

NOMENCLATURE OF SUBDIVISIONS WITHIN *PHACELIA*  
(BORAGINACEAE: HYDROPHYILLOIDEAE)

GENEVIEVE K. WALDEN

Department of Integrative Biology, University of California, Berkeley, CA 94720  
gkwalden@berkeley.edu

ROBERT PATTERSON

Department of Biology, San Francisco State University, 1600 Holloway Avenue,  
San Francisco, CA 94132

ABSTRACT

Nomenclature of subdivisions within *Phacelia* Juss. (Boraginaceae: Hydrophyllaceae) reflects an update to the classification of the genus, based largely upon the structure offered in summary by Ferguson. We consider this proposed classification a continuation of efforts to better understand interrelationships within the genus and tribe Romanzoffieae Dumort., and anticipate future research offering insights into systematics of *Phacelia*. New names, changes in status, and combinations include the following: *Phacelia* sect. **Baretiana** Walden & R. Patt., **sect. nov.**; *P.* subsect. **Bipinnatifidae** (Small) Walden & R. Patt., **stat. nov.**; *P.* subsect. **Cosmantha** (Nolte ex A. de Candolle) Walden & R. Patt., **stat. nov.**; *P.* subsect. **Cosmanthoides** (A. Gray) Walden & R. Patt., **stat. nov.**; *P.* subsect. **Dubiae** (Small) Walden & R. Patt., **stat. nov.**; *P.* subsect. **Eutoca** (R. Br.) Walden & R. Patt., **stat. nov.**; *P.* sect. **Glandulosae** (Rydb.) Walden & R. Patt., **stat. nov.**; *P.* subsect. **Humiles** Walden & R. Patt., **subject. nov.**; *P.* subsect. **Lineares** (Rydb.) Walden & R. Patt., **stat. nov.**; *P.* sect. **Pachyphyllae** Walden & R. Patt., **sect. nov.**; *P.* subg. **Pulchellae** (Rydb.) Walden & R. Patt., **stat. nov.**; *P.* sect. **Ramosissimae** (Rydb.) Walden & R. Patt., **stat. nov.**; *P.* subsect. **Ranunculaceae** Walden & R. Patt., **subject. nov.**; and *P.* subsect. **Sericeae** (Rydb.) Walden & R. Patt., **stat. nov.**

Key Words: Boraginaceae, Hydrophyllaceae, Hydrophyllaceae, *Phacelia*, Romanzoffieae.

Philibert Commerson (variously Commerson, Commerçon, or Commerçon) and Jeanne Baret (variously Jean Baret, Jeanne Baré, Bonnefoi, or Bonnefoy) collected the first specimens of *Phacelia* Juss. in the Straits of Magellan in the winter of 1767–1768 (Lamarck 1792). Commerson was the naturalist on the Bougainville expedition and called his own fascination with plants a “botanomania” (Bougainville 1771; Oliver and Elliot 1909). Baret, mistress of and field assistant to her “lover-master” Commerson, was disguised as a man for the majority of the lengthy sea journey and identified as a woman only when the expedition reached Tahiti (Dunmore 2002; Schiebinger 2003). Baret was the first woman to voyage around the world and was lauded as a skilled botanist (Bougainville 1771; Dunmore 2002; Schiebinger 2003; Ridley 2010; Tepe et al. 2012). Botanical collections from Brazil were lost on a return voyage across the Atlantic, and Commerson retained the remainder of his collections, including those from the Straits of Magellan, until his death (Godley 1965). Commerson willed his herbarium to the Muséum national d’Histoire naturelle in Paris, and from these collections de Jussieu described *Phacelia* as a genus; *P. secunda* was later described and designated the type species (Jussieu 1789; Gmelin 1791; Laissus 1978). Taxonomic confusion began at the very formation of *Phacelia*, as researchers

proposed different classifications and alliances for the variation observed from the Commerson collection. “L’*Hydrophyll* de Magellan” (*Hydrophyllum magellanicum* Lam.) was also published from “l’herbier de Commerson,” (Lamarck 1792; Coville 1893; Deginani 1982). Although the informal “*Magellanicae*” has been generally adopted for the group of perennial species (e.g., *Phacelia magellanica* polyploid complex, *Phacelia* “species group *Magellanicae*”), the type species of the genus is also included within the subdivision and so the epithet for the subsection is *Phacelia* (Heckard 1960; Constance and Chuang 1982).

Gray (1875) combined the genera of A. de Candolle (1845) within *Phacelia* as subgenera, establishing a structure within the genus that has remained largely unchanged. In the first edition of the Manual of Botany, Gray (1848) noted subgenera and sections with the same mark, §. Clarification came in the second edition, with subgenera and sections both noted with §, but subgenera in all capitals (Gray 1856). In the Synoptical Flora, Gray (1878) defined the use of symbols and rank: “The characters of sections of genera, when of comparatively high rank, are designated by the sectional mark (§) and printed in the larger type; and those of first importance, such as may be termed subgenera, are distinguished by having a substantive name. Subsections, and also primary divisions when of low

rank, are in small type.” These clarifications with discussion illustrated the need for hierarchical subdivisions in *Phacelia* and demonstrated acknowledgment of the intended use in the field (Candolle 1867; Brizicky 1968, 1969). Gray’s taxonomy developed with each iteration of published subdivisions within *Phacelia*, although adoption and application were not standardized. Nomenclature provided structure and guidance as contemporaries of Gray followed or challenged his revisions and additions to the flora of North America. The taxonomy of *Phacelia* was complicated when Bentham and Hooker (1876) inadvertently recombined taxa by citing the subgenera of Gray (1875) but mistakenly translated (§) at sectional status, considered a bibliographic error of citation, but a valid publication with priority (Brizicky 1968, 1969; Moore 2001; McNeill et al. 2006). Gray (1878) combined subgenera at sectional rank, citing himself, in his next publication, making these sectional names later isonyms, which may be disregarded (Bentham and Hooker 1876; McNeill et al. 2006). Later authors, such as Brand (1913), followed and perpetuated sectional combinations of Gray, which resulted in common use of names with no nomenclatural standing. We correct the sectional nomenclature of *Phacelia* in the taxonomic treatment.

Brand’s (1913) classification of sections, informal “*conspectus varietatum*,” and informal “*systema speciei*” has been the basis and inspiration for revisional taxonomic work in the genus, due in part to the large scale of his revision within Hydrophyllaceae. Characters of importance used to separate subdivisions in *Phacelia* were ovule and seed number, seed shape and surface morphology, and corolla scales (known as corolla squamae, corolla plicae, interstaminal scales, appendages, or lamellae) (Candolle 1845; Gray 1875, 1878; Munz 1935; Constance 1949; Gillett 1968; Hoffmann 1999).

