

THE GENUS *Pennellia* (CRUCIFERAE) IN NORTH AMERICA¹

REED C. ROLLINS

The genus *Pennellia* had its origin in the recognition by Robinson of section *Heterothrix* of *Thelypodium* in his treatment for the *Synoptical Flora of North America* (Robinson in Gray, 1895). Two species were included, *Thelypodium longifolium* (Benth.) S. Wats. and *T. micrantha* (Gray) S. Wats. Subsequently Rydberg (1907) raised section *Heterothrix* to generic rank. Nieuwland (1918) pointed out that *Heterothrix* had been used previously (Mueller, 1860) for a genus in the family Apocynaceae, and therefore *Heterothrix* of Rydberg is illegitimate. He proposed *Pennellia* as a replacement for *Heterothrix* and transferred *H. micrantha* to it. Thus *Pennellia micrantha* became the type species of *Pennellia*. However, Schulz (1924) used Rydberg's illegitimate *Heterothrix* when treating the group for *Das Pflanzenreich* and expanded it to include six species, three from North America and three from South America. In the course of his study, he became convinced that the species formerly known as *Heterothrix longifolia* should not be associated in the same genus with *H. micrantha* and described *Lamprophragma* as a monotypic genus to include it. Although no specific points were made by Schulz to justify splitting *Heterothrix longifolia* away from *H. micrantha*, it is clear from the protologue of *Lamprophragma* that he was much impressed with the slight zygomorphy present in the flower of *H. longifolia*. However, as distinctive as this feature is in *Pennellia longifolia*, it breaks down completely in *P. hunnewellii* where there is little or no zygomorphy shown by the flowers; yet this species is so close to what is here called *P. longifolia* that the collections of it have been included there up to the present. Schulz (1936) later recognized *Pennellia*.

The first two species of *Pennellia* described, *P. longifolia* and *P. micrantha*, were placed in *Streptanthus* (Benthams, 1839; Gray, 1849) but most subsequent authors have agreed that they do not belong in that genus. In fact, *Pennellia* is not closely related to *Streptanthus*. An early different disposition of these species was that of Watson (1871, 1882) who referred them to *Thelypodium*. However, Al-Shehbaz (1973) has concluded that species presently included in *Pennellia* do not belong to *Thelypodium*.

As *Pennellia* is now known from North America, including Mexico and Central America, it consists of eight species. We have deliberately not attempted to treat the species of South America because there is so little material available for study. Even with the North American species, one (*P. juncea*) is known from only one collection, a second

¹Research supported by National Science Foundation Grant DEB 78-08766.

(*P. mcvaughii*) is known from but two collections, and a third species (*P. robinsonii*) from only three collections. The genus is primarily Mexican with only two species occurring northward into southwestern United States. These are the two most widespread and best known species, *P. longifolia* and *P. micrantha*.

One of the distinctive features of *Pennellia* is the very small flower. In most species, just prior to full anthesis, the flower is cup-like in appearance with the petals only slightly exceeding the sepals. In some, the flower is almost closed. But as flower growth continues, both sepals and petals not only increase in length but they are less tightly associated than in early stages. The largest flower, with petals nearly twice the length of the sepals when fully expanded, is found in *P. mcvaughii* and this is exceptional. However, the flower form is in almost exactly the same mold as the other species with the exception that the petals only slightly exceed the sepals in all other species. The siliques of *Pennellia* are terete to very slightly flattened, very narrow (often ca. 1 mm. wide) and elongated. The seeds are numerous, either in a single or partially double row, and are often very crowded so that the seeds themselves are distorted in shape. The cotyledons are incumbent.

Pennellia is most closely related to the genus *Halimolobos* which in turn has been considered very close to *Sisymbrium*. Many of the species now placed in *Halimolobos* have been treated as *Sisymbrium* at one time or another. *Halimolobos berlandieri* is very much like *Pennellia patens* in general appearance and these two species of different genera can easily be mistaken for each other if only superficially examined. However, technical characters readily separate them. Recent trends in the systematic treatment of the Cruciferae have demanded a closer unity among the species of a given genus than was formerly acceptable. In part, this reflects an increased knowledge of the species and a better understanding of the interrelationships within each species group. This is especially true of genera whose species are concentrated primarily in Mexico or South America where new collections are providing the basis for a completely new assessment of their taxonomy.

Pennellia Nieuwland, Amer. Midl. Natur. 5: 224. 1918.

Heterothrix Rydberg, Bull. Torr. Bot. Club 34: 435, 1907; not *Heterothrix* Mueller, 1860.

Lamprophragma O. E. Schulz, Das Pflanzenreich IV. 105: 298. 1924.

Biennial or perennial herbs, densely pubescent with mostly branched trichomes to glabrous; stems usually single from base, erect, branched above, up to 1.5 m. tall; basal leaves oblanceolate to broadly oblong, entire or sinuate dentate to shallowly

lobed, petiolate, the petiole often short, usually densely pubescent with branched trichomes (except in *P. juncea* which is glabrous throughout); cauline leaves petiolate to cuneate at base, usually narrowed and sessile upward; inflorescences narrowly racemose, terminating each branch; buds globose to obovoid; flowers most often remote, cup-shaped; sepals erect, non-saccate or the outer pair slightly saccate, often purplish; petals lingulate to spatulate, erect, purple to white, in most species barely exceeding sepals; stamens subequal, paired erect, single often with filament curved toward base; infructescences narrow, secund in some species; pedicels erect to arched downward, usually slender; siliques narrowly linear, erect or pendant, terete to slightly flattened parallel to septum, usually straight or nearly so and one-nerved at least below, sessile or with a short gynophore; styles present or absent; seeds small, mostly 1 mm. or less long, wingless, plump, often misshapen from overcrowding in the silique; cotyledons most often incumbent. Type species: *Pennellia micrantha* (Gray) Nieuwl. Chromosome numbers are known for only two species: *P. longifolia* (Benth.) Roll., $2n = 16$; *P. mcvaughii* Roll., $n = 8$, $2n = 16$.

KEY TO THE SPECIES

- A. Siliques pendant; pedicels arched downward; infructescences usually secund.
 - B. Petals 4.5–6.0 mm. long, barely exceeding sepals; paired stamens included or nearly so; other floral parts relatively small.
 - C. Lower stems hirsute with coarse spreading simple or forked trichomes; basal and lower cauline leaves pubescent with coarse simple or few-branched stalked trichomes; buds and sepals glabrous; flowers slightly zygomorphic; pedicel apices asymmetrical 1. *P. longifolia*.
 - C. Lower stems pubescent with fine appressed many-branched trichomes; basal and lower cauline leaves pubescent with fine dendritically branched trichomes; buds and sepals sparsely pubescent; flowers regular; pedicel apices symmetrical or nearly so 2. *P. hunnewellii*.
 - B. Petals 9–21 mm. long, exceeding sepals by nearly half their length; paired stamens exerted by about one-third their lengths; other floral parts relatively large 3. *P. mcvaughii*.
- A. Siliques erect or ascending; pedicels erect or divaricately ascending; infructescences not secund.
 - D. Pedicels and siliques erect or nearly so, usually appressed to rachis; infructescence narrow, usually dense.
 - E. Buds and sepals glabrous; fruiting pedicels less than 8 mm. long, usually 4–7 mm.; siliques less than 4 cm. long.
 - F. Siliques pointed, slightly compressed, less than 2 cm. long; styles evident; sepals deep purple; petals purplish 4. *P. robinsonii*.
 - F. Siliques blunt, terete, more than 2.5 cm. long; styles obsolete or nearly so; sepals usually greenish; petals white 5. *P. micrantha*.
 - E. Buds and sepals pubescent; fruiting pedicels more than 1 cm. long, siliques 4–6 cm. long 6. *P. lasiocalycina*.
 - D. Pedicels rigidly divaricate; siliques erect to divaricate; infructescences broader, loose, pedicels usually remote.
 - G. Lower stems and leaves pubescent; fruiting pedicels 1 cm. or less long 7. *P. patens*.
 - G. Lower stems and leaves glabrous; fruiting pedicels 1.5–2.0 cm. long 8. *P. juncea*.

