

to my own satisfaction. It has been suggested that the growth was from a crack which had gathered soil. A mere glance negatives the suggestion. Again it has been said that the stump, though apparently sound, is really decayed. This, of course, is possible, but in no part of the stump to a depth of three inches was there the slightest trace of decay that could be detected.

To my mind it stands as the title indicates, as an exceptional growth of a wild rose.

A REVISION OF THE SPECIES OF THE GENUS *PLANTAGO* OCCURRING WITHIN
THE UNITED STATES. BY ALIDA MABEL CUNNINGHAM.¹

The genus *Plantago* of Tournefort under rule 2 of the Madison code is now to be referred to Linnaeus, Sp. Pl. 112 (1753). The description of the genus found in the 6th edition of Gray's Manual is so complete that it is here quoted without change.

The purpose of the following study was a revision of the various species of this genus, based upon seed characters because of the belief that such characters were most likely to be constant and of diagnostic value. The results obtained by this study have led to a confirmation of these views, and it is believed that an extension of studies of this character would be of high value.

The material examined was that contained in the herbaria of the United States Department of Agriculture, the University of Minnesota, Purdue University and the private herbarium of Dr. John M. Coulter. I extend my thanks to the gentleman owning or in charge of these collections for their kindness in permitting me to retain the material for the time needed, and to Mr. E. B. Uline for some original descriptions. I am also deeply indebted to Dr. Stanley Coulter for his trouble in procuring the material examined, and for his many valuable suggestions in the study of the subject.

The results show that the genus may be broken up into three sections, clearly separated by seed characters, as follows:

- I. Seeds oval in cross section.
 P. cordata, *major*, *Rugelii*, *eriopoda*, *decipiens*, *maritima*, *Tweedyi*.
- II. Seeds more or less anther shape in cross section.
 P. lanceolata, *Patagonica*, *hirtella*, *Virginica*, *rubra* and *minima*.
- III. Seeds irregularly lobed in cross section.
 P. elongata, *heterophylla* and *Bigelovii*.

¹Plates 1-20, photographs of the various species, which were intended to accompany this article, are omitted because of lack of funds.

The differences in present arrangement, resulting from this, are as follows: lanceolata and Patagonica are placed in section two, instead of one; while elongata and heterophylla are placed in a third section.

In the material examined it has been found necessary to establish two new species, *P. rubra* and *P. minima*, which was done somewhat reluctantly.

It has been found impossible to follow, in all particulars, the nomenclature in the "List of Pteridophyta and Spermatophyta, Botanical Club, A. A. A. S." There seems to be no good reason why varieties *aristata* and *gnaphalioides* of *Patagonica*, and *longifolia* of *Virginica* should be raised to specific rank. Certainly if seed characters have any value in determining specific rank, the reason would seem positive why they should still be considered as varieties.

P. decipiens, on the other hand, is not to be included under *P. maritima*, being clearly separable from it, as indicated below.

The original description of *P. Tweedyi* was not secured. A single specimen was examined, and on account of its seed characters was placed in section 1. Judgment as to exact relationship must be suspended until more specimens and the original description can be obtained.

No specimens of *P. sparsiflora* were examined, but from the description given in "Chapman's Flora of the Southern States," it probably belongs in section 2.

All specimens of *P. major*, var. *Asiatica*, were referred to either *P. major* or *P. Rugelii*.

P. media is mentioned in the "List of Pteridophyta and Spermatophyta of the United States," but is not described in "Gray's Manual," "Coulter's Rocky Mountain Botany" or "Chapman's Flora of the Southern States." The specimens examined were from Europe, and are not, therefore, included in this work.

ANALYSIS OF THE SPECIES OF PLANTAGO.

§1. Flowers perfect; stamens, 4; corolla not closed over fruit; seeds oval in cross section.

* Leaves broadly ovate, strongly veined.

† Leaves and scape glabrous, or slightly hairy; seeds light brown.

P. cordata.

†† Leaves and scape glabrous, or slightly hairy; seeds angled, black.

‡ Capsule ovoid, circumscissile at the middle, 8-18 seeded; seeds

$\frac{3}{4}$ mm. x $\frac{3}{8}$ mm.

P. major.

‡‡ Capsule conical, circumscissile below the middle, 4-9 seeded; seeds

$1\frac{5}{8}$ mm. x $\frac{3}{4}$ mm.

P. Rugelii.

- ** Leaves lanceolate to linear, not strongly veined, thick and rough.
 † Leaves smooth; scape smooth or slightly hairy. P. eriopoda.
 †† Leaves and scape slightly pubescent.
 ‡ Capsule circumscissile at the middle, seeds black; hilum not at
 centre of seed. P. decipiens.
 ‡‡ Capsule circumscissile below the middle; seeds dark brown; hilum
 at centre of seed. P. maritima.
- *** Leaves lanceolate, smooth; capsule circumscissile below the middle; seed
 light brown. P. Tweedyi.
22. Flowers various; stamens, 4; seeds more or less anther shape in cross section.
 * Corolla not closed over fruit; leaves lanceolate to linear.
 † Leaves lanceolate; scape grooved, slightly hairy; seeds yellow, surface
 smooth. P. lanceolata.
 †† Leaves linear; scape not grooved, densely hairy.
 ‡ Capsule twice as long as calyx; seeds yellow, surface smooth.
 P. minima.
 ‡‡ Capsule slightly longer than calyx; seeds dark brown, surface
 pitted. P. Patagonica.
- ** Corolla closed over fruit; leaves ovate to lanceolate.
 † Capsule oblong, circumscissile below the middle; seeds black.
 P. hirtella.
 †† Capsule ovoid, circumscissile at the middle; seeds yellow.
 P. Virginica.
 ††† Capsule oblong, circumscissile below the middle; seeds dark red.
 P. rubra.
23. Flowers polygamo-dioecious; stamens, 2; corolla closed over fruit; seeds
 irregularly lobed in cross section.
 * Leaves linear to filiform, smooth or minutely pubescent, scape very slender.
 † Capsule ovoid, circumscissile at the middle; 4 seeded; seeds $1\frac{5}{8}$ mm.
 x $\frac{1}{2}$ mm., P. elongata.
 †† Capsule conical, circumscissile below the middle; 10-28 seeded; seeds
 $\frac{5}{8}$ mm. x $\frac{1}{4}$ mm., P. heterophylla.
 ††† Capsule conical, circumscissile below the middle, 5 or 6 seeded; seed,
 $1\frac{1}{4}$ mm. x $\frac{1}{2}$ mm., - P. Bigelovii.

