of the pedicels is frequent in the genus and at least until other more convincing differences are found this plant of Friedrichsthal may be provisionally placed as

B. KELLERMANII, forma **podocephala**, forma nov., formae typicae simillima differt capitulis graciliter pedicellatis; pedicellis 3–10(–20) mm. longis erectis vel adscendentibus.—GUATEMALA: *Friedrichsthal* (K., phot. and fragm. Gr.).

## II. STUDIES IN THE BORAGINACEAE.

By I. M. JOHNSTON

### 1. RESTORATION OF THE GENUS HACKELIA.

As currently taken the genus *Lappula* is composed of two sharply differentiated groups. It is here proposed that the perennial and biennial species with pyramidal gynobase be segregated to form the genus *Hackelia*, while the annual species with subulate gynobase be left to constitute the genus *Lappula*. The very important characters which separate these very distinct genera may be realized by a study of the following contrast.

LAPPULA. Annual; inflorescence abundantly bracteate; pedicels erect; gynobase subulate, 5–10 times as tall as broad, about equaling the nutlets; style surpassing the nutlets; nutlets narrowly attached all along the well developed medial ventral keel.

HACKELIA. Biennial or perennial; inflorescence naked or rarely sparsely bracteate; pedicels recurved or deflexed in fruit; gynobase pyramidal, less tall than broad; style definitely surpassed by nutlets; nutlets attached by a large oblique submedial ovate or deltoid areola; ventral keel extending over only upper half of nutlet.

As usually taken *Lappula* has been an unnatural aggregate formed of two groups whose structures are so different that it seems improbable that the groups are immediately related. The species which I have refered to *Hackelia* do not find their nearest relations among the species of true *Lappula*, but rather among the species in section *Coloboma* of *Eritrichium*. Indeed so close and unmistakable are the relations between *Hackelia* and *Eritrichium* that with much justification the two genera might be merged. On the other hand *Hackelia* has been referred to *Lappula* only because the species in both genera have glochidiate bristles on the dorsal rim of the nutlets, and despite the fact that the species of the two groups differ markedly in habit and in a number of fundamental characters. As both *Lappula* and

*Hackelia* have in all probability evolved from the *Cynoglosseae* where glochidiate bristles are common as carpel appendages, it must be evident that the presence of barbed appendages is only of general phylogenetic significance and not a safe criterion upon which to judge immediate relationships.

*Hackelia* and *Lappula* differ in the manner by which the nutlets are attached to the gynobase. Among the borages this correctly has been considered of fundamental importance. In the characters of gynobase and nutlets *Hackelia* is almost exactly matched by developments in *Eritrichium* § *Coloboma*, for many species of that section approximate upon a reduced scale the characteristic habit of *Hackelia*, while furthermore some species, such as *E. strictum* Decne., *E. pectinatum* (Pall.) A.DC., etc., have the toothing on the dorsal margining of the nutlet tipped by subulate barbed prolongations.

Although approaching one another closely *Hackelia* and *Eritrichium* seem readily distinguished by habit, the former being rank-growing green biennials or perennials with broad thin leaves and stems 2–10 dm. high, whereas *Eritrichium* contains low, canescent or silvery, strongly rooted, caespitose plants with small firm leaves and stems 1–20 cm. high. The dorsal margining of the nutlets in *Hackelia* is usually broken up into flattened subulate glochidiate appendages, but in *Eritrichium* the margin is entire or merely dentate and usually without glochids. The only invariably diagnostic character by which the two genera can be separated is that found in the direction of the fruiting pedicels; in *Hackelia* the pedicels are recurved or reflexed in fruit whereas in *Eritrichium* they are always erect or nearly so. *Hackelia* centers in western North America and has outlying species in the Andes and Himalayas, and in central Europe, eastern United States, and Mexico. *Eritrichium* centers in Asia, but has an arctic series of species occurring at high latitudes or altitudes in Europe and North America.

The genus *Hackelia* was published for Opiz by Berchtold in the latter's "Oekonomisch-technische Flora Böhmens." The genus was separated from *Echinospermum* for reasons unstated, but evidently not because of the characters stressed now in resurrecting it, for although *H. deflexa* was the only species fully described under the genus, there were eight of Ledebour's species, all true Lappulas, referred to it in a footnote. The characteristic areola and attachment of the nutlets are described in the lengthy specific diagnosis of *H. deflexa*, but in the generic description the style and the attachment of the nutlets are described but vaguely, and in similar terms as in the

generic description of *Echinospermum* a few pages further on. *Hackelia deflexa* (Wahl.) Opiz, being the first species given under *Hackelia* and the only one treated with any detail, it is taken as constituting the type of the genus as here redefined. The species referable to *Hackelia* are as follows:—

HACKELIA DEFLEXA (Wahl.) Opiz in Bercht. Fl. Böhm. ii, pt. 2, 147 (1839). *Myosotis deflexa* Wahl. Vet. Acad. Handl. Stockholm, xxxi. 113, t. 4 (1810). *Echinospermum deflexum* Lehm. Asperif. i. 120 (1818). *Rochelia deflexa* R. & S. Syst. iv. 109 (1819). *Cynoglossum deflexum* Roth, Enum. i. 589 (1827). *Lappula deflexa* Greene, Pittonia ii. 182 (1891). *Echinospermum deflexum*, var. *americanum* Gray, Proc. Am. Acad. xvii. 224 (1882). *Lappula deflexa*, var. *americana* Greene, l. c. 183. *L. americana* Rydb. Bull. Torr. Cl. xxiv. 294 (1897).

**H. virginiana** (L.), comb. nov. *Myosotis virginiana* L. Sp. Pl. 131 (1753). *Echinospermum virginicum* Lehm. Asperif. i. 117 (1818). *Rochelia virginiana* R. & S. Syst. iv. 108 (1819). *Lappula virginiana* Greene, Pittonia ii. 182 (1891). *Cynoglossum Morisoni* A.DC. Prodr. x. 155 (1846).

**H. pinetorum** (Greene), comb. nov. *Echinospermum pinetorum* Greene in Gray, Proc. Am. Acad. xvii. 224 (1882). *Lappula pinetorum* Greene, Pittonia ii. 182 (1891). *L. pustulata* Macbr. Contr. Gray Herb. xlviii. 39 (1916). *L. heliocarpa* Brand in Fedde, Repert. xviii. 310 (1922).

**H. Roylei** (Wall.), comb. nov. *Cynoglossum Roylei* Wall. in Don, Gen. Syst. iv. 356 (1838). *C. laxum* Don, l. c. *Lappula laxa* Macbr. Proc. Am. Acad. li. 543 (1916). *C. uncinatum* Royle, acc. to Benth. in Royle, Ill. 305 (1839). *C. glochidiatum* Wall. acc. to Benth. in Royle, l. c. 306. *Echinospermum glochidiatum* A.DC. Prodr. x. 136 (1846). *Paracaryum glochidiatum* Benth. in Hook Fl. Brit. Ind. iv. 161 (1883). *L. glochidiata* Brand in Fedde, Repert. xiv. 146 (1915).

**H. macrophylla** (Brand), comb. nov. *Lappula macrophylla* Brand in Fedde, Repert. xiv. 147 (1915). *Cynoglossum uncinatum*, var. *laxiflora* Benth. in Royle, Ill. 305 (1839). *Echinospermum glochidiatum*, var. *laxiflorum* A.DC. Prodr. x. 136 (1846).—From their descriptions this and the next species seem scarcely distinct from the preceding one.

**H. Dielsii** (Brand), comb. nov. *Lappula Dielsii* Brand in Fedde, Repert. xiv. 147 (1915).

**H. revoluta** (R. & P.), comb. nov. *Cynoglossum revolutum* R. & P. Fl. Peruv. ii. 6 (1799). *Lappula revoluta* Brand in Fedde, Repert.

xiv. 148 (1915). *C. ovatifolium* Griesb. Götting. Abhandl. xxiv. 271 (1879). *L. revoluta*, f. *ovatifolia* Brand, l. c. *C. parviflorum* Krause, Engler Bot. Jahrb. xxxvii. 634 (1906). *C. Fiebrigii* Krause, l. c. *L. revoluta*, f. *Fiebrigii* Brand, l. c. *C. andicolum* Krause, l. c. 635.

**H. costaricensis** (Brand), comb. nov. *Lappula costaricensis* Brand in Fedde, Repert. xviii. 310 (1922). *L. guatemalensis* Brand, l. c. 311.

**H. mexicana** (Schl. & Cham.), comb. nov. *Cynoglossum mexicanum* Schl. & Cham. Linnaea v. 114 (1830). *Echinospermum mexicanum* Hemsl. Biol. Cent.-Am. Bot. ii. 377 (1882). *Lappula mexicanum* Greene, Pittonia ii. 182 (1891).—This and the preceding are closely related to *H. revoluta* and perhaps are not specifically distinct.

**H. leptophylla** (Rydb.), comb. nov. *Lappula leptophylla* Rydb. Mem. N. Y. Bot. Gard. i. 329 (1900). (?) *L. scaberrima* Piper, Bull. Torr. Cl. xxix. 545 (1902). (?) *L. angustata* Rydb. Bull. Torr. Cl. xxxi. 636 (1904). *L. Besseyi* Rydb. l. c. 636. (?) *L. grisea* Woot. & Standl. Contr. U. S. Nat. Herb. xvi. 164 (1913). *L. floribunda* of Piper (Bull. Torr. Cl. xxix. 537. 1902.) and other recent authors.

**H. hispida** (Gray), comb. nov. *Echinospermum diffusum*, var. *hispidum* Gray, Proc. Am. Acad. xvii. 225 (1882). *E. hispidum* Gray, l. c. xx. 259 (1884). *L. hispida* Greene, Pittonia ii. 182 (1891).

**H. ciliata** (Dougl.), comb. nov. *Cynoglossum ciliatum* Dougl. in Lehm. Pug. ii. 24 (1830). *Echinospermum ciliatum* Gray, Proc. Am. Acad. xvii. 225 (1882). *Lappula ciliata* Greene, Pittonia ii. 182 (1891).

**H. setosa** (Piper), comb. nov. *Lappula setosa* Piper, Bull. Torr. Cl. xxix. 544 (1902).

**H. cinerea** (Piper), comb. nov. *Lappula cinerea* Piper, Bull. Torr. Cl. xxix. 544 (1902).

**H. ursina** (Greene), comb. nov. *Echinospermum ursinum* Greene in Gray, Proc. Am. Acad. xvii. 224 (1882). *Lappula ursina* Greene, Pittonia ii. 182 (1891).

**H. hirsuta** (Woot. & Standl.), comb. nov. *Lappula hirsuta* Woot. & Standl. Contr. U. S. Nat. Herb. xvi. 164 (1913).

**H. gracilenta** (Eastw.), comb. nov. *Lappula gracilenta* Eastw. Bull. Torr. Cl. xxix. 523 (1902).

**H. floribunda** (Lehm.), comb. nov. *Echinospermum floribundum* Lehm. Pug. ii. 24 (1830). *Lappula floribunda* Greene, Pittonia ii. 182 (1891). *Rochelia patens* Nutt. Jour. Acad. Philad. vii. 44 (1834). *E. subdecumbens* Parry, Proc. Davenport Acad. i. 148 (1876). *L.*

*subdecumbens* Nels., Manual Rocky Mt. Bot. 412 (1909). (?) *L. leucantha* Greene, Leaflets i. 152 (1905). *L. Jessicae* McGreg. Bull. Torr. Cl. xxxvii. 262 (1910). *L. diffusa* of Piper and other recent authors.—The plant referred here has always been associated with Lehmann's *Echinospermum diffusum* despite the fact that it is perfectly portrayed in Hooker's, Fl. Bor. Am. ii. 84, t. 164 (1838), plate of *E. floribundum*, a plate apparently drawn from an isotype if not the actual type of that latter species. It is to be particularly noted that the plant, the *Lappula diffusa* of recent authors, which I refer to Lehmann's *Echinospermum floribundum* agrees with the pictured plant in perennial duration and in size of corolla, developments not present in *H. leptophylla*, the plant usually referred to Lehmann's species. In spite of the note by Nelson and Macbride, Bot. Gaz. lxi. 42 (1916), the account given by Parry, l. c., and the isotype preserved in the Gray Herbarium both clearly show that Gray, Proc. Am. Acad. xvii. 225 (1882), and Piper, Bull. Torr. Cl. xxix. 539 (1902), were correct in refering *Echinospermum subdecumbens* to the present species. The use of Parry's name in the Rocky Mountain Manual is incorrect! The plant is definitely blue-flowered, as the lack of mention of color in Parry's observations would suggest.

**H. Eastwoodae**, nom. nov. *Lappula micrantha* Eastw. Bull. Torr. Cl. xxx. 497 (1903); not *H. micrantha* (Ledeb.) Opiz.—Related to *H. floribunda*, but differing in small flowers and in having a few glochidiate prickles on the back of the nutlets. Perhaps only the Californian variety of that species.

**H. bella** (Macbr.), comb. nov. *Lappula bella* Macbr. Contr. Gray Herb. xlviii. 39 (1916). (?) *L. Rattanii* Brand in Fedde, Repert. xviii. 311 (1922).—Differing from the closely related *H. velutina* in possessing white corollas, and in having the back of the nutlets unarmed.