1. *Pennellia longifolia* (Benth.) Rollins

P. longifolia (Benth.) Rollins, *Rhodora* **62**: 16. 1960, based on *Streptanthus longifolius* Benth., Pl. Hartweg. 10. 1839. Type collected "In pascercis montosis, Aguas Calientes," Mexico, 1837, *Hartweg* 52. Holotype not seen, photo of type at Kew (MICH); isotype GH.

Thelypodium longifolium (Benth.) S. Wats., U.S. Geol. Explor. Fortieth Parallel (Bot.) V: 25. 1871.

Heterothrix longifolia (Benth.) Rydberg, Bull. Torr. Bot. Club 34: 435. 1907.

Lamprophragma longifolium (Benth.) O.E. Schulz, Das Pflanzenreich, Heft. 86. IV. 105: 299, fig. 63. 1924.

Thelypodium anisopetalum Greene, Pittonia 3: 247. 1897. Type collected in the Valley of Mexico, Federal District, Mexico, Sept. 30, 1896, C. G. Pringle 6548. Holotype not seen; isotypes F; GH, 2 sheets; MO; MSC; NY; PH; UC; US, 2 sheets.

Biennial; stems erect, most often single from base, branched above, usually virgate, 5–15 dm. tall, pubescent with coarse simple or forked spreading trichomes toward base, glabrous above; basal leaves usually not persisting beyond first year, rarely present on flowering or fruiting specimens, those seen petiolate, oblanceolate, entire to slightly sinuate, sometimes dentate, obtuse and short-petioled, i.e., petiole shorter than blade, mid-veins prominent below, 4–8 cm. long, sparsely pubescent on both upper and lower surface with simple stalked and forked or few-branched trichomes; cauline leaves linear, few, entire or lower shallowly dentate, narrower upward, sessile or lower with a short petiole, lower pubescent with coarse simple, forked, or few-branched trichomes, upper usually glabrous or nearly so; inflorescences terminating each branch, narrow and elongated; flowers remote, slightly irregular, cup-shaped; buds obovoid, glabrous; sepals purplish, oblong, 4–5 mm. long, 1.5–2.0 mm. wide; lateral pair slightly saccate at base, lower sepal larger than upper, both upper and lower non-saccate; petals purplish, narrowly lingulate, narrowing only slightly toward base, 5–6 mm. long, 1.0–1.5 mm. wide; paired stamens strictly erect, single stamens curved toward base; anthers erect, 1.0–1.2 mm. long, filament attachment below middle; glandular tissue surrounding base of single stamen filaments, only subtending paired filaments; pedicels slender, slightly ascending then arched downward, glabrous, 8–11 mm. long, markedly expanded and asymmetrical at apex; infructescences usually secund, 2–4 dm. long; siliques pendant, straight or nearly so, terete, glabrous, 6–8 cm. long, ca. 1 mm. wide, one-nerved from base nearly to apex; styles slender, 1.0–1.2 mm. long; seeds small, crowded, irregularly shaped, often angled, plump, marginless, variable in size, 0.7–1.3 mm. long, 0.4–0.5 mm. wide; funiculi slender, less than 1 mm. long; cotyledons incumbent, oblique or accumbent. $2n = 16$ (Rollins and Rüdénberg, 1977).

DISTRIBUTION: Arizona, Colorado, New Mexico, western Texas, and Mexico south to the Federal District. Mostly at elevations above 6,000 ft.

One of the outstanding and distinctive features of *Pennellia longifolia* when seen growing is the virgate or wand-like branches that bear pendulous siliques in a secund raceme. The plants are often a meter or more in height and may be abundant in favorable sites. They are sometimes aggressive colonizers, then tending to become established in disturbed places near or in cultivated fields, particularly in the mountains of Mexico.

It is difficult to understand why Schulz set this species apart as a monotypic genus. The flowers are so similar to those of *Pennellia micrantha* that the two species, when in flower, are sometimes misidentified as one another. The siliques, seeds, and other features are also basically of the same type and there are no fundamental differences that would justify placing these species into separate genera. The siliques are differently disposed, those of *P. longifolia* being pendulous while those of *P. micrantha* are erect. Plants in flower can be distinguished by the trichomes which are long-stalked and coarse

on the leaves, and simple or forked and spreading on the lower stems in *P. longifolia* while in *P. micrantha*, the leaf and stem trichomes are fine, many-branched, and extend farther up the stems than in the former species.

There is some variation in the intensity of pigmentation of both sepals and petals taking the full geographic range of *Pennellia longifolia* into account. In some populations, the sepals are markedly dark purple-red, other populations show less dense or incomplete coloration, the margins becoming whitish. The petals are similarly colored except the intensity is not as great or the coverage as complete as in the sepals. In some populations, the petals are nearly white.

In the protologue of *Pennellia longifolia*, Benthām (1839) did not give the place of collection of Hartweg no. 52, but supplied it in a subsequent fascicle of the publication as given above. According to McVaugh (1970), Hartweg collected in Aguascalientes between July 13 and September 17, 1837. The isotype specimen in the Gray Herbarium gives only the year, Mexico, the name Hartweg and the number 52 which Benthām assigned to the collection for purposes of publication and distribution.

REPRESENTATIVE SPECIMENS. **Mexico. Chihuahua:** Sierra de Santa Barbara, about 4 miles southwest of Villa Matamoros, 6,300 ft., Oct. 4-5, 1959, *D. S. Correll & H. S. Gentry* 22795 (GH); valley of Gonogochic, east of Creel and San Ignacio, Mnp. de Bocoyna, 7,400 ft., Aug. 24, 1973, *Robert A. Bye, Jr.* 4778 (GH); near Colonia Garcia in the Sierra Madres, 7,500 ft., July 29, 1899, *C.H.T. Townsend & C.M. Barber* 187 (F, GH, MEXU, MO, NMC, NY, POM, RM, UC, US); Memclichi, Rio Mayo, 7,500 ft., Sept. 16, 1936, *H. S. Gentry* 2738 (ARIZ, F, GH, MEXU, MO, UC, US). **Coahuila:** near summit at Las Cumbres Pass, 12 miles east of San Antonio, Sept. 28, 1974, *Reed C. Rollins and K. W. Roby* 7479 (GH); Canyon de Centinela, Sierra del Carmen, July 31, 1973, *James Henrickson* 11692 (GH); 26 km. northwest of Fraile, 3550 m., July 16, 1941, *L. R. Stanford, K. L. Retherford & R. D. Northcraft* 439 (ARIZ, GH, MO, NY). **Durango:** Otinapa, July 25-Aug. 5, 1906, *Edward Palmer* 546 (GH, NY, US); about 48 miles west of Parral and 12.5 miles west of Ojito, Sept. 13, 1972, *James L. Reveal & William J. Hess* 3053 (GH, MSC); arroyo of Rio Chico, 17 miles west/southwest of C. Durango, Sept. 1, 1951, *James H. Maysilles* 7659 (GH, MICH). **Federal District:** cerca del Cerro Conejo, al ENE de Ajusco, 2750 m., 23-VII-1967, *Rzedowski* 24118 (ARIZ, F). **Guanajuato:** summit east of Guanajuato, 8,000 ft., July 16, 1963, *Stuart K. Harris* 25887 (GH). **Hidalgo:** Tezoantha, Sept. 1945, *Maximino Martinez s.n.* (US); Sierra de Pachuca, Sept. 1, 1903, *J. N. Rose & Jos. H. Painter* 6734 (US); Pachuca, July, 1905, *J. N. Rose, Jos. H. Painter & J. S. Rose* 8850 (GH, US); below Guerrero on road from Real de Monte to Omitlán, Atotonilco el Grande, 2,700 m., July 30, 1948, *H. E. Moore, Jr. & C. E. Wood, Jr.* 4141 (GH). **Jalisco:** cerro viejo, cerca de la cumbre, municipio de Tlajomulco, Aug. 15, 1970, *Rzedowski* 27547 (MICH). **México:** near Santa Fe, Aug. 22, 1903, *J. N. Rose & Jos. H. Painter* 6501 (US); Cumbre Gavia, Sultepec, Oct. 27, 1935, *Geo. B. Hinton et al.* 8389 (NA, NY, PH, TEX, US); rich ravines, Mt. Orizaba, Aug. 8, 1891, *Henry E. Seaton* 250 (US); 8 km. al E de Coatlinchán, municipio de Texcoco, July 20, 1967, *Rzedowski* 24023 (MICH, MSC). **Michoacán:** vicinity of Morelia, Sept. 1, 1909, *G. Arsène* 7262 (US). **Nuevo Leon:** cerro Potosí, near microwave tower, ca. 9,000 ft., July 8, 1963, *R. L. McGregor et al.* 323 (GH); about 15 miles southwest of Galeana, June 28, 1934, *C. H. & M. T. Mueller* 907 (F, GH, MICH, TEX); Peña Nevada, 26 miles northeast of Dr. Arroyo, July 4, 1959, *John H. Beaman* 2707 (MSC). **Puebla:** Las Derrumbadas, municipio de Buenos Aires, Aug. 24, 1972, *F. Ventura A.* 5934 (GH). **San Luis Potosí:** in montibus

