 4 cm. longis; folia cum stipulis foliaceis 6-na, verticillata, basalia valde conferta, minima, obovata, usque 4 mm. longa et 2 mm. lata, superiora anguste oblanceolata, usque 8 mm. longa et 1·4 mm. lata, obsolete uninervia, plana, acutiuscula sed sine acumine hyalina; inflorescentia cymosa, ramis inferioribus elongatis pyramidalis; flores subcrateriformes, albi (vel $\pm$ rosei?), magni, c. 4 mm. diam., lobis acutis sed non apiculatis; ovaria glabra.

Typus: Gerölle des Masmutlidagh, 2300 m., Antitaurus im Norden von Bozanti, Vilajet Konia, Ende Juni 1906, *E. W. Siehe* 347 ("*Galium mite* Boiss. & Hoh."—holo. W).

Galium sieheanum, which has been lying in the herbarium wrongly labelled for fifty years, is quite a characteristic species which connects *Galium incanum* sens. lat. with the *G. subvelutinum* group. From *G. incanum*, especially subsp. *libanoticum* Ehrendf., it differs by the leaves being broader never revolute, with an obsolete nerve and lacking indumentum and hyaline tip, and the much broader inflorescence clearly flattened at the top. From all members of the *G. subvelutinum* group it is set apart by its densely conferted basal leaves—a character which is so significant for *G. incanum*. These basal leaves are very small and obovate; they originate in the first year on short vegetative shoots but persist into the second year, when the vegetative shoots develop flowering axes.

It is remarkable that Masmutli dağ carries a flora showing clear affinities with the Lebanon for which may be cited in *Rubiaceae* not only the occurence of *G. sieheanum*, closely akin to *G. incanum* subsp. *libanoticum*, but also the disjunct locality of *Asperula glareosa*.

Galium incanum Sibth. & Sm., Fl. Graec. Prodr. i, 91 (1806) et Fl. Graec. ii, 22, tab. 130 (1813).

Syn.: *G. orientale* Boiss., Diagn. Ser. I (3), 38 (1834).

A detailed monograph of this polymorphic complex has already been published (Oesterr. Bot. Zeitschr. xcviii, 427–490: 1951). I have therefore

* For the hybrids between *G. incanum* subsp. *pseudocornigerum* and *G. cilicicum* see p. 373 and p. 376.

listed here only the collections of Davis and other additional Anatolian specimens not incorporated in the original treatment. The general conceptions as presented in 1951 do not have to be modified; I still cannot interpret the extreme polymorphic subsp. *centrale* as the outcome of primary hybridization because quite *new* characters (such as glaucousness) are found here, which are lacking in all other related entities. Subsp. *pseudocornigerum* is clearly influenced by hybrid introgression, not only through *G. cilicicum* (as already pointed out in 1951) but most likely also through other forms of the *G. cornigerum* alliance; this is indicated by the infiltration of alien characters in subsp. *pseudocornigerum*: fruit form, indumentum and even occasional single persistent calyx teeth. Relics of an original connection between the *G. incanum* complex and the bulk of the more primitive *Orienti-Galia* are obviously represented by *G. sieheanum* and the high alpine forms of *G. subvelutinum* subsp. *subvelutinum* from the district of Van. Of *G. schlumbergeri* Boiss. I have now seen the holotype and can confirm my interpretation (1951, p. 433) that it represents a tall form of *G. incanum* subsp. *antilibanoticum* Ehrendf.

A. subsp. **centrale** Ehrendf. in Oesterr. Bot. Zeitschr. xcviii, 445 (1951).

TURKEY. Prov. Izmir, dist. Ödemiş (Lydia): Bozdağ, schist rocks, *Davis* 18194 (W). Prov. Muğla, dist. Fethiye (Lycia): Girdev dağ, 2600 m., *Davis* 14017 (W); Kara Tepe near Seki yayla, *Davis* 13875 (verg. ad subsp. D—W); Girdev dağ, among rocks, fls. white, *Davis* 13987 (W). Prov. Antalya (Lycia): Calbali dağ, rocks, fls. white, *Davis* 15278 (W); *ibid.*, 2100–2200 m., *Davis* 15306A (W). Prov. Antalya, dist. Kemer (Lycia): Tahtali dağ, 2100 m., *Davis* 14199 (W); *ibid.*, fls. white, *Davis* 15065 (W) (verg. subsp. D). Prov. Antalya, dist. Gebiz (Pisidia): Bozburun dağ above Tozlu Çukur yayla, rocks, fls. white, *Davis* 15618 (W); *ibid.*, *Davis* 15587 (W); *ibid.*, 1900 m., shady rocks, *Davis* 15582 (W); *ibid.*, N. side, 2200–2300 m., fls. white, *Davis* 15664 (W); *ibid.*, *Davis* 15678 (W). Prov. Antalya, dist. Alanya (Isauria): Geyik dağ, 2340 m., *Davis* 14529 (W—ad subsp. D. verg.); *ibid.*, E. side, rocks, *Davis* 14549 (W); *ibid.*, *Davis* 14519 (W—ad subsp. D verg.); *ibid.*, *Davis* 14503 (W); Ak dağ, S. of Geyik dağ, rocks, *Davis* 14345; *ibid.*, 2400 m., rocky slopes, fls. purplish, *Davis* 14356 (W, E); *ibid.*, *Davis* 14390 (ad subsp. D verg.—W). Prov. Isparta, dist. Sütçüler (Pisidia): Dedegöl dağ above Dedegöl tarn, 2800–2900 m., fls. white, *Davis* 16007 (W, E): *ibid.*, above Oruz Gaz yayla, *Davis* 15980. Prov. Denizli (Caria): Boz dağ above Geyran yayla, 2130 m., 16 Jul. 1947, *Davis* (W); Baba dağ, 2000 m., *Davis* 18390B (W).

B. subsp. **pseudocornigerum** Ehrendf. in Oesterr. Bot. Zeitschr. xcviii, 449 (1951).

TURKEY. Prov. Niğde, dist. Ulukişla (Cilicia): Bulgar dağ between Alihoca and Sari Tepe yayla, N. cliffs, *Davis* 16538 (W). Prov. Maraş, dist. Göksun: Binboğa dağ, in ravine above Yalak, 1500 m., *Davis* 19961 (verg. ad *G. cilicicum*—E).

C. subsp. **incanum.**

TURKEY. Prov. Kutahya, dist. Gebiz (Phrygia): Şaphane dağ, rocks, *Davis* 18474 (verg. ad subsp. A—W).

AEGEAN. Chios: Amades, *Platt* 567 (K).

GREECE. Supra urbem Karpenissi, Mt. Tymphrestos, in rup., c. 2000 m., 16 July 1938, *Grebenchikoff* (K).

D. subsp. **elatius** (Boiss.) Ehrendf. in Oesterr. Bot. Zeitschr. xcviii, 453 (1951).

TURKEY. Prov. Antalya (Lycia): Çalbali dağ near Fesliken yayla, *Davis* 15353 (glaucous form—W). Prov. Konya (Isauria): Bozkir vadisi, *Davis* 16608 (W). Prov. Konya, dist. Ermenek (Isauria): Oyuklu dağ near Kaya Pinari, 1800–1900 m., *Davis* 16164 (W). Prov. Mersin, dist. Anamur (Cilicia Trachea): between Çamurlu yayla and Olucak, 2000 m., *Davis* 16312 (W). Prov. Muğla, dist. Fethiye (Lycia): Girdev göl, S. side, 2200 m., *Davis* 13869B (verg. ad subsp. A—W). Prov. Adana, dist. Saimbeylyi: Bozoğlan dağ above Obruk yayla, 2100 m., rocks, fls. white, Davis 19739 (E). Prov. Maraş, dist. Göksun; Binboğa dağ above Yalak, 2200–2300 m., fl. white, *Davis* 20152 (W, E). Prov. Ankara: Hacikadun valley near Kecioren, open places by stream, fl. white, *Davis* 18757 (W, E). Çankiri, 800 m., gypsaceous hills, fl. white, *Davis* 21507 (W, E). Prov. Niğde: Hasan dağ above Taşpinar, 1700 m., fl. white, *Davis* 18921 (W, E). Prov. Kayseri: Develi, fl. white, *Davis* 19179 (W, E); Kayseri—Bunyan, fallow field reverting to steppe, fl. white, *Davis* 21844 (W, E). Prov. Bitlis: Pelli dağ above Pelli, 3050 m., stony ground, fl. white, *Davis* 22490 (W, E); Karz dağ above Kotum, 1830 m., fl. white, *Davis* 22245 (W, E).

The following five species, including the new *G. antitauricum* Ehrendf., belong to the *Ceratocarpa* group, described by Boissier (Fl. Orient. iii, 47, 66–67: 1875). Important key characters are the perennial, caespitose habit, the reduced inflorescences, the slightly crateriform flowers (as in all other *Orienti-Galia*), the elongate-ovate fruits with hairy surface, and especially the $\pm$ numerous (1–6) persisting and enlarged calyx teeth. A critical revision of the group incorporating the wrongly placed *G. lasiocarpum* Boiss. and adding the new *G. cerato-amanianum* Ehrendf. has been published (1952a). The present treatment is therefore limited to an enumeration of the collections and an evaluation of the new *G. antitauricum* Ehrendf.

Galium ceratocarpum Boiss. Diagn. Ser. I (3), 36 (1843).

Typus: Cappadocia ad Euphratem, *Aucher* 710 (holo. G).

TURKEY. Cappadocia orientalis, *Montbret* 2349 (W, probably from "loc. class."). Armenia turcica: Egin, Szanduk, ad parietes rupium, *Sintenis* 2253 "*G. sintenisii* var. *minor* Hausskn." (W, WU); Egin, Kirkgvezbaschi, ad parietes rupium, *Sintenis* 2470, "*G. sintenisii* Hausskn."* (W, WU).

Galium lasiocarpum Boiss. Diagn. Ser. I (3), 42 (1843).

Typus: Cappadocia, *Aucher* 694 (mixtum cum *G. incano* subsp. *elatiore*, subsp. *centrali* et *G. cornigero*†—holo. G, iso. P).

TURKEY. Taurus orientalis, Ak dağ, *Montbret* 2064 (obviously from the "loc. class."—W). Kurdistania occidentalis, Taurus Cataonicus, in monte Ak dagh ("Aryly Tash" tabularum) inter urbem Malatja et vicum Kjachta, in lapidosis substr. calc., c. 2250–2670 m., *Handel-Mazzetti* 2310 (W, WU).

* Descriptions of these herbarium names have never been published !

† These mixtures certainly come from *different* localities !

Because of the rather inconspicuous calyx teeth this species was erroneously referred to *G. orientale* var. *alpinum* by Boissier (1875).

Galium cornigerum Boiss. & Hausskn., in Boiss. Fl. Or. iii, 67 (1875).

Typus: In fissuris rupium montis Berytdagh Cataoniae, 2340 m., 9 Aug. 1865, *Haussknecht* (holo. et iso. W).