**H. nervosa** (Kell.), comb. nov. *Echinospermum nervosum* Kell. Proc. Calif. Acad. ii. 146, f. 42 (1862). *Lappula nervosa* Greene, Pittonia ii. 182 (1891).

**H. velutina** (Piper), comb. nov. *Lappula velutina* Piper, Bull. Torr. Cl. xxix. 546 (1902).—Perhaps only a good variety of the last. The Hackelias of the Yosemite Region seem best referred here although they vary as to pubescence and have small corollas with short tubes.

**H. californica** (Gray), comb. nov. *Echinospermum californicum* Gray, Proc. Am. Acad. xvii. 225 (1882). *Lappula californica* Piper, Bull. Torr. Cl. xxix. 546 (1902).

**H. arida** (Piper), comb. nov. *Lappula arida* Piper, Bull. Torr. Cl. xxviii. 44 (1901). *L. Cottoni* Piper, l. c. xxix. 549 (1902).

**H. arida**, var. **Cusickii** (Piper), comb. nov. *Lappula Cusickii* Piper, Bull. Torr. Cl. xxix. 542 (1902). *L. arida*, var. *Cusickii* Nels. & Macbr. Bot. Gaz. lxi. 41 (1916). *L. saxatilis* Piper, l. c. 541.

**H. diffusa** (Lehm.), comb. nov. *Echinospermum diffusum* Lehm. Pug. ii. 23 (1830). *Lappula diffusa* Greene, Pittonia ii. 182 (1891). *L. Hendersoni* Piper, Bull. Torr. Cl. xxix. 539 (1902). (?) *L. trachyphylla* Piper, l. c. 540. *L. subdecumbens* of Nels. Man. Rocky Mt. Bot. 412 (1909), as to description only.—The plant concerned here agrees with Lehmann's description in height of growth, pubescence, size and color of flowers, and in the arming of the nutlets. It fits the description far better than the other plant, here called *H. floribunda*, which has borne Lehmann's specific name in the past. In fact the present plant diverges from Lehmann's description only by having usually acutish rather than obtusish cauline leaves.

**H. diffusa** var. **caerulescens** (Rydb.), comb. nov. *Lappula caerulescens* Rydb. Mem. N. Y. Bot. Gard. i. 328 (1900). *L. subdecumbens caerulescens* Garrett, Fl. Wasatch Reg. 78 (1911).

## 2. The Genus Antiphytum.

In the literature concerned with the *Boraginaceae* the species of *Antiphytum* have been repeatedly confused with the species now referred to *Plagiobothrys*, *Cryptantha*, and allied genera, despite the fact that the former genus appears to belong not to the *Eritrichieae*, but rather to the *Lithospermeae*. This confusion has resulted from the attention being too closely centered upon similarities in nutlets, similarities which caused Gray, Proc. Am. Acad. xx. 265 (1885), to refer the Mexican species of *Antiphytum* to *Krynitzkia*, and which gave Macbride, Contr. Gray Herb. xlviii. 41 (1916), his reasons for saying that *Amblynotopsis*, here referred to *Antiphytum*, is "intermediate between the genera *Allocarya* and *Plagiobothrys*." The genus *Antiphytum*, however, differs from *Plagiobothrys* in habit, color of flowers, and particularly in the geminate stigmas. The stigmas of *Antiphytum* definitely remove it from the *Eritrichieae* in which *Plagiobothrys* and its other supposed allies are found.

The genus *Antiphytum* was first described in Meisner's Genera, i. 280 (1836–43). The original description, about fifty words in length, applies well to the genus as it has been taken in the past. In the Commentary accompanying his Genera, ii. 188 (1836–43), Meisner gives the bibliography of the genus as follows:—

"ANTIPHYTUM. DC. Mss. in Moç. ic. fl. Mex. ined. (4 sp.)—*Anchusa oppositifolia*, H.B.K., nov. gen. 3. p. 91. t. 200. *A. cruciata* et *stoechadifolia*, Cham. in Linnaea, 4. p. 438. et *A. Mexicana*, DC. ap. Moç. l. c.—Genus jam foliis oppositis (unde nomen) insigne."

Mociño's flora referred to was unpublished until 1874, or over thirty years after the appearance of Meisner's Genera. *Antiphytum mexicana* DC., published in the Prodromus, x. 121, in 1846, is *Heliotropium calcicola* Fernald, Proc. Am. Acad. xliii. 62 (1907). Although the only *Antiphytum* published in Mociño posthumous work, *A. mexicana* can scarcely be considered as the type of the genus since it remained so long unpublished and particularly since having typical *Heliotropium* fruit, it is not at all described in the original generic diagnosis. *Anchusa oppositifolia* HBK. is an *Allocarya*. This species being the first published species mentioned under *Antiphytum* and the only one with a cited illustration, might be considered the type of *Antiphytum* and that name treated as an older synonym of Greene's genus *Allocarya*, Pittonia i. 12 (1887). Usage, however, has restricted the name *Antiphytum* to the genus including Chamisso's *Anchusa cruciata* and *A. stoechadifolia*. This usage is justifiable by the workings of the logical process of residues, the other species originally placed in *Antiphytum* having been referred to other genera and the name *Antiphytum* left to that group which had a majority representation in the original definition of the genus. It is also to be noted that with the exception that they are never herbs, Chamisso's species agree with every item in Meisner's diagnosis. On the other hand *Anchusa oppositifolia* is never suffrutescent, and does not have scorpioid cymes, nor ciliate-papillose faucal protuberances.

In 1916 Macbride, l. c., erected the genus *Amblynotopsis* for the Mexican species which I refer to *Antiphytum*. Although four of the five recognized and previously published species had been at one time or another referred to *Antiphytum* no contrast was made between the members of the newly proposed genus and the old restricted one. A careful study of this relationship now shows that the Mexican plants, forming the genus *Amblynotopsis*, are distinguished from the Brazilian ones, forming the true *Antiphytum*, only by having non-blue corollas and alternate upper leaves. These are scarcely generic differences. The Mexican *Antiphytum heliotropioides* besides agreeing with the Brazilian *A. cruciatum* in shrubby habit and loose strigose pubescence of similar encrusted hairs, also has opposite leaves. The chief difference between the two plants being that in the Mexican plant the leaves of the inflorescence are alternate, whereas in the Brazilian

species the leaves are opposite throughout the plant. Among the Mexican species *A. floribundum* has all its leaves alternate. Such species as *A. peninsulare* and *A. nudicalces* have several pairs of opposite leaves. Hence within the enlarged *Antiphytum* there are all the stages from an entirely opposite-leaved condition to a completely alternate-leaved one. Since leaf-position has various degrees of development among the Mexican species and since the difference separating the Mexican and Brazilian species is simply a matter of slight degree it seems inadvisable to attempt the use of leaf-position as a generic character. Flower-color is equally unsatisfactory as a generic character. The Brazilian species have bluish flowers. Among the Mexican species *A. peninsulare* has white flowers, whereas the remainder have yellow ones. If the color of corolla is to be exalted to generic importance there will be need of three instead of merely two genera.

The Brazilian species have flat gynobases and nutlets that are basally attached by a short stipe-like prolongation. Although most Mexican specimens have their nutlets directly attached to a more or less pyramidal gynobase by a large oblique submedial ventral scar, certain specimens (*Palmer 443, 207*) here referred to the polymorphous *A. floribundum* have nutlets with basal attachments through a short stipe to a flattened gynobase quite like that exhibited in Brazilian specimens. A synopsis and bibliography of the genus follows:—

ANTIPHYTUM A.DC. in Meisner, Genera i. 280; ii. 188 (1836–43).
*Thaumatocaryon* Baill. Bull. Mens. Soc. Linn. Paris 839 (1890).
*Amblynotopsis* Macbr. Contr. Gray Herb. xlviii. 41 (1916).

Leaves all opposite; corolla bluish; South American.
Plant herbaceous; leaves 10–35 mm. broad; nutlets smooth, shiny; corolla tubular-funnelform.....1. *A. tetraquetrum.*
Plant suffrutescent; leaves 3–8 mm. broad; nutlets rugose, dull; corolla tubular-rotate.....2. *A. cruciatum.*
Leaves alternate at least above; corolla yellow or white; Mexican.
Pedicels elongating, becoming 5–10 mm. long; leaves alternate only in the inflorescence; corolla with definite tube and faucal appendages.....3. *A. heliotropioides.*
Pedicels not elongating, at most 5 mm. long; leaves in basal rosettes, alternate, or only lowermost opposite.
Corolla subrotate, throat broad and open, tube practically undeveloped; appendages lacking, stamens exposed.
Stems strictly erect, 3–8 dm. high; basal leaves few, oblanceolate to linear-oblanceolate, canescent, 3–10 mm. broad.....4. *A. floribundum.*
Stems decumbent, less than 2 dm. tall; basal leaves numerous, crowded, very narrowly linear, silvery, 1–2 mm. broad.....5. *A. paniculatum.*

Corolla salverform, tube cylindrical and well developed; appendages well developed; stamens included and hidden.
Corolla white; fruiting calyx 8 mm. long, sparsely strigose-hispid; plant bushy, about 5 dm. tall....6. *A. peninsulare.*
Corolla yellow; fruiting calyx 2–5 mm. long, densely strigose; plant caespitose or with a prostrate shrubby caudex, 1–2 dm. high.
Plant with a loosely branched shrubby caudex; leaves not in basal rosettes, all cauline.....8. *A. nudicalces.*
Plant densely caespitose; basal leaves in dense rosettes.
Corolla about 5 mm. broad; style surpassing nutlets; fruiting calyx 3–4 mm. long.....7. *A. caespitosum.*
Corolla about 1 mm. broad; style not surpassing nutlets; fruiting calyx 2–3 mm. long.....9. *A. Parryi.*

1. ANTIPHYTUM TETRAQUETRUM (Cham.) A.DC. Prodr. x. 122 (1846). *Anchusa tetraquetra* Cham. Linnaea viii. 113 (1833). *Thaumatocaryon Hilarii* Baill. Bull. Mens. Soc. Linn. Paris 839 (1890). *Antiphytum Bornmülleri* Pilger in Fedde, Repert. iii. 24 (1906). *Antiphytum Bornmülleri*, var. *asperior* Pilger l. c. 25.

2. A. CRUCIATUM (Cham.) A.DC. Prodr. x. 121 (1846). *Anchusa cruciata* Cham. Linnaea iv. 438 (1829). *Anchusa stoechadifolia* Cham. l. c. 439. *Antiphytum staechadifolium* A.DC. l. c. *Myosotis Berroi* Arech. Anal. Mus. Nac. Montevideo, ser. 2, i. 69, f. 5–6 (1911). —The lengthy descriptions given by Chamisso do not seem to contain any fundamental characters by which his two species can be distinguished, nor has any subsequent writer pointed out diagnostic characters.

3. A. HELIOTROPIOIDES A.DC. Prodr. x. 122 (1846). *Eritrichium heliotropioides* Torr. Bot. Mex. Bound. 140 (1859). *Krynitzkia heliotropioides* Gray, Proc. Am. Acad. xx. 265 (1885). *Cryptantha heliotropoides* Loes. in Fedde, Repert. xii. 243 (1913). *Amblynotopsis heliotropioides* Macbr. Contr. Gray Herb. xlviii. 41 (1916).

4. A FLORIBUNDUM (Torr.) Gray, Proc. Am. Acad. x. 55 (1875). *Eritrichium floribundum* Torr. Bot. Mex. Bound. 140 (1859). *Krynitzkia floribunda* Gray, l. c. xx. 265 (1885). *Amblynotopsis floribunda* Macbr. Contr. Gray Herb. xlviii. 41 (1916). *Amblynotopsis durangensis* Macbr. l. c. 42.—As here taken the species is extremely polymorphous and almost certainly capable of division, but at present the material is too meager to attempt satisfactory segregation.

5. **A. paniculatum**, nom. nov. *Lithospermum linifolium* Mart. & Gal. Bull. Acad. Belg. xi. 338 (1844); not *Antiphytum linifolium* A.DC. (1846).

6. **A. peninsulare** (Rose), comb. nov. *Krynitzkia peninsularis* Rose, Contr. U. S. Nat. Herb. i. 85 (1890). *Amblynotopsis peninsularis* Macbr. Contr. Gray Herb. xlviii. 41 (1916).

7. **A. caespitosum**, sp. nov., mexicanum; caulibus erectis vel valde ascendentibus 8–16 cm. altis apicem versus pauce stricteque ramosis; foliis dense strigosis argyro-canescentibus 1–2 mm. latis acutiusculis, inferioribus anguste linearibus 2–5 cm. longis erectis rosulatis, caulinis 8–15 mm. longis; racemis paucis unilateralibus manifeste bracteatis 2–3 cm. longis; calyce 2.5–3 mm. longo 5-partito breve pedicellato; corolla flava, limbo 4–5 mm. lato plano, lobis rotundatis imbricatis extus pubescentibus, tubo 1.5–2 mm. longo ad apicem cum 5 appendiculis gibbosis instructo, staminibus inclusis cum filamentis antheris brevioribus; nuculis rugoso-tuberculatis 1.5–2 mm. longis, areolis amplis distincte sub medio locatis; gynobasi angusta pyramidali; stylo nuculis longiore; stigmatibus geminatis.—MEXICO: Cerros near San Luis Tultitlanapa, Puebla, *Purpus 2606* (TYPE, Gray Herb.). Sonnige Kalkhügel bei Comitan, Chiapas, *Seler 3073*. Huauclilla, Nochixtlan, Oaxaca, *Conzatti & González 1222*.