San Miguelito, 1876, *J. G. Schaffer 156* in part (CA, GH, MEXU, PH); Sierra de San Miguelito, cerca de El Capulín, Sept. 5, 1954, *Rzedowski 3993* (GH); San Luis Posotí, 1879, *J. G. Schaffer 556* (US). **Sinaloa:** steep slopes of barranca, 3 km. northeast of El Palmito, 1950 m., Aug. 12, 1974, *D. E. Breedlove 36458* (CAS, GH); 3 miles north of Los Ornos along road to Ocurahui, Sierra Surutato, Municipio de Badiraguato, 6,500 ft., Oct. 2, 1970, *D. E. Breedlove & R. F. Thorne 18344* (CAS); Ocurahui, Sierra Surutato, 6–7,000 ft., Aug. 27–30, 1941, *H. S. Gentry 6203* (ARIZ, DS, GH, MICH, MO, NY, PH). **Tamaulipas:** on Peña Nevada, July 18, 1949, *Stanford, Lauber & Taylor 2512* (NY, US) and *2512A* (US). **USA. Arizona. Apache Co.:** 1.5 miles east of Sheep Spring, 24-mile Draw, Sept. 5, 1949, *W. S. & T. K. Phillips 3365* (ARIZ, CAS); Riverside Ranger Station, Greer, 2,700 m., Aug. 24, 1920, *W. W. Eggleston 17158* (F, GH); 8 miles E of Nutrioso, Aug. 24, 1951, *K. F. Parker & E. McClintock 7516* (ARIZ, CAS, US). **Cochise Co.:** Rustler's Park, Chiricahua Mts., 8,000 ft., Oct. 21, 1974, *Reed C. Rollins & K. W. Roby 74197* (GH); same locality, Nov. 22, 1974, *Reed C. Rollins, Charles T. Mason, Jr. & George B. Cummins 74202* (GH). **Coconino Co.:** 13 miles north of Flagstaff, San Francisco Mts., 9,400 ft., July 20, 1946, *K. F. Parker 5992* (ARIZ, CAS, RSA); 3.5 miles from Flagstaff on Schulz Pass road, San Francisco Mts., 7,300 ft., Sept. 11, 1968, *John Thomas Howell & Gordon H. True 45064* (CAS, GH); San Francisco Mt., October, Sitgreaves Expedition of 1861 (GH). **Pima Co.:** Spud Ranch, Rincon Mts., 7,400 ft., Aug. 31, 1909, *J. C. Blumer 3316* (ARIZ, F, GH, MO). **Pinal Co.:** Santa Catalina Mts., Aug. 23, 1931, *G. J. Harrison & T. H. Kearney 8115* (ARIZ, CAS, F). **Yavapai Co.:** hills of boulders near Prescott on road to Ash Fork, Nov. 7, 1928, *Alice Eastwood 16728* (CAS). **Colorado. La Plata Co.:** river bottom, Bayfield, Aug. 9, 1917, *E. B. Payson 1151* (RM). **New Mexico. Catron Co.:** Mogollon Mts., 18 mi. northeast of Mogollon, 7,500 ft., Aug. 1, 1938, *C. L. Hitchcock et al. 4442* (CAS, NA, RM, UC, UCLA, UTC, WS, WTU). **Colfax Co.:** vicinity of Ute Park, Aug. 24, 1916, *Paul C. Standley 13719* (US). **Grant Co.:** Fort Bayard watershed, Sept. 3, 1905, *J. C. Blumer 53* (GH, NY). **Lincoln Co.:** White Mts., 7,000 ft., Aug. 11, 1897, *E. O. Wooton 316* (GH, MO, NMC, NY, POM, RM, UC). **Mora Co.:** Morphy Lake, July 24, 1972, *Larry C. Higgins 5860* (NY). **Rio Arriba Co.:** vicinity of Brazos Canyon, Aug. 21, 1914, *P. C. Standley & H. C. Bollman 10695* (US). **Sandoval Co.:** Sandia Mts., Sept. 6, 1884, *Marcus E. Jones s.n.* (GH, NY). **Santa Fe Co.:** near Glorieta, Aug. 30, 1928, *Emma Viveash s.n.* (F). **Sierra Co.:** Mineral Creek, 7,000 ft., Sept. 26, 1904, *O. B. Metcalfe 1417* (F, NY). **Socorro Co.:** Mogollon Mts., 7,500 ft., Aug. 2, 1903, *O. B. Metcalfe 350* (ARIZ, MO, NMC, NY, RM, UC). **Texas. Jeff Davis Co.:** Madera Canyon, Mt. Livermore, Aug. 5, 1935, *L. C. Hinckley 288* (F, NY, TEX); Mt. Livermore, Davis Mts., ca. 2250 m., July, 1936, *L. C. Hinckley s.n.* (GH).

2. *Pennellia hunnewellii* Rollins, sp. nov.

Perennial; stems one or few from an elevated crown, 5–12 dm. tall, branched above, pubescent below with appressed several to many branched trichomes, glabrous or sparsely pubescent above; basal leaves petiolate, oblanceolate, sinuate dentate, obtuse, strongly 1-nerved, 4–8 cm. long, 8–15 mm. wide, evenly pubescent on both surfaces with minute many branched trichomes; lower cauline leaves similar to basal but smaller, more nearly entire and with shorter petioles; upper cauline leaves narrowly linear without a differentiated petiole, often subtending branches, less densely pubescent than lower leaves; flowering pedicels slender, at first erect then recurving as fruit development occurs, sparsely pubescent; buds globose to obovoid, sparsely pubescent; sepals greenish to dull purple, broadly oblong, scarious margined, 3–4 mm. long; petals lingulate, white to purplish, 4–5 mm. long, ca. 1 mm. wide; fruiting pedicels slender, arched downward, sparsely pubescent, to glabrous, 8–12 mm. long, apex symmetrical or nearly so; siliques widely spreading and pendulous, straight or nearly so, glabrous, slightly flattened parallel to septum to nearly terete, 5–8 cm. long, 1-nerved from base to apex, nearly sessile or with a short gynophore less than 1 mm. long; styles evident but less than 1 mm. long; seeds in an irregular row, plump, wingless, ca. 1 mm. long, ca. 0.5 mm. wide; cotyledons incumbent.

Herba perennis, caulibus erectis superne ramosis sparse pubescentibus vel glabris

inferne pubescentibus 5–12 dm. altis, foliis basalibus petiolatis oblanceolatis sinuato-dentatis obtusis 4–8 cm. longis, foliis caulinis linearis vel filiformibus sparse dentatis vel integris pubescentibus; floribus poculiformibus, sepalis plus minusve veridis vel purpureis late oblongis 3–4 mm. longis, petalis linguiformibus albis vel plus minusve purpureis 4–5 mm. longis, pedicellis fructiferis filiformibus recurvatis 8–12 mm. longis, siliquis pendulis plus minusve teretibus rectis glabris 5–8 cm. longis, seminibus immarginatis noncompressis ca. 1 mm. longis, cotyledonibus incumbentibus.

Holotype in the Gray Herbarium collected in Cumbre de Soledad, Volcán Acatenango, 8,500 ft., Dept. of Sacatepéquez, Guatemala, Feb. 16, 1937, *F. W. Hunnewell 1482*.