ANALYSIS OF THE SPECIES OF PLANTAGO, ACCORDING TO SEED CHARACTERS.

21. Seeds oval in cross section.
- † Black, surface glossy.
 - ‡ Size, $\frac{3}{4}$ mm. x $\frac{3}{8}$ mm., P. major.
 - ‡‡ Size, $1\frac{5}{8}$ mm. x $\frac{3}{4}$ mm., P. Rugelii.
 - †† Black, surface dull.
 - ‡ Hilum at centre of seed, P. eriopoda.
 - ‡‡ Hilum not at centre of seed, P. decipiens.
 - ††† Light-brown, surface dull.
 - ‡ Size, 6 mm. x 3 mm., P. cordata.
 - ‡‡ Size, $1\frac{1}{2}$ mm. x $\frac{5}{8}$ mm., P. Tweedyi.
 - †††† Dark-brown, surface dull, P. maritima.
22. Seeds more or less anther shape in cross section.
- † Yellow, surface smooth.
 - ‡ Size, $2\frac{1}{4}$ mm. x $\frac{3}{4}$ mm., P. minima.
 - ‡‡ Size, 5 mm. x $1\frac{3}{8}$ mm., P. lanceolata.
 - †† Yellow, surface striated; size, $1\frac{1}{4}$ mm. x $\frac{5}{8}$ mm., P. Virginica.
 - ††† Dark brown, P. Patagonica.
 - †††† Black, P. hirtella.
 - ††††† Red, P. rubra.
23. Seeds irregular in cross section.
- † Longitudinal section deeply lobed.
 - ‡ Size, $1\frac{5}{8}$ mm. x $\frac{1}{2}$ mm., P. elongata.
 - ‡‡ Size, $\frac{5}{8}$ mm. x $\frac{1}{4}$ mm., P. heterophylla.
 - †† Longitudinal section regular in outline, P. Bigelovii.

PLANTAGO, TOURN. PLANTAIN.

Calyx of four imbricated persistent sepals, mostly with dry membranaceous margins. Corolla salver form or rotate, withering on the pod, the border four-parted, or rarely two, in all or some flowers with long and weak exerted filaments, and fugacious two-celled anthers. Ovary two (or in No. 8, falsely, three-four) celled, with one-several ovules in each cell. Style and long hairy stigma single, filiform. Capsule two-celled, two-several seeded, opening transversely, so that the top falls off like a lid and the loose partition (which bears the peltate seeds) falls away. Embryo straight, in fleshy albumen. Leaves ribbed. Flowers whitish, small, in a bracted spike or head, raised on a naked scape.

§1. Flowers perfect; stamens four; corolla not closed over fruit; seeds oval in cross section.

* Leaves broadly ovate, strongly veined; petioles long, flat and channelled.

† Leaves and scape glabrous; seeds light brown.

1. *P. cordata* Lam.—150 mm. to 300 mm. high; leaves round ovate, glabrous, seven or nine veined, more or less cordate at the base, margins entire or slightly toothed; petioles smooth, long, flat, channelled; spike long, cylindrical, loosely flowered, lower ones scattered with round, ovate bracts; scape smooth, 150 mm. to 450 mm. long; corolla longer than the calyx (Plate I); capsule twice as long as the calyx, two-celled, from two to four-seeded; ripe seeds light brown, surface dull, minutely striate longitudinally, cross section oval (Plate A, Fig. 1); longitudinal section oval (Plate D, Fig. 1); size 6 mm. x 3 mm.; hilum at center of seed.

Found in low ground and along streams from New York to Missouri and southward.

Specimens examined: Chicago, Illinois (Brendol, National Herbarium); Allenton, Missouri (G. W. Letterman, 1882, National Herbarium); Winnetka, Illinois (Aiton Collection, May 10, 1891, Herbarium of the University of Minnesota); Alma, Michigan (C. A. Davis, May 29, 1893, Herbarium of the University of Minnesota); Alexandria, Virginia (Prof. Comstock, 1881, National Herbarium); Tippecanoe County, Indiana (Hussey, Herbarium of Purdue University); Hubbardston, Michigan (C. F. Wheeler, May, 1876, Herbarium of J. M. Coulter).

†† Leaves and scape glabrous or slightly hairy; seeds black.

2. *P. major* L.—75 mm. to 350 mm. high; leaves broadly ovate or oblong, smooth or slightly hairy, five or seven nerved, margins entire or slightly toothed, abruptly narrowed into a flat, channelled petiole; spike $47\frac{1}{2}$ mm. to 200 mm. long, cylindrical, obtuse at apex, densely flowered; bracts ovate; scape 125 mm. to 400 mm. long, smooth or sparingly hairy, round; sepals round, ovate, obtuse, not carinate (Plate 2); capsule short, ovoid, slightly longer than the calyx, circumscissile at the middle, eight-18-seeded; ripe seeds black, angled, surface glossy, minutely granular, granules irregularly arranged, cross section oval (Plate A, Fig. 2); longitudinal section oval (Plate D, Fig. 2); size $\frac{3}{4}$ mm. x $\frac{3}{8}$ mm.; hilum at center of seed.

An exceptional form of *P. major* found at St. Paul, Minnesota (Herbarium of the University of Minnesota), has a leafy spike. Just below each seed is a leaf. These leaves are of considerable size at the base of the spike, but become gradually smaller toward the apex.

Grows in moist places from Delaware to California and northward.

