

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF
HARVARD UNIVERSITY.

NEW SERIES.—LXXIII.

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I. Records preliminary to a general Treatment of the <i>Eupato-</i> <i>riaceae</i> ,—IV. By B. L. ROBINSON	3
II. New Plants collected by Mrs. Richard C. Curtis in Portu- guese West Africa. By I. M. JOHNSTON	31
III. On some South American <i>Proteaceae</i> . By I. M. JOHNSTON	41
IV. Studies in the <i>Boraginaceae</i> ,—III. By I. M. JOHNSTON. .	42
1. The Old World Genera of the <i>Boraginoideae</i>	42
2. Notes on miscellaneous American <i>Boraginaceae</i> . .	73

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Euplassa pinnata (Lam.), comb. nov. *Roupala pinnata* Lam. Encyc., Tab. i. 243 (1791). *E. meridionalis* Salisb. in Knight, Prot. 101 (1809). *Adenostephanus guyanensis* Meisn. in Mart. Fl. Brasil. v. pt. 1, 95 (1855).

Roupala monosperma (R. & P.), comb. nov. *Embothrium monospermum* R. & P. Fl. Peruv. i. 63, t. 98 (1798). *R. peruviana* R. Br. Trans. Linn. Soc. ser. 1, x. 192 (1811).

IV. STUDIES IN THE BORAGINACEAE.—III.

BY IVAN M. JOHNSTON.

1. THE OLD WORLD GENERA OF THE BORAGINOIDEAE.

WITH the object of furnishing substantial foundation for phylogenetic speculations concerning the American eritrichioid borages, a study was recently undertaken of the Asiatic genera of the tribe *Eritrichieae*. This raised so many doubts concerning the naturalness of the currently accepted classification of the tribe, that it was finally found advisable to review all the Old World genera of the subfamily *Boraginoideae* in order that certain peculiar genera might be satisfactorily placed tribally. The results of this study of generic and tribal lines, consisting of new generic keys, generic bibliography, and various systematic and taxonomic notes, are presented in this paper. The work was done wholly in the library and upon the rich boraginaceous collections of the Gray Herbarium. Through the courtesy of Dr. W. R. Maxon, however, I have had the privilege of studying certain very helpful material contained in the United States National Herbarium.

The system of tribal classification suggested in this paper finds its justification in the observation, that from the *Lithospermeae*, through the *Eritrichieae*, to the *Cynoglosseae* there is a group of roughly concomitant morphological trends. The most evident of these is for the nutlets to shift from a basal or abradicular attachment, through a lateral one, to an attachment that is apical or adradicular; for the nutlets to change from usually smooth and rounded towards commonly margined and roughened or appendaged; and for the lobed or divided style and two stigmas to tend towards a simple style and solitary stigma. It is also a notable fact that corolla-structures, variable in the *Lithospermeae*, tend to become rather uniform in the *Cynoglosseae*, whereas the nutlets act in directly the opposite manner. The tribe *Anchuseae* is a natural group, appearing to represent an off-shoot from the *Lithospermeae*, and does not seem to belong to the phylogenetic line terminating in the *Cynoglosseae*.

In the past the tribes have been defined entirely upon the basis of nutlet-attachment. Though this has thrown the genera into more or less homogeneous tribes, it has tended to separate from the groups to which they naturally belong such genera as *Bothriospermum*, *Trigonotis*, *Myosotis*, etc., which are aberrant in nutlet-structures, and has made it difficult for those not thoroughly acquainted with the plants to place tribally such genera as *Mertensia*, *Plagiobothrys*, *Antiphytum*, etc., which are more or less ambiguous in the crucial nutlet-characters. In placing the genera in the present system I have tried to balance the number and nature of the structural agreements with those of disagreement, and after grouping the genera in the manner which seems most natural have then tried to discover the character or characters which distinguish or commonly indicate the tribal groups formed. No single character was discovered which would invariably indicate the tribes, since, as is usually the case in such a variable natural group, the component elements, while agreeing in many details, all show the common tendency of departing individually and unexpectedly in one character or another from the condition perhaps otherwise uniform and diagnostic of the group. The chief fault with the current classification results from the lack of recognition of this well known fact. Nutlet-attachment, while diagnostic in the main, appears susceptible to the same aberrancies as the other characters, and it therefore seems advisable to attempt the use of several characters, rather than one, in determining the natural tribal positions of the genera treated. The tribes of the *Boraginoideae* and the Old World genera may be distinguished as follows:—

LITHOSPERMEAE.

Nutlets erect, straight (or bent in *Alkanna*), smooth or verrucose, unmarginated; areola basal or occasionally suprabasal, near tip of cotyledon, unmarginated, flat or nearly so, not at all strophiolate; gynobase flat or low-pyramidal, not excavated; style cleft or entire; stigmas 2 (or 4 in *Arnebia* sp.), distinct or proximate or rarely fused, capitate or obscurely thickened; corolla yellow or orange or occasionally white or somewhat purplish.—As here defined the tribe is in its broadest sense and includes those genera with more or less irregular corollas which have been grouped to form the tribe *Echieae*. The development of zygomorphy furnishes no substantial basis for the recognition of a fifth tribe, for between the conspicuously irregular corollas of certain *Echiums*, and the regular corollas of typical *Lithospermums*, there is every intermediate stage of irregularity. *Echium italicum*

has regular or subregular corollas, and in a number of the *Echiums* of the section *Lobostemon* the corolla is also regular or practically so. Even in the restricted *Lithospermeae* there is a tendency towards zygomorphy. It is slightly developed in *Macromeria*, and more so in *Megacaryon* and *Echiochilon*. On account of its noticeable development in the last two genera, and despite their certain relations with the restricted *Lithospermeae*, they have been forced into the *Echieae*. Zygomorphy is sporadic in the *Boraginoideae*, and there seems no good reason why its several occurrences in the *Lithospermeae* should characterize a special tribe when the corolla-irregularities of *Lycopsis* in the *Anchuseae*, and *Caccinia* in the *Cynoglosseae* go unrecognized. As the vegetative and fruiting structures of the *Lithospermeae* and the *Echieae* are quite similar, it seems best, especially since zygomorphy in the *Echieae* is probably polyphyletic, to combine the two tribes as is done in this paper. With the disappearance of the *Echieae* the four remaining tribes of the subfamily, like the subfamilies themselves, are all definable without reference to corolla-structures and entirely upon the characters of the pistil, particularly the attachment of the nutlets, the shape of the gynobase, and the number and relations of the stigmas. The endemic American genera referable to the *Lithospermeae* are *Macromeria*, *Lasiarrhenum*, *Onosmodium*, *Antiphytum*, *Moritzia*, and *Thaumatocaryon*. Concerning the correct tribal position of the last three genera there is still some doubt.

KEY TO GENERA OF LITHOSPERMEAE.

- Stamens deeply sagittate, auricles frequently tailed; corolla somewhat cylindrical or globose with very short broad lobes.
 Nutlets confluent to form two 2-celled nutlets; leaves amplexicaul; plant glabrate, green.....1. *Cerinthe*.
 Nutlets all distinct and single-celled; leaves narrowed to their attachment, never amplexicaul; plant conspicuously pubescent, more or less canescent.
 Corolla more or less cylindrical, not inflated towards the base; filaments slender.....2. *Onosma*.
 Corolla somewhat globose, with 5 saccate inflations near base; filaments broadened and thickened above attachment.....3. *Maharanga*.
 Stamens not conspicuously sagittate; corolla only exceptionally cylindrical, lobes well developed.
 Anthers apically with a subulate prolongation, this connivent about the style.
 Filaments dorsally inflated.....4. *Cystostemon*.
 Filaments not at all inflated.....5. *Vaupelia*.
 Anthers obtuse or merely mucronate at apex.
 Corolla regular or practically so.
 Nutlets strongly bent below the middle, arching over the somewhat convex gynobase, usually somewhat stipitate due to a constriction just above the basal areola.....6. *Alkanna*.

- Nutlets straight or practically so, substipitate only in *Sericostoma*.
 Throat of corolla appendaged or obviously pubescent or both.
 Stamens attached at unequal heights in the pubescent corolla-tube.....7. *Aipyanthus*.
 Stamens attached at equal heights.
 Throat of corolla conspicuously villous and more or less closed by the pubescence.....8. *Sericostoma*.
 Throat of corolla not notably villous and not obscured by the pubescence.
 Nutlets cornute-acuminate; foliage ample, herbaceous; corolla conspicuously pubescent in the tube, faucal appendages or downy areas not developed.....9. *Ancistrocarya*.
 Nutlets rounded or obtusely conical at apex; leaves narrow, firm; corolla with faucal protuberances or pubescent or with glandular areas.....10. *Lithospermum*.
 Throat of corolla glabrous or glabrate; corolla appendaged or pubescent inside only at very base if at all.
 Style and stamens protruded at least past corolla-sinuses and usually much beyond.....11. *Moltkia*.
 Style and stamens not reaching corolla-sinuses.
 Corolla longitudinally plicate within below, about half length of very elongate linear calyx-lobes; biennial.....12. *Macrotomia*.
 Corolla not plicate, always exceeding calyx; annual or perennial.....13. *Arnebia*.
 Corolla manifestly irregular.
 Corolla transversely plicate in throat; anthers somewhat sagittate; filaments equal and borne at equal heights in corolla.....14. *Zwackhia*.
 Corolla not plicate in throat; anthers oblong or ovate; filaments commonly unequal and borne at unequal heights in the corolla.
 Style and stamens short, included, not evident.....15. *Echiochilon*.
 Style and filaments usually long, evident, protruded from the corolla or nearly so.
 Nutlets smoothish and rounded, very large; rank herbs with fruiting calyx 2-3 cm. long.....16. *Megacaryon*.
 Nutlets tuberculate and somewhat angulate; herbs or shrubs with fruiting calyx 13 mm. long or less..17. *Echium*.

1. **Cerinthe** [Tourn.] L. Sp. Pl. 136 (1753); Gen. Pl. 66 (1754).

A very natural genus of 4 or 5 species, occurring in the Mediterranean Region and in Central Europe. The 2-celled nutlets characteristic of this genus are evidently the result of the confluence of 2 distinct nutlets, since in some species the line of fusion and the distinct apices of the conjoined nutlets are readily discernible. Although recently treated by me, Contr. Gray Herb. n. s. lxx. 5 (1924), as of the *Eritrichieae*, the genus is indubitably an immediate relative of *Onosma* and hence belongs to the *Lithospermeae*.

2. **Onosma** L. Sp. Pl. ed. 2, 196 (1762); Gen. Pl. ed. 6, 76 (1764).

Colsmannia Lehm. Mag. Ges. Naturf. Berlin viii. 92, t. 4 (1818); Asperif. ii. 356 (1818). *Podonosma* Boiss. Diag. ser. 1, xi. 113 (1849); Fl. Orient. iv. 178 (1875).—A large natural genus of the Mediterranean Region and western Asia. *Onosma syriacum* agrees with the other species of the genus in its flowers and habit, but differs in having incurved nutlets that are apparently joined laterally to a pyramidal gynobase. The genus *Podonosma* was erected for this species. It may be worthy of recognition.

3. **Maharanga** A. DC. Prodr. x. 71 (1846).

A genus closely related to *Onosma*, but readily separated by its saccate corolla. It occurs in Nepal and Sikkim and contains 2 closely related species, *M. Emondi* (Wall.) A. DC. and *M. Wallichianum* A. DC.

4. **Cystostemon** Balf. f. Proc. Royal Soc. Edinb. xii. 82 (1883); Trans. Royal Soc. Edinb. xxxi. 186, t. 56 (1888).

A remarkable genus containing one species, *C. socotranus* Balf. f., a very distinct endemic of Socotra.

5. **Vaupelia** Brand in Fedde, Repert. xiii. 82 (1914).

A genus of 7 species, ranging from southwest Africa to Arabia. The members of the genus have a remarkable habital similarity to *Trichodesmia*, and most of its species have been transferred from that genus. As pointed out by Brand, however, its relations are clearly with *Cystostemon*, from which it differs only in the form of the filament.

6. **Alkanna** Tausch, Flora vii. 234 (1824).