TURKEY. Cappadocia orientalis, *Montbret* 2352 (W). Dar Dagh bei Jarpuz, 2000 m., Juni 1914, *Tölg* (W). Jedikardash bei Zeitun, 2600 m., 13 Jul. 1914, *Tölg* (W). Prov. Maraş, dist. Çardak: Berit dağ, 2900 m., above Çukuru Yayla, fl. white, *Davis* 29298 (E, W).

Transitional forms between *G. cornigerum* and *G. incanum* subsp. *pseudocornigerum* have been found in the Cilician Taurus and Anti-Taurus (Burujik, Gilbe Kur, 1675 m., semishade, limestone rocks, *Balls & Gourlay* B 1276—K, W), with 0·1 mm. long indumentum, persistent calyx teeth and glabrous or hirsute ovaries, and on Binboğa dağ (Maraş, dist. Göksun: Işik dağ above Karli Y., 2700–2800 m., *Davis* 19991—E, W) with very short indumentum and persistent calyx teeth but glabrous ovaries. Detailed future field studies will have to verify the hypothesis that these connecting forms have a hybrid origin.

Galium cerato-amanianum Ehrendf. in Oesterr. Bot. Zeitschr. xcix, 166 (1952).

Typus: Amanus prope Beilan, in alpinis Akma Dagh, 1830 m., *Kotschy* 221 "*G. aretioides*" (holo. W).

Galium antitauricum Ehrendf., **spec. nov.**

Perenne, multicaule et dense pulvinato-caespitosum; caules procumbenti-adscendentes, c. 30 mm. alti, densissime foliosi, internodiis multo abbreviatis; folia cum stipulis foliaceis 6-na verticillata, lineari-acicularia, $\pm$ revoluta, media 5–8 mm. longa, $\pm$ 0·8 mm. lata, nervo mediano valde prominente, lucida, parce puberula pilis brevibus c. 0·08 mm. longis, apice hyalino-acuminato glabro c. 0·5 mm. longo; inflorescentiae reductae, flores enim pauci in axillis foliorum superiorum brevissime pedicellati, infundibuliformes, albi, c. 3·5 mm. diam., lobis acutis; ovaria et fructus elongato-ovati, brevissime hispidi vel rarius glabri, dentibus calycis filiformibus (0–)1–3(–4) persistentibus.

Typus: Prov. Kayseri: Bakir dağ at Akoluk yayla above Kisge, 2000 m., on rocks, *Davis, Dodds & Çetik* (D. 19453—holo. E, iso. W).

This local endemic of the geographically strongly disjunct *ceratocarpa* series is a somewhat larger edition of *G. cerato-amanianum* Ehrendf. from which it differs mainly by its longer and broader leaves and glabrous hyaline points. The needle leaves of *G. antitauricum* differentiate it from *G. cornigerum* and the rest of the *Ceratocarpa* with which it shares the persistent calyx teeth. This character and the short and loose hairs of the leaf indumentum separate it from some very similar forms of *G. incanum* subsp. *pseudocornigerum*.

The following three species of the needle-leaved *G. olympicum*—*G. pyrenaicum* group nearly always have glabrous ovaries (cf. *G. aretioides*) and fruits without calyx teeth.

Galium aretioides Boiss., Diagn. Ser. I (3), 42 (1843).

Typus: In summis Cadmi orientalis supra Colossam, Jun. 1842, *Boissier* (holo. G—from some adjacent localities; slight variation in habit and indumentum of ovaries).

TURKEY. Denizli (Caria): Baba dağ, 2000 m., *Davis* 18390 (W).

Galium cilicicum Boiss., Diagn. Ser. II (5), 105 (1856).

Typi: Taurus cilicicus, Bulgar Dagh, in alpinis austro oppositis Utsch Deppe, 2340–2750 m., *Kotschy* 144 b (syntyp. W). Région alpine du Taurus, au-dessus de Boulgarmaden, *Balansa* 582 (syntyp. W).

TURKEY. In monte Tauro, *Kotschy* 233 (W). Bulghar Maaden Felsen, 2000 m., *Siehe* 502 (WU). Bulghar Dagh, Kisyl Tepe, *Tölg* (WU). Région montagneuse supérieure du Taurus, entre Gulek-Boghas et Gülek-Maden, *Balansa* 583 (W, typus var. *procerior* Boiss., l.c. 1856=var. *suffrutescens* Boiss., Fl. Or. iii, 58: 1875). Prov. Konya, dist. Ermenek (Isauria): Oyuklu dağ near Kaya Pinari Cesmesi, 1800–1900 m., N. cliff, *Davis* 16167 (W). Masmulti dağ (=Ala dağ), *Siehe*, "*Asperula nitida*" (W).

G. cilicicum exhibits some ecotypic plasticity, with relatively tall to very condensed forms, ranging from the montane to the high alpine zone; the respective extremes can be designated var. *procerior* Boiss. and var. *cilicicum* (=var. *alpinum* Boiss., Fl. Or. iii, 158: 1875).

G. cilicicum and *G. incanum* subsp. *pseudocornigerum* are connected by intermediate forms, very probably of hybrid origin; such intermediates from the Cilician Taurus (Bulgar dağ) have been found mixed with the following collections: *Balansa* 582, *Siehe* 502, *Kotschy* 144b.

Galium olympicum Boiss., Diagn. Ser. I (3), 41 (1843).

Typi: In olympi Bithyni regione superiore, *Aucher* 692 (syntyp. W). Jul. 1842, *Boissier* (syntyp. W).

TURKEY. Various collections from the type locality (*Pichler* 74, *Clementi*, *Montbret* 2352, *Sibthorp*), including Ulu dağ (=Olympus Bith.), 2400–2500 m., *Davis* 14864 (W).

This is an extremely local endemic limited to the Bithynian Olympus. *Kotschy* 233 from the Cilician Taurus, included in the enumeration of type collections by Boissier in 1843, belongs to the condensed variety of *G. cilicicum*. A closely allied plant from the Alpi Apuane and the Mte. Pollino on the Italian Peninsula will be published as *G. palaeo-italicum* Ehrendf. (ined.).

Galium longifolium (Sibth. & Sm.) Griseb., Spicil. ii, 157 (1844).

Syn.: *Asperula longifolia* Sibth. & Sm., Prodr. Fl. Graec. i, 87 (1806) et Fl. Graec. ii, 15, t. 118 (1813).

TURKEY. Olympus Bithynicus, *Montbret* (W). Prov. Antalya (Isauria), dist. Alanya; Han boğaz forest near Geyik dağ, shady slopes under rocks (Abietum), *Davis* 14691 (W).

This is the only member of the *G. silvaticum* group (centre in S.E. Europe) found in Anatolia.

Galium mollugo L. complex.

One of the most critical complexes in the genus is the group of *Galium mollugo* L. in its widest sense; differential characters of this complex are: stout perennial rootstock; leaves and foliaceous stipules in whorls of (4–)6–9(–12), one-nerved, obovate to linear, with hyaline papillae directed forward along the margin and a sharp terminal point, ± revolute, never with special type of indumentum on the lower side; inflorescences many-flowered, with inconspicuous bracts, pedicels never reddish and capillary; flowers white, yellowish, greenish or reddish, rotate, never campanulate, with apiculate corolla lobes; ovaries and fruits never with persistent calyx rudiments, glabrous, rounded and never clearly truncate on top. These characters allow separation from Sect. *Orienti-Galium* (cf. Ehrendorfer, Oesterr. Bot. Zeitschr. xcviii, 435–436: 1951), Sect. *Lepto-Galium* (cf. Ehrendorfer, Oesterr. Bot. Zeitschr. xcvi, 112–113: 1949), *Galium graecum* L. and *G. purpureum* L. with relatives, where no transitional forms are known, and the groups around *G. silvaticum* L. and *G. verum* L. which are both connected by hybrid series with the *Galium mollugo* complex.

A final treatment of the complex of *G. mollugo* will only be possible after thorough studies of all the representatives from the Mediterranean and Europe have been linked with cytological, experimental and careful field work. The great importance of hybridization and polyploidy in the group has been ascertained already (unpublished). The present data concerning the East Mediterranean representatives of the complex have necessarily a provisional character, and are a continuation of the critical studies executed by K. H. Rechinger (1943) in his Flora Aegaea (pp. 571–575). To burden the nomenclature of the group as little as possible, already published specific names have been maintained, using a rather narrow species concept, even if subsequent lumping will probably be inevitable in the future.

The East Mediterranean forms of the *Galium mollugo* complex ranging from northern Greece, the Macedonian countries, to Transcaucasia and Syria are separable into two groups:

A. Races of mesic localities: leaves rather broad, narrowly obovate to lanceolate, usually greenish to brownish when dried, nerves never prominent; stems glabrous or hirsute but never rough with short papillae towards the base; inflorescences not divaricate; flowers whitish-yellowish, with spreading corolla lobes; anthers mostly not nigrescent when dried. The group comprises *Galium heldreichii* Hal., *G. prusense* C. Koch, *G. samothracicum* Rech. f. (and *G. mollugo* L. s.str. with *G. pycnotrichum* Kern. as alien elements).

B. Races of ± xeric localities: leaves narrowly lanceolate to linear, even needle-like, often nigrescent when dried; nerves often very prominent on lower surface, stems mostly rough bearing (sometimes above a basal hirsute zone) short papillae towards the base (microscope!); inflorescences distinctly divaricate; flowers more intensely yellowish to greenish-yellowish with corolla lobes inflexed towards the centre; anthers nigrescent when dried. The group contains *Galium scabrifolium* (Boiss.) Hausskn., *G. melanantherum* Boiss., *G. asparagifolium* Boiss. & Heldr., *G. incurvum* Sibth. & Sm. (=*G. amorginum* Hal.), *G. bornmuelleri* Hau sskn. ex Bornm.

G. flavescens Borb., *G. subuliferum* Somm. & Lev., *G. rhodopeum* Vel. (and *G. lucidum* All. as an alien element).

These two groups A and B can be confronted with:

C. *G. firmum* Tausch s.str. (=*G. aureum* Vis.) limited in its distribution to southern Dalmatia, Hercegovina, Montenegro and northern Albania. This entity, which has been unduly enlarged in its circumscription with the treatment in Boissier's Flora Orientalis (iii, 61–62) is one of the most clearly defined in the complex. The important differential characters are: rather broad oblanceolate leaves, numerous internodes, ± dense papillae towards the rough stem bases, and rather ample, quite multiflorous inflorescences with very small (c. 1·5 mm.) intensely yellow-coloured flowers.

Separation of groups A and B is relatively easy in the Eastern Mediterranean (only occasionally intermediate forms have been seen, obviously of hybrid origin), in contrast to the areas towards the North and North-West (Yugoslavia, Alps, etc.) where transitional forms and the appearance of new races blur the picture. A very peculiar entity of the Balkans is *G. mirum* Rech. fil. (in Engl. Bot. Jahrb. lxix, 512: 1939) in eastern and central Macedonia and Thrace with robust and hirsute stems, lower leaves lanceolate, upper linear, ample inflorescences and flowers of type B (similar to *G. flavescens*), which seems to combine the characters of *G. flavescens* with some of *G. pycnotrichum* (or *G. pseudo-aristatum* Schur—*G. laconicum* Boiss. & Heldr. from the *G. silvaticum* alliance?).

