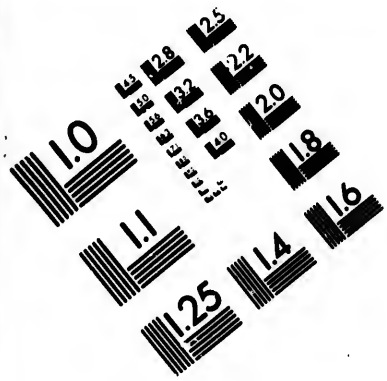

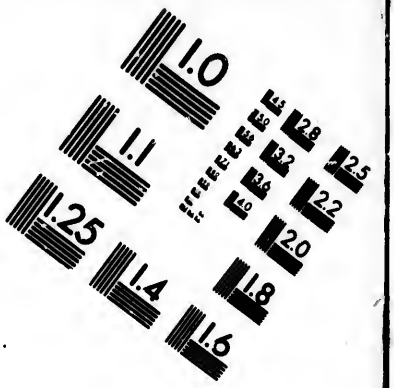

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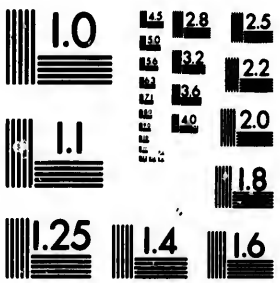

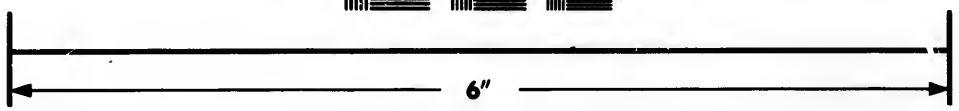

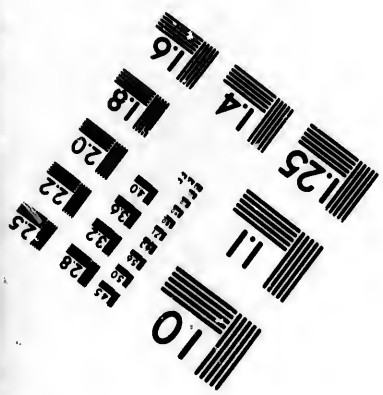

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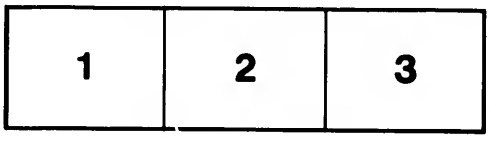

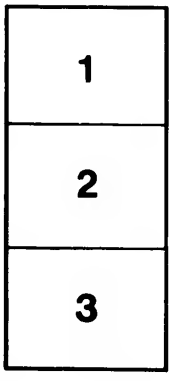

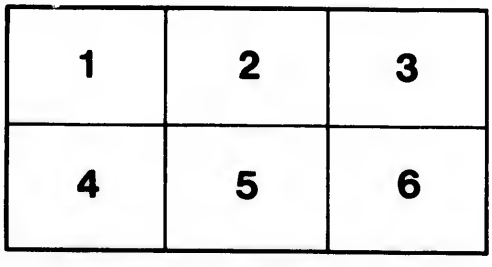

The North American Species of Gayophytum and Boisduvalia.

By WILLIAM TRELEASE.

REPRINTED IN ADVANCE FROM THE FIFTH ANNUAL REPORT OF THE MISSOURI BOTANICAL GARDEN.

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REVISION OF THE NORTH AMERICAN SPECIES OF GAYOPHYTUM AND BOISDUVALIA.

BY WILLIAM TRELEASE.

Though few in numbers, our species of Gayophytum and Boisduvalia are difficult because of the great variability of several species, and as the naming in herbaria is usually much confused, it is hoped that the following revision may facilitate the determination of future collections. In its preparation I have examined the material in the Engelmann herbarium and the general herbarium of the Missouri Botanical Garden, and the collections of Columbia College, Harvard University, the California Academy, and the United States Department of Agriculture, for the use of which I wish to express my thanks. Several western correspondents have also placed me under obligation by contributing specimens for the Garden herbarium.

GAYOPHYTUM, Juss. Ann. Sci. Nat. 1832, xxv. 18, pl. 4; Bentham & Hooker, Gen. Pl. i. 786, 789.

Gayophytum is a small genus of Onagraceae of the aspect of the *paniculatum* group of Epilobium, and also more or less similar in appearance to species of Oenothera of the group Sphaerostigma. From the former it differs by having its seeds quite destitute of a coma, and by its two-celled ovary and fruit, and isolated pollen grains. Oenotheras of similar habit and with equally reflexed sepals, may be distinguished from it by their more elongated calyx-tube, and 4-celled ovary, and the prevailing color of their flowers is yellow, while the flowers of our Gayophytums are white or rose-purple. The bark is very frequently papery-exfoliating at base, as in some Epilobiums.

The geographical distribution of the genus is peculiar. The species represented in our flora are plants of the mountain region of the west. One or two other represent-

atives, — including the species on which the genus was founded by Jussieu, — occupy the corresponding part of the South American continent; but the genus appears to be entirely absent from the intervening country. None of the species are truly alpine, though several of them reach up to considerable altitudes in the higher mountains; nevertheless the indication is that the former distribution of the genus was continuous along the backbone of both North and South America. Plants of this distribution are often represented also across the North American continent in high latitudes, and not infrequently they occur likewise in Europe, where they enjoy a similar arctic-alpine distribution. In the present case, however, the prototype of the genus appears to be of rather recent differentiation from Oenothera, which is of wide American distribution (one species, Tasmanian, according to Bentham and Hooker), of which genus it represents an accentuated mountain type.

The principal revisions of our species appear in Torrey & Gray, Fl. N. A. i. 512; Watson, Bot. Calif. i. 221; Coulter, Man. Rocky Mt. Bot. 103; and Greene, Flora Franciscana, 218. For other references see Watson, Bibl. Index, 370.

SYNOPSIS.

* Seeds canescent with appressed hairs.
Flowers small, the petals about 1 mm. long..... *G. lastospermum.*
Flowers large, the petals 3 to 6 mm. long..... *G. eriospermum.*
** Seeds glabrous, either smooth or low papillate.
+ Much forked above, mostly remotely leafy: stigma rather small: pedicels filiform, elongated: capsules subclavate, mostly torulose: seeds rather few, suberect, large, mostly dark colored.
Large flowered, the petals 3 to 6 mm. long: seeds about 1.5 mm. long..... *G. diffusum.*
Small flowered, the petals 1 to 2 mm. long: seeds 1 to 1.5 mm. long. ..... *G. ramosissimum.*
+ + Subsimple or paniculately branched, especially toward the base, densely leafy: stigma large, capitate: pedicels short or almost wanting: capsules neither clavate nor conspicuously torulose: seeds numerous, small, pale.
Capsules narrowly linear, with suberect seeds..... *G. caespitosum.*
Capsules broadly oblong, flattened contrary to the septum, with very oblique seeds..... *G. pumilum.*

G. LASIOSPERMUM Greene, Pittonia, 1891, ii. 164. — A span to a foot high, loosely dichotomous with filiform branches, the upper leaves and inflorescence more or less canescent with appressed or spreading short hairs; leaves ascending; flowers small, the petals about 1 mm. long; shorter stamens with small anthers; stigma globose, about .3 mm. in diameter; capsules erect, about equaling the subtending leaves, narrowly linear or slightly clavate, scarcely torulose, their slender pedicels about 3 mm. long; seeds mostly numerous, erect, not papillate, finely appressed pubescent, about .46×1.25 mm. (varying from .29 to .60 ×.92 to 1.72 mm). — Washington to Southern California and Nevada.