8. **A. nudicalces**, sp. nov., diffusum; *A. caespitosum* similans sed differt ramis numerosis ramosis e caudice suffruticoso laxe ramoso prostrato vel etiam paullo subterraneo orientibus et foliis majoribus 2–3 mm. latis omnibus caulinis.—MEXICO: Sosola, alt. 7000 ft., Oaxaca, *L. C. Smith 393* (TYPE, Gray Herb.). Although differing from *A. caespitosum* conspicuously in habit this species is identical with it in inflorescence, floral, and fruit characters and may prove to be worthy of no more than varietal recognition.

9. A. PARRYI Wats. Proc. Am. Acad. xviii. 122 (1883). *Krynitzkia Parryi* Gray, Proc. Am. Acad. xx. 265 (1885). *Amblynotopsis Parryi* Macbr. Contr. Gray Herb. xlviii. 41 (1916).—MEXICO: En route from San Luis Potosi to San Antonio, Texas, *Parry* (TYPE). Sosola, Oaxaca, *L. C. Smith 394*. Without locality, *Coulter 1050* in part. The type is in advanced maturity and entirely lacks flowers. It is associated with the small-flowered Oaxacan plant only because of the remarkable similarity in the size and developments of all other parts.

## 3. NOVELTIES AND NEW COMBINATIONS IN THE GENUS CRYPTANTHA.

**Cryptantha Abramsii**, sp. nov., annua basem versus simplex supra sparse ascendenter ramosa 15–30 cm. alta strigosa; foliis linearibus vel lineari-filiformibus 1–3 cm. longis 1–1.5 mm. latis sessilibus acutiusculis basem versus hispidis, infimis oppositis; spicis solitariis vel geminatis 2.5–10 cm. longis conspicue bracteatis, bracteis linearibus vel lanceolatis; corolla evidenti 1.5–2 mm. lata; calycibus maturitate 3–4 mm. longis remotis non biseriatis strictis vel ascendentibus, lobis lanceolatis breviter hispidis calyce ⅓–¼ brevioribus

abaxillaribus crassissimis et hispidissimis; nuculis 1–4 lanceolatis laevibus nitidis basi truncatis compressis 2–2.2 mm. longis, sulcis clausis basem versus furcatis; stylo alto ⅓–¼ nuculis breviori; gynobasi subulata.—CALIFORNIA: San Pedro Hills near Malaga Cove, Los Angeles Co., March 14, 1903, *Abrams 3139* (TYPE, Gray Herb.; ISOTYPE, Univ. Calif. Herb.). Allied to *Cryptantha leiocarpa* (F. & M.) Greene, but differing from that species in its short style, erect habit, and fewer nutlets. It suggests the large-flowered forms of *C. Clevelandi* Greene, and possibly may be only a bracteate form of the latter species. Further material is a great desideratum.

**Cryptantha Brandegei,** sp. nov., annua diffusa decumbens; caulibus gracilibus 1–4 dm. longis strigosis pustulatis vel levibus; foliis oblongo-lanceolatis vel linearibus obtusis 6–15 mm. longis 2–3(–4) mm. latis basem versus sparse hispidis concoloribus; spicis solitariis vel rare geminatis aliquid sparse bracteatis vetustis 4–8 cm. longis; calycibus maturitate congestis vel remotis 2–4 mm. longis strictis; lobis calycis linearibus costatis cum setis flavescentibus horrentissimis marginibus sparse strigosis abaxillaribus longissimis hispidissimis; corolla parva minus quam 1 mm. lata; nuculis 1–4 laevibus 1.5–2 mm. lanceolatis nitidis basi truncatis, sulcis clausis basem versus furcatis; stylo alto nuculis ⅓–⅕ breviori; gynobasi subulata.—CALIFORNIA: Santa Rosa Island, June 1888, *T. S. Brandegee* (TYPE, Gray Herb.; ISOTYPE, Univ. Calif. Herb.). This is an ally of *Cryptantha leiocarpa* (F. & M.) Greene, from which it differs in its southern island occurence, greater range in nutlet-number, and particularly in its shorter style. It suggests phases of the polymorphous *C. Clevelandi* Greene, but is readily told from that species by its bracteate inflorescence and slightly longer style. *Cryptantha Brandegei* is to be distinguished from *C. Abramsii* by its smaller corolla and diffuse spreading habit.

**Cryptantha albida** (HBK.), comb. nov. *Myosotis albida* HBK. Nov. Gen. et Sp. iii. 91 (Aug. 1818). *Lithospermum ramosum* Lehm. Asperif. ii. 328 (Nov. or Dec. 1818). *Eritrichium ramosum* A.DC. Prodr. x. 132 (1846). *Krynitzkia ramosa* Gray, Proc. Am. Acad. xx. 274 (1885). *Cryptanthe ramosa* Greene, Pittonia i. 115 (1887). *Eritrichium hispidum* Buckley, Proc. Acad. Philad. 1861, 462 (1861). (?) *Krynitzkia mexicana* Brandg. Zoe v. 182 (1904).—Information kindly supplied me by Dr. J. H. Barnhart of the New York Botanical Garden has given the reason for reviving the long neglected *Myosotis albida* HBK. This name was published in the ninth part of the Nova Genera which, according to Dr. Barnhart, appeared probably

late in August 1818 since it was noted under the date of October 3, 1818 in the Bibliographie de la France, a work in which the appearance of books was usually announced about six weeks after their actual publication. The first part of Lehmann's Asperifoliae appeared before the ninth part of the Nova Genera and its priority was recognized by Kunth, Flora i. 601 (1818) and Nov. Gen. et Sp. iii. 451 (1820). When the first part of the Asperifoliae was reviewed in Flora, i. 501, under the date October 30, 1818, it was accompanied by the statement "Der zweyte Theil ist unter der Presse" which would seem to indicate that the second part of Lehmann's work did not appear for at least two months after the ninth part of the Nova Genera. The second part of the Asperifoliae may have appeared in November or December but at present there seems no way of telling whether it actually did appear before the end of 1818, the year given on the title page.

**Cryptantha falcata** (Hieron.), comb. nov. *Eritrichium falcatum* Hieron. Bol. Acad. Córdoba iv. pt. 1, 64 (1882).

**Cryptantha patagonica** (Speg.), comb. nov. *Amsinckia patagonica* Speg. Anal. Soc. Cient. Argent. liii. 137 (1902).

**Cryptantha Spegazzinii**, nom. nov. *Amsinckia angustifolia*, var. *microcarpa* Speg. Anal. Soc. Cient. Argent. liii. 136 (1902).—The nutlets described by Spegazzini are evidently not those of an *Amsinckia*. I am associating with this name a specimen from near General Roco, Rio Negro, *Fischer 131*, although the plant has the corolla and calyx subequal and not "corollae . . . calyce duplo longioris."

**Cryptantha granulosa** (R. & P.), comb. nov. *Myosotis granulosa* R. & P. Fl. Peruv. ii. 5 (1799).

**Cryptantha corymbosa** (R. & P.), comb. nov. *Myosotis corymbosa* R. & P. Fl. Peruv. ii. 5 (1799).

In 1887 Greene, Pittonia i. 58–60, proposed the genus *Eremocarya* and reëstablished Torrey's *Piptocalyx*. Since that time the two genera have received almost universal acceptance despite the fact that they appear to lack fundamental characters and much resemble members of the genus *Cryptantha*. The nutlets found in *Eremocarya* and *Piptocalyx* are indistinguishable from those of *Cryptantha*, being of similar shape, possessing similar markings, and having a very similar groove. The gynobase also is much the same in all three genera. In fact, *Eremocarya* and *Piptocalyx* seem merely well marked species of *Cryptantha* and are consequently referred to *Cryptantha* where their species can be disposed of as follows:—

**Cryptantha § Piptocalyx.** *Piptocalyx* Torr. in Wats. Bot. King Exped. 240 (1871); not Oliver (1870). *Krynitzkia* Subsect. *Piptocalyx* Gray, Proc. Am. Acad. xx. 275 (1885). *Krynitzkia* Sect. *Piptocalyx* Greene, Bull. Calif. Acad. i. 206 (1885). *Greeneocharis* Gürke & Harms in E. & P. Nat. Pflanzenf., Gesamtreg. 462 (1899). *Wheelerella* Grant, Bull. So. Calif. Acad. v. 28 (1906).—This section of *Cryptantha* is characterized by its peculiar circumscissile calyx which is tubular to above the middle and has its lobes practically unribbed. A short distance below the sinuses the calyx-tube suddenly changes, at the line of dehiscence, from firm siliceous-hyaline to herbaceous. In the characters of its calyx the plants much resemble certain species of *Plagiobothrys*. Among the suggested generic characters of *Piptocalyx*, Greene especially stressed its possession of persistent pedicels although that development is present in such Cryptanthas as *C. albida*, *C. racemosa*, *C. holoptera*, and *C. pterocarya*. The character most emphasized by Greene, however, was the dichotomy of *Piptocalyx*. Unfortunately this character also fails since unmistakable and very similar dichotomy occurs in such species as *Cryptantha recurvata* and *C. micromeres*. The only distinctive character possessed by *Piptocalyx* is its circumscissile calyx. This development, however, is both present and absent in the closely related genus *Plagiobothrys* and there seems no particular reason why in the present case the character should be considered of generic value. The following two species are recognized.

**Cryptantha circumscissa** (H. & A.), comb. nov. *Lithospermum circumscissum* H. & A. Bot. Beech. 370 (1840). *Piptocalyx circumscissus* Torr. in Wats. Bot. King. Exped. 240. (1871). *Eritrichium circumscissum* Gray, Proc. Am. Acad. x. 58 (1874). *Krynitzkia circumscissa* Gray, l. c. xx. 275 (1885). *Wheelerella circumscissa* Grant, Bull. So. Calif. Acad. v. 28 (1906). *Greeneocharis circumscissa* Rydb. Bull. Torr. Cl. xxxvi. 677 (1909). *Cryptanthe depressa* Nels. Bot. Gaz. xxxiv. 29 (1902).

**Cryptantha dichotoma** (Greene), comb. nov. *Krynitzkia dichotoma* Greene, Bull. Calif. Acad. i. 206 (1885). *Piptocalyx dichotomus* Greene, Pittonia i. 60 (1887). *Wheelerella dichotoma* Grant. Bull. So. Calif. Acad. v. 28 (1906). *Greeneocharis dichotoma* Macbr. Proc. Am. Acad. li. 546 (1916). *G. circumscissa*, var. *hispida* Macbr. l. c.—Macbride's variety of *G. circumscissa* is evidently a reduced montane form of *C. dichotoma* which simulates *C. circumscissa* in gross aspect. It makes it impossible to use robustness as a distinguishing character between *C. dichotoma* and *C. circumscissa*, and leaves pubescence as the only differentiating character.

According to Greene, Pittonia i. 56 (1887), "*Eremocarya* is most excellently marked in a three-fold way by its racemes" which are biserial and very dense, conspicuously bracteate, and repeatedly dichotomous. Neither singly nor in combination do these characters distinguish *Eremocarya* from *Cryptantha*. Almost every species of *Cryptantha* has its flowers somewhat biserial. In *Cryptantha Grayi*, *C. albida*, *C. pusilla*, *C. maritima*, etc., particularly dense biserial racemes may be found. Dichotomy is also frequently present in *Cryptantha* and is quite unmistakable in *C. albida*. Bracteate racemes are well developed in *C. maritima*, *C. leiocarpa*, *C. albida*, etc. Also emphasized by Greene was the dye-secreting tissue of *Eremocarya*. Following him most recent authors have dignified that development by treating it as the crucial generic character. In *Plagiobothrys*, even as limited by Greene, there are species with dye-secreting tissue and those without. This example would give precedent for including dye-secreting and non-dye-secreting species within the same genus, even were there no recognized case of dye-secretion among the indubitable species of *Cryptantha*. Dye-secretions in the roots are not uncommon in *Cryptantha* and in the Gray Herbarium are found present in specimens of such distinct species as *C. Fendleri* (*Osterhout 3425*, *Patterson 112*, *Baker 780*) and *C. muricata* (*Parish 929*). During 1921 I collected on the islands of the Gulf of California a yet unpublished variety of *C. Grayi* which has its roots as heavily charged with purple dye as do the most characteristic specimens of *Eremocarya*. In addition to the above characters, which are evidently insufficient to justify generic segregation, Greene gave *Eremocarya* as having "a persistent open calyx and an enlarged persistent style." The persistent open calyx of *Eremocarya* is well matched in *C. holoptera* and in *C. albida*, while in what Greene calls an "enlarged persistent style" *Eremocarya* is indistinguishable from the several species allied to true *C. muricata*. A careful study of *Eremocarya* has failed to reveal characters other than those unsatisfactory ones enumerated by its author and I am consequently forced to the conviction that Greene's genus is unworthy of recognition even as a section. Accordingly the following species and variety are referred to *Cryptantha* where they fit naturally into the same group of species as *C. Grayi* and and *C. angustifolia*.