In group A the white flowering *G. mollugo* L. s. str. and some closely related forms like the robust and hirsute *G. pycnotrichum* Kern. (reaching from S.E. Middle Europe southwards to Macedonia and the island of Thasos) are replaced in the Eastern Mediterranean by races with yellowish (greenish) flushed corollas; even when dried this tinge is mostly recognizable while the white corollas of Middle European forms turn brownish in the herbarium. *G. samothracicum* Rech. fil. (in Fedde, Rep. Beih. c, 134: 1938=*G. citraceum* Boiss. & Heldr., nom. nud.) has ± unbranched, rather low and nearly always glabrous stems, leaves of rather thin texture, loose and not very many-flowered inflorescences and a habit similar to what has been called so far "*G. erectum* Huds."; here belong forms of higher montane to subalpine (alpine) altitudes from Macedonia through the mountains of the Greek peninsula to the Peloponnesus and from the Aegean islands of Samothrace, Euboea and Crete*; differentiation from white-flowering forms in the North is difficult. *G. heldreichii* Hal. is characterized by its strong branching from the base, the rather tall but weak stems, the hirsute indumentum nearly always present, the often leathery texture of the leaves and the ample and usually densely flowered inflorescences; typical forms come from the Mediterranean zone of S.E. Greece, ranging from the eastern Peloponnesus and Achaia to Attica, Phocis and the Pindus Mts., the islands of Euboea, Skopelos, Paros, Chios and Rhodes and from Anatolia around Smyrna (see below); separation from *G. samothracicum* at higher altitudes is sometimes critical. The taxon *G. prusense* C. Koch (type: Brussa, *Thirke*, B—probably destroyed) is used here to comprise all forms of group A with yellowish-tinged flowers, rather stout and erect habit, somewhat branched but always glabrous stems,

* See footnote p. 380.

leathery leaves of quite variable shape—obovate to narrowly oblanceolate—and relatively dense inflorescences which neither fit *G. samothracicum* nor *G. heldreichii*; such forms occur from Macedonia and the Athos peninsula all through Anatolia (see below) to the mountains of Syria (Cassius, Lebanon), the Crimean peninsula and the Kuban area. The conspicuous ecotypic and morphological variability (habit, leaf form, etc.) of *G. prusense* makes delimitation from *G. heldreichii* and *G. samothracicum* sometimes difficult. Separation of the three species (?) from white-flowered forms belonging to *G. mollugo* in the Northern Balkans, the Caucasus and Transcaucasus and the eastern Pontus regions remains to be thoroughly studied. The origin of *G. samothracicum*, *G. heldreichii* and *G. prusense* might be explained on the basis of introgression of characters from the primitive and diploid *G. firmum* s. str. (n=11, unpubl.) into forms of *G. mollugo* penetrating into the mountain systems of the Eastern Mediterranean during the Pleistocene.

Group B is of much more intricate structure and has obviously had a long history in the Eastern Mediterranean. Its affinities are with many other xeric and narrow-leaved forms of the complex in the northern Balkans, southern Middle Europe and the central and western Mediterranean, for example with *G. pallidum* Presl, *G. cinereum* All., *G. lucidum* All. and *G. corrudifolium* Vill. The provisional treatment adopted here may be briefly outlined as follows. *G. rhodopeum* Vel. (in Sitzungsber. Böhm. Ges. Wiss. 1893, p. 37 and 1894, p. 32) in a restricted sense refers to small plants of limestone crevices in the Rhodope Mts. (Tekir, Kocovo) and near Skoplje, with very narrow and elongated inflorescences, short and stiff needle leaves with a long hyaline point on densely crowded nodes, and a fine puberulent indumentum of the stems. *G. flavescens** comprises tall plants with very narrow, long and filiform leaves and ample, pyramidal inflorescences, and ranges from Transsylvania to E. Serbia, Bulgaria, Greek Macedonia and Thrace (Tekir Dagh). Very closely allied and of questionable distinctness is *G. subuliferum* Somm. & Lev. (in Acta Hort. Bot. Petrop. xii, 151: 1892) from Batum in Transcaucasia. The separation of *G. flavescens* and *G. scabrifolium* (Boiss.) Hausskn. on the basis of the shorter and somewhat broader linear leaves and the less ample inflorescences (with shorter basal branches) of the *G. scabrifolium* also offers some problems in the areas of geographical proximity. *G. scabrifolium* is widely distributed from Macedonia to the Peloponnesus and from central and southern Anatolia (for detailed indications see below) to the Amanus, rather variable and with a definite regional pattern of differentiation; it will probably be possible to recognize a number of local races, for example a very short-leaved one from the Athos peninsula to Mt. Ida (as "*G. rhodopeum*" in K. H. Rechinger, Flora Aegaea, 574), and a strongly branched one in the Peloponnesus; into this pattern belong some already described micro-species like *G. asparagifolium* Boiss. & Heldr. (Diagn. Ser. II (6), 91: 1859) from Parnassus with very short leaves and many branches from the base, *G. melanantherum* Boiss. (Diagn. Ser. I (6), 68: 1845) from the limestone mountains of Attica (Hymettus, Parnes, Pentelikon,

* *G. flavescens* Borb. in Akad. Közl. xi (7), 266 (1874). Syn. *G. asparagifolium* Kern. (1870), non Boiss. (1859); *G. ochroleucum* Kit. in Schultes (1814), non Wolf in Schweigg. & Körte (1804).

etc., and Euboea) with rather low stems and very loose and elongated inflorescences, and *G. bornmuelleri* Hausskn. ex Bornm. from northern central Anatolia (detailed list of collections given below), which is similar to *G. rhodopeum* in its low and condensed stature, but differs in its stiff and spreading needle leaves with a short hyaline point, and rough papillose indumentum on the stems. Vicarious races of group B towards the south are *G. incurvum* Sibth. & Sm. (Prodr. Fl. Graec. i, 12: 1806=*G. amorginum* Hal.) from Euboea and the Cyclades to Crete* and Karpathos distinguished by its rather low stature, absolutely glabrous and smooth stems and somewhat succulent leaves, and the new *G. libanoticum* Ehrendf. (ined., see 1958c) from the Lebanon and Antilebanon with elongated and many-flowered narrow inflorescences, somewhat thickish leaves and rough stems.

G. scabrifolium and its allies have to be separated from forms with northern affinities which range at higher altitudes through the Greek mountain systems south to Achaia; such forms have been provisionally designated as *G. lucidum* All. and may be recognized by their stems with relatively few (not more than twelve) elongated internodes, rather narrow inflorescences, and the colour of the leaves remaining green when dried.

Hybrids between members of the *G. mollugo* complex and *G. verum* L. sensu lat., which are common in Middle Europe, are very scarce in the Eastern Mediterranean and have been ascertained so far only for Syria where occasional intermediates between *G. libanoticum* Ehrendf. (ined.) and *G. verum* L. (s. lat.) have been observed.

The following enumeration contains all specimens seen by the author belonging to races of the *G. mollugo* complex in Anatolia and some adjacent areas.

Galium heldreichii Hal. in Oest. Bot. Zeitschr. xlvii, 94 (1897).

TURKEY. Berget Papasian, Burnova, 100 m., Smyrna—Manisa, 19 May 1935, *E. Wall* (S).

Galium prusense C. Koch in Linnaea, xxiv, 466 (1851).

TURKEY. Prov. Antalya, dist. Kemer (Lycia): Teke dağ near Ovacik, among shady rocks, flowers greenish, 1100–1200 m., *Davis* 15179 (W). Prov. Antalya, dist. Gebiz (Pisidia): Bozburun dağ at Taşli yayla, 1700 m., *Davis* 15552 (W). Prov. Antalya, dist. Alanya (Isauria): Han Boğaz forest near Geyik dağ, *Davis* 14700 (W). Prov. Isparta, dist. Sütçüler (Isauria): Dedegöl dağ between Oruz Gaz yayla and Selköşe, metamorphic rocks in ravine, *Davis* 15912 (W). Prov. Muğla, dist. Köyceğiz; Sandras dağ near Kökluce, *Davis* 13603. Bithynia: Ulu dağ, 2300 m., *Davis* 14826 (W). Bithynischer Olympus, *Friedrichs* (W); *ibid.*, *Montbret* (W); *ibid.*, *Aucher* 2031 (W). Brussa, Wegrand, 15 May 1930, *E. Wall* (S). Prov. Kastamonu: Küre—Inebolu, 732 m., ledges of metamorphic rocks, *Davis* 21599 (W, E). Kalkberg 13 km. S. Kutaya, 6 June 1935, *E. Wall* (S). Sandschak Trapezunti: in valle Kalanema Dere prope oppidum Aktsche Abad (Platana), in declivibus siccis lapidosis ab ore usque ad vicum Ginik, substr. eruptivo, 30–200 m., *Handel-Mazzetti* 342 (WU); *ibid.*, locis umbrosis in eius ramo Melingania Dere, substr. eruptivo, c. 300 m., *Handel-Mazzetti* 994 (WU).

* The determination of Davis 18162: W. Crete, Katsiveli in Levka Ori (in Notes R.B.G. Edinb. xxi (3), 121:1953) as *G. samothracicum* has to be corrected to *G. incurvum*.

Lycia: ad Guruva et Tschesme, 14 Jul. 1882, *Luschan* (WU). Gülik Han, *Heider*, Iter Pamphyl.-Pisid. (WU). Prov. Cappadocia (Thyanitis), Maaden, Gerölle, 1450 m., 12 June 1898, *Siehe* (WU). Amasia, in fissuris rupium, 400–500 m., *Bornmüller* 924 ("*G. lucidum*", W, WU). Lydia, Bunarbaschi, in monte Takhtali-dagh, 600–700 m., *Bornmüller* 9272 ("*G. firmum*," W). Mt. Kassan Oghlu, in saxosis ad Gorumse, 1280 m., *Kotschy* 101 (W). "Bulgar Dagh," in graminosis jugi Ketsiebele, 2600 m., *Kotschy* 142a ("*G. lucidum* var." mixed with *G. scabrifolium*, W). Amanus, *Haradjian* 233, 282, 283, 575, 580 (G); *ibid.*, 1300–2000 m., *Haradjian* 4626 (G). Beilan, rég. subalp. vers Akma (=Alma?) Dagh, 1650 m., *Kotschy* 95 (*G. beilanense*, S, W). Supra Arsouz, in fauce rupis supra Urusa, vers. Medyk Dagh, *Kotschy* 126 (*G. amani*, S, W). Doumanli Dagh, 700–1200 m., *Haradjian* 3712, 3781 (G). Düldül Dagh, 1650–1850 m., *Haradjian* 2398, 3882 (G). Kusliji Dagh, 1650–2100 m., *Haradjian* 2504 (G).

Galium scabrifolium (Boiss.) Hausskn. in Mitt. Thür. Bot. Ver. N.F. v, 120 (1893).

Syn.: *G. melanantherum* var. *scabrifolium* Boiss., Diagn. Ser. I (6), 68 (1845).