Baphorhiza Link, Handb. i. 578 (1829). *Campylocaryum* DC. in Meisner, Gen. i. 280; ii. 189 (1840). *Camptocarpus* C. Koch, Linnaea xvii. 304 (1843).—About 25 species in the Mediterranean Region and western Asia. Although commonly referred to the *Anchuseae* the species of this genus have nutlets lacking a broadly rimmed areola and plug-shaped strophiola, and have a habit somewhat different from the other members of that tribe. It seems best referred to the *Lithospermeae*, since, as shown by the direction of the funicle and the bent seed, the nutlets are in fact basally attached. Although attached by the morphological base, the sharp bend at the middle of the nutlet gives an impression of a lateral attachment. The areola,

which is substipitate and slightly oblique, is attached to a convex gynobase.

7. **Aipyanthus** Stev. Bull. Soc. Nat. Moscou xxiv.
pt. 1, 599 (1851).

A single species, *A. echiioides* (L.) Stev., growing at high altitudes in western Asia. Commonly referred to *Macrotomia*, but differing in having the corolla-tube pubescent within, and in having the stamens placed at unequal heights on the corolla. It differs also in habit.

8. **Sericostoma** Stocks in Wight, Icones iv. pt. 2, 14,
t. 1377 (1850).

Species above 5, all of restricted range, and occurring in western India, Persia, Arabia, and Somaliland, usually at no great distance from the ocean. *Sericostoma pauciflorum* Stocks, *S. strigosa* Deffl., and *S. verrucosum* Beck have nutlets with a suprabasal substipitate attachment. I have seen no fruit of *S. Kotschyi* (Boiss.) Benth. or *S. albidum* Franch. The genus departs from the *Lithospermeae* in its nutlets and pyramidal gynobase, but its corolla, style, habit, and range emphasize its relations in that tribe.

9. **Ancistrocarya** Maxim. Bull. Acad. St. Petersb. xvii.
443 (1872).

With a single species, *A. japonica* Maxim., from Japan. Evidently related to *Lithospermum*, but differing in its broad veined foliage, acuminate nutlets, and densely pubescent corolla-tube.

10. **Lithospermum** [Tourn.] L. Sp. Pl. 132 (1753);
Gen. Pl. 64 (1754).

Buglossoides Moench, Meth. 418 (1794). *Aegonychon* S. F. Gray, Nat. Arrang. Brit. Pl. ii. 354 (1821). *Rhytispermum* Link, Handb. i. 579 (1829). *Margarospermum* Reichb. in Spach, Hist. Nat. Veg. Phaner. ix. 31 (1840); Decne. in Jacquemont, Voy. Ind., Bot. 122 (1844).—A polymorphous genus of 50 to 60 species, about 10 in South Africa and about the same number in Eurasia, the remainder in America. The American species find their nearest relations in South Africa, and in Japan and adjacent Asia. The shrubby Mediterranean species, usually referred to *Lithospermum*, appear to be generically distinct, and seem best placed in the *Anchuseae*.

11. **Moltkia** Lehm. Neu. Schrift. Naturf. Ges. Halle iii. pt. 2, 3 (1817).

A genus of 8 species, 6 in the Balkans and Near East, one in the Himalayas, and one widely distributed in the deserts of northern Africa and southwestern Asia. The genus is taken here as defined by Wettstein, Oesterr. Bot. Zeitschr. lxxvii. 367 (1918). The plant current as *Lithospermum callosum* fits best into *Moltkia*, but in habit and slightly irregular corollas it is aberrant. The lobes of the corolla of *M. callosa* (Vahl) Wetts. are a trifle irregular and two of the lower stamens are usually shorter than the others. It seems best to leave the plant in *Moltkia*, however, since its distinctive characters are not positive.

12. **Macrotomia** DC. in Meisner, Gen. i. 281; ii. 190 (1840).

Leptanthe Klotzsch, Bot. Ergenb. Reise Prinz Waldemar 95, t. 63 (1862).—Containing a single species, *M. Benthami* (Wall.) DC., which occurs in the western Himalayas. From *Arnebia*, its closest relative, *Macrotomia* differs in its characteristic biennial habit, in its short corollas much exceeded by the calyx-lobes, and in the longitudinal plication that marks the lower side of the corolla-tube. As *Macrotomia* has been usually defined it is patently unnatural, since the three species referred to it represented as many genera, and in other than tribal characters agree only in a rank habit of growth. *Macrotomia echiioides* is here referred to *Aipyanthus*, and *M. cephalotes* is transferred to *Arnebia*.

13. **Arnebia** Forsk. Fl. Aegypt. 62 (1775).

Dioclea Spreng. Syst. i. 502 and 556 (1825). *Strobila* Don, Gen. Syst. iv. 327 (1837). *Meneghinia* Endl. Gen. 648 (1838). *Stenosolenium* Turcz. Bull. Soc. Nat. Moscou xiii, pt. 2, 253 (1840). *Munbya* Boiss. Diag. ser. 1, xi. 114 (1849). *Toxostigma* A. Rich. Ten. Fl. Abyss. ii. 86, t. 77 (1851).—A large polymorphous genus centering in western Asia. It is well characterized by its herbaceous habit, included stamens and style, and corolla with glabrous tube and unappendaged throat. There seems no good reason why the plants passing as *Macrotomia cephalotes* (DC.) Boiss. and *M. euchroma* (Royle) Hook. f. & Thoms. should not be referred to *Arnebia*. Both differ in habit and floral characters from *Macrotomia Hookeri*, the type of its genus, and both lack structural characters by which they can be distinguished from *Arnebia*. The former was originally described as *Arnebia cephalotes* by De Candolle, and is notable only

because of its coarse habit and large flowers. It seems merely a glorified member of its genus. There is even less reason for excluding *M. euchroma* from *Arnebia*, since it differs from the members of that genus only in its coarser habit of growth. Its relations seem so obvious that the following combination appears entirely justified.

Arnebia euchroma (Royle), comb. nov. *Lithospermum euchromon* Royle acc. Benth. in Royle, *Illust.* i. 305 (1839); DC. *Prodr.* x. 82 (1846). *Macrotomia euchroma* Hook. f. & Thom. acc. Clarke, Hook. *Fl. Brit. India* iv. 177 (1883); Paulsen, *Bot. Tidssk.* xxvii. 216 (1906). For further synonymy see Lipsky, *Act. Hort. Petrop.* xxvi. 505 (1910).

14. ***Zwackhia*** Sendtn. in Reichb. *Icon. Fl. Germ.* xviii. 65, t. 115 (1858).

Halacsya Dörfler, *Allgem. Bot. Zeitschr.* 1903, pg. 46 (1903).—A single species, *Z. Sendtneri* (Boiss.) Maly., in Jugo-Slavia. Although with an irregular corolla the relations of the plant seem to be with *Lithospermum* or *Moltkia*, cf. Wettstein, *Oesterr. Bot. Zeitschr.* lxvii. 365 (1918), rather than with *Echium*, the genus with which it has been usually associated.

15. ***Echiochilon*** Desf. *Fl. Atlant.* i. 166, t. 47 (1800).

Chilochium Raf. *Ann. Gen. Soc. Phys.* viii. 269 (1821). *Exioxylon* Raf. *Fl. Tellur.* iv. 85 (1838). *Leurocline* S. Moore, *Jour. Bot.* xxxix. 257, t. 424, fig. 1, (1901).—Six species in Africa and southwestern Asia. There seems to be no valid reason for recognizing *Leurocline*. All the species referred to *Leurocline* and to *Echiochilon* have a similar rather odd, bilabiate corolla, and short included stamens that are borne at unequal heights in the hairy throat of the corolla. The bracteate inflorescence and irregular calyx is common to all, in addition to a common general aspect. The range of the enlarged *Echiochilon* is thoroughly natural. The difference in nutlet-attachment that is supposed to distinguish the two genera does not seem to be borne out in fact. *Leurocline* is said to be distinguished from its relative by having its nutlets "fixed by a flat base to a flat (not conical) gynobase." However, in the type species of *Leurocline*, *L. lithospermoides* Moore, the nutlets are not so affixed, but are clearly attached suprabasally to a subulate gynobase. In *Echiochilon fruticosum*, the type species of its genus, the nutlet has a straight and angled inner edge, is strongly constricted dorsally at the base, and bears its very small areola on the slightly oblique tip of the neck-like

basal portion. The areola of *E. fruticosum*, which is more nearly basal than in any species of *Leurocline*, is attached to a subulate gynobase quite like that in *Leurocline*, but much nearer the base than in any species of that genus. When all the species of these two genera are considered and the various nutlet-attachments studied, the hopes of finding generic characters in the form of nutlets or in their attachments are completely blasted. Past writers have relied upon the irregular calyx of *Echiochilon* to distinguish it from *Echium*. This is not only unnecessary, but is impossible, for the calyces of such *Echiums* as *E. piniana* Webb & Berth. and *E. Decaesnei* Webb are even more irregular than are those of *Echiochilon*. The bibliography of the species referable to *Echiochilon* is as follows:—

ECHIOCHILON FRUTICOSUM Desf. Fl. Atlant. i. 167, t. 47 (1800); Blatter, Record Bot. Surv. Ind. viii. 316 (1921). *Lithospermum divaricatum* Sieb. in Spreng. Syst. i. 543 (1825–28).—Northern Africa and southwestern Asia.

E. LONGIFLORUM Benth. in Hook. Icon. xiii. 60, t. 1277 (1878).—Aden.

E. somalense (Franchet), comb. nov. *Lobostemon somalensis* Franchet, Sert. Somal. 44 (1882). *Leurocline somalensis* S. Moore, Jour. Bot. xxxix. 258 (1901).—Somaliland.

E. cryptocephalum (Baker), comb. nov. *Lobostemon cryptocephalum* Baker, Kew Bull. 1894, pg. 30 (1894).—British Central Africa. Perhaps not of this genus.

E. lithospermoides (S. Moore), comb. nov. *Leurocline lithospermoides* S. Moore, Jour. Bot. xxxix. 257, t. 424, fig. 1 (1901). *Lobostemon lithospermoides* Baker, Fl. Trop. Africa iv. pt. 2, 60 (1905).—British East Africa.

E. Chazaliei (Boissieu), comb. nov. *Lithospermum Chazaliei* Boissieu, Jour. de Bot. x. 220 (1896). *Leurocline Chazaliei* Bonnet, Bull. Soc. Bot. France lviii. 38 (1911); Chevalier, Expl. Bot. Afri. Occ. Franç. i. 452 (1920). *Leurocline mauritanica* Bonnet, Bull. Mus. Hist. Nat. Paris xiv. 403 (1908); Fedde, Repert. ix. 496 (1911).—Mauritania.

16. **Megacaryon** Boiss. Pl. Orient. Nov. i. 7 (1875).

A genus of the Levant which is doubtfully distinct from *Echium*, from which it is weakly separated by its smoothish nutlets and greatly accrescent calyx. A discussion of this monotype is given by Lacaita, Jour. Linn. Soc. xlv. 393 (1919).

17. **Echium** [Tourn.] L. Sp. Pl. 139 (1753); Gen. Pl. 68 (1754).

Lobostemon Lehm. Linnaea v. 378, t. 5 (1830); Buek, Linnaea xi. 129 (1837). *Isorium* Raf. Fl. Tellur. ii. 61 (1836). *Traxara* Raf. Fl. Tellur. iv. 85 (1838). *Isoplesion* Raf. l. c. 86. *Oplexion* Raf. l. c. 86. *Larephes* Raf. l. c. 86. *Argyrexias* Raf. l. c. 86. *Penthysa* Raf. l. c. 86.—The largest and most difficult genus of its tribe. Native in the Mediterranean Region, on the Atlantic Islands, and in South Africa. I have searched in vain for characters which would distinguish generically the South African species from those north of the equator. Most of the South African species have stamens with a tuft of hair at the base of the filament. It was with this character that *Lobostemon* was originally distinguished from the more northern *Echiums*, and upon which it has been chiefly maintained subsequently. It is strange, therefore, to find that a goodly number of species of *Lobostemon*, such as *L. alopecuroideus*, *L. eriostachyus*, *L. latifolius*, *L. sanguineus*, *L. splendens*, etc., have stamens which not only in pubescence and attachment, but in size and appearance are quite indistinguishable from those of indubitable *Echiums*. These species, in fact, were at one time referred to *Echium* by De Candolle, Prodr. x. 13 (1846). Some authors, realizing the utter failure of staminal structures as generically diagnostic characters, have sought to maintain *Lobostemon* by finding diagnostic characters in the shape of the stigma. The stigma in the South African species, though usually given as entire or subcapitate, in fact varies from entire and solitary to divided with the stigmas geminate. *Echium* usually has lobed styles, but *E. rubrum*, as pointed out by Lacaita, Jour. Linn. Soc. xlv. 365 (1919), has the stigma merely emarginate or divided in a manner quite indistinguishable from that of *Lobostemon*. *Echium* and *Lobostemon* are not to be distinguished habitally, and if such authors as Wright, Fl. Cap. iv. pt. 2, 44 (1904), are followed in the generic disposition of *Echium formosum*, then there is no distributional difference between the two genera. Since its claims to generic rank are no more strong than are those of the giant *Echiums* of the Atlantic Islands, I see no reasons why *Lobostemon* should not be merged with *Echium*. The following new combinations are required:—

Echium acutissimum (Buek), comb. nov. *Lobostemon acutissimus* Buek, Linnaea xi. 139 (1837).