Rydberg (1917) limited his flora to species occurring within geographical bounds of the Rocky Mountains and organized *Phacelia* into seven unranked, but validly published, named subdivisions. Following a long-term study of chromosome numbers, Constance (1963) proposed a classification of three subgenera and ten informal “species groups.” Investigations of pollen surface morphology, trichomes, and seed surface morphology resulted in expanded taxonomic characters for the genus (Atwood 1975; Halse 1979; Constance and Chuang 1982; Di Fulvio and Dottori 1995). Ferguson (1998) offered an update to Constance’s classification, and although not a formal taxonomic revision, the synopsis of subdivisions in *Phacelia*, recognized to contain three subgenera, five sections, and six informal species groups, and broad sampling of genera within Hydrophyllaceae,

offered a structure for future taxonomic directions in the genus. The monospecific *Phacelia* subg. *Howellanthus* Constance (1953) has since been removed to *Howellanthus* (Constance) Walden & R. Patt., and although we assigned the genus to tribe Phacelieae Benth. ex A. Gray (1875), Reveal’s *Indices Supragenericorum Nominum Plantarum Vascularium* (2012) identified Romanzoffieae Dumort. (Dumortier 1829) as having priority at rank tribe, and we correct our error here (Walden and Patterson 2010). *Phacelia* subg. *Cosmanthus* (Nolte ex A. de Candolle) A. Gray contains 20 species, *P.* subg. *Phacelia* encompasses the remaining 187 species across five sections, and 50 species were not assigned to a species group within *P.* sect. *Phacelia* (Ferguson 1998). By reviewing protologues, revisions, and molecular studies, we clarify the status of those unassigned taxa within this proposed classification. With additional species descriptions and systematic studies in *Phacelia* since Ferguson (1998), there is a need to formally recognize subdivisions in the genus, combine some previously separate subdivisions (*P.* subg. *Phacelia* and *P.* subg. *Eutoca*), provide names for other subdivisions (see Appendix 1 for outline), and note traditional taxonomic characters that are useful for classification and identification in a key to subdivisions.

#### PHACELIA SUBG. PHACELIA

Howell published revisions on two groups of annual species with entire-margined leaves from *P.* sect. *Euphacelia* (Howell 1943b) and *P.* sect. *Eutoca* (Howell 1945), later combined as the informal “species group *Humiles*” by Constance (1963). Lee (1986) examined the systematics of “species group *Humiles*” using corolla venation patterns and identified five morphological groups. Molecular studies of *Phacelia* support a sister relationship between the annual “species group *Humiles*” and perennial “species group *Magellanicae*,” which we recognize formally here as *P.* subsect. *Humiles* and *P.* subsect. *Phacelia* within *P.* sect. *Phacelia* (Ferguson 1998; Gilbert et al. 2005; Walden 2010). It is clear that the nomenclature and taxonomic relationships of South America annual and perennial taxa should be reconsidered (Deginani 1982).

Molecular studies have supported a clade consisting of three perennial species: *P. hydrophyloides* Torr. ex A. Gray, *P. procera* A. Gray, and *P. bolanderi* A. Gray (Ferguson 1998; Gilbert et al. 2005; Walden 2010). These species have been traditionally included within *Phacelia* subg. *Eutoca* A. Gray, and were described together in one publication (Gray 1875). We treat this perennial group as *P.* sect. *Baretiana* within *P.* subg. *Phacelia*, named to honor the contributions of Baret to the botanical history of the genus, her

long life, and long journey to public recognition (Walden 2010).

“Species group *Crenulatae*” is an assemblage of 50 species, traditionally grouped by the morphological characteristics of trichomes stipitate-glandular with unicellular or multicellular heads, plants generally mephitic or malodorous, seeds cymbiform and excavated along one or both sides of a central adaxial ridge, seed surface reticulate-pitted and sometimes alveolate, and  $n = 11$  (Voss 1937a, b; Atwood 1975; Garrison 2007; Walden 2010). Brand (1913) first grouped species within the informal “*P. crenulata conspectus varietatum*,” “*P. glandulosa systema speciei*,” and “*P. neo-mexicana systema speciei*,” in his monograph of Hydrophyllaceae. Rydberg’s (1917) *Phacelia* [unranked] *Glandulosae* somewhat encompassed the informal groupings of Brand (1913). Voss (1937a, b) revised the “*Phacelia Crenulatae* group,” an informal name that has stayed with the subdivision (Constance 1963; Atwood 1975). Taxa are distributed from Wyoming to México, with an amphitropical disjunction of three taxa in South America (*P. artemisioides* Griseb., *P. pinatifida* Griseb. ex Wedd., and *P. setigera* Phil.) (Deginani 1982). Molecular studies have supported sampled “species group *Crenulatae*” as monophyletic, although clearly not limited to a four-seeded capsule, and sister to a monophyletic “species group *Tanacetifoliae*” [treated here as *P. sect. Ramosissimae*] (Gilbert et al. 2005; Garrison 2007; Hansen et al. 2009; Walden 2010). We treat Rydberg’s validly published name as the basionym for *P. sect. Glandulosae* within *P. subg. Phacelia*.

When Gray (1875) established *P. subg. Cosmanthus* and *P. subg. Cosmanthoides*, he did so by splitting *Cosmanthus* Nolte ex A. de Candolle sect. *Eucosmanthus*, and assigning the majority of species to *P. subg. Cosmanthoides*. The typification of each subdivision has not been made explicit, and we provide lectotypification here. Orthographic changes in gender are required in subdivisions combined from *Cosmanthus* to *Phacelia*. In the preface to his Manual, Small (1933) wrote: “Complex genera have been divided into more natural groups, both for convenience of study and also in order to make the genera, as far as possible, correspond to the great majority of groups of species now recognized as genera by most present-day botanists.” The unranked subdivisions of Small (1933) are treated as the basionyms for *P. subsect. Bipinnatifidae* and *P. subsect. Dubiae*. Constance (1949, 1950) authored revisions of *P. subg. Cosmanthus*, documenting the distribution of the group from northeastern United States into México and Guatemala. Gillett (1968, pg. 368) noted “a basis for deleting the subgenus *Cosmanthus* as a systematic group”; in its place he proposed five

informal groups from biosystematic studies (Gillett 1964, 1965a, b, 1968). Molecular studies have maintained the monophyly of this subdivision, although with limited sampling, supported as sister to Gillett’s “species group *Franklinii*” (treated here as *P. sect. Eutoca*) and nested within *P. subg. Phacelia* (Ferguson 1998; Gilbert et al. 2005; Hansen et al. 2009; Walden 2010). We treat *P. sect. Cosmanthus* within *P. subg. Phacelia*. Gillett’s “*P. ranunculacea* Group” has been further explored by Sewell and Vincent (2009), and by Glass and Levy (2011), and we treat this clade as *P. subsect. Ranunculacea* within *P. sect. Cosmanthus*.

Gray (1875) included *Eutoca* R.Br. within *Phacelia*, justifying the merger by noting that *Phacelia* and *Eutoca* were “polymorphous” (Gray 1875). Rydberg’s (1917) *Phacelia* [unranked] *Lineares* and *Phacelia* [unranked] *Sericeae* were investigated in a series of biosystematic studies by Gillett (1960a, b, 1961, 1962, 1963) as the informal “species group *Franklinii*.” We treat Rydberg’s taxa as *P. subsect. Lineares* and *P. subsect. Sericeae* within *P. sect. Eutoca*.

