

## FIVE NEW SPECIES OF NAVARRETIA

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In preparing the manuscript of the Polemoniaceae for Abram's Illustrated Flora of the Pacific Coast States, the following five species of *Navarretia* were found to be undescribed. All species will be illustrated in that work.

Under the name, *Navarretia Bowmanae*, Miss Eastwood described a plant from Anderson's Ranch, Lake County, California. In the discussion accompanying the description, she called attention to its relationship to *N. cotulaefolia* and hazarded the opinion that it may be "too closely allied" to that species. In this opinion we concur. Jepson (Flora of California, p. 152, 1943), concluded that the plant described by Miss Eastwood had blue or possibly white flowers which had changed to yellow on drying. On the basis of this decision, Jepson re-diagnosed *N. Bowmanae* and tentatively referred to that name a group of specimens unlike the type specimen described by Miss Eastwood. The individuals in the large colony of yellow-flowered plants seen by the writer at the type locality, however, do agree with Miss Eastwood's description. The plants placed under *N. Bowmanae* by Jepson, on the other hand, fall into two groups representing two distinct entities, both of which are undescribed. One centers in the Sierra Nevada foothills and adjacent plains from Calaveras County to Eldorado County and adjacent Sacramento County with an outlying occurrence in Solano County. The other occurs in Tehama and Lake counties, thus centering on the north and west sides of the Great Valley. Both entities appear to occur in soils rich in ferro-magnesian metals.

*Navarretia eriocephala* sp. nov. Annuæ erecta, 5–35 cm. alta, simplex vel racemosa-ramosa; folia rache crasso, lato vel tenui, 1–5 mm. longa, bipinnate seccata; bracteae rigidae-coriaceae rache lato, bipinnate seccata, subter dense albae-villosae; flores in capitibus; calyx inaequaliter seccatum, 2–3 lobae integrae, aliae dentibus, 6–8 mm. longae; corolla 5-mera infundibuliformis, 8–12 mm. longa, lutea saepe purpurea-maculosa; stamina ad faucium aequaliter affixa, filamenta inaequaliter, 1–3 mm. longi, illorum maximi exserti; stigma 2-lobatum; capsula obovoidea, valvi 4, semina 1.

Erect annual, 5–35 cm. high, stems tan to reddish brown, simple or racemosely branched, densely white canescent with retrorse hairs; leaves bipinnately dissected, often with a stout broad rachis or the rachis narrow, 1–5 mm. long, puberulent; bracts stiff-coriaceous, bipinnately dissected into linear, acerose lobes, the rachis expanded below, densely white villous below; flowers in heads, 5-merous; calyx unequally cleft, some lobes entire, others 3-lobed or toothed, 6–8 mm. long, densely white

coarse villous above, glabrate below; corolla funnelform, 8–12 mm. long, cream yellow and often spotted or marked with purple, tube 6 mm., throat 3 mm., lobes 3 mm. long; stamens equally inserted on the throat, filaments unequal in length, 1–3 mm. long, exerted from throat; stigma exerted, 2-lobed, lobes 0.5 mm. long; capsule obovoid, 4-valved, 1-celled, 1-seeded, seed brown, smooth or slightly furrowed.

Type. Folsom, Sacramento County, California, July, 1910, *K. Brandegee* (Herbarium of the University of California no. 142954). Other collections. Copperopolis, Calaveras County, *J. Burt Davy 1877*; between Pilot Hill and Cool, Eldorado County, June 3, 1908, *K. Brandegee*; west side Brown's Valley, Solano County, May 2–6, 1891, *W. L. Jepson*.

Range. Foothills of the northern Sierra Nevada, Calaveras to Eldorado and Sacramento counties; Solano County, California.

**Navarretia heterandra** sp. nov. Plantae simplices vel basi ramosae, 3–20 cm. altae; folia bipinnata-dissecta, inferiora molli-ter herbacea, superiora rigidentia acerbaque; bractae divaricate pinnatifidae, infra crasse albae-villosae; flores in capitibus; calyx inaequaliter scissum, lobae inaequales, 2–3 integrae, 2 dentibus duobus vel lobis, membrana sinus inaequaliter, tubus glabratus, lobae albae-villosae; corolla 4-, aliquando 5-mera, caerulea vel alba, calyx inaequalis, 5–7 mm. longum, tubus aliquando pubescens; stamina inaequaliter affixa, 0.5–1 mm. longitudine, inclusa, filamentes inaequales; stigma 2-lobatum, inclusum; capsula obovoidea, valvi 4, semina 1.