TURKEY. Prov. Muğla, dist. Fethiye (Lycia): Girdev dağ, S. side, 2000 m., *Davis* 13825 (W); *ibid.*, 2200 m., *Davis* 13849 B (W). Lycia: in rupestribus regionis subalpinae montis Elmalu, *Bourgeau* 132 (W); auf Felsen am Ali Dagh nächst Elmali, 18 Jul. 1883, *Pichler* (WU); auf den Bergen bei Elmali, 3 Jul. 1883, *Pichler* (BP); Gilewgy Zaillamy, 1882, *Luschan* (WU). Rupes Cadmi, Jun. 1842, *Boissier* ("*G. ochroleucum* W.K. var. *minor*," W). Phrygia, Sultandagh, in rupestribus et saxosis ad Akscheher (Wilajet Konia), 1100 m., *Bornmüller* 4548 ("*G. aureum* f.", W, WU). Paphlagonia australis, ditionis opp. Çankri (Tschangry, Germanicopolis), in collibus aridis petrosis, c. 800–900 m., *Bornmüller* 14226 (W). In monte Tauro, *Kotschy* 229 (W), 498—I (W), 231 (W). Süd-Taurus, Mersina, bei Efrenk im Walde von Juniperus excelsa, 1700 m., *Siehe* 504 (W). Taurus, Bulgar Dagh, in graminosis jugi Ketsiebele, 2600 m., *Kotschy* 142a ("*G. lucidum* var." mixed with *G. prusense*—W). Cilicien, Gülek Depe, 1200 m., *Siehe* 459 (W). Sommet des montagnes dominant le défilé des Portes Ciliciennes, *Balansa* 590 (W). Cilicien, Grugula-Thal, an Felsen, 1400 m., *Siehe* 246 (WU). Prov. Niğde: Hasan Dağ below Taşpinar Y., 1900 m., in Quercus forest, *Davis* 19006 (E). Armenia turcica: Gumuschkhane, Kibribaschi in Ciganadagh, *Sintenis* 1360 (W). Amanus, environs du village d'Harounié, 300–400 m., *Haradjian* 3600 (G). Amanus, mont. Düldül, 1500–2000 m., *Haradjian* 3880 (G).

Galium bornmuelleri Hausskn. ex Bornm. in Mitt. Thür. Bot. Ver., N.F. xx, 14–15 (1904).

TURKEY. Pontus: Amasia, in rupestribus saxosis regionis calidae, 400–500 m., *Bornmüller* 926 (iso. W). Paphlagonia, Wilajet Kastambuli, Tossia Giaurtschaidere, *Haussknecht* 4375b (WU, W). Prov. Ankara; between Kayaş and Kübrüs, dry hills, *Davis* 13223 (W, E).

Galium rivale (Sibth. & Sm.) Griseb., Spicil. ii, 156 (1844).

Syn.: *Asperula rivalis* Sibth. & Sm., Prodr. Fl. Graec. i, 87 (1806) et Fl. Graec. ii, 15, t. 117 (1813).
Asperula aparine M. Bieb., Fl. Taur. Cauc. i, 102 (1808).

TURKEY. Prov. Ankara (Galatia): Beyram, *Davis* 13033 (W). Prov. Denizli (Caria): Boz dağ near Geyran yayla, 1370 m., *Davis* 13355 (W). Prov. Antalya, dist. Kemer (Lycia): Tahtali dağ near Kuz dere yayla, in hedge by stream, *Davis* 14209 (W). Prov. Antalya, dist. Gebiz (Pisidia): Bozburun dağ, N. side, 2000–2300 m., *Davis* 15653 a (E: together with *Asperula stricta* subsp. *stricta*). Prov. Aydin dist. Söke; Samsun dağ (Mykale), 400 m., banks by water channel above Priene, *Davis* 18353 (W).

Together with *G. uliginosum* L., *G. asperrimum* Gray, *G. caripense* H.B.K. and others, this is a member of a ± hygrophilous Eurasiatic-American group of divaricate climbers (scramblers) with rough stems and leaf margins.

The following species, *G. humifusum*, *G. verum* sensu lat. (including *G. consanguineum*) and the new *G. davisii* and *G. trojanum* belong to a group of perennial *Galia* with whorls of numerous leaves and stipules, characterized by inflorescences with bracteate peduncles and pedicels becoming somewhat thickened and divaricate during the ripening of the fruits; the flowers are red-green, yellowish to whitish, flat or (in *G. humifusum*) ± trumpet-shaped, the fruits with spreading hairs or glabrous. Other more important members of this group are *G. maritimum* L., *G. brachyphyllum* Schultes, *G. thymifolium* Boiss. & Heldr. and *G. kerneri* Deg. & Dörfler.

Galium humifusum M. Bieb., Fl. Taur. Cauc. i, 104 (1808).

Syn.: *Asperula humifusa* (M. Bieb.) M. Bieb., Suppl. Fl. Taur. Cauc. 105 (1819).
A. pycnantha Boiss., Diagn. Ser. I (10), 64 (1849).
A. dissitiflora Post in Trans. Linn. Soc. Bot. xxiv, 432 (1888) (type G–Boiss!).
A. ghautensis Post, Pl. Postianae, iii, 10 (1892) (type G–Boiss!).

TURKEY. Prov. Maraş, dist. Elbistan: Kapidere, edge of fields, fls. white, *Davis* 20401 (W, E). Van, in fallow fields at foot of castle rock, fls. white, *Davis* 22636 (E). Prov. Bitlis: Tatvan, 1450 m., fls. white, *Davis* 22202 (E). Prov. Hakkari: Cilo dağ, 1650 m., gravel terraces, fls. white, *Davis* 23900 (E). "Armenia", *Calvert & Zohrab* (E). Amanus, inter Kharne et Hasroun Beyli, 650–1000 m., *Haradjian* 7533 (G). Amanus, prope vic. Ekbès, 500–650 m., *Haradjian* 603 (G). Amanus, in montibus Hassan Beyli, 1000 m., *Haradjian* 2162 (G).

Galium verum L., Sp. Pl. 155 (1753), sensu lat.

This complex is quite polymorphic in the Near and Middle East. As long as there is no critical survey of all the Eurasiatic forms at hand, I prefer to apply a rather wide specific concept without using too many infraspecific names. There seem to be two main lines of differentiation in our area; one running from forms ± identical with Middle European specimens (puberulent inflorescence axes and lower leaf surface, glabrous ovaries, linear leaves) (1)* to absolute glabrous forms in Syria and adjacent Anatolia (*G. karduchorum* Ronn., ? *G. bassitense* Thiéb.) (2). If the leaves become broader at the same time we have *G. majmechense* Bordz. and

* Numbers in brackets in the text and after collection enumerations are in conformity to give a clue to possible taxonomic position.

finally—with leaves up to 4 mm. broad and 45 mm. long—*G. consanguineum* Boiss. (3) which is relatively distinct and looks—at least partly—as if influenced by *G. subvelutinum* subsp. *leiophyllum*. Another morphological sequence starts with forms which have hairy ovaries but are otherwise typical (*G. ruthenicum* Willd.) and leads to strongly hairy forms, like the short-leaved *G. kuetzingii* Boiss. & Buhse (=*G. meyeri* Grossh.) and the long-leaved *G. atropatanum* Grossh. Other Near and Middle East members of the *G. verum* alliance are *G. anfractum* Som. & Lev., ?*G. caucasicum* Lag. *G. fistulosum* Som. & Lev. (sphalm. "*G. pabulosum*" in Index Kewensis), *G. krylovii* Iljin and *G. saurense* Litw.

TURKEY. Prov. Muğla/Antalya: Girdev dağ, S. side, 2000 m., in a cultivated hollow, *Davis* 13819 (W, E) (1); Girdev Göl, 1675 m., *Davis* 13748 (W, E) (1). Prov. Anatlya, dist. Kemer (Lycia): Tahtali dağ at Penirlik yayla, *Davis* 15103 (W) (1). Prov. Denizli (Caria): between Denizli and Çukur yayla, *Davis* 13459 (W) (1). Prov. Maraş: ad radices Akher Dagh pr. Marash, 930 m., *Haradjian* 1534 (G); Akher Dagh, 1830–2130 m., *Haradjian* 1687. Prov. Maraş, dist. Elbistan: west foot of Nuruhak dağ, rocky slope, *Davis* 20441 (E) (1). Prov. Maraş, dist. Göksun: Binboğa dağ above Yalak, 1500 m., in ravine, *Davis* 19942 (W) (1). Amanus, pr. vic. Harunié, 300–400 m., *Haradjian* 3624 (G). Prov. Adana, dist. Feke: Göksu gorge below Himmetli, 700–800 m., *Davis* 19831 (W, E) (2). Prov. Kayseri: Bakir dağ above Kisge, 1400 m., *Davis* 1930 (W, E) (1). Giant Mountain, Constantinopel, *Post* 510 (BM) (1). Prov. Rize, dist. Ikizdere: Basköy (Cimil)—Cermanin yayla, 2300 m., edge of meadow, *Davis* 21042 (E) (1). Prov. Hakkari: Kara dağ, 2900 m., slopes above flush, *Davis* 24360 (W, E) (3). Inter Musch et Erzerum, in monte Bimgöll, in valle Goschkar, 1700 m., *Kotschy* 661 p.p. (W) (3). Mardin: Bakakri, *Sintenis* 1296 (W) (3 and 2). Prov. Van: Erek dag, 2290 m., dry rocky volcanic slopes, *Davis* 22941 (W, E) (4). Prov. Van, dist. Başkale: Ispiriz dağ, rocky slope, *Davis* 23656 (E) (4). Prov. Bitlis, dist. Kotum: Karz dağ above Kamer, 2300 m., *Davis* 24599 (W, E) (3 and 1–3). Bitlis-Tatvan, 1800 m., steppe, *Davis* 23371 (W, E) (4).

SYRIA. Djebel Ansarieh, Aïn Halakim, 800–1000 m., *Haradjian* 3442 (G).

IRAN. In dumetis inter Kaliser pr. Maribin, 1525 m., 6 Aug. 1867, *Haussknecht* (BM) (3). Fars, Shiraz—Tale Khoorou, Caleh Kalagh, *Behboudi* 941 E (W) (3).

Galium davisii Ehrendf., **spec. nov.** (fig. 6).

Perenne, multicaule et laxe caespitosum e radice lignosa; caules basi ± longe procumbentes, adscendenti-erecti, c. 10–15 cm. alti, dense puberulo-hirsuti, supra medium ramosi, internodiis ± aequilongis, c. 1–2 cm. longis; folia cum stipulis foliaceis 6-na verticillata, ovato-acuminata, media 9–12 mm. longa et 3·5–4·5 mm. lata, hirsuta, uninervia, ± revoluta, in sicco viridia; inflorescentiae pyramidales, cymosae, parce foliosae, ramis lateralibus trichotomis, floribus ± confertis, pedunculis pedicellisque post anthesin ± incrassato-divaricatis; flores parvi, c. 2 mm. diam., ochroleuci, rotati, lobis acutis brevissime apiculatis, erecto-patentibus; antherae subglobosae; ovaria et fructus ovoidei, pilis albidis rectis ± dense obsiti, maturi c. 1–1·5 mm. alti.