E. Buekii, nom. nov. *L. elongatus* Buek, l. c. 140. Not *Echium elongatum* Lam. (1791).

E. capitiforme (DC.), comb. nov. *L. capitiformis* DC., Prodr. x. 12 (1846).

- E. cephaloideum** (DC.), comb. nov. *L. cephaloideus* DC., l. c. 12.
E. cinereum (DC.), comb. nov. *L. cinereus* DC., l. c. 10.
E. curvifolium (Buek), comb. nov. *L. curvifolius* Buek, l. c. 137.
E. diversifolium (Buek), comb. nov. *L. diversifolius* Buek, l. c. 140.
E. echioides (Lehm.), comb. nov. *L. echioides* Lehm., *Linnaea* v. 378, t. 5 (1830).
E. fastigiatum (Buek), comb. nov. *L. fastigiatus* Buek, l. c. 141.
E. Galpinii (Wright), comb. nov. *L. Galpinii* Wright, *Fl. Cap.* iv. pt. 2, 41 (1904).
E. microphyllum (Buek), comb. nov. *L. microphyllus* Buek, l. c. 142.
E. nitidum (Bolus), comb. nov. *L. nitidus* Bolus in Wright, l. c. 38.
E. obovatum (DC.), comb. nov. *L. obovatus* DC., l. c. 10.
E. obtusifolium (DC.), comb. nov. *L. obtusifolius* DC., l. c. 7.
E. oederiaefolium (DC.), comb. nov. *L. oederiaefolius* DC., l. c. 7.
E. paniculaeforme (DC.), comb. nov. *L. paniculaeformis* DC., l. c. 8.
E. pilicaule (Wright), comb. nov. *L. pilicaulis* Wright, l. c. 30.
E. pubiflorum (Wright), comb. nov. *L. pubiflorus* Wright, l. c. 39.
E. sanguineum (Schlechter), comb. nov. *L. sanguineus* Schlechter, *Engler's Bot. Jahrb.* xxiv. 450 (1897).
E. Schlechteri, nom. nov. *L. collinus* Schlechter in Wright, l. c. 28. Not *E. collinum* Salisb. (1796).
E. stachydeum (DC.), comb. nov. *L. stachydeus* DC., l. c. 7.
E. virgatum (Buek), comb. nov. *L. virgatus* Buek, l. c. 142.
E. Wurmbii (DC.), comb. nov. *L. Wurmbii* DC., l. c., 11.

ANCHUSEAE.

Nutlets erect or oblique or horizontal, straight or curved, smooth or rugose, unmarginated; areola basal or lateral, along side or near tip of cotyledons, surrounded by a tumid annular rim, more or less plug-like or rarely merely high-convex, strophiolate; gynobase usually convex, commonly with broad cavities left by the strophiolate plugs; style lobed or entire; stigmas 1 or 2, distinct or completely fused, capitate; corolla blue or rarely white or yellow.—The tribe is confined to the Old World.

KEY TO GENERA OF ANCHUSEAE.

- Throat of corolla bearing well developed appendages formed by the intrusion of tissue.
 Filaments with a broad dorsal appendage.....18. *Borago*.
 Filaments unappendaged dorsally.
 Stamens conspicuously exerted from the corolla; corolla-lobes linear, revolute.....19. *Trachystemon*.

- Stamens included or barely exserted; corolla-lobes broad, never revolute.
- Corolla broadly tubular; throat conspicuously developed, campanulate or weakly dilated; lobes short, erect or apically recurved; faucal appendages linear or lanceolate, acute, margin dentate.....20. *Symphytum*.
- Corolla funnel-form or more or less long-salverform; throat undeveloped or ill-defined or abruptly expanded; lobes usually elongate, spreading or divergent; faucal appendages deltoid or oblong, obtusish, usually hairy.
- Corolla-lobes convolute in the bud.....21. *Trigonocaryum*.
- Corolla-lobes imbricate in the bud.
- Corolla evidently irregular, limb oblique, tube usually bent.....22. *Lycopsis*.
- Corolla regular, limb not oblique, tube straight.
- Nutlet-attachment small, borne on a bent supra-basal stipitate prolongation of the nutlet; flowers in long-peduncled leaf-subtended glomerules; leaves broad, netted-veined...23. *Caryolopha*.
- Nutlets with a broad sessile basal or lateral attachment; flowers racemose or in axillary glomerules.
- Inflorescence naked; leaves herbaceous, broad, obviously netted-veined.....24. *Brunnera*.
- Inflorescence bracteate throughout; leaves firm, elongate, vernation absent or obscure....25. *Anchusa*.
- Throat of corolla unappendaged or practically so, commonly glabrous or villous in spots.
- Corolla glabrous within; calyx-tube indurated and thickened in fruit; plant fruticose.....26. *Lithodora*.
- Corolla more or less pubescent within; calyx herbaceous; herbs.
- Stamens borne at summit of corolla-throat and evidently protruded from it.....27. *Elizaldia*.
- Stamens borne on corolla-tube, not at all protruded.
- Plants mainly annual; nutlets usually rugose.....28. *Nonea*.
- Plants perennial; nutlets smooth.....29. *Pulmonaria*.

18. **Borago** [Tourn.] L. Sp. Pl. 137 (1753); Gen. Pl. 67 (1754).

Buglossites Moris, Enum. Sem. Hort. Taur. (1845); Ann. Nat. Sci. ser. 3, v. 365 (1846).—A natural genus with 3 very distinct species, all in the Mediterranean Region. Hance, Jour. Bot. xvii. 301 (1879), has an interesting discussion of the etymology of the word, "borage."

19. **Trachystemon** Don, Edinb. New Philos. Jour. xiii. 239 (1832).

Nordmannia Ledeb. in Nordmann, Bull. Acad. St. Petersb. ii. 312 (1837). *Psilostemon* DC. Prodr. x. 35 (1846).—A natural genus with 2 well marked species in the Mediterranean Region.

20. **Symphytum** [Tourn.] L. Sp. Pl. 136 (1753); Gen. Pl. 66 (1754).

Twenty-five species in Europe and adjacent Asia. The genus was recently monographed by Bucknell, Jour. Linn. Soc. xli. 493 (1913).

21. **Trigonocaryum** Trautv. Act. Hort. Petrop. iii. pt. 2, 278 (1875).

With a single Caucasian species. I know the plant only from descriptions.

Trigonocaryum involucratum (Stev.), comb. nov. *Myosotis involucrata* Stev. Mém. Soc. Nat. Moscou iii. 253 (1812); Bull. Soc. Nat. Moscou xxiv. pt. 1, 602 (1851); Boiss. Fl. Orient. iv. 242 (1875). *T. prostratum* Trautv. Act. Hort. Petrop. iii. pt. 2, 278 (1875); l. c. iv. pt. 2, 395 (1876).

22. **Lycopsis** L. Sp. Pl. 138 (1753); Gen. Pl. 68 (1754).

Buglossa S. F. Gray, Nat. Arrang. Brit. Pl. ii. 351 (1821).—Three species in the Mediterranean Region and Near East. A very close relative of *Anchusa*, from which it differs only in its more or less irregular corollas. Some of the undoubted *Anchusas* show a slight tendency towards zygomorphy, though never in such an extreme manner as characteristic of *Lycopsis*. Many authors have treated *Lycopsis* merely as a section of *Anchusa*, a treatment with which I am not unsympathetic.

23. **Caryolopha** Fisch. & Trautv. Ind. Sem. Hort. Petrop. iii. 31 (1837).

With a single species, *C. sempervirens* (L.) Fisch. & Trautv., in the northwestern Mediterranean Basin. In recent works usually referred to the closely related genus *Anchusa*. *Caryolopha*, however, appears to merit recognition because of its peculiar nutlets, leafy and ranker habit, and different inflorescence.

24. **Brunnera** Stev. Bull. Soc. Nat. Moscou xxiv. pt. 1, 582 (1851).

A neglected genus, with 3 species in western Siberia and the eastern Mediterranean Region. The species have been usually referred to *Anchusa*, but their quite different habit and naked racemes seem to justify their recognition as generically distinct.

Brunnera macrophylla (Marschall), comb. nov. *Myosotis macrophylla* Marschall, Fl. Taur.-Cauc. i. 119 (1808); Ledeb. Fl. Ross. iii.

121 (1847-49). *Anchusa myosotidiflora* Lehm. Asperif. i. 234 (1818); Boiss. Fl. Orient. iv. 157 (1875). *B. myosotidiflora* Stev. Bull. Soc. Nat. Moscou xxiv. pt. 1, 582 (1851).

B. SIBIRICA Stev. Bull. Soc. Nat. Moscou. xxiv. pt. 1, 582 (1851). *Anchusa myosotidiflora*, var. *grandiflora* DC. Prodr. x. 50 (1846).

B. orientalis (Schenk), comb. nov. *Myosotis orientalis* Schenk, Pl. Sp. Itin. Aegypt. 26 (1840). *Anchusa neglecta* A. DC. Prodr. x. 49 (1846).

25. **Anchusa** L. Sp. Pl. 133 (1753); Gen. Pl. 64 (1754).

Buglossum Gaertn. Fruct. i. 322 (1788). (?) *Stomotechium* Lehm. Asperif. ii. 395 (1818). *Pentaglottis* Tausch, Flora xii. 643 (1829). *Gastrocotyle* Bunge, Mem. Acad. Sav. Etr. St. Petersb. vii. 405 (1847).—A variable genus of 30-40 species centering in the Mediterranean Region, but extending through Europe and western Asia, and occurring also in South Africa. Why authors have deemed it advisable to segregate *A. hispida* Forsk. as forming the monotypic genus *Gastrocotyle* is very puzzling, but their reasons for removing it from the *Anchuseae* and placing it in the *Eritrichieae* are utterly incomprehensible. As indicated by Boissier, Fl. Orient. iv. 151 (1875), *A. hispida* is an obvious relative of the annuals, *A. aggregata* Lehm., and *A. Aucheri* A. DC., and is clearly congeneric with these two species, the generic determination of which has never been questioned.

The following species seems to have never been properly named:—

Anchusa humilis (Desf.), comb. nov. *Echium humile* Desf. Fl. Atlant. i. 165 (1800). *A. aggregata* Lehm. Asperif. i. 219 (1818); Icon. 27, t. 47 (1821); Boiss. Fl. Orient. iv. 157 (1875).

26. **Lithodora** Griseb. Spicil. Fl. Rumel. ii. 85 (1844).

Gymnoleima Decne. in Jacquemont, Voy. Ind., Bot. 122 (1844).—A genus of 7 local species, centering in the western Mediterranean Basin. These plants have been commonly referred to *Lithospermum*, but they differ from that genus in their shrubby habit, indurated fruiting calyx-tube, corollas which inside are destitute of either appendages or pubescence, cf. Spengler, Oesterr. Bot. Zeitschr. lxviii. 115, t. 1, fig. 17-22 (1919), and plug-shaped somewhat margined attachment of the nutlets. The group is certainly not referable to *Lithospermum* if the current standard of generic characters is maintained. *Lithodora* has many characters in common with *Moltkia*, and perhaps it should be associated with that genus in the *Lithospermeae*, rather than classed under the *Anchuseae*. The shape and

attachment of the nutlets, as well as its unappendaged corollas, are similar to those found in *Pulmonaria* and *Nonea*, particularly in the former genus. In the attachment of its nutlets *Lithodora* is clearly characteristic of the *Anchuseae*. Besides *Lithodora fruticosa* (L.) Griseb., *L. hispidula* (Sibth. & Sm.) Griseb., and *L. oleifolia* (Lapeyr.) Griseb. there are the following species which have not been properly named.

