PHYTOLOGIA

An international journal to expedite plant systematic, phytogeographical and ecological publication

Vol. 86 December 2004 No. 3

PHYTOLOGIA

(ISSN 00319430)

Phytologia, a journal of plant systematics, phytogeography and vegetation ecology, is published three times a year by the Warner Herbarium, a research unit of the Department of Biological Sciences, Sam Houston State University.

Editor

Justin K. Williams
e-mail: bio_jkw@shsu.edu
PHONE: (936) 294-1552
FAX (936) 294-3940

Subscription Information & Scholarly Exchange

Phytologia
P.O. Box 2012
Sam Houston State University
Huntsville, TX 77341-2012

e-mail: bio_jkw@shsu.edu

The editor would like to thank the following individuals for reviewing articles in Volume 86

Larry Brown
Charles Bryson
Richard Carter
Vicki A. Funk
David W. Hall
Alice Hemphill
James Henrickson
Walter S. Judd
Eric Keith
Robert W. Kiger
Joseph H. Kirkbride
Marjorie Knowles
Jim Neal
Guy Nesom
Kent D. Perkins
Jennifer Pontius
Mike Powell
John Pruski
James Reveal
M. Akmal Siddiqi
Jason Singhurst
Richard Spellenberg
John Strother
Arnold Tiehm
B. L. Turner
Gayle Turner
Justin K. Williams
James L. Zarucchi

PUBLICATION DATES FOR PHYTOLOGIA VOLUME 86

86(1) March 8, 2004
86(2) September 24, 2004
86(3) December 23, 2004

NEW SUPERTRIBES, HELIANTHODAE AND SENECIONODAE, FOR THE SUBFAMILY ASTEROIDEAE (ASTERACEAE)

Harold Robinson

Department of Botany; National Museum of Natural History, P.O. Box 37012, Smithsonian Institution, Washington DC, 20013-7012.

ABSTRACT

Three supertribes are recognized in the subfamily Asteroideae of the Asteraceae; two new supertribes, Helianthodae and Senecionodae, and the typical supertribe Asterodae.

KEY WORDS: Subfamily Asteroideae, supertribes, Asterodae, Helianthodae, Senecionodae.

DNA studies in the Asteraceae have reached the point where the main elements of the family have been mostly resolved. Two papers (Panero and Funk 2002; Baldwin et al. 2002) have already made taxonomic changes needed to accommodate some of the new findings. The present paper is restricted to providing needed new major taxonomic groupings for the subfamily Asteroideae. The main divisions in the subfamily are presently the tribes, but these are obviously grouped into larger units below the subfamily level. There has been some discussion of merging well-established tribes, such as the Eupatorieae and Heliantheae, to represent these larger groupings. Reducing the number of hierarchical strata in the taxonomy of a large complex family such as the Asteraceae is not considered here as a viable option. The solution offered here is to adopt a scarcely used but functional category to increase the number of strata in the classification by adding the supertribe. The three-supertribe system for the subfamily Asteroideae adopted here includes the typical supertribe Asterodae and the new supertribes Helianthodae and Senecionodae.

The adoption of the supertribal classification has involved a search for the proper ending to be used. The supertribe rank is one of those that might be expected from provisions in the International Code of Botanical Nomenclature, but it is not found there and the rank has rarely been used in practice. Thanks to Rob Soreng, working in the Smithsonian Grass Laboratory, three examples of supertribes in the grasses can be cited. These are cited in the Catalogue of New World Grasses (Soreng et al. 2003). They are:

Supertribe Stipodae L. Liou, Acta Phytotax. Sin. 18(3):324-325 (1980), type *Stipa* L.

Supertribe Poodae L. Liou, Acta Phytotax. Sin. 18(3):324 (1980), type *Poa* L.

Supertribe Triticodae T.D. Macfarl. & L. Watson, Taxon 31(2):192 (1982), type *Triticum* L.

These previous examples of the use of the supertribe rank are helpful as a precedent, and as a source for a previously established ending for the category, -odae.

The general pattern of DNA results can be seen in Panero and Funk (2002) and Funk et al. (2004, in press). The groups here described as the Helianthodae, Senecionodae, and typical subtribe Asterodae all appear as strictly monophyletic in that study. This is achieved by placing the Inuleae in the supertribe Helianthodae in spite some features that are closer to the Asterodae. The limits of the new groups seem clearly defined in the DNA results, but supporting structural characters are not as consistent. The best character for the Senecionodae remains the specialized involucre and the best character for the Helianthodae is the presence of phytomelanin in the achene walls although this has important exceptions as indicated below.

The supertribes and the tribes they include are as follow:

Supertribe Asterodae: type *Aster* L. Achene walls without phytomelanin, usually with raphides; involucral bracts not subvalvate, mostly gradate, with margins often broadly scarious; anthers with or without long tails; style tips blunt to triangular or truncate; receptacles rarely paleate.

Included are the following tribes.

Anthemideae Cass., J. Phys. Chim. Hist. Nat. Arts 88:192 (1819).

Astereae Cass., J. Phys. Chim. Hist. Nat. Arts 88:195 (1819) (typical).

Calendulae Cass., J. Phys. Chim. Hist. Nat. Arts 88:161 (1819).

Gnaphalieae Cass. ex Lecoq & Juillet, Dict. Rais. Term. Bot.: 296. 1831.

Helianthodae H. Rob., **supertribus nov.**, type *Helianthus* L. Achaenia in parietibus plerumque phytomelaninifera rarius raphidifera; bracteae involucri non subvalvatae saepe gradatae vel herbaceae; receptacula saepe paleata; antherae non vel longe caudatae; styli apice non truncati non triangulares.

The primary characteristic, phytomelanin in the achene walls, is unique in the subfamily Asteroideae to the supertribe Helianthodae; it seems to be lacking through loss of the character in included groups such as *Marshallia* Schreb., the Gaillardiinae of the Helenieae, and *Sartoria* R.M.King & H. Rob. of the Eupatorieae. The Inuleae, which have a more basal position in the DNA results may be showing an ancestral lack of phytomelanin.

Included are the following tribes.

Athroismeae J.L. Panero, Proc. Biol. Soc. Wash. 115(4):917 (2002). The tribe probably also includes the genera of the *Anisopappus* Hook. & Arn. group, in spite of the more prismatic achenes lacking phytomelanin in the latter.

Coreopsideae (Less.) B.L.Turner & A.M.Powell, in V.H. Heywood, J.B. Harborne & B.L.Turner, eds., Biology and Chemistry of the Compositae 2:724 (1977); based on subtribe Coreopsidinae Less., Linnaea 5:153 (1830).

Eupatorieae Cass., J. Phys. Chim. Hist. Nat. Arts 88:202 (1819).

Helenieae Lindl. in Loud., Encycl. Pl.: 1074. 1829.

Heliantheae Cass., J. Phys. Chim. Hist. Nat. Arts 88:180 (1819).

Inuleae Cass., J. Phys. Chim. Hist. Nat. Arts 88:193 (1819). Including Plucheeae (Benth.) Anderb., Canad. J. Bot. 67:2293 (1989); based on subtribe Plucheinae Benth. in Benth. & Hook.f., Gen. Pl. 2:180 (1873)(Plucheineae).

Tageteae Cass., J. Phys. Chim. Hist. Nat. Arts 88:162 (1819).

Senecionodae H. Rob., **supertribus nov.**, type *Senecio* L. Achaenia in parietibus non phytomelaninifera; bracteae involucri subvalvatae non gradatae plerumque inferne calyculatae; antherae non vel breviter caudatae; styli plerumque truncati vel penicillati rarius triangulares; receptacula non paleata.

The achene walls examined of the Senecioneae lack raphides, but the raphides in the ovules show through and often seem to be in the wall (Janovec & Robinson 1997).

The supertribe includes only the single following tribe.

Senecioneae Cass., J. Phys. Chim. Hist. Nat. Arts 88:196 (1819).

ACKNOWLEDGMENTS

I thank Vicki A. Funk, Marjorie Knowles, Guy L. Nesom, and James Reveal for reviewing the paper and making helpful suggestions.

LITERATURE CITED

Baldwin, B. G., B. L. Wessa, and **J. L. Panero.** 2002. Nuclear rDNA evidence for major lineages of Helenioid Heliantheae (Compositae). Syst. Bot. 27:161-198.

Funk, V. A., R. J. Bayer, S. Keeley, R. Chan, L. Watson, B. Gemeinholzer, E. Schilling, J. L. Panero, B. G. Baldwin, N. T. Garcia-Jacas, A. Susanna and **R. K. Jansen.** 2004. Everywhere but Antarctica: Using a supertree to understand the diversity and distribution of the Compositae. In: Friis, I. & Balslev, H. (eds.) Proceedings of a Symposium on Plant Diversity and Complexity Patterns - Local, Regional and Global Dimensions. The Royal Danish Academy of Sciences and Letters, Copenhagen. Pp. 000-000. (page proofs expected in August 04)

Janovec, J. P. and **H. Robinson.** 1997. *Charadranaetes*, a new genus of the Senecioneae (Asteraceae) from Costa Rica. Novon 7(2):162-168.

Panero, J. L. and **V. A. Funk**. 2002. Toward a phylogenetic subfamilial classification for the Compositae (Asteraceae). Proc. Biol. Soc. Wash. 115(4):909-922.

Soreng, R. J., P. M. Peterson, G. Davidse, E. J. Judziewicz, F. O. Zuloaga, T. S. Filgueiras and **O. Morrone.** 2003. Catalogue of New World Grasses (Poaceae): IV. Subfamily Pooideae. Contr. U. S. Natl. Herb. 48:1-730.

NEW ENTITIES IN *ERIOGONUM* (POLYGONACEAE: ERIOGONOIDEAE)

James L. Reveal

University of Maryland, College Park, MD 20742-5815
Honorary Curator, New York Botanical Garden, Bronx, NY 10458-5126, U. S. A.
Mailing Address: 18625 Spring Canyon Road, Montrose, CO 81401-7906, U. S. A., jr19@umail.umd.edu

ABSTRACT

A series of new species and varieties of *Eriogonum* (Polygonaceae: Eriogonoideae) are validated for inclusion in forthcoming volumes of *Intermountain Flora* and *Flora of North America*. The new species are *E. artificis*, *E. evanidum*, *E. mitophyllum* and *E. terrenatum*. The new varieties are *E. brevicaule* var. *caelitum*, *E. corymbosum* var. *heilii*, *E. corymbosum* var. *nilesii*, *E. douglasii* var. *elkoense*, *E. douglasii* var. *meridionale*, *E. heermannii* var. *subspinosum*, *E. microthecum* var. *arceuthinum*, *E. microthecum* var. *lacus-ursi*, *E. microthecum* var. *schoolcraftii*, *E. prociduum* var. *mystricum*, *E. umbellatum* var. *ahartii*, *E. umbellatum* var. *canifolium*, *E. umbellaltum* var. *lautum*, *E. umbellatum* var. *mohavense*, *E. umbellatum* var. *nelsoniorum*, *E. umbellatum* var. *ramulosum*, *E. umbellatum* var. *sandbergii* and *E. umbellatum* var. *stragulum*. One variety, *E. microthecum* var. *lacus-ursi*, is proposed jointly with Andrew C. Sanders.

KEY WORDS: Polygonaceae, Eriogonoideae, *Eriogonum*.

In the process of preparing treatments of Polygonaceae Juss. subfam. Eriogonoideae Arn. for the Intermountain Flora and Flora of North America projects, a number of new entities were found. These are validated below.

Eriogonum artificis Reveal, ***sp. nov.*** TYPE: UNITED STATES. Utah, Beaver Co.: San Francisco Mts., lower slope of Squaw Peak, 1.3 air

mi W of Squaw Peak and 3.4 air mi SW of Frisco, 1.2 mi S of Utah Hwy. 21, associated with *Ephedra*, *Grayia*, and *Juniperus*, N38°25′11″, W113°18′00″, T27S, R13W, sec. 34 center, 5925 ft elev., 14 Jul 2001, *J. L. Reveal 8328*. HOLOTYPE: NY. Isotypes: ARIZ, ASC, ASU, BM, BRY, CAS, COLO, GH, ID, K, MARY, MICH, MO, MONTU, OSC, RENO, RM, RSA, TEX, UC, UNLV, US, UT, UTC, WS, WTU.

A *Eriogono spathulato* caulis glabris cum inflorescentibus longioribus et involucris solitaris differt.

Plants erect, spreading, herbaceous perennials (2) 3–4.5 dm tall, 1–2 (3) dm across, with a short, spreading, sparsely branched caudex system arising from a woody taproot; *leaves* basal or sheathing up the stem 1–3 cm, the leaf-blades narrowly elliptic, 2–5 cm long, (0.8) 1–1.5 (1.7) cm wide, grayish tomentose on both surfaces, the margins plane, the petioles 2.5–4 cm long, tomentose; *flowering stems* erect, 1–2 dm, glabrous except pubescent among the leaves; *inflorescences* cymose, 1–2.5 dm long, 0.5–1.5 dm wide, glabrous; *bracts* 3, scalelike, 2–3 mm long, triangular; *peduncles* commonly present at lower nodes, erect, slender, 2–10 mm long, lacking at the upper nodes; *involucres* solitary at each dichotomy, turbinate, 3.5–4 mm long, 2–2.5 mm, glabrous, the teeth 5 (6), erect, 0.5–0.8 mm long; *flowers* ochroleucous to pale yellow, rarely yellow, 3.5–4 mm long, glabrous, the tepals monomorphic, oblong, united 1/5 their length; *stamens* exserted, the filaments 5–6 mm long, pilose basally; *achenes* light brown, trigonous, 3.5–4 mm long, glabrous.

Other specimens seen.

UNITED STATES. Utah, Beaver Co.: Squaw Peak, T27S, R13W, sec. 34, 30 Aug 1981, *B. Welsh & K. H. Thorne 1302* (BRY, NY).

Eriogonum artificis (from the Latin *artificis*, meaning "artist") is here proposed to honor Kaye Hughie Thorne, 1939-2004, the noted botanical illustrator formerly at Brigham Young University. The new species is known currently only from the type location where it occurs on sandy to somewhat gravelly, volcanic slopes in a mixed grassland and sagebrush community in association with *Juniperus osteosperma* (Torr.) Little. It

flowers from August through September. The only known population consists of several hundred individuals in a geologically restricted area of less than three acres. The new species is most closely related to *E. spathulatum* A. Gray of the subg. *Eucycla* Nutt., differing from the normal phase of that species by having glabrous flowering stems and branches and a longer (1-2.5 dm versus 0.3-1 dm) inflorescence. In addition, the involucres of Kaye's wild buckwheat are consistently solitary at each node whereas those of *E. spathulatum* are typically in clusters of mostly three to six per node. Scattered populations of *E. spathulatum* in western Utah (and especially in the nearby San Francisco Mountains) consist of plants with both tomentose and glabrous flowering stems and branches; those with glabrous stems have been recently segretated as *E. spatulatum* var. *kayeae* S. L. Welsh. Such plants are restricted to rocky limestone outcrops mainly on slopes and ridges, with both glabrous and tomentose individuals intermixed, and a formal taxonomic distinction can be justified.

Eriogonum brevicaule Nutt. var. ***caelitum*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Utah, Sanpete Co.: Wasatch Plateau, N of Horseshoe Flat at the junction of Skyline Drive and road to Clay and Olsen benches, 6 mi N of Utah Hwy. 29, about 10.2 air mi E of Ephraim, N39°22′21″, W111°23′45″, T17S, R5E, sec. 6 NESE¼, 10835 ft elev., 23 Aug 2001, *J. L. Reveal 8352*. HOLOTYPE: NY. Isotypes: BM, BRY, CAS, COLO, GH, ID, IDS, MO, OSC, RENO, RM, RSA, TEX, UC, US, UT, UTC, WTU.

A *Eriogono brevicaulis* var. *laxifloro* plantis caespitosis cum foliis brevioribus et inflorescentibus aeque capitatis differt.

Plants cespitose perennials 0.6–1.8 (2) dm tall, 1–2.5 dm across, forming tight, dense clumps composed of a highly branched caudex system and persistent leaf bases atop of stout, woody taproot; *leaves* basal, not sheathing up the stems, the leaf-blades narrowly oblanceolate, 0.2–5 (5.5) cm long, (0.2) 0.3–0.6 (0.7) cm wide, tomentose abaxially, thinly floccose and bright green adaxially, the margin plane but slightly

thickened, the petioles 0.5–1.5 (2) cm long; *flowering stems* scapose, erect, 0.5–1.5 dm long, densely floccose to tomentose, greenish; *inflorescences* capitate, 1–2 cm across; *involucres* 3–7 per cluster, turbinate to turbinate-campanulate, 2–3.5 (4) mm long, 2–3 (3.5) mm wide, floccose to more commonly tomentose; *flowers* yellow, 2.5–3.5 (4) mm long.

Representative specimens seen.

UNITED STATES. Utah, Emery Co.: East Mtn., 12 mi NW of Orangeville, T16S, R6E, sec. 23, 10000 ft elev., 1 Aug 1982, *Albee 5318* (UT). Sanpete Co.: Heliotrope Mtn. above Ferron Reservoir, T19S, R4E, sec. 34 SWSE¼, 17 Jul 1981, *Atwood 8003* (ASU, BRY); Horseshoe Ridge, 10600 ft elev., 4 Aug 1913, *Becraft 430* (USFS); 1 mi NW of Willow Lake, Ferron Canyon, aspen, T19S, R5E, sec. 21, 8000 ft elev., 28 Jul 1977, *Clark 1854* (BRY); plateau S of Olsen Canyon, 9700, T17S, R5E, sec. 32, 9700 ft. elev., 12 Aug 1977, *Clark 3198* (BRY, MARY); ridge between Ferron Reservoir and Duck Creek Reservoir, T19S, R4E, sec. 13, 10400 ft elev., 12 Aug 1977, *Clark 3219* (BRY); Horseshoe, 11000 ft elev., 4 Aug 1952, *Cottam 13401* (UT); Horseshoe Summit, 3330 m elev., 17-18 Aug 1914, *Eggleston 10584* (US); Wasatch Plateau, 19 Aug 1938, *Flowers 8024* (UC); S end of Heliotrope Mtn., T19S, R4E, sec 34SE¼SW¼, 10950 ft elev., 10 Jul 1989, *Franklin 6786* (BRY); S end of Wagon Road Ridge, 10000 ft elev., 18 Jul 1951, *B. F. Harrison 11856* (US); Wasatch Plateau, 1 mi E of Skyline Drive on Horseshoe Ridge, 10700 ft elev., 5 Aug 1948, *Holmgren & Holmgren 7814* (BRY, CAS, CS, DAV, DS, GH, IDS, NY, RSA, UTC, WTU); Wasatch Plateau, S of Big Horseshoe, T17S, R5E, sec. 6, 10700 ft elev., *N. H. Holmgren et al. 2404* (ARIZ, BRY, CAS, IDS, GH, NY, RSA, UC, UTC, WTU); top of Wasatch Peak [sic., Plateau], 11000 ft elev., 3 Aug 1927, *Humphrey 103* (USFS); Heliotrope Mtn., 11000, 13 Jul 1977, *M. E. Lewis 4921* (BRY, COLO); Wasatch Plateau, Heliotrope Point, 11100 ft elev., 23 Jul 1976, *M. E. Lewis 4309* (BRY, UTC); road gap to head of Reeder Canyon, 10900 ft elev., 10 Aug 1978, *M. E. Lewis 5625* (BRY); Buck Ridge, 9700 ft elev., 24 Aug 1917, *Sampson 683* (USFS); E tip of Wagon Road Ridge, 10100 ft elev., 10 Aug 1962, *J. D. Walker s.n.* (BRY); 17 mi W of Ferron, T20S, R4E, sec 33, 11000 ft elev., 13 Jul 1977, *Welsh & Clark 15384* (BRY); Wasatch Plateau, 21 mi S of Mt. Pleasant, T18S, R4E, sec. 25, 10700 ft elev., 12 Aug 1977, *S. L. Welsh et al. 16105* (BRY,

MARY). Sevier Co.: White Mtn., T21S, R4E, sec. 3, 10700 ft elev., 3 Aug 1979, *Albee 4694* (UT); White Mtn., T21S, R4E, sec. 4 SE¼, 14 mi NW of Emery, 3440 m elev., 6 Aug 1983, *Tuhy 1043* (BRY).