**Cryptantha micrantha** (Torr.), comb. nov. *Eritrichium micranthum* Torr. Bot. Mex. Bound. 141 (1859). *Krynitzkia micrantha* Gray, Proc. Am. Acad. xx. 275 (1885). *Eremocarya micrantha* Greene, Pittonia i. 59 (1887). *Eremocarya muricata* Rydb. Bull. Torr. Cl. xxxvi. 677 (1909).

**Cryptantha micrantha**, var. **lepida** (Gray), comb. nov. *Eritrichium micranthum*, var. *lepidum* Gray, Synop. Fl. N. A. ii. pt. 1, 193 (1878). *Krynitzkia micrantha*, var. *lepida* Gray, Proc. Am. Acad. xx. 275 (1885). *Eremocarya lepida* Greene, Pittonia i. 59 (1887). *Eremocarya micrantha*, var. *lepida* Macbr. Proc. Am. Acad. li. 545 (1916).

4. A Synopsis and Redefinition of the Genus Plagiobothrys.

In 1835 the name *Plagiobothrys* was originally used by Fischer and Meyer for what then appeared to be a monotypic Chilean genus. The first species, *P. fulvus*, was separated from *Eritrichium* because of the peculiar annular scar on its nutlets. In 1874 Gray, Proc. Am. Acad. x. 57, reduced *Plagiobothrys* to a section under *Eritrichium* and placed in the section besides the original species five others which lacked annular scars on the nutlets. *Plagiobothrys* was reëstablished by Gray, Proc. Am. Acad. xx. 281, in 1885 when he amplified it to include fourteen species, five of which were placed in a newly erected section, and nine of which were put in his section *Genuini*, a group coëxtensive with his *Eritrichium* § *Plagiobothrys* of 1874.

Gray, Proc. Am. Acad. xi. 89, founded the genus *Echidiocarya* in 1876, and at that time included in it only the anomalous *E. arizonica* (*P. Pringlei* Greene). The character for the genus was found in the long-stiped nutlets. In 1877, Proc. Am. Acad. xii. 163, the genus was enlarged so as to include the newly described and obviously related *E. californica*. A third member of the group was added in 1883, Proc. Am. Acad. xix. 90, when Gray described *P. ursinus* and noted that, "The comparatively recent discovery of the preceding species [*P. ursinus*] of this section has made it clear that both of them should fall into *Plagiobothrys*, . . ." As a result of the transfer *Echidiocarya* was reduced to its original species and characterized by its "conspicuously stipitate" nutlets. In 1887 Greene, Pittonia i. 9 & 21, argued the artificiality of this latter concept and transferred to *Plagiobothrys* the remaining and type species of *Echidiocarya* saying that it had "every aspect and every character of *Plagiobothrys*, except that there is a stipe between the scar, or point of attachment to the gynobase, and the body of the nutlet." Greene's disposal of *Echidiocarya* has remained unchallenged.

Anyone who will study Gray's *Echidiocarya arizonica*, *E. californica*, and *Plagiobothrys ursinus* can not help appreciating the close relations between those species and the naturalness of *Echidiocarya* in its broadest sense, for the species agree not only in gross aspect, but in

scores of important and unimportant minute details as well. The fruit, though varying somewhat in the development of the stipe-like base, is similar in form and marking. Furthermore there is a strong similarity among the three species as regards calyx and corolla. None of the species have obvious relations within *Plagiobothrys* as that genus is currently taken. The three are sharply set off from it by their lack of a conspicuous caruncular scar on the nutlets and by their bearing the scar on a stipe projected above the ventral keel and not in a broad shallow transverse groove below the level of the keel. In fact *Echidiocarya* is not a part of *Plagiobothrys*, as that genus is usually taken, but belongs rather to the group which Greene named *Allocarya*. This latter relation is indicated by the occurence of lower opposite leaves in all three species. Significant also is the fact that the habit of *Echidiocarya* is approached by various species of *Allocarya*, and its nutlet-form simulated by the fruit of *Allocarya australasica*. The species of *Echidiocarya* seem clearly congeneric with those of *Allocarya*, and since Gray's generic name is about ten years older than that of Greene the concept commonly called *Allocarya* will have to be called *Echidiocarya* if it be actually worthy of generic recognition.

The genus *Sonnea* was proposed by Greene, Pittonia i. 22, in 1887. It consists of two quite distinct and apparently not immediately related elements. The typical section of *Sonnea* contains the species which Gray called *Plagiobothrys glomeratus* and *P. hispidus*, and placed in the specially formed *Plagiobothrys* § *Hypsoula*. This group differs from all others of *Plagiobothrys* in its glomerate inflorescence, rough hispid pubescence, and supramedial caruncular scar. Although the group is a natural one and is fairly well marked, the form and structure of its nutlets reveal such unmistakable relations with *Plagiobothrys* that it seems best to consider it a member of that genus as most recent authors have been content to do. The fragile nature of the caruncle, particularly emphasized by Greene, is not positive nor capable of exact definition. It is not worthy of particular note and is certainly not of generic value.

The second section of *Sonnea* is composed of three species falling under what Gray, Proc. Am. Acad. xx. 281, in 1885 indicated as *Plagiobothrys* * *Ambigui*. These species differ from those in genuine *Plagiobothrys* by having a coarse hispid pubescence and nutlets which superficially closely simulate the nutlets of *Amsinckia*. There is little in common between the species of the second section of *Sonnea* and those of the first and typical section, apparently the most important agreement being in the coarse hispid pubescence. Greene

attributed to the second section a fragile caruncular scar similar to that in the typical section, but this attribute I am utterly unable to appreciate. The second section has a peculiar and characteristic nutlet development. The nutlets have a submedial scar that is borne, not at or below the lower end of the ventral keel, but surrounded by and wedged in between the pericarpial margins that form the keel and consequently appearing at first glance as if borne upon it. The striking nutlet difference seems of funamental importance and were other important concomitant characters forthcoming I should feel that the group merits generic recognition. The problem deserves further study and for the present I am following current usage and referring the group to *Plagiobothrys* where it can form a new section which may appropriately be called **Amsinckiopsis**.

The genus *Allocarya* was erected by Greene, Pittonia i. 10–12, in 1887. In proposing the genus Greene argued that its species "agree admirably in that best mark of a good and natural genus, the habit" and that they possessed "a character very rare in the order, if not indeed unique, that of the lower leaves being not only opposite, but distinctly connate-perfoliate." He states further that "*Allocarya* is, in truth, much more nearly allied to *Plagiobothrys* than to *Krynitzkia* [*Cryptantha*]. Its nutlets are in general, not very different, being rugose, keeled more or less both dorsally and ventrally, and showing distinct lateral angles." Since its proposal *Allocarya* has been universally accepted in manuals and floras of western United States. The presence of opposite leaves in its species has been taken as the crucial character. Piper, Contr. U. S. Nat. Herb. xxii. 79 (1920), in his detailed "Study of Allocarya" speaks generally of the genus as follows,—"The genus as delimited by Greene has been generally accepted as valid. It is best distinguished from allied genera by the ventrally keeled nutlets, which are attached basally or suprabasally to a low gynobase, and by having the lowermost leaves opposite." Recently Macbride, Contr. Gray Herb. lix. 34 (1919), wrote, apropos of the reduction of *Allocarya* to *Lappula*, as follows:—"*Allocarya* is most closely related to *Plagiobothrys* and if Mr. Druce had referred his plant to the latter genus some well-taken arguments for his action could be presented. These genera also, however, are nicely distinct although in nutlet-characters they approach each other closely. The attachment of the nutlets of *Plagiobothrys* is nearly or quite medial rather than basal or supra-basal and the leaves are never opposite as are the lower ones of *Allocarya*. The fact that both genera contain numerous species none of which fail in any degree to conform to the

generic character in each case is the best argument to my mind as to the validity of those genera." Summing up the above paragraph it may be said that *Allocarya* deserves generic recognition because of its naturalness, this evidenced by its universal acceptance, and because of the constancy and generic value of its habit, the attachment of its nutlets, and its opposite leaves.

*Allocarya* is said to have a characteristic habit, but at least this is not evident upon a comparison of species so diverse in appearance as *A. mollis, A. Scouleri, A. Greenei, A. humistrata, A. californica,* and *A. stricta.* Not only do the species present quite different habits, but they are closely simulated by species commonly referred to *Plagiobothrys.* For example in gross aspect *A. mollis* is strikingly like southern forms of *P. canescens; A. Greenei* and *A. Scouleri* suggest *P. fulvus* and *P. nothofulvus,* while *A. scopulorum* and *A. Cooperi* simulate forms of *P. californicus.* It can be positively said that the species of *Allocarya* do not have a common and distinctive aspect, and furthermore that they are not as a group habitally distinct from *Plagiobothrys.*

The attachment of the nutlet is not distinctive of *Allocarya.* This is at once evident upon a comparison of the fruit of *A. Greenei* with that of *P. fulvus,* for in these species there is a remarkable agreement in size and shape of the nutlets and in the arrangement of keels and ridges upon them. Most striking of all is the occurrence in both species of similarly placed, very similar excavated scars. A Patagonian *Allocarya* described further along in this paper has nutlets closely approximating in both form and attachment those of *P. Torreyi.* The nutlets of *P. Torreyi* are also suggested by those of *A. mollis. Allocarya* does present extremes in fruit developments such as the elongate lance-like basally attached nutlets of *A. stipitata* and allies, but these are but culminations of tendencies which intermediate developments bring very close to the conditions present in various species of *Plagiobothrys.*

It would seem that the claims of *Allocarya* for generic recognition must rest upon the occurrence of opposite leaves on its species. This condition seems to have been at least vaguely realized by the authors who have maintained the genus, for in every keyed or descriptive account of the group the presence of opposite leaves has been given as its crucial character. What has not been realized, however, is that opposite leaves are not particularly characteristic of *Allocarya,* the development being quite evident and exactly similar in mature plants of *Cryptantha rostellata* and *C. affinis,* as well as in the younger stages

of most other species of *Cryptantha*. Furthermore the character is well developed and very obvious in *P. Pringlei* and in most (not all) specimens of *P. californicus*. *Allocarya Greenei* shows unmistakable relationships with *P. fulvus* and is probably the nearest relative of that species, yet because it has opposite lower leaves it is forthwith put into another genus. This species alone seems a good argument against the genus *Allocarya*. It should also be realized that opposite leaves occur in varying abundance in the several species of *Allocarya*, some having all the leaves opposite, others having a less large proportion or only the lowest pair opposite. In other words there seems to be a complete set of intermediate stages which connect up morphologically the completely opposite-leaved Allocaryas with the completely alternate-leaved *Plagiobothrys*. In the light of the unquestionably close relation between *Allocarya* and *Plagiobothrys*, and the varying proportion of opposite leaves in the species of *Allocarya*, it is most evident that the use of opposite leaves as a generic criterion is arbitrary and that the currently accepted line of cleavage between the genera is neither a profound nor a particularly natural one. Summing up the present paragraph it can be said that opposite leaves are considered a poor diagnostic character in the present instance because they are present or absent in certain species of *Plagiobothrys*, and because their absence in *Plagiobothrys* seems but the culmination (or the beginning) of the variable quantitative development of the character in *Allocarya*.

Although much stress has been placed on the fact that *Allocarya* has remained unchallanged since its promulgation over thirty years ago, the fact is significant only as it shows the lack of study of generic relations within the eritrichioid borages. The genus may have had wide acceptance, but it has not had repeated critical reconsiderations. The last critical study of the generic lines of the group was by Greene. Greene's grasp of the relations and characters of the western American eritrichioid borages is undeniable, but unfortunately his subdivisions within the borages, as in many other families, represent intergrading or scarcely distinct groups which seem better treated as sections or subgenera.

*Plagiobothrys* can not be separated from *Allocarya*, *Echidiocarya*, and *Sonnea* by developments possessed by the latter genera, and neither can it be distinguished from the enumerated genera by peculiar structures of its own. The character usually given as generically diagnostic for *Plagiobothrys* is the occurrence of a "caruncular scar" upon its nutlets. However, this character is probably best

developed in *Sonnea glomerata* and *S. hispida*, and is present although weakly developed in *Allocarya Scouleri* and in the Patagonian *Allocarya* described in this paper. In *A. Greenei* the character fails completely, for the scar in that species is essentially the same as the scar in *P. fulvus*. Although it can be said that the caruncular scar reaches a high development in *Plagiobothrys*, it can not be said that it characterizes the genus or reaches its greatest development there.

Although not previously pointed out, the species of true *Plagiobothrys* are fairly well characterized by the position of the scar. In *Plagiobothrys* the nutlet-scar is in a broad shallow transverse groove, and distinct from the ventral keel and below the level of it. In *Allocarya* and *Echidiocarya* the scar is usually contiguous with the ventral keel and either flush with it or projected from it on a stipe-like base. As with most other characters its universality is destroyed by *Allocarya Greenei*, that species which is an *Allocarya* only in its lower leaves.