Lithodora consobrina (Pomel), comb. nov. *Lithospermum consobrinum* Pomel, Nouv. Mat. Fl. Atl. 296 (1874)

L. diffusa (Lag.), comb. nov. *Lithospermum diffusum* Lag. Varied. Cienc. iv. pt. 4, 39 (1805); Gen. Sp. Pl. 10 (1815); Rouy & Fouc. Fl. Fr. x. 314 (1908). *Lithospermum prostratum* Lois. Fl. Gall. ed. 1, 105 (1806). *Lithodora prostrata* Griseb. Spicil. Fl. Rumel. ii. 531 (1844).

L. rosmarinifolia (Ten.), comb. nov. *Lithospermum rosmarinifolium* Ten. Prodr., Suppl. ii. 66 (1811-13); Fl. Nap. i. t. 114 (1811-15).

L. Zahnii (Heldr.), comb. nov. *Lithospermum Zahnii* Heldr. in Halacsy, Verh. Zool.-Bot. Ges. Wien xlix. 190 (1899); Consp. Fl. Graecae. ii. 347 (1902). *Lithospermum fruticosum* of Sibth. & Sm. Fl. Graeca ii. 52, t. 161 (1813).

27. ***Elizaldia*** Willk. Strand- u. Steppengeb. Iber. Halbins. 128 (1852).

The 3 species of this western Mediterranean genus have been usually referred to *Nonea*, but in having a slightly different habit, and stamens placed high in the corolla-throat and exserted, they seem generically distinct. The generic name, *Phaneranthera*, is a synonym of *Elizaldia*, but appears to have never been legitimately established. The founding of the genus is usually attributed to Meisner, Gen. ii. 189 (1840), but he does not even mention the name. The following combinations are necessary.

Elizaldia violacea (Desf.), comb. nov. *Echioides violacea* Desf. Fl. Atlant. i. 164 (1800). *Nonnea violacea* DC. Fl. Fr. iii. 626 (1805). *N. multicolor* G. Kunze, Flora xxix. 691 (1846). *E. nonneoides* Willk. Strand- u. Steppengeb. Iber. Halbins. 129, cum tab. (1852).

E. phaneranthera (Viv.), comb. nov. *Nonnea phaneranthera* Viv. Fl. Lib. Specim. 9, t. 1, fig. 3 (1824); Murb. Lunds Univ. Årsskr. xxxiv. Afd. 2, no. 7, 10, t. 7, fig. 10-12 (1898).

E. heterostemon (Murb.), comb. nov. *Nonnea heterostemon* Murb. Lunds Univ. Årsskr. xxxiv. Afd. 2, no. 7, 7, t. 7, fig. 13-15 (1898).

28. **Nonea** Medik. Phil. Bot. i. 31 (1789).

Oskampia Moench, Meth. 420 (1794). *Echioides* Desf. Fl. Atlant. i. 163 (1800). *Onochilis* Mart. Denkschr. Acad. Muenchen v. 177 (1817). *Nephrocarya* Candargy, Bull. Soc. Bot. France xliv. 150 (1897).—About 25 species, these chiefly in the Mediterranean Region. Although maintained here, I am of the opinion that *Nonea* should be treated as a section of *Pulmonaria*, for there is no character by which it can be decisively separated from that genus. *Nonea* and *Pulmonaria* have the same corolla and calyx. Though the nutlets of *Nonea* are usually rugose, smooth and shiny ones, similar to those in *Pulmonaria*, occur in *N. obtusifolia* (Willd.) DC. *Nonea* usually has a loosely racemose inflorescence, whereas *Pulmonaria* commonly has a loosely glomerate one, but when the inflorescence of the latter occasionally loosens it reveals an arrangement of flowers quite like that in *Nonea*. The most striking difference between the two genera seems to reside in the root. *Pulmonaria* is always perennial, the stems, in scaly-based tufts, terminating rather fleshy shallow rhizomes. *Nonea* is mostly annual, but in such species as *N. pulla* and *N. alpestris* the subterranean development is apparently a long deep perennial tap-root. It seems probable that *Nonea* and *Pulmonaria* have common immediate ancestors, and that the former is a xerophytic adaptation to rather arid open situations, whereas the latter is a mesophytic adaptation to scopuline and sylvestrine habitats.

29. **Pulmonaria** [Tourn.] L. Sp. Pl. 135 (1753); Gen. Pl. 65 (1754).

Bessera Schult. Observ. Bot. 27 (1809).—A genus with about 12 ill-defined Eurasian species. It centers in southern Europe.

ERITRICHIEAE.

Nutlets erect or suberect (or rarely horizontal), straight or slightly bent, smooth or verrucose or appendaged, margined or marginless; areola lateral or basal, at side of cotyledons or near their tip; gynobase pyramidal or columnar or rarely even flat; style entire; stigma 1, entire or very rarely somewhat emarginate, capitate or disciform; corolla blue or white or less commonly yellow or orange.—As a group the *Eritrichieae* are intermediate in degree of development between the *Lithospermeae* and the *Cynoglosseae*. Such genera as *Megastoma*, *Oreocarya*, and *Mertensia* are among the most primitive members of the tribe, whereas such genera as *Eritrichium*, *Lappula* and *Trigonotis* are the most specialized, coming nearest the *Cynoglosseae*. The

tribe reaches its great development in Asia and in western America. The endemic American genera properly referable to this tribe are *Amsinckia*, *Cryptantha*, *Oreocarya*, and *Selkirkia*.

KEY TO GENERA OF ERITRICHIEAE.

- Nutlets circumdorsally winged, or with a definite upturned usually toothed or lacerate rim or flange, or some or all with an epidorsal annulate or cupulate crest, or pronouncedly angular and evidently tetrahedral.
- Gynobase flat; nutlets regularly tetrahedral, attached at one corner.
- Style conspicuously long-exserted; anthers fully exposed; leaves crowded above, subverticillate.....30. *Brachybothrys*.
- Style and anthers included; leaves scattered, alternate....31. *Trigonotis*.
- Gynobase pyramidal or columnar; nutlets not obviously and regularly tetrahedral.
- Nutlets about equalling the elongate gynobase, attached for nearly their whole length, (with rare exceptions) exceeded by style.
- Bracteate weedy annuals with narrow strigose canescent firm unnerved leaves; nutlet-margin toothed or lacerate, frequently glochidiate.....32. *Lappula*.
- Ebracteate rank decorative perennial with broad glabrous herbaceous veiny leaves; nutlets with a broad merely undulate wing.....33. *Myosotidium*.
- Nutlets much surpassing the stout pyramidal gynobase, attached obliquely supramedi ally by a deltoid or ovate areola, surpassing the style.
- Nutlets with a circumdorsal, commonly lacerate or dentate margin.
- Fruiting calyx reflexed; rank tufted plants with broad herbaceous leaves.....34. *Hackelia*.
- Fruiting calyx erect or ascending; low densely caespitose plants with small firm leaves.....35. *Eritrichium*.
- Nutlets (some or all of each fruit) with an epidorsal cupulate or annulate crest.
- Stamens conspicuously exserted from the unappendaged corolla; nutlets with a subapical cupulate crest.
36. *Craniospermum*.
- Stamens included within the appendaged corolla; some of nutlets with a thick medial dorsal annulate crest.....37. *Microula*.
- Nutlets not encircled by a wing, rim, or flange, never bearing epidorsal annulate or cupulate crests, somewhat lanceolate or lenticular and never conspicuously angular or polyhedral.
- Corolla-lobes convolute in bud; style disciform, mucronate...38. *Myosotis*.
- Corolla-lobes imbricate in bud; style usually capitate.
- Pericarp not fused along medial ventral line, nutlets hence more or less broadly grooved anteriorly.
- Flowers fasciculate, falsely umbellate; diminutive Himalayan annuals.....39. *Microcaryum*.
- Flowers loosely racemose; plants not diminutive.
- Corolla appendaged, blue; nutlets several times as long as gynobase, attached suprabasally by a small areola; perennial; central Asia.....40. *Amblynotus*.

- Corolla unappendaged, yellowish; nutlets broadly and laterally affixed to gynobase, exceeding it in length; annual; northern Africa.....41. *Megastoma*.
- Pericarpial walls fused along medial ventral line, forming a medial ventral keel extending from areola to apex of nutlet.
- Nutlets attached firmly to gynobase for nearly whole length.
- Ovules 2; nutlets contorted.....42. *Rochelia*.
- Ovules 4; nutlets not contorted.....43. *Oreogenia*.
- Nutlets attached to gynobase through a definite areola.
- Flowers solitary, terminal; nutlets densely pubescent; pulvinate Himalayan perennials.....44. *Chionocharis*.
- Flowers several to many, inflorescence various; nutlets glabrous.
- Fruiting calyx strongly accrescent, plicate, veiny, irregularly toothed and lobed; nutlets obliquely attached to an elongate strongly compressed gynobase.45. *Asperugo*.
- Fruiting calyx moderately if at all accrescent, not plicate, nor conspicuously veiny, nor irregularly toothed and lobed; gynobase pyramidal or flat.
- Corolla tubular with a well developed campanulate or funnelform throat, tube surpassing calyx-lobes; nutlets usually smooth, attached basally or suprabasally.46. *Mertensia*.
- Corolla salverform, throat not differentiated, tube usually shorter than calyx-lobes; nutlets usually rough, attached ventrally suprabasally or medially.
- Calyx somewhat accrescent, reflexed in age; corolla-tube exceeding nutlets; style very much surpassing nutlets.....47. *Anoplocaryum*.
- Calyx practically non-accescent, not reflexed; corolla-tube surpassed by calyx; style little if at all surpassing nutlets.....48. *Plagiobothrys*.

30. **Brachybothrys** Maxim. in Oliver, Hook. Icones xiii.
43, t. 1254 (1878).

With a single species, *B. paridiformis* Maxim., in southern Manchuria and adjacent Korea. Evidently a close ally of *Trigonotis*, and like it to be included in the *Eritrichieae*. It differs from its relative in its open subrotate corollas, conspicuously protruded stamens, and coarse habit.

31. **Trigonotis** Stev. Bull. Soc. Nat. Moscou xxiv.
pt. 1, 603 (1851).

Endogonia Lindl. Veg. Kingd. ed. 2, 656 (1847).—A genus with a dozen odd species in Asia and temperate Melanisia. Evidently a relative of *Eritrichium*. Though the nutlets appear to be basifixed, morphologically they are attached medially and laterally to a very

depressed gynobase. The decidedly tetrahedral nutlets are very characteristic of this and the preceding genus.

32. **Lappula** Moench, Meth. 416 (1794).

Lapula Gilib. Fl. Lithuan. i. 25 (1781), nom. nud. *Echinospermum* Sw. in Lehm. Asperif. i. 113 (1818). *Rochelia* R. & S. Syst. iv. pg. xi and 108 (1819). *Heterocaryum* A. DC. Prodr. x. 144 (1846). *Cynoglossospermum* [Siegesb.] Kuntze, Rev. Gen. ii. 436 (1891).—A natural, but difficult genus of 30 to 40 closely related species centering in central and southwestern Asia and having outlying species in Europe, Africa, Australia, and America. *Lappula spinocarpa* (Forsk.) Aschers. is aberrant in the arming of its nutlets. These agree with those of typical *Lappula* in size, outline and attachment, but differ in lacking a well defined toothed margin, being instead coarsely and irregularly muricate over the back. The habit of *L. spinocarpa* is so obviously that of the other species of *Lappula* that generic segregation of the species seems quite unacceptable.

The first generic name applied to the genus was that published by Gilibert in his Flora Lithuanica. Though he described the species, *Lapula* [sic!] *echinata* and indicated that it was synonymous with *Myosotis Lappula* L., Gilibert did not describe his genus, nor indicate any character whereby it might be recognized. Hence, according to the International Rules (Art. 38), it is a nomen nudum. The first characterization given the genus was by Moench. Although Gilibert's specific name was launched under a generic name not effectively published, it has, in recent years, been generally accepted for the common European representative of the genus.

33. **Myosotidium** Hook. Bot. Mag. lxxxv. t. 5137 (1859).