Specimens examined: Vegas Valley, Nevada (Coville and Funston, 1891, 390, alt. 1,065 meters, National Herbarium); Sleepy Eye, Minnesota (E. P. Sheldon, July, 1891, Herbarium of the University of Minnesota); California (C. R. Orcutt, June, 1889, National Herbarium); Shore of Lake Superior, Minnesota (F. F. Wood, 1891, Herbarium of the University of Minnesota); Ogden, Utah (G. W. Letterman, July 29, 1885, National Herbarium); Nicolle's Northwestern Expedition (C. A. Geyer, July 24, 1839, National Herbarium); Minnesota (F. F. Wood, 1891, National Herbarium); Centreville, Delaware (Commons, August 3, 1878, National Herbarium); Mishawaka, Indiana (E. B. Uline, July, 1891, Herbarium of J. M. Coulter); Elliston, Montana (F. D. Kelsey, Herbarium of J. M. Coulter); Georgetown, Colorado (H. N. Patterson, July 11, 1885, Herbarium of J. M. Coulter); Oregon (*P. major*, var. *Asiatica*, T. J. Howell, May, 1880, National Herbarium).

3. *P. Rugelii* Decaisne:—125 mm. to 300 mm. high; leaves broadly ovate or oblong, smooth or sparingly hairy, five or seven nerved, margin entire or toothed; petioles flat, channelled; spike, 75 mm. to 250 mm. long, cylindrical, loosely flowered, acute at apex; bracts acute; scape, 125 mm. to 450 mm. long, smooth or sparingly hairy; sepals oblong, acute, carinate (Plate 3); capsule conical, twice as long as calyx, circumscissile below the middle, 4-9 seeded: ripe seeds black, angled, surface glossy, minutely granular, granules irregularly arranged. cross section oval (Plate A, Fig. 3); longitudinal section oval (Plate D, Fig. 3); size $1\frac{3}{8}$ mm. x $\frac{3}{4}$ mm.; hilum at center of seed.

Grows in moist soil from Vermont to Minnesota and south to Texas and Georgia.

Specimens examined: Peoria, Illinois (McDonald, Aug. 4, 1893, Herbarium of the University of Minnesota); Allenton, Missouri (G. W. Letterman, 1882, National Herbarium); Camden, New Jersey (I. C. Martindale, 1878, National Herbarium); Harrisburg, Pennsylvania (Sandberg Collection, Aug. 14, 1888, Herbarium of the University of Minnesota); Michigan (C. F. Wheeler, July 23, 1890, National Herbarium); Minneapolis, Minnesota (C. L. H., June 20, 1876, Herbarium of the University of Minnesota); Blue Earth Co., Minnesota (Sandberg Collection, Herbarium of the University of Minnesota); Jordan, Scott Co., Minnesota (C. A. Ballard, June, 1891, Herbarium of the University of Minnesota); Cannon Falls, Minnesota (*P. major*, J. H. Sandberg, Aug., 1881, Herbarium of the University of Minnesota); Charlotte, Vermont (C. G. Pringle, Sept. 8, 1878, National Herbarium); Belle Isle, Detroit, Michigan (O. A. Farwell, July 3, 1893, Herbarium of the University of Minnesota); Centreville, Delaware (Commons, Sept. 23, 1878, National Herbarium); Indian Territory (Dr. Palmer, 1868,

National Herbarium); Glencoe, Minnesota (P. major, T. J. M., Aug. 1, 1890, Herbarium of the University of Minnesota); Cambridge, Massachusetts (Kellerman, July 5, 1878, Herbarium of J. M. Coulter).

Between *P. major* and *P. Rugelii* are found a number of intermediate forms which are difficult to classify except in fruiting stage.

** Leaves lanceolate to linear, not strongly veined, thick and rough.

† Leaves smooth, scape smooth or slightly hairy.

4. *P. eriopoda* Torr.—50 mm. to 150 mm. high; usually having a mass of yellowish wool at the base; leaves ovate to lanceolate, thick, rough, three to seven nerved, obtusely or acutely pointed, tapering gradually into a short, margined petiole, margins entire; spike 25 mm. to 125 mm. long, cylindrical, densely or loosely flowered; scape 100 mm. to 300 mm. long, smooth or hairy; sepals ovate, scarious (Plate 4); capsule ovoid, slightly exceeding the calyx, circumscissile below the middle, from 2-4 seeded; ripe seeds black, surface dull, striated longitudinally; cross section oval (Plate A., Fig. 4); longitudinal section oval (Plate D.; Fig. 4); size, $2\frac{1}{4}$ mm. x 1 mm.; hilum at center of seed.

An exceptional form found at Evaston, Utah (G. W. Letterman, National Herbarium), is 200 mm. high; has thin leaves; scape 425 mm. long; spike 150 mm. long; petioles nearly as long as the leaves.

Moist and saline soil, from Minnesota to California and the lower St. Lawrence.

Specimens examined: Rimouski County, P. Q. (J. A. Allen, August 5, 1881, National Herbarium); Kearney County, Nebraska (P. A. Rydberg, June 25, 1891, 304 National Herbarium); Nicollet's Northwestern Expedition (C. A. Geyer, July 16, 1839, 276, National Herbarium); Montana (L. F. Ward, 1883, National Herbarium); Han's Fork, Wyoming (L. F. Ward, 1881, National Herbarium); Gottenburgh, Nebraska (Sandberg Collection, June 19, 1889, Herbarium of the University of Minnesota); Oak Wood Lakes, Dakota (Sandberg Collection, June 4, 1892, Herbarium of the University of Minnesota); Brookings, South Dakota (E. N. Wilcox, May 19, 1891, National Herbarium); Western Dakota (Sandberg Collection, Herbarium of the University of Minnesota); Ruby Valley, Nevada (S. Watson, August, 1868, 740, alt. 6,000 ft., National Herbarium); Hayden's Gulch, Granite, Colorado (*P. Patagonica*, var. *nuda*, Mrs. S. B. Walker, 1890, 544, National Herbarium); Ft. Bridger, Wyoming (Porter, July, 1893, National Herbarium).