Eriogonum brevicaule var. *caelitum* (from the Latin *caelitus*, meaning "from heaven," alluding to the high elevation of the type locality) is restricted to the high ridge and mesa tops of the southern Wasatch Mountains mainly in Sanpete Co., Utah, at elevations from 2750-3650 m elevation. The Wasatch Plateau wild buckwheat is found on the edges of high-elevation meadows typically on exposed rock outcrops. The plants now assigned to var. *caelitum* were long included within var. *laxifolium*. (Torr. & A. Gray) Reveal. As now defined plants of var. *laxifolium* are taller, non-cespitose plants of lower elevations with longer and narrower leaves that are markedly hairy on the upper surface. The inflorescences of var. *laxifolium* are typically branched but may be capitate; populations with both conditions are rather common along the Wasatch front. Unlike the var. *nanum* (Reveal) S. L. Welsh found in the northern Wasatch Mountains, the scapes of var. *caelitum* are tomentose rather than glabrous.

Eriogonum corymbosum Benth. var. ***heilii*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Utah, Wayne Co.: Fishlake National Forest, Thousand Lake Mts., head of Red Canyon, 0.9 air mi WSW of Saddle Pass Spring and 0.9 air mi SE of Horse Pasture, 3.8 air mi ESE of Lyman and 2.9 air mi ENE of Bicknell, on shaly slopes of the Carmel Formation, associated with *Pinus aristata*, *Heterotheca villosa*, *Theliosperma windhamii*, *Tetraneuris acaulis* var. *nana*, *Cercocarpus montanus*, *Phlox*, and *Cirsium* at 9100 ft elev., N38°22′45″, W111°31′21″, T28S, R4E, sec. 18 NWNW¼, 1 Sep 2004, *J. L. Reveal*, *C. R. Broome*, *D. J. Clark* & *C. M. Groebner 8543*. HOLOTYPE: NY. Isotypes: ARIZ, ASU, BM, BRY, CAS, COLO, GH, MARY, MICH, MO, OSC, RENO, RSA, TEX, UC, US, UTC, WTU.

A *Eriogono cormyboso* var. *corymboso* inflorescentibus capitatus, raro umbellatus, floribus glabris vel infrequenter parce pilosis differt.

Plants low sprawling subshrubs (0.25) 0.5–2 dm tall and (1.2) 2–4 dm across or, occasionally, spreading to rounded shrubs 2–4.5 dm tall and 4–9 dm across; *leaves* sheathing up the stem 1–4 cm, the leaf-blades lanceolate to elliptic or oblanceolate, 0.5–2 cm long, 3–6 (8) mm wide, densely white tomentose abaxially, tomentose to floccose and greenish adaxially, the margins entire or slightly wavy, the petioles 1–3 mm long; *flowering stems* erect, 1–3 (5) cm long or, if scapose, 3-9 cm long, tomentose to floccose; *bracts* ternate, elongate-triangular to linear, 1–3 mm long, 0.3–1 mm wide, thinly tomentose; *inflorescences* capitate and 1–1.5 cm across, or umbellate or cymose, di- or trichotomous at the nodes and 2–4 (8) cm long, 3–6 (12) cm across, the branches tomentose to floccose; *peduncles* lacking; *involucres* solitary at each dichotomy, turbinate, (2) 2.5–3.5 mm long, 1.5–2.5 mm wide, tomentose to floccose, the teeth 5, triangular, 0.4–0.6 mm long; *flowers* white to pink with dark red midribs, 2–3 mm long, glabrous abaxially, rarely with scattered pilose hairs basally and then only before anthesis, sparsely pilose and/or minutely glandular along the midrib adaxially, the tepals essentially monomorphic, oblong, connate 1/4 to 1/3 their length; *stamens* slightly exserted, 2–3 mm long, the filaments pilose basally, the anthers red or purple, oval, 0.3–0.4 mm long; *achenes* light brown, trigonous, 2.5–3 mm long, glabrous, the globose base tapering abruptly to a 3-angled beak.

Other specimens seen.

UNITED STATES. Utah, Wayne Co.: Fish Lake National Forest, Thousand Lake Mts., 3 air mi N of Bicknell, T28S, R4E, sec, 13NE¼ [sic?, 18NW¼], 9000 ft elev., 20 Jul 1980, *Atwood & Thompson 7645* (BRY); Fishlake National Forest, Thousand Lake Mts., Bristlecone Toe N of Deep Creek, NE of Indian Spring and W of Deep Creek Spring, S of Billings Pass and SW of Billings Peak, 9.4 air miles NE of Bicknell, N38°26′24″, W111°25′28″, T27S, R4E, sec. 25 NW¼, 9040 ft elev., 9 Sep 2004, *Clark & Groebner 1* (BRY, CAS, GH, NY, US, UTC); Capitol Reef National Park, Thousand Lake Mts., Bristlecone Flats N of Deep Creek near head of Bullberry Creek, SE of Deep Creek Spring, SE of Billings Pass and SSE of Billings Peak, 9.6 air miles NE of Bicknell, N38°26′13″, W111°25′02″, T27S, R4E, sec. 25 NENE¼, 8840 ft elev., 9

Sep 2004, *Clark & Groebner 2* (BRY, CAS, GH, NY, US, UTC); Capitol Reef National Park, Thousand Lake Mts., Red Cone near head and N of Bullberry Creek, E of Billings Pass and Billings Peak, ESE of Pine Spring, 10.5 air miles NE of Bicknell, N38°26′43″, W111°24′09″, T27S, R5E, sec. 19 NWSE¼, 8200 ft elev., 9 Sep 2004, *Clark & Groebner 3* (BRY, CAS, GH, NY, US, UTC); Capitol Reef National Park, Thousand Lake Mts., Deep Creek near Billings Pass, T27S, R4E, sec. 25 NW¼, 11 Jul 1986, *Heil 2638* (BRY, SJNM); Capitol Reef National Park, Thousand Lake Mts., upper Deep Creek near the head of Bullberry Creek, T27S, R5E, sec. 19 SW¼, 2600 m elev., 24 Jul 1987, *Heil 3558* (SJNM); Capitol Reef National Park, Thousand Lake Mts., upper Deep Creek, T27S, R4E, sec. 25 NE¼, 9000 ft elev., 28 Jul 1988, *Heil & Mietty 4648* (SJNM); Capitol Reef National Park, Thousand Lake Mts., upper Deep Creek, T27S, R4E, sec. 25 NE¼, 9000 ft elev., 28 Jul 1988, *Mietty 3321* (SJNM).

Eriogonum corymbosum var. *heilii* (named for Kenneth D. Heil, 1941–, professor of biology at San Juan College, Farmington, New Mexico), is allied to *E. corymbosum* var. *corymbosum*, differing mainly in its low, sprawling habit, smaller leaves, and capitate or umbellate inflorescences. Some of the flowers at the Deep and Bullberry creek sites have sparsely pilose hairs in early anthesis; they are consistently glabrous at the type location.

Heil's wild buckwheat is confined to the upper slopes of the Thousand Lake Mountains. It occurs with Rocky Mountain bristlecone pine (*Pinus aristata* Engelm.), elevationally well above most known population of *E. corymbosum* except some populations of var. *revealianum* (S. L. Welsh) Reveal which do not occur on sites dominated by bristlecone pine. At lower elevations above Bullberry Creek, but still on the white shale outcrops of the Carmel Formation where var. *heilii* occurs, the plants become larger, more shrubby, and clearly approach var. *corymbosum* in aspect. Only the plants at Red Canyon (the type location) have capitate to compact umbellate inflorescences. Elsewhere, they are compact to openly umbellate.

In addition to the associated species mentioned with the type collection, others found there and elsewhere include *Pinus ponderosa*, *Pseudotsuga menziesii* var. *glauca*, *Juniperus osteosperma*, *Eremogone fendleri*, *Physaria acutifolia*, *Oxytropis oreophila*, *Purshia tridentata*, *Shepherdia rotundifolia*, *Chrysothamnus viscidiflorus*, *Townsendia aprica*, and *Leymus salina*.

Detailed searches for additional populations of Heil's wild buckwheat by Deborah J. Clark of the National Park Service (who also serves as botanist to the Fishlake National Forest via an interagency agreement) have yet to reveal additional populations. Although the Carmel Formation, where the plant is found, is broadly exposed on Thousand Lake Mountain, shale outcrops–where the variety is confined–are rare. Plants at the type location are subject to some off-road vehicle (ORV) activity, but the Deep and Bullberry Creek sites within Capitol Reefs National Park are remote and not subject to disturbance. Each of the known populations harbors some three hundred individuals with a broad range of age-classes present.

Eriogonum corymbosum Benth. var. ***nilesii*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Nevada, Clark Co.: Muddy Mts., White Basin area, W of West Longwell Ridge, 4.2 air mi NW of Bitter Spring and 15.4 air mi SW of Overton, 2.7 mi N of American Borax Road in an unnamed side wash associated with *Larrea*, *Ambrosia*, and *Atriplex*, N36°20′15″, W114°33′09″, T18S, R66½E, sec. 31 SE¼, 2140 ft elev., 4 Oct 2002, *J. L. Reveal 8380*. HOLOTYPE: NY. Isotypes: ARIZ, ASC, ASU, B, BM, BRY, CAS, COLO, CTES, GH, ID, K, MARY, MICH, MO, MONTU, OSC, RENO, RM, RSA, SJCC, TEX, UC, UNLV, US, UTC, WTU.

A *Eriogono corymboso* var. *glutinoso* foliis lanatis differt.

Plants open to somewhat spreading or rarely slightly roundish perennial shrubs, 0.3–1.2 m tall, 0.4–2.3 m across; *leaves* elliptic to oblong, 0.8–2.5 (3) cm long, 0.4–0.8 cm wide, white lanate to densely white tomentose abaxially, slivery-floccose adaxially, the petioles 0.3–1.5 cm long; *inflorescences* 0.2–2 dm long, compact to open, floccose;

involucres 1.5–2 mm long, 1–1.5 mm wide; *flowers* yellow to pale yellow, rarely white, 2–3 mm long, the tepals slightly dimorphic.

Representative specimens seen.

UNITED STATES: Arizona, Mohave Co.: Pierce Wash, T41N, R11W, sec. 3, 3000 ft elev., 13 Sep 1978, *Gierisch 4506* (ARIZ). Nevada: Clark Co.: Sunset Road at Whitney Mesa, Las Vegas, 15 Sep 1980, *G. T. Austin s.n.* (BRY, MNA); 2 mi NE of Gold Butte, 3500 ft (1067 m), 27 Sep 1985, *Bechtel & Verchick s.n.* (MNA); near McCarran Airport, 14 Aug 1970, *Bourde s.n.* (ASC); University of Nevada campus, Las Vegas, 2800 ft elev., 23 Oct 1970, *Christensen s.n.* (UNLV, UT); Patrick Land and Maryland Parkway, Las Vegas, 2000 ft elev., *Knight 2003b* (BRY, MNA, NY); Longwell Ridge, Muddy Mts., T18S, R67E, sec. 30, 650 ft elev., 15 Oct 1999, *Niles et al. 6214* (NY); 1 mi N of Craig Road, w side of I-15, North Las Vegas, T20S, R62E, sec. 31, 1930 ft (588 m), 15 Oct 1999, *Niles et al. 6218* (RENO); S of Corn Creek Wash, W of North Decater Boulevard, T19S, R61E, sec. 7 NE¼ and sec. 8 NW¼, 2300 ft elev., 4 Oct 2002, *Reveal & Glenne 8379* (ARIZ, ASC, ASU, BM, BRIT, BRY, CAS, COLO, GH, ID, K, KANU, MARY, MICH, MO, NY, OSC, RENO, RM, RSA, SJCC, TEX, UC, UNLV, US, UTC, WTU).

Eriogonum corymbosum var. *nilesii* (for Wesley Everett Niles, 1939– , associate professor and curator of the herbarium at the University of Nevada at Las Vegas) is a widely scattered variety found primarily on the Mojave Desert of southern Nevada. The Las Vegas wild buckwheat has traditionally been assigned to the Colorado Plateau variant, var. *glutinosum* M. E. Jones, but differs in its white lanate to densely white tomentose leaves and disjunct distribution. A population from the flood plain of the Paria River in Kane Co., Utah, might be var. *nilesii* but remains to be studied in the field.

Eriogonum douglasii Benth. var. ***elkoense*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Nevada, Elko Co.: Sunflower Flat, S side of U.S. Forest Service Road 930, 0.8 mi E of U.S. Forest Service Road 931 (McDonald

Creek Road), 1.4 air mi ESE of Point of Rock and approximately 11 air mi SE of Mountain City, associated with *Artemisia nova* and various grasses, N41°46′24″, W115°46′06″, T44N, R55E, sec. 28 NE¼, 6550-6600 ft elev., 30 Jun 2001, *J. L. Reveal 8315*. HOLOTYPE: NY. Isotypes: ASU, BM, BRY, CAS, COLO, GH, MARY, MO, OSC, RENO, RM, RSA, TEX, UC, US, UTC, WTU.

A *Eriogono douglasii* var. *douglasii* foliis lanatis differt.

Plants matted; *leaf-blades* elliptic, densely lanate on both surfaces, sometimes slightly less so and faintly greenish adaxially, the margins plane; *flowers* cream or ochroleucous, 5–8 mm long, sparsely villous.

Other specimens seen.

UNITED STATES. Nevada, Elko Co.: Jarbidge Range, 5 air mi NE of Wildhorse State Park along U.S. Forest Service Road 929, T44N, R55E, sec. 2, 6920 ft elev., 29 Jun 1995, *Curto & Smith 1455* (MNA, NY, UTC); Sunflower Flat, 1.3 air mi NE of Point of Rocks along U.S. Forest Service Road 931, T45N, R55E, sec. 21, 6500 ft elev., 30 Jun 1995, *Curto & Smith 1457* (UTC); N of Sunflower Flat, near Bieroth Spring, T45N, R55E, sec. 14, 6700 ft elev., 18 Jul 1980, *Williams & Tiehm 80-210-5* (CAS, NY, RENO); Chipman Meadow, 1.3 air mi NE of Point of Rock, along U.S. Forest Service Road 931 (McDonald Creek Road), NW of Sunflower Flat, T44N, R55E, sec. 21, 30 Jun 2001, *Reveal 8313* (BRY, CAS, MARY, NY, RENO, UC, US, UTC).

Eriogonum douglasii var. *elkoense* is known only from the Sunflower Flat area northeast of Wild Horse State Park in Elko Co., Nevada. The Sunflower Flat wild buckwheat is well isolated from the nearest populations of var. *douglasii* in north central Oregon, and populations of var. *meridionale* Reveal that occur only along the western edge of Nevada.

Eriogonum douglasii Benth. var. ***meridionale*** Reveal, ***var. nov.*** TYPE: UNITED STATES. California, Plumas Co.: Squaw Valley at the road junction of Forest Service roads 28N01 and 28N70 on flat W of road, 11.9 air mi NNW of Beckwourth, associated with *Artemisia nova*, *Purshia*

tridentata, and *Eriogonum umbellatum* var. *nevadense*, N39°59′28″, W120°24′21″, T.25N, R14E, sec. 27 NWSW¼, 5600 ft elev., 25 Jun 2002, *J. L. Reveal 8361*. HOLOTYPE: NY. Isotypes: ARIZ, BRY, CAS, COLO, CPH, GH, HSC, MARY, MICH, MO, OSC, RENO, RM, RSA, TEX, UC, US, UTC, WTU.

A *Eriogono douglasii* var. *elkoense* floribus brevioribus (4–5 mm nec 5–8 mm longis).

Plants matted; *leaf-blades* broadly elliptic to spatulate, densely grayish lanate on both surfaces, plane; *flowers* yellow or ochroleucous to rose-red, 4–5 mm long, densely villous.

Representative specimens seen.

UNITED STATES: California: Lassen Co.: between Aspen Flat and Red Rock Lookout, Diamond Mtn., 7380 ft elev., 24 Jun 1997, *Oswald & Ahart 8639* (JEPS); S of Johnstonville, 4350 ft elev., 13 Jun 1943, *Ripley & Barneby 5712* (CAS); 14 air mi NE of Ravendale, 5700 ft elev., 7 Jun 1988, *Schoolcraft 1812* (UC). Modoc Co.: S of Warren Peak, Warner Mts., 1 Aug 1932, *Applegate 8019* (DS); Lake City Mtn., Jun 1898, *Bruce 2315* (UC); N of Parker Creek, Warner Mts., 26 Jun 1932, *Payne 605* (JEPS). Nevada Co.: 5.2 mi N of Boca on the Stampede Dam Road, 5800 ft elev., 12 May 1972, *Howell & True 7128* (CAS). Plumas Co.: turnoff of Marble Lane and Co. Rd.A-23, T22N, R14E, sec 13 SW¼, 4888 ft elev., 27 May 1989, *Harnach & Harnach 119* (RENO); ridge E of Red Clover Valley, 4 Jul 1907, *Heller & Kennedy 8717* (BKL, CAS, DS, F, GH, ILL, IND, MO, TEX); along the road N of Conklin Park above Willow Creek, 0.8 mi S of U.S. Forest Service Road 27N25, T26N, R14E, sec. 26, 5750 ft elev., 25 Jun 2002, *Reveal 8362* (MARY, US); 3.75 mi NE of Beckwith Butte, 4900 ft elev., 4 Jun 1935, *Sawyer 61* (UC). Sierra Co.: 1.5 mi NW of Sierraville along California Hwy. 89, 5000 ft elev., 13 Jun 1962, *Breedlove 3509* (CAS, DS); Newman Point, T21N, R14E, sec. 25 NE¼, 5000 ft elev., 7 May 1989, *Harnach & Harnach 60* (RENO); Webber Lake, sin date, *Lemmon s.n.* (JEPS); 4 mi NE of Loyalton, 1750-1800 m elev., 22 May 1937, *Stebbins & Jenkins 2127* (UC). Siskiyou Co.: 1 mi NE of Buckhorn, 17 Jul 1986,

Heckard et al. 6544 (JEPS), N side of Black Mtn., 6800 ft elev., 8 Jul 1935, *Hitchcock & Martin 5304* (BRY, CAS, DS, GH, OKL, POM, UC, UTC, WTU). Nevada, Washoe Co.: 8 mi SW of Reno on the Hunter Creek Road, 24 Jun 1938, *Archer 6117* (ARIZ, GH, RENO, WIS/LCU); Ecology Canyon, 3.5 mi N of Reno on U.S. Hwy 395, 16 May 1950, *Bandoni 29* (RENO); N side of Hunter Creek road, 8 mi SW of Reno, 12 May 1937, *Breene 24* (RENO); S side of Hunter Creek, 6 mi SW of Reno, 13 May 1937, *Breene 46* (RENO); Ecology Canyon, 3.5 mi N of Reno, 5000 ft elev., 23 Apr 1947, *D. Brown s.n.* (RENO); N of Reno, 1906, *Frandsen s.n.* (RENO); E side of Peavine Mtn., 15 Jun 1901, *Heizer 315* (NESH, RENO); Peavine Mtn., 22 Jun 1909, *Heller 9756* (DS, GH, NESH); 5 mi W of Reno on Hunter Lake Road, 25 May 1937, *Henrichs 82* (RENO); Dinsmore Camp, Hunter Creek Canyon, 20-25 Jun 1907, *P.B. Kennedy 1637* (NESH); 6 mi W of Reno, 5800 ft elev., 23 Apr 1959, *Schank s.n.* (RENO); 5 mi N of Reno on US Hwy 395, to the left of highway on Peavine Mtn., 5000 ft elev., 23 Apr 1959, *W. Short 26* (RENO); 3 mi N of Reno on US Hwy 395, 1 mi W on a high ridge, T19-20N, R 19E, 4500 ft elev., 25 Apr 1959, *Sloan 11* (RENO); Virginia Mts., 0.5 mi E of Spanish Fork Road along road to Lower Scott Spring, T25N, R20E, sec. 18, 6850 ft elev., 28 May 2002, *Tiehm 13869* (ARIZ, NY, RENO, 12 duplicates to be distributed); NW side of Peavine Mtn. just beyond Martin's Meadow, 6000 ft elev., 28 May 1972, *M.J. Williams 72-37-4* (RENO); E side of Peavine Mtn., hill W of N Virginia Street and SE Black Springs, 5220 ft elev., 20 May 1973, *M.J. Williams & E. McPherson 73-8-3* (RENO).