Specimens examined from Washington (near Mt. Adams, Henderson, Aug. 6, 1892, 2466, and Suksdorf, Aug. 31, 1881, 22; Spokane, Henderson, June 10, 1892, 2467), California (Julian, Dunn, 1888; Congdon, 1889; Pringle, 1881; Cuiamaca Mts., Palmer, 1875, 99; Mojave River, Parish, 1884 and 1886, 1824; Summit, Mrs. Curran, Sept. 1888; Donner, Brandegee, Aug. 1883; Tehachapi, Brandegee, July 1884, and Mrs. Curran; Susanville, Brandegee, July 1, 1892; Lassen Co., hb. Calif. Acad.; Laguna, Cleveland, 1885, 462; San Diego Co., Palmer, 1875, 138, — with seeds as large as in the next, and torulose capsules, and Palmer, 1876, 131 in part; Sierra Co., Lemmon, 1874; Kernville, Coville & Funston, 1891, 1040 and 2167; Ft. Tejon, Coville & Funston, 1891, 1180), and Nevada (Carson City, Anderson, 1864.)

As here understood, this species is quite variable in aspect, the habit of some specimens being that of *ramosissimum*, while others more nearly resemble *caesium*. The numerous usually small seeds recall the latter species, but in some cases the capsules and seeds have more nearly the form and size of those of the former, and it is possible that another species may be separated, intermediate between *lasiospermum* and *eriospermum*.

G. ERIOSPERMUM Coville, Botany of the Death Valley

Expedition, 1893, 103.— Larger and more loosely forked; flowers very large, the petals 3 to 6 mm. long, rosy; anthers and stigma twice as large as in the preceding; capsules more spreading, torulose; seeds few, 1.3 to 1.5 mm. long.— Oregon to Central California.

Specimens examined from Oregon (Camp Harney, Bendire, 1875), and California (Bolander, 1866, 6371; Peru Creek, Rothrock, 1875, 225; Fresno Co., Engelmann, Sept. 13, 1880 — the seeds of some specimens of this collection glabrous and papillate, strongly suggesting hybridity with *diffusum;* Kern Co., Palmer, 1888, 155; Tulare Co., Coville and Funston, 1891, 1316; Siskiyou Co., Pringle, Sept. 6, 1882).

G. DIFFUSUM Torrey and Gray, Fl. 1840, i. 513.— A foot or two high, loosely dichotomous, somewhat canescent above or with spreading hairs throughout; flowers large, the petals about 3 mm. long; stamens all with good anthers; stigma little enlarged, about .25 mm. in diameter; capsules thick, subclavate, torulose, erect or refracted; seeds few, low papillate, about .55×1.3 mm. (varying from .42 to .85×1.05 to 2 mm).— Washington to Central California, Idaho and Northern Utah.

Specimens examined from Washington (Snake River, Fremont, 1843, 782; Spokane River, Cooper, 1860; Falcon Valley, Suksdorf, Sept. 2, 1881, and Howell, Aug. 19, 1882), Oregon (Nuttall; Harford; Klamath Valley, Cronkhite, 1864; Geyer, 546; Cusick, June 1878; Lyall, 1860; Howell, June 1877, and 1880), California (Bridges; Brewer, 1860–2, 1414; Lassen Co., Bryant; Amador Co., Mrs. Wiley, July 1886; Plumas Co., Mrs. Ames, 1874, and Cleveland, June 1882; Alta, Jones, July 3, 1882; Crescent Lake, Kellogg and Harford, 1868, 280; Sequoia Mills, Brandegee, July 19, 1892; Mt. Shasta, Pringle, Aug. 29, 1882; Sierra Nevada Mts., Lemmon, 1875; Sissons, Mrs. Curran, July 1887; Yosemite, Gray, 1872, Torrey, 1865, 112, Bolander, 1866, 4922, Mrs. Curran, July 1883, and Brandegee, July 1883), the Yellowstone Region? (Hayden,

various numbers of 1859–60, in the Engelmann herbarium,—these plants of leafy habit with more ample foliage than usual, and less dichotomous, but too young for satisfactory study), Idaho (Teton Foot Hills, Hayden Expedition, 1872), and Utah (Parley's Park, Watson, July 1869, 404).

G. RAMOSISSIMUM Torr. & Gray, Fl. i. 1840, 513.—A span to a foot or two high, intricately dichotomous with filiform branches, glabrous, appressed canescent above, or very exceptionally with spreading hairs throughout; leaves mostly narrow, usually less conspicuous than in the last, often appressed against the branches; flowers small, the petals 1 to 2 mm. long; stamens in two sets, the shorter ones often with abortive anthers; stigma larger, about .4 mm. in diameter; capsules about 1 mm. thick, oblong to subclavate, often torulose, erect or refracted, on filiform peduncles; seeds few, nearly erect in a single series, papillate, about .5×1.3 mm. (varying from .38 to .80×.84—1.89 mm.), often abruptly dilated one-third above the base.—Washington to the Yellowstone, Arizona and Southern California.

Specimens examined from Washington (Brandegee, 1882, 280, and 1883, 781; Yakima Co., Henderson, May 30, 1892, 2463, and Aug. 3, 1892, 2464; Falcon Valley, Suksdorf, Aug. 2, 1881, 20, and Sept. 2, 1881, 13; North Branch of the Columbia, Wilkes Exped. 1838–42, 1052), Oregon (Geyer, 4 and 547; Hall, 1871, 183; Howell, 1880; John Day Valley, Howell, May 12, 1885; Stein's Mountain, Howell, June 1, 1885), Idaho (Kootenai Co., Sandberg, July 1892), Montana (Birch Lakes, Canby, Aug. 8, 1883, 133), Yellowstone Park (Miss Cooley, June 1891, 4), Rocky Mountains (Nuttall; Hall and Harbour, 1862, 172 for the most part), Black Hills of the Platte (Hayden), Colorado (Central City, Letterman, 1885; Palmer Lake, Miss Eastwood, 1890; Sierra Mojado, Brandegee, June 1877; Fremont Co., Brandegee, 1872, 450; Golden, Greene, 1870; Parry, 1872; Clear Creek, Parry, 1861–2, 124;

Eagle River, Coulter, Aug. 20, 1873; Empire, Patterson, Aug. 13, 1892, 208; South Park, Wolf, 1873, 150 (447); Leadville, Trelease, July 1886; Breckenridge, Mrs. Wislizenus, 1887; Vasey, 1868, 190; Rabbit's Ear Pass, Sheldon, 1884, 186), Utah (Frisco, Jones, June 22, 1880, 1953; Ogden, Tracy & Evans, July 31, 1887, 573; Alta, Jones, Aug. 1, 1879, 1148; Salt Lake City, Watson, May 1869, 401; City Creek Cañon, Jones, Sept. 11, 1882; Palmer, 1877, 157 in part; Antelope Island, Stansbury Exped. June 30, 1850, and Watson, June 1869, 401), Arizona (Williams, Rusby, July 20, 1883), Nevada (Carson City, Anderson, 1864, 239, 282, and Stretch, May 1865; Gray, 1872; Aurum, Jones, June 12, 1893; Soda Springs, Jones, July 20, 1881, 2403; Empire City, Torrey, 1865, 96; Monitor Valley, Watson, July 1868, 401; Virginia Mountains, Watson, July 1867, 401; Palisade, Tracy & Evans, July 26 and 29, 1887, 515), California (Tuolumne, Bolander, 1866, 5059; Brewer, 1860–2, 1711, 1945; Palmer, 1876, 131; Mt. Shasta, Brandegee, July 1887, and Pringle, Aug. 29, 1882 in part, toward *diffusum;* Merced River, Torrey, 1865, 96a; Yosemite, Torrey, 1865, 96; San Jacinto Mts., Parish, July 1881, 1023; Summit, Mrs. Curran, Sept. 1888; Snow Mountain, Brandegee, Aug. 24, 1892; Del Norte Co., Brandegee, Sept. 1885; Donner Lake, Torrey, 1865, 98; Truckee, Brandegee, July 1884, and Mrs. Curran, Sept. 1887).