DISTRIBUTION: Hidalgo and Jalisco, Mexico to Guatemala.

This species is named for the collector, Mr. Francis Welles Hunnewell (1880–1964) who was Phanerogamic Curator of the New England Botanical Club from 1913 until 1958 and a Research Associate of the Gray Herbarium for most of his adult life. He was Comptroller of Harvard University and later Secretary to the Corporation of the University. In establishing the Fernald Fund in Harvard College for field research in systematic Botany, Mr. Hunnewell left an enduring commitment to botanical field work, which he so enthusiastically enjoyed.

Most of the material cited below has been considered to belong to *Pennellia longifolia*. Certainly the phenological aspects of the specimens are very similar to that species and it is assumed *P. hunnewellii* and *P. longifolia* are closely related. In general, the geographical range of *P. hunnewellii* is to the south of *P. longifolia* but there is a broad area of overlap in the highland region of Mexico. The two species may be distinguished from each other by carefully examining the trichomes, particularly on the leaf surfaces and toward the base of the stems. The trichomes of *P. hunnewellii* are fine and many-branched whereas those of *P. longifolia* are coarse and simple or forked. The latter are spreading and produce a hirsute condition, especially on the stems. On the other hand, the trichomes of *P. hunnewellii* are so small that they scarcely show any divergence from the stem or leaf surfaces.

The siliques of *Pennellia hunnewellii* are slightly compressed parallel to the septum while those of *P. longifolia* are strictly terete. The former species is a perennial with strong tendencies to produce a woody foot at the apex of which the lower leaves are clustered. The latter species is biennial and the lower leaves are infrequently present on fruiting specimens. A woody foot is not produced.

OTHER SPECIMENS STUDIED. **Guatemala.** Calderas, July 5, 1941, *J. R. Johnston 1914* (F). **Chimaltenango:** Volcán de Agua, July 22, 1937, *J. R. Johnston 902* (F). **Huehuetenango:** Sierra de los Cuchumatanes, between Tojiah and San Juan Ixcay at km. 323 on Ruta Nacional 9N, ca. 3200 m., Aug. 1, 1960, *John H. Beaman 3951* (MSC); small limestone ridge covered with *Juniperus standleyi*, Sierra de los Cuchumatanes, between Paquix and Chemel at km. 311 on Ruta Nacional 9N, ca. 3360 m., Aug. 2, 1959,

John H. Beaman 2964 (GH, MSC). **Sacatepéquez:** above Santa María de Jesús, north-facing slopes of Volcán de Agua, by trail, Nov. 8, 1958, *J. G. Hawkes et al.* 1911 (GH). **Mexico. Hidalgo:** Cerro Alto, 3 km. al SE de Epazoyucan, July 19, 1963, *Rzedowski* 16911 (GH). **Jalisco:** Nevado de Colima, a few miles south of Ciudad Guzman (Zapotlan), 2700–2800 m., July 2, 1956, *David P. Gregory & George Eiten* 307 (MICH); Nevado de Colima, northeast side of mountain near Puerto de los Cruces, ca. 3600 m., Aug. 27, 1958, *John H. Beaman* 2385 (MSC); northeastern slopes of Nevado de Colima, below Canoa de Leoncito, Sept. 10, 1952, *Rogers McVaugh* 12836 (GH, MICH). **México:** 19 km. NE de Texcoco, sobre la carretera a Calpulalpan, Aug. 17, 1971, *Rzedowski* 28498 (MICH); Crucero, Temascaltepec, 3400 m., Oct. 24, 1933, *Geo. B. Hinton* 4920 (GH); 1 km. al N de Llano Grande, Chalco, en las faldas del Cerro Telapón, July 26, 1964, *Rzedowski* 18420 (GH); near Contreras, D.F., Aug., 1944, *G. T. Goodman* 3457 (F); same locality, Aug. 9, 1910, *C. R. Orcutt* s.n. (F); Alrededores de la Estación la Cima, Serranía del Ajusco, D.F., Aug. 14, 1960, *Rzedowski* 12586 (CAS, MICH). **Oaxaca:** Sierra de San Filipe, 10,000 ft., Sept. 18, 1894, *C. G. Pringle* 5622 (GH). **Queretaro:** near summit of Cerro Zamorano, 2950 m., Aug. 3, 1972, *Melinda F. Denton* 1958 (MICH); parte más alta Cerro Zamorano, Colón, 3,200–3,270 m., Nov. 13, 1971, *Rzedowski & McVaugh* 419 (MICH). **Veracruz:** faldas del Pico de Orizaba, 3220 m., Oct. 16, 1971, *R. Hernandez M.* 1321 (GH).

3. *Pennellia mcvaughii* Rollins

Pennellia mcvaughii Rollins, *Taxon* 28: 24. 1979.

Type collected near Mexican Highway 40, 26 miles east of El Salto, Sierra Madre Occidental, Durango, Mexico, Sept. 21, 1974, *Reed C. Rollins & K. W. Roby* 7423 (holotype, GH). Isotypes to be distributed.

Biennial or perennial, 1.0–1.5 m. tall; stems single or occasionally more from base, branched above, sparsely pubescent with spreading simple or sometimes branched trichomes below, glabrous above; complete basal and lower cauline leaves not seen, remnants sparsely pubescent with coarse stalked dendritically-branched trichomes, middle and upper cauline leaves linear, 4–8 cm. long, 1–4 mm. wide, sparsely pubescent with simple or forked trichomes to glabrous, upper leaves very narrow; inflorescences narrow, greatly elongated, up to 3.5 dm. long; buds purple, obovoid; flowers slightly zygomorphic with an asymmetrical receptacle and the lower stamen pair curved upward; sepals purple, scarious toward apex, 7–9 mm. long, 3–4 mm. wide, outer pair saccate, inner pair plain; petals purple, narrowly oblong to narrowly lingulate, scarcely narrowed below except at point of insertion, straight, 9–12 mm. long, 2–3 mm. wide; filaments gradually broadened toward base, those of paired stamens 8–10 mm. long, stamens exerted, anthers oblong, 1.5–2.0 mm. long; ovary and style slightly curved upward; stigma entire, slightly exceeding style in diameter; infructescences usually secund; fruiting pedicels slender, ascending then arched downward, glabrous, 7–11 mm. long, markedly expanded at summit, expanded portion asymmetrical; siliques pendant, straight to very slightly bowed, slender, terete to slightly flattened parallel to septum, glabrous, strongly 1-nerved below, 6–9 cm. long, ca. 1 mm. wide, usually purplish; septum without a median nerve; gynophore evident but short, less than 0.5 mm. long; styles 1.0–1.5 mm. long; seeds crowded, marginless, ca. 1 mm. long, less than 1 mm. wide, somewhat angled, pendant on funiculi ca. 1 mm. long, $n = 8$, $2n = 16$ (Rollins and Rüdénberg, 1977).

Known only from the Sierra Madre Occidentale west of C. Durango, Mexico.

The lower cauline and basal leaves are missing in the 14 individual plants of the two collections I have studied. Thus it is not known at present exactly the nature of these features of the plants. At the site of the type collection an effort to locate basal rosettes of the

species was made but none were found. Notes made at the time of this collection suggested that *P. mcvaughii* is probably a perennial but there was no positive evidence available. The root is sufficiently thick and the leafscars cover a sufficient distance on the crown to suggest a perennial habit. However, the fact that all basal leaves have been shed suggests a biennial which produces a rosette the first year, then when flowering occurs, the basal leaves wither and are ultimately shed. In any case, it is certainly not an annual species.

It is clear that *Pennellia mcvaughii* is most closely related to *P. longifolia*. These species are very similar in habit and in general they occupy the same types of habitats. Mostly, they occur in open conifer or oak forest areas at relatively high elevations in the mountains. *Pennellia mcvaughii* was found in the pine zone at about 8,000 ft.

SPECIMEN CITED OTHER THAN TYPE. **Mexico. Durango:** frequent in moist sloping meadow, pine-forest zone, 3 miles north of Coyotes, Sierra Madre Occidentale, ca. 2400 m., about 80 km. west of C. Durango, Sept. 28, 1962, *Rogers McVaugh 21680* (MICH, NY).