Eriogonum douglasii var. *meridionale* (from the Latin *meridionalis*, for "southern") has long been confused with the more northern var. *douglasii* of north central Oregon and central Washington. The southern wild buckwheat is found primarily in northeastern California, but extends from southern Washoe Co., Nevada, northward to southern Jackson Co., Oregon. The plant just enters the Intermountain Region near Pyramid Lake north-northeast of Reno. None of the varieties of *E. douglasii* overlap in their distributions.

Eriogonum evanidum Reveal, ***sp. nov.*** TYPE: UNITED STATES. California: San Bernardino Co.: Bear Valley, San Bernardino Mts., 5

Aug 1902, *L. Abrams 2894*. HOLOTYPE: NY. Isotypes: C, CAS, F, GH, MIN, MO, NEB, NY, P, POM, UC, WTU.

A *Eriogono folioso* caulis erectis et bractis minutis differt.

Plants erect annual herbs 1–2 dm tall; *leaves* basal, the leaf-blades broadly ovate to orbicular or reniform, 0.7–1.2 cm long and wide, densely white tomentose abaxially, floccose and greenish adaxially, the margins plane, the petioles 0.5–1.5 cm long, tomentose; *flowering stems* erect, 3–6 cm long, tomentose to floccose; *inflorescences* narrowly cymose, 0.5–1.5 dm long, tomentose to floccose; *bracts* 3, scalelike, 0.5–2 mm long, 0.5–1 mm wide, triangular, floccose abaxially, glabrous adaxially; *peduncles* lacking; *involucres* solitary at each dichotomy, campanulate, 1–2 mm long and wide, glabrous except for a few scattered hairs on the rim in some, the teeth 5, spreading, 0.4–0.8 mm long; *flowers* ochroleucous, 0.8–1.2 mm long, glabrous, the tepals dimorphic, those of the outer whorl ovate and weakly hastate, those of the inner whorl lanceolate to narrowly elliptic, connate about ¼ of their length; *stamens* included, the filaments 0.4–0.6 mm long, glabrous, the anthers oval, 0.3–0.4 mm long; *achenes* dark brown, trigonous, 1.3–1.5 mm long, glabrous, abruptly tapering to a slightly 3-angled beak.

Other specimens seen.

UNITED STATES. California, Riverside Co.: Hemet Valley, San Jacinto Mts., 4600 ft elev., 10 Oct 1967, *Ziegler s.n.* (GH, RSA, UC, UTC). San Bernardino Co.: San Bernardino Mts., Bear Valley, 3 Aug 1901, *Abrams 2087* (DS, NY, POM); Metcalf Bay, Big Bear Lake, 6800 ft elev., 29 Jul 1929, *Ewan 1494* (RM); flat above Big Bear Lake, 29 Sep 1927, *Hoffmann 2954* (JEPS); Baldwin Lake, 23 Sep 1927, *M. E. Jones s.n.* (POM); Baldwin Lake, 17 Aug 1929, *M. E. Jones 24824* (MIN, POM); SW slope of Baldwin Lake, 6800 ft elev., 23 Aug 1929, *Pierson 8587* (RSA); S of Peter Pan Woodland Club, Bear Valley, 7000 ft elev., 5 Oct 1929, *Pierson s.n.* (POM); Bear Valley, Aug 1900, *Shaw & Illingsworth 124* (DS); between Big Bear and Baldwin Lake, 6750 ft elev., 7 Sep 1931, *Templeton 1588* (BRY, KANU, NY). San Diego Co.: Pine Valley, 23 Oct 1893, *Alderson 339* (DS); Pine Valley, 25 Oct 1930,

Fosberg S4143 (SD, mixed with *E. gracile*); Pine Valley, 2 Sep 1938, *Gander 6450* (SD); San Diego, 1883, *Parry s.n.* (ISC). MEXICO: Baja California: Lower California, 1884, *Orcutt s.n.* (ARIZ, MO, NY).

This distinctive species has been hidden quietly under *Eriogonum foliosum* S. Watson awaiting the rediscovery of an extant population so that it might be more precisely characterized than possible from dried material. None has been found and so it is described from a widely distributed collection. *Eriogonum evanidum* (from the Latin *evanidus*, meaning "vanishing" or "disappearing") differs from *E. foliosum* and *E. hastatum* Wiggins, both restricted to Baja California, in being an erect (not sprawling) plant with scalelike (not foliaceous) inflorescence bracts. The flowers of the vanishing wild buckwheat are more like those of *E. foliosum* than *E. hastatum*, as the outer tepals are only weakly hastate basally. Furthermore, the basal leaves of *E. evanidum* are broadly ovate to orbicular or reniform, where those of the Mexican endemics are elliptic.

Eriogonum heermannii Durand & Hilg. var. ***subspinosum*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Utah, Washington Co.: Beaver Dam Mts., along the power line road above Bull Dog Pass on limestone outcrops, T43S, R17W, sec. 18, 6 May 1986, *Atwood 12168*. HOLOTYPE: NY. Isotypes: BRY, UTC.

A *Eriogono heermannii* var. *sulcato* ramis laevis et a var. humile ramis spinosis differt

Plants low, rounded shrubs, 1–3 dm high, 1.5–5(–8) dm across; *leaf-blades* lanceolate to narrowly elliptic or spatulate, 0.5–1 cm long, 0.2–0.6 cm wide, thinly tomentose to floccose abaxially; *inflorescences* 0.3–0.7(–1) dm long, 0.3–1(–1.2) dm wide, the branches stoutish and apically spinose, glabrous and rounded but faintly grooved, with dichotomously arranged involucres; *involucres* campanulate, 2–3 mm long, 3–4 mm wide; *flowers* yellowish-white, 2.5–4 mm long.

Other specimens seen.

UNITED STATES. Arizona, Mohave Co.: 0.7 mi NW of the rest stop in the Virgin Narrows, 28 May 1976, *Atwood 6674* (BRY, NY); Virgin Narrows along I-15, 18 May 1972, *Atwood & Higgins 3881* (BRY); Sullivan Canyon, S of the Virgin River, 1 mi W of Cedar Pocket Rest Stop along I-15, T41N, R14W, sec. 21, 2200 ft elev., 24 Apr 2000, *Atwood & Furniss 25270* (BRY, NY); near Cedar Pocket, T41N, R14W, sec. 15, 2400 ft elev., 25 May 1978, *Gierisch 4350* (ARIZ, ASC, ASU, BRY); Virgin Narrows along I-15, 6 mi E of Littlefield, 17 May 1972, *Higgins & Atwood 5312* (BRY, NY); Cedar Pockets, 2 May 1989, *N. Rogers 36* (BRY). Utah, Washington Co.: Baird Cove on the S side of Tabeau Peak, near Bulldog Knolls, T42S, R18W, sec. 28 SE¼, 1 May 1986, *G. I. Baird & S. L. Welsh 2392* (BRY); N side of Bulldog Canyon, E end of Bulldog Knolls, T43S, R18W, sec. 21, 1050 m elev., 30 Mar 1984, *J. Chandler et al. 186* (BRY, not in flower); S side of Bulldog Knolls, T43S, R18W, sec. 28, 1000 m elev., 12 May 1984, *J. Chandler et al. 196* (BRY); SW of Bulldog Canyon, T43S, R18W, secs. 28/33, 17 May 1986, *Higgins 16550* (BRY, NY); S slope of Bulldog Knolls, T43S, R18W, sec. 28, 3400 ft., 30 Apr 1986, *S. L. Welsh & G. I. Baird 23702* (BRY, MONT, NY, RM).

Eriogonum heermannii var. *subspinosum* (from the Latin *sub-*, for "less than", and *spinosus*, meaning "thorny") is infrequently encountered on limestone gravelly slopes and outcrops at the southern end of the Beaver Dam Mountains in southern Washington Co., Utah, and at the eastern end of the Virgin Mountains in Mohave Co., Arizona. Its stout, spinose branches that resemble those of *Mortonia utahensis* (Coville ex A. Gray) A. Nelson, with which var. *subspinosum* is often associated, may readily distinguish it from all other varieties of *E. heermannii*. Also, unlike other members of the species, the Tabeau Peak wild buckwheat flowers in the spring of the year.

Eriogonum microthecum Nutt. var. ***arceuthinum*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Nevada, Lincoln Co.: Juniper (now Mahogany) Mts., Aug 1898, *C. A. Purpus 6249*. HOLOTYPE: NY (00280684). Isotypes: DS, M, MIN, NEB, NY, POM, RM, UC, UTC).

A *Eriogono microtheco* var. *lapidicola* foliis et scapo persaepe glabris differt.

Plants low spreading and matted subshrubs, 0.5–0.8 dm tall, 1–1.5 dm across; *leaves* cauline, the leaf-blades linear, 5–8 (10) mm long, 0.5–1 mm wide, densely white-tomentose adaxially, sparsely floccose to much more commonly glabrous and green adaxially, the margins revolute; *flowering stems* spreading, 1–3 cm long, glabrous; *inflorescences* cymose, compact, 0.5–2.5 cm long, sparsely floccose to glabrous; *involucres* narrowly turbinate, 2–3 mm long, 1–1.2 mm wide, glabrous; teeth 5, erect, 0.5–1 mm long; *flowers* white, 1.5–2 mm long, glabrous; *achenes* light brown, trigonous, 1.5–2 mm long, glabrous.

Other specimens seen.

UNITED STATES. Nevada, Lincoln Co.: Mahogany Mts., E of Deer Lodge Canyon, 2 Jun 1983, *Shultz & Shultz 7109* (GH).

The var. *arceuthinum* (from the Greek *arkeuthinos*, meaning "of juniper") is narrowly restricted known, seemingly, only from the Deer Lodge area of Lincoln Co., Nevada. It closely resembles both *E. microthecum* var. *lapidicola* Reveal and the weakly defined var. *phoeniceum* (L. M. Shultz) Reveal, and approaches *E. ericifolium* Torr. & A. Gray. The tightly revolute, adaxially glabrous and green leaves readily distinguish var. *arceuthinum* from all other expressions of *E. microthecum*.

The exact type location of the Juniper Mountain wild buckwheat is uncertain. I have attributed the collection to Lincoln Co., Nevada, but the original site might be in Iron Co., Utah. The sterile Shultz and Shultz collection (GH) has confused label data. The location given above does not conform to the given township and range data (T1N, R70E), the vague latitude/longitude data (37°49'N, 114°W), or where Dr. L. Shultz believes they found the plant (possibly east of Buck Mountain). Attempts to relocate the plant in the field have been unsuccessful.

Eriogonum microthecum Nutt. var. ***lacus-ursi*** Reveal & A. Sanders, ***var. nov.*** TYPE: UNITED STATES. California, San Bernardino Co.: Bear Valley, along south shore of Big Bear Lake just east of the northern extension of Alden Road in Big Bear Lake, on gray silty soil in conifer woodlands at 6770 ft elev., N34°14′46″, W116°54′29″, T2N, R1E, sec. 20 SWNW¼, 23 Jul 2001, *J. L. Reveal & A. C. Sanders 8351*. Holotype: NY; isotypes: BM, BRY, CAS, GH, MARY, MO, RM, RSA, UC, UCR, US, UTC.

A var. *johnstonii* foliis anguste ellipticis et revolutis, et involucris 3–4 mm longis differt.

Plants decumbent subshrubs 1.5–2 dm tall, 4–6 dm across; *leaves* narrowly elliptic, 0.7–1.5 cm long, (0.7) 1–3 mm wide, densely white tomentose abaxially, subglabrous to glabrous adaxially, the margins usually revolute; *inflorescences* 1–3 cm long, sparsely floccose to glabrous; *involucres* 3–4 mm long, glabrous or thinly floccose near base of teeth in some; *flowers* cream, 2–2.5 mm long; *achenes* 2–2.5 mm long.

Other specimens seen.

UNITED STATES. California, San Bernardino Co.: Bear Valley, Jul ----, *Davidson 2284* (US); Bear Valley, 19 Jul 1900, *M. E. Jones s.n.* (POM); on knoll on the S shore of Bear Lake, W side of Alden Road, T2N, R1E, sec. 20NW¼, 6746 ft elev., 17 Jul 1986, *Krantz s.n.* (UCR); Bear Valley, Aug 1882, *Parish & Parish 1512* (BM, US).

The Bear Lake wild buckwheat, *Eriogonum microthecum* var. *lacus-ursi* (from the Latin *lacus*, lake, and *ursus* bear, for the location), is known only from Bear Valley in the San Bernardino Mountains, San Bernardino Co., California (see Reveal 1971). It is restricted to a single site where there are approximately a hundred individuals. The variety is somewhat similar to the nearby var. *johnstonii* Reveal, a plant of higher elevations (2600–2900 m vs. 2050 m) that occurs in the upper reaches of the San Gabriel Mountains near the San Bernardino–Los Angeles county line. Although the flowering stems of var. *lacus-ursi* may be thinly

floccose (and thus like that of var. *johnstonii*), more often the stems are glabrous.

Eriogonum microthecum Nutt. var. ***schoolcraftii*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Nevada, Washoe Co.: Seven Lakes Mtn., 3.2 mi W and N of main road to Dry Valley, just S of an ephemeral lake, associated with *Juniperus* and *Artemisia* on north-facing slope at 5675 ft elev., T24N, R18E, sec 27, 9 Aug 2002, *A. Tiehm & J. Nachlinger* 14053. HOLOTYPE: NY. Isotypes: ARIZ, ASC, ASU, B, BLMLK, BM, BRIT, BRY, CAS, CIC, COLO, CPH, CTES, DAV, GH, HSC, ID, IDS, ISC, K, KANU, LE, MARY, MICH, MO, MONTU, OSC, PE, PR, RENO, RM, RSA, S, SRP, TEX, UC, UNLV, US, UT, UTC, W, WIS, WS, WTU).

A *Eriogono microtheco* var. *ambiguo* foliis latioribus et floribus et involucro longioribus differt.

Plants roundish shrubs 3–8 dm tall, (2) 5–10 (12) dm across; *leaves* 1.5–3.5 cm long, 0.5–1.2 cm wide, densely reddish-brown tomentose abaxially, floccose adaxially, the margins plane; *inflorescences* 1–8 cm long, 5–8 cm across, floccose; *involucres* 2.5–4 mm long, floccose; *flowers* yellow, 2.5–3 mm long; *achenes* 2.5–3 mm long.

Other specimens seen.

UNITED STATES. California, Lassen Co.: 0.2 mi W of Plinco Mine Road (Lassen Co. Rd. 331), 3.5 mi E of U.S. Hwy. 395 at Doyle, 5450 ft elev., N40°01′, W120°09′, T.25N, R16E, sec. 14 SENW¼, 2 Aug 2002, *Reveal 8370* (ARIZ, ASU, BM, BRY, CAS, COLO, GH, ID, MARY, MO, NY, OSC, RENO, RM, RSA, TEX, UC, UNLV, US, UTC, WTU); lower slopes of Wagner Canyon, T26N, R16E, sec. 19, 4600 ft elev., 20 Jul 1982, *Schoolcraft 807* (NY); Doyle Crade Road W of Doyle, 5200 ft elev., 18 Aug 1982, *Schoolcraft 898* (UC); Robinson Canyon W of Doyle, T25N, R16E, sec. 13, 5200 ft elev., 8 Sep 1982, *Schoolcraft 912* (NY); slopes below McKessick Peak, ca 10 mi SE of Milford, T26N, R16E, sec. 19, 4935 ft elev., *Schoolcraft 2945* (BRY, MARY, NY, RENO); W of The Mark Store, 6 mi SE of Milford, T26N, R15E, sec. 11, 4330 ft elev., 26 Aug 2003, *Schoolcraft 2946* (MARY, NY); 1 mi S

of Constantia, W of U.S. Hwy. 395, T24N, R17E, sec. 13, 4662 ft elev., 8 Sep 2003, *Schoolcraft 2947* (BRY, MARY, NY, RENO); W slope of the Fort Sage Mts., 4 mi NE of Doyle, T26N, R17E, sec. 34 NE¼, 5565 ft elev., *Schoolcraft 2948* (MARY, NY, RENO); ca 3 mi NW of Constantia, 1 mi W of U.S. Forest Service Road 24N22X, T25N, R17E, sec. 32, 4650 ft elev., *Schoolcraft 2949* (MARY, NY, RENO). Nevada, Washoe Co.: Seven Lakes Mtn., N end of Red Rock Valley, T24N, R18E, sec. 21, 21 Aug 1985, *Tiehm 10226* (IDS, MONTU, MNA, NY, RM).

The var. *schoolcraftii* was brought to my attention by two Gary Dean Schoolcraft (1942– , formerly a botanist with the Bureau of Land Management) collections from Lassen Co., California, followed shortly thereafter by an Arnold Tiehm collection from Washoe Co., Nevada. It was a decade before I was able to see the plant in the field, observing it on the foothills of the Diamond Mountains near Doyle, California, just as it was coming into flower. Tiehm gathered slightly more mature material a few days later on Seven Lakes Mountain in Nevada, and Schoolcraft gathered the plant from four new locations in 2003. It is most distinctive in late flower and early fruit when the reddishness of the tomentum is most pronounced. The large, broad leaves are diagnostic.

Variation within the variety appears to be related to fire. Schoolcraft noted that the plants he observed in the Fort Sage Mountains were only 2–3 dm high where a fire had burned three years earlier. The plants were growing back from the root crown and they were not yet producing achenes. Plants at the remaining sites vary from (4) 5–10 (12) dm tall, with the majority about 8 dm, more or less matching the size of the intermixed sagebrush. The var. *schoolcraftii* is found in sagebrush communities composed primarily of *Artemisia tridentata* Nutt., *Tetradymia canescens* DC., *Ericameria nauseosa* (Pall. ex Pursh) G. L. Nesom & Baird, *Ribes velutinum* Greene, and *Ephedra viridis* Coville with nearby *Quercus kelloggii* Newberry.

The Schoolcraft wild buckwheat is allied to the other yellow-flowered expressions of *Eriogonum microthecum*, namely var. *ambiguum* (M.

E. Jones) Reveal and var. *microthecum*. The latter occurs far to the north, but the low, sprawling subshrubby var. *ambiguum* occurs on Seven Lakes Mountain (e.g., *Tiehm & Nachlinger 14054*, NY) where it remains distinct from var. *schoolcraftii*. While individual plants in some populations of var. *ambiguum* can be rather shrubby, none is as tall as var. *schoolcraftii*.

Eriogonum mitophyllum Reveal, ***sp. nov.*** TYPE: UNITED STATES. Utah, Sevier Co.: Along a dirt road on foothills ESE of Aurora, 1.3 mi W of Sage Flat Road, 1.1 mi W of Lost Creek, 1.6 air mi NW of Carter Peak and 4.6 air mi SW of Salina, on low ridges of Arapien Shale associated with *Atriplex* at 5350 ft elev., N38°53′46″, W111°53′33″, T26S, R13E, sec. 15 NWNE¼, 1 Sep 2004, *J. L. Reveal & C. R. Broome 8548*. HOLOTYPE: NY. Isotypes: ARIZ, ASC, ASU, BM, BRIT, BRY, CAS, COLO, GH, ID, K, KANU, MARY, MICH, MO, MONTU, OSC, RENO, RM, RSA, TEX, UC, UNLV, US, UT, UTC, WS, WTU.

A *Eriogono ostlundii* foliis lineribus differt.

Plants erect herbaceous perennials (1.5) 2–3.5 dm tall, 0.5–1 (1.5) dm across, with a short, compact caudex system arising from a stout, woody taproot. *Leaves* basal; leaf-blades linear, 1.5–6 cm long, 0.5–1 mm wide, 2–3.5 mm when forcible unrolled with the midvein about half the width, sparsely floccose and green abaxially, glabrous and green adaxially, the margin tightly revolute; petioles 0.5–1 mm long and indistinct, glabrous, the petiole base elongate-triangular, 2–3 mm long, 0.8–1.3 mm wide, glabrous except for a tuft of tomentose at the point of attachment abaxially, glabrous adaxially. *Flowering stems* erect, slender, 1–2 dm long, glabrous, light green to green. *Inflorescences* narrowly cymose, 0.5–1.5 dm long, 0.2–0.8 dm wide, the branches slender, glabrous, light green to green; bracts 3, scalelike, 1–4.5 mm, elongate-triangular, glabrous. *Peduncles* lacking. *Involucres* solitary at each dichotomy, turbinate, 2.5–4.5 mm long, 1.5–2.5(–3) mm wide, glabrous; teeth 5, erect, 0.5–0.8 mm long, the pedicels 1.5–3.5 (4) mm long, glabrous, the bractlets linear, 1–3 (3.5) mm long, minutely glandular on the edges. *Flowers* pale or greenish yellow, rarely white, becoming fused with pink

to red at least on the midveins in fruit, (2) 2.5–4 mm long, glabrous, the tepals essentially monomorphic, oblong, those of the outer whorl slightly broader than those of the inner whorl, united □–½ or more of their length. *Stamens* exserted, 2.5–4 mm long; filaments glabrous or minutely pubescent basally, the anthers pale yellow, 0.3–0.4 mm long, oval. *Achenes* light brown to light reddish-brown, trigonous, 2.5–3.5 (4) mm long, exserted from the flower, glabrous, globose, taping abruptly to a narrow, slightly 3-angled beak.