Specimens apparently referable here, but with larger flowers, the stamens of the two sets subequal, from California (Strawberry Valley, Pringle, Aug. 16, 1881, 108; Big Trees, Bolander, 1866, 6365) and Washington (Falcon Valley, Suksdorf, Aug. 2, 1881, 21). A leafy paniculately branched plant from Sierra Valley, Calif., Lemmon, 1873, with leaves as much as 4×35 mm., apparently belongs here also. The more villous plants can hardly be distinguished from *lasiospermum* except by seed characters. What may be this species was collected by Brandegee at Baja California, L. Cal., May 28, 1893.

Sir William Hooker (London Journ. Bot. 1847, vi. 224), distinguishes two forms of this species, *α. strictipes*, and *β. deflexum*, respectively with erect and refracted capsules (the characters, however, transposed in his descriptions, as has been noted by Dr. Gray in Proc. Phila. Acad. 1863, 61). Both forms are about equally abundant and of similar distribution. Corresponding forms occur in other species, so that it has hardly seemed desirable to maintain the varieties here unless similar varieties are to be admitted for the others.

G. CAESIUM Torr. & Gray, Fl. i. 1840, 514. — *G. racemosum* Torrey & Gr. *l. c.*; *G. Nuttalii* Torr. & Gr. *l. c.* — A span to rarely a foot high, subsimple or diffusely paniculate and fertile from the base, glabrous or with spreading soft pubescence; leaves uniformly distributed along the branches, the upper mostly small and erect; flowers very small, the petals mostly under 1 mm. long; stamens in two sets, the anthers of the shorter ones smaller; stigma globose, large for the genus, .6 to .8 mm. in diameter; capsules .5 mm. wide, narrowly linear, little flattened, nearly sessile, often finely torulose, erect; seeds numerous, nearly erect, smooth, about .36×.93 mm. (varying from .25 to .50×.76 to 1.17 mm).—Oregon to the Yellowstone, Colorado, and California.

Specimens examined from Oregon (Nuttall's type of *Oenothera cresia;* Douglas; Union Co., Cusick, 1877), Idaho (Beaver Cañon, Watson, 1880, 148), Yellowstone region (Hayden, 1859–60 ?, with *diffusum*), Rocky Mountains (Hall & Harbour, 1862, 171, and 172 in part in some sets; Nuttall, types of *O. micrantha* and *O. racemosa* in hbs. Gray and Torrey), Colorado (Empire, Patterson, 1892, 207; Steamboat Springs, Miss Eastwood, July 1891; Breckenridge, Brandegee, 1871, 169), Utah (Alta, Jones, 1879, 1249; Palmer 1877, 157 in part), Nevada, (Aurum, Jones, June 12, 1893 — a canescent form; Carson Valley, Stretch, 1865, 179; Clover Mts., Watson, 1868, 403; E. Humboldt Mts., Watson,

1868, 402 and 403; Flagstaff, MacDougal, 1891, 313), and California (Downieville, Bigelow, 1853–4; White Mts., Coville & Funston, 1891, 1797; Susanville, Brandegee, July 1, 1892; Kern Co., Palmer, 1888, 156a and 156b in part.

It is evident that Nuttall wrote the name *cresia*, on the labels of the specimens preserved in the Gray and Torrey herbaria, but the name published by Torrey and Gray is here adopted. The only reason for preferring this to the name *racemosum* which is now in almost universal use, is its prior position on the page on which both of the synonyms of the species are published. Reflexed fruit occurs on some of no. 1249 Jones.

G. PUMILUM S. Watson, Proc. Amer. Acad. xviii. 1883, 193. — A span or two high, simple or paniculately few branched toward the base, the branches quickly erect, minutely spreading puberulent to mostly glabrous; leaves lanceolate, very acute, rather large, longer than the internodes, the lower spreading; flowers very small, the petals about 1 mm. long; stamens and stigma as in the last; capsules 1 to 1.5 mm. wide, strongly flattened contrary to the septum, nearly sessile, not at all torulose, erect; seeds numerous, very oblique in the cells, smooth, smaller, about .5 × .8 mm. (varying from .25 to .34 × .71 to .97 mm.)— Washington to southern California.

Specimens examined from Washington (Yakima region, Brandegee; Henderson, Aug. 3, 1892, 2465; Falcon Valley, &c., Suksdorf, 1880, 376, June 29 and Aug. 31, 1881; Klickitat River, Suksdorf, 1885, 82), Oregon (Klamath Valley, Cronkhite, 1864; Siskiyou Mts., Howell, July 19, 1887, 1141), Nevada (Reno, Brandegee, Sept. 1887), and California (Fresno Co., Engelmann, Sept. 13, 1880; Kellogg, 1870; Kern Co., Palmer, 1888, 156b in part; Sierra Co., Lemmon, 1874 in part, and Parry and Lemmon, 1876, 131; Headwaters of Sacramento, Pringle, Sept. 1, 1882; San Bernardino, Parish, 1892, 2372, and Parry, May 1876; Trinity River, Rattan, June, 1883; Lake Co., Torrey, 1865,

97; Truckee, Sonne, 1886, 112, and Brandegee, July 1884; Bartlett Mt., Brandegee, June 1884; Snow Mt., Brandegee, June 1891; Sequoia Mills, Brandegee, July 1892).

G. strictum, Gray, Proc. Amer. Acad. vii. (1867), 340, according to Watson (Bibl. Index, 363), and the type specimens, is Boisduvalia Torreyi.

The genus *Gayophytum* was founded on a South American species, *G. humile* Juss.,* of Chili and Peru. The original plate of Jussieu, and Gay's plate for a tracing of which I am indebted to Mr. Hemsley, show that this species is nearly identical with *G. pumilum*, having flattened capsules with numerous oblique seeds. Specimens referable here occur in the herbarium of the California Academy, from the mountains about Santiago, as *G. humile* Juss. and *G. densifolium* Ph., and it may be questioned whether study of additional material may not necessitate the adoption of Jussieu's name for the North American plant which now bears the name of *pumilum*. *G. micranthum* Hook. & Arnott, in Hook. Bot. Miscell. iii. 311 (*Oenothera micrantha* Presl, Rel. Haenk. ii. 31†), which is generally held to be the same as *humile*, is represented in the Gray herbarium by a fragment from Hooker, which has the elongated internodes, dichotomous habit, clavate torulose capsules on filiform pedicels, and few large dark seeds, of the *ramosissimum* group, and from this fragment one would hesitate to call it different from the latter, but it is possible that some error has occurred in the labeling. Apparently of a single species, separable from *humile*, are the following specimens in the herbarium of the California Academy, from the Andes near Santiago: — *G. minutum*, Ph., *G. gracile*, Ph., and *G. robustum*, Ph., — all of which appear more closely related to *caesium* than to any other species. I am disposed to think that these (together with

* Jussieu, Ann. Sc. nat. 1832, xxv. 18, pl. 4; Gay, Flora Chilena, ii. 324, pl. 22.

† Datlug from 1825, as Mr. Hemsley informs me.

the Hooker fragment referred to above?) should all bear the name *micranthum*.

BOISDUVALIA, Spach, Hist. Nat. des Vég. 1835, iv. 383, and Atlas, pl. 85, f. 2; Monogr. Onagrearum, 1835, 398, pl. 31, f. 2; Benth. and Hook., Gen. Plant. i. 790, — as section of *Oenothera*.

Like Gayophytum, this is a small group, confined to the mountains of Western North and South America, what has been said of the distribution of the former genus applying equally to this, except that our species are more closely confined to the Pacific coast. In general habit it approaches closest to Oenothera, with which Bentham and Hooker unite it, but in aspect it differs from most species of Oenothera proper, from which it also differs (so far as our species are concerned) in its short, nearly basifixed anthers in two sets, erect calyx lobes, and pollen grains adnate in tetrads. It is also closely related structurally to Epilobium, from which it differs in aspect, and in its seeds destitute of a coma. In my study, I have thought best to follow most American botanists in treating it as a distinct genus. The principal revisions of our species appear in Torrey & Gray, Fl. N. A., i. 505 (under *Oenothera*); Watson, Bot. Calif. i. 233; Behr, Flora of the vicinity of San Francisco; and Greene, Flora Franciscana, 224. — For other references see Watson, Bibl. Index, 362, and Jackson, Index Kewensis, i. 318.