A monotype with the single species known only from Chatham Island, New Zealand. *Myosotidium hortensia* (Decne.) Baill. is a very decorative plant, and has its closest relatives in *Selkirkia* of Juan Fernandez and in the widely distributed genus *Hackelia*. Brand, Pflanzenr. iv. Fam. 252, 45 (1921), follows past authors in placing *Myosotidium* in the *Cynoglosseae*, but the erect nutlets and their attachment are clearly those of an *Eritrichia*.

34. **Hackelia** Opiz in Bercht. Fl. Boehm. ii. pt. 2, 146 (1839).

A genus of 25 to 30 species, most of which occur in western North America. Four species are known from the cooler parts of

Eurasia. The present study of the *Eritrichieae* has only increased my convictions, Contr. Gray Herb. n. s. lxxiii. 43 (1923), that *Hackelia* is not immediately related to *Lappula*, but is related rather to *Eritrichium*, and that it merits the generic rank here accorded it.

35. **Eritrichium** Schrad. in Gaud. Fl. Helv. ii.
57 (1828).

Centering in Asia where there are perhaps 12 scarcely separable species. One species occurs on the high mountains of Europe, and several more are known from America. The genus is a natural one, and contains canescent perennial herbs characteristic of bleak plateaus or cold mountain-slopes. In the past the genus was vastly amplified, and at one time contained a large proportion of the *Eritrichieae*. As here defined, however, it is reduced to homogeneity and is a relatively small genus.

36. **Craniospermum** Lehm. Asperif. ii. 336 (1818).

Diploma Schrenk, Bull. Phys.-Math. Acad. St. Petersburg. ii. 195 (1844).—A well marked genus with several closely related species in the Altai-Baikal region of Asia.

37. **Microula** Benth. in Benth. & Hook. Gen. Pl. ii. 853 (1876).

Tretocarya Maxim. Bull. Acad. St. Petersburg. xxvii. 505 (1881); Mém. Biol. xi. 270 (1881). *Schistocaryum* Franch. Bull. Mens. Soc. Linn. Paris 930 (1891).—As Gray, Proc. Am. Acad. xx. 261 (1884), has suggested, this genus seems very closely related to *Plagiobothrys*. It differs, however, in normally having blue corollas, and at least several of the nutlets of each fruit bearing a characteristic epidorsal annulate crest. Except for the crest, the nutlets are quite indistinguishable from those of *Plagiobothrys* § *Euplagiobothrys*, and it may be that further study will give reasons for reducing *Macroula*. *Schistocaryum* is evidently a synonym. The peculiar dehiscence of the nutlets, which was the justification for proposing the genus, may have been caused by extreme pressure in drying fruiting material. It is to be noted, also, that the author later, Jour. de Bot. v. 105 (1891), admitted, because of habitual similarity, other species to his genus which lacked the peculiar dehiscence. The species of *Schistocaryum* have the nutlets of *Microula*, and seem to be close relatives of *M. sikkimensis*. Indeed *S. myosotidium*, the type of its genus, seems so close to *M. sikkimensis* as to throw doubt on their specific distinctness. The following 9 species are referable to *Microula*. They occur

at high altitudes in the Himalayas, in Tibet, and in the mountains of western China.

1. *MICROULA TIBETICA* Benth. in Benth. & Hook. Gen. Pl. ii. 853 (1876); Maxim. Bull. Acad. St. Petersb. xxvi. 501 (1880); Mél. Biol. x. 682 (1880); Hemsley in Hook. Icon. xxvi. t. 2562 (1898); Hemsley, Jour. Linn. Soc. xxxv. 192 (1902). *M. Benthami* Clarke in Hook. Fl. Brit. India iv. 167 (1883); Oliver in Hook. Icon. xxiii. t. 2257 (1893). *Tretocarya pratensis* Maxim. Bull. Acad. St. Petersb. xxvii. 505 (1881); Mél. Biol. xi. 272 (1881).—Tibet and adjacent Himalayas.

2. *M. TANGUTICA* Maxim. Bull. Acad. St. Petersb. xxvi. 500 (1880); Mél. Biol. x. 682 (1880).—Northwestern China. Doubtfully distinct from *M. tibetica*.

3. *M. PUSTULATA* (Clarke) Duthie, Kew Bull. 1912, pg. 39 (1912). *Eritrichium pustulatum* Clarke in Hook. Fl. Brit. India iv. 164 (1883).—Himalayas.

4. *M. SIKKIMENSIS* (Clarke) Hemsley in Hook. Icon. xxvi. sub t. 2562 (1898). *Anchusa sikkimensis* Clarke in Hook. Fl. Brit. India iv. 168 (1883). *Tretocarya sikkimensis* Oliver in Hook. Icon. xxiii. t. 2255 (1893).—Himalayas and adjacent Tibet.

5. *M. myosotidea* (Franch.), comb. nov. *Schistocaryum myosotideum* Franch. Bull. Mens. Soc. Linn. Paris 930 (1891).—Yunnan.

6. *M. ciliaris* (Bur. & Franch.), comb. nov. *Schistocaryum ciliare* Bur. & Franch. Jour. de Bot. v. 105 (1891).—Szechwan.

7. *M. ovalifolia* (Bur. & Franch.), comb. nov. *Schistocaryum ovalifolium* Bur. & Franch. Jour. de Bot. v. 105 (1891).—Szechwan.

38. *Myosotis* L. Sp. Pl. 131 (1753); Gen. Pl. 63 (1754).

Scorpioides Gilib. Fl. Lithuan. i. 20 (1781). *Exarrhena* R. Br. Prodr. 495 (1810). *Strophiosoma* Turcz. Bull. Soc. Nat. Moscou xiii. pt. 2, 258 (1840).—A cosmopolitan genus of about 50 species, having two important distributional centers, one in Europe and the other in New Zealand. Attempts have been made to segregate, as a genus *Exarrhena*, those New Zealand species having large flowers and conspicuous stamens. As Cheeseman, Man. N. Zealand Fl. 458 (1906), has indicated, however, there appear to be no characters whereby this segregation can be sharply and naturally made. The large-flowered New Zealand species are clearly related to the European ones, having quite similar nutlets, nutlet-attachment, style, corolla-attachment, uncinat pubescence, and frequently even the same habit, and since there are undoubted transitional forms it seems best to treat *Exarrhena* as a section of *Myosotis*. *Myosotis sparsiflora* Mikan

and allies have been grouped to form the genus *Strophostoma*, characterized by its conspicuous exerted strophiole. Though well developed in *Strophostoma*, the character is somewhat developed in many species of true *Myosotis*. This tendency towards a strophiolate condition is very suggestive of the *Anchuseae*, and it is a notable fact that the only other member of the subfamily with contorted corolla-lobes (i.e., *Trigonocaryum*) has been placed in that tribe. *Myosotis*, however, does not have a habit at all suggestive of the *Anchuseae*, nor a tumid rim surrounding the nutlet-attachment, while furthermore its habit, somewhat margined nutlets, and peculiar solitary stigma make it much more at home in the *Eritrichieae*. Because of its practically basally attached nutlets, the genus in the past has been referred to the *Lithospermeae*, but its habit, compressed slightly margined nutlets, solitary disciform stigmas, and blue corollas seem to indicate stronger affinities in the *Eritrichieae*.

39. *Microcaryum*, gen. nov.

Calyx 5-fidus, lobis angustis, fructifer immutatus. Corollae tubus cylindricus calyce paullo brevior, fauce fornicibus 5 emarginatis clausa, lobi 5 ovati imbricati obtusi breves patentis. Stamina 5 tubo affixa inclusa, filamentis brevibus et antheris ovatis minimis obtusis. Ovarii lobi 4 in gynobasi elongata laterales, stylus inter lobos brevis, stigmatibus subcapitato, ovula lateraliter affixa. Nuculae 4 erectae immarginatae dorso convexae rugosae et tuberculatae medio longitudinaliter carinatae ventre obtusae medio sulcatae sulco longitudinali basi divaricatim furcato ab ima basi fere ad medium gynobasi columnari affixae. Semina recta, cotyledones planae indivisae.—Herba annua perennans himalayana villosa. Folia alterna oblanceolata obtusa. Inflorescentia pseudo-umbellata, floribus in fasciculos plures spicate dispositis. Corolla alba minima hypocraterimorpha. Pedicellae elongatae erectae. (Name from μικρός, *small*, and κάρυον, *nut*, in reference to the minute size of the nutlets.)

Although it has been associated with *Eritrichium*, this monotype is not at all closely related there, appearing rather to have its closest affinities in *Cryptantha*. *Microcaryum* differs from *Eritrichium* in habit, inflorescence, and in the shape and attachment of its nutlets. It agrees with *Cryptantha* in all floral and fruiting structures, and has quite similarly shaped and attached nutlets, but differs, however, in its habit, falsely umbellate inflorescence, villous pubescence, and widely separated range. *Microcaryum* occurs at very high altitudes in the Himalayas and adjacent Tibet, whereas *Cryptantha* grows on

the deserts and warm mountain-slopes at relatively low altitudes, from Alaska to Mexico, and Peru to Chile.

Microcaryum pygmaeum (Clarke), comb. nov. *Eritrichium pygmaeum* Clarke in Hook. Fl. Brit. India iv. 165 (1883). *E. Riae* Winkl. in Fedde, Repert., Beiheft. xii. 473 (1922).

40. **Amblynotus**, gen. nov.

Calyx 5-fidus, lobis angustis elongatis, fructifer paullo accrescens. Corollae hypocraterimorphae tubus brevis calyce brevior, fauce fornicibus 5 obtusis clausa; lobi 5 imbricati obtusi patentés. Stamina 5, tubo affixa inclusa, filamentis brevibus; antherae oblongae obtusae. Ovarii lobi 4 in gynobasi pyramidalis erecti; stylus inter lobos brevis; stigmatibus subcapitato disciformi; ovula erecta. Nuculae 4 erectae emarginatae, dorso convexae obscure rugulosae nitidae glaberrimae, ventre basin versus cum areola triangulari obliqua instructae supra areolam secus angulum interiorem sulcatulae. Semina recta; cotyledones planae indivisae.—Herba perennis asiatica caespitosa serico-villosa strigosa. Folia alterna obtusa oblanceolata. Racemi simplices bracteati. Corolla coerulea.—*Eritrichium* § *Amblynotus* A. DC. Prodr. x. 128 (1846).

Amblynotus has been confused with *Eritrichium* which it somewhat suggests in habit and pubescence, but from which it differs in the attachment and form of its nutlets, since these are suprabasally attached by an areola which is prolonged above into a usually closed groove, and are polished and rounded and quite lack any suggestion of the dorsal marginal crests characteristic of *Eritrichium*. The proposed genus is probably related to *Cryptantha*, though not very closely so, differing in habit and pubescence, as well as in the color and texture of the corolla. *Amblynotus* seems to be a very distinct genus well worthy of recognition. It surely can not be left in *Eritrichium* if the latter is to be naturally defined.

Amblynotus obovatus (A. DC.), comb. nov. *Eritrichium obovatum* A. DC. Prodr. x. 128 (1846); Ledeb. Fl. Ross. iii. 152 (1847–9); Herder, Act. Hort. Petrop. i. 540 (1872). *Myosotis obovata* Ledeb. Fl. Altaica i. 190 (1829).

41. **Megastoma** Coss. & Dur. in Bonn. & Barr. Cat. Pl. Tunis 301 (1896).

A single species, *M. pusillum* Coss. & Dur., occurring in Algeria and Tunis. Although referred to *Eritrichium* by Bentham & Hooker, Gen. Pl. ii. 851 (1876), it is not at all closely related to that genus

though it does approach *Cryptantha* which Benthams & Hooker also reduced to *Eritrichium*. *Megastoma* differs from *Cryptantha* in its nude, unappendaged corolla-throat, very irregular calyx, and opposite branching; and of course has a widely separated range. A beautiful illustration of the plant has been given by Bonnet & Barratte, Ill. Phaner. Tunis t. 11, fig. 4-11 (1895).

42. **Rochelia** Reichb. Flora vii. 243 (1824); Icon. Crit. ii. 13, t. 123 (1824).