Other specimens seen.

UNITED STATES. Utah, Sevier Co.: Lost Creek, about 9 mi N of Siguard, T22S, R1W, sec. 14 SESW¼, on Arapien Shale badlands with *Juniperus*, *Ephedra* and *Atriplex*, 5600 ft elev., 19 Sep 1995, *R. Kass & K. Preston 4446* (BRY, plus two other sheets); 0.4 mi W of Sage Flat Road, 1.7 air mi N of Carter Peak and 4 air mi SSW of Salina, N38°54′01″, W111°52′43″, T26S, R13E, sec. 11 SWSE¼ and sec. 14 NENW¼, 1 Sep 2004, *Reveal & Broome 8547* (ARIZ, ASC, ASU, BM, BRIT, BRY, CAS, COLO, GH, ID, K, KANU, MARY, MICH, MO, MONTU, NY, OSC, RENO, RM, RSA, TEX, UC, UNLV, US, UT, UTC, WS, WTU).

Eriogonum mitophyllum (from the Greek *mitos*, meaning "thread," and *phyllos*, "leaf," as to the linear, thread-like leaf-blades) is known only Arapien Shale badlands west of Lost Creek, about four miles south of Salina, Sevier Co., Utah. The plant is locally common where it occurs, the whole of the area subject to intensive mining and ORV activity. Much of the potential habitat west of the above-cited locations has been so altered as to exclude the thread-leaf wild buckwheat. No attempt was made in 2004 to search the base of nearby foothills of Carter Peak or the search for potential sites along Lost Creek to the east and south. Nonetheless, the Kass and Preston collection was the only known prior to 2004 suggesting that the species is uncommon if not rare.

Eriogonum mitophyllum is allied with *E. ostlundii* M. E. Jones, but differs in its linear leaves, narrow, strict inflorescences with di- and

trichotomous, U-shaped branches, and its longer, pale yellow flowers. The leaf-blades are technically revolute but the fusion of the margins is so complete that only by its position and the presence of an expanded midrib can one identify the abaxially surface. The lower surface of the blade is finely but sparsely cover with a thin tomentum of white hairs. The dominant midrib remains glabrous. The only distinctly hairy portion of the leaf is the tuft of tomentum on the petiole base where it is attached to the stem.

Eriogonum prociduum Reveal var. ***mystrium*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Oregon, Harney Co.: Cottonwood Creek, Pueblo Mts., 14 mi N of Denio, T39S, R35E, sec. 31, 4500-5000 ft elev., 14 Jun 1959, *A. Cronquist 8439*. HOLOTYPE: NY. Isotypes: GH, MICH, RSA, TEX, UTC, WS, WTU.

A *Eriogono prociduo* var. *prociduo* folius longioribus differt.

Leaves 0.7–1.5 cm long, 3–8 mm wide, floccose and greenish abaxially, the petioles 1–1.5 (1.8) cm; *scapes* 0.4–0.8 (0.9) dm long; *involucres* 3–4 mm long; *flowers* 2.5–3.5 (4) mm long; *achenes* 2.5–3.5 mm long.

Other specimens seen.

UNITED STATES. Idaho, Owyhee Co.: War Eagle Peak, Owyhee Mts., 21 Jul 1951, *Baker 8147* (ID); War Eagle Peak, T5S, R3W, sec 9NW, 8000 ft elev., 15 Jul 1985, *Cholewa & Henderson 1200* (ID); South Mtn., T8S, R5W, sec. 10, 7780 ft elev., 4 Jul 1992, *Smithman & Smithman* LS-2554 (CIC, MARY, NY). Nevada: Humboldt Co.: Santa Rosa Range, SE side of Auto Hill, NW of Buckskin Mtn., T46N, R39E, sec. 33, 6500 ft elev., 29 May 1987, *Tiehm 11128* (BRY, NY). Oregon, Harney Co.: Wild Horse Creek Canyon, E side of Steens Mts., 22 May 1929, *Applegate 5644* (DS); Pueblo Mts., Cottonwood Creek, 1.5 mi from the intersection of the Trout Creek/Field-Denio road, T40S, R34E, sec 9/10, 6000 ft elev., 10 Jun 1981, *Grimes 2086* (ASU, BRY, CAS, CIC, MARY, NY, RM, UTC, WTU); Pueblo Mts., Machine Meadow (Roschene Place), T39N, R34E, sec. 27 SWSE¼, 6000 ft elev., 22 Jul 1980, *Wright 1407* (MARY, NY); Pueblo Mts., Cottonwood Creek drainage, ca 1 mi E of

McLean Hunting Cabin along road to Ten Cent Meadow, 6000 ft elev., T40N, R34E, sec. 2 SWNE¼, 22 Jul 1980, *Wright 1408* (BRY, MARY, NY); Pueblo Mts., ridgetop above Denio Basin, T41S, R34E, sec. 15 NW¼, 6900 ft elev., 23 Jul 1980, *Wright 1410* (MARY); Pueblo Mts., ridgetop above Denio Basin, T41S, R34E, sec. 10 NE¼, 7000 ft elev., 23 Jul 1980, *Wright 1411* (MARY); Pueblo Mts., ridgetop above Denio Basin, T41S, R34E, sec. 15 NESW¼, 6800 ft elev., 23 Jul 1980, *Wright 1413* (MARY); ridge S of Cottonwood Creek, T39S, R35E, sec 28, 4900 ft elev., 3 Jul 1982, *Wright 1662* (NY); Pueblo Mts., Machine Meadow (Roschene Place), T39N, R34E, sec. 27 SE¼, 6000 ft elev., 26 Jun 1980, *Wright & Franklin 1356* (BRY, MARY, NY, RENO, UC); Pueblo Mts., ridgetop above Denio Basin, T41S, R34E, sec. 15 W½, 6900 ft elev., 11 Jun 1980, *Wright & Price 1321* (BRY, MARY, NY, RENO. Malheur Co.: W side of Mine Creek on road to Turner Ranch, N of McDermitt Creek, SE edge of Trout Creek Mts., T41S, R40E, sec. 9 SWSE¼, 4800 ft elev., 1 Jul 1981, *Ertter 4331* (MARY); 0.5 mi S of Disaster Peak Road, 18.1 mi NW of McDermitt, T41S, R40E, sec. 15 SWNW¼, 5000 ft elev., 5 Jun 1997, *Mansfield 97-51* (CIC); Trout Creek Mts., on ridge between Oregon Canyon and Cottonwood Creek, N of Twin Butte, T39S, R40E, sec. 15 SE¼, 7200 ft elev., 6 Jul 2001, *Mansfield 01-163* (CIC, NY); McDermitt Basin, below Opalite Mine, T41S, R40E, sec. 4, 4 Jun 1979, *Packard & Grimes 79-197* (CIC, UTC, mixed with *E. crosbyae*); McDermitt Basin, near Mine Creek, T41S, R40E, sec. 5, 4 Jun 1979, *Packard & Grimes 79-203* (CIC); 13.5 mi W of McDermitt Road on road to Disaster Peak, W side of Mine Creek, T41S, R40E, sec. 9, 5150 ft elev., 11 Jun 1984, *Tiehm 8673* (ASU, CAS, ID, MARY, NY, RM, RSA, UT, UTC, WTU).

The var. *mystrium* (from the Greek *mystrion*, meaning "small spoon," as to the size and shape of the leaves) has long been misunderstood. Most specimens of the Pueblo Mountains wild buckwheat have been termed *Eriogonum ochrocephalum* S. Watson, but that assignment was almost always with apologies. The new variety differs from typical var. *prociduum* of Modoc Co., California, Washoe Co., Nevada, and Lake Co., Oregon, in having abaxially floccose and greenish leaf-blades (not tomentose) on longer (10–20 mm versus 2–5 mm) petioles. The two

entities do not overlap in their distribution.

Eriogonum terrenatum Reveal, ***sp. nov.*** TYPE: UNITED STATES. Arizona, Cochise Co.: San Pedro Riparian National Conservation Area, on low eroded bluffs W of the San Pedro River, 0.4 air mi NE of Boquillas (ruins) and 1.2 air mi NW of Contention (ruins), about 4.1 air mi NNW of Fairbank and Arizona Hwy. 82, N of Presidio Santa Cruz de Terrenate (ruins), associated with *Larrea* and other desert shrubs, 3860 ft elev., N31°46′29″, W110°13′20″, T19S, R21E, sec. 17 SESW¼, 20 Oct 2003, *J. L. Reveal, J. L. Anderson, E. Makings, & M. J. Whetstone 8417.* HOLOTYPE: NY. Isotypes: ARIZ, ASC, ASU, B, BM, BRY, CAS, COLO, GH, ID, K, MARY, MICH, MO, OSC, RENO, RM, RSA, TEX, UC, UNLV, US, UTC, WTU.

A *Eriogonum pulchro* floribus longioribus (3.5–5 mm nec 1.5–2.5 mm longis) et involucris latioribus (2.5–3.5 mm nec 1–1.5 mm latis) differt.

Plants sprawling to erect woody shrubs, 1–4 (5) dm tall, (1) 2–6 (9) dm across; *leaves* cauline, fasciculate, the leaf-blades linear-oblanceolate or linear-elliptic, 0.3–0.8 (1) cm long (0.5) 1–2 mm wide, densely white-tomentose abaxially, thinly floccose to glabrous and green adaxially, the margin inrolled, the petioles 0.5–1 mm long, glabrous; *flowering stems* erect or nearly so, 0.5–3 cm long, thinly tomentose, green; *inflorescences* cymose, compact, 1–3 cm long, 1–3 cm wide, thinly tomentose, green; *bracts* 3, scalelike, (0.5) 1–2 mm long, triangular; *peduncles*, when present, erect, 1–8 (10) mm long, thinly tomentose; *involucres* solitary at each dichotomy, campanulate, 3–4.5 mm long, 2.5–3.5 mm wide, thinly tomentose to subglabrous, the teeth 5, erect, 0.5–1.2 mm long; *flowers* white, 3.5–4.5 (5) mm long, glabrous, the tepals dimorphic, the outer whorl of tepals broadly cordate, 2–3 mm wide, the inner whorl of tepals oblanceolate, 1–2 mm wide, connate 1/3 their length; *stamens* exserted, 3.5–4.5 mm long, the filaments pilose basally; *achenes* light brown, trigonous, 4–4.5 mm long, glabrous.

Other specimens seen.

UNITED STATES. Arizona, Cochise Co.: San Pedro Riparian National Conservation Area, upper San Pedro River, southwest of old Terrenate site, associated with *Acacia neovernicos*a, *Tiquilia canescens*, *Ziziphus obtusifolia*, *Thymophylla acerosa*, *Ephedra trifurca*, *Hilaria mutica*, and *Hymenopappus filifolius* var. *pauciflorus* at 31°46.544′N, W 110°13.277′W, 1193 m elev., 10 Apr 2003, *Makings & M. Whetstone 1467* (ASU, NY - not in flower); San Pedro Riparian National Conservation Area, on low eroded bluffs W of the San Pedro River, 04 air mi NE of Boquillas (ruins) and 1.2 air mi NW of Contention (ruins), about 4.1 air mi NNW of Fairbank and Arizona Hwy. 82, N of the site of Presidio de Santa Cruz de Terrenate, associated with *Larrea* and other desert shrubs, 3856 ft elev., N31°46′29″, W110°13′20″, T19S, R71E, sec. 20 SESW¼, 20 Oct 2003, *Makings, et al. 1684* (ASU). Pima Co.: 8.3 mi SE of Vail exit along Interstate Hwy. 10 on shaley brown outcrops of the Pantano Formation, associated with *Juniperus*, *Acacia*, *Krameria*, *Psilostrophe*, *Menodora* and *Dyssodia* at 3520 ft elev., T16S, R17E, sec. 27 NW¼, 30 Nov 1984, *J. Anderson 84-70* (ASU, MARY) and *84-71* (ASU, MARY); 1.6 km W of Cross Hill near old Pantano Railroad siding, 0.3 km S of Marsh Station Road, and about 1 km N of Southern Pacific Railroad and Cienega Creek, T16S, R17E, sec. 27 NESE¼, 1082 m elev., 19 Aug 2002, *Duncan s.n.*, also 7 Nov 2002 (ARIZ, NY, US); N of East Marsh Station (or Pantano) Road N of Cienega Creek, 6.3 mi ENE of the Mountain View Exit (Exit 281) along Interstate Hwy. 10, 1.4 air mi NW of Cross Hill and 6.85 air mi ESE of Vail, associated with *Larrea*, 3520 ft elev., 32°01′00″N, 110°36′01″W, T16S, R17E, sec. 27 NWNW¼, 20 Oct 2003, *Reveal & Anderson 8415* (ARIZ, ASC, ASU, BRY, CAS, GH, MARY, MO, NY, RM, RSA, UC, US, UTC); S of East Marsh Station (or Pantano) Road N of Cienega Creek, 6.8 mi ENE of the Mountain View Exit (Exit 281) at Interstate Hwy. 10, 1.1 air mi WNW of Cross Hill and 7.1 air mi ESE of Vail, associated with *Larrea*, 3560 ft elev., 32°00′35″N, 110°35′58″W, T16S, R17E, sec. 27 NWSW¼, 20 Oct 2003, *Reveal & Anderson 8416* (ARIZ, ASU, BRY, NY, UC).

Eriogonum terrenatum (from the Latin *terra*, meaning "earth," and *natus*, "birth," and indirectly from the Spanish *terrenate*, "earthy," in

reference to Presidio Santa Cruz de Terrenate, see below) is known only from two disjunct populations, but is likely more widespread, especially along the San Pedro River in Cochise Co. The plant occurs on the eroded slopes of the St. David Formation above the river where it is locally common wherever the gray, alluvial outcrop is exposed. The San Pedro River wild buckwheat is a member of the *E. microthecum* Nutt. complex, and most similar to *E. pulchrum* Eastw. of the Colorado Plateau in northern Arizona. It differs from that species is being a larger, more robust shrub with campanulate (not turbinate) involucres and broadly cordate (not orbicular) tepals.

The Chihuahuan Desert population occurs in the San Pedro Riparian National Conservation Area managed by the Bureau of Land Management, and is thus afforded a degree of environmental projection. The Sonoran Desert populations near Vail, Pima Co., Arizona, incorrectly reported as *Eriogonum ericifolium* Torr. & A. Gray (Duncan & Reveal 2003), are restricted to state-owned land and are subject presently to ongoing mining and off-road activities. It is confined to the Pantano Formation.

The species epithet is taken from the name given to the Spanish Presidio Santa Cruz de Terrenate. An Irish mercenary named Hugh O'Conor selected the site along the San Pedro River above the now abandoned railhead and mill town of Fairbank in August of 1775; construction was started early in 1776. Its soldiers came from the village of Terrenate in Sonora, Mexico, but the Arizona location proved too vulnerable to attack by the Apaches, and was abandoned in 1780. Two officers and some eighty soldiers were killed over the five years of occupation (Bannon 1974; Moorhead 1975). Today, only the eroded remnants of the abode walls of various buildings remain (Negri 1997).

Eriogonum umbellatum Torr. var. ***ahartii*** Reveal, ***var. nov.*** TYPE: UNITED STATES. California, Butte Co.: Feather River Canyon, along California Hwy. 70 at turnoff to Pulga, N39°47′40″, W121°27′11″, T22N, R5W, sec. 6 NW¼, 1600 ft elev., 24 Aug 1975, *J. L. Reveal 3977*. Holotype: US. Isotypes: BRY, CAS, GH, MARY, MICH, MO, NY, OKL, RSA, TEX.

A *Eriogono umbellato* var. *polyantho* tomentosis ferrugineis differt.

Plants large, densely branched, spreading shrubs 3–8 × 5–13 dm across; *leaves* in loose rosettes, the leaf-blades elliptic to broadly elliptic or ovate, 1–2.5 (3) cm long, 0.7–1.5 cm wide, densely rusty lanate to tomentose abaxially, floccose to glabrous and olive-green adaxially; *flowering stems* erect, stout, 1–2 dm long, mostly tomentose or at least densely floccose; *inflorescences* compound umbellate, divided 3–4 times; *involucral tubes* 2.5–4 mm long, the lobes 2–3 mm long; *flowers* bright yellow, 5–8 mm long.

Representative specimens seen.

UNITED STATES. California, Butte Co.: 2.5 mi NE of Forbestown, 2900 ft elev., 15 Aug 1985, *Ahart 5164* (GH, MO); Lumpkin Ridge, 8 mi NE of Feather Falls, 3200 ft elev., 9 Jul 1985, *Ahart & Ahart 5113* (GH, MO); Margalia, 2 Aug 1938, *Hoover 3720* (UC); 2 mi W of Pulga, 19 Aug 1951, *J. T. Howell 28160* (CAS, RSA); Pulga Bridge, T22N, R5E, sec. 6, 1600 ft elev., 17 Sep 1981, *C. Taylor 4280* (CHSC, MO)

Eriogonum umbellatum var. *ahartii* (for Lowell Ahart, 1938– , California rancher, conservationist and botanical collector) is restricted to serpentine slopes in oak and pine woodlands in the Paradise area of Butte Co., California, where it is known from four sites. Ahart's sulphur flower is by far the most elegant member of the species and is worthy of widespread cultivation. It is most closely related to var. *polyanthum* (Benth.) M. E. Jones.

Eriogonum umbellatum Torr. var. ***canifolium*** Reveal, ***var. nov.*** TYPE: UNITED STATES. California, Tulare Co.: Sierra Nevada, Sherman Pass Road, 0.4 mi above junction of Rattlesnake and Woodpecker trails, 3.5 mi E of Paloma Meadows and 9.2 mi E of Sherman Pass, on modified granitic soil with *Artemisia*, *Purshia* and conifers, N36°01′40″, W118°16′35″, T.22S, R34E, sec.11 NE¼ of the SW¼, 8400 ft elev., 16 Jul 2001, *J. L. Reveal 8342*. HOLOTYPE: NY. Isotypes: ASU, BM, BRY, CAS, COLO, GH, MARY, MO, OSC, RENO, RM, RSA, TEX, UC, US, UTC, WTU.

A *Eriogono umbellato* var. *nevadense* foliis lanatis differt.

Plants low mats 3–10 dm across; *leaves* in rather tight rosettes, the leaf-blades elliptic, 0.4–2 cm long, 0.3–0.7(–0.9) cm wide, densely grayish lanate on both surfaces or tomentose and grayish to greenish adaxially, rarely thinly floccose to glabrous on individual leaf-blades; *flowering stems* erect, slender, (0.5–)1–1.8(–2) dm long, tomentose; *inflorescences* umbellate, the branches 1–2.5(–4) cm long, tomentose to floccose; *involucral tubes* 2–3 mm long, the lobes 2–3.5 mm long; *flowers* bright yellow, (4–)5–7(–8) mm long.

Representative specimens seen.

UNITED STATES. California, Inyo Co.: South Fork of Big Pine Creek, 8000 ft elev., 13 Jul 1941, *Alexander & Kellogg 2544* (RM). Los Angeles Co.: ENE of Sawmill Campground, Liebre Mts., T17N, R16W, sec 14 & 15, 5160 ft elev., 23 Jun 1994, *Ross & Boyd 8053* (BRY). San Bernardino Co.: Stockton Flats, head of Lytle Creek Canyon, San Bernardino Mts., 15 Jul 1937, *Roos 355* (ASU). Tulare Co.: pass at the head of Dark Canyon, Kern Plateau, 8075 ft elev., 26 Jun 1968, *Twisselmann 14405* (BRY, CAS).