4. *Pennellia robinsonii* Rollins, sp. nov.

Perennial with a multicapital caudex; stems one to several, up to 1 m. tall, branched above, pubescent with fine dendritic trichomes below, glabrous above, old stems often persisting; basal leaves tufted at apex of caudex branches, oblanceolate, obtuse, sinuate dentate to entire, petiolate, with a strong central vein, densely pubescent with fine dendritic trichomes, 5–15 cm. long, 6–20 mm. wide; lower cauline leaves linear to linear-lanceolate, sessile and tapered toward base but scarcely petiolate, entire or nearly so, sparsely pubescent or glabrous; upper cauline leaves narrowly linear to filiform, glabrous; inflorescence narrow, greatly elongating in fruit; buds globose to obovoid; glabrous; flowers cup-shaped; sepals dark purple, broadly oblong to ovate, nonsaccate, 3.5–4.0 mm. long, ca. 2 mm. wide; petals tipped with light purple, whitish below, oblong, not tapering toward base, 4–5 mm. long, ca. 1.5 mm. wide, barely exceeding sepals; fruiting pedicels strictly erect, appressed to rachis, glabrous, 4–6 mm. long; stamens erect, paired and single nearly the same length; filaments stocky, gradually broadening toward base; 2.5–3.0 mm. long; anthers ca. 1 mm. long, ca. 1 mm. broad; glandular tissue well-developed, surrounding base of single stamen, subtending base of paired stamens; siliques erect or nearly so, acute at apex, glabrous, slightly compressed parallel to septum, indistinctly one-nerved below, 1.5–2.0 cm. long, obscurely gynophorate; styles ca. 0.5 mm. long; stigma elongated over valves; seeds numerous, crowded, marginless, plump, angled, ca. 1 mm. long, in two distinct rows in each loculus; funiculi filiform; cotyledons incumbent.

Herba perennis, caudicibus ramosis, caulibus erectis superne ramosis glabris inferne pubescentibus, foliis basalibus petiolatis oblanceolatis sinuato-dentatis vel integris, foliis caulinis linearis vel filiformis superne glabris, inflorescentiis angustis elongatis, floribus poculiformibus, sepalis purpureis late oblongis vel ovatis nonsaccatis 3.5–4.0 mm. longis, ca. 2 mm. latis, petalis oblongis 4–5 mm. longis, pedicellis fructiferis erectis glabris 4–6 mm. longis, siliquis erectis 1.5–2.0 cm. longis plus minusve teretibus, stylis ca. 0.5 mm. longis, seminibus noncompressis immarginatis ca. 1 mm. longis, cotyledonibus incumbentibus.

Holotype in the Gray Herbarium, collected on a steep granitic rocky hillside, 21 miles south of Chihuahua City, Chihuahua, Mexico, Oct. 15, 1974, *Reed C. Rollins and Kathryn W. Roby 74182*. Named for the late Professor B. L. Robinson, former

curator of the Gray Herbarium who first recognized *Pennellia* as section *Heterothrix* of *Thelypodium* and who annotated the Pringle specimen in the Gray Herbarium calling attention to the elongated stigma which has the lobes over the valves.

Known only from the state of Chihuahua, Mexico.

Pennellia robinsonii is nearest related to *P. micrantha* and the specimens of it have been distributed under that name. One of the most striking features of *P. robinsonii* is the multicipital caudex found in older plants. The short acute fruits are also distinctive when compared to those of *P. micrantha*. The flowers of *P. robinsonii* are cup-shaped and barely open during anthesis. They are fully as large as those of *P. longifolia*. The sepals are dark purple instead of greenish as in *P. micrantha* and the petals are purple-tipped, oblong, and non-tapering toward the base in *P. robinsonii* as contrasted with white lingulate petals that taper toward their bases in *P. micrantha*.

The habit illustration given by Schulz (1924, p. 296, fig. 62) is that of *Pennellia robinsonii* and probably was made from *Pringle 636* which he cites under *Heterothrix micrantha*. Unfortunately, the source of the illustration is not given in the legend. The different petal shapes "D-E Petala speciminum diversorum" are of two species. D illustrates a petal of *Pennellia micrantha* and E shows a petal of *P. robinsonii*.

Our field notes made at the time the type of *Pennellia robinsonii* was collected indicate that plants of the species were infrequent in the area. There were granitic outcrops on a steep, otherwise grassy hillside and the plants were growing at the base of these outcrops.

OTHER SPECIMENS STUDIED. **Mexico. Chihuahua:** rocky hills near Chihuahua, Sept. 12, 1885, C. G. Pringle 636 (DS, F, GH, NA, NY, PH, RSA, US); same locality, Oct. 1885, C. G. Pringle 294 (US).

5. *Pennellia micrantha* (Gray) Nieuwl.

Pennellia micrantha (Gray) Nieuwland, Amer. Midl. Natur. 5: 224. 1918, based on *Streptanthus micranthus* Gray, Mem. Amer. Acad. Arts and Sci. IV: 7. 1849. Type collected near Santa Fe Creek, New Mexico, A. Fendler 23, July, 1847. Holotype GH; isotypes GH, MO.

Thelypodium micranthum (Gray) Wats., Proc. Amer. Acad. Arts and Sci. XVII: 321. 1882.

T. longifolium (Benth.) Wats. var. *catalinense* M. E. Jones, Contrib. West. Bot. 12:2. 1908. Type collected in Sabino Canyon, Catalina Mts., Arizona, 3000 ft., August 20, 1903, Marcus E. Jones s.n. Holotype POM; isotypes MO, UC, US.

Heterothrix micrantha (Gray) Rydberg, Bull. Torrey Bot. Club 34: 435. 1907.

Perennial or biennial, stems usually one, sometimes several, from base, 5-10 dm. tall, branched above, pubescent below with simple, forked or dendritic trichomes, glabrous above or with scattered dendritic trichomes; basal leaves oblanceolate, sinuate dentate to shallowly lobed, rarely nearly entire, obtuse, densely pubescent with dendritic trichomes, lower cauline leaves similar to basal, petiolate, up to 10 cm. long but usually shorter, upper cauline leaves much reduced, cuneate at base, sparsely pubescent to

glabrous, usually entire; inflorescences narrow, elongated; buds globular to obovoid, glabrous or with a few trichomes near apex, usually greenish; sepals broadly oblong, scarious margined above, 2.5–3.0 mm. long, 1.5–2.0 mm. wide, outer pairs slightly saccate, inner pair plain; petals white or rarely purplish, spatulate to narrowly lingulate, gradually narrowed toward base, 3.5–4.5 mm. long, 1.0–1.3 mm. wide; stamens included, nearly equal, paired stamens straight, single stamens curved, filaments 1.5–2.5 mm. long, anthers ca. 1 mm. long; glandular tissue surrounding base of single stamens, supporting paired stamens; ovary sessile, glabrous or sometimes sparsely pubescent, terete, stigma entire or nearly so; pedicels erect or ascending, glabrous, (3-)4-7(-8) mm. long; siliques erect or nearly so, terete, nerved to middle or above; glabrous or rarely sparsely pubescent when young, (2-)2.5–3.5(-4.5) cm. long; styles obsolete or nearly so; seeds numerous, crowded, plump, angled, marginless, 1.0–1.2 mm. long, ca. 0.5 mm. wide; cotyledons incumbent.

DISTRIBUTION: Colorado to southern Arizona, New Mexico, west Texas and the mountains of Mexico south to the state of San Luis Potosí.

This is the most variable species of the North American members of the genus. Silique length, pedicel length, density of the indument, style length and the number of flowers per raceme all vary considerably. In all but three specimens seen, the siliques are sessile or very nearly so. In one specimen at the Gray Herbarium, collected by Wright, presumably in the Fort Davis area of Texas, the siliques are on a gynophore 1–2 mm. long. Similarly, specimens of *Stephen S. White* 3494 from northeastern Sonora, Mexico, at the University of Michigan show a definite gynophore. The siliques of a specimen at the U.S. National Herbarium, *Standley* 40609 from the Guadalupe Mts., Texas, are not quite sessile. Here the gynophore is less than 0.5 mm. long. Usually in the Cruciferae, a definite gynophore is a significant distinction often correlated with other differences that set off separate taxa. However, in this instance I have not been able to discover any correlated distinctions from other specimens of *Pennellia micrantha* and it seems best to regard the presence of a gynophore as an unusual feature of erratic occurrence. It is in the Wright specimen collected in 1851 where the striking gynophore suggests a closer look at other material from the area. However, with the exceptions given above, in all Texas material as well as that from elsewhere in the species range, the siliques are sessile or very nearly so.