Because of the lack of consistently diagnostic characters which would separate them, *Allocarya*, *Echidiocarya*, and *Sonnea* are all merged with *Plagiobothrys*. The result is a genus which appears to be a very natural one, and one which admits of great precision in definition. The amplified *Plagiobothrys* is at once distinguished from its nearest relatives, *Cryptantha* and *Oreocarya*, by the lack of a pronounced longitudinal ventral groove, and the possession instead of a well developed ventral keel and a definitely circumscribed small scar. The gynobase is a pyramid or low frustum and very much shorter than the nutlets, and is not subulate and about equalling the nutlets as in *Cryptantha* and *Oreocarya*. The nutlets in *Plagiobothrys* are commonly keeled and usually rugose, whereas in *Cryptantha* and *Oreocarya* they are rarely if ever keeled and the roughenings usually tuberculate or muricate. The pubescence in *Plagiobothrys* is mostly appressed and is less stiffly spreading than is the hispid indument characteristic of *Cryptantha*.

In order intelligently to select the specific names which should be transferred to *Plagiobothrys* it has been necessary to go into the intrageneric classification. As a result of this study and with the hope that it will give the paper a wider usefulness I have included a rough key to the accepted species. It is not pretended that the present paper supplies a finished study of the specific classification, but rather only a hastily prepared conservative synopsis which I hope may be preliminary to a future detailed descriptive account. Although it seems certain that future detailed work would cause the

reduction of some of the species here recognized, it is believed that the equally certain recognition of species here reduced will keep the total number of recognized species about as here given. The chief result of a protracted study would be the clarifying of specific lines and the naming and classifying of the abundant intraspecific variation.

During the preparation of this paper I have had Professor Piper's "Study of Allocarya" continually at hand, and have given his suggested classification a careful study. His treatment is based almost entirely upon the shape, sculpturing, and attachment of the nutlets; characters upon which he comments as follows:—"The nutlet characters seem remarkably constant, and in mixed gatherings serve perfectly to segregate the species. Relying on the constancy of the nutlet characters in particular, it is necessary to recognize additional species." The number of recognized species was increased from eighteen to seventy-nine. Although Piper's revision is based upon a wealth of material and shows every evidence of a patient and prolonged investigation I find that I am unable to follow it since I differ from its author in a fundamental point; *i.e.* I believe that the sculpturing and markings of the nutlets in *Allocarya* had best be considered excessively variable and consequently of minor if of any importance in the characterization of species. I am led to believe as I do because surprisingly numerous nutlet variations may be discovered in very small areas among plants remarkably uniform in aspect and in all other characters save those of nutlets. Piper has taken the nutlets as constant and has practically disregarded all other characters, whereas I have felt that a paralleling of several vegetative characters were more important than the variation of a single fruiting structure. The nutlet variations of *Allocarya* have been patiently worked out by Piper and named as species. These minute, very numerous microscopic species appear unpractical and seem justifiable only if they greatly increase the precision in identification and result in a more natural classification. Unfortunately even after considerable familiarity with his key to the numerous species I find it difficult to name plants satisfactorily according to Professor Piper's treatment, and I am compelled to believe that the minute nutlet sculpturings merely appear constant because their great arc of variation has been broken up and specific names associated with very short segments of variation. Though the classification seems carried to an unpractical extreme I would be glad to accept it were it clearly natural. Distribution, I feel, supplies one of the best tests of the naturalness of a species. By the disregard which Piper's species show for the principles underlying

Jordan's Law, Science n. s. xxii. 547 (1905), I feel forced to consider them, in a large part, to be unnatural entities. It is highly significant that by largely disregarding nutlet characters and basing species upon obvious external characters that a classification can be made which does not place closely related species together in the same small area. The four species of *Allocarya* recently published by Brand, Fedde Repert. xviii. 312 (1922), should also make one realize that the acceptance of species based upon unit nutlet characters will undoubtedly lead to the further multiplication of species, for future collecting is bound to turn up unnamed developments and a more careful examination of Piper's specimens is certain to reveal unnamed variations. This will soon make *Allocarya* one of those genera that are overdivided and hopelessly snarled, and one in which an identification is but rarely attempted—then only with a sigh—and never accomplished with either expedition or with confidence.

PLAGIOBOTHRYS F. & M. Ind. Sem. Hort. Petrop. ii. 46 (1835). *Echidiocarya* Gray, Proc. Am. Acad. xi. 89 (1876). *Sonnea* Greene, Pittonia i. 22 (1887). *Allocarya* Greene, Pittonia i. 12 (1887).

KEY TO SPECIES.

Leaves all alternate.
- Caruncle of nutlet elongate, apparently extending along crest of ventral keel; nutlets trigonous, *Amsinckia*-like. § *Amsinckiopsis*.
  - Nutlets irregularly rugose; corolla 4–7 mm. broad.
    - Inflorescence elongated, loosely flowered; plant 1–4 dm. high. . . . . 1. *P. Kingii*.
    - Inflorescence glomerate or scarcely elongated, congested; plant 5–15 cm. tall. . . . . 2. *P. Harknessii*.
  - Nutlets conspicuously tessellate; corolla 1–2.5 mm. broad. 3. *P. Jonesii*.
- Caruncle ovate or orbicular, at or below end of ventral keel.
  - Caruncle weakly developed, borne at tip of a short ventral stipe; nutlets lacking a broad transverse ventral groove. . . . . 16. *P. californicus*.
  - Caruncle well developed, sessile on nutlet, in a broad shallow transverse ventral groove.
    - Inflorescence glomerate; caruncle fragile, at or above the middle of nutlet; basal leaves lacking at maturity of plant. § *Sonnea*.
      - Nutlets dark, dull, conspicuously rugose and tuberculate, 1–2.3 mm. long. . . . . 4. *P. hispidus*.
      - Nutlets light colored, somewhat shiny, nearly smooth, 2.5–3 mm. long. . . . . 5. *P. glomeratus*.
    - Inflorescence elongate, racemose; caruncle cartilaginous, at or below middle of nutlet; basal leaves evident at maturity of plant. § *Euplagiobothrys*.
      - Calyx circumscissile in fruit, less than 4 mm. long; lobes usually connivent over fruit; usually only 1–2 nutlets developing.
        - Inflorescence a long simple bracteate raceme; stems usually about 2 dm. long, ascending,

hispid, branched mainly below middle; nutlets highly arched in lateral outline, 1–2.5 mm. long; corolla 3 mm. broad ..... 7. *P. arizonicus.*

Inflorescence furcate, bracteate only at base if at all; stems strictly erect, about 3.5 mm. high, appressed hispid-villous, branched only above middle if at all; nutlets low and flattened in lateral outline, 2–3 mm. long; corolla 3–9 mm. broad..... 6. *P. nothofulvus.*

Calyx not circumscissile or if so the strongly accrescent calyx over 4 mm. in length; calyx-lobes erect or spreading; 4 nutlets usually developing.

Nutlets with a conspicuous annular caruncle, 2.3–3.3 mm. long; calyx cleft to near base, fulvescent; corolla-tube slightly exceeding calyx..... 8. *P. fulvus.*

Nutlets with solid caruncle, less than 2.3 mm. long; calyx cleft ⅔ to base.

Transverse dorsal crests of nutlets very narrow and sharp, with medial keel enclosing polygonal granulate areas.

Corolla-tube shorter than calyx; plants erect to prostrate, comparatively coarse-stemmed; leaves 3–7 mm. broad; Californian.

Plant dye-stained throughout; nutlets 2..9. *P. catalinensis.*

Plant dye-stained if at all only at base; nutlets 4..... 10. *P. canescens.*

Corolla-tube equalling or slightly exceeding the calyx; plants very slender, strict or ascending; leaves 1.5–2.5 mm. broad; Chilian. ..... 11. *P. tinctorius.*

Transverse dorsal crests of nutlets very low and broad, separated only by low lineate grooves.

Nutlets ovate, usually constricted only at apex, the base being rounded or rarely weakly constricted, dark-colored; plant dye-stained..... 12. *P. Torreyi.*

Nutlets decidedly cruciform due to the abrupt equal constrictions at base and apex, glassy; plant only exceptionally dye-stained.

Calyx 5–7 mm. long and nearly as wide; nutlets 2–2.7 mm. long; inflorescence bracteate; plant coarse, few-stemmed. 13. *P. shastensis.*

Calyx 3–5(–7) mm. long, and about half as broad; nutlets 1.5–2 mm. long; slender, many-stemmed plants..... 14. *P. tenellus.*

Leaves opposite at least below.

Nutlets attached to gynobase by a more or less well developed stipe-like ventral projection. § *Echidiocarya.*

Stipe-like base about equaling body of nutlet, frequently united into pairs..... 15. *P. Pringlei.*

Stipe-like base less than half length of body of nutlet, never joined into pairs ..... 16. *P. californicus.*

Nutlets attached directly to gynobase, without a definite stipe-like ventral prolongation. § *Allocarya.*

Plant perennial.
- Flowers solitary in the axils.
  - Leaves linear; style greatly surpassing the nutlets. 17. *P. Kunthii.*
  - Leaves oblance-linear; style shorter or about equaling nutlets.
    - Leaves obtusish usually strigose-hispidulous 10–15 mm. long; corolla small, 2–3 mm. broad; compact alpine plants. 18. *P. pygmaeus.*
    - Leaves acute, somewhat ciliate-strigose along margins and below on midrib; corolla 4–5 mm. broad; loosely branched submontane plants. 19. *P. linifolius.*
  - Flowers in axillary glomerules or racemes, frequently terminal; leaves linear.
    - Style greatly surpassing the nutlets. 20. *P. mollis.*
    - Style about equaling nutlets or evidently exceeded by them.
      - Pedicels becoming 2–5(–8) mm. long; mature herbage glabrate.
        - Leaves 2–2.5 mm. long; stems simple; calyx-lobes narrowly oblong, acutish, 3 mm. long. 21. *P. mexicanus.*
        - Leaves 4.4–5 mm. long; stems branched above; calyx-lobes narrowly linear, obtusish, 2 mm. long. 22. *P. pedicellaris.*
      - Pedicels evidently less than 2 mm. long; mature herbage somewhat strigose-hispid.
        - Leaves 25(20)–60 mm. long; fruiting calyx 3 mm. long, lobes very narrowly linear; inflorescence a rather loose elongated raceme 15–20 mm. long, sparsely bracteate or naked. 23. *P. humilis.*
        - Leaves 6–15(–25) mm. long; fruiting calyx 2 mm. long, lobes lance-linear; inflorescence a dense stout glomerule, 5–10 mm. long, leafy bracted throughout. 24. *P. congestus.*

Plant annual.
- Spikes geminate. 25. *P. Scouleri.*
- Spikes solitary.
  - Dorsal keel extending down length of nutlet, usually well developed.
    - Scar of nutlet solid, not below level of ventral keel; nutlets vitreous; Australian. 26. *P. australasicus.*
    - Scar of nutlet deeply excavated, below level of ventral keel; nutlets usually dull or glossy; Californian.
      - Nutlets 1–1.5 mm. long, weakly keeled dorsally; stems prostrate, much branched; fruiting calyces crowded. 27. *P. Piperi.*
      - Nutlets 1.5–2 mm. long, strongly keeled dorsally; stems erect or ascending, loosely branched; fruiting calyces remote. 28. *P. Greenei.*
  - Dorsal keel not extending down to the middle of the nutlet, usually weakly developed.
    - Scar of nutlet nearly medial; plant dye-stained. 29. *P. patagonicus.*
    - Scar of nutlet at or near the base; plant not dye-stained.

Ventral keel of nutlet sunken in a longitudinal groove; pedicels of lower fruiting calyces 5–20 mm. long, slender, spreading or recurved.
Nutlets smooth and shiny, ovoid.....30. *P. lithocaryus.*
Nutlets roughened, somewhat compressed. 31. *P. Chorisianus.*
Ventral keel of nutlet prominent, not in a groove; pedicels of lower fruiting calyces less than 5 mm. long, coarse, stiff, strict or ascending.
Midrib of calyx-lobes becoming indurated and enlarged in fruit; calyx sessile or subsessile by a narrowly conic base, usually asymetrical in fruit.
Plant very stout and fleshy.....32. *P. glaber.*
Plant not stout and fleshy.
Nutlets transversely rugose.....33. *P. humistratus.*
Nutlets reticulately rugose.
Branches strict or ascending.....34. *P. stipitatus.*
Branches prostrate or widely spreading.
Branches stiff; bracts few, mainly near base.....35. *P. divergens.*
Branches merely stiffish; bracts more or less throughout inflorescence. 36. *P. Nelsoni.*
Midrib of calyx-lobes scarcely indurate or thickened in fruit; calyx-lobes tending to differ sharply from the tube in structure; calyx usually pedicellate, symetrical, base broadly conic.
Plant sparsely hispid, lacking appressed hairs.
Calyx 2.5–4 mm. long, short pedicellate; calyx-lobes 1–2 mm. long, much surpassed by corolla; inflorescence naked or with 1 or 2 bracts.....39. *P. Parishii.*
Calyx 4–6 mm. long, subsessile; calyx-lobes 2–3 mm. long, about equaling corolla; inflorescence conspicuously leafy bracted.....40. *P. salsus.*
Plant with pubescence at least in part of appressed hairs.
Calyx-lobes spreading or reflexed in fruit, usually twice length of fruit.
Nutlets reticulately rugose; scar large. 37. *P. plebejus.*
Nutlets transversely rugose; scar medium size.....38. *P. trachycarpus.*
Calyx-lobes connivent to ascending, 1–2 times length of nutlets.
Calyx firm, strict; plant stiffly erect, glabrate .....41. *P. strictus.*
Calyx herbaceous, tending to spread; plant prostrate to erect but not stiff, usually densely pubescent.
Calyx-lobes 2–3 mm. long, 2 times length of nutlets.