Eriogonum umbellatum var. *canifolium* (from the Latin *canus*, meaning "gray," and *folius*, "leaf") is infrequently found in the southern Sierra Nevada of Inyo and Tulare counties, California, and in the Argus Mountains to the east. It also occurs in the Transverse Ranges of western Los Angeles Co. The densely lanate leaf surfaces and the low, matted habit of the Sherman Pass sulphur flower are distinctive features especially when compared with the more commonly encountered var. *nevadense* Gand. of the Sierra Nevada. As the plants mature the amount of tomentum on the upper surface of the leaf-blades thins and individual blades can become floccose or even glabrous.

Eriogonum umbellaltum Torr. var. ***lautum*** Reveal, ***var. nov.*** TYPE: UNITED STATES. California, Siskiyou Co.: Scott Valley, along South Kidder Creek Road 0.5 mi WSW of California Hwy. 3, about 6.1 air mi SW of Fort Jones and 5.7 air mi N of Etna, on gravelly soil in open grasslands, N43°32′20″, W122°54′54″, T.43N, R9W, sec. 30 NENE¼,

2850 ft elev., 19 Jul 2001, *J. L. Reveal 8348*. HOLOTYPE: NY. Isotypes: BRY, CAS, GH, HSC, MARY, MO, OSC, RENO, RM, RSA, UC, US, UTC.

A *Eriogono umbellato* var. *polyantho* plantis tegetes, a var. *goodmanii* inflorescentibus nec divisis, et a var. *modocense* foliis lanatis abaxialis differt.

Plants low spreading mats 3–10 dm across; *leaves* in rather loose rosettes, the leaf-blades elliptic, (1) 1.5–4 cm long, (0.5) 0.8–1.8 (2) cm wide, densely white tomentose to lanate abaxially, white tomentose and greenish or, rarely, floccose or even glabrous adaxially; *flowering stems* erect, stoutish, 1–2 dm long, tomentose; *inflorescences* compound umbellate, 3–10 (12) cm long, divided 2–3 times; *involucral tubes* (3) 3.5–5 mm long, the lobes (3) 4–6 mm long; *flowers* bright yellow, 4–7 mm long.

Other specimens seen.

UNITED STATES. California, Siskiyou Co.: Scott Valley, Etna Creek, 1.5 mi from Etna, 2940 ft elev., 2 Aug 1948, *Parker 161* (DS, RSA, UC); Scott Valley, 1 mi E of Etna, 2900 ft elev., 16 Sep 1949, *Tracy 18562* (TEX, UC).

Eriogonum umbellatum var. *lautum* (from the Latin *lautus*, meaning "neat" or "elegant") is restricted to sandy or gravelly flats in oak and conifer woodlands in the Scott Valley area of Siskiyou Co., California. It is allied to var. *polyanthum* (Benth.) M. E. Jones, but is a low spreading mat rather than an erect, more or less open shrub. The Scott Valley sulphur flower is also related is var. *goodmanii* Reveal and to a lesser degree var. *modocense* (Greene) S. Stokes, both matted perennials but with simple, umbellate inflorescences. This elegant plant deserves a place in the horticultural trade.

Eriogonum umbellatum Torr. var. ***mohavense*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Arizona, Mohave Co.: Dixie Corridor, NE side of Wolf Hole Mtn., SW of Quail Hill, 0.1 mi W of Mohave County Road 5, 0.6 mi E of the turnoff to Seegmiller Mtn., in pinyon-juniper woodlands,

N36°49′29″, W113°34′19″, T40N, R12W, sec. 34 NESW¼, 5100 ft elev., 21 May 2003, *J. L. Reveal 8384*. HOLOTYPE: NY. Isotypes: ARIZ, ASC, ASU, BRY, CAS, COLO, GH, MARY, MO, RENO, RM, RSA, UC, UNLV, US, UTC.

A *Eriogono umbellato* var. *subarido* plantis tegetes nec fruticosis differt.

Plants mostly low, spreading mats 1–3 dm across; *leaves* in rather tight rosettes, the leaf-blades elliptic, 0.7–2.5 cm long, 0.3–1 cm wide, thinly floccose and greenish on both surfaces or glabrous and green adaxially; *flowering stems* erect or nearly so, (0.3) 0.5–1.5 (2) dm long, thinly floccose to nearly glabrous; *inflorescences* umbellate, (0.2) 0.3–1 dm long, thinly floccose to nearly glabrous; *involucral tubes* 2–3 mm long, the lobes 1.5–3 mm long; *flowers* bright yellow, 3–7 mm long.

Representative specimens seen.

UNITED STATES. Arizona, Mohave Co.: 19 mi S of Virgin River bridge along Hwy 64, 26 May 1969, *Atwood 1731* (BRY); Andrus Canyon, 30 mi S of Mt. Trumbull Village, T32N, R11W, sec. 1, 12 Jun 1983, *Atwood 9417* (BRY); Jump Canyon, SE of Black Rock Mtn., T37N, R13W, sec. 16 NE¼, 15 May 1985, *Atwood 10986* (BRY); junction of Mud Spring/Pacoon Ranch roads, T38N, R14W, sec. 25, 12 May 2000, *Atwood 25603* (BRY, MNA, NY); Road Canyon, T38N, R13W, sec. 20/21, 11 May 2000, *Atwood 25635* (BRY, NY, SJNM); 13.6 mi S of I-15 on Black Rock Road, T40N, R13W, sec. 14, 22 May 2001, *Atwood 27480* (BRY); E base of Black Rock Mtn., 18 May 1982, *Atwood & Higgins 3910* (BRY); Maple Canyon, 1 mi N of Little Wolf Pass, T39N, R13W, sec. 16, 5000 ft elev., 18 May 1989, *Baird 3079* (BRY); 5.2 mi SW of Wolf Hole along AZ Hwy 64, T38N, R12W, sec. 16 NW¼, 5000 ft elev., 30 Apr 1978, *Brown & Parfitt 430* (ASU – in bud); E base of Wolf Hole Mtn., near Wolf Hole Spring, T39N, R12W, sec. 21, 5200 ft elev., 20 May 1978, *Brown & Parfitt 733* (ASU); 16.1 mi S of Utah line on AZ Hwy 67, 2.7 mi S of Mokaac Pass, W side of Seegmiller Mtn., T39N, R12W, sec. 11, 4300 ft elev., 9 Jun 1978, *Coombs & Bundy 2499* (ARIZ, ASU, BRY); between St. George and Wolf Hole, near junction of BLM roads 1069 and 1038, SE of Wolf Hole Mtn., 5200 ft elev., 18 Apr

1993, *Christy 1411* (ASU – in bud); 15.8 mi S of I-35 on road to Black Rock Mtn., 24 May 1986, *Grimes & Meurer-Grimes 2938* (BRY); SW of Seegmuller Mtn., T39N, R12W, sec. 17, 5000 ft elev., 26 May 1998, *Higgins 19584* (BRY); Wolf Hole Valley, T39N, R12W, sec. 26, 27 May 1999, *Higgins et al.* 20287 (BRY, NY); Black Rock Gulch, T39N, R13W, sec. 10, 1500 m, 15 May 2000, *Higgins 21316* (BRY); Black Rock Gulch, T40N, R13W, sec. 35, 1450 m, 10 May 2001, *Higgins 22861* (BRY); 1 mi NW of Mollie's Nipple, T21N, R10W, sec. 8, 23 May 2001, *Higgins 23059* (BRY); Wolf Hole Mtn., 0.2 mi W of Mokiah Pass, 5000 ft elev., 22 May 1969, *Holmgren 3292* (BRY, C, COLO, IDS, ILL, KANU, MIN, NY, OKL, RSA, US); NE side of Wolf Hole Mtn., T40N, R12W, sec. 34, 5200 ft elev., 24 May 2001, *Holmgren & Holmgren 14271* (NY); Pocum Wash, ca 18 mi W of Wolf Hole, near Cane Spring, 8 Jun 1968, *Mason et al.*, 2833 (ARIZ); without location, 1877, *Palmer 426* (MIN, MO, NY); between Seegmuller and Wolf Hole mts., T40N, R12W, sec. 34, 5040 ft elev., *Reichenbacher & Wilson 1725* (ARIZ, ASU).

Eriogonum umbellatum var. *mohavense* is restricted to sandy or more commonly dark, volcanic, gravelly flats and slopes in sagebrush communities, and in oak, pinyon-juniper and montane conifer woodlands in the Black Rock and Wolf Hole mountains of Mohave Co., Arizona. The var. *mohavense* flowers in late spring and early summer, well before its nearest relative, the late summer and fall flowering var. *subaridum* S. Stokes. The Mohave sulphur flower flowers even earlier than the var. *vernum* Reveal of central Nevada. The compact caudex system and the long inflorescence branches (2–8 cm long) of the simple, umbellate inflorescence readily distinguishes the new variety from all other expression of *E. umbellatum* in the area.

Eriogonum umbellatum Torr. var. ***nelsoniorum*** Reveal, ***var. nov.*** TYPE: UNITED STATES. California, Humboldt Co.: Along U.S. Forest Service Road 1 at S end of Whiting Ridge, about 0.5 air mi WNW of High Salt Ground and 9.3 air mi W of Hyampom, on serpentine outcrops in an open grassland at 4250 ft elev., N40°37′36″, W123°37′50″, T.3N, R5W, sec. 20 NWSE¼, 18 Jul 2001, *J. L. Reveal 8345*. HOLOTYPE:

NY. Isotypes: BM, BRY, CAS, COLO, GH, MARY, MO, OSC, RENO, RM, RSA, UC, US, UTC, WTU.

A *Eriogono umbellato* var. *bahiiforme* inflorescentibus nec divisis differt.

Plants low spreading mats or subshrubs up to 7 dm across; *leaves* in rather loose rosettes, the leaf-blades elliptic to oblong, (0.5) 1–1.5 (2) cm long, 0.4–0.8 cm wide, densely white tomentose to lanate abaxially, to floccose and greenish or, rarely, glabrate and green adaxially; *flowering stems* erect, stoutish, 1–2 dm, thinly floccose; *inflorescences* umbellate, 1–3 cm long; *involucral tubes* 3–4 mm, the lobes 2–4 mm long; *flowers* bright yellow, (5) 6–7 mm.

Representative specimens seen.

UNITED STATES. California, Humboldt Co.: North Trinity Mtn., T8N, R6E, sec. 3, 6100 ft elev., 3 Aug 1973, *Klipfel 300* (HSC); along U.S. Forest Service Road 1 NW of Grouse Mtn. at milepost 14.3, ca 10.3 air mi SW of Salyer, N40°45′51″, W123°41′29″, T5N, R4E, sec. 35 SWSE¼, 4500 ft. elev., 18 Jul 2001, *Reveal 8346* (BM, BRY, CAS, COLO, GH, MARY, MO, NY, OSC, RENO, RM, RSA, TEX, UC, US, UTC, WTU); along U.S. Forest Service Road 1 near White Rock Springs at milepost 7.8, ca 7.8 air mi SW of Salyer, N40°48′51″, W123°41′49″, T5N, R4E, sec. 14 NESE¼, 4900 ft. elev., 18 Jul 2001, *Reveal 8347* (BRY, CAS, MARY, MO, NY, OSC, RSA, UC); Trinity Summit, head of Devil's Hole, 6000 ft elev., 28 Jul 1935, *Tracy 14328* (UC). Trinity Co.: top of Seven-up Pass, T36N, R9W, sec. 27, 7500 ft elev., 9 Jul 1975, *Di Tomaso 113* (DAV); saddle between North Yolla Bolly Mtn. and Black Rock Mtn., T27N, R10W, sec. 15, 7100 ft elev., 39 Jun 1974, *Lester 334* (HSC); Mt. Lassic (Signal Peak), T1S, R5E, sec. 36, 5872 ft elev., 10 Jul 1973, *T. W. Nelson 1032* (HSC, RSA); 1 mi SE of Mud Spring, T29N, R11W, sec. 19, 4600 ft elev., 21 Aug 1980, *M. S. Taylor 3295* (MO).

Eriogonum umbellatum var. *nelsoniorum* (named for the collecting team of Thomas W. Nelson, Jr. and Jane P. Nelson, experts on the serpentine flora of northern California; formerly associated with

Humboldt State University [now California State University Humboldt]) is found in widely scattered locations on sandy to gravelly serpentine slopes and ridge tops of the northern coastal ranges in oak and montane conifer woodlands in Humboldt and Trinity counties, California. There appears to be a disjunct population on the eastern Scott Bar Mountains of Siskiyou Co. The var. *nelsoniorrum* is somewhat akin to var. *argus* Reveal but probably more closely related to var. *bahiiforme* (Torrey & A. Gray) Jepson. It differs from both in consistently having a simple, rather than compound umbellate inflorescence. The large bracts that subtend the umbel of Nelson's sulphur flower are long (1–1.5 cm) and foliaceous, like those of var. *bahiiforme*, but the distribution of tomentum of the leaves is like that found in var. *argus*.

Eriogonum umbellatum Torr. var. ***ramulosum*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Colorado, Jefferson Co.: Along U.S. Hwy 6 adjacent to I-70, 0.4 mi E of Exit 256 to Buffalo Bill's Grave, N39°42′12″, W105°14′32″, T4S, R70W, sec. 18, 7100 ft elev., 25 Jul 1992, *J.L. Reveal 7244*. HOLOTYPE: NY. Isotypes: BRY, CAS, COLO, GH, MARY, MO, RENO, RM, RSA, UC, US, UTC.

A *Eriogono umbellato* var. *umbellato* inflorescentibus divisis differt.

Plants low, often rather compact, mats 2–4 dm across; *leaves* in loose rosettes, the leaf-blades mostly elliptic to oval, 1–2.5 cm long, 0.5–1.5 cm wide, densely white to gray tomentose abaxially, floccose and green adaxially; *flowering stems* erect, mostly 1–3 dm long, floccose; *inflorescences* compound umbellate and divided 2–3 times; *involucral tubes* 2–3 mm long, the lobes 1.5–3 mm long; *flowers* bright yellow, 4–7 mm.

Other specimens seen.

UNITED STATES. Colorado, El Paso Co.: Colorado Springs, Jul 1892, *Eastwood s.n.* (F, MO, RM); Jefferson Co.: Mt. Vernon Country Club, Golden, 7 Aug 1941, *Ehlers 8159* (COLO, MICH, TEX, WTU). Larimer Co.: Cherokee Park, 15 Jul 1934, *R. J. Davis 394-W* (IDS); Estes Park, 16 Jul 1978, *Hampton s.n.* (NY); 2.1 mi W of Drake, 9 Aug 1967, *Neal &*

Neal 2 (ASU); YMCA Camp, Estes Park, 17 Aug 1966, *Rominger 455-66* (ASC); Estes Park, Aug 1931, *E. C. Smith s.n.* (MONT); Big Thompson Canyon, 7500 ft elev., 3 Jul 1934, *S. Stokes 201a* (RM). Mineral Co.: Piedra, 12 Jul 1899, *C.F. Baker 291* (RM).

Eriogonum umbellatum var. *ramulosum* (from the Latin *ramulosus*, meaning "with small branches") is encountered mainly but infrequently along the Front Range of the Colorado Rocky Mountains mainly west of Fort Collins south to Colorado Spring and then westward to Piedra. Buffalo Bill's sulphur flower is related to var. *umbellatum*, differing consistently in having a compound umbellate inflorescence.

Eriogonum umbellatum Torr. var. ***sandbergii*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Washington, Chelan Co.: Tumwater Canyon, 1600 ft elev., 21 Jul 1893, *J. H. Sandberg & J. B. Leiberg 521* HOLOTYPE: NY. Isotypes: C, CAN, CAS, F, MO, NY(2), US, WS.

A *Eriogono umbellato* var. *umbellato* plantis subfruticosis et foliis glabris adaxialis differt.

Plants low subshrubs to spreading woody mats, 2–6 dm across; *leaves* in loose rosettes, the leaf-blades elliptic to ovate, 1–2.5 (3) cm long, 0.5–1.5 (2.3) cm wide, densely lanate abaxially, glabrate to glabrous and bright green adaxially; *flowering stems* mostly 1–2.5 (3) dm, thinly tomentose to floccose; *inflorescences* umbellate; *involucral tubes* 2–3 mm long, the lobes 1.5–4 mm long; *flowers* bright yellow, 4–7 (8) mm.

Representative specimens seen.

UNITED STATES. Oregon, Hood River Co.: Cloud Cap Inn, NE slope of Mt. Hood, 6000 ft elev., 6 Aug 1959, *Bennett 1680* (NY). Morrow Co.: head of Little Wall Creek, 28 Jun 1937, *Umatilla Range Survey Team 36* (USFS). Wasco Co.: Marion's Point Lookout, Mount Hood, 4500 ft elev., *G. N. Jones 4106* (IDS, LA, NY, UC, UTC, WTU); summit of Bluegrass Ridge, Mount Hood, 5000 ft elev., 31 Jul 1927, *M. E. Peck 3297* (WTU). Washington, Chelan Co.: Tumwater Campground, T25N, R17E, sec. 9 SW¼, 2000 ft elev., 28 Jun 1968, *Batterson s.n.* (WS);

3 mi SE of Stuart Lake on trail to Stuart Lake, 4500 ft elev., 27 Aug 1974, *Denton 3574* (WTU); Little Grade Creek, N side of Lake Chelan, 3100 ft elev., 9 Jun 1936, *Edwards 268* (WS); Tumwater Canyon W of Tumwater Mtn., 4 mi NW of Leavenworth, N47°37.5′, W120°43′, 1550 ft elev., 29 Jun 1998, *Fishbein & McMahon 3510* (WS); along U.S. Hwy 2, 0.5 mi E of dam, T24N, R17E, sec. 4 SE¼, 12 Jul 1972, *Grable 4207* (WS); knoll at S end of Tumwater Canyon E of Leavenworth, 15 May 1949, *Hagen s.n.* (WTU); mouth of Tumwater Canyon, 11 Jun 1983, *Hagen s.n.* (WTU); Icicle Creek, Fourth of July Trail, 1900 ft elev., 4 Aug 1996, *Hammond 10951a* (ASC); Stehekin, Lake Chelan, 7 Jul 1911, *M. E. Jones s.n.* (DS, POM); junction of Hwy. 2 and Icicle Canyon Road, 1200 ft elev., 23 May 1964, *Kern 498* (DS, HSC, KANU, NY, UC, WS, WTU); along McCue Ridge trail below McCue Ridge Lookout, 2800 ft elev., 20 Jul 1936, *Perkins 168* (WS); Leavenworth, 3 Jul 1904, *Piper 2561* (WS); Peshastin, Jul 1893, *Sandberg & Leiberg s.n.* (MICH, MIN, NY, UTC, WS, WTU); Leavenworth, Jul 1898, *Savage et al. s.n.* (WS); Fourth of July Hill, Icicle Ridge, 2000 ft elev., 26 Jun 1931, *Seely 49* (MIN, MO, NY, WTU); near Leavenworth, 23 May 1931, *Thompson 6414* (WTU); Tronsen Ridge, 4000 ft elev., 5 Jul 1933, *Thompson 9317* (DS, MIN, MO); Stehekin, 4 Jul 1901, *Whited 1383* (WS); mountain at head of Gulch No. 1, Wenatchee, 4 Jul 1899, *Whited 1167* (WS). Kittitas Co.: 2 mi NW of Mission Peak, Wenatchee Mts., 6000 ft elev., 14 Jul 1954, *C. L. Hitchcock 20279* (NY, WTU); Bald Mtn., 5900 ft elev., 22 Jun 1940, *Thompson 14813* (CAN, CAS, DPU, MIN, MO, NY, OKL, UTC, WTU). Okanagon Co.: Little Slate Creek, T34N, R19E, sec. 27, 9 Jul 1936, *Edwards 283* (WS); road leading the Harts Pass, 27 Jul 1937, *Fiker 2376* (WS); Harts Pass Road, 3 mi from Harts Pass, 5000 ft elev., 15 Jul 1974, *Grable 5782* (WS); Yellowjacket Creek, T37N, R19E, sec. 32 SE¼, 2900 ft elev., 21 Jun 1979, *Naas & Naas 3819* (WS); Leavenworth, Jul 1898, *Savage et al. s.n.* (F, IA, MO, RENO); Methow River, Twisp, 17 Jul 1921, *St. John et al. 5545* (MIN, MO, NY, UC, UTC, WS, WTU). Yakima Co.: Big Klickitat River, 3200 ft elev., 1 Sep 1903, *Cotton 1476* (WS, WTU); 1 mi above Rimrock along Wildcate Creek, 19 Jul 1937, *Dillon 879* (MO, NY, UC, UTC, WS, WTU); Wodan's Vale, Mt. Adams, 2100 m elev., 5 Aug 1906, *Suksdorf 5821* (WTU); 0.25 mi N of Tieton

Ranger Station, 2400 ft elev., 21 Jun 1936, *Reid 59* (WTU); Mt. Adams, 6000 ft elev., 30 Jul 1934, *Thompson 11164* (MIN, MO, NY, WTU); near Tieton River, 19 Jun 1932, *Warren 1813* (WTU); Snowplow Mtn., 16 mi N of Trout Lake, 9 Jul 1936, *Zuberbuhler s.n.* (NY, UC, WS).