SYNOPSIS.

* Capsule membranaceous, loculicidal, a considerable portion of the septa remaining attached to the valves on dehiscence.

Leaves ovate lanceolate, toothed, the upper not reduced: seeds minute, fusiform ..... *B. glabella.*

Leaves narrowly lanceolate, nearly entire, the upper small: seeds broad and flattened ..... *B. stricta.*

** Capsule membranaceous, septifragal, the septa wholly adherent to the placenta, rendering the latter strongly 4 winged: leaves lanceolate, toothed, the upper broader ..... *B. densiflora.*

*** Capsule coriaceous, 4 sided, very tardily (loculicidally?) dehiscent: leaves narrowly lanceolate, toothed, the upper not enlarged. ..... *B. clavigama.*

B. GLABELLA (Nutt.) Walpers, Repert. 1843, ii. 89; Watson, Bot. Calif. 1876, i. 233; Index, 362, — *Oenothera glabella* Nutt. in Torrey & Gray, Flora, 1840, i. 505.— A span or two high, simple or mostly decumbently branched near the base and frequently with ascending branches above, bluish, densely soft villous to glabrous; leaves half an inch long, ovate lanceolate, acute, serrulate, the upper similar; flowers in a terminal cluster and a few shorter lateral spikes, also occasionally in the lower axils, shorter than the subtending leaves; corolla about 2 mm. long, violet; capsules rather slender, nearly straight, usually acute, about 7 mm. long, subterete with 4 broad nerves or laterally somewhat 2-keeled, loculicidal; seeds about 6 in each cell, subfusiform, small, about .35×1 mm. (varying from .25 to .42 × .84 to 1.26 mm.).— British Columbia to Montana, Nevada, and southern California.

Specimens examined from British Columbia (Cypress Hills, Macoun, 1880, 67; Bullrush Lake, Macoun, July 25, 1880,— both with narrower leaves than usual), Washington (Pullman, Henderson, July 17, 1892, 2469), Oregon (Hall, 1871, 190; Walla Walla, Nuttall; Howell, 1887, 702; Grant's Pass, Howell, 1887, 1145; Wasco Co., Suksdorf, 1886, 862), Montana (Sand Coulee, Anderson, July 1887; Deer Lodge?, Notestein, 1892), Nevada (Carson Valley, Watson, Aug. 1867, 413; Truckee Valley, Bailey, 1867, 413), and California (Vasey, 1875; Mrs. Austin, July 1884, 176; Elmira, Mrs. Curran, Aug. 1883; San Diego, Cleveland, 1882, 868, and Orcutt, 1887, 1119; San Luis Obispo, Brandegee, July 1886, and Palmer, 1876, 145½; Santa Monica, Hasse, June 1892; Siskiyou Co., Greene, 1876, 892; Gilroy, Brandegee, June 1885; Antioch, Brandegee, June 8, 1892; Mt. Eden, Brandegee, June 16, 1893; Snow Mt., Brandegee, June 23, 1891 and Aug. 1892; Byron, Brandegee, June 9, 1892; Monterey Co., Congdon, June 1881).

B. STRICTA (Gray). — *Gayophytum strictum* Gray, Proc. Amer. Acad., 1867, vii. 340. — *Oenothera Torreyi*

Watson, Proc. Amer. Acad. 1873, viii. 600.— *O. densiflora* var. *tenella* Gray, Proc. Amer. Acad. 1873, viii. 384.— *Boisduvalia Torreyi* Watson, Bot. Calif. 1876, i. 233; Index, 363.— A foot to a foot and a half high, slender, simple or with a few long erect virgate branches chiefly toward the base, densely villous, often hoary; leaves commonly under 1 in. long, narrowly lanceolate, acute, entire or minutely denticulate, the upper shorter and not widened; flowers axillary along the branches, about equaling the leaves; corolla 2 to 4 mm. long, violet; capsules slender, generally curved outwards, tapering above, more or less 2-edged, about 10 mm. long, loculicidal, the lateral nerves commonly heavier; seeds 6 to 8 in each cell, similar to those of *densiflora* but smaller, about .5×1 mm. (varying from .38 to .63×.88 to 1.6 mm.).— Washington to Idaho and Central California.

Specimens examined from Washington (Brandegee, 1882 and 1883, 788; Seattle, Piper, 1888, 411; Spokane, Henderson, 1892, 2468 in part, and Sandberg, Aug. 1892; Klickitat Co., Suksdorf, Aug. 8, 1881; Falcon Valley, Suksdorf, Aug. 1880, 378, and July 3, 1882), Oregon (Henderson, 1882, 360; Howell, Aug. 1880; Hall, 1871, 189; Grant's Pass, Howell, June 23, 1884; Idaho (Kootenai Co., Heller, 1892, 905), and California (Rockville, Earle, Aug. 1, 1880; Yreka, Greene, 1876, 853; Humboldt & Sonoma Counties, Bolander, 1866–7, 6535; Almaden, Torrey, 1865, 109; Borax Lake and Bear Mountain, Torrey, 1865; Sta. Lucia Mts., Vasey, July 1880, Kernville, Coville and Funston, 1891, 1041; Lake Co., Brandegee, July 1884, and June 1890; Howell Mt., Brandegee, Aug. 1888; Plumas Co., Brandegee, July 4, 1892; Byron Sta., Greene, May 24, 1886; Newcastle, Brandegee, July 5, 1889; Sonoma, Brandegee, June 1892; Modoc Co., Mrs. Austin, Aug. 1885; Humboldt Co., Mrs. Bush.)

B. DENSIFLORA (Lindley) Watson, Bot. Calif. 1876, i. 223; Index, 362. — *B. Douglasii* Spach, Hist. Nat. Végétaux, 1835, iv. 385, atlas, pl. 85, f. 2; Monographia

Onagrearum, 1835, 400, pl. 31, f. 2. — *Oenothera densiflora* Lindley, Bot. Reg. 1833, xix. pl. 1593. — Mostly a foot or two high, simple or with few ascending branches, green to hoary, more or less villous; leaves 1 to 3 in. long, lanceolate, acute, denticulate to rather sharply serrate, the upper abruptly becoming shorter, broadly ovate, acuminate, mostly entire, sometimes much crowded; flowers in an often dense terminal spike, similar but shorter clusters ending the branches; corolla 12 mm. long, deep violet, mostly exceeding the subtending leaves; capsules stout, straight, usually blunt, terete, about 7 mm. long, shorter than the leaves, septifragal, with 4 broad but low nerves; seeds rarely over 6 in each cell, pale at both ends, generally very concave on the inner face and much deformed by mutual pressure, about .9 × 1.7 mm. (exceptionally varying from .63 to 1.26 × 1.26 to 2.31 mm.). — Vancouver Island and Washington to Nevada and Lower California.