Typus: Prov. Maraş, dist. Göksun: Hobek dağ, 2100 m., cliffs, 21 July 1952, *Davis, Dodds & Çetik* (D. 20205—holo. E, iso. W).

TURKEY. Prov. Adana, dist. Feke: gorge between Süphandere and Belanköy, 900 m., on dry calcareous rocks, *Davis* 19542b (together with 19542a, *G. canum*—E).

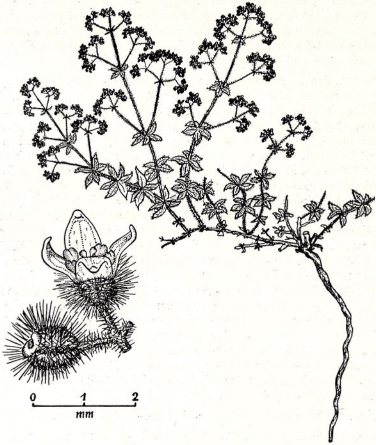

FIG. 6. *Galium davisii* Ehrendf., spec. nov.; habit (×0), flower and young fruit (enlarged).

This splendid new endemic of the Anti-Taurus is named in honour of Dr. P. H. Davis (Edinburgh) who has brought together the richest collections of flowering plants from Anatolia ever made. In habit similar to members of the *Orienti-Galia*, for example *G. kurdicum* (some forms with hairy fruits!), *G. davisii* has quite different flowers: they are rotate and creamy—characters altogether lacking in *Orienti-Galium*. Members of the *G. canum*—*G. graecum* alliance have quite different capillary and purplish pedicels, they are short, ± stout and later divaricate in *G. davisii*. Other groups of perennial *Galia* with more than two leaves and two stipules in their whorls, like the *G. silvaticum*—*G. mollugo* alliance or the *Lepto-Galia* are even more different. This finally brings us to the present group, including as a quite isolated member *G. degenii* Bald. (ap. Degen in Oesterr. Bot. Zeitschr. xlv, 131: 1895=*G. ossaeum* Hal., Consp. Fl. Graec., i, 717: 1904).

This species is an endemic of limestone crevices in northern Greece and adjacent Albania and shares a number of common characters with *G. davisii*: structure of root and stem bases, indumentum of stems, leaves and ovaries, flower shape and colour. Obvious differences are the much more reduced, strongly leafy inflorescences with much longer pedicels, the shorter and narrower, lanceolate leaves and the more densely leafy stems with quite conferted internodes. The collection of *G. davisii* from the gorge between Süphandere and Belanköy (*Davis* 19452b) has a slightly more rigid and sparse indumentum on stems and fruits than the type collection.

Galium trojanum Ehrendf., **spec. nov.**

Habitu *Galio incano* subsp. *elatiori* simile, perenne e basi ± lignosa; caules numerosi, laxe caespitosi basi procumbentes et radicantes, ceterum erecti, steriles abbreviati, floriferi c. 15–20 cm. alti, internodiis inferioribus confertis, superioribus valde elongatis, usque 45 mm. longis, vix ramosi, parce sed rigide puberuli; folia et stipulae foliaceae 5–6-na verticillata, lineari-subulata, usque ad 7 mm. longa, hyalino-acuminata, margine valde revoluta, supra lucida et antrorsum aculeolata, infra minutissime crispulo-puberula; inflorescentiae anguste elongatae, ramis floriferis lateralibus brevibus remotis paucifloris; flores ± conferti, breviter pedicellati, pedunculis pedicellisque post anthesin ± divaricatis, plane rotati, flavescentes (?), c. 5 mm. diam., lobis acutis nec apiculatis; ovaria ovoidea, glabra.

Typus: Anatolia, Mons Ida, in monte Kara-Dagh, *Sintenis* a. 1883, 499 (holo. E, iso. GH, K, W, TL, GOET).

This new species is quite isolated from other *Galia* and known so far only from the type collection. Superficially similar to *G. incanum* subsp. *elatius*, it has escaped correct interpretation since it was wrongly determined by Ascherson. On closer inspection the essential differences from *G. incanum* become very obvious: the peculiar leaves with involute margins, shining and aculeolate above, with fine crisp indumentum below, the flat, rotate (never infundibuliform) flowers, probably of yellowish colour, and the short lateral inflorescence axes with intricate-divaricate branching in early (and later) fruiting stage. All these characters bring *G. trojanum* much closer to two other southern Balkan elements, *G. thymifolium* Boiss. & Heldr. (Central and S. Greece) and especially *G. kerneri* Deg. & Dörfler (Central Macedonia); both have much smaller flowers with apiculate corolla lobes and more elongated pedicels; in addition, *G. thymifolium* has glabrous and smooth dull leaves, while *G. kerneri* is puberulous all over (including the leaf surface), to mention only the outstanding differential characters.

Galium palustre L., Sp. Pl. 153 (1753), sensu lat.

This group—distributed with numerous taxa all over the temperate regions of the Northern Hemisphere—very much needs critical revisional study. Only peripheral elements reach the Anatolian area.

TURKEY. "Armenia"; *Calvert & Zohrab* (BM).

SYRIA. Djebel Ansarieh, Bhamra, 15 mi a Latakieh orient. vers., c. 35 m., *Haradjian* 2663 (G).

The following twelve species are all annuals and members of the probably natural Sect. *Aparine* DC. in the sense of Boissier (Fl. Or. iii, 47: 1875), with the exception of *G. setaceum* and *G. cassium* mentioned on p. 392 and p. 393.

Galium aparine L., Sp. Pl. 157 (1753), sensu lat.

A short survey of this very polymorphic group in the Near and Middle East will appear in my treatment of the Rubiaceae of Afghanistan (1958a). As a provisional basis of classification I have adopted the names *G. aparine*, *G. spurium* and *G. ibicinum* for micro-specific segregates of the complex; but there are intermediate forms connecting these taxa.

G. spurium L., Sp. Pl. 154 (1753).

TURKEY. Prov. Niğde: Hasan dağ, *Davis* a. 1952 (E). Prov. Rize, distr. Hemşin: Ortaköy—Çat, 2000 m., *Davis* 21182 (E). Aintab, *Post* (BM). Amanus, *Haradjian* 228 (G). Cilicien, Gülek Gala, *Sintenis* 461 (WU).

G. ibicinum Boiss. & Hausskn. in Boiss., Fl. Or. iii, 70 (1875).

TURKEY. Prov. Niğde; Hasan dağ below Taşpinar Y., in Quercus forest, *Davis* 19005 (intermediate between this and *G. spurium*—E). Prov. Kayseri: Bakir dağ between Kisge and Bakir Oluğu Y., 1700 m., in Abietum, *Davis* 19473 (ad *G. spurium* verg.). Oberhalb Fertek bei Niğde, 1700 m., trockene, steinige Orte, *Sintenis* 500 (E). Cilicien, Karli Boghas, *Sintenis* 331 (E).

Detailed studies on recently collected material of "*Galium adhaerens* Boiss. & Bal." from Syria and Lebanon as well as from the Adana province and comparison with older collections, have shown that this represents a polymorphic complex composed of some closely related but nevertheless quite distinct entities. The whole group is sharply separated from other annual *Galia* by the following differential characters: retrorsely aculeate leaf margins, hyaline acuminate leaf tips; partial inflorescences with numerous flowers, ultimate branchings ebracteate; flowers only slightly dimorphic, white; ovaries and fruits minutely papillose or with admixed blunt tubercles or with longitudinal undulate wings, the fruits borne on curved pedicels.* Most closely allied are *G. pisiferum* Boiss. with very large and shining, smooth fruits and the *G. aparine* L.—*G. spurium* L. group with much fewer flowers in the partial inflorescences and mostly hamate hairs on ovaries and fruits. *G. brevifolium*,† in spite of its white flowers, is obviously much more closely related to the *G. nigricans* Boiss. alliance with forwardly directed setulae along the leaf margins and thickened, elongated and erect fruiting pedicels.

In spite of close relationship, the following entities within the *G. adhaerens* group are presented here as species, a status which awaits further checking when more material becomes available.

* The statement in Boissier's Flora Orientalis to the contrary is incorrect!

† **G. brevifolium** Sibth. & Sm., Prodr. Fl. Graec. i, 95 (1806).
Syn.: *G. album* Vahl, Symbol. ii, 30 (1791)—non Garsault (1764, 1767), nec Miller (1768).
G. caudatum Boiss. Diagn. Ser. I (3), 48 (1843).

1a. Stems retrorsely aculeate, the bristles sometimes admixed with hairs towards the nodes 2

1b. Stems loosely hairy, without any hooked bristles. Corolla lobes acuminate with long aristae; fruits rather densely arranged, nearly smooth, only with minute papillae (fig. 7a) (Pamphylian and Cilician Taurus) *G. adhaerens* Boiss. & Bal.

2a. Corolla lobes not aristate, only acute; fruits ± glomerulate, nearly smooth, with only minute papillae (Aintab to Lebanon) *G. samuelssonii* Ehrendf.

a. Tall plants; stems somewhat fistulose with only relatively short lateral inflorescence branches; flowers very small, only about 1·5 mm. diam.; fruits densely glomerulate; sunny habitats var. *samuelssonii*

b. Lower plants, not climbing; stems more slender with many flexuose and elongated branches from the base; flowers larger, up to 3 mm. diam.; fruits not too densely arranged; ± shady rock crevices . . . . . . var. *pseudadhaerens* Ehrendf.

2b. Corolla lobes clearly aristate; fruits nearly always tuberculate or alate, rather loosely arranged. Flowers 2–3 mm. diam.; tall and ± divaricate-climbing plants with little basal branching 3

3a. Fruits with minute papillae and admixed larger tubercules (only rarely lacking) (fig. 7b) (southern foothills of Kurdic mountains) *G. haussknechtii* Ehrendf.

3b. Each of the mericarps with three low, undulate, longitudinal wings (fig. 7 c) (Anti-Taurus: Feke) . . *G. pterocarpum* Ehrendf.

Galium adhaerens Boiss. & Bal. in Boiss., Diagn. Ser. II (5), 106 (1856) (fig. 7a).

Typus: Haies du village de Bouloukli, près de Mersina (Cilicie), région chaude, 22 May 1855, *Balansa* 591 (iso. W).

TURKEY. Pamphylia, Kirkoz, 300 m., *Tengwall* 321 (S). Cilicien, Grugula-Tal (sic?), 1300 m., *Siehe* 245 (WU). Taurus Cilicicus, Bozanti supra Adana, 760 m., *Christian* a. 1917 (reduced form).

Typical *G. adhaerens* is easily recognized by the absolute lack of hooked hairs on the stems; whether the fruits are always minutely papillose like the type and the Pamphylian specimen remains to be verified.

Galium samuelssonii Ehrendf., **spec. nov.**

Affine *G. adhaerenti*; caules retrorsum aculeolati; corollae lobi acuti nec caudato-aristati; fructus agglomerati, paulum papillosi.

a. var. **samuelssonii.**

Caules elati, erecti, ± scandentes, crassiusculi, ramis floriferis brevibus; flores parvi, c. 1·5 mm. diam.