Eriogonum umbellatum var. *sandbergii* (for John Herman Sandberg, 1848–1917, Swedish-born agronomist, botanist, and forester who collected widely in the Pacific Northwest) is restricted to a series of scattered populations in the Cascade Ranges of Oregon and Washington from Mt. Hood northward. Plants at lower elevations and in protected situations tend to be subshrubby as opposed to the somewhat more mat-like habit seen in the mountains. Sandberg's sulphur flower appears to be most closely related to var. *modocense*, differing in its larger size and typically glabrous and bright green upper leaf-surface. This has passed under the name var. *umbellatum*.

Eriogonum umbellatum Torr. var. ***stragulum*** Reveal, ***var. nov.*** TYPE: UNITED STATES. Idaho, Blaine Co.: Along U.S. Hwy. 20, 19 mi E of Fairfield and 0.1 mi E of Poison Creek, N of Magic Reservoir, on sandy loam volcanic soil associated with *Artemisia tridentata*, N43°20′15″, W114°24′50″, T1S, R17E, sec. 15 NWSE¼, 4850 ft elev., 20 Jun 2003, *J. L. Reveal 8394*. HOLOTYPE: NY. Isotypes: BRY, CAS, GH, ID, IDS, MARY, MO, MONTU, RENO, RSA, UC, UTC, US.

A *Eriogono umbellato* var. *umbellato* foliis late ellipticus vel ovatis cum sparse tomentosis a glabris differt.

Plants low spreading mats 2.5–10 (20) dm across; *leaves* in loose rosettes; leaf-blades broadly elliptic to ovate, (0.8) 2–3 (3.5) cm long, (0.7) 1–2 (2.5) cm wide, thinly tomentose to sparsely floccose abaxially, thinly floccose to glabrous and green adaxially; *flowering stems* erect, mostly 1–3 dm long, thinly floccose; *inflorescences* umbellate, the branches (1) 2.5–5 (8) cm long; *involucral* tubes 2–3 mm long, the lobes 3–5 mm long; *flowers* bright yellow, 4–7 (8) mm.

Representative specimens seen.

UNITED STATES: Idaho, Bannock Co.: Mink Creek Canyon, 4 Jul 1949, *Lingenfelter 735* (BRY, COLO, MIN, NY, RSA, UC). Boise Co.: 16 mi N of Horseshoe Bend, 9 Jun 1965, *Raven 18521* (MARY, NY). Camas Co.: 0.2 mi SE of Divide Reservoir, Mount Bennett Hills, 5800 ft elev., 20 Jul 1978, *Ertter 2401* (NY). Clark Co.: Dubois, T11N, R36E, sec. 16, 5200 ft elev., 1 Jun 1934, *Pechanec 34-20* (USFS). Custer Co.: 2 mi NE of Toxaway Lake, ca 8 mi WSW of Obsidian, 8000 ft elev., 12 Aug 1939, *Hitchcock & Martin 5702* (DS, ISC, NY, OKL, POM, UC, UTC, WTU). Elmore Co.: 26 mi NE of Mountain Home, 1 Jun 1966, *Collotzi & Davidse 672* (NY, UC, UTC); 10 mi S of the W side of Anderson Ranch reservoir, 12 Jun 1960, *Hitchcock & Muhlick 21991* (WTU); above Big Roaring River Lake, 20 mi N of Pine, 24 Aug 1937, *Meyer & Meyer 2311* (F, MO, NY, UC); head of Slater Creek, 6100 ft elev., 18 Aug 1930, *Pearse 25* (USFS). Fremont Co.: Island Park Plateau, along U.S. Hwy 20 between Antelope Flat Road and Little Butte Road, T11N, R42E, sec. 14, 6300 ft elev., 6 Jul 1992, *Markow 8885* (RM). Goodding Co.: rim of Thorne Creek Canyon, Mount Bennett Hills, 4900 ft elev., 15 Jun 1976, *Ertter 76-139* (NY). Lemhi Co.: Birch Creek Valley, above Willow Creek, ca 1.5 air mi NW of Nicholia, T12N, R29E, sec. 18, 6900-7200 ft elev., 1 Jul 1992, *Markow 8454* (RM). Madison Co.: along USFS Road 213 near Hinckley Creek, T4N, R42E, sec. 26, 7100-7400 ft elev., 20 Jul 1991, *Hartman & Molina 29984* (RM). Valley Co.: 9 mi E, 12 mi N of Bear Valley, 10 Jul 1940, *R. J. Davis 2744* (IDS, NY, OKL, UC, UTC). Nevada, Elko Co.: 0.2 mi N of Jay Creek, 2.4 mi NW of Nile Spring, T47N, R69E, sec. 23 NW¼, 24 Jul 1991, *Morefield & Price 5566* (NESH, NY, RENO). Wyoming, Teton Co.: Jackson Lake, 17 Aug 1899, *A. Nelson & E. Nelson 6545* (ISC, MIN, MO, NEB, NY, RM, UC, UTC); Snake River, 20 Aug 1899, *A. Nelson & E. Nelson 6572* (MO, NY, RM).

Eriogonum umbellatum var. *stragulum* (from the Latin *stragulus*, meaning "spreading" or "covering like a rug or mat," as to the sprawling nature of the matted caudex system) is found mainly from the foothills and low mountains on the northern edge of the Snake River Plains northward into the mountains of central Idaho. The spreading sulphur flower also occurs in scattered montane locations on the southern edge of the plains.

This expression has been referred to var. *umbellatum* but differs in have longer and broader leaf-blades that are thinly tomentose to floccose on the lower surface (not densely tomentose). The plant forms more open and sprawling mats than those found typically in var. *umbellatum*. In its leaf size and pubescence var. *stragulum* approaches the condition seen in var. *ellipticum* (Nutt.) Reveal, a variant with compound inflorescences that is found mostly to the north and west of known range of the new variety.

I have tentatively included here a single collection from extreme northeastern Elko Co., Nevada. It differs from all other specimens in having short leaf-blades (1–1.8 cm) and inflorescence branches (1–1.5 cm). The leaf tomentum is not that of var. *umbellatum*, but is somewhat denser than that seen in the majority of specimens assigned to var. *stragulum*. Further fieldwork is necessary in southern Idaho to ascertain the significance of the Nevada collection.

ACKNOWLEDGEMENTS

My thanks to Rose Broome, Arnold Tiehm, Gary Schoolcraft, John Anderson, Jeanne Glenne, Julie Knorr, Deb Clark, and Chris Groebner for their help in collecting certain plants, and to the Jepson Herbarium at the University of California, the Flora of North America Committee, The New York Botanical Garden, and The Academy of Natural Sciences in Philadelphia for making it possible to visit critical herbaria and field sites in my retirement. Arnold Tiehm and Jim Zarucchi kindly reviewed the manuscript.

LITERATURE CITED

Bannon, J. F. 1974. The Spanish borderlands frontier: 1513-1821. Albuquerque: University of New Mexico Press.

Duncan, R. B. & J. L. Reveal. 2003. Noteworthy collections. *Eriogonum ericifolium* Torr. & A. Gray (Polygonaceae). Madroño 50: 53.

Moorhead, M. 1975. The Presidio: Bastion of the Spanish borderlands. Norman: University of Oklahoma Press.

Negri, S. 1997. The San Pedro River's tragic Spanish presidio. Arizona Hwy. 73(10): 40-43.

Reveal, J. L. 1971. Notes on *Eriogonum* - VI. A revision of the *Eriogonum microthecum* complex (Polygonaceae). Brigham Young Univ. Sci. Bull., Biol. Ser. 13(1): 1-45.

A NEW VARIETY OF *ERIOGONUM URSINUM* (POLYGONACEAE, ERIOGONOIDEAE)

James L. Reveal

University of Maryland, College Park, MD 20742-5815
Honorary Curator, New York Botanical Garden, Bronx, NY 10458-5126, U. S. A.
Mailing Address: 18625 Spring Canyon Road, Montrose, CO 81401-7906, U. S. A., jr19@umail.umd.edu

Julie D. Knorr

Botanist, Klamath National Forest, U.S. Forest Service, 11263 No. Highway 3, Fort Jones, CA 96032, U. S. A.
jdknorr@fs.fed.us

ABSTRACT

Eriogonum ursinum var. ***erubescens***, a new taxon of *Eriogonum* subg. *Oligogonum* (Polygonaceae: Eriogonoideae), is known presently from scattered populations in the northern coastal ranges of Siskiyou and Trinity counties, California. A portion of its range is the same as that of the rare Siskiyou mariposa lily (*Calochortus persistens*). The blushing wild buckwheat differs from the var. *ursinum* of the Sierra Nevada in having an umbellate (not biumbellate) inflorescence, longer peduncles (5–25 vs. 2–5 mm) in fruit, involucres (4.5–8 vs. 3.5–4.5 mm), mature flowers (5–9 vs. 5–6 mm) and achenes (5.5–8 mm vs. 3–5 mm).

KEY WORDS: *Eriogonum*, Polygonaceae, California

An opportunity to examine collections of *Eriogonum* Michx. (Polygonaceae Juss: Eriogonoideae Arn.) in the various district herbaria of the Klamath National Forest in 2001 resulted in the discovery of a novel wild buckwheat. Gathered initially in 1982 at Mahogany Point at

the northeastern end of the Scott Bar Mountains west of Yreka, Siskiyou Co., California, the unicate collection was identified as *E. umbellatum* Torr. var. *stellatum* (Benth.) M. E. Jones. A second collection made in 1992 was identified as *E. ternatum* Howell. The cream-colored flowers, villous involucres and exceptionally long achenes should have quickly differentiated these collections from those species.

Fieldwork conducted in the fall of 2001 showed that the new species was growing in some profusion near Mahogany Point on metavolcanic and metasedimentary soils with *Holodiscus discolor* (Pursh) Maxim. and *Prunus emarginata* (Douglas ex Hook.) Walp. Additional and much more detailed work was conducted in 2002; this is described below. Significantly, the new wild buckwheat is found in the same area occupied by the California state threatened Siskiyou mariposa lily (*Calochortus persistens* Ownbey), a taxon that is currently under consideration for federal protection under the Endangered Species Act. Additional herbarium work has shown the plant to be found to the south along the backbone of mountain ridges forming the Trinity, Tehama, and Shasta county lines.

Eriogonum ursinum S. Watson var. **erubescens** Reveal & J. D. Knorr, **var. nov.**

TYPE: United States. California, Siskiyou Co.: Scott Bar Mountains, n and w slope and ridge of Deadwood Baldy Peak, Klamath National Forest, on metasedimentary (chert) soils associated with *Ericameria nauseosa* (Pall. ex Pursh) G. L. Nesom & G. I. Baird var. *speciosa* (Nutt.) G. L. Nesom & G. I. Baird and scattered *Pseudotsuga menziesii* (Mirb.) Franco, 1675-1725 m elev., T45N, R8W, sec. 6 SESW¼ and sec. 7 NW¼, N41°46′06″, W122°49′09″ (top of the peak), 5 Aug 2002, *J. L. Reveal & J. D. Knorr 8371* (holotype, NY; isotypes, BRY, CAS, CHSC, DAV, GH, HSC, K, KNFY, MO, OSC, RENO, RSA, SOC, UC, US, UTC).

A var. *ursino* inflorescentiis umbellatis (nec biumbellatis) divisis differt.

Plants low, spreading, loosely matted, herbaceous perennials 1–2.5 dm high and (1.5) 2–8 (12) dm across, with a spreading, woody caudex arising from a woody taproot, the caudex branches often rooting at the nodes where in contact with the ground; *flowering stems* erect, slender, 0.4–2 dm long, thinly tomentose to floccose, the bracts below inflorescence 4–6, foliaceous, lanceolate to narrowly elliptic, 1–2 cm long, 2.5–6 mm wide, villous on both surfaces but generally more so abaxially; *leaves* in rather dense compact basal rosettes restricted to the base of flowering stems and tips of exposed caudex branches, the leaf-blades elliptic, 0.7–2 (2.2) cm long, 0.4–1 (1.2) cm wide, densely white tomentose abaxially, sparsely floccose to subglabrous or glabrous and green to yellowish-green adaxially, the margins slightly wavy, the petioles 0.5–1.5 cm long, tomentose, the petiole-bases elongate-triangular, 1–2.5 (3) mm long, 1.5–2.5 mm wide, thinly tomentose abaxially, glabrous adaxially; *inflorescences* umbellate, thinly tomentose, the branchlets 3–5(–7), villous, 1–2 mm long in anthesis, 3–15 (17) mm long in fruit, each branchlet terminate by (2) 3, linear to narrowly lanceolate, semifoliaceous bracts, 0.7–1 cm long, 1–2.5 mm wide, these villous on both surfaces; *peduncles* erect, slender, villose, often obscured by the numerous flowers, those terminating branchlets (1–)2–5 mm long at anthesis, 5–10 mm long in fruit, the centrally positioned one 5–10 mm long at anthesis, 10–25 mm long in fruit; *involucres* solitary at each dichotomy, turbinate to turbinate-campanulate, 4.5–8 mm long, 3–4 mm wide, villous abaxially, glabrous adaxially, the teeth 5–8, erect, triangular, 0.5–2 mm long; *pedicels* erect, slender, becoming recurved and exserted from involucre when flowers in fruit, (5) 6–8 (9) mm long, glabrous, the two subtending bractlets linear, 5–7 (8) mm long, densely hirsutulous with numerous, long, marginal cells; *flowers* stipitate, cream-colored or rarely yellow with an indistinct midrib, (4) 5–7 mm long at anthesis, becoming fused with a blush of pinkish red to maroon and 6.5–9 mm long in fruit, including the 0.5–0.8 mm long stipe, glabrous abaxially, thinly tomentose along the midvein adaxially, the tepals slightly dimorphic, those of the outer whorl broadly obovate, 5–7 mm long, 3–3.5 mm wide, those of the inner whorl oblong, 4.5–6 mm long, 1.5–2.5 mm wide, connate basally; *stamens* slightly exserted, 3–5 mm

long, the filaments densely pilose at least half their length, the anthers yellow, 0.7–0.8 mm long, oblong, the styles 1.5–2.5 mm long; *achenes* light brown, obscurely trigonous, (5) 5.5–8 mm, glabrous except for the slightly pubescent, indistinctly 3-angled beak; embryo straight.

Other collections examined.

UNITED STATES. California, Siskiyou Co.: Mahogany Point, 5 Aug 1982, *Reed 433* (KNFY); 0.25 mi NW of Mahogany Point, T45N, R8W, sec. 22, 26 Jun 1992, *Knorr 387* (KNFY); 0.25 mi SW of Montana Peak along Gunsight Ridge, T45N R8W, sec. 23 NWNE¼, 11 Jul 2002, *Knorr 652* (CHSC, KNFY); 0.25 mi NW of Mahogany Point along Gunsight Ridge, T45N R8W, sec. 22 NE¼, 18 Jul 2002, *Knorr & Barnes 657* (HSC, KNFY); 0.25 mi NE of Mahogany Pt. along Gunsight Ridge, T45N R8W, sec. 23 NW¼, 18 Jul 2002, *Knorr & Barnes 658* (KNFY); 0.25 mi W of Indian Creek Baldy summit, T45N R9W, sec. 24 NWNW¼, 23 Jul 2002, *Knorr 659* (KNFY); 0.1 mi W of Indian Creek Baldy summit, T45N R9W, sec. 24SENW¼, 23 Jul 2002, *Knorr 660* (DAV); 0.25 mi N of Indian Creek Baldy summit, T45N R9W, sec. 24 NWNE¼, 23 Jul 2002, *Knorr 663* (KNFY); top of Deadwood Baldy Peak at old lookout site, T45N R8W, sec. 7 NW¼, 27 Jul 2002, *Knorr & Fickert* 664 (JEPS, SOC); 1 mi E of Montana Peak along Gunsight Ridge, T45N R8W, sec. 13 S½ , 27 Jul 2002, *Knorr & Fickert 666* (UC). Trinity Co.: Trinity Mtn. [7.6 air mi ESE of Ridgeville, T34N, R7W, sec. 9], 4700 ft elev., 20 Jul 1913, *Dayton 402* (USFS); Trinity Mtn., N side of ridge, 4200 ft elev., 25 Jul 1913 (USFS); Trinity Mtn., 5000 [sic, ca. 4700] ft elev., 3 Jul 1937, *True 756* (UC).

RELATIONSHIPS

The blushing wild buckwheat, *Eriogonum ursinum* S. Watson var. *erubescens* (from the Latin for blushing) belongs to the subg. *Oligogonum* Nutt. (typified by *E. umbellatum* Torr.). The var. *ursinum* occurs well to the south and east of var. *erubescens* and has decidedly smaller involucres (3.5–4.5 mm), mature flowers (5–6 mm), and achenes (3–5 mm). The most significant difference is in the inflorescence. In var. *erubescens*, the umbellate inflorescence is composed of three to five (or

rarely seven) branchlets that surround a central peduncle. Two or three linear to narrowly lanceolate bracts terminates each branchlet. Atop each branchlet is an erect peduncle. Taken together, the combination of the branchlet and peduncle appears to be a branch with a whorl of bracts about midlength. The single, centrally positioned peduncle is bractless (the lack of bracts defines a peduncle). In var. *ursinum* its compound umbellate inflorescence is composed of seven to eleven branchs each of which is terminated by three to five (or more) bracts. Atop each of these branches is a central peduncle and three to five additional branchlets. Each of these branchlets is terminated by a short peduncle. The peduncles atop the branchlets in var. *erubescens* can be up to 10 mm long in fruit whereas those of var. *ursinum* do not exceed 5 mm.

As a result the inflorescence in *Eriogonum ursinum* var. *erubescens* is a simple umbel whereas it is typically branched twice (or biumbellate) in var. *ursinum*. The combination of more numerous branches, branchlets and short peduncles means the inflorescence atop each flowering stem of var. *ursinum* is larger and more congested than that seen in var. *erubescens*. The overall height of the Bear Valley wild buckwheat is about twice that of the blushing wild buckwheat (0.4–4 vs. 0.4–2 dm), but given the complete overlap this can be considered only a population tendency. Both varieties occur on soils of a volcanic origin unlike the related *E. nervulosum* (S. Stokes) Reveal, a plant of serpentine soils of the northern Coast Ranges (Sonoma and Lake counties).

DISTRIBUTION, HABITAT, AND PHENOLOGY

The six populations of *Eriogonum ursinum* var. *erubescens* located from five to eight km west of Yreka, have been studied in detail. The populations are located along ridge tops near Gunsight Peak, and on the peaks of Indian Creek Baldy and Deadwood Baldy. These high-elevation peaks and ridge system form the eastern end of the Scott Bar Mountains, a small mountain range that runs from the Marble Mountains northeast to Yreka. Geographically these peaks and ridges are part of the Klamath

Ranges that border the Cascade Ranges in Shasta Valley, seven km east of Yreka (Hickman 1993). The plants are found at elevations of 1620 m to 1890 m where they occur on the north-facing slopes of open rocky ridge tops.

These populations of var. *erubescens* show no particular edaphic endemism. The plants are found in the Western Paleozoic and Triassic belt, a broad arc of rocks that are found extensively in the Klamath Mountains. The four populations found along the ridgeline near Gunsight Peak are on rocks of a Late Triassic age greenstone-chert assemblage composed of metavolcanic and metasedimentary rocks that meet with great complexity in this area (Elder, pers. comm.). The Indian Creek Baldy population occurs on metavolcanics whereas the Deadwood Baldy Peak population is found on chert (USDA Forest Service 2002). The soils derived from the open rock outcrops consist of shallow, well-drained soils formed in residuum from metamorphic rocks.