The holotype of *Pennellia micrantha* consists of two branches, one bearing flowers, the other having more or less mature siliques. The lower parts of the plants are missing. However, *Fendler* 22, collected at the "foot of mts. on Santa Fe Creek" is from the same area as the holotype and the specimen on one sheet (GH) is complete except for lower and basal leaves. In reviewing the application of the name, *P. micrantha*, I have taken into account both *Fendler* 23 and *Fendler* 22. But the latter is a mixed collection with specimens of both *P. micrantha* and *P. longifolia* present on one sheet at GH.

The two more northerly collections of *Pennellia micrantha* in

Colorado have unusually small flowers and the specimens differ in other minor ways from those collected further south. However, the material is inadequate to fully test the possibility that a distinct taxon is represented.

REPRESENTATIVE SPECIMENS. **Mexico. Chihuahua:** Culebra Mts., Aug. 18, 1936, *Harde LeSueur* 749 and 643 (F, GH); 7 road miles north of Colonia Juarez in "The Tinaja," 1600 m., July 28, 1972, *M. & E. Wilson, L. A. & M. C. Johnston* 8431 (GH); Cañon de St. Diego, Sierra Madre Occidentale, Sept. 16, 1891, *C. V. Hartman* 804 (F, GH, NY, UC, US); same locality, 6,600 ft., Sept. 16, 1903, *Marcus E. Jones s.n.* (POM, 2 sheets). **Coahuila:** Sierra de Santa Rosa, south of Múzquiz, July 25, 1938, *Ernest G. Marsh* 1459 (F, GH, TEX); Cañon Hundido on N side of Pico de Centinela, Sierra del Jardín, 1500-2250 m., July 27, 1973, *M. C. Johnston et al.* 11799b (TEX-LL); Hidalgo Piedra Blanca, Villa Acuña, 1936, no. 6647 (no collector given MEXU); Cañon de Centinela just S and SW of Pico de Centinela, Sierra del Jardín, 1600-2225 m., July 31, 1973, *M. C. Johnston et al.* 11984 (GH). **San Luis Potosí:** San Migulito Mts., 1876, *J. G. Schaffner* 156 in part (CAS, GH, MEXU, PH). **Sonora:** Cañon de Bavispe, NE Sonora, Aug. 11-14, 1940, *Stephen S. White* 3253 (GH, MICH); Arroyo de la Galera, NE Sonora, July 27, 1940, *Stephen S. White* 3053 (ARIZ, GH, MICH, US); Cañon de El Temblor, NE Sonora, Aug. 19, 1940, *Stephen S. White* 3367 (ARIZ, GH, MICH, US). **USA. Arizona. Apache County:** 4.8 miles south of junction on Green's Mountain road, July 26, 1973, *Lehto, McGill and Pinkava* 11505 (NY). **Cochise Co.:** Guadalupe Canyon, Guadalupe Mts., 4300 ft., Oct. 4, 1947, *Frank W. Gould & H. S. Haskell* 4532 (ARIZ); Cave Creek, Chiricahua Mts., Sept. 21, 1929, *G. J. Harrison & T. H. Kearney* 6166 (GH); Barefoot Park, Chiricahua Mts., Sept. 12, 1906, *J. C. Blumer* 1363 (ARIZ, GH); Garden Canyon, Huachuca Mts., Sept. 21, 1949, *Leslie N. Goodding* 550-49 (ARIZ); near Fort Huachuca, Huachuca Mts., 1882, *J. G. Lemmon* 2635 (GH). **Greenlee Co.:** Blue River, 4000 ft., Sept. 1902, *A. Davidson* 848 (GH). **Pima Co.:** White House Canyon, Santa Rita Mts., 5200 ft., Aug. 27, 1939, *Lyman Benson* 9722 (ARIZ, POM); South Canyon, Baboquivari Mts., 3600-4000 ft., Aug. 31, 1940, *T. H. Kearney & R. H. Peebles* 14948 (ARIZ, NY, US); Santa Catalina Mts., May 16, 1881, *C. G. Pringle* 281 (GH). **Santa Cruz Co.:** Santa Rita Mts., July 25, 1884, *C. G. Pringle s.n.* (CAS, F, GH, MICH, NY); Sycamore Canyon, Ruby, July 17, 1938, *R. Darrow s.n.* (ARIZ); Stone Cabin Canyon, Santa Rita Mts., July 6-10, 1903, *J. J. Thornber s.n.* (ARIZ). **Colorado. Mineral Co.:** near Pagosa Peak, Aug. 5, 1899, *C. F. Baker* 5509 (POM). **Park Co.:** granite slide under cliff, North Fork, South Platte River, east of Shawnee, 7950 ft., July 13, 1950, *H. D. Ripley and R. C. Barneby* 10457 (CAS). **Teller Co.:** rocky cliffs, Mountain View, Pikes Peak, July 1901, *F. Clements s.n.* (NY). **New Mexico. Santa Rita de Cobre,** Aug. & Oct., 1880, *Edward Lee Greene s.n.* (F, MO, NY, PH); Florita Mts., Sept. 7, 1903, alt. 5300 ft., *Marcus E. Jones s.n.* (POM). **Dona Ana Co.:** Filmore Canyon, Organ Mts., Aug. 4, 1895, *E. O. Wooton s.n.* (NMC, NY); Organ Mts., Aug. 16, 1895, *E. O. Wooton s.n.* (US). **Grant Co.:** mts. near copper mines (Santa Rita), Aug. 1851, *C. Wright* 844 (GH, NY, PH). **Lincoln Co.:** El Capitan Mts., July, 1900, *F. S. & E. S. Earle* 491 (MO). **San Miguel Co.:** Provenir Creek, Las Vegas, 6.9.1926, *G. Arsène* 17750 (F). **Santa Fe Co.:** foot of mts., Santa Fe Creek, 1847, *A. Fendler* 22 (GH). **Sierra Co.:** Mineral Creek, south end of Black Range, Sept. 26, 1904, *O. B. Metcalfe* 1417 (ARIZ, ENCB, MO, NMC). **Socorro Co.:** Mogollon Creek, Mogollon Mts., July 18, 1903, *O. B. Metcalfe* 260 (ARIZ, GH, MO, NMC, UC); Mogollon Mts., Aug. 1887, *Henry H. Rusby* 25-1/2 (F, MO, NA, PH). **Texas. Brewster Co.:** Toronto Canyon, ca. 5 miles west of Alpine, June 26, 1941, *Omer T. Sperry* T1179 (US); Chisos Mts., *C. H. Mueller* 8004 (F, TEX). **Culbertson Co.:** Pine Canyon, Guadalupe Mts., Aug. 15-17, 1924, *Paul C. Standley* 40609 (US); vicinity of Frijole Post Office, Aug. 10, 1930, *Carl O. Grasel* 187 (MICH). **Hudspeth Co.:** Eagle Mts., ca. 35 miles southeast of Sierra Blanca, Aug. 22, 1946, *U. T. Waterfall* 6708 (GH). **Jeff Davis Co.:** Livermore Peak and spur ridges, Davis Mts., July 9-12, 1921, *Roxana S. Ferris and Carl D. Duncan* 2570 (CAS); Madera Canyon, Mt. Livermore, June, 1936, *L. C. Hinckley s.n.* (ARIZ); Fort Davis, 1883, *V. Havard* 214 (GH); Limpia

Canyon, 1889, *J. C. Nealley 11* (F); mountains and arroyos of the Limpia, July, 1852, *J. M. Bigelow 33* (NY). **Presidio Co.:** west branch of ZH Canyon, above mouth, July 16, 1941, *L. C. Hinckley 1003* (ARIZ, GH, TEX, US); head of Pinto Canyon, northwest of Chinati Peak on the Marfa-Ruidosa road, Sept. 10, 1961, *D. S. Correll and M. C. Johnston 24385* (GH, TEX-LL).