Maccoya F. Muell. Fragm. Austr. i. 127 (1859).—An anomalous genus of 10 to 15 species, centering in southwestern Asia and ranging from central Asia to the Mediterranean Basin. One species occurs in Australia. Although properly placed in the tribe *Eritrichieae* by Benthams & Hooker, Gen. Pl. ii. 836 (1876), Gürke, E. & P. Pflanzenf. iv. Abt. 3, 131 (1895), associated it with the American genus *Harpagonella* to form the tribe *Harpagonelleae*. A study of the nutlets and their attachment in *Harpagonella* and *Rochelia* should convince anyone that Gürke's tribe is clearly an artificial association of two only distantly related, anomalous, biovulate annuals. *Rochelia* fits clearly and naturally into the *Eritrichieae*, probably nearest *Lappula*, but *Harpagonella*, as pointed out on another page, is a *Cynoglossea*. The correct combination for the Australian species of *Rochelia* appears to never have been made.

Rochelia plurisepalea (F. Muell.), comb. nov. *Maccoya plurisepalea* F. Muell. Frag. Austr. i. 127 (1859). *R. Maccoya* F. Muell. in Benth. Fl. Austr. iv. 408 (1869).

43. **Oreogenia**, gen. nov.

Calyx 5-fidus, lobis angustis, fructifer immutatus. Corollae tubus cylindricus intus infra medium transverse plicatus, calyci subaequalis; fauce fornicibus 5 obtusis clausa; lobi 5 orbiculares imbricati obtusi breves patentés. Stamina 5 tubo affixa inclusa, filamentis brevibus; antherae ovatae minimae obtusae. Ovarii lobi 4, in gynobasi elongata erecti; stylus inter lobos brevis, stigmatē truncato plano vel concavo; ovula lateraliter affixa. Nuculae 4 lanceolatae immarginatae erectae, in facie interiori longitudinaliter carinatae carina ab ima basi fere ad apicem gynobasi columnari firmiter affixae, dorso rugosae strigoso-hispidulosae convexae medie carinatae. Semina recta; cotyledones planae indivisae.—Herba annua pumila villosa himalayana. Folia alterna obtusa oblanceolata. Racemi bracteati. Corolla coerulea.—(Name from ὄρος, *mountain*, and γένεα, *birth*.)

An Himalayan monotype which has been mistakenly referred to *Eritrichium*, a genus which is obviously not a close relative and which differs much in its perennial habit and margined broadly attached nutlets. The nutlets of *Oreogenia* are attached along the length of the keeled inner face.

Oreogenia Munroi (Clarke), comb. nov. *Eritrichium Munroi* Clarke in Hook. Fl. Brit. India iv. 165 (1883). *E. densiflorum* Duthie, Kew Bull. 1912, pg. 39 (1912).

44. **Chionocharis**, gen. nov.

Calyx 5-partitus, lobis lineari-spathulatis, fructifer immutatus. Corollae tubus calyci subaequalis, fauce fornicibus 5 obtusis clausa; lobi 5 imbricati obtusi patentes. Stamina 5 tubo affixa inclusa, filamentis brevibus; antherae ovatae obtusae. Ovarii lobi 4 in gynobasi pyramidaliter erecti; stylus inter lobos brevis, stigmate disciformi mucronato; ovula erecta. Nuculae 4 vel abortu pauciores erectae immarginatae strigoso-pubescentes dorso convexae laeves ventraliter obtusae cum areola parva triangulari supra basin ornatae. Semina recta, cotyledones planae indivisae.—Herba perennis himalayana pulvinata. Folia alterna numerosissima confertissime imbricata obtusa lata. (Name from χιών, *snow*, and χάρις, *beauty*.)

A remarkably distinct monotype of the Himalayas. The species has passed as a *Myosotis*, and indeed it does suggest in gross habit such New Zealand species as *M. uniflora* Hook. and *M. pulvinaris* Hook., but it is readily distinguished by its spathulate calyx-lobes, imbricate corolla-lobes, and laterally (suprabasally) affixed lanceolate very pubescent nutlets.

Chionocharis Hookeri (Clarke), comb. nov. *Myosotis Hookeri* Clarke in Hook. Fl. Brit. India iv. 174 (1883).

45. **Asperugo** L. Sp. Pl. 138 (1753); Gen. Pl. 67 (1754).

A European monotype now widely disseminated as a weed. The plicate accrescent calyces of this plant are highly characteristic, and its nutlets also distinctive. The latter are strongly flattened with the small circular areola placed above the middle and clearly to one side of the medial line. The gynobase is strongly compressed.

46. **Mertensia** Roth, Cat. Bot. i. 34 (1797).

Pneumaria Hill, Veg. Syst. vii. 40 (1764). *Casselia* Dumort. Comment. Bot. 21 (1822). *Steenhammerea* Reichb. Fl. Germ. Excur.

i. 337 (1831). *Platynema* Schrad. Ind. Sem. Hort. Goetting. (1835); *Linnaea* Litt. (1837) 89. "*Winkleria* Reichb. Nom. 236 (1841)." *Hippoglossum* Hartm. ex Lilja. *Linnaea* xvii. 111 (1843). *Oreocharis* Lindl. Veg. Syst. ed. 2, 656 (1847). *Cerinthodes* [Ludw.] Kuntze, Rev. Gen. ii. 436 (1891).—With 50 to 60 species in the temperate portions of Eurasia and North America, most of them in western United States. The genus exhibits a number of diverse trends, which in a few instances have been given generic recognition, e. g. *Pneumaria* for *M. maritima* and allies, and *Oreocharis* for the racemose Himalayan species related to *M. echiioides*. The recognition of *Pneumaria* would set the generic values too low, and logically compel the recognition of monotypic genera for such species as *M. virginica* (L.) DC., *M. rivularia* DC., *M. bella* Piper, etc. This seems quite inadvisable since *Mertensia* in the broad sense is a natural and readily recognized entity. On account of its usually basifixed nutlets *Mertensia* has been placed in the *Lithospermeae*. Its relations, however, appear to be rather in the *Anchuseae* or the *Eritrichieae*. *Mertensia* has much in common with *Pulmonaria*, in fact the most important difference seems to be the absence on its nutlets of a plug-shaped strophiole surrounded by a tumid rim. On account of this difference, and because the nutlets are frequently attached obliquely or suprabasally by a flat areola, as well as from its abundance in western North America,—a region without any indubitable native anchusoid borages, I have thought it best to place the genus in the *Eritrichieae*. The style of *Mertensia* is almost always single.

47. **Anoplocaryum** Ledeb. Fl. Ross. iii. 154 (1847).

A monotype known only from Transbaikalia. The genus has received practically no recognition since its publication, being considered at most only a section of *Eritrichium* or *Echinospermum*. It is certainly distinct, however, from *Eritrichium* and *Echinospermum* since it has a very different habit, glabrate herbage, firm reflexed calyces, and unmargined and very differently attached nutlets. *Anoplocaryum compressum* (Turcz.) Ledeb. appears to be a close ally of *Mertensia*, from which it differs in the corolla-shape and nutlet-attachment.

48. **Plagiobothrys** Fisch. & Mey. Ind. Sem. Hort. Petrop.
ii. 46 (1835).

Allocarya Greene, Pittonia i. 12 (1887); Johnston, Contr. Gray Herb. n. s. lxviii. 64 (1923). *Havilandia* Stapf, Trans. Linn. Soc.

ser. 2, Bot. iv. 209 (1894).—A very large American genus with a few representatives in the Old World. Of the section *Allocarya* there are two species within our limits, one in Australia and another in Kamchatka, the former probably derived from South America and the latter evidently from North America. A careful study of *Havilandia* has convinced me that its species, which occur at high altitudes in the East Indian Islands, should be placed under *Plagiobothrys*. If these species had opposite lower leaves they would be referable to the section *Allocarya*, since they have sheathing leaf-bases like many members of that section, and nutlets which in shape and attachment are indistinguishable from it. The nutlets are smooth, but so are those of *P. lithocaryus* and several other species. The resemblance in gross habit between *Havilandia borneensis* Stapf and *P. linifolius* is remarkable, cf. HBK. Nov. Gen. et Sp. iii. t. 200 (1818) (as *Anchusa oppositifolia*), and Stapf, l. c., t. 16a (1894). The *Havilandias* have been referred to *Lithospermum*, but they are obviously of the *Eritrichieae* and of the above mentioned relationship.

§ **ALLOCARYA** (Greene) Johnston.—Leaves opposite, at least toward root, usually somewhat sheathing; flowers axillary or in spicate racemes; nutlets usually with a suprabasal non-carunculate areola.

1. **PLAGIOBOTHRYS AUSTRALASICUS** (A. DC.) Johnston, Contr. Gray Herb. n. s. lxxviii. 66 (1923). *Eritrichium australasicum* A. DC. Prodr. x. 134 (1846); Benth. Fl. Austral. iv. 406 (1869). *Allocarya australasica* Greene, Erythea iii. 57 (1895). *Heliotropium elachanthum* F. Muell. Linnaea xxv. 424 (1852).—Southern Australia.

2. **P. asiaticus** (Kom.), comb. nov. *Allocarya asiatica* Kom. in Fedde, Repert. xiii. 236 (1914). *Eritrichium plebejum* var. *tenu* Herder, Act. Hort. Petrop. i. 542 (1872).—Kamchatka.

§ **HAVILANDIA** (Stapf) Johnston.—Leaves alternate, broadly attached and somewhat sheathing; flowers axillary; nutlets with suprabasal, small, non-carunculate areola.

3. **P. borneensis** (Stapf), comb. nov. *Havilandia borneensis* Stapf, Trans. Linn. Soc. ser. 2, Bot. iv. 209, t. 16a (1894). *Lithospermum borneense* Boerl. Handl. Fl. Nederl. Ind. ii pt. 2, and 488 (1899); Merrill, Enum. Born. Pl. 511 (1921).—British North Borneo.

4. **P. minutus** (Wernh.), comb. nov. *Lithospermum minutum* Wernh. Trans. Linn. Soc. ser. 2, Bot. ix. 118 (1916).—Dutch New Guinea.

5. **P. (?) Zollingeri** (A. DC.), comb. nov. *Lithospermum Zollingeri* A. DC. Prodr. x. 587 (1846); Miquel, Fl. Ind. Batav. ii. 930 (1857); Boerl. Handl. Fl. Nederl. Ind. ii. pt. 2, 485 and 488 (1899); Koorder, Exkur. Fl. Java iii. 131 (1912).—Java. This is evidently not a

Lithospermum, and though the habit of growth and elongate corolla-tube are different from those of indubitable *Havilandias*, it seems best referred to *Havilandia* until good fruiting material becomes available.

CYNOGLOSSEAE.

Nutlets ascending or divergent or rarely even inverted (*Harpagonella* and *Bothriospermum*) or suberect, straight or slightly bent, appendaged or verrucose or smooth, usually margined; areola lateral to apical, near the radicle, unmargined, without strophiole; gynobase columnar or pyramidal or flat; style entire; stigma 1, capitate; corolla blue or white.—The most highly evolved tribe in the subfamily if not in the family. Its outstanding features are adradicular nutlet-attachment and commonly appendaged or margined nutlets. Although cosmopolitan in distribution it centers in southwestern Asia and the eastern Mediterranean Basin. *Harpagonella*, the most evolved member of the tribe, comes from western North America. There are only three endemic American genera of this tribe; they are *Mimophytum*, *Pectocarya*, and *Harpagonella*.

KEY TO GENERA OF CYNOGLOSSEAE.

Apex of anthers subulate and contorted.

Corolla-throat unappendaged.....49. *Trichodesma*.

Corolla-throat with ten intruded triangular appendages.....50. *Lacaitaea*.

Apex of anthers obtuse or apiculate, not subulate and contorted.

Anthers strongly heteromorphous, the upper one several times larger than others.....51. *Caccinia*.

Anthers homomorphous, all of equal size.

Gynobase inflated, globose; nutlets with entire inner face permanently affixed to gynobase, only one maturing...52. *Suchtelenia*.

Gynobase solid, flat or pyramidal or subulate; nutlets with ventral face only partially affixed to gynobase, deciduous, usually several maturing.

Nutlets with straight or uncinat unicellular hairs, never tuberculate nor with multicellular glochidiate appendages, rarely smooth and glabrous but then always with stamens included.....53. *Omphalodes*.

Nutlets with some multicellular glochidiate appendages or evidently tuberculate, rarely smooth and glabrous but then with stamens always exerted.

Nutlets covered with glochidiate appendages, marginless or with a weakly developed margin that is thick and glochidiate or is evidently formed by the basal fusion of the lateral appendages.....54. *Cynoglossum*.

Nutlets with very few glochidiate appendages or surface tuberculate or even smooth, with a well developed rather wide cartilaginous margin (this tumid in *Bothriospermum*).