†† Leaves and scape slightly pubescent.

5. *P. decipiens* Barneoud.—50 mm. to 200 mm. high; leaves linear, channelled, acuminate, erect, three or five veined, margins entire; spike slender,

loosely flowered, 25 mm. to 100 mm. long; scape slightly or densely hairy, 100 mm. to 275 mm. long; calyx obtuse; scarious (Plate 5); capsule ovoid, obtuse, twice as long as calyx, circumscissile at the middle, 2-4 seeded; ripe seeds black, surface dull, minutely granular, cross section oval (Plate A, Fig. 5); longitudinal section oval (Plate D, Fig. 5); size, $1\frac{1}{2}$ mm. x $2\frac{3}{8}$ mm.; hilum not at center of seed.

This species can be distinguished from *P. maritima* by the shape and surface of the calyx, the shape, length and dehiscence of capsule, color of seeds and the position of the hilum.

Salt marshes along the Atlantic coast from Labrador to New Jersey.

Specimens examined: Nahant, Massachusetts (J. A. Manning, July 29, 1886, Herbarium of the University of Minnesota); New Foundland (H. L. Osborn, July 23, 1879, National Herbarium); Newport, Rhode Island (W. W. Bailey, 1878, Herbarium of Purdue University); Cambridge, Massachusetts (Walter Deane, Oct. 5, 1890, National Herbarium); New Haven, Connecticut (A. H. Young, Sept., 1874, Herbarium of Purdue University).

6. *P. maritima* L.—50 mm. to 225 mm. high; leaves linear, acuminate, channelled, nearly as long as the scape, three or five nerved, margins entire; spike loosely to densely flowered, 25 mm. to 75 mm. long; scape round, slightly hairy, 50 mm. to 325 mm. long; calyx acute, carinate (Plate 6), capsule acute, slightly longer than the calyx, circumscissile below the middle, two seeded; ripe seeds dark brown, surface dull, minutely granular, cross section oval (Plate A, Fig. 6); longitudinal section oval (Plate D, Fig. 6); size, $2\frac{1}{4}$ mm. x $1\frac{1}{2}$ mm.; hilum at center of seed.

Grows in salt marshes along the Atlantic and Pacific coasts, the Gulf of St. Lawrence to Labrador and Greenland.

Specimens examined: San Francisco, California (G. R. Vasey, 1880, 513, National Herbarium); Little Metis, P. Q. (J. A. Allen, July, 2, 1881, National Herbarium); Pigeon Cove, Massachusetts (Aiton Collection, Herbarium of the University of Minnesota); Portland, Oregon (Drake and Dickson, July, 1882, Herbarium of J. M. Coulter); Charlotte, Vermont (Herbarium of J. M. Coulter).

7. *P. Tweedyi* Gray.—The original description of this species has not been secured. A single specimen, so referred, from Pelican Creek, in the National Herbarium, has been examined. According to its seed characters it belongs in the first section. The other characters of the plant are as follows: 125 mm. high; leaves lanceolate, smooth, five-nerved, margins entire; spike 50 mm. long; scape smooth below, slightly hairy above, cylindrical, 175 mm. long; sepals obtuse, scarious, with a thick centre; capsule oblong, twice as long as calyx, circumscissile below the middle, four-seeded; ripe seeds light brown, surface dull, striated

longitudinally, cross section oval (Plate A, Fig. 7); longitudinal section oval (Plate D, Fig. 7); size, $1\frac{1}{2}$ mm. x $\frac{5}{8}$ mm.; hilum at centre of seed.

‡2. Flowers various; stamens 4; seeds more or less anther shape in cross section.

*Corolla not closed over fruit; leaves lanceolate to linear.

†Leaves lanceolate, acute; scape grooved, angled, slightly hairy; seeds yellow, with smooth surface.

8. *P. lanceolata* L.—50 mm. to 275 mm. high; leaves lanceolate, acute, tapering gradually into margined petioles, five or seven-nerved, margins entire or slightly denticulate, sparingly to densely hairy; spike densely flowered, capitate at first, in age cylindrical, $12\frac{1}{2}$ mm. to $62\frac{1}{2}$ mm. long; scape grooved, slightly hairy, 225 mm. to 600 mm. long; sepals acuminate, scarious (Plate 7); capsule short, ovoid, circumscissile below the middle, two-seeded, ripe seeds light yellow, having a longitudinal line through the centre lighter than the margins, surface smooth, cross section anther shape (Plate B, Fig. 1); longitudinal section oval (Plate E, Fig. 1); size, 5 mm. x $1\frac{1}{3}$ mm.; hilum at centre of seed.

Dry fields, waste places and along the shores of lakes. (Introduced.)

Specimens examined: Providence, Rhode Island (J. F. Collins, July 15, 1892, National Herbarium); Kootinai County, Idaho (Aiton Collection, September, 1887, Herbarium of the University of Minnesota); North Carolina (G. R. Vasey, 1878, National Herbarium); Virginia (C. Wright, 1853, National Herbarium); Central California (Dr. Palmer, 1876, National Herbarium); Jefferson County, Indiana (C. R. Barnes, May 20, 1876, Herbarium of Purdue University); Pittsford, Vermont (H. L. Osborn, July 2, 1880, Herbarium of Purdue University); Mishawaka, Indiana (E. B. Uline, July, 1891, Herbarium of J. M. Coulter); Arizona (Palmer, 1876, 308, Herbarium of J. M. Coulter); Charlotte, Vermont (June 10, 1879, Herbarium of J. M. Coulter); Hope, Idaho (Sandberg, July, 1887, 113, Herbarium of J. M. Coulter).

†† Leaves linear, acute or obtuse; scape cylindrical, not grooved, densely hairy; seeds dark brown, surface minutely pitted.