*PHACELIA* SUBG. *MICROGENETES*

Molecular studies have supported a monophyletic clade formed of three species: *P. pachyphylla* A. Gray, *P. calthifolia* Brand, and *P. neglecta* M. E. Jones, sister to *P. sect. Euglypta* and *P. sect. Miltitzia* (Dempsy 1996; Ganong 2002; Gilbert et al. 2005). Gray (1883) noted in his description of *P. pachyphylla*, “A most peculiar species, to be placed at the end of the *Microgenetes* section.” Howell (1942) provided a diagnosis for the informal group within a key when forming the “compact triad among our desert phacelias,” and Gilbert et al. (2005) noted, “All analyses supported Howell’s (1946) *Phacelia pachyphylla* complex as a distinct lineage.” We treat this group as *P. sect. Pachyphyllae* within *P. subg. Microgenetes*.

*PHACELIA* SUBG. *PULCHELLAE*

Rydberg’s (1917) *Phacelia* [unranked] *Pulchellae*, diagnosed within keys, contained ten species of annual or perennial plants of low habit, corollas open-campanulate to tubular, corollas with stamens included, reticulate-pitted seeds, leaves long-petiolate, and leaf margins entire to lobed. Although only implied, the sharing of similar characteristics of *Phacelia* [unranked] *Pulchellae* to *Phacelia* [unranked] *Bicolores* suggested a close relationship between the two subdivisions (Torrey 1871; Gray 1875; Rydberg 1917). In discussion, Howell (1943a) referred to the “section *Pulchellae*” of Rydberg, but it does not appear that was a formal publication at that rank. Howell’s (1943a) revision included 19

species of annual or perennial plants with tubular corollas, stamens included, styles shallowly bifid, leaf margins entire to shallowly lobed, capsules elliptic or oblong, and ovules more than four per ovary. *Phacelia* [unranked] *Pulchellae*, *P.* sect. *Euglypta*, *P.* sect. *Miltitzia*, and *Romanzoffia* Cham. have tricolpate pollen without pseudocolpi; the remainder of sampled *Phacelia* share tricolpate-tripseudocolpate pollen (Ferguson 1998). *Phacelia* [unranked] *Pulchellae*, consisting of the species around which Howell (1943a) centered his revision, was supported to have basal placement within the genus in molecular studies, sister to *P.* subg. *Phacelia* (Ferguson 1998; Gilbert et al. 2005; Walden 2010). We treat Rydberg's validly published name as the basionym for *P.* subg. *Pulchellae*.

#### TAXONOMIC TREATMENT

*Phacelia* Juss., Gen. Pl. 129. 1789. —Type (lectotype designated by J. F. Gmelin 1791): *Phacelia secunda* J. F. Gmel., Syst. Nat. ed. 13. 2:330. 1791.

*Aldea* Ruiz & Pavón, Fl. Peruv. Prodr. 16–17. 1794[1798]. —Type (lectotype designated by Ruiz & Pavón, 1799): *Aldea pinnata* Ruiz & Pavón, Fl. Peruv. 2:8, pl. 114 [CXIV], fig. a. 1799 (refers to p. 19 of the protologue in error).

*Phacelia* Juss. subg. *Phacelia*.

*Phacelia* Juss. sect. *Phacelia*.

*Phacelia* Juss. subsect. *Phacelia*.

*Phacelia* [unranked] *Heterophyllae* Rydb., Fl. Rocky Mts. 702. 1917. —Type: *Phacelia heterophylla* Pursh, Fl. Amer. Sept. 140. 1814.

Included taxa: *Phacelia argentea* A. Nelson & J. F. Macbr., *P. californica* Cham., *P. capitata* Kruckeb., *P. corymbosa* Jeps., *P. egena* (Brand) J. T. Howell, *P. hastata* Douglas ex Lehm., *P. hastata* var. *hastata*, *P. hastata* var. *charlestonensis* Cronquist, *P. hastata* var. *compacta* (Brand) Cronquist, *P. heterophylla* Pursh, *P. heterophylla* var. *heterophylla*, *P. heterophylla* var. *virgata* (Greene) Dorn, *P. imbricata* Greene, *P. imbricata* var. *imbricata*, *P. imbricata* var. *bernardina* (Greene) Walden & R. Patt., *P. imbricata* var. *patula* (Brand) Walden & R. Patt., *P. leptosepala* Rydb., *P. mutabilis* Greene, *P. nemoralis* Greene, *P. nemoralis* var. *nemoralis*, *P. nemoralis* var. *oregonensis* (Heckard) Walden & R. Patt., *P. secunda* J. F. Gmel., *P. secunda* var. *secunda*, *P. secunda* var. *pinnata* (Vahl) Deginani.

*Phacelia* Juss. subsect. **Humiles** Walden & R. Patt., **subsect. nov.** —Type: *Phacelia humilis* Torr. & A. Gray, in War Department (U.S.), Pacif. Railr. Rep. 2:122. 1855.

Plants annual; herbage mephitic or unscented. Stems decumbent to ascending to erect, sometimes

wiry, simple, or branched; hirtellous to hispidulous to hirsute, eglandular or glandular, glands colorless- to amber- or dark-tipped. Leaves rosulate, or opposite proximally and alternate distally, or alternate and cauline; petiolate or sessile; blade linear to lanceolate to oblong or narrowly ovate, simple and margins entire, or margins shallowly pinnatifid or toothed or shallowly lobed with 1–4 pairs, lobe margins entire, bases cuneate or attenuate, hirtellous to hispidulous to hirsute, eglandular or glandular. Inflorescence unit a cyme, secund or racemose, usually solitary, or sometimes geminate, ascending to erect, one- or two-ranked, extending or not beyond vegetation. Flowers pedicellate, pedicels short or long, spreading to ascending, or arcuate in fruit; calyx slightly accrescent or strongly accrescent in fruit, lobes equal or unequal, linear to oblanceolate to spatulate to obovate, sometimes foliaceous, hirsute and glandular, margins ciliate; corollas deciduous or marcescent, campanulate to open-campanulate to subrotate, white or blue or lavender or purple, lamina sometimes with translucent areas, glabrous adaxially, puberulent to sparsely hirsute abaxially, lobe margins entire or erose; nectary gland usually absent, rarely present (*P. douglasii*); corolla scales usually present, sometimes absent, linear to lanceolate to ovate, adjacent scale edges divergent or not across base of filament, glabrous or ciliate; stamens included or exsert, filaments equal or unequal in length, glabrous or papillate, anthers bronze; style included or exsert, branched 1/2 length to branched nearly to base, hirsute proximally; ovules 2–12 per placenta. Fruits ellipsoid to ovoid and compressed along sutures, or globose and plump, hirsute and sparsely glandular. Seeds 2–20, brown, oblong or ovoid, rounded or truncate at ends, sometimes angled, surface finely or coarsely reticulate-pitted, reticulations rarely in transverse striations.  $n = 7, 8, 9, 10, 11$ .