Stamens exerted; fruit smooth and glabrous or nearly so.

- Corolla cylindrical with erect lobes; attachment-face of nutlets free above and decurrent on the style; Eurasian. 55. *Rindera*.
- Corolla salverform, lobes divergent; attachment-face of nutlets sessile, not decurrent. 56. *Tysonia*.
- Stamens included; fruit evidently tuberculate or glochidiate.
- Nutlets with a small apical or subapical attachment.
- Nutlets tuberculate, with a double margin.
- Nutlets inverted, parallel, with backs proximate, margin low, tumid and inconspicuous. 57. *Bothriospermum*.
- Nutlets divergent, with backs upturned, margins conspicuous, well developed. . 58. *Thyrocarpus*.
- Nutlets glochidiate, with a single margin. . . 59. *Actinocarya*.
- Nutlets with an elongate lateral attachment, commonly decurrent on style, rarely tuberculate, margin single. 60. *Paracaryum*.

49. **Trichodesma** R. Br. Prodr. 496 (1810).

Pollichia Meic. Bot. Beobacht. 247 (1783). *Borraginoides* Moench, Meth. 515 (1794). *Friedrichsthalia* Fenzl in Endl. Nov. Stirp. Dec. 53 (1839). *Leiocarya* Hochst. Flora xxvii. 30 (1844). *Streblanthera* Steud. in Hochst. Flora xxvii. 29 (1844). *Spiroconus* Stev. Bull. Soc. Nat. Moscou xxiv. pt. 1, 576 (1851). *Boraginella* [Siegesb.] Kuntze, Rev. Gen. ii. 435 (1891).—About 40 species in the warmer parts of Asia, Africa, and Australia. The genus has been recently monographed by Brand, Pflanzenr. iv. Fam. 252, 19–44 (1921).

50. **Lacaitaea** Brand in Fedde, Repert. xiii. 81 (1914).

A single species, *L. calycosa* (Coll. & Hemsley) Brand, in the eastern Himalayas. I know the genus only from the literature. The latest discussion of it is that given by Brand, Pflanzenr. iv. Fam. 252, 44 (1921).

51. **Caccinia** Savi, Cose Bot. 1, t. 1 (1832).

Anisanthera Raf. Fl. Tell. iii. 80 (1836). *Helicocarya* Bunge, Helioc. 4 (1871).—About 7 species in western Asia. *Helicocarya* has been maintained as a monotypic genus, but its relations with *Caccinia* are patent and its distinguishing characters are merely the culmination of trends well developed in that genus. These facts seem to justify the following combination.

Caccinia monandra (Bunge), comb. nov. *Helicocarya monandra* Bunge, Helioc. 4 (1871); Brand, Pflanzenr. iv. Fam. 252, 94 (1921).

52. **Suchtelenia** Karelin in Meissn. Gen. i. 279; ii. 188 (1840);
Bull. Soc. Nat. Mosc. 16, t. 2 (1841).

A monotype of the southern Caspian Sea basin. An anomalous plant with a narrowly ovoid, inflated gynobase. The nutlets, several of which are usually aborted, are borne with their inner face entirely adnate to the hollow gynobase. The best description of the genus is that given by Popow in the *Flora Caucasica Critica*, iv. pt. 2, 101 (1913). The description and analytic figures given by Brand, *Pflanzenr.* iv. Fam. 252, 161, fig. 22 (1921), are misleading.

53. **Omphalodes** [Tournef.] Moench, Meth. 419 (1794).

Picotia R. & S. Syst. iv. x (1819). *Omphalium* Roth, Enum. Pl. Germ. i. 590 (1827).—About 24 species in Eurasia and Mexico. *Omphalodes scorpioides* has a strongly recurved radicle, opposite lower leaves, and may be worthy of generic recognition, though no special generic name has ever been associated with it.

54. **Cynoglossum** [Tournef.] L. Sp. Pl. 134 (1753); Gen. Pl. 65 (1754).

Solenanthus Ledeb. Icon. Fl. Ross. i. 8, t. 26 (1829). *Lindelofia* Lehm. Hamb. Gart. u. Blumenzeitung vi. 351 (1850). *Anchusopsis* Bisch. Del. Sem. Hort. Heidelberg. 8 (1852). *Trachelanthus* Kunze, Bot. Zeitung viii. 665 (1850). *Kuschakewiczia* Regel & Smirnow, Act. Hort. Petrop. v. pt. 2, 625 (1878). *Adelocaryum* Brand in Fedde, Repert. xiii. 547 (1915).—A cosmopolitan genus of 80 to 90 species, with the center of distribution in southern Europe and Asia. The species with exserted stamens have been segregated to form the genus *Solenanthus*, but this staminal difference is developed in various degrees and is not correlated with any character of corolla, fruit, or habit, these latter characters, in fact, being the exact duplicates of those found in *Cynoglossum*. In *Lindelofia* the stamens are barely extruded, thereby showing unmistakable transition between the staminal developments characteristic of *Solenanthus* and *Cynoglossum*. Brand separates *Lindelofia*, and the obviously related *Adelocaryum*, from *Solenanthus* and *Cynoglossum* by attributing to the two former, nutlets which touch one another while in the bud, and to the two latter, nutlets which are separated from the beginning. These characters are not only very difficult to use, but in most instances are inconclusive, and I am convinced that the supposed differences are not of particular phylogenetic importance. No attempt is made here to put on record the numerous combinations rendered necessary by

this amplification of the generic limits of *Cynoglossum*, but the following species, incorrectly referred to *Paracaryum*, may be transferred.

Cynoglossum Thomsoni (Clarke), comb. nov. *Paracaryum Thomsoni* Clarke in Hook. Fl. Brit. India iv. 161 (1883).

55. **Rindera** Pallas, Reise i. 486 (1771).

Mattia Schult. Obs. Bot. 30 (1809). *Cyphomattia* Boiss. Fl. Orient. iv. 272 (1875). *Bilegnum* Brand in Fedde, Repert. xiii. 549 (1915).—About 15 species, most of them in western Asia and adjacent Europe.

56. **Tysonia** Bolus in Hook. Icon. xx. t. 1942 (1890).

A South African monotype which is unrepresented in the Gray Herbarium. The plant originally figured by Bolus has peculiar sub-disciform, unarmed, and winged nutlets, characters which, substantiated by the odd corolla-developments, seems to furnish ample justification for the recognition of the genus. The plant described and figured by Brand, Pflanzenr. iv. Fam. 252, 88, fig. 11 (1921) is obviously quite different in fruiting structures, having the depressed, broadly ovoid, densely glochidiate, wingless nutlets of a *Cynoglossum*.

57. **Bothriospermum** Bunge, Enum. Pl. China Bor. 47 (1835).

See Roy. Soc. Cat.

A well-marked genus of 3 to 4 species, all of them occurring in China and one of them ranging from northern India to Manchuria and on the Japanese, Philippine, Mascarene, and Hawaiian islands. Though this genus has been placed in the *Eritrichieae* it seems clear that its proper position is in the *Cynoglosseae* next to *Thyrocarpus*. *Bothriospermum* and this relative are remarkably similar in general habit and in floral structures, in fact appear to differ only in the direction of their nutlets and in the degree to which the dorsal margining is developed on the latter. The two genera agree in having the attachment-surface of their verrucose nutlets proximate to the radicle end of the seed, or in other words have nutlets morphologically apical in attachment. In *Thyrocarpus* the nutlets are divergent, but in *Bothriospermum* they are inverted, parallel and with their backs together. In *Bothriospermum* the peculiar scar above the nutlet-attachment, which has been frequently mistaken for the real attachment-scar, is, hence, morphologically the equivalent of the dorsal cupulate structure on the nutlets of *Thyrocarpus*. The tumid margin of the scar on the back of the nutlets of *Bothriospermum* is the homologue of the outer lobed dorsal margin on the nutlets of *Thyrocarpus*,

and the cartilaginous veil within the tumid rim is the homologue of the inner one of the double margin of *Thyrocarpus*. The cartilaginous veil, well developed in *Bothriospermum*, is also present, but early evanescent, in numerous species of *Omphalodes* and *Paracaryum*.

58. **Thyrocarpus** Hance, Ann. Sci. Nat. ser. 4, xviii.
225 (1862).

A chinese genus of 3 species.

59. **Actinocarya** Benth. in Benth. & Hook. Gen. Pl. ii.
846 (1876).

An interesting monotype from Tibet. According to Brand, Pflanzenr. iv. Fam. 252, 15 (1921), this genus is to be excluded from the *Cynoglosseae* and associated with *Myosotis*, since its nutlets are said to be basifixed. My dissections of the type collection agree with the details in the plate given by Oliver, Hook. Icon. xxiii. t. 2257 (1893), and clearly point to a relationship in the *Cynoglosseae*. Not only do the nutlets bear glochidiate appendages and a coroniform dorsal crest suggestive of the *Cynoglosseae*, but the radicle end of the seed is next to the attachment-surface of the nutlet and, hence, the latter is unquestionably apical in attachment.

60. **Paracaryum** (A. DC.) Boiss. Diag. Pl. Orient. ser. 1,
xi. 128 (1849).

Mattiastrum Brand in Fedde, Repert. xiv. 150 (1915).—With 40 to 45 species in the area between the eastern Mediterranean Basin and India. There seems to be no marked difference between *Paracaryum* and *Mattiastrum*.

2. NOTES ON MISCELLANEOUS AMERICAN BORAGINACEAE.

Cryptantha latifolia, sp. nov., annua laxa ramosa 7–30 cm. alta; ramis breviter graciliterque hispido-strigosis et sparse setosis; foliis subdistantibus firmis oblongo-linearibus vel oblongis obtusis integerimis 1–3.5 cm. longis 2.5–8(–10) mm. latis sessilibus concoloribus pustulato-setosis; spicis solitariis vel geminatis pauci- vel multi-bracteatis 3–12 cm. longis unilateralibus; floribus juventate congestis biseriatis maturitate remotis; calycibus maturitate ovoideis subsessilibus ascendentibus 2–4 mm. longis, lobis linearibus vel lineari-oblongis obtusis breviter hirsutis; corolla conspicua calycem multo superanti 2.5–5 mm. lata, lobis late obovatis 1.2–1.8 mm. longis albis; nuculis 4 triangulari-ovatis compressis fuscescentibus homomorphis

1.5–1.7 mm. longis apice acutis basi rotundo-truncatis dorso muricatis ventre verrucosis apice acutis, sulcis clausis vel infra medium anguste apertis basin versus divaricate furcatis; gynobasi quadrangulari-columnari ca. 1 mm. alta; stylo ca. 1 mm. longo nuculam ca. 0.5 mm. superanti.—PERU: loose stony upper slopes of sea-side hills, Chorrillos near Lima, about 150 m. alt., Sept. 15, 1923, *Macbride 5861* (TYPE, Field Mus. no. 536,865; ISOTYPE, Gray Herb.).—Differing from *C. limensis* (A. DC.) Johnston in its broad rotate corollas that much surpass the calyces, broad leaves, larger calyces, and acute ovate muricate nutlets that are about half the length of the calyx. From the briefly described *C. granulosa* (R. & P.) Johnston it differs in its broad leaves, loosely branched habit and muricate nutlets.

Cryptantha Macbridei, sp. nov., annua basaliter ramosa 5–15 cm. alta; ramis paucis ascendentibus adpresse hispidis; foliis oblanceolatis firmis integerrimis sessilibus saepe acutis 1–2 cm. longis 2–3 mm. latis saepe pustulato-setosis, superioribus reductis, inferioribus oppositis majoribus; spicis solitariis vel geminatis 3–12 cm. longis unilateralibus; floribus obscure biseriatis omnibus angusto-bracteatis maturitate 2–5 mm. separatis; calycibus fructiferis oblongis subsessilibus ascendentibus vel divaricatis 4–5.5 mm. longis basi conicis; lobis calycis oblanceolatis vel linearibus saepe acutis in costa infra medium cum setis flavescens horridis in marginibus adpresse hispidis, supra medium herbaceis paullo hispidis saepe recurvatis vel ascendentibus; corolla tubulosa calyce vix longiori ca. 2 mm. longa, lobis orbicularibus erectis ca. 0.5 mm. longis; nuculis 4 ovato-lanceolatis ca. 1.5 mm. longis fuscescentibus subnitidis verrucosis heteromorphis margine obtusis apice anguste acutis basi rotundatis ventre $\frac{3}{5}$ longitudinis ad gynobasem quadrangulari-columnarem 1–1.2 mm. longam adfixis, sulcis clausis vel anguste apertis basi in areolam deltoideam semper dilatatis; nucula axillari persistenti dorso basin versus laeve quam nuculae consimiles sublongiori.—PERU: loose stony upper slopes of seaside hills, Chorrillos near Lima, about 150 m. alt., Sept. 15, 1923, *Macbride 5869* (TYPE, Field Mus. no. 536,873; ISOTYPE, Gray Herb.).—Collected with and somewhat resembling *C. latifolia*, but differing in its small tubular corollas, coarsely hirsute calyxlobes with spreading herbaceous tips, and narrower verrucose heteromorphous nutlets. From the description of *C. limensis*, of which it appears to be a very close relative, it differs in its much larger (4–5 not 3 mm. long) calyces, spreading calyxlobes, and verrucose nutlets.