9. *P. Patagonica* Jacq.—75 mm. to 225 mm. high; leaves glabrate or silky lanate, linear, acutely or obtusely pointed, three or five nerved, margins entire; spike 25 mm. to 75 mm. long; densely flowered; scape cylindrical, densely hairy, 100 mm. to 300 mm. long; sepals very obtuse, villous; corolla with broad cordate or ovate lobes (Plate 8); capsule short, ovoid, circumscissile at the middle, slightly longer than the calyx, 2-seeded; ripe seeds dark brown, surface dull, covered with minute pits arranged in longitudinal lines; seeds have a transverse line on the

surface near the center; cross section anther shape (Plate B, Fig. 2); longitudinal section oval (Plate E, Fig. 2); size, $5\frac{1}{2}$ mm. x $2\frac{3}{4}$ mm.; hilum at center of seed.

Dry ground, from the Mississippi River westward.

Specimens examined: Brazos, Texas (G. C. Nealley, 1889, National Herbarium); San Bernardino County, California (S. B. Parish, April, 1890, Herbarium of J. M. Coulter); Prescott, Arizona (Dr. Palmer, 1869, National Herbarium); San Diego, California (C. R. Orcutt, April 22, 1882, Herbarium of J. M. Coulter); San Quentin Bay, California (Palmer, January, 1889, Herbarium of J. M. Coulter); Austin, Texas (P. Patagonica, var. nuda, Elihu Hall, May 12, 1872, 397, National Herbarium); St. George, Utah (M. E. Jones, April 2, 1880, Herbarium of J. M. Coulter); Portland, Oregon (Drake and Dickson, May, 1889, Herbarium of J. M. Coulter); Uintah, Utah (M. E. Jones, July 2, 1880, alt. 5,000 ft., Herbarium of J. M. Coulter); Los Angeles, California (P. Bigelovii, H. E. Hasse, April, 1888, National Herbarium); Oregon (P. Bigelovii, Mrs. Nevins, National Herbarium.)

Var. *gnaphalioides* Gray.—75 mm. to 125 mm. high; leaves canescently villos, wool often floccose and deciduous, linear to lanceolate, acutely pointed, margin entire; spike $12\frac{1}{2}$ mm. to $112\frac{1}{2}$ mm. long, densely flowered, varying to capitate and few flowered; bracts oblong to linear, acute, not exceeding the calyx; scape 50 mm. to 225 mm. long, densely woolly; sepals obtuse, villous; capsule slightly longer than the calyx, 2 seeded; size of seeds, 4 mm. x 2 mm.; other seed characters same as species (Plate 9).

Dry, sandy soil, from Minnesota westward and south to Texas.

Specimens examined: Courtland, Minnesota (C. A. Ballard, July, 1892, National Herbarium); Klickitat County, Washington (W. N. Suksdorf, May 16, 1885, National Herbarium); Minnesota (E. P. Sheldon, August, 1891, Herbarium of the University of Minnesota); Oregon (Elihu Hall, 1871, 362, National Herbarium); San Diego, Texas (M. B. Croft, 1884, 112, National Herbarium); Minnesota (Aiton Collection, May 11, 1888, Herbarium of the University of Minnesota); Lincoln, Nebraska (T. A. Williams, June 1, 1890, National Herbarium); Blue Earth County, Minnesota (P. Patagonica, Sandberg Collection, Herbarium of the University of Minnesota); Kearney, Nebraska (J. H. Holmes, August, 1889, National Herbarium); Mexican Boundary Survey (706, National Herbarium); Washington (Dr. Cooper, National Herbarium); Utah Valley, Utah (S. Watson, July, 1869, alt. 4,500 feet, 750, National Herbarium); Eastern Texas (Elihu Hall, April 20, 1872, 396, National Herbarium); Ponca Agency, Oklahoma (Bailey, August 5, 1892, National Herbarium); El Paso, Texas (M. E. Jones, April 16, 1884, Herbarium of J. M. Coulter); Hastings, Nebraska (June

23, 1888, Herbarium of J. M. Coulter); Indian Territory (G. D. Butler, June 2, 1877, Herbarium of J. M. Coulter); Redfield, Dakota (E. Butler, Herbarium of J. M. Coulter).

Var. *spinulosa*, Gray.—75 mm. to 125 mm. high; leaves linear, very acutely pointed, three or five nerved, nearly as long as the scape, margins entire, white, with long, soft hairs; spike loosely flowered, 25 mm. to 100 mm. long; bracts slightly exceeding the calyx, obtuse, densely hairy; scape covered with soft, white hairs, 100 mm. to 275 mm. long; sepals obtuse, scarious, with a thick centre, densely hairy; slightly longer than calyx, 2 seeded; size of seeds $3\frac{3}{4}$ mm. x 2 mm.; other seed characters same as species. (Plate 10.)

Found on dry prairies from the Mississippi River westward.

Specimens examined: Blue Earth County, Minnesota (P. Patagonica, John Leiberg, 1883, Herbarium of the University of Minnesota), Zanesville, Minnesota (P. Patagonica, var. *gnaphalioides*, B. C. Taylor, June, 1891, 177, Herbarium of the University of Minnesota); Crete, Nebraska (P. Patagonica, var. *gnaphalioides*, Herbarium of the University of Minnesota); St. James, Nebraska (P. Patagonica, var. *gnaphalioides*, Fred Clements, 1893, 2615, National Herbarium); Jordan, Minnesota (P. Patagonica, var. *gnaphalioides*, C. A. Ballard, June, 1891, 241, Herbarium of the University of Minnesota); Wilson Creek, Washington (Sandberg Collection, June, 1893, Herbarium of the University of Minnesota); North Dakota (P. Patagonica, G. A. Holzinger, 1891, National Herbarium); New Mexico (P. Patagonica, var. *gnaphalioides*, Sandberg Collection, April, 1880, Herbarium of the University of Minnesota); Kansas (P. Patagonica, var. *gnaphalioides*, B. B. Smyth, August 19, 1890, 161, National Herbarium); Kansas (P. Patagonica, var. *gnaphalioides*, Sandberg Collection, July, 1887, Herbarium of the University of Minnesota); Minneapolis, Minnesota (P. Patagonica, var. *gnaphalioides*, Sandberg Collection, June, 1892, Herbarium of the University of Minnesota); Pueblo, Colorado (Aiton Collection, June, 1890, 188, Herbarium of the University of Minnesota); Dublin, Texas (C. F. Maxwell, 1893, Herbarium of J. M. Coulter).