Specimens examined from Vancouver (Macoun, July 9 and Aug. 27, 1887), Washington (Brandegee, 1883, 787; Yakima Co., Henderson, May 27, 1892, 2470; Seattle, Smith, July 6, 1889, 108; Piper, July 1 and Aug. 9, 1888, 2761, and Miss Shumway, May 1892; Klickitat Co., Suksdorf, Aug. 8, 1881, 15), Oregon (Hall, 1871, 185, 186, 187, 188 in part; Lyall, 1860; Newberry, Williamson Survey; Kellogg & Harford, 1868–9, 1152; Douglas; Geyer, 591; Nuttall — types of *imbricata*, *salicina*, and *salicina albiflora;* Dalles, Brandegee, 1882; Grant's Pass, Brandegee, Sept. 1885; Clear Water, Spalding), California (Fitch; Kellogg & Harford, 1868–9, 275; Vasey, 1875; Brewer, 1860–2, 811; Alta, Pringle, Sept. 29, 1882; Sierra Nevada Mts., Lemmon, 1875; Susanville, Brandegee, July 2, 1892; Sonoma Co., Samuels, 72; Sonoma Valley, Torrey, 1865, 104; Sta. Lucia Mts., Vasey, July 1880, 205 and an albino, Brandegee, 1886; Placer Co., Vasey, 1880; Jolon, Vasey, July 1880, 206; Kern Co., Palmer, 1888, 141 — an albino; Oakland, Jones, 1881, 2358; Stanislaus

River, Bigelow, 1853–4; Healdsburg, Bryant, July 1887; Napa Co., Brandegee Aug. 1888; Folsom, Brandegee, July 1883; Adobe Flats, Mrs. Austin, July 1884, 118; Mt. Tamalpais, Jepson, Sept. 9, 1892, and Brandegee, July 1891; Yosemite, Torrey, 1872; Yreka, Greene, 1876, 947; Monterey, Nuttall; Auburn, Vasey, Oct. 1880; Peru Creek, Rothrock, 1875, 235; Truckee, Jones, 1881, 392a; Nevada Co., Jones, 1881, 2715), Nevada (Carson City, Anderson, 1864, 26, 54, 118; Yolo, Brandegee, Sept. 20, 1892; Palisades, Brandegee, 1886; Modoc Co., Mrs. Austin, Aug. 1885; Verano, Heaton, 1888; Sta. Cruz Mts., Price, 1890; Ukiah, Mrs. McCowen, June 1892), and Lower California (Orcutt, July 30, 1883).

The typical, usually green form, with ample serrate leaves, large bracts and dense inflorescence, passes into a grayer form with longer spikes and smaller bracts, and this in turn grades into var. . of Torrey and Gray's Flora, which is the *Oenothera salicina* of Nuttall, and is very canescent, with narrower leaves and bracts, smaller flowers and slenderer capsules. Variety *imbricata* Greene, is a virgate form, in wet ground becoming six or seven feet high, with the floriferous branches as much as two feet and a half long (Jepson, Erythea, i. 241 and 244). I do not see how to separate these forms as even varieties, although as here defined, *densiflora* is far more variable than the other species of the genus. Specimens from California (Yreka, Greene, 1876, 853; Sta. Lucia Mts., Vasey, July 1880), and Washington (Falcon Valley, Suksdorf, Aug. 3, 1882, 56, July 30, 1885, 343, 557 and 558), are variously intermediate between this species and *stricta*, in bract, flower, capsule and seed characters, as well as in habit, and are indicative of hybridity or a possible intermediate species which I cannot define.

A portion of Hall 188 is *Oenothera lepida*, var. *parviflora*, as noted by Mr. Watson on several sheets; but this may be distinguished by its larger acuminate buds, more strigose pubescence above, larger capsules and entire leaves

with incurved tomentum, though in habit it bears a rather close resemblance to *B. densiflora*.

B. CLEISTOGAMA Curran, Bull. Calif. Acad. 1884, i. 12; Mrs. Brandegee, Zoe, iii. 370.— A span or two high, decumbently branched from the base, very villous to glabrous except for a few spreading hairs; leaves pale, an inch or two long, lanceolate to linear lanceolate, acute, remotely denticulate to sharply serrulate, the upper similar; flowers axillary along the branches, shorter than the subtending leaves, "the earlier ones fertilized in the bud and never expanding;" corolla rose purple, 2 to 4 mm. long; capsules stout, spreading from the stem, acute, 10 to 15 mm. long, sharply 4-sided and with 4 intermediate nerves, (tardily loculicidal?), much surpassed by the leaves; seeds numerous, about .5 × 1.4 mm.— California (Antioch, Brandegee, May 1886; Elmira, Mrs. Curran, May and Aug. 1883).

In aspect this is between *glabella* and *stricta*, but its capsular characters are quite unlike those of other species.

Besides these North American species, Jackson enumerates the following Chilian species, referring them to Oenothera: — *B. andina* Phil., *B. concinna* Spach, *B. Tocornalii* Gay, and *B. Volckmanni* Phil., — which I have not in sufficient material to warrant a revision of the South American forms.

EXPLANATION OF PLATES.

The figures were drawn from herbarium specimens by Miss Grace E. Johnson, under supervision of the author, and details are from his sketches.

Plate 17, *Gayophytum lasiospermum*. — 1, Habit, natural size; 2, capsule, enlarged; 3, dehiscent capsule, × 5; 4, hair from ovary, × 200; 5, stigma, × 37; 6, three seeds, × 18.

Plate 18, *G. eriospermum*. — 1, Habit, natural size; 2, branch, × 2; 3, long and short stamen, from one flower, × 18; 4, pollen grain, × 200; 5, two stigmas, × 37; 6, seed, × 18; 7, seed of the *diffusum* type, from an Engelmann specimen.

Plate 19, *G. diffusum*. — 1, Habit (from a Nuttall specimen), natural

size; 2, flower, × 3; 3, stigma, × 37; 4, two capsules, somewhat enlarged; 5, seed, × 18.

Plate 20, *G. ramosissimum.* — 1, Habit, natural size; 2, two stigmas, × 37; 3, stamen, × 18; 4, germinating pollen grain, × 200; 5, elongated erect capsule, × 5; 6, shorter deflexed capsule, × 5; 7, capsule in section, × 15; 8, two seeds, × 18.

Plate 21, *G. caesium.* — 1, Habit, natural size; 2, flower, × 9; 3, stigma, × 37; 4, capsule, × 5; 5, section of capsule, × 15; 6, seed, × 18.

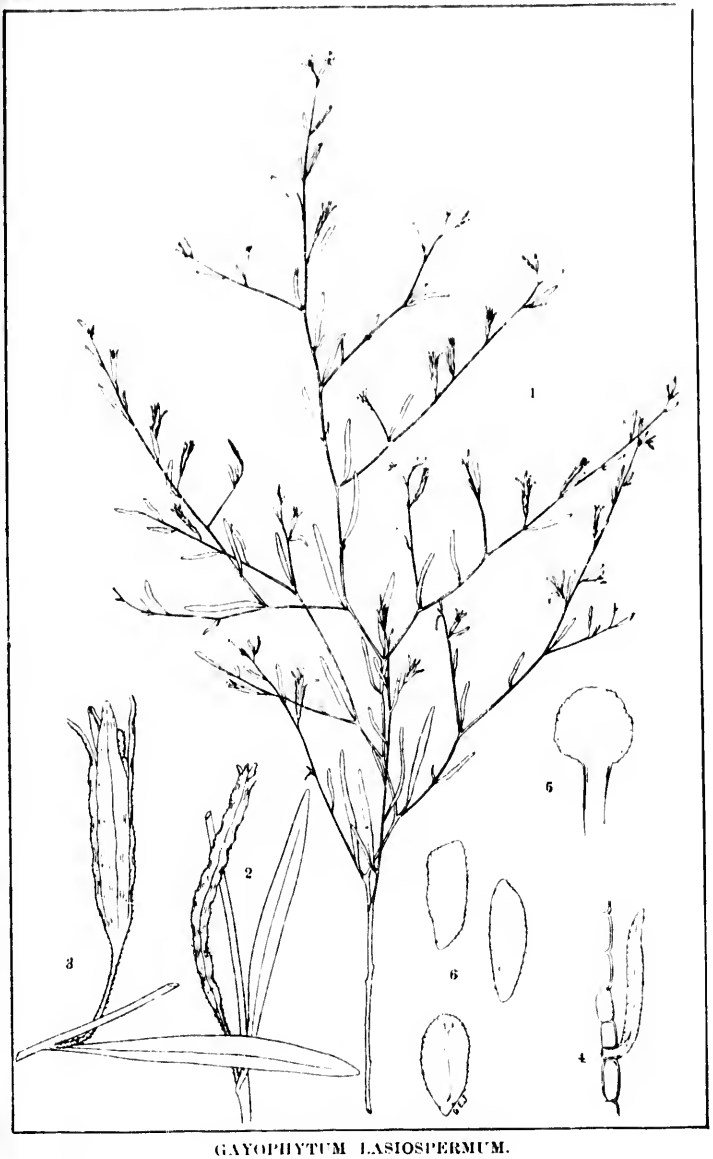
Plate 22, *G. pumilum.* — 1-2, Habit, natural size; 3, flower, × 3; 4, stigma, × 37; 5, capsule, × 5; 6, section of capsule, × 15; 7, two seeds, × 18.