Included taxa: *Phacelia austromontana* J. T. Howell, *P. brachyantha* Benth., *P. breweri* A. Gray, *P. congdonii* Greene, *P. curvipes* Torr. ex S. Watson, *P. davidsonii* A. Gray, *P. divaricata* (Benth.) A. Gray, *P. douglasii* (Benth.) Torr., *P. eisenii* Brandegee, *P. exilis* (A. Gray) G. J. Lee, *P. greenei* J. T. Howell, *P. grisea* A. Gray, *P. humilis* Torr. & A. Gray, *P. humilis* var. *humilis*, *P. humilis* var. *dudleyi* J. T. Howell, *P. inconspicua* Greene, *P. insularis* Munz, *P. insularis* var. *insularis*, *P. insularis* var. *continentis* J. T. Howell, *P. leonis* J. T. Howell, *P. marcescens* Eastw. ex J. F. Macbr., *P. minutissima* L. F. Hend., *P. mohavensis* A. Gray, *P. novemmillensis* Munz, *P. orogenes* Brand, *P. peckii* J. T. Howell, *P. phacelioides* A. Gray, *P. pringlei* A. Gray, *P. purpusii* Brandegee, *P. quickii* J. T. Howell, *P. racemosa* (Kellogg) Brandegee, *P. stebbinsii* Constance & Heckard, *P. stellaris* Brand, *P. vallicola* Congdon ex Brand, *P. verna* J. T. Howell.

**Phacelia** Juss. sect. **Baretiana** Walden & R. Patt., **sect. nov.** —Type: *Phacelia hydrophylloides* Torr. ex A. Gray, Proc. Amer. Acad. Arts 7(2):400. 1868.

Plants perennial; herbage malodorous. Stems decumbent to ascending to erect; usually hirtellous to hirsute, glandular, glands colorless- to amber- to dark-tipped, sometimes glabrate proximally. Leaves petiolate; blade oblong to ovate to subrhombic, simple or pinnatifid to lyrate or pinnate with 1–3 pairs of leaflets at base, leaflets oblong to ovate, bases attenuate or truncate to subcordate, margins usually incised or serrate or dentate, rarely subentire, faces usually hirtellous to hirsute, sometimes glabrate, margins sometimes hispid-ciliate, glandular. Inflorescence unit a cyme, paniculate or capitate, solitary or in 2–3 clusters. Flowers pedicellate, pedicels short or long, straight in fruit; calyx slightly accrescent in fruit, lobes equal, linear to oblanceolate to oblong to narrowly spatulate, hirsute and glandular, margins hispid-ciliate, tips spreading; corollas deciduous, rotate to open-campanulate, white to cream to green-white or pale blue to lavender, throat sometimes fading brown in age, glabrous adaxially, puberulent abaxially, lobe margins entire or erose, spreading or revolute; nectary gland absent; corolla scales present, oblong, adjacent scale edges divergent across bases of filaments, scale edges sometimes adnate and forming a narrow sac, glabrous; stamens slightly exsert to exsert, filaments equal or slightly unequal, glabrous or hirsute, anthers blue or purple-brown or white; style included or exsert, branched 1/2 to 3/4 length, hirsute proximally; ovules 3–30 per placenta. Fruits plumply ovoid to subglobose, apiculate, hirsute. Seeds 3–60, brown or black, oblong to ellipsoid to irregularly cylindrical, angled, acute at both ends, adaxial surface sometimes with shallow keel, surface shallowly foveolate or finely scrobiculate, reticulate-pitted.  $n = 11$ .

Included taxa: *Phacelia bolanderi* A. Gray, *P. hydrophylloides* Torr. ex A. Gray, *P. procera* A. Gray.

*Phacelia* Juss. sect. *Cosmantha* (Nolte ex A. de Candolle) Benth. & Hook.f., Gen. Pl. 2:828. 1876. *Cosmanthus* Nolte ex A. de Candolle, Prodr. 9:296. 1845. *Phacelia* subg. *Cosmanthus* (Nolte ex A. de Candolle) A. Gray, Proc. Amer. Acad. Arts 10:320. 1875 (as § 2. COSMANTHUS). —Type (lectotype designated here): *Phacelia fimbriata* Michx., Fl. Bor.-Amer. 1:134. 1803.

**Phacelia** subject. **Cosmantha** (Nolte ex A. de Candolle) Walden & R. Patt., **stat. nov.** *Phacelia* [unranked] *Fimbriatae* Small, Man. S.E. Fl. 1097. 1933. —Type (lectotype designated here):

*Phacelia fimbriata* Michx., Fl. Bor.-Amer. 1:134. 1803.

Included taxa: *Phacelia fimbriata* Michx., *P. purshii* Buckley

**Phacelia** Juss. subsect. **Bipinnatifidae** (Small) Walden & R. Patt., **stat. nov.** *Phacelia* [unranked] *Bipinnatifidae* Small, Man. S.E. Fl. 1097. 1933. —Type: *Phacelia bipinnatifida* Michx., Fl. Bor.-Amer. 1:134. 1803.

Included taxon: *Phacelia bipinnatifida* Michx.

**Phacelia** Juss. subsect. **Cosmanthoides** (A. Gray) Walden & R. Patt., **stat. nov.** *Phacelia* subg. *Cosmanthoides* A. Gray, Proc. Amer. Acad. Arts 10:320. 1875 (as § 3. COSMANTHOIDES). *Phacelia* sect. *Cosmanthoides* (A. Gray) Benth. & Hook.f., Gen. Pl. 2:828. 1876. —Type (lectotype designated here): *Phacelia platycarpa* (Cav.) Spreng., Syst. Veg. (ed. 16) [Sprengel] 1:584. 1824 [1825].

Included taxa: *Phacelia altotonga* B. L. Turner, *P. austrotexana* (J. A. Moyer) B. L. Turner, *P. carmenensis* B. L. Turner, *P. gilioides* Brand, *P. glabra* Nutt., *P. hirsuta* Nutt., *P. laxa* Small, *P. neffii* B. L. Turner, *P. patuliflora* A. Gray, *P. platycarpa* (Cav.) Spreng., *P. platycarpa* var. *platycarpa*, *P. platycarpa* var. *bursifolia* (Willd. ex Roem. & Schult.) Constance, *P. platycarpa* var. *madrensis* (Greenm.) Constance, *P. pulcherrima* Constance, *P. strictiflora* (Engelm. & A. Gray) A. Gray, *P. strictiflora* var. *strictiflora*, *P. strictiflora* var. *connexa* Constance, *P. strictiflora* var. *lundelliana* Constance, *P. strictiflora* var. *robbinsii* Constance, *P. teucrifolia* I. M. Johnst., *P. zaragozana* B. L. Turner.

**Phacelia** Juss. subsect. **Dubiae** (Small) Walden & R. Patt., **stat. nov.** *Phacelia* [unranked] *Dubiae* Small, Man. S.E. Fl. 1097. 1933. —Type: *Phacelia dubia* (L.) Trel. & Small, Rep. (Annual) Arkansas Geol. Surv. (for 1888). 4:205. 1891.