6. *Pennellia lasiocalycina* (Schulz) Rollins, comb. nov.

Based on *Heterothrix micrantha* (Gray) Rydberg var. *lasiocalycina* O. E. Schulz, Das Pflanzenreich IV. 105. Cruciferae-Sisymbrieae. 86: 296. 1924. Collected in the Sierra de Parras, Coahuila, Mexico, 8-9000 ft., July, 1910, C. A. Purpus 4604 (holotype B, not seen; isotypes F, GH, MO, UC, US).

Pennellia micrantha (Gray) Nieuwl. var. *lasiocalycina* (Schulz) Rollins, Contrib. Gray Herb. no. 206: 8. 1976.

Perennial; stems one or few, branched above, 6-10 dm. tall, densely to sparsely pubescent with fine dendritically branched trichomes sometimes glabrous above; basal leaves petiolate, oblanceolate, sinuate dentate to entire, obtuse, densely pubescent with stalked dendritically branched trichomes, usually the indument matted on lowermost leaves, 2-4 cm. long, 6-10 mm. wide, lower cauline leaves similar to basal leaves but less densely pubescent, cauline leaves gradually reduced upward, short-petioled to cuneate at base, pubescence reduced upward on both stems and leaves; inflorescences terminating each branch, narrow, lax; buds nearly globose, pubescent with branched trichomes; flower pedicels slender, erect, usually pubescent; flowers cup-shaped, regular, petals barely exceeding sepals; sepals purplish, pubescent, broadly oblong, scarious-margined, 2.5-3.0 mm. long, 1.5-2.0 mm. wide; petals white to tinged with purple, narrowly oblong, not differentiated into blade and claw, not tapered below, 3.0-3.5 mm. long, ca. 1 mm. wide; stamens included; fruiting pedicels strictly erect, pubescent or glabrous, 1.0-1.5 cm. long; siliques glabrous, erect, slightly flattened parallel to septum to nearly terete, 4-6 cm. long, acute at apex; styles evident but less than 1 mm. long; seeds numerous, marginless, plump, often misshapen, slightly more than 1 mm. long, ca. 0.6 mm. wide, in an irregular combination of one and two rows; cotyledons obliquely incumbent.

DISTRIBUTION: Coahuila to Hidalgo and Nuevo Leon, Mexico.

Unfortunately, most of the specimens studied are in flower, sometimes with young fruit, but they do not give an adequate basis for determining the variation undoubtedly present in this species. The isotypes show relatively long siliques compared to those of *Pennellia micrantha* and in the one specimen with mature siliques, *Chiang et al. 9435*, the siliques are about 6 cm. long. The siliques and pedicels of *P. lasiocalycina* are strictly erect and closely appressed to the rachis of the infructescence. The flowers are relatively larger and broader than those of *P. micrantha* and in general, the plants are taller. If there is any confusion of identity, it would most likely be with *P. micrantha*. But the upper parts of the latter species, particularly pedicels and buds, are always glabrous whereas those structures, particularly the buds, are sparsely to densely pubescent in *P. lasiocalycina*. The presently known distribution, from Coahuila to Hidalgo, is only sparsely represented by collections in the herbaria consulted.

SPECIMENS EXAMINED. **Mexico. Coahuila:** Sierra de la Madera SE and SSE of Rancho Cerro de la Madera, 1500–2900 m., Sept. 20, 1972, *F. Chiang, T. Wendt and M. C. Johnston* 9435 (TEX); Sierra Madre, 40 miles south of Saltillo, July, 1880, *Edward Palmer* 37 (GH); ca. 35 km. W of Cuatro Ciénegas, above Cañon de la Hacienda, in limestone, Sierra de la Madera, 8900 ft., August 5, 1973, *James Henrickson and T. Wendt* 11947 (GH). **Hidalgo:** cerro alto, 3 km. al SE de Epazoyucan, 2500 m., July 19, 1963, *Rzedowski* 16911 (MICH); cerro de Santa Monica, N of Santa Monica, 40 km. NW of Apam on Pachuca highway, 2650 to 2850 m., July 11, 1966, *Robert C. West* P-11 (MICH). **Nuevo Leon:** wooded slope near Ojo de Agua at foot of Cerro de Potosí, 6600 ft., July 14, 1945, *A. J. Sharp* 45732 (GH).

7. *Pennellia patens* (Schulz) Rollins

Pennellia patens (Schulz) Rollins, *Rhodora* **62**: 15, 1960; based on *Heterothrix patens* O. E. Schulz, *Pflanzenr. IV. fam.* 105: 296. 1924. Lectotype from District Comitán, Chiapas, Mexico, 18 Aug. 1898, *Caec. and Ed. Seler* 3038 (holotype B, not seen; isotype GH).

Biennial; stems usually single from base, up to 1.3 m. tall, branched above, sparsely pubescent below with fine dendritically branched trichomes or glabrous, glabrous above; basal leaves usually not persisting beyond first year, rarely present on flowering or fruiting specimens; sinuate dentate, oblanceolate, petiolate, pubescent on both surfaces with minute dendritically branched trichomes; lower cauline leaves cuneate or short petioled, lanceolate, irregularly dentate, sparsely pubescent with fine dendritically branched trichomes, one-nerved nearly entire length, 3–6 cm. long, 4–15 mm. wide, acuminate toward apex, often apiculate, lowermost usually missing; upper cauline leaves linear to narrowly linear, sparsely pubescent to glabrous; inflorescences greatly elongated, terminating each branch; buds ovoid, with a few trichomes at apex or glabrous; flowers remote; sepals greenish to purplish, oblong, glabrous, 3–4 mm. long, ca. 1–3 mm. wide; petals white, scarcely differentiated into blade and claw, slightly narrowed toward base, ca. 4 mm. long, ca. 1 mm. wide; stamens erect, single only slightly shorter than paired; fruiting pedicels slender, divaricate, glabrous, stiff, nearly straight, (4-)5–9(-9) mm. long; siliques divaricately ascending, terete, 3–6 cm. long, less than 1 mm. wide; seeds numerous in a single row to densely packed in semi-double rows, marginless, oblong, slightly over 1 mm. to less than 1 mm. long, ca. 0.6 mm. wide; cotyledons incumbent.

DISTRIBUTION: Mexico from Durango to Chiapas.

There are some inconsistencies evident in the material I have referred to *Pennellia patens* and it is possible that when a greater knowledge of the populations is available, more than one taxon will be recognized. The problem centers on the lack of mature fruiting material so that the size of the seeds and their positioning in the siliques cannot be properly assessed throughout the taxon at the present time. Of the 16 sheets of specimens studied, only seven possessed siliques that have mature or nearly mature seeds. The rest of the specimens are in flower or have flowers and young fruits. The isotype has the seeds strictly in a single row and they are definitely oblong and relatively smooth. Other specimens have less elongated, angular seeds that are much more crowded in the silique and are in an imperfect single row or approach a double-rowed condition. These differences,

if ultimately correlated with other features, could provide for the recognition of more than one taxon. But such correlations are not possible from the material under study. There are some puzzling specimens from Durango and Aguascalientes that I have included under *P. patens*, but which have shorter pedicels and siliques than the usual material of this species from further south. These in particular may represent a distinct taxon.

Aside from the divaricate pedicels and longer siliques distinguishing *Pennellia patens* from *P. micrantha*, the long pedicels and narrow fruits are distinctive. As the siliques become mature, they tend to take on a purplish pigmentation.