Plate 23, *Boisduvalia glabella.* — 1, Habit, half size; 2, branch, half size; 3, two stigmas, × 18; 4, two pollen tetrads, × 200; 5, capsule, × 1; 6, two seeds, × 18.

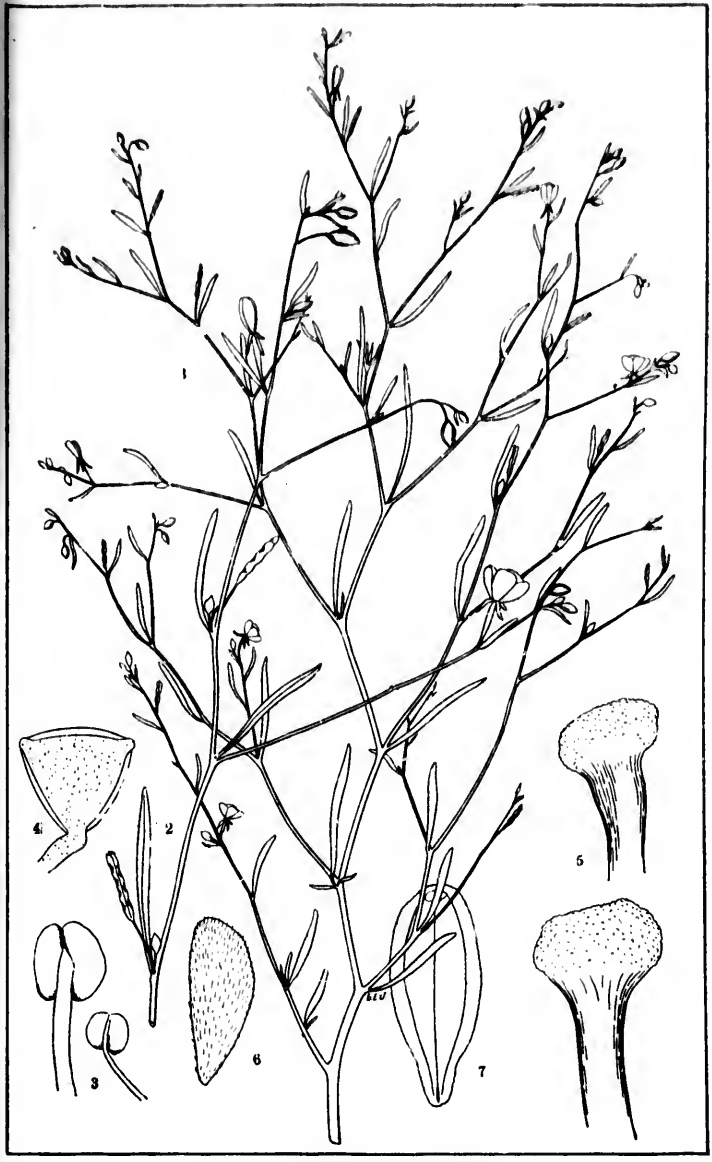
Plate 24, *B. stricta.* — 1, Habit, half size; 2, branch, natural size; 3, opened flower, × 9; 4, stigma, × 18; 5, capsule, × 5; 6, four seeds, × 18; 7, pollen tetrad, × 200; 8, glandular and non-glandular hairs, × 200.

Plate 25, *B. densiflora.* — 1, Branch, half size; 2, diagramatic section of flower, enlarged; 3, pollen tetrad, × 200; 4, capsule and bract, natural size; 5, capsule, × 3, and section × 3; 6, two seeds, × 18.

Plate 26, *B. c leistogama.* — 1, Habit, half size; 2, smaller plant, natural size 3, capsule, × 5, and section, × 5; 4, stigma, × 18; 5, seed, × 18.



GAYOPHYTUM LASIOSPERMUM.



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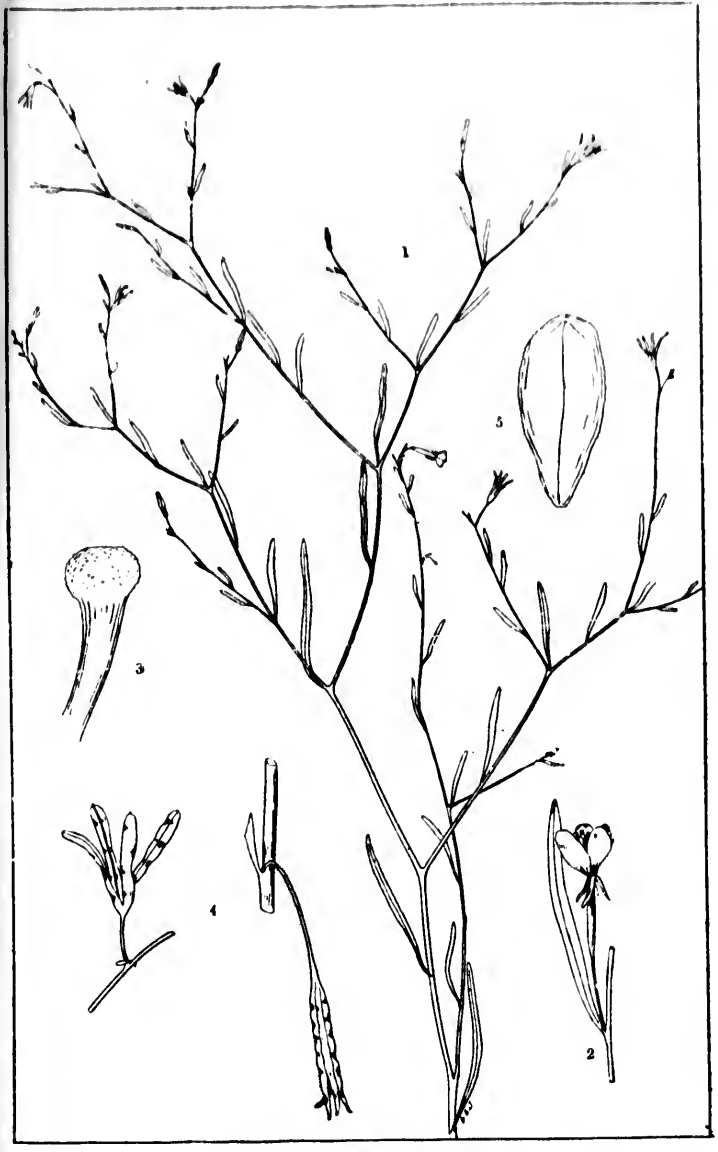