Included taxa: *Phacelia dubia* (L.) Trel. & Small, *P. dubia* var. *dubia*, *P. dubia* var. *georgiana* McVaugh, *P. dubia* var. *interior* Fernald, *P. maculata* Wood.

**Phacelia** Juss. subsect. **Ranunculacea** Walden & R. Patt., **subject. nov.** —Type: *Phacelia ranunculacea* (Nutt.) Constance, Rhodora 42:39. 1940.

Plants annual, (5)10–25 cm; herbage unscented. Stems prostrate to erect; hirsute and glandular, glands colorless-tipped. Leaves blade oblong to ovate, pinnatifid or pinnate with 2–6 pairs of leaflets, lobes oblong to round, bases cuneate, margins entire or toothed, hirsute and glandular.

Inflorescence unit a cyme, secund, 1–6 flowers. Flowers pedicellate, pedicels short or long, reflexed to pendent in fruit; calyx slightly accrescent in fruit, lobes unequal, linear to lanceolate, hirsute and sparsely glandular; corollas tubular-campanulate, pale violet or lavender, lobe margins entire; stamens included, filaments equal, glabrous; style included, branched 1/3 to 2/3 length, glabrous; ovules 2 per placenta. Fruits depressed globose, hirsute. Seeds 2–4, globose to ovoid, surface finely reticulate-pitted.  $n = 6, 14$ .

Included taxa: *Phacelia covillei* S. Watson ex A. Gray, *P. ranunculacea* (Nutt.) Constance.

*Phacelia* Juss. sect. *Eutoca* (R. Br.) Benth. & Hook. f., Gen. Pl. 2: 828. 1876. *Eutoca* R. Br., Narr. Journey Polar Sea. 764–765, tab. 27. 1823. *Eutoca* R. Br. sect. *Ortheutoca* A. de Candolle, Prodr. 9:296. 1845. *Phacelia* subg. *Eutoca* (R. Br.) A. Gray, Proc. Amer. Acad. Arts 10:322. 1875 (as § 6. EUTOCA). —Type: *Phacelia franklinii* (R.Br.) A. Gray, Manual ed. 2:329. 1856.

**Phacelia** subsect. *Eutoca* (R.Br.) Walden & R. Patt., stat. nov. —Type: *Phacelia franklinii* (R.Br.) A. Gray, Manual ed. 2:329. 1856.

Included taxon: *Phacelia franklinii* (R. Br.) A. Gray.

**Phacelia** Juss. subsect. *Lineares* (Rydb.) Walden & R. Patt., stat. nov. *Phacelia* [unranked] *Lineares* Rydb., Fl. Rocky Mts. 702. 1917. —Type: *Phacelia linearis* (Pursh) Holz., Contr. U.S. Natl. Herb. 3:242. 1895.

Included taxon: *Phacelia linearis* (Pursh) Holz.

**Phacelia** Juss. subsect. *Sericeae* (Rydb.) Walden & R. Patt., stat. nov. *Phacelia* [unranked] *Sericeae* Rydb., Fl. Rocky Mts. 702. 1917. —Type: *Phacelia sericea* (Graham) A. Gray, Amer. J. Sci. Arts, ser. 2. 34(101):254. 1862.

Included taxa: *Phacelia idahoensis* L. F. Hend., *P. lenta* Piper, *P. lyallii* Rydb., *P. mollis* J. F. Macbr., *P. sericea* (Graham) A. Gray, *P. sericea* var. *sericea*, *P. sericea* var. *ciliosa* Rydb.

**Phacelia** Juss. sect. *Glandulosae* (Rydb.) Walden & R. Patt., stat. nov. *Phacelia* [unranked] *Glandulosae* Rydb., Fl. Rocky Mts. 702. 1917. —Type: *Phacelia glandulosa* Nutt., J. Acad. Nat. Sci. Philadelphia, ser. 2, 1:160. 1847.

Included taxa: *Phacelia alba* Rydb., *P. amabilis* Constance, *P. anelsonii* J.F. Macbr., *P. argylensis* N. D. Atwood & S. L. Welsh, *P. argillacea* N. D. Atwood, *P. arizonica* A. Gray, *P. artemisioides* Griseb., *P. bakeri* (Brand) J. F. Macbr., *P. bombycina* Wooton & Standl., *P. cloudcroftensis*

N. D. Atwood, *P. coerulea* Greene, *P. congesta* Hook., *P. constancei* N. D. Atwood, *P. corrugata* A. Nelson, *P. cottamii* N. D. Atwood, *P. coulteri* Greenm., *P. crenulata* Torr. ex S. Watson, *P. crenulata* var. *crenulata*, *P. crenulata* var. *ambigua* (M. E. Jones) J. F. Macbr., *P. crenulata* var. *angustifolia* N. D. Atwood, *P. crenulata* var. *minutiflora* (J. W. Voss ex Munz) Jeps., *P. denticulata* Osterh., *P. formosula* Osterh., *P. furnissii* N. D. Atwood, *P. glandulosa* Nutt., *P. glandulosa* var. *glandulosa*, *P. glandulosa* var. *deserta* Brand, *P. gypsogenia* I. M. Johnst., *P. higginsii* N. D. Atwood, *P. hintoniorum* B. L. Turner, *P. howelliana* N. D. Atwood, *P. hughesii* N. D. Atwood, *P. infundibuliformis* Torr., *P. infundibuliformis* var. *infundibuliformis*, *P. infundibuliformis* var. *phanerandra* I. M. Johnst., *P. integrifolia* Torr., *P. integrifolia* var. *integrifolia*, *P. integrifolia* var. *texana* (J. W. Voss) N. D. Atwood, *P. mammillarensis* N. D. Atwood, *P. marshall-johnstonii* N. D. Atwood & Pinkava, *P. marshall-johnstonii* var. *marshall-johnstonii*, *P. marshall-johnstonii* var. *deliciasana* B. L. Turner, *P. neomexicana* Thurb. ex Torr., *P. orbicularis* Rydb., *P. pallida* I. M. Johnst., *P. palmeri* Torr. ex S. Watson, *P. pedicellata* A. Gray, *P. petrosa* N. D. Atwood, F. J. Sm., & T. A. Knight, *P. pinkavae* N. D. Atwood, *P. pinnatifida* Griseb. ex Wedd., *P. popei* Torr. & A. Gray, *P. potosina* B. L. Turner, *P. rafaelensis* N. D. Atwood, *P. robusta* (J. F. Macbr.) I. M. Johnst., *P. rupestris* Greene, *P. sanzinii* Hicken, *P. scariosa* Brandegee, *P. serrata* J. W. Voss, *P. setigera* Phil., *P. setigera* var. *setigera*, *P. setigera* var. *humahuaquense* Deginani, *P. sinuata* Phil., *P. sivinskii* N. D. Atwood, P. J. Knight, & Lowrey, *P. sonoitensis* S. P. McLaughlin, *P. splendens* Eastw., *P. utahensis* J. W. Voss, *P. vossii* N. D. Atwood, *P. welshii* N. D. Atwood.