Cryptantha peruviana, sp. nov., annua grisea subsimplex vel laxe ramosa 10–20 cm. alta adpresse villosa-hispida inconspicue pustulata; ramis gracilibus ascendentibus; foliis lanceolato-linearibus vel lineari-

bus ascendentibus integerrimis sessilibus acutis 1–3 cm. longis 1–2.5 mm. latis adpresse villosa-hispidis costa et marginibus hispidociliatis supra viridioribus, superioribus paullo reductis; spicis saepe evidenter geminatis rare ternatis vel solitariis ebracteatis 1–5 cm. longis unilateralibus; floribus uniseriatis maturitate 2–5 mm. separatis; calycibus fructiferis ovoideis sessilibus ascendentibus 2–4 mm. longis, lobis erectis linearibus vel lanceolato-linearibus in costa cum setis flavescentibus crassis pungentibus ornatis et in marginibus hispidovillosis; corolla tubulosa quam calyx sublongiori ca. 2 mm. longa, lobis orbicularibus ca. 0.3 mm. longis; nuculis 4 (rare 1–2 abortis) ca. 1.5 mm. longis lanceolato-ovatis compressis acutis pallidis rugosoverrucosis dense minuteque granulatis quam lobi calycis $\frac{3}{5}$ brevioribus homomorphis margine acutis basi truncatis ventre $\frac{1}{2}$ longitudinis ad gynobasem quadrangularem columnarem ca. 1 mm. longam affixa, sulcis apertis vel clausis; stylo ca. 0.6 mm. longo nuculas subsuperanti. —PERU: in loose rocks on dry slopes above Rio Blanco, about 3600 m. alt., May 8–19, 1922, *Macbride & Featherstone 674* (TYPE, Field Mus. no. 517,202; ISOTYPE, Gray Herb.); ravines and hillsides on southern slopes of El Chachani, north of Arequipa, alt. 3355 m. March 1920, *Mr. & Mrs. F. E. Hinkley 77* (G).—A very distinct species with an erect habit of growth, short ebracteate spikes, and pale tuberculate rugose nutlets. The five species of *Cryptantha* which are at present known from Peru may be distinguished by aid of the following

KEY TO THE PERUVIAN SPECIES OF CRYPTANTHA.

Corolla at anthesis twice length of calyx, limb broad.

Leaves oblong-linear or oblong; nutlets muricate or verrucose... *C. latifolia*.

Leaves linear; nutlets granulate... *C. granulosa*.

Corolla tubular, always shorter than or barely exceeding calyx.

Spikes naked, usually geminate; nutlets pale; leaves linear or lance-linear, very obscurely pustulate... *C. peruviana*.

Spikes bracteate, usually solitary; nutlets dark; leaves oblong or oblanceolate, conspicuously pustulate.

Calyx 4–5 mm. long, lobes spreading or recurving above middle; nutlets verrucose... *C. Macbridei*.

Calyx 3 mm. long, lobes erect; nutlets granulate... *C. limensis*.

Amsinckia hispida (R. & P.), comb. nov. *Lithospermum hispidum* R. & P. Fl. Peruv. ii. 5 (1799).—Ruiz & Pavon's specific name is the oldest in the genus, and hence should replace *A. angustifolia* Lehm., cf. Contr. Gray Herb. n. s. lxx. 44 (1924). The type of *A. hispida* was collected in the arid belt to the north of Lima, Peru.

Harpagonella Palmeri, var. **arizonica**, n. var., corneis calycis quam ea formae typicae gracilioribus longioribus ca. 4 mm. longi-

tudine; nuculis paullo grandioribus.—ARIZONA: plains, Lowell, May 3, 1884, *W. F. Parish* 162 (TYPE, Gray Herb.); near Tucson, April 1881, *Pringle* 363; Tucson, *Lemmon*; Tucson, 1877, *Greene* 1110.—The plant of Arizona currently referred to *H. Palmeri* Gray differs from that of California and Lower California in having more elongate cornute processes on the fruiting calyx and noticeably larger nutlets. The type of *H. Palmeri*, collected on Guadalupe Island by Palmer in 1875, is quite indistinguishable from the plant of coastal Southern California and adjacent Lower California.

Harpagonella was placed in a special tribe by Gürke, E. & P. Nat. Pflanzenf. iv. Abt. 3a, 130 (1895), and was so treated in a paper of my own, Contr. Gray Herb. n. s. lxx. 5 (1924). A recent detailed study of *Harpagonella*, however, has convinced me that it has been treated with too much dignity, and that it clearly falls into the *Cynoglosseae* next to *Pectocarya* as first indicated by Gray, Proc. Am. Acad. xi. 88 (1876).

Harpagonella has only two ovules. The nutlets which develop from these are somewhat different in shape, attachment, and pubescence. The axial nutlet (that next the distinct calyx-lobes) is pubescent on all faces, and is slightly shorter and more loosely affixed to the gynobase than is the abaxial nutlet. The abaxial nutlet is enclosed by the peculiarly modified abaxial calyx-lobes, and is pubescent only on the face proximate to the axial nutlet. In both nutlets the radicle-end of the seed is next the attachment-end of the nutlet, and hence, morphologically at least, the nutlets are apically attached. It is quite evident, therefore, that the nutlets must stand inverted with their backs juxtaposed. A close examination reveals a margin surrounding the pubescent inwardly facing side of the abaxial nutlet which further suggests that this is, indeed, morphologically the back of the nutlet. The style, gynobase, and corolla, the indurated recurved pedicels, and all the vegetative characters of *Harpagonella* are those of *Pectocarya*, a genus which also has very elongate nutlets apically attached, and hence there seems to be every reason for returning to the treatment of Gray, l. c., and Bentham & Hooker, Gen. Pl. ii. 846 (1876), placing the genus next to *Pectocarya* and considering it no more than a highly specialized and anomalous member of the *Cynoglosseae*.

PECTOCARYA LATERIFLORA (Lam.) DC. Prodr. x. 120 (1846). *P. gracilis*, var. *boliviana* Johnston, Contr. Gray Herb. n. s. lxx. 37 (1924).—The study of the material of *Pectocarya*, recently collected by Mr. J. F. Macbride in Peru, has convinced me that *P. gracilis*, var. *boliviana* is synonymous with *P. lateriflora*, since the habit-

difference, by which *P. gracilis* and *P. lateriflora* were distinguished, has proved illusory. The three species constituting the § *Eupectocarya* appear to be remarkably similar in habit, differing only in the shape and arming of the nutlets. *Pectocarya lateriflora* is characterized by its obovate, rather than parallel-sided oblong-linear nutlets, and appears to represent its section in Peru and Bolivia. Weberbauer, Engler & Drude, Veg. Erde xii. 136, fig. 5 (1911), has given a suggestive, but not accurately detailed illustration of *P. lateriflora*.

CYNOGLOSSUM LIMENSE Willd. Sp. Pl. i. 762 (1798).—This species is based entirely upon a plate and description given by Feuillée, Jour. Obs. Phys. ii. 765, t. 49 (1714), who found the plant in the "vallée d'Ylo." As clearly shown by Feuillée's maps and discussion, the locality known to him as "Ylo" is the same as the port near the southern boundary of Peru now known under that name. The type of *C. limense*, hence, was not collected near Lima as Willdenow's inappropriate specific name, and Brand's statement, Pflanzenr. iv. Fam. 252, 142 (1921), would suggest. As the plant has not been reported from within 500 miles of Ylo it is possible that its reputed occurrence there is the result of some confusion of data.

CYNOGLOSSUM TRIANAEUM Wedd. Chlor. And. ii. 90 (1859).—A fine plate of this was published by Oliver, Hook. Icon. xxv. t. 2458 (1896). Brand, Pflanzenr. iv. Fam. 252, 136 (1921), apparently intended to cite this illustration, but part of his citation has been omitted and the remainder, the plate-number, was added to the citation to Weddell's Chloris Andina.

CORDIA GERASCANTHUS L. Syst. ed. 10, 936 (1759); not of Griseb. Fl. Brit. W. Ind. 478 (1861), nor Chodat, Bull. Soc. Bot. Genève ser. 2, xii. 209 (1920). *Gerascanthus* P. Browne, Hist. Jamaica 170, t. 29, fig. 3 (1756). *C. gerascanthoides* HBK. Nov. Gen. et Sp. iii. 69 (1818).—In 1910 Urban, Symb. Antil. iv. 516, indicated that, as then used, the binomial, *Cordia gerascanthus* L., was incorrectly applied to the widely distributed tree with canescent, densely stellate calyces, and that the name is properly applicable to the relatively localized species of the West Indies and southern Mexico which has glabrous or sparingly hirsute calyces and larger flowers, and which was described and current as *C. gerascanthoides* HBK. Ten years later, in his paper on *Cordia* § *Gerascanthus*, Chodat, l. c., declared Urban's interpretation of *C. gerascanthus* L. to be incorrect and used the name in the traditional sense, applying it to the widely distributed plant with stellate calyces. Further examination of this matter has recently been made to determine the correct specific name for use by

Dr. W. M. Wheeler in his publications on myrmecophytes. For the convenience of others the results of this study are here put on record.

Cordia gerascanthus L. is based upon the Jamaican plant which Patrick Browne, l. c., described and figured under the name "*Gerascanthus*." Browne's illustration, showing only the floral structures, portrays a corolla of large size which has broad short obtuse lobes with conspicuous pinnate veining, a broad saucer-shaped throat, a stocky weakly ribbed calyx, and deltoid calyx-lobes. These characters definitely associate Browne's plant with *C. gerascanthoides* HBK. and prohibit the use of the Linnean name for the plant with stellate calyces. It is to be also noted that not only does Grisebach, l. c., cite Browne's figure under "*C. gerascanthoides* HBK.," but he gives *C. gerascanthoides* HBK. as "common in the lowlands and mountains" of Jamaica, and gives the plant with stellate calyces (under *C. gerascanthus* Jacq.) as "rare" on that island. Browne's plant was not rare, for he speaks of it as follows, "This tree grows in many parts of Jamaica, and is generally esteemed as one of the best timber woods in the island; it rises to considerable height, . . . , especially in the low-lands, where it is most common," It is significant that concerning the Jamaican occurrence of the plant with stellate calyces, Urban, l. c. (under *C. alliodora* Cham.), comments parenthetically as follows, "fortasse a cl. Wilson introducta ex cl. Stapf. in lit." Since the identity of *C. gerascanthoides* HBK. and *Gerascanthus* Browne is certain from a study of Browne's plate and description, and from distributional considerations, it is evident that *Cordia gerascanthus* L. is, indeed, improperly applied to the widely distributed plant with stellate calyces. Among its close relatives in the West Indies and Central America, *C. gerascanthus* L. is readily recognized by its large flowers, saucer-shaped throat, hirsute or glabrescent stout weakly ribbed calyx-tube, and deltoid calyx-lobes. It is known only from Cuba!, Isle of Pines!, Jamaica!, southern Mexico!, and northern Central America. As Urban, Symb. Antil. iv. 516 (1910) and viii. 574 (1921), has pointed out, *Cordia alliodora* (R. & P.) Cham. is the correct name for the widely distributed plant with stellate calyces, or, in other words, for the one incorrectly current as "*C. gerascanthus*." *Cordia alliodora* ranges from Mexico and the West Indies southward along the Andes to Bolivia. A number of critical species, doubtfully distinct from it, have been described from southern Brazil, adjacent Paraguay, and Argentina.