Var. *aristata*, Gray.—100 mm. to 225 mm. high; leaves linear, glabrous to densely hairy, three or five-veined, margins entire; spike cylindrical, loosely or densely flowered, 25 mm. to 125 mm. long; bracts linear, acute, several times longer than the calyx; scape slightly to densely hairy, 125 mm. to 300 mm. long; sepals obtuse, scarious with a thick centre; capsule slightly longer than calyx, 2 seeded; size of seeds, 5 mm. x $2\frac{1}{4}$ mm., other seed characters same as species. (Plate II.)

Grows on prairies and in dry soil from the Atlantic coast to California.

Specimens examined: Stone Mountain, Georgia (G. McCarthy, 1888, National Herbarium); San Diego County, California (C. R. Orcut, April, 1870, National Herbarium); Dunson County, Montana (John Lieberg, 1883, Herbarium of the University of Minnesota); Scottville, Texas (L. C. Johnson, May 14, 1886, National Herbarium); Ellis, Kansas (Sandberg Collection, June 17, 1888, Herbarium of the University of Minnesota), Providence, Rhode Island (J. F. Collins, July 8, 1892, National Herbarium); Knoxville, Tennessee (Aiton Collection, July, Herbarium of the University of Minnesota); Cranston, Rhode Island (J. F. C., July 7, 1892, National Herbarium); Fayetteville, Arkansas (F. L. Harvey, Herbarium of the University of Minnesota); Colbert's Station, Indian Territory (C. S. Sheldon, June 20, 1891, National Herbarium); Suffolk, Virginia (P. aristata, A. A. Heller, June, 1893, National Herbarium); Indian Territory (Dr. Palmer, 1868, 251, National Herbarium); DeKalb County, Georgia (P. aristata, J. K. Small, July 28, 1893, altitude 1,100 feet, National Herbarium); Converse, Missouri (C. R. B., July, 1877, Herbarium of Purdue University); Vigo County, Indiana (W. S. B., June 10, 1888, Herbarium of DePauw University); Northwest Arkansas (Harvey, 1881, National Herbarium); Nicollet's Northwestern Expedition (P. aristata, C. A. Geyer, June 6, 1839, 275, National Herbarium); New Mexico (E. A. Merus, April 20, 1892, 126, National Herbarium); Eastern Texas (Elihu Hall, April 20, 1872, 399, National Herbarium); Dakota (Sandberg Collection, Herbarium of the University of Minnesota); Texas (P. Patagonica, var. spinulosa, Steele, July, 1881, National Herbarium); Oklahoma (M. A. Carleton, July, 1891, 182, National Herbarium); Wilmington, North Carolina (F. V. Coville, June 28, 1890, 191, National Herbarium), Suffolk, Virginia (A. A. Heller, June 8, 1893, Herbarium of J. M. Coulter); Camp Lowell, Arizona (C. G. Pringle, April 9, 1881, Herbarium of J. M. Coulter); Hockley, Texas (W. F. Thurrow, 1890, Herbarium of J. M. Coulter); Indian Territory (G. D. Butler, June 14, 1877, Herbarium of J. M. Coulter); Converse, Missouri (C. R. B., July 14, 1877, Herbarium of J. M. Coulter).

Var. *nuda* Gray.—leaves linear, margins entire, scape slender, slightly hairy; sepals obtuse, scarious, with a thick center, hairy; bracts very short, acute.

Specimens examined: California (M. E. Jones, March 27, 1882, National Herbarium).

Var. *lanatifolia* C. and F.—112½ mm. to 137½ mm. high; leaves linear, acute or obtuse, very densely woolly, five or seven veined, margins entire; spike 25 mm. to 75 mm. long, cylindrical, densely flowered; scape 100 mm. to 225 mm. long, densely hairy; sepals obtuse, scarious, with a thick center, woolly;

capsule ovoid, obtuse, circumscissile at the middle, two seeded; seed characters the same as the species (Plate 12).

Specimens examined: Industry, Texas (W. H. Wurtzelow, 1891, Herbarium of J. M. Coulter).

10. *P. minima*, *Nor. Sp.*—25 mm. to 50 mm. high; leaves linear, acute, white, with long, soft hairs, margins entire; scape round, very slender, densely hairy, 25 mm. to 125 mm. long; spike capitate, loosely flowered, $6\frac{1}{4}$ mm. to $18\frac{3}{4}$ mm. long; sepals obtuse, scarious, with a thick center; capsules ovoid, twice as long as calyx, 2 seeded; seeds light yellow, surface smooth and glossy, cross section anther shaped, longitudinal section oval; size, $2\frac{1}{4}$ mm. \times $\frac{3}{4}$ mm.; hilum at center of seed (Plate 13).

Separated from *P. Patagonica*, var. *gnaphalioides*, to which it is closely allied by size of plant, surface of sepals, size of capsule, color, size and surface of seed.

Dry soil in western United States.

Specimens examined: Lincoln, Nevada (*P. Patagonica*, var. *gnaphalioides*, Bailey, May 6, 1891, 1912 National Herbarium); Arizona (*P. Patagonica*, var. *gnaphalioides*, Dr. Palmer, 1869, National Herbarium); Panamint Valley, California (*P. Patagonica*, var. *gnaphalioides*, Coville and Funston, April 17, 1891, 678, alt. 400 meters, National Herbarium); California (*P. Patagonica*, var. *gnaphalioides*, C. and F., April 17, 1891, alt. 400 meters, Herbarium of J. M. Coulter).

* Corolla closed over fruit; leaves ovate to lanceolate.

† Scape grooved; capsule oblong, circumscissile below the middle; seeds black.