*Phacelia* Juss. sect. *Gymnobytha* (A. de Candolle) Benth. & Hook.f., Gen. Pl. 2:828. 1876. *Cosmanthus* Nolte ex A. de Candolle sect. *Gymnobythus* A. de Candolle, Prodr. 9:296. 1845. *Phacelia* subg. *Gymnobythus* (A. de Candolle) A. Gray, Proc. Amer. Acad. Arts 10:321. 1875 (as § 4. GYMNOBYTHUS). —Type: *Phacelia viscida* (Benth.) Torr., Rep. U.S. Mex. Bound., Bot. (Emory) 143. 1859.

Included taxa: *Phacelia grandiflora* (Benth.) A. Gray, *P. viscida* (Benth.) Torr., *P. viscida* var. *viscida*, *P. viscida* var. *albiflora* (Nutt.) A. Gray.

**Phacelia** Juss. sect. *Ramosissimae* (Rydb.) Walden & R. Patt., stat. nov. *Phacelia* [unranked] *Ramosissimae* Rydb., Fl. Rocky Mts., 702. 1917. —Type: *Phacelia ramosissima* Douglas ex Lehm., Nov. Stirp. Pug. (Lehmann) 2:21. 1830.

Included taxa: *Phacelia cedrosensis* Rose, *P. cicutaria* Greene, *P. cicutaria* var. *cicutaria*,

*P. cicutaria* var. *hispida* (A. Gray) J. T. Howell, *P. ciliata* Benth., *P. cinerea* Eastw. ex J. F. Macbr., *P. cryptantha* Greene, *P. distans* Benth., *P. floribunda* Greene, *P. gentryi* Constance, *P. hirtuosa* A. Gray, *P. hubbyi* (J. F. Macbr.) L. M. Garrison, *P. ixodes* Kellogg, *P. lyonii* A. Gray, *P. malvifolia* Cham. *P. malvifolia* var. *malvifolia*, *P. malvifolia* var. *loasifolia* (Benth.) Brand, *P. phyllomanica* A. Gray, *P. platyloba* A. Gray, *P. pauciflora* S. Watson, *P. ramosissima* Douglas ex Lehm., *P. ramosissima* var. *ramosissima*, *P. ramosissima* var. *austrolitoralis* Munz, *P. ramosissima* var. *eremophila* (Greene) J. F. Macbr., *P. ramosissima* var. *latifolia* (Torr.) Cronquist, *P. ramosissima* var. *montereyensis* Munz, *P. rattanii* A. Gray, *P. tanacetifolia* Benth., *P. thermalis* Greene, *P. umbrosa* Greene, *P. vallis-mortae* J. W. Voss.

*Phacelia* Juss. sect. *Whitlavia* (Harv.) Benth. & Hook.f., Gen. Pl. 2:828. 1876. *Whitlavia* Harv., London J. Bot. 5:311–312, pl. 11. 1846. *Phacelia* subg. *Whitlavia* (Harv.) A. Gray, Proc. Amer. Acad. Arts 10:321. 1875 (as § 5. WHITLAVIA). —Type: *Phacelia minor* (Harv.) Thell. ex F. Zimm., Ber. Bayer. Bot. Ges. 14:79. 1914.

*Phacelia* subsect. *Whitlaviae* (Harv.) G. W. Gillett, Univ. Calif. Publ. Bot. 28:60. 1955. —Type: *Phacelia minor* (Harv.) Thell. ex F. Zimm., Ber. Bayer. Bot. Ges. 14:79. 1914.

Included taxa: *Phacelia minor* (Harv.) Thell. ex F. Zimm., *P. parryi* Torr.

*Phacelia* Juss. subsect. *Campanulariae* G. W. Gillett, Univ. Calif. Publ. Bot. 28:62. 1955. —Type: *Phacelia campanularia* A. Gray, Syn. Fl. N. Amer. 2(1):164. 1878.

Included taxa: *Phacelia campanularia* A. Gray, *P. campanularia* var. *campanularia*, *P. campanularia* var. *vasiformis* (G. W. Gillett) Walden & R. Patt., *P. longipes* Torr. ex A. Gray, *P. nashiana* Jeps.

*Phacelia* Juss. subg. *Microgenetes* (A. de Candolle) A. Gray, Proc. Amer. Acad. Arts 10:326. 1875 (as § 7. MICROGENETES). *Microgenetes* A. de Candolle, Prodr. 9: 292–293. 1845. —Type (lectotype designated by J. T. Howell 1946): *Phacelia cumingii* (Benth.) A. Gray, Syn. Fl. N. Amer. 2(1):169. 1878.

*Phacelia* Juss. sect. *Euglypta* S. Watson, Botany (Fortieth Parallel) 254. 1871. *Phacelia* sect. *Microgenetes* (A. de Candolle) Benth. & Hook.f., Gen. Pl. 2:828. 1876. —Type (lectotype designated by J. T. Howell 1946): *Phacelia cumingii* (Benth.) A. Gray, Syn. Fl. N. Amer. 2(1):169. 1878.

*Phacelia* [unranked] *Bicolores* Rydb., Fl. Rocky Mts. 702. 1917. —Type: *Phacelia bicolor* Torr. ex S. Watson, Botany (Fortieth Parallel) 255. 1871.

Included taxa: *Phacelia affinis* A. Gray, *P. bicolor* Torr. ex S. Watson, *P. brachyloba* (Benth.) A. Gray, *P. cephalotes* A. Gray, *P. cumingii* (Benth.) A. Gray, *P. fremontii* Torr., *P. glandulifera* Piper, *P. gymnoclada* Torr. ex S. Watson, *P. ivesiana* Torr., *P. leibergii* Brand, *P. nana* Wedd.

*Phacelia* Juss. sect. *Miltitzia* (A. de Candolle) J. T. Howell, Leaf. W. Bot. 4:15. 1944. *Miltitzia* A. de Candolle, Prodr. 9:296. 1845. *Emmenanthe* Benth. subg. *Miltitzia* (A. de Candolle) A. Gray, War Department (U.S.), Pacif. Railr. Rep. 1854–5, 6:84–85. 1857 (Gray wrote, “It will be seen that I incline to the latter view; but should retain *Miltitzia* as a subgenus.”). —Type: *Phacelia lutea* (Hook. & Arnott) J. T. Howell, Leaf. W. Bot. 4:15. 1944.

Included taxa: *Phacelia adenophora* J. T. Howell, *P. glaberrima* (Torr. ex S. Watson) J. T. Howell, *P. inundata* J. T. Howell, *P. inyoensis* (J. F. Macbr.) J. T. Howell, *P. lutea* (Hook. & Arnott) J. T. Howell, *P. lutea* var. *lutea*, *P. lutea* var. *calva* Cronquist, *P. lutea* var. *mackenziorum* J. W. Grimes & P. L. Packard, *P. lutea* var. *purpurascens* J. T. Howell, *P. monoensis* Halse, *P. salina* (A. Nelson) J. T. Howell, *P. scopulina* (A. Nelson) J. T. Howell, *P. submutica* J. T. Howell, *P. tetramera* J. T. Howell.