Leaves extremely narrow, 1–1.5 mm. broad; inflorescence practically naked.....42. *P. tenuifolius.*
Leaves broadly linear, 2–5 mm. broad; inflorescence leafy-bracted.
Nutlets not at all rugose or granulate.....43. *P. nitens.*
Nutlets rugose or granulate or both.....44. *P. orthocarpus.*
Calyx-lobes 1–2 mm. long, 1–1.5 times length of nutlets.
Leaves fleshy, terete. 45. *P. mesembryanthemoides.*
Leaves herbaceous, flattened.
Nutlets muricate.....46. *P. muricatus.*
Nutlets rugose.
Nutlets transversely rugose, rugae usually low and broad; inflorescence usually naked above.....47. *P. scopulorum.*
Nutlets reticulately rugose, rugae usually narrow and high; inflorescence usually leafy-bracted.
Plant closely prostrate.....48. *P. Lechleri.*
Plant erect or ascending. 49. *P. procumbens.*

1. Plagiobothrys Kingii (Wats.) Gray, Proc. Am. Acad. xx. 281 (1885). *Eritrichium Kingii* Wats. Bot. King Exped. 243, t. 23 (1871). *Sonnea Kingii* Greene, Pittonia i. 23 (1887). *Krynitzkia Kingii* Wats. acc. to Hillman, Agric. Exper. Sta. Nev. Bull. xxiv. 71 (1894).—Western Nevada and adjacent California. Apparently a rare species and known only from the vicinity of southern Washoe County, Nevada. It is well marked by its coarse spreading pubescence, large flowers, and naked geminate or ternate racemes.

2. P. Harknessii (Greene) Nels. & Macbr. Bot. Gaz. lxii. 143 (1916). *Sonnea Harknessii* Greene, Pittonia i. 23 (1887).—Eastern Oregon to Inyo County, California, and eastward to northwestern Utah. Much more common than the last and perhaps only a form of it.

3. P. Jonesii Gray, Synop. Fl. ed. 2, ii. pt. 1, 430 (1886). *Sonnea Jonesii* Greene, Pittonia i. 23 (1887).—Eastern border of Southern California. Specimens from Inyo County, California, differ from the type in their prostrate habit and may represent an unnamed variety or species. The nutlets of this species remarkably simulate those of *Amsinckia tessellata.* Because of this Jones, Contr. W. Bot. xii. 57 (1908), wrote that "Plagiobothrys Jonesii Gray is an Amsinckia in every thing but the flowers, which are white. It has the tessellated pavement-like nutlets of A. tessellata and a little sharper

rugae, and illustrates again the very slim foundation on which some Borraginaceous genera rest." These ideas were accepted and repeated by Nelson and Macbride, Bot. Gaz. lxii. 143 (1916), in the following form,—"In this connection Jones has called attention to the fact that *P. Jonesii* . . . is an *Amsinckia* in everything but its white flowers. . . . The pubescence of *P. Jonesii* and the tessellated nutlets surely suggest a relationship to *A. tessellata*, but the white and short corollas that are so widely at variance with the long yellow ones of *Amsinckia* are perfectly congeneric with the SONNEA section of *Plagiobothrys*." The above quotations show a striking lack of acquaintance with the real characters of *Plagiobothrys* and *Amsinckia* and are examples of hasty generalizations based upon superficialities. *Plagiobothrys Jonesii* and immediate relatives simulate species of *Amsinckia* in the form of nutlets, but are clearly not directly related in that genus, for like other species of *Plagiobothrys* they have undivided cotyledons and short appendaged corollas.

4. P. HISPIDUS Gray, Proc. Am. Acad. xx. 286 (1885). *Sonnea hispida* Greene, Pittonia i. 22 (1887).—Eastern Oregon southward through northeastern California and extreme western Nevada to the region about Mono Lake.

4a. **P. hispidus**, var. **foliaceus** (Greene), comb. nov. *Sonnea foliacea* Greene, Pittonia i. 222 (1888). *P. foliaceus* Nels. & Macbr. Bot. Gaz. lxii. 143 (1916).—Known only from Washoe Mts., Nevada. Nelson and Macbride speak of the "dorsal depressions of the nutlets" as being "particularly unique" for this plant, but I find that exactly similar developments are frequent in **P. hispidus**, var. **genuinus** and in *P. glomeratus*. The nutlets of the var. *foliaceus* are 2–2.5 mm. long, instead of 1.5–2 mm. long as in the var. *genuinus*, and appear to be elongated so that the scar appears decidedly above the middle rather than near the middle of the nutlet. The dorsal surface of the nutlets in the var. *foliaceus* lack the coarse papillae or irregular short elongate roughenings characteristic of the var. *genuinus*, instead showing a maximum development of the granulations which in the case of the var. *genuinus* are crowded by the larger rugosities nearly to extinction. Greene's species is not given specific recognition because it is only known from the type collection. It is possible that the plant is a hybrid between *P. hispidus* and *P. glomeratus*.

5. P. GLOMERATUS Gray, Proc. Am. Acad. xx. 286 (1885). *Sonnea glomerata* Greene, Pittonia i. 22 (1887).—Western Nevada, rare. Characterized by its large rather smooth nutlets.

6. P. NOTHOFULVUS Gray, Proc. Am. Acad. xx. 285 (1885). *Eritrichium nothofulvum* Gray, l. c. xvii. 227 (1882).—Frequent over the length of California and locally reaching to the Columbia River Valley.

7. P. ARIZONICUS (Gray) Greene in Gray, Proc. Am. Acad. xx. 284 (1885). *Eritrichium canescens*, var. *arizonicus* Gray, l. c. xvii. 227 (1882).—Western New Mexico to Southern California. The species grows in arid situations, and in California is primarily a plant of the desert from which it occasionally extends through the low passes to the dryest of the transmontane valleys. The species is quite variable as to nutlets, and in calyx and habit makes a close approach to, if it does not actually intergrade with *P. canescens*.

8. **P. fulvus** (H. & A.), comb. nov. *Myosotis fulva* H. & A. Bot. Beech. 38 (1830). *Eritrichium fulvum* A.DC. Prodr. x. 132 (1846). *M. alba* Colla, Mem. Acad. Torino xxxviii. 128, t. 42 (1835). *P. rufescens* F. & M. Ind. Sem. Hort. Petrop. ii. 46 (1835 or early 1836). *E. asperum* Phil. Anal. Univ. Chile xliii. 516 (1873). *E. laxiflorum* Phil. l. c. xc. 527 (1895). *P. rufescens*, var. *laxiflorus* Reiche, Anal. Univ. Chile cxxi. 812 (1908). *E. Rengifoanum* Phil. l. c. xc. 529 (1895). *P. rufescens*, var. *Renjifoanus* Reiche, l. c.—Central Chile.

8a. **P. fulvus**, var. **campestris** (Greene), comb. nov. *P. campestris* Greene, Pittonia ii. 282 (1892). *P. rufescens*, var. *campestris* Jeps. Fl. W. Midd. Calif. 446 (1901). *P. californicus* Greene, Pittonia ii. 231 (1892); not Greene (1887).—California from San Luis Obispo County and the upper San Joaquin Valley northward through the Sacramento Valley to southern Oregon. Through a misunderstanding Gray, Proc. Am. Acad. xx. 282 (1885), cited a specimen of *P. rufescens* as from "near Los Angeles." The Nevin collection upon which this record was based actually came from "n. Sacramento Co." The Oregon collections may represent a distinct variety, their nutlets being dark in color and nearly lacking the transverse dorsal rugae. The Californian plants do not differ in fruit from the Chilian ones, and it is only because the southern plants seem more slender than the northern material that the latter is put into a distinct variety.

9. P. CATALINENSIS (Gray) Macbr. Proc. Am. Acad. li. 546 (1916). *P. arizonicus*, var. *catalinensis* Gray, Synop. Fl. ed. 2, ii. pt. 1, 431 (1886).—Endemic on Santa Catalina Island, California. This species is intermediate in its characters between *P. canescens* and *P. arizonicus*, having the few nutlets and dye-stained herbage of the latter, and the spreading non-circumscissile calyx of the former. As dye is frequently developed in indubitable *P. canescens* (cf. *Heller*

*7758* from Mohave, Calif.), and specimens of the var. *apertus* frequently have imperfectly circumscissile calyces, the claims of *P. arizonicus* and *P. catalinensis* to specific rank are clouded ones, the two species being maintained only for convenience pending further study.

10. P. CANESCENS Benth. Pl. Hartw. 326 (1849). *Eritrichium canescens* Gray, Proc. Am. Acad. x. 57 (1874). *P. microcarpa* Greene, Pittonia i. 21 (1887). *P. canescens*, var. *apertus* Greene, l. c.—Ranging the length of California. The typical phase of this species is the small, 1.5–2 dm. high, erect-growing plant which is most common in the Sacramento Valley. The var. *apertus* is best restricted to the large prostrate or subprostrate plant, usually with stellately spreading calyx-lobes, which is most common in the upper San Joaquin Valley. There are numerous other unnamed variations.

11. P. TINCTORIUS (R. & P.) Gray, Proc. Am. Acad. xx. 283 (1885). *Lithospermum tinctorium* R. & P. Fl. Peruv. ii. 4, t. 114 (1799). *Eritrichium tinctorium* A.DC. Prodr. x. 132 (1846). *L. myosotoides* Lehm. Asperif. ii. 319 (1818). *L. tingens* R. & S. Syst. iv. 44 (1819). *E. verrucosum* Phil. Linnaea xxix. 17 (1857).—Central Chile.

12. P. TORREYI Gray, Proc. Am. Acad. xx. 284 (1885). *Eritrichium Torreyi* Gray, l. c. x. 58 (1875). *Cryptanthe Torreyi* Rydb. Mem. N. Y. Bot. Gard. i. 331 (1900).—California; apparently confined to vicinity of Yosemite Valley.

12a. **P. Torreyi**, var. **diffusus**, var. nov., laxus prostratus; caulibus ad basin florigeris; floribus numerosis; calyce fructifero 3–4 mm. longo 3–4.5 mm. lato; bracteis grandis conspicuissimis.—CALIFORNIA: Sierra Valley, *Lemmon.* Donner Lake, *Heller 6986* (TYPE, Gray Herb.). Sunnyside, Lake Tahoe Region, *Eastwood 1067.* About Tallac, July 1904, *M. S. Baker.* Echo Camp on Lincoln Highway, *Heller 12,158.* Yosemite, 1878, *Lemmon.* Upper San Joaquin, Madera Co., 1895, *Congdon.* Okenden, Pine Ridge, Fresno Co., *Hall & Chandler 273.* Volcano Cr., Tulare Co., *Hall & Babcock 5317.* This is the most common and widely distributed phase of *P. Torreyi.* It was mentioned by Gray when he described the species, but was not named by him. The type of *P. Torreyi* is evidently *Torrey 338* and that is the slender erect-growing plant with few leaves and bracts which is frequently collected in the region about Yosemite Valley. The typical phase of *P. Torreyi* and the var. *diffusus* are quite dissimilar in aspect, differing as they do in direction of growth, leafiness, amount of branching, and size of bracts. Young forms of var. *diffusus* might be confused with typical *Torreyi*, but may be usually distinguished by having the lower floral bracts three or more times as long as the calyx.

12b. **P. Torreyi**, var. **perplexans**, var. nov., erectus gracilior altior apicem versus laxe ramosus; bracteis inconspicuis paucis; nuculis ovatis basin versus paulo constrictis; habitu *P. tenelli* sed caulibus colorantibus.—CALIFORNIA: Greenhorn Pass, alt. 4–5000 ft., *Purpus 5542* (TYPE, Univ. Calif.). Greenhorn Range, Kern Co., alt. 5000 ft., *Hall & Babcock 5041*. This variety has a characteristic habit, but it is primarily distinguished by its nutlets which, while most like those of *P. Torreyi*, have weakly constricted bases and so suggest the nutlets of *P. tenellus*. The new variety can be looked upon as a connecting link between *P. tenellus* and *P. Torreyi*, but due to its combining of characters it suggests a hybrid and so, pending further information, I am leaving the status of its possible parents unchanged.

13. P. SHASTENSIS Greene in Gray, Proc. Am. Acad. xx. 284 (1885). —California from the lower San Joaquin Valley northward to southern Oregon; not common. A very near relative of *P. tenellus* and perhaps only a rankly growing strain of it, but usually to be recognized by its large fruiting calyces and nutlets, erect simple few-flowered stems, and soft pubescence. It superficially suggests *P. canescens* but may be readily told by its very different nutlets.