Typus: Amanus, inter Baghlama et Batrakem, inter frutices ad margines viae, c. 110 m., 26 Apr. 1933, *Samuelsson* 4058, *Wall* 26 Apr. 1933 (holo. and iso. S).

TRANSJORDAN. Umm-Qays (=Umm Keis), 350 m., fields, *Dinsmore* 11944 (S).

SYRIA. Qalaat—Samaan, 500 m., *Dinsmore* 14045 (S).

TURKEY. 30 km. south of Antiochia, c. 800 m., *Dinsmore* 3785 (S). Cassius, inter Yaila et Tchiflik, in saxosis calcareis, c. 900 m., *Samuelsson* 5305 (S). Syria borealis, inter urbem Aleppo et opp. Antakieh (Antiochia), in rupestribus calcareis prope pagum Tell Akibrin, c. 430 m., *Samuelsson* 3941, *Wall* 24 Apr. 1933 (S, ad var. b. vergens). Aintab, *Montbret* 1978 (W).

b. var. **pseudadhaerens** Ehrendf., **var. nov.**
Caules humiliores, graciles, a basi valde flexuosa-ramosi; flores maiores, 2·5–3 mm. diam.; inflorescentiae partiales fructiferae laxiores.

Typus: Turkey, Aintab, in fissuris rupium calc. 610 m., 29 Apr. 1865, *Haussknecht* (holo. W).

SYRIA. Dahr el Litani (inter partes australes montium Libanon et Antilibanon), solo calcareo, inter Zellaya et Yohmor, in lapidosis, c. 900 m., *Samuelsson* 4198, *Hafström* 30 Apr. 1933 (S, p.p. ad var. a. verg.).

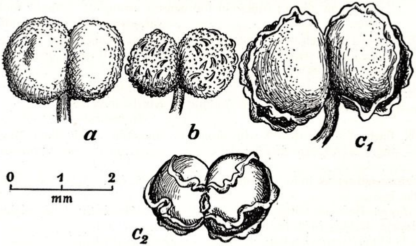

FIG. 7. Fruits of *Galium adhaerens* Boiss. & Bal. (a), *G. haussknechtii* Ehrendf., spec nov. (b), and *G. pterocarpum* Ehrendf., spec. nov. (c_1, side; c_2, top).

Though general habit, branching and flower size are quite different in the typical variety and var. *pseudadhaerens**, the occurrence of forms closely connecting the two extremes and the lack of a more general geographical separation strongly suggest that it is wisest at the moment not to consider these entities as species. Field studies and more material will be necessary before the final position (ecological variants, mere modifications) for these provisional varieties can be fixed. In spite of its plasticity, *G. samuelssonii* is nicely separated from the other entities of the *G. adhaerens* group by the lack of long corolla lobe appendages, the rather strong agglomeration of the fruits (at least in its typical form), their minutely papillose surface and by the retrorsely aculeate stems. Further collections will show whether the separation from *G. haussknechtii* bordering towards the N.E. is sharp enough to maintain the two as distinct species.

* Pictures of these varieties will appear in "Reliquiae Samuelssonianae" (Ehrendorfer 1958b).

Galium haussknechtii Ehrendf., **spec. nov.** (fig. 7b).

Affine *G. adhaerenti*; caules retrorsum aculeolati; fructus papillis et plerumque etiam tuberculis obsiti; corollae lobi caudato-aristati; inflorescentiae partiales fructiferae ± laxae.

Typus: Kurdistan, in Quercetis Pir Omar Gudrun, 1525 m., *Haussknecht* a. 1867 (holo. W).

TURKEY. Kurdistan: Shat, Daharakol Dağ, 1600 m., *Frödin* 119 (W). Kurdistan: Mardin, Senar, *Sintenis* 950 (S, WU: forma fructibus papillosis nec tuberculosis).

IRAQ. Jebel Baradost near Diana Rowandiz, *Field & Lazar* 917 (S).

G. haussknechtii occupies the eastern part of the general distributional area of the *G. adhaerens* group. The lack of tubercles on the fruits of the form from Mardin, situated towards the West, might suggest a tendency to approach *G. samuelssonii*.

Galium pterocarpum Ehrendf., **spec. nov.** (fig. 7c).

Affine *G. adhaerenti*; caules retrorsum aculeolati; mericarpia limbis albidis undulatis longitudinalibus 3-alata; corollae lobi caudato-aristati; inflorescentiae partiales fructiferae ± laxae.

Typus: Prov. Adana, distr. Feke: Sencan dere between Görumze and Süphandere, 100–1200 m., among shady metamorphic rocks, *Davis* 19606 (holo. E, iso. W).

TURKEY. In montibus Kassan Oghlu ad pagum Gorumse, in fruticetis versus fontes, 1220 m., *Kotschy* 173 (W, S).

This local new species of the *G. adhaerens* alliance from the Anti-Taurus has absolutely unique fruits within the genus: they are alate by three undulate seams or low wings running longitudinally down the mericarps and situated in a position where other species only develop slight bulges. Though already quite clearly visible on close inspection in the young stages of fruit development (as in *Kotschy* 173), this outstanding feature has been detected first in the splendid fruiting specimens collected by Davis in 1952.

Galium tricorne Stokes in With., Bot. Arr. Brit. Pl. ed. 2, i, 153 (1787).

TURKEY. Prov. Kayseri: nr. Develi, fallow field in steppe, *Davis* 19199 (E). In planitie Amuk inter montes Amanus et Kurd Dagh, *Haradjian* 924 (G). Kurd Dagh, Radjou—Meidan Ekbei, *Gombault* 2703 (S). Inter Alexandrette et Aintab, 330–1000 m., *Haradjian* 3952 (G). Balkis, 400 m., *Haradjian* 999 (G). Prope Aintab, 1000 m., *Haradjian* 4 (G).

IRAQ. Tigris plain near Kirkuk, 305 m., cultivated fields, *Low* 130 (BM).

Galium peplidifolium Boiss., Diagn. Ser. I (3), 46 (1843).

TURKEY. Taurus cilicicus, Bozanti supra Adana, 760 m., *Christian* (W). Prov. Adana, distr. Feke: Bakir dağ between Görumze and Süphandere (in Sencan dere), 1000–1200 m., *Davis* 19433 (W, E).

SYRIA. Prope Azaz, 500–700 m., *Haradjian* 4425 (G).

Galium floribundum Sibth. & Sm., Prodr. Fl. Graec. i, 94 (1806).

TURKEY. Prov. Antalya, distr. Gebiz: Kozlu dere N. of Bozburun dağ, gravel of dry river bed, *Davis* 15751 (W). Prov. Ankara (Galatia): Beyram, by a stream, in shade, *Davis* 13066 (W). Prov. Denizli (Caria): Boz dağ near Geyran Y., 1375m., *Davis* 13331 (W). Prov. Isparta, distr. Sütçüler (Pisidia): Dedegöl dağ between Daribuku and Selkoşe, metamorphic valley, *Davis* 15867 (W). Prov. Niğde: Hasan dağ above Taşpinar, 1400 m., rocky S. slopes, *Davis* 19036 (E); *ibid.*, 1600 m., *Davis* 18930 (E).

Galium nigricans Boiss., Diagn. I (3), 48 (1843).

TURKEY. Aintab, 20 Jun. 1882, *Post* (BM).

Galium verticillatum Danth. in Lam., Encycl. ii, 585 (1786).

TURKEY. Prov. Niğde: Hasan dağ above Taşpinar, 1400 m., rocky S. slope, *Davis* 19037 (W, E).

Galium murale (L.) All., Fl. Pedem. i, 8, t. 77–1 (1785).

Syn.: *Sherardia muralis* L., Sp. Pl. 149 (1753).

TURKEY. Ad pontem Mourad Pacha et in pascuis ad lacum Baleuk Göl, 50 m., *Haradjian* 4147 (G).

The following species belong to a group of *Galia* with perennial and annual members. The perennials are isolated chamaephytes and mostly chasmophytes with strongly woody rootstock, limited in their distribution to the Eastern Mediterranean, Sinai and Arabia. The number of elements in their whorls of leaves and stipules is variable, ranging from 2 (no stipules) to 4–6–8; the ovaries and fruits have an indumentum of straight, sometimes somewhat hooked or reduced and appressed hairs of different density on their backs, but mostly with glabrous zones* running along the joining points of the two mericarps; the pedicels are thin, often capillary and purplish; the flowers, small and of reddish-purplish to greenish colour. To this group belong *G. sinaicum* (Decne.) Boiss., *G. petrae* Hart, *G. exstipulatum* P. H. Davis, *G. jemense* Kotschy, *G. kahelianum* Defl., *G. cappadocicum* Boiss., *G. jungermannioides* Boiss. and the *G. graecum* L. —*G. canum* Req. group, including the new glabrescent *G. thiebautii* Ehrendf. (1958b) from the Lebanon (Chekka). Annual members of the group are *G. setaceum* Lam. s.l. and *G. cassium* Boiss. All these species together form the new section *Jubo-galium* Ehrendf. (1958c).

The *G. graecum*—*G. canum* group represents an enormously variable complex. While the two very different-looking basic species are well separated in spite of growing intermingled on Rhodes, they are connected by an array of most diversified intermediate forms in S.W. Anatolia, forms to which specific names like *G. dumosum* Boiss. and *G. lycium* Boiss. have been applied. *G. canum* occurs on Rhodes, Karpathos and some other small Aegaean islands and reappears in the eastern Taurus chains, but only closely allied forms have been found in S.W. Anatolia; populations in Cyprus and Syria-Lebanon represent other geographical subspecies. *G, graecum* is limited to Crete, Rhodes, some small eastern Aegaean islands and some localities in Caria. Especially on Crete a number of populations show strong influence of *G. canum* characters, but the transi-

* More or less hairy in very strongly tomentose forms like *G. canum* or *G. dumosum* and in *G. thiebautii*.

tions to *G. graecum* are complete. Statistical and graphical analyses of character combinations and the whole set-up of the group strongly suggest the following sequence of differentiation and secondary hybridization:

(1) Geographical separation between *G. graecum* in the West, *G. canum* in the East.
(2) Overlapping migrations.
(3) Effective internal isolation barrier on isolated smaller islands like Rhodes.
(4) Breaking down of the isolation in larger areas with possibilities for the establishment of introgressive forms as in Western Crete, where *G. graecum* has been strongly infiltrated by *G. canum*, or on the S.W. Anatolian mainland where the extremely polymorphic *G. dumosum* —*G. lycium* complex has practically absorbed the original entities.

Since the breaking down of the old land connections in the Eastern Mediterranean the whole complex gradually seems to have "frozen" to what it is today: a "fossil" hybrid complex. As a detailed monograph of this situation is in preparation (1957c), the present treatment is limited to an enumeration of the rich material collected by Dr. Davis on Karpathos (Dodecanese) and in Anatolia during 1947, 1949 and 1950.

Galium graecum L., Mant. 38 (1767).

TURKEY. Prov. Muğla, dist. Fethiye (Lycia): Minara, near Fethiye, rocks, *Davis* 13708 (W).

