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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

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