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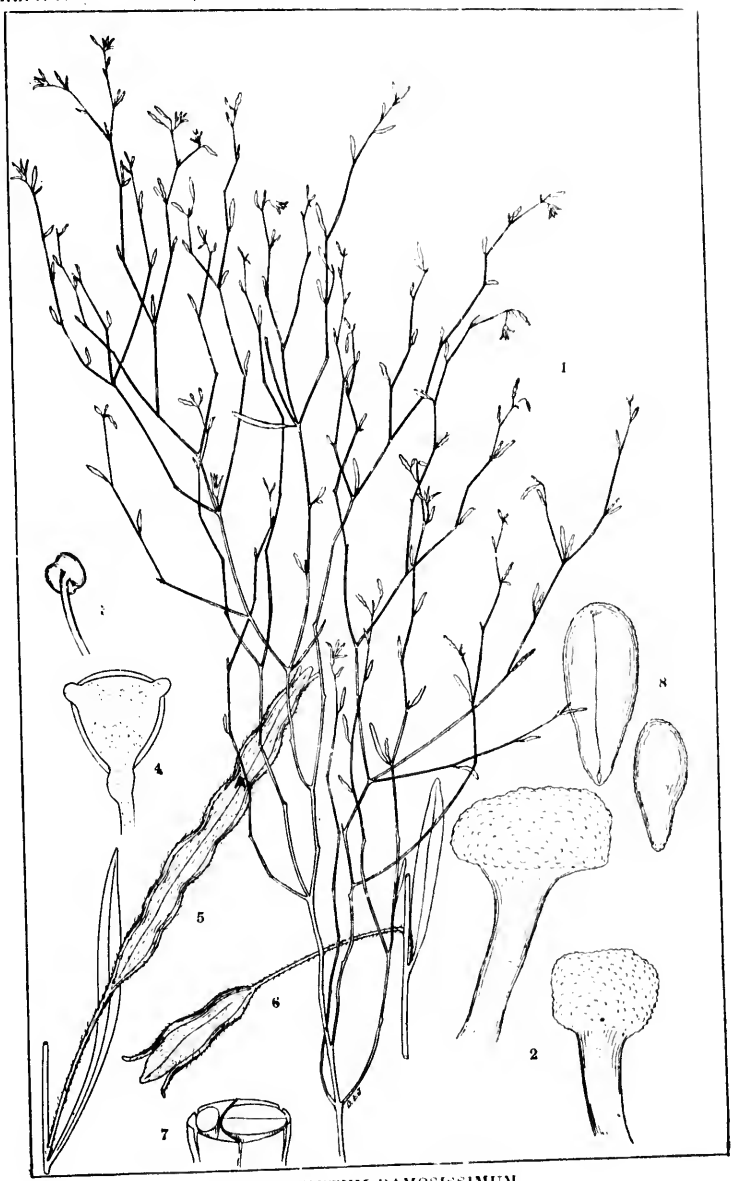
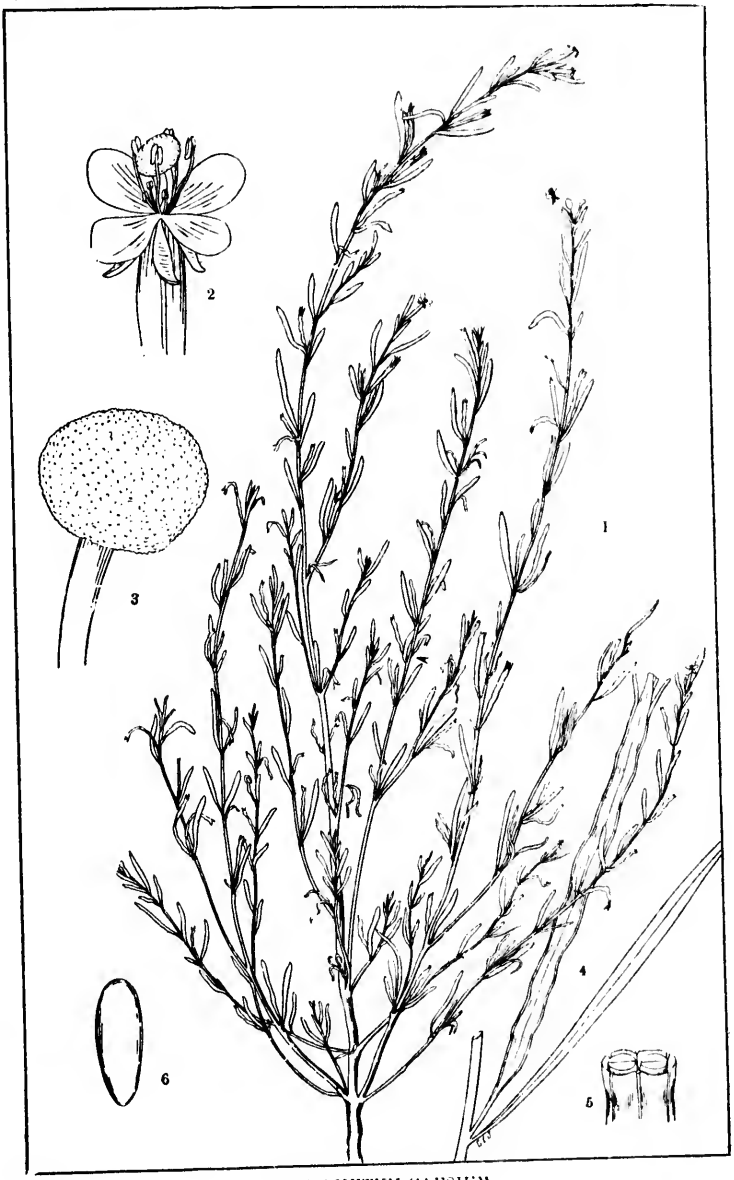
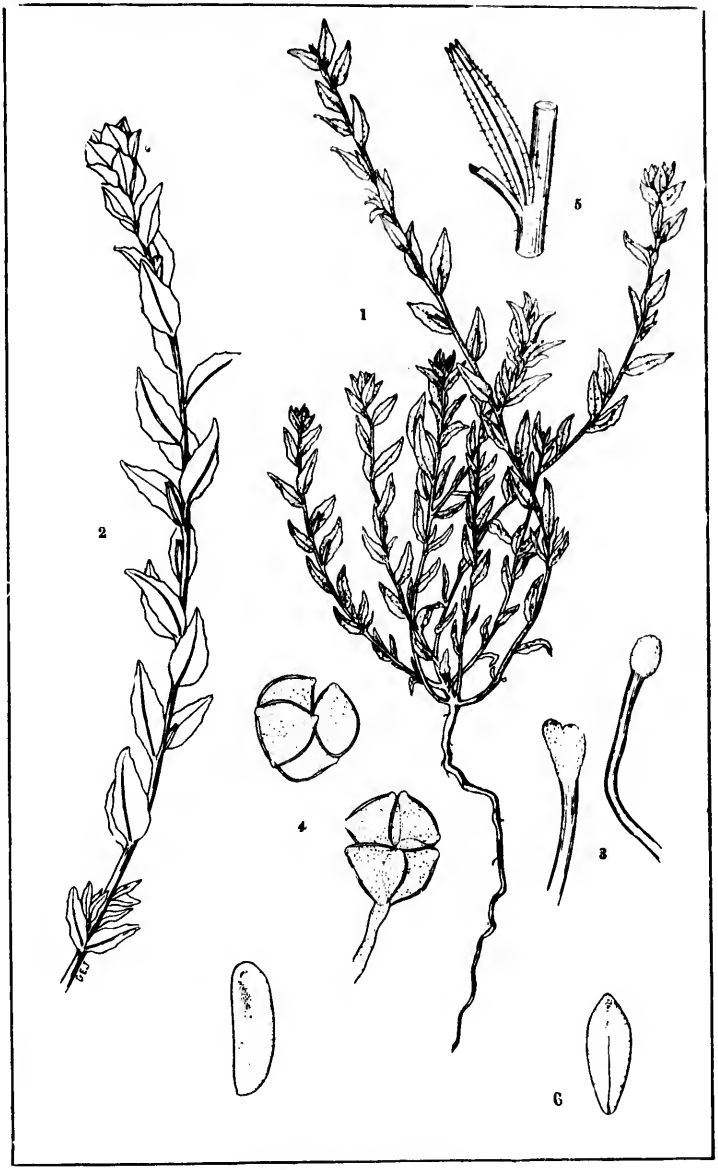


GAYOPHYTUM RAMOSISSIMUM.