11. *P. hirtella* H. B. K.—75 mm. to 500 mm. high; leaves oblong to lanceolate, smooth or slightly hairy, five or seven nerved, margins entire or slightly denticulate; spike cylindrical, very densely flowered, lower ones often scattered, 75 mm. to 300 mm. long; scape round, slightly hairy, 150 mm. to 875 mm. long; sepals obtuse, scarious (Plate 14); capsule oblong, slightly longer than the calyx, circumscissile below the middle, three seeded; ripe seeds black, surface dull, minutely striate longitudinally, cross section slightly anther shape (Plate B, Fig. 3); longitudinal section oval (Plate E, Fig. 3); size, $1\frac{1}{2}$ mm. \times $\frac{7}{8}$ mm.; hilum at center of seed.

Dry ground in western United States.

Specimens examined: Mendocino, California (C. S. Pringle, Aug. 3, 1882, National Herbarium); Los Angeles, California (Dr. H. E. Hasse, June 5, 1888, National Herbarium); Central California (Dr. E. Palmer, 1876, 306, National Herbarium); Sweet Water, California (May 7, 1884, Herbarium of J. M. Coulter); Mendocino, California (C. S. Pringle, Aug. 3, 1882, Herbarium of J. M. Coulter).

†† Scape grooved; capsule ovoid, circumscissile at the middle; seeds yellow.

12. *P. Virginica* L.—25 mm. to 125 mm. high; leaves ovate to oblong, obtuse, tapering gradually into margined petioles, sparingly to densely hairy, three or five nerved, margins entire or slightly denticulate; spike cylindrical, densely flowered above, often loosely flowered below, 25 mm. to 175 mm. long; scape grooved, densely hairy, 50 mm. to 350 mm. long; sepals obtuse, scarious with a thick center, hairy (Plate 15); capsule short, ovoid, not exceeding the calyx, two-seeded; ripe seeds golden yellow, surface striated longitudinally, cross section anther shape (Plate B, Fig. 4); longitudinal section oval (Plate E, Fig. 4); size $1\frac{1}{2}$ mm. \times $\frac{3}{4}$ mm.; hilum at center of seed.

Low, sandy ground from Pennsylvania to Arizona.

Specimens examined: Cincinnati, Ohio (Sandberg collection, June 17, 1883, Herbarium of the University of Minnesota); District of Columbia (W. J. Canby, 1881, National Herbarium); Smithville, Pennsylvania (A. A. Heller, May 30, 1893, 900, National Herbarium); Baumgardner, Pennsylvania (Aiton Collection, May 24, 1890, Herbarium of the University of Minnesota); Tucson, Arizona (Dr. Smart, 1867, National Herbarium); Vinita, Indian Territory (M. A. Carleton, April 17, 1891, 21, National Herbarium); Wichita, Kansas (Sept. 30, 1889, Herbarium of J. M. Coulter); Hockley, Texas (W. F. Thurrow, 1890, Herbarium of J. M. Coulter); Guthrie, Oklahoma (M. A. Carleton, May 28, 1891, 168, National Herbarium), Gillespie County, Texas (G. Jerney, Herbarium of J. M. Coulter); Fayette County, Texas (H. Wurzlow, 1891, Herbarium of J. M. Coulter); Duval County, Florida (A. H. Curtiss, National Herbarium); Lancaster, Pennsylvania (A. A. Heller, June 2, 1893, National Herbarium); Arizona (C. G. Pringle, April, 1881, Herbarium of J. M. Coulter); Hibernia, Florida (W. M. Canby, March, 1869, National Herbarium); Charleston, Indiana (C. R. B., May 14, 1877, Herbarium of Purdue University); Lancaster, Pennsylvania (A. A. Heller, May 30, 1893, Herbarium of J. M. Coulter).

Var. *longifolia*, Gray.—Leaves oblong, spatulate, $62\frac{1}{2}$ mm. to 125 mm. long, tapering gradually into long petioles, margins slightly denticulate or strongly toothed; seed characters same as species (Plate 16).

Specimens examined: Little Rock, Arkansas (Dr. Hasse, May, 1886, National Herbarium); Brazos, Texas (G. C. Nealley, 1889, National Herbarium); Brazos, Texas (*P. Virginica*, G. C. Nealley, 1889, National Herbarium); Industry, Texas (H. Wurzlow, 1890, Herbarium of J. M. Coulter).

†††Scape not grooved; capsule oblong, circumscissile below the middle; seeds dark red.

13. *P. rubra*, *Noe. Sp.*—62½ mm. to 100 mm. high; leaves oblong, densely hairy, sometimes having a reddish color, three or five-nerved, obtuse, margins entire or strongly denticulate, petioles short, densely hairy; spike cylindrical, densely flowered, 12½ mm. to 125 mm. long; scape densely hairy, 25 mm. to 200 mm. long; sepals acute, scarious, with a thick centre (Plate 17); capsule oblong, obtuse, sometimes purple, longer than the calyx, circumscissile below the middle, two-seeded; ripe seeds dark red, surface dull, minutely striate longitudinally, cross section slightly anther shape (Plate B, Fig. 5); longitudinal section oval (Plate E, Fig. 5); size 5 mm. x 2½ mm.; hilum at centre of seed.

Separated from *P. Virginica* by the dense hairs, acute sepals, shape and dehiscence of capsule, color, cross section and size of seeds.

Sandy soil in western United States.

Specimens examined: Indian Territory (*P. Virginica*, Dr. Palmer, 1868, 253, National Herbarium); Southwestern Texas (*P. Virginica*, Dr. Palmer, September, 1879, 1108, National Herbarium); Mesas, Arizona (*P. Virginica*, var. *longifolia*, C. F. Pringle, May 3, 1884, National Herbarium); Mexican Boundary Survey (*P. Virginica*, W. H. Emory, 707, National Herbarium); Mesas, Texas (*P. Virginica*, var. *longifolia*, C. F. Pringle, May 3, 1884, Herbarium of J. M. Coulter).

14. *P. sparsiflora* Michx.—The description of this species, according to Chapman's Manual, is as follows: Leaves smooth, lanceolate, toothed or entire, narrowed into a long petiole; scape much longer than the leaves, pubescent below; spike 6' to 9' long, loosely flowered; bracts ovate; calyx lobes obtuse; capsule two-seeded.