Plants simple or branched from the base, erect or radiately spreading, 3–20 cm. high; stems densely white canescent with minute, retrorse hairs; leaves bipinnately dissected, the lobes and rachis slender, lobes of the lower leaves soft-herbaceous becoming pungent and rigid on upper leaves; bracts divaricately pinnatifid with rigid, acerose lobes, densely white villous below with coarse white hairs; flowers sessile in clusters, these aggregated into heads, 4-merous or occasionally one or two 5-merous in the same head; calyx unequally cleft, some to the base, others only two-thirds to base, lobes unequal, usually 3 entire and 2 with lateral teeth or short lobes; sinus membranes unequal, calyx tube white villous above, glabrate on lower half; corolla subequal, longest sepals, 5–7 mm. long, white or blue, tube 4–5 mm. long, sometimes pubescent, throat 1 mm. long, lobes 1 mm. long; stamens unequally inserted on the throat, 0.5–1 mm. long, filaments unequal, anther 0.5 mm. long, included; stigma 2-lobed, included; capsule 4-valved, 1-celled, 1-seeded, seed brown, smooth or slightly furrowed.

Type. "Near Cottonwood, Tehama Co." [Shasta County], June 17, 1934, *J. T. Howell 12223* (Herbarium University of California no. 526143). Other collections. Three miles southeast of Redding, June, 1945, *G. L. Stebbins*; Kelseyville, *K. Brandegee* (?).

The literature of the Polemoniaceae makes repeated references to *Navarretia minima* as occurring in the Coast Ranges of California. The writer has thus far been unable to verify any such record. There are, instead, three inhabitants of vernal pools in Lake County which would key to *N. minima* in the literature, but which differ sufficiently from that species and from each other to warrant separate treatment. Field studies of these species suggest that their differences are related to the edaphic conditions to which they must be genetically adapted. One occurs in a pool in adobe soil, surrounded by white oak savanna; another occupies a pool on volcanic ash-obsidian rubble, surrounded by chaparral; and the third is on the margin of a bog actively building up a peat deposit and is surrounded by a forest of Douglas fir. In all these sites the plants are submerged during the period of germination of the seeds and establishment of the seedlings; they thus begin their life as aquatics. The details of floral morphology are strikingly alike and indicate close interrelationship. However, the great differences in habitat, indicative of considerable physiological differentiation, and the great difference in habit, produced by differences in the vegetative organs, is very striking and warrants specific segregation. These three species with their stamens inserted in the sinuses of the corolla lobes seem more closely related to *N. prostrata* of southern California which has a similar insertion of the stamens than to the northern *N. leucocephala* and *N. minima* in which the stamens are inserted midway on the corolla throat.

**Navarretia Bakeri** sp. nov. Annuæ erecta vel expansa, 2–5 cm. alta; caules 0.5–1.4 mm. crassitudine; folia infera simplices lineares vel dentibus raris vel pinnatifidis, supera pinnate seccata lobis raris divaricatis vel proliferatis, subter glabrata, super pilis brevibus crispisque; bracteae foliosae pinnatae, super paribus dentium subter paribus lobarum saepe aut lobis proliferis ad basim aut ex partibus dorsalibus rachis; flores in capitibus; calyx cum membrana ampla ad basim infra sinibus, margo solutus ciliatus, lobae tenues, aristatae; corolla 5–7 mm. longa, alba; stamina in sinibus affixa, exserta; stigma minutum, 2-lobatum, exsertum; capsula 2 mm. longa; semina pauca.

Erect spreading annual, 2–5 cm. high; stems racemosely branched, 0.5–1.5 mm. thick, densely clothed with retrorse crisped hairs; lower leaves linear, entire to few toothed or pinnatifid, upper dissected, lobes often proliferating, glabrate below, pilose with short, crisped hairs above; outer bracts foliaceous, pinnatifid with highly dissected proliferations; bracts within head pinnate with 1–2 pair of teeth in upper third and 1 pair of lobes below middle with proliferating lobes from their bases or from the dorsal surface of the rachis; flowers in heads; calyx lobes unequal, the longest lobes 5.5 mm., slender aristate, with a few weak hairs,

membranous to base in sinuses, free margin of membrane ciliate; corolla white, 5–7 mm. long, tube 4 mm., throat 0.5–1 mm., lobes 1–1.5 mm. long; stamens inserted in the sinuses of corolla lobes, 2.5 mm. long, exserted from throat; style exserted, stigma minutely 2-lobed; capsule about 2 mm. long, the somewhat thickened top breaking away irregularly circumscissily from the membranous base; seeds few, minutely pitted, reddish brown.

Type. In vernal pool in adobe soil surrounded by oak savanna, 1.5 miles southwest of Lower Lake, Lake County, California, June 28, 1945, *H. L. Mason 12599* (Herbarium of the University of California no. 700272). Other collections. 1.5 miles west of Lower Lake, Lake County, (topotype) *Baker 11070*; Sherwood Valley, Mendocino County, *Davy* and *Blasdale 5162*; Trinity County, *Manning 99*.

Range. Vernal pools in meadows of the inner north Coast Ranges from Lake County to Trinity County, California.