The local climate varies widely from summer to winter. In the winter the eastern Scott Bar Mountains receive an average 58 cm of precipitation that falls primarily as snow along the high-elevation ridgelines (Golden Gate Weather Service 2002). Although the summers are hot and dry, snow banks persist on the north slopes of the ridges well into May. The majority of the var. *erubescens* populations are found on the north slopes where melting snow provides additional water well into the summer.

The blushing wild buckwheat is found in rocky openings within a sparse *Holodiscus discolor–Prunus emarginata* shrub community that follows the open ridges above a mixed conifer forest dominated by *Pseudotsuga menziesii* (Mirb.) Franco, *Pinus ponderosa* C. Lawson, *Calocedrus decurrens* (Torr.) Florin, and *Pinus lambertiana* Douglas. The rock outcrops support a depauperate plant community that is dominated by herbaceous species in the pockets of slightly deeper soils. The most commonly associated species are *Eriogonum umbellatum* Torr. (an undescribed variant near var. *bahiiforme* (Torr. & A. Gray) Jeps.),

Penstemon parvulus (A. Gray) Krautter, *Monardella glauca* Greene, *Achnatherum lemmonii* (Vasey) Barkworth, and *Calochortus persistens*.

Although the majority of the species within the population sites are common within the Klamath Ranges, species such as *Phlox rigida* Benth. and *Juniperus occidentalis* Hook. var. *australis* (Vasek) N. H. Holmgren show affinities with Great Basin plant communities. This may be due to the presence of an isolated island of Great Basin flora in Shasta Valley less than ten km east of Gunsight Peak (Hickman 1993).

The initial population of *Eriogonum ursinum* var. *erubescens* was located in November of 2001 using herbarium label data and personal knowledge of the specimen collection location. Additional surveys were conducted in June and July of 2002 to locate potential new sites. A stratified search method using soil and parent material types, elevations, plant community types, and the presence of *Calochortus persistens* proved fruitful, and five additional populations were discovered during seven days of surveying. These surveys focused on potential locations that were closest to the first known site and radiated out to cover additional suitable habitat. Although the variety will remain a regional endemic, additional surveys in similar habitats on the Klamath National Forest may reveal new populations.

The six studied populations of *Eriogonum ursinum* var. *erubescens* range in size from 49 plants covering less than 0.1 hectares to approximately 4000 plants covering 2-3 hectares. Primarily mature flowering individuals have been observed, with mature, but non-flowering individuals forming the next largest age class. Only a few seedlings have been seen in small sites that received complete coverage while counting plant numbers. In larger sites, plant numbers were estimated and few seedlings were observed, although they can be easily overlooked.

The plants were first observed in full bloom during the last week of June 2002. The inflorescences were a pale cream color as the flowers opened. By mid-July they were in full bloom and some plants had started to develop the characteristic red blush. By the end of July 2002, nearly all

the flowers had begun to set fruit and were fading from cream to varying shades of pink and red. It is possible that the change in flower color may be a signal to pollinators that a specific flower has been successfully pollinated. At the type locality, three individuals among an estimated population of 1200 were seen to have yellow flowers.

Herbarium studies have shown the blushing wild buckwheat also occurs on Trinity Mountain on the Shasta-Trinity county line some 63 air miles to the south.

CONSERVATION CONSIDERATIONS

All of the *Eriogonum ursinum* var. *erubescens* populations currently known are located on lands managed by the Klamath National Forest. Four of the Scott Bar Mountains populations are located within a Special Habitat Management Area designated for Sensitive plant habitat protection. This management area, designed to protect *Calochortus persistens*, encompasses the open rocky ridgelines where var. *erubescens* is found. The primary management goal for the Area is to manage the habitat to provide for a viable population of *C. persistens* (USDA Forest Service 1994). The Standards and Guidelines for this area will also provide protections for the four *Eriogonum* sites located within the Special Habitat Management Area. The two other locations known from ths Scott Bar Mountains are located on the open tops of two peaks (Deadwood Baldy and Indian Creek Baldy) where little disturbance is expected to occur. Designation as a Forest Service Region 5 listed Sensitive plant species will provide protection for these two sites should any management activities be proposed within the areas.

ACKNOWLEDGMENTS

Special thanks to Susan Stresser of the Klamath National Forest for recognizing the importance of this project and supporting our fieldwork. D. R. Elder, geologist for the Forest, provided us with information on

the geology and soils of the area. Arnold Tiehm and Jim Zarucchi kindly reviewed the manuscript.

LITERATURE CITED

Golden Gate Weather Service. 2002. California average monthly precipitation. http://ggweather.com/ca_climate/rain_mean.htm.

Hickman, J. C. (ed.). 1993. The Jepson Manual: Higher plants of California. University of California Press, Berkeley, CA.

USDA FOREST SERVICE. 1994. Final environmental impact statement and land and forest resource management plan. Klamath National Forest, Yreka, CA.

USDA FOREST SERVICE. 2002. Geographic information systems, bedrock geology. Electronic GIS Files. Klamath National Forest, Yreka, CA.

A NEW VARIETY OF *ERIOGONUM LACHNOGYNUM* (POLYGONACEAE: ERIOGONOIDEAE)

James L. Reveal
University of Maryland, College Park, MD 20742-5815
Honorary Curator, New York Botanical Garden, Bronx, NY 10458-5126, U. S. A.
Mailing Address: 18625 Spring Canyon Road, Montrose, CO 81401-7906, U. S. A., jr19@umail.umd.edu

Arnold Clifford
Herbarium, San Juan College, 4601 College Boulevard, Farmington, NM 87402

ABSTRACT

Eriogonum lachnogynum var. *colobum* is proposed for a series of populations confined to mesa tops formed by outcrops of the upper Jurassic Todilto limestone near Thoreau, McKinley Co., New Mexico. The variety differs from var. *lachnogynum* and the recently established var. *sarahiae* by its low, flattened mats of numerous caudex branches with short leaf-blades (up to 12 mm long and 3.5 mm wide), and capitate inflorescences that are about as long as to slightly surpassing the height of the leaves. Members of this species have long been used medicinally by the indigenous Navajo (Diné) people.

KEYWORDS: Polygonaceae, Eriogonoideae, *Eriogonum lachnogynum*, Navajo medicinal plants. New Mexico

Eriogonum lachnogynum Torr. ex Benth. var. **colobum** Reveal & A. Clifford, ***var. nov.***

TYPE: UNITED STATES. New Mexico, McKinley Co.: On a low ridge overlooking the San Antonio Mission site, 0.5 mile southeast of the Elkins Lime Pit, 6.1 airmiles northeast of Thoreau and 1 airmile east of New Mexico Highway 57 at San Antonio Spring, on limestone caprock

associated with *Juniperus*, 7460 ft elev., T14N, R12W, sec. 21 NW¼, 27 May 2003, *A. Clifford 03-390*. Holotype: NY; isotypes: BRY, GH, MO, RSA, SJNM, UNM, US.

A var. *lachnogyno* plantis (0.05–0.2 vs 1–3.5 dm altis) et foliis (0.4–8 (1.2) vs 1–3 cm longis) brevioribus differt.

Plants low, cespitose, matted, herbaceous perennials, 0.5–2 cm tall, 5–35 cm across, with a pluricipital caudex of 30 or more branches arising from a stout, woody taproot; *leaves* basal, in fascicles, the leaf blades narrowly elliptic to oblanceolate, 4–8 (12) mm long, 1–3 (3.5) mm wide, silky tomentose on both surfaces but more densely so adaxially, the margins slightly revolute, the petioles 1–3 mm long, pilose, tapering to elongated, sparsely pilose or more commonly glabrous bases, 3–6 mm long; *flowering stems* numerous, erect, scapose, (1) 2–5 (13) mm long, silky tomentose, about as long as to slightly surpassing the height of the leaves; *inflorescences* capitate, 3–8.5 mm across; *peduncles* lacking; *involucres* 1 per flowering stem, broadly campanulate, 2–3.5 mm long, 4–6 (8) mm wide, silky tomentose adaxially, the teeth 5, slightly spreading, 1–1.5 mm long; *flowers* yellow, 3–4.5 mm long, densely white pilose adaxially, the tepals monomorphic, broadly lanceolate, united only near the base; *stamens* slightly exserted, 2.5–4 mm long, the filaments glabrous; *achenes* dark brown, trigonous, 3–4 mm long, tomentose.

Other specimens seen.

UNITED STATES. New Mexico, McKinley Co.: On a low ridge overlooking the San Antonio Mission site near the Elkins Lime Pit, 6.1 airmiles NE of Thoreau and 1 airmile E of New Mexico Highway 57 at San Antonio Spring, 7460 ft elev., T14N, R12W, sec. 21 NW¼, 18 May 2000, *A. Clifford et al. 00-268* (BRY, SJNM); 7 mi N of Thoreau along New Mexico Highway 371, N of road above mine, 29 May 1997, *K. Heil 10961* (SJNM); N of Thoreau on point of mesa, 21 May 1998, *S. L. O'Kane 4227* (BRY, SJNM); on a low ridge overlooking the San Antonio Mission site near the Elkins Lime Pit, 6.1 airmiles NE of Thoreau and 1 airmile E of New Mexico Highway 57 at San Antonio Spring, on limestone caprock associated with *Juniperus*, 7450 ft elev., 35°26′11″N,

108°07′18″W - T14N, R12W, sec. 16 SW¼ of the SW¼, 31 Oct 2003, *Reveal, Broome & Clifford 8434* (NY); ca 5 mi NE of Thoreau along New Mexico Highway 57, on the S side of a quarry, T14N, R12W, sec 17, center, 2225 m, 11 Jun 1997, *Sivinski 3784* (BRY); 5 mi NNW of Prewit on top of first small mesa W of Casamero Mesa, 35°24′50.4″N, 108°03′45.2″W - T14N, R12W, sec. 24 SE¼ of the NE¼, 2190 m, 12 Jun 1994, *Sivinski et al. 2737* (BRY, MARY, NMC, UNM).

At the type location northeast of Thoreau, New Mexico, *Eriogonum lachnogynum* var. *colobum* (from the Greek *kolobos*, shortened or stunted, alluding to habit) is confined to a windswept ridge formed by a shallow north-facing dip of the Pinedale Monocline that exposes a caprock lens of the upper Jurassic Todilto limestone. The outcrop consists of grayish, thin-bedded, gravelly limestone, gypsiferous lens, and reddish brown shale and siltstone (Cooley et al. 1969). The clipped wild buckwheat occurs there with other low-growing species along with sparsely scattered, stunted pinyon pine (*Pinus edulis* Englem.), Utah juniper [*Juniperus osteosperma* (Torr.) Little], James' galleta (*Pleuraphis jamesii* Torr.) and bluegrama [*Bouteloua gracilis* (Willd. ex Kunth) Lag. ex Griffiths]. The variety has been collected north-northwest of Prewitt about 7 miles to the east, and reported to be west of New Mexico Highway 371 along the western extension of the Pinedale Monoclinal ridge.

The var. *colobum* joins the newly proposed *Eriogonum lachnogynum* var. *sarahiae* (N. D. Atwood & A. Clifford) Reveal (Reveal 2004) as one of two depauperate variants of the species. Compared to the flattened mats of var. *colobum* with its flowers at or just above the height of the leaves, the var. *sarahiae* has long, exserted scapes (3–6.5 cm long) atop a hemispheric mat. Like its counterpart, Sarah's wild buckwheat occurs on windswept ridges on limestone caprock in widely scattered locations in Apache and Navajo counties, Arizona, and along the edge of Red Valley in western McKinley Co., New Mexico.

According to the late Sarah Charley of Beclahbito, New Mexico, for whom the var. *sarahiae* is named, the Navajo (Diné) people believe *Eriogonum lachnogynum* is a lifeway medicinal plant. Shredded roots of

this plant, and other tap-rooted species such as *Eriogonum alatum* Torr., *E. jamesii* Benth., and *E. racemosum* Nutt., are soaked in water and used for any internal and sometimes external injuries, including back pain and diarrhea. When the plants are used medicinally, the user is required to disclose their name, age and type of ailment for the plant to work properly. Sacred Navajo names, prayers, and offerings are given to the plants before they are collected for ceremonial use.

ACKNOWLEDGEMENTS

We wish to thank Drs. Robert W. Kiger and James Zarucchi for reviewing the manuscript.

LITERATURE CITED

Cooley, M. E., J. W. Harshbarger, J. P. Akers & W. F. Hardt. 1969. Regional hydrogeology of the Navajo and Hopi Indian reservations, Arizona, New Mexico and Utah. U. S. Geol. Surv. Prof. Pap. 521-A: 1-61.

Reveal, J. L. 2004. Nomenclatural summary of *Polygonaceae* subfamily *Eriogonoideae*. Harvard Pap. Bot. 9: 143-230.

A NEW SPECIES OF *MENTZELIA* (LOASACEAE) FROM NORTHEASTERN MEXICO

B. L. Turner

Plant Resources Center, University of Texas, Austin, TX, 78712-0471, U.S.A.

ABSTRACT

Mentzelia pattersonii B. L. Turner, **sp. nov.**, is described from northeastern Mexico where it occurs in the states of Coahuila, Nuevo Leon, and Tamaulipas. It is closely related to the widespread *M. oligosperma* Nutt. ex Sims and the relatively localized *M. pachyrhiza* I. M. Johnst., but differs from both in having larger flowers and markedly pedicellate fruits. A map showing the distribution of these several species is provided.

KEY WORDS: Loasaceae, *Mentzelia*, Mexico, Coahuila, Nuevo Leon, Tamaulipas

A broad overview of the genus *Mentzelia* (Turner, in prep.), this prompted by the preliminary taxonomic studies of Hemphill (1995), has revealed the following novelty:

Mentzelia pattersonii B. L. Turner, **sp. nov.**

Similis *M. oligospermae* sed floribus majoribus, et capsulis valde stipuliferis (vice capsularum sessilium).

Suffruticose much-branched tuberous herbs to 60 cm high. Stems moderately pubescent with stiff pilose hairs 0.8-1.0 mm high, beneath these an array of much shorter, more numerous hairs 0.1-0.2 mm high; with age the outer epidermal layers turning white and peeling. Mid-stem leaves ovate to somewhat deltoid in outline, 3-7 cm long, 1.0-3.5

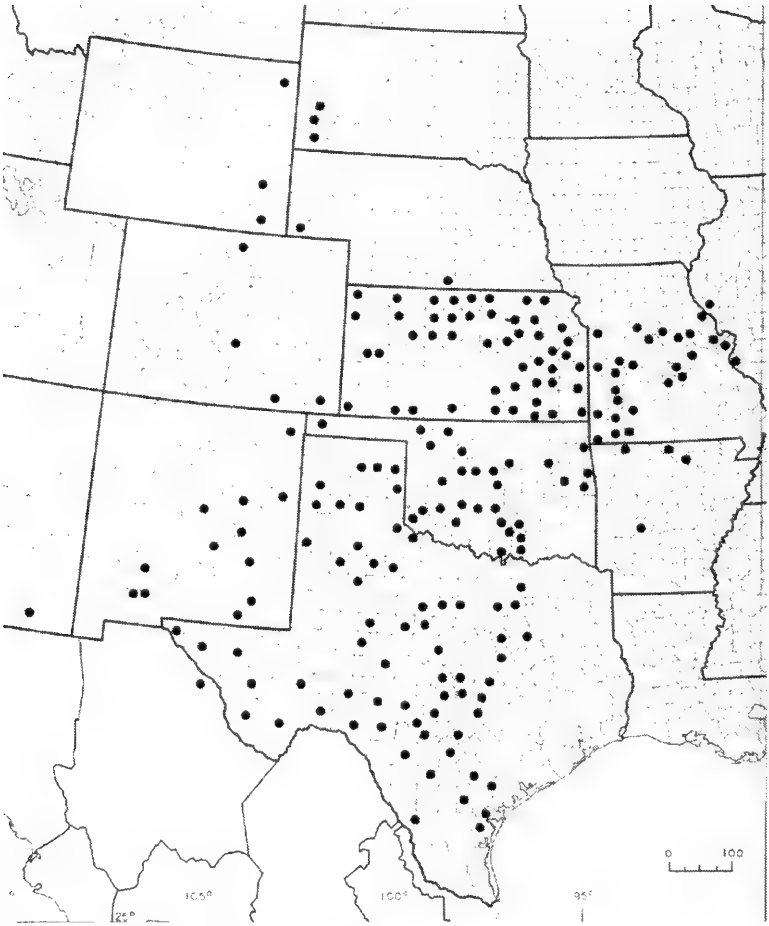

Fig. 1. Distribution of *Mentzelia oligosperma.*

cm wide, their margins irregularlr lobed and/or dentate; petioles 3-10 mm long. Flowers pedicellate, axillary; sepals linear-lanceolate, 10-12 mm long, ca. 1 mm wide at the base; petals orange, oblanceolate, 15-20 mm long, 8-10 mm wide; stamens numerous, the outer whorl of ca. 10 stamens up to 18 mm long, those of the inner whorls mostly 8-12

Fig. 2. Distribution of *Mentzelia pachyrhiza* (circles) and *M. pattersonii* (dots).

mm long; anthers yellow, 0.5-0.8 mm long. Capsules mostly decidedly stipitate (rarely both sessile and pedicellate capsules on the same plant, the latter predominating), the stipes mostly 2-8 mm long; seeds and/or ovules 1-2 per capsule.

TYPE: **MEXICO. NUEVO LEON:** Mpio. Lampazos de Naranjo, Pichacho Carrizal, lower slopes near mines monzaite, 950-1250, 19 Aug 1988, *Patterson 6823* (Holotype: TEX).

ADDITIONAL SPECIMENS EXAMINED: **MEXICO. COAHUILA:** ca. 10 mi S of Sabinas Hidalgo, 5 Sep 1978, *D'Arcy 11764* (MO); Monclovo, 23-31 Aug 180, *Palmer 352* (NY); 70 mi N of Saltillo along hiway 57, 3 Jun 1966, *Wilson 11380* (TEX); between Hipolito and Sacramento along a dry creek bed in El Desierto de la Payla, 15 Jun 1936, *Wynd & Mueller 73* (ARIZ, GH, TEX). **NUEVO LEON:**

Monterrey, 1924, *Orcutt 1149* (US); Mpio. Bustamante, Sierra Gomaz, Bustamante Canyon, 12 Aug 1988, *Patterson 6506, 6507* (TEX); same locality, 17 Aug 1988, *Patterson 6789* (TEX). **TAMAULIPAS:** vicinity of San Miguel, 25 Jul 1930, *Bartlett 10584* (F, NY, US); 4 mi S of Jaumave, 3 Jul 1949, *Stanford* et al. *2251* (NY,US).

So far as known this novelty was first collected by E. J. Palmer at Monclovo, Mexico and was identified by Watson (1882) as *M. hispida* Willd., which it resembles in having large flowers with numerous stamens. Vegetatively, because of its sprawling habit, peeling epidermis, and tuberous roots, it resembles the widespread *M. oligosperma* Sims. (Fig. 1) and the much more restricted, little known species, *M. pachyrhiza* I. M. Johnst. (Fig. 2). Thompson and Powell (1981) provided an excellent account of the latter taxon. *Mentzelia pattersonii* can be distinguished from both of the foregoing by its much larger flowers and markedly stipitate capsules, as noted in the above diagnosis.

The species is named for Mr. Thomas Patterson who has collected several sheets, including type material at my request. Tom obtained a M.S. degree under my supervision, having produced a revisionary study of the genus *Conoclinium* DC. (Asteraceae).

ACKNOWLEDGEMENTS

I am grateful to Dr. Alice Hemphill for providing critical literature relating to the genus *Mentzelia*, to Tom Patterson for the collection of type materials, and to my wife Gayle for the Latin diagnosis, and to Mike Powell for helpful suggestions. The following herbaria loaned materials which served as the basis for the distributions shown in figures 2 and 3: ARIZ, CAS, F, GH, LA, LL, MEXU, MICH, MO, NY, PH, RM, TEX, UC, and US.

LITERATURE CITED

Hemphill, A.L. 1995. Molecular systematics of the Loasaceae. Doctoral Thesis, Univ. of Texas, Austin, 167 pp.

Thompson, H.J. and **A.M. Powell.** 1981. Loasaceae of the Chihuahun Desert region. Phytologia 49: 16-33.