*Phacelia* Juss. sect. **Pachyphyllae** Walden & R. Patt., sect. nov. —Type: *Phacelia pachyphylla* A. Gray, Proc. Amer. Acad. Arts 19:88. 1883.

Plants annual, 3–35 cm, herbage mephitic. Stems erect, hirsute and glandular, glands colorless- to amber- to black-tipped. Leaves rosulate and long-petiolate proximally, reduced and subsessile distally, petioles stout, proximal petioles usually channeled; blade broadly ovate or reniform or round, simple, bases truncate or cordate, margins undulate to shallowly lobed or crenate or serrulate, thick and succulent to coriaceous, hirtellous and glandular adaxially, glabrate and glandular abaxially, veins impressed adaxially. Inflorescence unit a cyme, secund, erect, solitary or in 2–3 clusters, compact and not elongate proximally, extending or not beyond vegetation. Flowers pedicellate, pedicels short, spreading to arcuate proximally in fruit; calyx slightly accrescent in fruit, lobes equal, oblong to oblanceolate, pubescent to hirsute and glandular; corollas deciduous, funnelform-campanulate or open-campanulate or subrotate, tube white to purple, lobes white to purple, glabrous adaxially, puberulent abaxially, lobe margins entire; nectary gland absent; corolla scales reduced and narrow, adjacent scale

edges sometimes divergent and adnate across base of filament, hirsute or ciliate; stamens included, filaments subequal or unequal, glabrous or puberulent, anthers yellow or violet; style included, branched 1/2 to 3/4 length, hirtellous and glandular; ovules 50–120. Fruits plumply ovoid to globose, prominently sulcate, puberulent and glandular. Seeds dark brown, 30–120, ellipsoid to ovoid, angular, surface transversely corrugated, corrugations 4–8. *n* = 11, 12.

Included taxa: *Phacelia calthifolia* Brand, *P. neglecta* M. E. Jones, *P. pachyphylla* A. Gray.

**Phacelia** Juss. subg. **Pulchellae** (Rydb.) Walden & R. Patt., stat. nov. *Phacelia* [unranked] *Pulchellae* Rydb., Fl. Rocky Mts. 702. 1917. —Type: *Phacelia pulchella* A. Gray, Proc. Amer. Acad. Arts 10:326. 1875.

Included taxa: *Phacelia barnebyana* J. T. Howell, *P. beatleyae* Reveal & Constance, *P. cookei* Constance & Heckard, *P. cronquistiana* S. L. Welsh, *P. demissa* A. Gray, *P. demissa* var. *demissa*, *P. demissa* var. *heterotricha* J. T. Howell, *P. demissa* var. *minor* N. D. Atwood, *P. filiae* N. D. Atwood, F. J. Sm., & T. A. Knight, *P. filiformis* Brand, *P. geraniifolia* Brand, *P. glechomifolia* A. Gray, *P. incana* Brand, *P. indecora* J. T. Howell, *P. keckii* Munz & I. M. Johnst., *P. laxiflora* J. T. Howell, *P. lemmonii* A. Gray, *P. mustelina* Coville, *P. parishii* A. Gray, *P. peirsoniana* J. T. Howell, *P. perityloides* Coville, *P. pulchella* A. Gray, *P. pulchella* var. *pulchella*, *P. pulchella* var. *gooddingii* (Brand) J. T. Howell, *P. rotundifolia* Torr. ex S. Watson, *P. sabulorum* (J. T. Howell) N. D. Atwood, *P. saxicola* A. Gray, *P. suaveolens* Greene.

KEY TO SUBDIVISIONS IN *PHACELIA*

- 1. Plants 3–35 cm; corolla tubular to campanulate; corolla scales reduced and narrow, or absent; stamens included, subequal to unequal in length; style shallowly 2-lobed to branched 1/2 length; capsule costate and longitudinally sulcate
  - 2. Annuals or perennials; seed compressed or angled, surface reticulate-pitted or foveolate. . . . . *Phacelia* subg. *Pulchellae*
  - 2' Annuals; seeds terete and plump, surface transversely corrugated or transversely striate. . . . . *Phacelia* subg. *Microgenetes*
  - 3. Leaf blades round, simple, bases cordate; corolla not yellow at base, tube white or purple; style branched 1/2 length; capsule globose, plump, exceeding calyx lobes; seeds 30–120 per capsule. . . . . *Phacelia* sect. *Pachyphyllae*
  - 3' Leaf blades oblong to ovate, usually pinnatifid to pinnate to bipinnatifid, rarely simple, bases cuneate to truncate; corolla yellow at base, tube white or yellow or blue; style shallowly 2-lobed to branched 1/4 length; capsule oblong to ellipsoid to cylindric, not plump, not exceeding calyx lobes (except *P. tetramera*); seeds 4–30 per capsule
    - 4. Stems prostrate to ascending; herbage neither mephitic nor malodorous; corolla tardily deciduous or marcescent in fruit, lobes white or yellow to yellow-purple. . . . . *Phacelia* sect. *Miltitzia*
    - 4' Stems ascending to erect; herbage usually mephitic or malodorous; corolla readily deciduous in fruit, lobes white or pink or purple or blue . . . . . *Phacelia* sect. *Euglypta*
- 1' Plants 5–200 cm; corolla tubular or campanulate or rotate; corolla scales present in pairs along lateral veins of lamina (10 total in 5 pairs), reduced, or absent; stamens usually exsert, usually equal in length; style branched 1/4 length to parted nearly to base; capsule ecostate and shallowly longitudinally sulcate. . . . . *Phacelia* subg. *Phacelia*
  - 5. Annuals; corolla scales absent; seed surface shallowly reticulate-pitted and foveolate
    - 6. Staminal appendages at base of filaments absent; seeds 40–200 per capsule, ovules 50–120 per placenta . . . . . *Phacelia* sect. *Gymnobytha*
    - 6' Staminal appendages at base of filaments present; seeds 10–90 per capsule, ovules 5–45 per placenta . . . . . *Phacelia* sect. *Whitlavia*
    - 7. Corolla usually purple, rarely white, corolla markings opposite corolla lobes or none; staminal appendages hairy; seeds 1–1.5 mm. . . . . *Phacelia* subsect. *Whitlaviae*
    - 7' Corolla white or pink to pale violet or bright blue, corolla markings opposite corolla sinuses or none; staminal appendages glabrous; seeds 1.5–2 mm. . . . . *Phacelia* subsect. *Campanulariae*
  - 5' Annuals, biennials, or perennials; corolla scales usually present, wholly or partially adnate to corolla tube along one or both scale edges, sometimes reduced or absent; seed surface reticulate-pitted, alveolate, or foveolate
    - 8. Nectary gland present on lamina midvein, sometimes reduced to minute ridge; corolla scale distal edges bordering or overlapping midvein, not divergent proximally across base of filament
    - 9. Corolla scales wholly adnate along one edge to lateral vein, distal free edge overlapping midvein or nectary gland; seeds 6–60 per capsule; western North America (usually west of Great Plains, except some *P. franklinii* populations) . . . . . *Phacelia* sect. *Eutoca*
    - 10. Perennials; nectary gland surface hairy; stamens exsert, filaments glabrous or glabrate. . . . . *Phacelia* subsect. *Sericeae*
    - 10' Annuals or biennials; nectary gland surface glabrous; stamens included or equal to corolla, filaments hairy
    - 11. Annuals; stamens included, filaments stipitate-glandular; seeds 6–15 per capsule, surface coarsely reticulate-pitted . . . . . *Phacelia* subsect. *Lineares*