*Navarretia plieantha* sp. nov. Annu prostrata lata 5–20 cm.; caules 0.8–1.4 mm. crassitudine, epidermis saepe exfolians; folia 3–4 cm. longa, integra vel paucis lobis filiformibus remotis rarisque; bracteae foliosae 3–4 capite quoque, 1–2 capites longitudine, pinnatae, lobae 1–2 proliferatae, rachis membranis ciliatis ab utroque latere; capita lata 1–2 cm., 20–50 floribus; calyx 4–5 mm. longum, membrana ciliata-marginata truncata in sinibus, lobae acerosae, subaequales; corolla 5–6 mm. longa, caerulea; stamina in sinibus lobarum corollarum affixa, exserta; stigma aut 2-scissum aut 2-lobatum aut integrum; capsula irregulariter dehiscens, pars summa nonnihil crassa ab lateribus membranosis cum humida frangens; semina 1–3.

Prostrate annuals forming a mat 5–20 cm. broad with several stout branches but not proliferating from below a central head, the main axis often with crisped retrorse hairs, lateral stems glabrate, the epidermis often exfoliating as a white membrane-like tissue; leaves 3–4 cm. long, linear and entire or pinnate with a few remote filiform lobes; outer bracts foliaceous, 3 or 4 to each head, 1–2 times the head, pinnate, the lobes often 2–4 times proliferated or the bract simple pinnate, rachis flanked by a ciliate membrane below, bracts within the inflorescence with from 1 to several pairs of lobes below the middle, entire above or with a pair of acerose teeth; flowers in heads 1.5–2 cm. broad, heads 20–50 flowered; calyx somewhat constricted above, 4–5 mm. long, membranous throughout except for the herbaceous lobes and a line of herbaceous tissue immediately below the lobes, glabrous or with a few weak hairs except for the ciliate margin of the truncated membrane in the sinus of calyx lobes; corolla 5–6 mm. long, blue, funnelform, tube 3–3.5 mm. long, included in calyx tube, throat 0.5 mm., lobes 2 mm. long; stamens inserted in the sinuses of the corolla lobes, 2.5 mm. long; stigma exserted, 2-cleft to 2-lobed or entire; capsule not regularly dehiscent, the somewhat

thickened top breaking away irregularly from the membranous walls when wetted, the seeds working out of the constricted orifice of the calyx and resting on top; seeds about 3 to each capsule, reddish brown and minutely pitted.

Type. In peaty soil of lake margin surrounded by a black oak, madrone, Douglas fir and yellow pine forest. Boggs Lake, northwest slope of Mount Hannah, Lake County, California, June 29, 1945, *H. L. Mason 12628* (Herbarium of the University of California no. 700273).

***Navarretia pauciflora* sp. nov.** Annu prostrata 1–4 cm. alta; hypocotula cortice crassa spongiosaque; caulis filiformis crassus 0.2–0.5 mm.; folia 1–2.5 cm. longa, linearia integraque vel pinnate divisa, glabra; bracteae raras foliosae, 1–3 capites longitudine paribus pluribus lobarum sub medio; flores 2–10 in capite quoque; calyx cylindricum, 4–5 mm. longum, lobis inaequalis acerosis vel cuspidatis, ad basim sine membrana, membrana truncata et supra ciliata; corolla 5–6 mm. longa, caerulea vel alba; stamina in sinibus lobarum corollarum affixa, aequalia, exserta; stigma bilobata; capsula irregulariter dehiscens, pars summa nonnihil crassa ab muris lateralibus sejuncta; semina 1–plures.

Prostrate annual, 1–4 cm. high and spreading 2–8 cm.; hypocotyl with a thick spongy cortex; stems slender, filiform, 0.2–0.5 mm. thick, white with streaks of purple, densely clothed with short white retrorse crisped hairs or almost glabrous; leaves 1–2.5 cm. long, linear and entire or pinnately parted into 1 or 2 pairs of linear cuspidate lobes each about 2 mm. long, glabrous; outer bracts foliaceous, few, 1.5–3 times the head, with several pairs of lobes below the middle, membranous winged below, those within the head little exceeding the calyx, membranes ciliate margined, lobes acerose to cuspidate; flowers sessile or subsessile in 2–10 flowered heads, heads 4–10 mm. broad; calyx cylindric, 4–5 mm. long, membranous except for the lobes and the narrow band of tissue below them, this often reduced to a single vascular strand, membrane in the sinus truncate across the top and ciliate on the upper margin, lobes pubescent within; corolla funnelform, 5–6 mm. long, blue or white, fading blue, tube 3 mm., throat 1.5 mm., lobes 1.5 mm. long; stamens inserted in the sinuses of corolla lobes, equal in length somewhat exceeding the petals and well exerted from throat; stigma exerted, 2-lobed, lobes minute; capsule irregularly dehiscent, the somewhat thickened top falling away irregularly from the membranous sidewalls, seeds 1–several, minutely pitted, reddish brown.

Type. Playa strewn with obsidion rubble and surrounded by chaparral, 5 miles north of Lower Lake, Lake County, California, *H. L. Mason 12583* (Herbarium of the University of California no. 700271).

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