Galium canum Req. in DC., Prodr. iv, 602 (1830).

Syn.: *G. incompletum* Barbey in Stefani, Forsyth-Major & Barbey, Karpathos, III, tab. xi (1895).

DODECANESE. Karpathos (N). Vurgunda, 0–10 m., sea rocks, dry vertical or overhanging, *Davis* 18028 (W, E, K). Vurgunda, 100 m., near place called Akrotirias, *Davis* 18048 (W, E, K).

TURKEY. Prov. Adana, dist. Feke: between Süphandere and Belanköy, 1000 m., in Sencan dere, *Davis* 19567 (W, E); *ibid.*, 900 m., *Davis* 19542a* (E). Göksu gorge below Himmetli, dry S. cliffs, *Davis* 19866 (W, E). Amanus, prov. vic. Ekbès, 530 m., *Haradjian* 647 (G). Amanus, prov. vic. Harounié, 300–400 m., *Haradjian* 3545 (G).

Galium dumosum Boiss., Diagn. Ser. I (3), 44 (1843).

Syn.: *G. musciforme* Boiss., Diagn. Ser. I, (3), 44 (1843).
G. canum var. *musciforme* (Boiss.) Boiss., Fl. Or., iii, 66 (1875).
G. lycium Boiss., Diagn. Ser. I (10), 71 (1849).

This specific name will be used in future to designate all critical forms of the "fossil" hybrid complex connecting *G. canum* and *G. graecum* in S.W. Anatolia; for more detailed characterization of single specimens and populations samples an index method will be developed.

TURKEY. Prov. Muğla/Antalya: Girdev Göl, 1675 m., rocks, *Davis* 13768 (W, E). Prov. Antalya, dist. Gebiz (Pisidia): Bozburun dağ above Tozlu Çukur yayla, 1900–2100 m., rocks, *Davis* 15631 (W, E);Bozburun dağ, N. side, rocks, *Davis* 15687 (W, E). Prov. Antalya, dist. Elmali(Lycia):

* Together with *Galium davisii* Ehrendf., Davis 19542 b (E).

Yuva, rocks, *Davis* 13729 (W, E). Prov. Denizli (Caria): Taş Oçagi near Denizli, rocks, *Davis* 13261 (W, E); Boz dağ above Geyran yayla, rocks, *Davis* 16 Jul. 1947 (W); Babadağ, 610 m., shady limestone rocks, *Davis* 18411 (E, W). Prov. Konya: Bozkir Vadisi, cliffs, *Davis* 16603 (W, E). Prov. Mersin, dist. Anamur (Cilicia Trachea): Olucak between Ermenek and Anamur, 1500 m., *Davis* 16331 (W, E). Prov. Antalya, dist. Kemer (Lycia): Kesme boğaz near Kemer, *Davis* 14072 (W, E); Gönük, rocks *Davis* 15035 (W, E). (The last three gatherings all approach *G. canum**). Prov. Konya, dist. Ermenek (Isauria): Kamis dere (Ermenek—Oyuklu dağ), crevices in mouths of caverns, *Davis* 16182 (W, E).

Galium cappadocicum Boiss., Diagn. Ser. I (3), 43 (1843).

TURKEY. Prov. Malatya: Derende, 1065 m., limestone rocks, *Davis* 21853 (E).

Galium jungermannioides Boiss., Diagn. Ser. I (3), 43 (1843).

TURKEY. Prov. Adana, dist. Bahce: Düldül dağ Gökcayir and Atlik Yayla, 1000 m., on shady metamorphic rocks, *Davis* 16456 (W, E). Amanus: Düldül, 1700–2300 m., *Haradjian* 2425 (G). Amanus, prope vicum Harounié, 200–400 m., *Haradjian* 3601 (G).

This species has been previously known only from the Lebanon; the present specimens from the northern Amanus differ slightly by the presence of sparse ciliolate indumentum on the upper leaf surface towards the leaf bases, and in their more greenish flowers.

Galium setaceum Lam., Encycl. ii, 584 (1786) sensu lato.

A brief survey of the complex has been published (Ann. Naturhist. Mus. Wien, lvi, 236–238: 1948); a supplement will be found in my treatment of the *Rubiaceae* from Afghanistan (1958a).

subsp. **decaisnei** (Boiss.) Ehrendf. in Ann. Naturhist. Mus. Wien, lvi, 236–238 (1948).

Syn.: *G. decaisnei* Boiss., Diagn. Ser I (6), 69 (1845).

forma **lasiocarpum** Bornm. in Verh. Zool. Bot. Ges. Wien, lxviii, 596 (1898).

TURKEY. Prov. Adana, dist. Feke: Sencan dere nr. Görumze, 1300 m., *Davis* 19687 (W, E). Amanus, région d'Hassan Beyli, 1220–1520 m., *Haradjian* 2261 (G); Dere Bagtché, ca. 320 m., *Samuelsson* 3998, 5358, 5359 (S); infra Tchakallii, ca. 300 m., *Samuelsson* 3965 (S); Top Boghazi—Baghlama, c. 120 m., *Samuelsson* 4050 (S); Baghlama, *Wall* (S).

CYPRUS. Skarenou (distr. Larnaca), under Tamarix in river bed, *Davis* 2676 (E).

SYRIA. Djebel Ansarieh, pr. Massiaf, 650–850 m., *Haradjian* 3383 (G).

f. decaisnei.

TURKEY. Prov. Antalya, dist. Gebiz (Pisidia): above Kuzdere (in Kozlu dere), N. of Bozburun dağ, stony slopes in Pinus brutia forest, *Davis* 15841 (W).

Davis 15841 deviates from the typical form in its broader, narrowly oblanceolate leaves: the ovaries are beset with adpressed hairs.

* These collections from Antalya are now classified as *G. canum* subsp. *antalyenes* Ehrendf. (1958c).

Galium cassium Boiss., Diagn. Ser. I (10), 68 (1849).

TURKEY. Amanus, prope vic. Ekbès, 500–650 m., *Haradjian* 637 (G).

SYRIA. Djebel Ansarieh, Bahamra, 15 mi. a Latakieh orient., c. 330 m., *Haradjian* 2680 (G).

CRUCIATA Mill., Gard. Dict. abridged ed. 4 (1754)

Originally described in 1700 by Tournefort in his Institutiones Rei Herbariae, this genus was again accepted by Miller (1754) and Adanson (1763). By other authors it has usually been placed as a section under *Galium*, but the absolute isolation of the species belonging here strongly suggests the maintenance of their treatment as a separate genus. *Cruciata* contains perennial and more derived annual forms leading towards *Valantia*. Perennial are the group of *Cruciata chersonensis* and *C. coronata* (=*Galium cruciata* & *G. coronatum*) as well as the forms around *C. glabra**: annual are *C. pedemontana* and *C. articulata*.

Cruciata coronata (Sibth. & Sm.) Ehrendf., **comb. nov.**

Syn.: *Galium coronatum* Sibth. & Sm., Prodr., Fl. Graec. i, 90 (1 Jul. 1806) et Fl. Graec. ii, t. 125 (1813).
Valantia humifusa Willd. Sp. Pl. ed. 4, iv (2), 949 (1806).
Galium cruciata var. *angustifolium* Req. ex DC., Prodr. iv, 606 (1830) (holo. G!).

As long as there is no definite proof that *Valantia humifusa* Willd. was published earlier than *Galium coronatum* Sibth. & Sm., it seems preferable to adopt the epithet of the latter, which has been much more widely used and will obviate any confusion with *Galium* [*Asperula*] *humifusum* M. Bieb.

The *C. coronata* group has already been revised (as *Galium coronatum* sens. lat., in Ann. Naturhist. Mus. Wien, lvi, 238–244: 1948) and a sketch given of the distribution of the diverse intraspecific entities. The pattern of differentiation of this group—apart from the closely related *C. taurica*†, and the eastern *C. coronata* subsp. *persica*—is rather irregular and therefore it is advisable to apply only varietal rank to its racial constituents. As a result of accepting the genus *Cruciata*, new combinations for these entities are now required. These are followed by a key for their identification and a list of new collections.

subsp. **coronata.**

Syn.: *Galium coronatum* Sibth. & Sm. sens. strict.; Ehrendf. in Ann. Naturhist. Mus. Wien, lvi, 239 (1948).

var. **glaberrima.**

Syn.: *Galium coronatum* var. *glaberrimum* DC., Prodr. iv, 605 (1830); Ehrendf. l.c. 244.

var. **euboea** (Ehrendf.) Ehrendf., **comb. nov.**

* **Cruciata glabra** (L.) Ehrendf., **comb. nov.**
Syn.: *Valantia glabra* L., Sp. Pl. ed. 2, 1491 (1763).
Galium vernum Scop., Fl. Carn. ed. 2, ii, 99 (1772).

† **Cruciata taurica** (Pallas) Ehrendf., **comb. nov.**
Syn.: *Valantia taurica* Pallas in Nov. Act. Petrop. x, 315 (1797).
Galium tauricum (Pallas) Roem. & Schult., Syst. Veg. iii, 250 (1818).

Syn.: *Galium coronatum* var. *euboeum* Ehrendf., l.c. 240 (1948).

var. **coronata**

Syn.: *Galium coronatum* var. *bithynicum* Ehrendf., l.c. 240 (1948).

var. **occidentalis** Ehrendf., **var. nov.**

Caules glabri, ± alti, foliis basalibus confertis; bracteae florales ciliolatae vel glabrescentes.

Syn.: "*Kahle westanatolische* Formen" Ehrendf., l.c. 240.

Typus: Phrygia, Akscheher, in reg. alp. mont. Sultan Dagh, *Bornmüller* 4544 (holo. W).

var. **isophylla** (Boiss.) Ehrendf., **comb. nov.**

Syn.: *Galium coronatum* var. *isophyllum* Boiss., Fl. Or. iii, 80 (1875); Ehrendf., l.c. 241.

var. **laxa** (Thiéb.) Ehrendf., **comb. nov.**

Syn.: *Galium coronatum* var. *laxum* Thiéb. Fl. Lib.-Syr. ii, 189 (1940).
G. coronatum var. *syriacum* Ehrendf., l.c. 241 (1948).

var. **diversifolia** (Ehrendf.) Ehrendf., **comb. nov.**

Syn.: *Galium coronatum* var. *diversifolium* Ehrendf., l.c. 241.

var. **cilicica** (Ehrendf.) Ehrendf., **comb. nov.**

Syn.: *Galium coronatum* var. *cilicicum* Ehrendf., l.c. 241.

var. **anatolica** (Ehrendf.) Ehrendf., **comb. nov.**

Syn.: *Galium coronatum* var. *anatolicum* Ehrendf., l.c. 243.

var. **mesopotamica** (Ehrendf.) Ehrendf., **comb. nov.**

Syn.: *Galium coronatum* var. *mesopotamicum* Ehrendf., l.c. 243.

subsp. **persica** (DC.) Ehrendf., **comb. nov.**

Syn.: *Galium persicum* DC., Prodr. iv, 605 (1830).
G. coronatum subsp. *persicum* (DC.) Thiéb., Fl. Lib.-Syr. 190 (1940); Ehrendf., l.c. 239.

var. **persica.**

var. **pilosa** (Ehrendf.) Ehrendf., **comb. nov.**

Syn.: *Galium coronatum* var. *pilosum* Ehrendf. l.c. 240.
? *Galium sosnowskyi* I. Mand. ex Grossh., Fl. Kavk. ed. 2, 249 (1949).