14. P. TENELLUS (Nutt.) Gray, Proc. Am. Acad. xx. 283 (1885). *Myosotis tenella* Nutt. in Hook. Kew Jour. Bot. iii. 295 (1851), nom. subnudum. *Eritrichium tenellum* Gray, l. c. x. 57 (1875). *P. echinatus* Greene, Pittonia iii. 262 (1898). *P. asper* Greene, l. c. *P. humifusa* Jones, Contr. W. Bot. xiii. 7 (1910).—British Columbia to northern Utah and Nevada, and southward through the coastal drainage of California to northern Lower California. This is the most widely ranging and most variable of the species of true *Plagiobothrys*. Greene has named a number of forms, but these do not seem striking or constant enough to warrant their recognition. *Plagiobothrys asper* is a conspicuously hispid phase, which is not geographically correlated and intergrades so gradually and completely with the normal villous forms that its recognition even as a *forma* seems unpractical. *Plagiobothrys humifusus* is a compact form of *P. asper*.

14a. **P. tenellus**, var. **parvulus** (Greene), comb. nov. *P. parvulus* Greene, Pittonia iii. 261 (1898).—California; along the South Coast Ranges from San Francisco Bay Region to San Luis Obispo County. This is the prevailing form of the species in the area of its occurrence, and from its geographic correlation perhaps deserves minor recognition. It differs from other forms of the species by having its nutlets 1–1.5 mm. long and its fruiting calyces 2 mm. long or less.

In the typical form of the species the nutlets are 1.5–2 mm. long and the calyces measure 2–3 mm. in length.

14b. **P. tenellus,** var. **colorans,** comb. nov. *P. colorans* Greene Pittonia iii. 262 (1898).—Known only from extreme northern California. A poorly understood plant which appears to be only a dye-stained form of *P. tenellus.*

15. P. PRINGLEI Greene, Pittonia i. 21 (1887). *Echidiocarya arizonica* Gray, Proc. Am. Acad. xi. 89 (1875).—Southern Arizona and adjacent Sonora.

16. P. CALIFORNICUS (Gray) Greene, Bull. Calif. Acad. ii. 407 (1887). *Echidiocarya californica* Gray, Proc. Am. Acad. xii. 164 (1877). *P. Cooperi* Gray, l. c. xx. 285 (1885).—Southern California and northern Lower California. Differing from the last only in the length of the stipe-like base of the nutlet. There are the following well marked varieties.

Corolla 4–7 mm. broad; pubescence fine, appressed, usually somewhat silky.....var. *genuinus.*
Corolla 1–3 mm. broad; pubescence usually spreading.
Leaves narrowly linear, 2–2.5 mm. broad; pubescence fine, canescent.....var. *gracilis.*
Leaves oblanceolate, 3–5 mm. broad; pubescence coarse, fulvescent.
Racemes dense, hidden among the leaves..... var. *ursinus.*
Racemes elongated, projected from among the leaves and evident.....var. *fulvescens.*

16a. **P. californicus,** var. **genuinus,** var. nov.—CALIFORNIA: Near San Gabriel, *Brewer 147.* Near Upland, *Johnston 1839.* San Bernardino, *Parry 213.* Corona, *Johnston 1876.* Las Flores, *Abrams 3276.* La Jolla, *Clements 110.* San Diego, *Spencer 126; Brandegee 1637.* LOWER CALIFORNIA: Tia Juana Valley, April 1882, *Pringle.* San Rafael Valley, April 1885, *Orcutt.* The above cited suite of selected specimens covers the range of *genuinus.* It is the common form on the grassy hillsides on the coastal drainage of Southern California. The stems are long, lax, and strigose-canescent. It has conspicuous corollas, large fruiting calyces, and broad oblanceolate leaves.

16b. **P. californicus,** var. **gracilis,** var. nov., hispidulosus minutiflorus; caulibus pergracilibus; foliis lanceolato-linearibus acutis sparsis; sepalis angustis.—CALIFORNIA: La Jolla, *Clements 111.* San Diego, *Brandegee 1658* (TYPE, Gray Herb.); *Orcutt 1014,* in part. LOWER CALIFORNIA: Cedros Island, *Palmer 711.* Without locality *Parry.* A very well marked variety which apparently grows with var. *genuinus* and seems much less common. It is perhaps specifically distinct.

16c. **P. californicus**, var. **ursinus** (Gray), comb. nov. *Echidiocarya ursina* Gray, Proc. Am. Acad. xix. 90. (1883). *P. ursinus* Gray, l. c. xx. 285 (1885).—CALIFORNIA: San Bernardino Mts., *Parish 927* (TYPE); *Munz 5725*. San Jacinto Mts., *Spencer 1656; Munz & Johnston 5416*. LOWER CALIFORNIA: Without locality. *Orcutt 908*. A variety inhabiting warm montane valleys and differing from the following only in its congested inflorescence.

16d. **P. californicus**, var. **fulvescens**, var. nov., hispidus minutiflorus; caulibus elongatis prostratis; foliis oblanceolatis; inflorescentia elongata remotiflora a foliis non obscurata.—CALIFORNIA: Santa Barbara, 1888, *T. S. Brandegee* (TYPE, Gray Herb.). Witch Creek, *Alderson 7625*. LOWER CALIFORNIA: Hansen's Ranch, April 1885, *Orcutt*.

17. **P. Kunthii** (Walp.), comb. nov. *Anchusa Kunthii* Walp. Nov. Act. Nat. Cur. xix. suppl. 1, 372 (1843). *Allocarya linifolia*, var. *Kunthii* Macbr. Proc. Am. Acad. li. 545 (1916). *Antiphytum Walpersii* A.DC. Prodr. x. 122 (1846). *Eritrichium Walpersii* Wedd. Chlor. And. ii. 90 (1859).—I associate with this name two Bolivian collections (*Mandon 382, 383*) in the herbarium of the New York Botanical Garden. The flowers are solitary in the axils and the corollas have very elongate tubes and conspicuous (ca. 4 mm. broad) limbs. The style surpasses the mature nutlets by nearly 2 mm. The pedicels are very slender becoming nearly 5 mm. long. Walpers's description is extremely short and vague, the Mandon collections being associated with it only because they come from Lake Titicaca, the type region of *Anchusa Kunthii*, and because they alone among the available Peruvian and Bolivian material agree with the "floribus solitariis, axillaribus" of the original diagnosis.

18. **P. pygmaeus** (HBK.), comb. nov. *Anchusa pygmaea* HBK. Nov. Gen. et Sp. iii. 92 (1818). *Eritrichium pygmaeum* Wedd. Chlor. And. ii. 89 (1859). *Lithospermum alpinum* R. & S. Syst. iv. 742 (1819).—Ecuador.

19. **P. linifolius** (Lehm.), comb. nov. *Anchusa linifolia* Lehm. Asperif. i. 215 (1818). *Antiphytum linifolium* A.DC. Prodr. x. 121 (1846). *Eritrichium linifolium* Wedd. Chlor. And. ii. 89 (1859). *Krynitzkia linifolia* Gray, Proc. Am. Acad. xx. 266 (1885). *Allocarya linifolia* Macbr. Proc. Am. Acad. li. 545 (1916). *Anchusa oppositifolia* HBK. Nov. Gen et Sp. iii. 91, t. 200 (1818).—Ecuador.

20. **P. mollis** (Gray), comb. nov. *Eritrichium molle* Gray, Proc. Am. Acad. xix. 89 (1883). *Allocarya mollis* Greene, Pittonia i. 20 (1887).—California, along the northern Sierras, and in adjacent Nevada and Oregon.

20a. **P. mollis** var. **vestita** (Greene), comb. nov. *Allocarya vestita* Greene, Erythea iii. 125 (1895). *A. mollis*, var. *vestita* Jepson, Fl. Midd. W. Calif. 442 (1901).—Middle California; rare. Known only from Marin and Tulare counties. It is apparently a geographical variety differing from the typical form of the species in its darker and more loosely reticulate-rugose nutlets.

21. **P. mexicanus** (Macbr.), comb. nov. *Allocarya mexicana* Macbr. Contr. Gray Herb. lix. 34 (1919).—Mexico. Known only from the type collection made in the state of Mexico.

22. **P. pedicellaris** (Phil.), comb. nov. *Eritrichium pedicellare* Phil. Anal. Univ. Chile xc. 549 (1895). *Allocarya pedicellaris* Reiche, Anal. Univ. Chile cxxi. 809 (1907).—Chile. Known to me only by descriptions.

23. **P. humilis** (R. & P.), comb. nov. *Myosotis humilis* R. & P. Fl. Peruv. ii. 5 (1799). *Eritrichium humile* A.DC. Prodr. x. 133 (1846). *Allocarya humilis* Greene, Pittonia i. 17 (1887). *Amsinckia humifusa* Walp. Nov. Act. Nat. Cur. xix. suppl. 1, 371 (1843). *Benthamia humifusa* Druce, Rep. Bot. Exch. Cl. Brit. Isl. iv. 298 (1916). *E. Germaini* Phil. Anal. Univ. Chile xc. 550 (1895). *Allocarya Germaini* Reiche, Anal. Univ. Chile cxxi. 809 (1907).—Peru and Bolivia. Apparently also in Chile, Philippi's species being doubtfully associated with the Peruvian one.

24. **P. congestus** (Wedd.), comb. nov. *Eritrichium humile*, var. *congestum* Wedd. Chlor. And. ii. 88 (1859).—Peru and Bolivia, apparently at high altitudes.

25. **P. Scouleri** (H. & A.), comb. nov. *Myosotis Scouleri* H. & A. Bot. Beech. 370 (1840), nom. subnudum. *Eritrichium Scouleri* A.DC. Prodr. x. 130 (1846). *Krynitzkia Scouleri* Gray, Proc. Am. Acad. xx. 267 (1885). *Allocarya Scouleri* Greene, Pittonia i. 18 (1887). *E. sessiliflorum* A.DC. l. c. 133. *A. sessilifolia* Greene, l. c. 17. *A. hirta* Greene, l. c. 161 (1888). *A. Scouleri*, var. *hirta* Nels & Macbr. Bot. Gaz. lxi. 36 (1916). *A. calycosa* Piper, Contr. U. S. Nat. Herb. xxii. 101 (1920). *A. figurata* Piper, l. c. 101. *A. dichotoma* Brand in Fedde, Repert. xviii. 313 (1922).—Oregon to southern British Columbia, and apparently also in central Chile.

26. **P. australasicus** (A.DC.), comb. nov. *Eritrichium australasicum* A.DC. Prodr. x. 134 (1846). *Allocarya australasica* Greene, Erythea iii. 57 (1895).—Australia. This is the only extra-American species of the genus.

27. **P. Piperi**, nom. nov. *Allocarya microcarpa* Piper, Contr. U. S. Nat. Herb. xxii. 91 (1920); not *P. microcarpus* Greene (1887).—

Known only from Mariposa County, California. Superficially nearly indistinguishable from *P. scopulorum*, but in fruit-characters clearly allied with *P. Greenei*.

28. **P. Greenei** (Gray), comb. nov. *Echinospermum Greenei* Gray, Proc. Am. Acad. xii. 163 (1877). *Allocarya Greenei* Greene, Bot. San Francisco 259 (1894). *A. Echinoglochin* Greene, Pittonia i. 15 (1887). *A. Austinae* Greene, Pittonia i. 18 (1887). *A. hystricula* Piper, Contr. U. S. Nat. Herb. xxii. 87 (1920). *A. acanthocarpa* Piper, l. c. 87. *A. oligochaeta* Piper, l. c. 88. *A. echinacea* Piper, l. c. 88. *A. cristata* Piper, l. c. 89. *A. Eastwoodae* Piper, l. c. 89. *A. glyptocarpa* Piper, l. c. 90. *A. spiculifera* Piper, l. c. 90. *A. anaglyptica* Piper, l. c. 90. *A. papillata* Piper, l. c. 91. *A. distantiflora* Piper, l. c. 91.—Occuring over the length of California. Very conspicuously variable in the sculpturing and arming of the nutlets, even in a single locality, and apparently showing no tendency to break up into definite geographic variants. Some of the conspicuous extremes might well be treated as *formae*. *Allocarya glyptocarpa* probably is specifically distinct differing from the great mass of *P. Greenei* in its large corollas and elongate nutlets.

29. **P. patagonicus**, sp. nov., annuus tinctus; caulibus prostratis diffuse ramosis ca. 1 dm. longis sparse breveque villosis; foliis ovato-oblongis vel oblongis 13–15 mm. longis 3–5 mm. latis, infimis oppositis; racemis elongatis maturitate remote florentibus cum bracteis foliaceis; floribus albis ca. 2.5 mm. longis; corollae tubo calyce longiori cylindrato, lobis ascendentibus; calyce strigoso-hispido ad basin partito ad anthesin ca. 2 mm. longo fructifero aperto 3–4 mm. longo; nuculis 4 late ovatis ca. 1.5 mm. longis dorso congeste humileque rugosis ventrale carinatis in media parte ad gynobasin humilem adfixis.—ARGENTINA: Patagonia, 50° 3′ Lat., 1882, *Moreno & Tonini 530* (TYPE, N. Y. Bot. Gard.). San Carlos de Bariloche, 800 m. alt., *Buchtien 118* (U. S.). In gross aspect much resembling *P. Torreyi*, var. *diffusus*, and in most parts suggesting a true *Plagiobothrys* rather than a species of *Allocarya* which it must be because of its opposite lower leaves. It is probably the "*Plagiobothrys decumbens*" of Macloskie, Fl. Patag. 679 (1905), and perhaps also the "*Cryptanthe globulifera*" of Skottsberg, Svenska Vet. Akad. Handl. lvi. no. 5, 290 (1916).