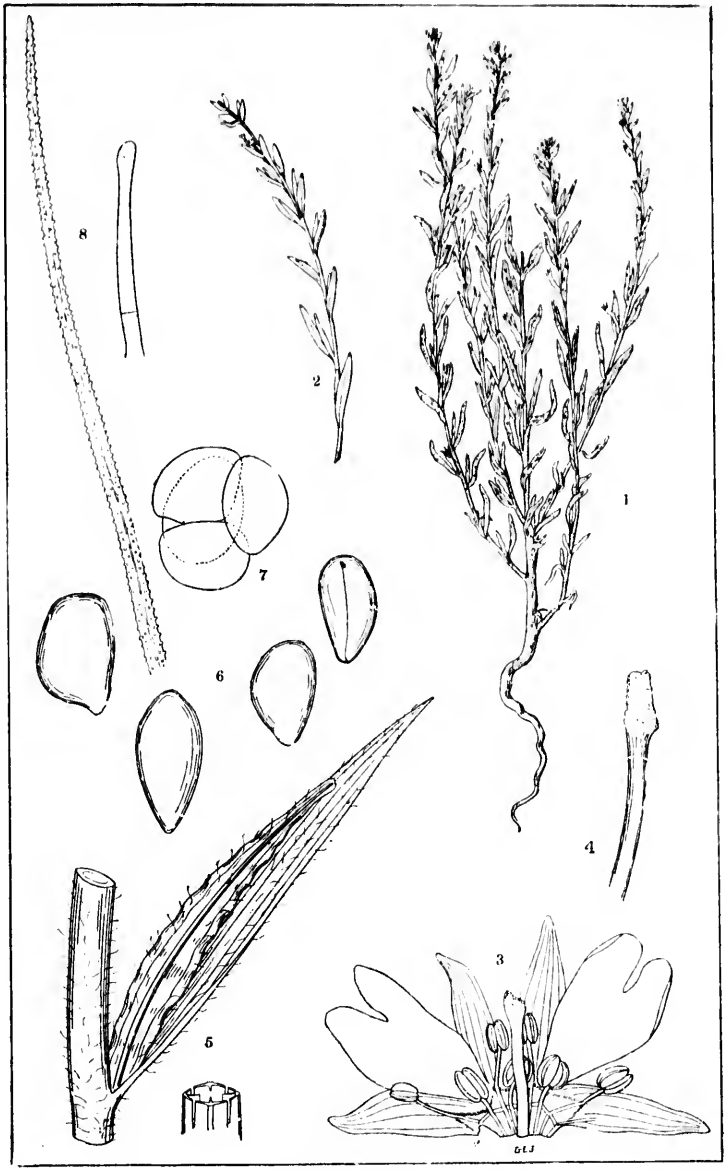


GAYOPHYTUM CAESIUM.

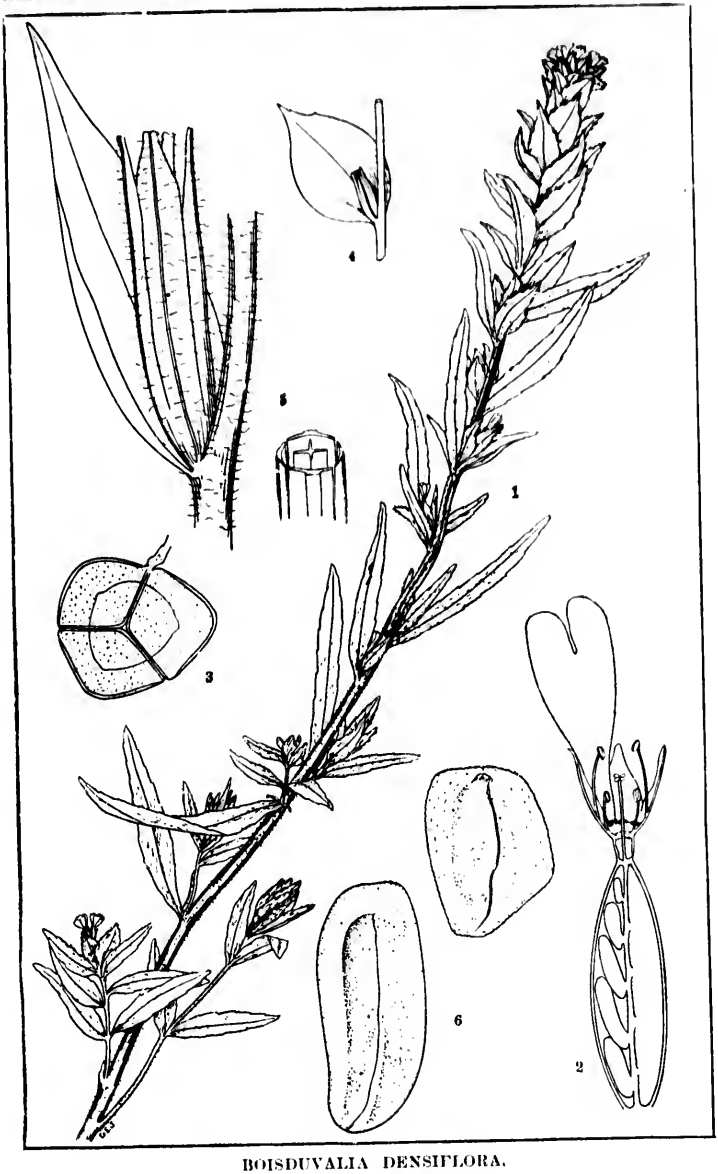
GAYOPHYTUM PUMILUM.



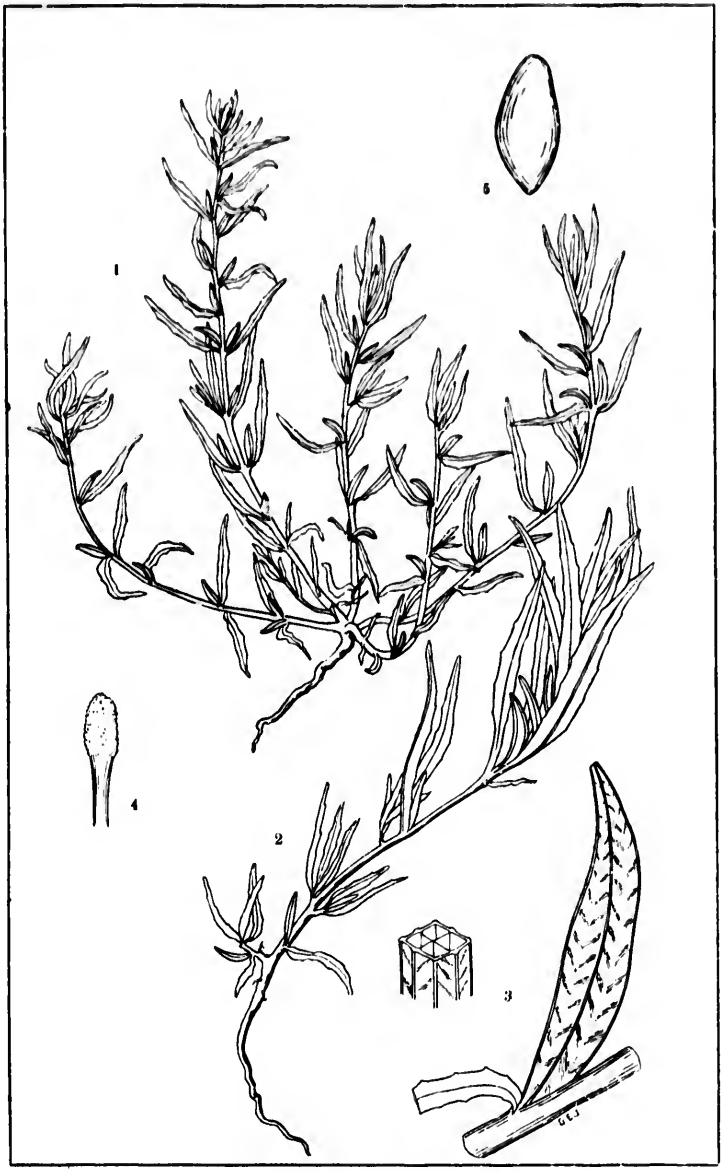
BOISDUVALIA GLABELLA.



BOISDUVALIA STRICTA.



BOISDUVALIA DENSIFLORA.



BOISDUVALIA CLEISTOGAMA.