1a. Vegetative shoots rather short with small and one-nerved, often narrow leaves (Euboea, Samos, Anatolia to Caucasus, Syria to Lebanon and Iraq) . . . . subsp. *coronata*

2a. Stems absolutely glabrous, densely leafy towards base:

3a. Plants absolutely glabrous with thickened floral bracts (Euboea, Mt. Dirphys=Delphi) . . . . . . var. *euboea*

3b. Margin of bracts and peduncles ciliolate; condensed plants; (Bithynian Olympus) . . . . . var. *coronata*

3c. Margins of bracts ciliolate to glabrescent; stems taller (Samos, S.W. Anatolia) . . . . . . var. *occidentalis*

2b. Stems usually ± hairy, at least towards the base:

4a. Stems and leaves ± densely hirsute with straight hairs:

5a. Floral bracts rather small, not turning purplish; often relatively weak plants:

6a. Leaves of fertile and vegetative shoots similar [broadly] ovate (S.W. Anatolia) . . . . . var. *isophylla*

6b. Leaves of vegetative shoots smaller, ovate-elongate; (Southern central Taurus to Lebanon and Anti-Lebanon) var. *laxa*

6c. Leaves of vegetative shoots ± narrowly lanceolate (Inner Taurus from S.W. Anatolia to Lake Van, Amasia) var. *diversifolia*

5b. Floral bracts very large, pale yellow, turning purplish; tall plants (Cilician Taurus) . . . . var. *cilicica*

4b. Stems puberulent with short, ± curved hairs or glabrescent, leaves mostly glabrescent or glabrous. Often taller, robust plants:

7a. Stems stiffly erect; fruits ± puberulent, leaves of vegetative shoots not longer than 12 mm. (N. and Central Anatolia) var. *anatolica*

7b. Fruits glabrous; stems more glabrescent, often slender; (N.E. Anatolia to Transcaucasus and (?) Caucasus). var. *glaberrima*

7c. Fruits puberulent; tall and robust plants with coriaceous leaf texture and narrowly lanceolate leaves (–20 mm. long) on the vegetative shoots (N. Iraq, Syria, Lebanon) var. *mesopotamica*

1b. Vegetative shoots very strongly developed with broadly elongate 3-nerved leaves, up to 25 mm. long (N., W. and S. Iran, with adjacent Anatolia and Iraq) . . . . subsp. *persica*

8a. ± glabrous. . . . . var. *persica*

8b. Leaves and ovaries hirsute (Elburs, Hakkari) . . var. *pilosa*

TURKEY. Prov. Muğla, dist. Köyceğiz (Caria): Sandras dağ, Gökce ova, 1400 m., *Davis* 13532 (W—var. *occidentalis*). Prov. Isparta, dist. Sütçüler (Pisidia): Dedegöl dağ above the tarn, 2800–2900 m., *Davis* 16008 (W—var. *occidentalis*): Dedegöl dağ at Taş Oluk yayla, scree by late snow pockets, 2100 m., *Davis* 15998 (W—var. *isophylla*). Prov. Antalya, dist. Kemer (Lycia): Tahtali dağ, scree, 2100 m., *Davis* 15067 (W—var. *isophylla*). Prov. Antalya (Pisidia): Bozburun dağ above Tozlu Çukur yayla, 19–2200 m., scree under cliff, *Davis* 15625 (W—var. *diversifolia*). Prov. Mersin, dist. Anamur (Cilicia trachea): between Beşkuyu and Çamurlu yayla, *Davis* 16282 (W—var. ?). Prov. Maraş, dist. Çardak: Berit dağ above Arpa Çukuru yayla, 2700 m., scree, *Davis* 20323 (W, E—var. *laxa*). Amanus, 1800 m., *Haradjian* 726, 729 (G—var. *laxa*). Amanus, in monte Doumanli, 230–400 m., *Haradjian* 2733 (G—var. *laxa*). Amanus, reg. Hassan Beyli, 1300–1700 m., *Haradjian* 2273 (G—var. *laxa*). Prov. Konya: Cihanbeyli, steppe N. of village, *Davis* 18602 (E—var. *anatolica*). Çankiri, 800 m., gypsaceous hills, *Davis* 21505 (E—var. *anatolica*). Prov. Niğde, Hasan dağ above Taşpinar yayla, 2200 m., *Davis* 18937 (W, E—var. *glaberrima*). Prov. Kayseri/Malatya: W. side of pass between Pinarbasi and Gürün, 1830 m., steppe, *Davis* 21977 (W, E—var. *anatolica* verg. ad var. *diversifoliam*). Prov. Kayseri: Bakir dağ above Kisge, 1400 m., *Davis* 19287 (E, W—var. *glaberrima*). Prov. Bitlis: Süphan dağ above Adilcevaz, 3960 m., steep bare screes near snow, *Davis* 24672 (E, W—var. *glaberrima* verg. ad var. *diversifoliam*). Ad radices Akher dağ pr. Marache, 900 m., *Haradjian* 1504 (G—var. *mesopotamica*). Balkis, 400 m., *Haradjian* 1012, 1013 (G—var. *mesopotamica*). Prov. Bitlis: Karz dağ above Kotum, 1980 m., rocky slope, *Davis* 22238 (W, E—subsp. *coronata*). Prov. Hakkari: Cilo dağ, 10 km. W. of Cilo Tepe, 3660 m., scree, *Davis* 24203 (W, E—subsp. *persica*, p.p. var. *pilosa*). Prov. Bitlis: Kambos dağ above Hürmüz, 2340 m., *Davis* 23480 (E—subsp. *persica*). Prov. Van, dist. Şatak: Kavuşşahap dağ, rocky slope, *Davis* 23147 (E—subsp. *persica* var. *pilosa*).

IRAQ. Kurdish hills near Rayat, 1830 m., *Nus Ahow* 207 (BM—subsp. *persica*).

IRAN. Bicheh, 1200 m., 19 May 1937, *Köie* (K, W—subsp. *persica*). Bordsch, 2100 m., 16 Jun. 1937, *Köie* (K, W—subsp. *persica*). Fars, Dena, Sicani pass, 1 Aug. 1949, *Behboudi* (W—subsp. *persica*).

LEBANON/SYRIA. Antilebanon, Ouadi-el-Qarn, ad exitum orient., ad radices rup. calc., c. 1150 m., *Samuelsson* 1470 (S); *ibid.*, in glareosis calc. c. 1300 m., *Samuelsson* 1728, *Wall*, *Hafström* (S—var. *mesopotamica*). Antilebanon, Bloudan, in colle stepposo, 15–1650 m., *Samuelsson* 4864, *Wall* (S—var. *mesopotamica*). Coelesyria, Baalbek, in glareosis vineti, c. 1150 m., *Wall* (S—var. *mesopotamica*). Lebanon, summit of Sanin, *Post* 879 (BM). Lebanon, cedretum supra Bcharré, *Hafström* (S—var. *laxa*, p.p. var. *mesopotamica*). Lebanon, Foum-el-Mizhab, supra cedros, in lapidosis calc., c. 2400 m., *Samuelsson* 2315 (S—var. *laxa*). Lebanon, Arz Er Rab, loco umbroso cedreti, c. 1925 m., *Wall*, *Samuelsson* 2262, 2263 (S—var. *laxa*, p.p. var. *mesopotamica*). Hermon, *Post* 1007 (BM—var. *laxa*).

Cruciata chersonensis (Willd.) Ehrendf., **comb. nov.**

Syn.: *Valantia cruciata* L., Sp. Pl. 1052 (1753).
Galium cruciata (L.) Scop., Fl. Carn. ed. 2, 100 (1772).
Valantia chersonensis Willd., Sp. Pl. ed. 4, iv, 951 (1806).

TURKEY. Amanus, in monte Doumanli, 230–400 m., *Haradjian* 3668 (G). Amanus, reg. Hassan Beyli, 1700–2300 m., *Haradjian* 2369 (G).

Cruciata pedemontana (All.) Ehrendf., **comb. nov.**

Syn.: *Galium pedemontanum* All., Auct. Fl. Pedem. 2 (1789).

TURKEY. Prov. Ankara: Ravli—Kalecik, 1000 m., water meadow with Bromus, *Davis* 21404 (E). Prov. Niğde: Hasan dağ below Taşpinar yayla, 1900 m., in Quercus forest, *Davis* 19007 (E); *ibid.*, 1600 m., grassy places, *Davis* 18908 (E). Prov. Adana, dist. Feke: Sencan dere Görumze, 1300 m., *Davis* 19667 (E).

Cruciata articulata (L.) Ehrendf., **comb. nov.**

Syn.: *Valantia articulata* L., Sp. Pl. 1052 (1753).
Galium articulatum (L.) Roem. & Schultes, Syst. Veg. iii, 250 (1818).
Valantia pusilla Stev. in Mém. Soc. Nat. Mosc. vii, 274 (1829) (holo. G!).

TURKEY. Çankiri, 800 m., gypsum hills, *Davis* 21525 (W, E).

SHERARDIA L., Sp. Pl. 102 (1753)

Sherardia arvensis L., Sp. Pl. 102 (1753).

TURKEY. Amanus, *Haradjian* 197 (G). Balkiz prope flumen Euphratem, 400 m., *Haradjian* 1007 (G). Ad pontem Mourad Pacha et in pascuis ad lacum Baleuk Göl, 50 m., *Haradjian* 4211 (G).

SYRIA. Djebel Ansarieh, Aïn Halakim, 850–1000 m., *Haradjian* 3476 (G). Djebel Ansarieh, Bhamra, 15 mi ab opp. Latakieh orient., 330 m., *Haradjian* 2772, 2813 (G).

IRAQ. Kurdish Hills, 850 m., *Low* 140 (BM).

CALLIPELTIS Stev. in Mem. Soc. Nat. Mosc. vii, 275 (1829)

Callipeltis cucullaris (Jusl.) Rothm. in Fedde, Rep. l, 72 (1941).

Syn.: *Valantia cucullaris* Jusl. in Linn., Cent. Pl. i, 33 (1755).

TURKEY. Prov. Niğde: Hasan dağ above Taşpinar, 1600 m., *Davis* 18927 (E). Aintab, *Haradjian* 1326 (G); *ibid.*, 100 m., *Haradjian* 141 (G). Kurd Dagh, 1300–1700 m., *Haradjian* 1158 (G).

SYRIA. Djebel Semaan, 500 m., *Haradjian* 2613 (G).

IRAQ. Tigris Plain, 215 m., near river, *Low* 285 (BM).

Callipeltis aperta Boiss. & Buhse is but a form with open (not folded) floral bracts and has to be classified as **Callipeltis cucullaris f. aperta** (Boiss. & Buhse) Ehrendf., **comb. nov.** (cf. 1958a).

INDEX OF NAMES

(*Synonyms are in italics, main references in bold type*)