Moist pine barrens, Georgia and South Carolina. June—September.

The following specimens so referred were examined: Patnam County, Indiana (D. T. McDougal, July 30, 1888, DePauw Herbarium); Union County, Illinois (G. H. French, July 27, 1878, National Herbarium); Wyandotte, Kansas (Elihu Hall, September, 1869, National Herbarium); Columbia, South Carolina (E. A. Smith, April 15, 1891, Herbarium of the University of Minnesota).

The first three of these should be referred to *P. Rugelii* and the fourth one to *P. Virginica*.

‡3. Flowers polygamo—dioecious; stamens, 2; corolla closed over fruit; seeds irregularly lobed in cross section.

* Leaves linear to filiform, smooth or minutely pubescent; scape very slender.

15. *P. elongata* Pursh. (*P. pusilla*, Nutt.).—25 mm. to 100 mm. high; leaves linear to filiform, smooth or minutely pubescent, margins entire; spike 12½ mm.

to 100 mm. long, loosely flowered; scape $31\frac{1}{4}$ mm. to 150 mm. long, slender, sparingly hairy; sepals obtuse, scarious with a thick center (Plate 18); capsule short, ovoid, obtuse, slightly longer than the calyx, circumscissile at the middle, 4 seeded; ripe seeds light brown, surface dull, deeply pitted, cross section irregularly and deeply lobed (Plate C, Fig. 1); longitudinal section irregularly lobed (Plate F., Fig. 1); size, $1\frac{2}{3}$ mm. x $\frac{1}{2}$ mm.; hilum at center of seed.

Dry, sandy soil, or damp places in western and southern United States.

Specimens examined: Shannon County, Missouri (B. F. Bush, April 13, 1889, National Herbarium); Nicollet's Northwestern Expedition (C. A. Geyer, June 20, 1839, 279, National Herbarium); Western Klickitat County, Washington (W. N. Suksdorf, April 26, 1883, National Herbarium); Lincoln, Nebraska (Aiton Collection, May, 1888, Herbarium of the University of Minnesota); Muskogee, Indian Territory (M. A. Carleton, April, 1891, 64, National Herbarium); Iodan Valley, Utah (Sereno Watson, June, 1869, 749, National Herbarium); Portland, Oregon (Drake and Dickson, April, 1887, Herbarium of J. M. Coulter); East Hampton, Long Island (E. S. Miller, June 2, 1877, Herbarium of J. M. Coulter); Oregon (T. Howell, April, 1885, National Herbarium); Georgia (T. C. Porter, 1847, National Herbarium); Dakota (Sandberg Collection, Herbarium of the University of Minnesota); Springfield, Missouri (J. W. Blankinship, 1888, National Herbarium); Montana (R. S. Williams, June 25, 1888, 301, Herbarium of the University of Minnesota); Arkansas (Sandberg Collection, April-May, 103, Herbarium of the University of Minnesota); Seattle, Washington (P. Bigelovii, E. C. Smith, June 21, 1890, National Herbarium); California (P. Bigelovii, M. E. Jones, March 28, 1882, National Herbarium).

16. *P. heterophylla* Nutt.—25 mm. to 100 mm. high; leaves linear to filiform, smooth or slightly pubescent, margins entire; spike $6\frac{1}{4}$ mm. to 50 mm. long, loosely flowered, lower ones often scattered; scape smooth or slightly pubescent, very slender, 25 mm. to 125 mm. long; sepals obtuse, scarious with a thick center (Plate 19); capsule conical, nearly twice as long as calyx, circumscissile below the middle, 10-28 seeded; ripe seeds light brown, surface dull, deeply pitted, cross section irregularly and deeply lobed (Plate C, Fig. 2); longitudinal section irregularly lobed (Plate F, Fig. 2); size $\frac{5}{8}$ mm. x $\frac{1}{4}$ mm.; hilum at center of seed.

Low or sandy ground in western and southern United States.

Specimens examined: Statesville, North Carolina (Sandberg Collection, Herbarium of the University of Minnesota); Eastern Texas (Elihu Hall, April 10, 1872, 395, National Herbarium); Wilmington, California (C. G. Pringle, March 31, 1882, National Herbarium); Aiken, South Carolina (W. M. Canby, May, 1869, National Herbarium); Wilmington, California (C. G. Pringle, March

31, 1882, Herbarium of the University of Minnesota); Aiken, South Carolina (W. M. Canby, May, 1869, Herbarium of J. M. Coulter); Florida (Chapman, National Herbarium); Hockley, Texas (W. F. Thurrow, 1890, Herbarium of J. M. Coulter); Wilmington, California (C. G. Pringle, March 31, 1882, Herbarium of J. M. Coulter).

17. *P. Bigelovii*, Gray.— $37\frac{1}{2}$ mm. to 75 mm. high; leaves linear to filiform, obtuse, smooth or minutely pubescent, entire or slightly denticulate; spike $6\frac{1}{2}$ mm. to $31\frac{1}{2}$ mm. long, loosely or densely flowered; scape slightly hairy, 50 mm. to 100 mm. long; sepals broadly oval, obtuse, scarious with a thick center; flowers twice as large as those of *P. pusilla*, stamens exerted but not as long as the style (Plate 20); capsule conical, slightly longer than the calyx, circumscissile below the middle, 5 or 6-seeded; seeds light brown, surface dull, minutely pitted, cross section slightly irregularly lobed (Plate C, Fig. 3); longitudinal section oval (Plate F, Fig. 3); size $1\frac{1}{2}$ mm. \times $\frac{1}{2}$ mm.; hilum at center of seed.

Moist and saline soil western United States.

Specimens examined: Vacaville, California (W. L. Jepson, May 31, 1891, National Herbarium); Vacaville, California (W. L. Jepson, May 31, 1891, Herbarium of the University of Minnesota); North Lower California (Sandberg Collection, March, 1886, Herbarium of the University of Minnesota).