- 11' Biennials; stamens equal to corolla, filaments eglandular; seeds 40–60 per capsule, surface finely reticulate-pitted . . . . . *Phacelia* subsect. *Eutoca*
- 9' Corolla scales usually wholly adnate along one or both edges to lateral vein, free edge bordering and not overlapping midvein or nectary gland, sometimes each reduced to a ridge; seeds 2–20 per capsule; eastern North America (east of Great Plains), México, and Guatemala . . . . . *Phacelia* sect. *Cosmantha*
- 12. Annual or biennial herbs; seeds 2–4 per capsule, ovules 2 per placenta; seed globose or ovoid, not angled
  - 13. Corolla tubular-campanulate; stamens included, filaments glabrous; seed adaxial keel absent . . . . . *Phacelia* subsect. *Ramunculacea*
  - 13' Corolla open-campanulate to rotate-campanulate; stamens equal to corolla or exsert, filaments hairy; seed adaxial keel present.
    - 14. Biennial herbs; corolla lobe margins entire or erose; stamens exsert; seed surface coarsely reticulate-pitted, excavated along one side of adaxial keel . . . . . *Phacelia* subsect. *Bipinnatifidae*
    - 14' Annual herbs; corolla lobe margins fimbriate; stamens equal to corolla; seed surface finely reticulate-pitted, not excavated alongside adaxial keel . . . . . *Phacelia* subsect. *Cosmantha*
- 12' Annual or perennial herbs; seeds usually 5–20 per capsule, ovules usually 4–14 per placenta, rarely ovules 2 per placenta and seeds (2–3)4 per capsule (*P. zaragozana*); seed ovoid or ellipsoid, angled
  - 15. Annual herbs; plants usually east of Mississippi River (not of México or Guatemala). . . . . *Phacelia* subsect. *Dubiae*
  - 15' Annual or perennial herbs; plants usually west of Mississippi River (except some populations of *P. strictiflora* var. *lundelliana*, also of México, Guatemala) . . . . . *Phacelia* subsect. *Cosmanthoides*
- 8' Nectary gland usually absent on lamina midvein, rarely present (*P. douglasii*); corolla scales usually divergent proximally across base of filament, distal scale edges between filaments free or connate, sometimes reduced or absent
  - 16. Seed cymbiform (shallowly cymbiform in *P. sonoitensis* and *P. infundibuliformis*), usually excavated along one or both sides of adaxial ridge, forming two longitudinal grooves, sometimes shallowly excavated (*P. bakeri*), surface reticulate-pitted or alveolate, adaxial ridge sometimes corrugated, seeds sometimes marginate, margins sometimes corrugated . . . . . *Phacelia* sect. *Glandulosae*
  - 16' Seed terete or carinate or angled, not cymbiform, sometimes shallowly excavated alongside adaxial ridge or keel, surface reticulate-pitted or foveolate or alveolate or scrobiculate or rugose, adaxial ridge or keel not corrugated, seeds rarely marginate, margins not corrugated
    - 17. Leaves cauline, alternate, usually pinnatifid or pinnate or bipinnatifid, rarely simple (*P. bolanderi*, *P. malvifolia*, and *P. rattanii*), margins lobed or pinnatifid
    - 18. Annuals or perennials; annuals with seeds 1–40 per capsule, perennials with seeds 1–4 per capsule; calyx usually strongly accrescent in fruit, lobes usually unequal. . . . . *Phacelia* sect. *Ramosissimae*
    - 18' Perennials; seeds 3–60 per capsule; calyx slightly accrescent in fruit, lobes equal . . . . . *Phacelia* sect. *Baretiana*
  - 17' Leaves in basal rosette or rosulate, or first pair opposite to subopposite, or leaves cauline and alternate, simple or shallowly lobed and margins entire, or pinnatifid to pinnate and leaflet margins entire. . . . . *Phacelia* sect. *Phacelia*
- 19. Perennials or biennials; stamens exsert; seeds (1–2)3–4 per capsule, ovules 2 per placenta. . . . . *Phacelia* subsect. *Phacelia*
- 19' Annuals; stamens included or exsert; seeds (1–2)3–20 per capsule, ovules 2–20 per placenta. . . . . *Phacelia* subsect. *Humiles*

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## APPENDIX 1

CLASSIFICATION OF *PHACELIA*

- Phacelia* Juss.
- Phacelia* subg. *Phacelia*
- Phacelia* sect. *Phacelia*
- Phacelia* subsect. *Phacelia*
- Phacelia* subsect. *Humiles* Walden & R. Patt.
- Phacelia* sect. *Baretiana* Walden & R. Patt.
- Phacelia* sect. *Cosmantha* (Nolte ex A. de Candolle) Benth. & Hook.f.
- Phacelia* subsect. *Cosmantha* (Nolte ex A. de Candolle) Walden & R. Patt.
- Phacelia* subsect. *Bipinnatifidae* (Small) Walden & R. Patt.
- Phacelia* subsect. *Cosmanthoides* (A. Gray) Walden & R. Patt.
- Phacelia* subsect. *Dubiae* (Small) Walden & R. Patt.
- Phacelia* subsect. *Ranunculacea* Walden & R. Patt.

*Phacelia* sect. *Eutoca* (R. Br.) Benth. & Hook.f.  
*Phacelia* subsect. *Eutoca* (R. Br.) Walden & R.  
Patt.  
*Phacelia* subsect. *Lineares* (Rydb.) Walden & R.  
Patt.  
*Phacelia* subsect. *Sericeae* (Rydb.) Walden & R.  
Patt.  
*Phacelia* sect. *Glandulosae* (Rydb.) Walden & R.  
Patt.  
*Phacelia* sect. *Gymnobytha* (A. de Candolle) Benth.  
& Hook.f.  
*Phacelia* sect. *Ramosissimae* (Rydb.) Walden &  
R. Patt.

*Phacelia* sect. *Whitlavia* (Harv.) Benth. & Hook.f.  
*Phacelia* subsect. *Whitlaviae* (Harv.) G. W.  
Gillett  
*Phacelia* subsect. *Campanulariae* G. W. Gillett  
*Phacelia* subg. *Microgenetes* (A. de Candolle) A.  
Gray  
*Phacelia* sect. *Euglypta* S. Watson  
*Phacelia* sect. *Miltitzia* (A. de Candolle) J. T.  
Howell  
*Phacelia* sect. *Pachyphyllae* Walden & R.  
Patt.  
*Phacelia* subg. *Pulchellae* (Rydb.) Walden & R.  
Patt.



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