30. **P. lithocaryus** (Greene), comb. nov. *Krynitzkia lithocarya* Greene in Gray, Proc. Am. Acad. xx. 265 (1885). *Allocarya lithocarya* Greene, Pittonia i. 12 (1887).—California, along the North Coast Ranges. Rare.

31. **P. Chorisianus** (Cham.), comb. nov. *Myosotis Chorisiana* Cham. Linnaea iv. 444 (1829). *Eritrichium Chorisianum* A.DC. Prodr. x. 130 (1846). *Krynitzkia Chorisiana* Gray, Proc. Am. Acad. xx. 267 (1885). *Allocarya Chorisiana* Greene, Pittonia, i. 13 (1887). *E. connatifolium* Kell. Proc. Calif. Acad. ii. 163, f. 51 (1862). *A. Hickmanii* Greene, Pittonia i. 13 (1887). *A. myriantha* Greene, Erythea iii. 125 (1895). *A. Jonesii* Brand in Fedde, Repert. xviii. 313 (1922).—California, from San Francisco to Santa Barbara counties.

32. **P. glaber** (Gray), comb. nov. *Lithospermum glabrum* Gray, Proc. Am. Acad. xvii. 227 (1882). *Allocarya glabra* Macbr. Proc. Am. Acad. li. 543 (1916). *A. salina* Jepson, Fl. W. Midd. Calif. 442 (1901).—Middle California, and doubtfully also Arizona. Mrs. Brandegee, Zoe v. 94 (1901), doubts the Arizonian origin of the type of *L. glabrum*. No undoubted material is at hand from Arizona, and Professor J. J. Thornber of the University of Arizona writes me that he has neither collected such a plant in Arizona nor knows of anyone else having done so. It is possible that the following four species had best be treated as varieties of the present one.

33. **P. humistratus** (Greene), comb. nov. *Allocarya humistrata* Greene, Pittonia i. 16 (1887). *A. scripta* Greene, l. c. 142. *A. limicola* Piper, Contr. U. S. Nat. Herb. xxii. 97 (1920). *A. sigillata* Piper, l. c.—Middle California.

34. **P. stipitatus** (Greene), comb. nov. *Allocarya stipitata* Greene, Pittonia i. 19 (1887).—*Lappula stipitata* Druce, Rep. Bot. Exch. Cl. Brit. Isl. v. 38 (1918). *A. stipitata*, subsp. *micrantha* Piper, Contr. U. S. Nat. Herb. xxii. 94 (1920). *A. ambigens* Piper, l. c. 96. —Middle California. There are two conspicuous extremes in flower-size.

35. **P. divergens** (Piper), comb. nov. *Allocarya divergens* Piper, Contr. U. S. Nat. Herb. xxii. 92 (1920). *A. charaxata* Piper, l. c. 96.—California, from Tulare County to San Diego County.

36. **P. Nelsonii** (Greene), comb. nov. *Allocarya Nelsonii* Greene, Erythea iii. 48 (1895). *A. leptoclada* Greene, Pittonia iii. 109 (1896). *A. oricola* Piper, Contr. U. S. Nat. Herb. xxii. 92 (1920). *A. asperula* Piper, l. c. 93. *A. Wilcoxii* Piper, l. c. 93. *A. setulosa* Piper, l. c. 93. *A. Leibergii* Piper, l. c. 95. *A. tuberculata* Piper, l. c. 95. *A. fragilis* Brand in Fedde, Repert. xviii. 312 (1922).—Eastern Oregon and northern Nevada and northwestward to Montana and adjacent Saskatchewan.

37. **P. plebejus** (Cham.), comb. nov. *Lithospermum plebejum* Cham. Linnaea iv. 446 (1829). *Eritrichium plebeium* A. DC. Prodr.

x. 133 (1846). *Krynitzkia plebeia* Gray, Proc. Am. Acad. xx. 266 (1885). *Allocarya plebeia* Greene, Pittonia i. 16 (1887).—Alaska.

38. **P. trachycarpus** (Gray), comb. nov. *Krynitzkia trachycarpa* Gray, Proc. Am. Acad. xx. 266 (1885). *Allocarya trachycarpa* Greene, Pittonia i. 14 (1887). *Myosotis californica* F. & M. Ind. Sem. Hort. Petrop. ii. 42 (1835). *Eritrichium californicum* A.DC Prodr. x. 130 (1846). *K. californica* Gray, l. c. *A. californica* Greene, l. c. 20; not *P. californicus* Greene (1887). *A. diffusa* Greene, l. c. 14. *A. interrasilis* Piper, Contr. U. S. Nat. Herb. xxii. 108 (1920). *A. commixta* Brand in Fedde, Repert. xviii. 312 (1922).—Coast Ranges of middle California. The type of *K. trachycarpa, Brewer 1007* from Sonoma County, is a good match for authentic specimens of *M. californica*, and appears to represent the very slender plant with long lax leafy stems and linear spreading calyx-lobes which seems to replace *P. scopulorum* in the region along the middle Coast Ranges of California. As I have taken it *P. trachycarpus* may consist of two things, the southern plants seeming to be less diffuse and to have shorter calyx-lobes.

39. **P. Parishii**, nom. nov. *Eritrichium Cooperi* Gray, Proc. Am. Acad. xix. 89 (1883). *Krynitzkia Cooperi* Gray, l. c. xx. 267 (1885). *Allocarya Cooperi* Greene, Pittonia i. 19 (1887); not *P. Cooperi* Gray (1885).—Mohave Desert of California.

40. **P. salsus** (Brandg.), comb. nov. *Allocarya salsa* Brandg. Bot. Gaz. xxvii. 452 (1899). *A. jacunda* Piper, Bull. Torr. Cl. xxix. 643 (1902). *A. Cusickii*, var. *jacunda* Nels. & Macbr. Bot. Gaz. lxi. 36 (1916).—Nevada and eastern Oregon.

41. **P. strictus** (Greene), comb. nov. *Allocarya stricta* Greene, Pittonia ii. 231 (1892).—Northern California, perhaps best restricted to the Calistoga plant.

42. **P. tenuifolius** (Gray), comb. nov. *Krynitzkia tenuifolia* Gray, Proc. Am. Acad. xx. 267 (1885). *Eritrichium tenuifolium* Phil. Anal. Univ. Chile xlii. 518 (1873), nom. nudum, & xc. 546 (1895). *Allocarya tenuifolia* Greene, Erythea iii. 57 (1895). *E. humile*, var. *capitatum* Clos in Gay, Fl. Chile iv. 471 (1849). *E. tenuifolium*, var. *longipes* Phil. l. c. xlii. 518 (1873). *A. tenuifolia*, var. *longipes* Reiche, Anal. Univ. Chile cxxi. 806 (1907).—Chile.

43. **P. nitens** (Greene), comb. nov. *Allocarya nitens* Greene, Pittonia iii. 108 (1896).—Nevada and Utah, apparently rare. Perhaps only a phase of the next.

44. **P. orthocarpus** (Greene), comb. nov. *Allocarya orthocarpa* Greene, Pittonia iv. 235 (1901).—Washington and Nevada, eastward to Utah and Colorado. A rare and poorly understood species.

45. **P. mesembryanthemoides** (Speg.), comb. nov. *Eritrichium mesembryanthemoides* Speg. Anal. Soc. Cientf. Argent. liii. 136 (1902). —Patagonia.

46. **P. muricatus** (R. & P.), comb. nov. *Lithospermum muricatum* R. & P. Fl. Peruv. ii. 4 (1799). *Eritrichium muricatum* A.DC. Prodr. x. 132 (1846). *Allocarya muricata* Reiche, Anal. Univ. Chile cxxi. 810 (1907).—Chile. This plant may be a *Cryptantha*, although Philippi's note, Anal. Univ. Chile xc. 540 (1895), makes it seem improbable. It is possible that the species should be amplified to include the concepts here called *P. procumbens* and *P. scopulorum*.

47. **P. scopulorum** (Greene), comb. nov. *Allocarya scopulorum* Greene, Pittonia i. 16 (1887). *Eritrichium californicum*, var. *subglochidiatum* Gray in Wats. Bot. Calif. i. 526 (1876). *Krynitzkia californica*, var. *subglochidiata* Gray, Proc. Am. Acad. xx. 266 (1885). *A. subglochidiata* Piper, Contr. U. S. Nat. Herb. xi. 485 (1906). *A. hispidula* Greene, l. c. 17. *A. Cusickii* Greene, l. c. 17. *A. penicillata* Greene, l. c. 18. *A. tenera* Greene, l. c. iii. 109 (1896). *A. cognata* Greene, l. c. iv. 235 (1901). *A. bracteata* Howell, Fl. N. W. Amer. 481 (1901). *A. cryocarpa* Piper, Contr. U. S. Nat. Herb. xxii. 98 (1920). *A. gracilis* Piper, l. c. 98. *A. laxa* Piper, l. c. 98. *A. pratensis* Piper, l. c. 99. *A. cervina* Piper, l. c. 100. *A. ramosa* Piper, l. c. 100. *A. vallata* Piper, l. c. 101. *A. undulata* Piper, l. c. 104. *A. minuta* Piper, l. c. 104. *A. scalpta* Piper, l. c. 104. *A. reticulata* Piper, l. c. 105. *A. areolata* Piper, l. c. 105. *A. inornata* Piper, l. c. 106. *A. media* Piper, l. c. 107. *A. divaricata* Piper, l. c. 107. *A. insculpta* Piper, l. c. 109. *A. dispar* Piper, l. c. 109. *A. granulata* Piper, l. c. 109. *A. conjuncta* Piper, l. c. 109. *A. corrugata* Piper, l. c. 110. *A. scalpocarpa* Piper, l. c. 111.—Western United States and adjacent Canada. This is the most common and widely distributed *Allocarya*, and that which has mostly borne the name *A. californica*. It varies considerably in the marking and sculpturing of the nutlets, and to a less extent in habit as well. A careful study will probably cause the recognition of a number of forms here submerged. There is a large-flowered plant on Vancouver Island (e.g. *Macoun 56, 680*), and a stiffish strict one of western Oregon (e.g. *Sheldon 10,577*) which may be distinct. Some plants from the Argentine, for the present referred to *P. procumbens*, seem indistinguishable from certain of the North American specimens.

48. **P. Lechleri**, nom. nov. *Eritrichium albiflorum* Griseb. Abhandl. Ges. Wiss. Gött. vi. 131 (1854); not *Myosotis albiflora* B. & S. in Hook. f. Fl. Antarct. ii. 329 (1847).—Patagonia and Fuego. This

is the plant which has been variously identified as *Eritrichium albiflorum* (Grisebach, l. c.), *E. diffusum* (Dusén, Svenska Exped. Magell. iii. 132 (1900)), and *Allocarya procumbens* (Skottsberg, Svenska Vet. Akad. Handl. lvi. 289 (1916)). It was a specimen of this species, incorrectly identified as *Myosotis albiflora*, that gave Greene, Erythea iii. 57 (1895), his reasons for proposing the combination, *Allocarya albiflora*. Regarding the identity of *Myosotis albiflora* B. & S. see the lengthy note by Skottsberg, l. c. 290–291, t. 23, f. 8a–d.

49. P. PROCUMBENS (Colla) Gray, Proc. Am. Acad. xx. 283 (1885). *Myosotis procumbens* Colla, Mem. Acad. Torino xxxviii. 130 (1834). *Eritrichium procumbens* A.DC. Prodr. x. 133 (1846). *Allocarya procumbens* Greene, Pittonia i. 17 (1887). *E. tenuicaule* Phil. Linnaea xxix. 18 (1857). *A. tenuicaulis* Macbr. Proc. Am. Acad. li. 544 (1916). *E. uliginosum* Phil. Anal. Univ. Chile xliii. 519 (1873). *A. uliginosa* Greene, l. c. 14. *E. calandrinioides* Phil. Anal. Univ. Chile xc. 541. (1895). *E. oppositifolium* Phil. l. c. 542. *A. oppositifolia* Reiche, Anal. Univ. Chile cxxi. 807 (1907). *E. polycaule* Phil. l. c. 542. *E. delicatulum* Phil. l. c. 544. *E. flavicans* Phil. l. c. 544. *E. pulchellum* Phil. l. c. 545. *E. cinereum* Phil. l. c. 545. *A. cinerea* Reiche, l. c. 808. *E. limonium* Phil. l. c. 546. *E. graminifolium* Phil. l. c. 547. *E. illapelinum* Phil. l. c. 548. *E. bracteatum* Phil. l. c. 548. *E. vernum* Phil. l. c. 550.—Chile and Argentine. This appears to be the South American homologue of *P. scopulorum*, and like it is very variable in its structures.

## III. DIAGNOSES AND NOTES RELATING TO THE SPERMATOPHYTES CHIEFLY OF NORTH AMERICA.

By I. M. Johnston.

The subjoined paragraphs bring together miscellaneous data which have accumulated during the past few months as a by-product of general herbarium work. Considerable time has been spent by the author in ordering up the *Euphorbiaceae* of the Gray Herbarium. As a result of this work it has been found desirable to place on record certain undescribed species which have been detected and to make some new combinations which were needed in order that the naming of the collection could be strictly in accord with the International Rules of Nomenclature. Some time has also been spent in an