SPECIMENS STUDIED. **Mexico. Aguascalientes:** ca. 20 km. east of Rincón de Romos, road to Asientos, between Cerro Altamire and Cerro de San Juan, 2200–2450 m., Sept. 4–8, 1967, *Rogers McVaugh 23754* (GH, MICH). **Distrito Federal:** pedregal (lava beds), Valley of Mexico, Aug. 21, 1896, *C. G. Pringle 6454* (CAS, DS, F, GH, MEXU, MICH, MO, MSC, NY, PH, POM, UC, US); Tlalpan, Aug. 16, 1910, *C. R. Orcutt 3644* (F, GH, MO, US); same locality, July, 1905, *J. N. Rose et al. 8489* (GH, NY, US); Vertiente E del Cerro de Santa Catarina, cerca de Sta. Catarina, deleg. Tláhuac, Aug. 13, 1968, *Rzedowski 26074* (MICH). **Durango:** along route 40, 5.3 miles west of Los Mimbres, July 26, 1972, *D. J. Pinkava et al. 9484* (ASU); Tejamén, Aug. 21–27, 1906, *Edward Palmer 503* (GH, NY, US); city of Durango and vicinity, April to November, 1896, *Edward Palmer 696* (US); north slope of Canyon of Rio Chico, 18 miles west of the city of Durango, route no. 40, July 24, 1958, *D. S. Correll and Ivan M. Johnston 20070* (GH). **Hidalgo:** Cerro Ventoso, entre Pachuca y Real del Monte, Aug. 29, 1965, *Rzedowski 20595* (GH, MICH); Sierra de Pachuca, July 20 and 24, 1905, *J. N. Rose et al. 7842* (US); 22 miles east of Pachuca (4 miles west of Tulancingo), Sept. 8, 1962, *Frank W. Gould 10170* (MICH). **Jalisco:** mts. west of Hacienda Chinampas, ca. 15 miles west southwest of Ajuelos, Aug. 16, 1957, *Rogers McVaugh 17009* (GH, MICH). **México:** Vertiente E del Cerro del Pino, cerca de Ayotla, July 13, 1967, *Rzedowski 23996* (MICH, RSA); Entre El Oro y Via Victoria, Jun. 19–20, 1954, *E. Matuda 30926* (MEXU); near San Bernabe, Amaxac de Guerrero, Tlaxcala, Aug. 20, 1944, *A. J. Sharp and Ephraim Hernandez Xolocotzi 44469* (GH); La Gavi, 35 km. f. Toluca, Toluca-Morelia highway, Aug. 9, 1944, *A. J. Sharp 44287* (GH); cerca de la Presa "El Capulin," Fraccionamiento La Herradura, mpio. Huixquilucan, July 7, 1968, *Rzedowski 25866* (MICH). **Michoacán:** vicinity of Morelia, north of Zapote, Aug. 4, 1910, *G. Arsène 6850* (GH, MO, US); vicinity of Morelia, Jaripeo, July 13, 1911, *G. Arsène 5598* (GH, MO). **Oaxaca:** 19 km. southwest of Sola de Bega along road to Puerto Escondido, Aug. 30, 1965, *D. E. Breedlove 12296* (GH, MICH, US). **Puebla:** vicinity of Puebla, *G. Arsène s.n.* (US); Chila-Zapotitlan, Jul. 15, 1932, *F. Miranda 2814* (MEXU). **San Luis Potosí:** alrededores de La Salitrera, municipio de Zaragoza, Aug. 2, 1959, *Rzedowski 11408* (ENCB).

8. *Pennellia juncea* (Schulz) Rollins, comb. nov.

Based on *Heterothrix juncea* O. E. Schulz, Das Pflanzenreich IV. 105. Cruciferae-Sisymbrieae 86: 297, 1924. Collected in San Luis, Puebla, Mexico, 1908, *C. A. Purpus 3486a* (holotype B), vicinity of San Luis, Tultitlanapa, Puebla, near Oaxaca, July, 1908, *C. A. Purpus 3486* (UC, probable isotype).

Biennial, or possibly perennial, glabrous throughout; stems stiffly erect, virgately branched above, 4–6 dm. tall, purplish especially above; basal leaves not present; lower cauline leaves petiolate, narrowly oblanceolate, entire to shallowly dentate, obtuse, 3–5 cm. long including petiole, 4–8 mm. wide; upper cauline leaves narrowly

linear, acute, entire; inflorescences terminating each branch, branches subtended by leaf-bracts; buds globose to slightly elongated; sepals erect at anthesis, non-saccate, narrowly oblong, 3–4 mm. long, ca. 1.2 mm. wide; petals white to faint lavender, spatulate, not differentiated into blade and claw, 5–6 mm. long, ca. 1.5 mm. wide; glandular tissue nearly surrounding base of single stamens, subtending paired stamens, poorly developed; anthers narrowly ovate, ca. 1 mm. long; fruiting pedicels widely spreading, rigid, remote, 12–18 mm. long; siliques terete, divaricately ascending, 3.0–3.5 cm. long, ca. 1.2 mm. wide; valves obscurely nerved toward base, purplish; styles obsolete to less than 0.5 mm. long; stigma entire; seeds oblong, in a single row, not crowded, somewhat embedded in tissue of septum, marginless, 1.0–1.2 mm. long, less than 1 mm. wide; radicle exceeding cotyledons; cotyledons incumbent.

Known only from the type collection from near Oaxaca, Mexico.

Pennellia juncea is most closely related to *Pennellia patens* with which it shares the distinctive feature of having smooth oblong seeds that occur in a single row in the silique. This feature apparently characterizes the more southerly populations of *P. patens* but in the northerly populations, the seeds are crowded and misshapen as in most species of *Pennellia*. From the specimens available, the impression of rigidity of stems, pedicels and siliques is a striking feature of *P. juncea*. This is the only North American species we have seen that is completely glabrous.

The holotype of *Pennellia juncea* at Berlin bears *Purpus* no. 3486a with slightly different data than *Purpus* no. 3486 at the University of California as indicated above. It is clear that these specimens are of the same species and it is quite likely that they are of the same gathering. If the latter is so, it makes the UC specimen an isotype even though the number of the holotype is modified by the addition of the letter *a*. The handwriting on the labels of the two specimens is the same and is presumably that of Purpus. The UC specimen is more complete than the Berlin specimen having both flowers and mature siliques. The Berlin specimen lacks flowers and the siliques are immature.

LITERATURE CITED

- AL-SHEHBAZ, ISHAN A. 1973. The biosystematics of the genus *Thelypodium* (Cruciferae). Contrib. Gray Herb. 204: 1–148.
- BENTHAM, GEORGE. 1839–1857. *Plantae Hartwegianae*. London. 1–393.
- GRAY, A. 1849. *Plantae Fendlerianae*. Mem. Amer. Acad. Arts & Sci. IV (1): 1–16.
- McVAUGH, ROGERS. 1970. Introduction to the Facsimile Reprint of George Bentham's "Plantae Hartwegianae." J. Carmer, 1–102.
- MUELLER, ARG. 1860. Apocynaceae in Martius, Fl. Bras. VI(1): 1–195. (p. 133, t. 40).
- NIEUWLAND, J. A. 1918. *Heterothrix* (B. L. Robins.) Rydb. A synonym and other notes. Amer. Midl. Natur. 5: 224–225.
- ROBINSON, B. L. 1895. Cruciferae in Gray, Synop. Flora N. Amer. 1(1): 98–180.
- ROLLINS, R. C. AND L. RÜDENBERG. 1977. Chromosome numbers in the Cruciferae III. Contrib. Gray Herb. no. 207: 101–116.

- RYDBERG, P. A. 1907. Studies on the Rocky Mountain flora—XVIII. Bull. Torr. Bot. Club **34**: 417-437.
- SCHULZ, O. E. 1924. Cruciferae-Sisymbrieae. Das Pflanzenreich, heft 86, IV (105): 294-300.
- . 1936. A. Engler and K. Prantl, Die Natur. Pflanzenf. ed. 2, 17b: 643-644.



Rollins, Reed C. 1980. "The genus *Pennellia* (Cruciferae) in North America." *Contributions from the Gray Herbarium of Harvard University* (210), 5–21.
<https://doi.org/10.5962/p.336449>.

View This Item Online: <https://www.biodiversitylibrary.org/item/326164>

DOI: <https://doi.org/10.5962/p.336449>

Permalink: <https://www.biodiversitylibrary.org/partpdf/336449>

Holding Institution

Harvard University Botany Libraries

Sponsored by

Harvard University Botany Libraries

Copyright & Reuse

Copyright Status: In copyright. Digitized with the permission of the rights holder.

License: <http://creativecommons.org/licenses/by-nc-sa/4.0/>

Rights: <https://biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.