Watson, S. 1882. List of plants from southwestern Texas and Northern Mexico, collected by Dr. E. Palmer in 1879-80. Proc. Amer. Acad Arts 17: 316-382.

A NEW COMBINATION IN MEXICAN *MANDEVILLA* (APOCYNACEAE SUBFAMILY APOCYNOIDEAE) III

Justin K. Williams

Department of Biological Sciences, Sam Houston State University, Huntsville, TX 77341-2116 U.S.A.

ABSTRACT

Trachelospermum stans A. Gray is here treated as a species of *Mandevilla*: *M. stans* (A. Gray) J. K. Williams, **comb. nov.**

KEYWORDS: *Mandevilla*, Mexico, Apocynaceae, SEM

Preparation of a treatment of the Apocynaceae of Mexico (Williams, 1999), revealed populational variation in the endemic but widespread Mexican species, *Mandevilla foliosa* (Müll. Arg.) Hemsl.

A distribution map (Fig. 1) of *Mandevilla foliosa* s.l. shows two disjunct populations, a northern and a southern, separated by a distance of approximately 600 km. Comparisons of the two populations indicate that the northern populations are densely pubescent, while the southern populations are wholly glabrous (except the midribs; Fig. 2).

The northern populations were originally described as *Trachelospermum stans* A. Gray. The species was later synonymized under *Mandevilla foliosa* by Woodson (1933) and maintained there as a synonym by Morales (1998). Observations of the type of *T. stans* show it to be pubescent, consistent with other northern collections of *M. foliosa*.

Another Apocynaceae genus, *Haplophyton* A. DC., has a similar disjunct distribution with a population in northern Mexico and one in southern Mexico. *Haplophyton* was traditionally treated as monotypic (Pichon, 1950; Kartez, 1994) until Williams (1995) presented evidence in

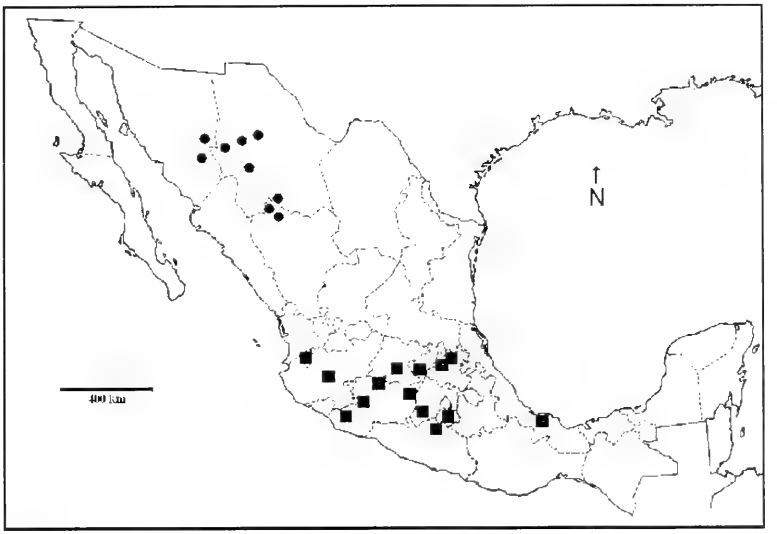

Fig. 1. Distribution of *Mandevilla foliosa* sensu lato (squares *M. foliosa*, circles *M. stans*).

support of two species based on a "correlation of... character [states] with the allopatric distribution of the two populations". As in *Haplophyton*, *Mandevilla foliosa* is composed of two allopatric populations that are reproductively isolated in geography and readily distinguished by morphological characters.

Accordingly, *Trachelospermum stans* is here treated as a distinct species of *Mandevilla* and the following combination is made:

Mandevilla stans (A. Gray) J. K. Williams, **comb. nov.**

Trachelospermum stans A. Gray, Proc. Amer. Acad. Arts 21: 394. 1886. *Secondantia stans* (A. Gray) Standl., Contrib. U.S. Natl. Herb. 23: 1165. 1924. TYPE: **MEXICO. CHIHUAHUA**: rocky hills near Chihuahua, 19 Oct 1885, *Pringle 640* (HOLOTYPE: GH; ISOTYPES: NY!; P!).

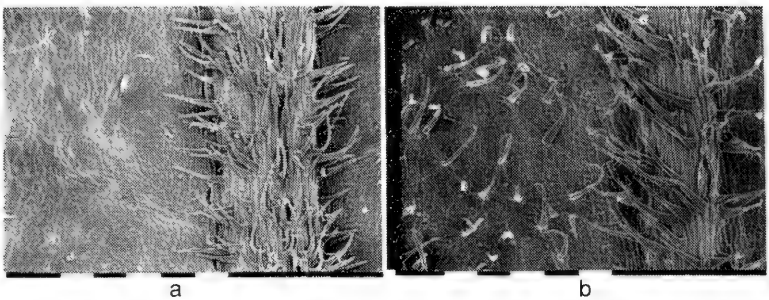

Fig. 2. Scanning electron micrographs of the lower leaf epidermis of *Mandevilla foliosa* (a., *Ventura 6928* (TEX)) and *M. stans* (b., *Spellenberg 9309* (TEX)). Note both taxa possess hairs along the midrib, but only *M. stans* has hairs along the blade. White bars on both photos represent 0.1 mm. Micrographs made by the author using a Phillips 515 SEM (Cell Resource Center, University of Texas Austin).

Distribution (Fig. 1)**:** northwestern Mexico (Chi, Dur, Sin, Son), typically found in open rocky slopes, chaparral and pine-oak forest, 1200-2200 m.

Representative specimens. MEXICO. CHIHUAHUA: Mpio. Ocampo, Parque Nacional de la Cascada de Basaseachic, on the S and SW facing slopes in the canyon below the falls, with pines and oaks, (28° 10' N, 108° 12' W), 14 Sep 1987, *Spellenberg 9309* (TEX); Mpio. Temosachi, Nabogame (28° 03' N, 108° 30' W), 24 Jun 1988, *Laferriére 1459* (TEX); about 30 mi N of Cd. Chihuahua, W of HWY 45, W of Boca del Potero in mountains, in canyon 1 mi W of Bella Vista (29° 2' N, 106° 27' W), with *Acacia* and oaks, 16 Jul 1981, *Ward & Worthington 81-344* (NMC, TEX, MEXU); N of Chihuahua, 29 Jul 1935, *LeSueur 839* (F); vicinity of Quirire, between Creel and La Bufa, 2 Aug 1973, *Bye 4475* (TEX); 20 mi S of Parral on HWY 45, 5900 ft, 28 Jul 1975, *Engard 644* (TEX); mouth of canyon, along road, E of Majalca, 28 Jul 1958, *Correll 20284* (TEX); Balleza, Dec 1945, *Martínez s.n.* (F); Sierra Charuco, Río Fuerte, 21 Jul 1935, *Standley 1503* (F); Canyons near Chihuahua, 24 Jul 1886, *Pringle 701* (US). **DURANGO:** Mpio. de Santiago Papasquiaro, 20 km W of Santiago Papasquiaro, 15 Jul 1982, *Hernández 7889* (US); along the road W of Indé toward Santa María, ca 3 mi W of Indé on a steep mountain slope of volcanic origin, 10 Aug 1971, *Reveal 2727* (US); 45 mi W of Hildago de Parral, along road from Parral to El Vergel (Hwy 24), ca 54 km W of jct with HWY 12, 7 Aug 1978, *Funk 2766* (TEX, US); Tobar, 28 May 1906, *Palmer 238* (F); Santiago Papasquiaro, Apr 1896, *Palmer 395* (F, US); Indé, Jun 1927, *Reko 5166* (US); Canyon Cantero, Sierra Gamon, 12 Sep 1948, *Gentry 8385* (US). **SINALOA:** La Petaca, Concordia, 1915, *Dehesa 1653* (US). **SONORA:** Maicoba, Jul 1968, *Pennington 195* (TEX); near Santa Barbara (27° 06'

N, 108° 43' W), 18 Oct 1992, *Jenkins 92-119* (TEX); canyon on the NE side of the Sierra Batuc, 10 mi NE of Mátape on the road to Batuc, 9 Sep 1941, *Wiggins 446* (US); ridge S of Arroyo Gochico, E of San Bernardo, granitic soil, 5-9 Aug 1935, *Pennell 19569* (US).

Madevilla stans is distinguished from *M. foliosa* by the following contrasts:

1. Stems, petioles, sepals, and inflorescence densely pubescent, leaf blades and midribs pubescent (Fig. 2b); northwestern Mexico (Chi, Dur, Sin, Son).....*M. stans*

1. Stems, petioles, sepals, and inflorescence glabrous, leaf blades glabrous (Fig. 2a), midrib pubescent; south-central Mexico (Gua, Gue, Hid, Jal, Mex, Mich, Mor, Nay, Que,Ver).....*M. foliosa*

Mandevilla foliosa (Müll. Arg.) Hemsl., Biol. Centr. Amer. Bot. 2: 316. 1881.

Amblyanthera foliosa Müll. Arg., Linnaea 30: 427. 1860. *Laseguea foliosa* (Müll. Arg.) Miers., Apoc. S. Am. 253. 1878. TYPE: **MEXICO. MEXICO:** Near Mexico city, 1842, *Ghiesbreght s.n.* (HOLOTYPE: G!, photos F!, MO!).

Echites apocynifolia A. Gray, Proc. Amer. Acad. Arts 22:435. 1887. *Mandevilla apocynifolia* (A. Gray) Woodson, Ann. Missouri Bot. Gard. 19:65. 1932. TYPE: **MEXICO. JALISCO**: Río Blanco, Jun-Oct 1886, *Palmer 734* (HOLOTYPE: GH; ISOTYPE: NY!).

Distribution (Fig. 1)**:** pine-oak forests of central Mexico, typically found in volcanic soils, 1000-2000 m. Associated species include *Acacia spp.*, *Juniperus flaccida*, *Opuntia spp.*, and *Quercus hypoleucoides*.

Representative specimens. MEXICO. GUANAJUATO: Mpio. Abasolo, 4 km ESE of Saucillo, 19 Aug 1989, *Galván 3300* (NY); Mpio. León, 5 km N of Ibarrilla, 15 Jul 1987, *Galván 2652* (NY); Mpio. Puríssima, 3 km SW of Puríssima de Bustos, 1770 m, 20 Jul 1986, *Galván 1880a* (NY); Mpio. Silao, 10 km N of Silao, 21 Aug 1989, R. *&* *J. D. Galván 3403* (NY, TEX); Lagunilla, 15 km N of Victoria, 24 Aug 1989, 1800 m, *Ventura 6928* (TEX); Sierra de Obrajuelo, 12 Oct 1913, *Salazar s.n.* (US). **GUERRERO:**

Dist. Mina, Zihuqueo-Ojo de Agua, 1500 m, 22 Aug 1936, *Hinton et al. 9319* (F, TEX); Dist. Montes de Oaxaca, San Antonio, 20 Oct 1937, *Hinton et al. 11514* (TEX, US); Tehuilotepec, Mar 1945, *Martínez s.n.* (F); 3 mi N of Taxco, 21 Aug 1947, *J. B. Paxson 17M895* (F, TEX); Between Taxco and Tehuilotepec, Sep 1942, *Martínez 104* (US). **HIDALGO:** Mpio. Jacala, 23 Jun 1939, *Chase 7074* (F); Mpio. Metzquititlan, 9.1 km N of Metzquititlan on Hwy 105, 25 Oct 1985, *Bartholomew 3391* (NY); Mpio. Zimapán, between Puerto las Trancas and Puerto de la Estancia on highway NE of Zimapán, with pines and juniper, 5 Aug 1948, *Moore 4263* (TEX); Mpio. Zimapán, 4 km NE of Trancas, 17 km NE of Zimapán on road to Jacala, 1990 m, 6 Sep 1979, *García 1078* (TEX); Jacala, 13 Aug 1937, *Edwards 810* (F, TEX); Puerto de la Zorra, near km 284 on highway NE of Jacala, 20 Sep 1949, *Moore 5028* (TEX). **JALISCO:** 13 mi S of Guadalajara, 18 Aug 1959, *Waterfall 15619* (F); Volcanic soil of mountain side near Lake Chapala, 12 Aug 1947, *Barkley 7660* (TEX); Brecha a Manuel M. Dieguez km 40, 21 Feb 1987, *Díaz Luna 18341* (NY). **MEXICO:** Temascaltepec, 1 Aug 1934, *Hinton et al. 6379* (TEX, US). **MICHOACÁN:** Coalcoman, 22 Jul 1939, *Hinton et al. 13980* (F); 2 mi N of Río Tuxcan, 13 Jul, 1940, *Hitchcock 7136* (F, US); Mpio. Tlazazalca, road to Cerro de la Cruz, 5 Jul 1990, *Pérez 1360* (F); Moist field above road with areas of exposed flat rock, Rte. 15, 8 km E of Morelia, 3 Sep 1970, *D. Burch 2650* (F); Mpio. Puruándiro, 9 km SE of Puruándiro, along road to Cuitzeo, 2050 m, 22 Jun 1985, *Barriga 1146* (TEX); slopes of Cerro Potrerillos, ca. 5 mi N of Cotija and 22 mi S of Jiquilpan, 6000-6200 ft, 5 Oct 1961, *King 4632* (TEX, US); Zitacuaro, 25 Jul 1938, *Hinton et al. 13059* (F, TEX); Lava fields, near Monteleon, 19 Aug 1902, *Pringle 11015* (F, US). **MORELOS:** on lava field, km 15 of HWY between Yautepec-Cuernavaca road, 2 Oct 1943, *Lundell 12499* (TEX, US). **NAYARIT:** Mpio. Amatlan de Casas, 10-13 km S of Ahuacatlán, road to Amatlan de Casas (20° 59' N, 104° 31' W), 8 Aug 1990, *Téllez 12836* (F, NY). **QUERETARO:** 32 mi NE of Zimapán, 21 Aug 1957, *Waterfall 14204* (F); Black volcanic soil, 3 mi W of Querétaro, 28 Aug 1947, *Barkley 693* (TEX); Mpio. Pinal de Amoles, 3 km S of Escanelilla, 8 Jun 1986, *Fernández & Rzedowski 3376* (NY); near San Juan del Río, on rocky hillside, 17 Aug 1905, *Rose 9510* (US); Querétaro, 1910-13, *Arséne 10408* (US). **VERACRUZ:** Grassland above Santiago de Tuxtla, 20 Jul 1971, *Nevling & Gómez-Pompa 1808* (F).

Woodson (1938) and Morales (1998) regarded *Mandevilla apocynifolia* A. Gray as specifically distinct from *M. foliosa*. Williams (1998) discussed the misinterpretation of *M. apocynifolia* and regarded it as a synonym of *M. foliosa*.

ACKNOWLEDGMENTS

I thank the curators of the following herbaria for the loan of their specimens (F, G, GH, NY, P, TEX, US). Drs. Guy Nesom, James Reveal and B. L. Turner provided critical reviews of the manuscript.

LITERATURE CITED

Kartez, J. T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland, 2nd. Ed. Published by the author.

Morales, J. F. 1998. A synopsis of the genus *Mandevilla* (Apocynaceae) in Mexico and Central America. Brittonia 50(2): 214-232.

Pichon, M. 1950. Classification des Apocynacées: XXVIII, Supplémente aux Plumerioïdées. Mém. Mus. Natl. Hist. Nat., Sér. B, Bot. 1: 1-174.

Williams, J. K. 1995. Miscellaneous notes on *Haplophyton* (Apocynaceae: Plumerieae: Haplophytinae). Sida 16: 469-475.

----------. 1998. A new species of *Mandevilla* (Apocynaceae) from Jalisco, Mexico. Sida 18: 231-235.

----------. 1999. A phylogenetic and taxonomic study of the Apocynaceae subfamily Apocynoideae of Mexico with synopsis of subfamily Plumerioideae. Ph.D. dissertation. Austin, TX: University of Texas.

Woodson, R. E., Jr. 1933. Studies in the Apocynaceae IV. The American genera of Echitoideae. Ann. Missouri Bot. Gard. 20: 605-790.

----------. 1938. Apocynaceae. In: N. L. Britton et al. N. Amer. Fl. 29: 103-192.

TAXONOMY OF MEDICINAL PLANTS FROM TROPICAL RAINFORESTS AND THERAPEUTIC CATEGORIES OF THEIR DRUG DERIVATIVES

Mohammad Athar*

California Department of Food and Agriculture, 2014 Capitol Avenue, Suite 109, Sacramento, CA 95814, USA. E-mail: atariq@cdfa.ca.gov

ABSTRACT

Taxonomic position of 47 medicinal plants from tropical rainforests yielding clinically useful drug derivatives is described. Therapeutic categories of the drug derivatives from these plants are mentioned. These plants belong to 46 genera in 31 families of angiosperms and yield more than 100 derivatives. Families Apocynaceae, Fabaceae, Rubiaceae and Solanaceae included four species each, followed by Acanthaceae, Asteraceae, Brassicaceae and Lauraceae having two species each of medicinal plants. The remaining 23 families, including a monocotyledonous family Arecaceae, had one species each of medicinal plants. Exploitation of rainforest plants may provide further drug derivatives that will alleviate or correct every known human ailment.

KEY WORDS: Rainforests, medicinal plants, taxonomy, drug derivatives, therapeutic categories.

Tropical rainforests are green, lush forests that support a tremendous amount of species. These forests are typically located within a narrow band four degrees either side of the equator. Although it is the Amazon rainforests that spring most readily to mind, it is

*__Disclaimer:__ The views expressed in this article are those of author and do not necessarily represent those of the department. This article is for informational, scientific and academic purposes only. It should not be treated as a substitute for medical and health care advice, or as a substitute for consultation with a qualified professional.

important to remember that they are also found in parts of central and south America, Africa and Madagascar, south and southeast Asia, New Guinea and Australia, the Philippines and Malaysia, and Hawaii (Allo, 1996). All these rainforests are located near the equator, but each of these forests is separated by thousands of miles and is unique (Terborgh, 1992). Tropical rainforests are mainly the product of climatic interactions, particularly temperature and rainfall. High temperatures in the rainforests cause high evaporation that result in frequent rain. In general, tropical rainforests occur where a mean monthly temperature between 20 and 28° C is combined with an annual rainfall between 1.5 and 10 meters, evenly distributed throughout the year (Terborgh, 1992).

Rainforests play an important role in the climate of our planet by having an effect on the wind, rainfall, humidity, and temperature. Within the rainforest, water, oxygen, and carbon are recycled. This natural recycling helps to reduce flooding, soil erosion, and air pollution. The rainforests support over one half of the plant and animal life on earth (Terborgh, 1992). While tropical forests only constitute about 7% of the earth's surface, they account for 50-80% of the world's plant species. These forests, with their mighty trees and extraordinary flora and fauna, constitute the planet's richest habitats, and one of our most precious natural resources (Allo, 1996; Terborgh, 1992).

Rainforests contain an amazing abundance of plant life. About one hectare of Amazon rainforest is believed to house approximately 900 tons of botanicals. Approximately one fourth of the pharmaceuticals (medicines) we use come from plants of the tropical rainforests (Duke, 1997; Foster & Duke, 1990; Joyce, 1994; Moerman, 1996). It is exciting that scientists and researchers have begun to uncover the medicinal properties of rainforest herbs and flora (Farnsworth, 1988; Iwa et al., 1999; Joyce 1994). Nature has provided us with a treasure of herbal remedies-secrets that offer new approaches to health and healing. It is interesting to note that 70% of the plants from which we derive medicines that are effective in the treatment of cancer can only be found in the rainforests (Taylor 2004).

Classification of medicinal plants is organized in different ways depending on the criteria used. In general, medicinal plants are arranged according to their active principles in their storage organs, particularly roots, leaves, flowers, seeds and other plant parts (Athar & Ahmad, 2004; Athar & Nasir, 2004; Athar & Siddiqi, 2004; Duke 1997; Moerman, 1986, 1991, 1996). These principles are valuable to humans for treatment of different diseases (Ebadi, 2002; Palaniswamy, 2003; Ross 2003). This paper describes the taxonomy of medicinal plants from tropical rainforests and summarizes the therapeutic category of the useful drug derivatives obtained from them.

MATERIALS AND METHODS

A literature search was conducted to determine medicinal plants from tropical rainforests (Arvigo & Balick, 1993; Duke, 1997; Ebadi, 2002; Farnsworth, 1988; Foster & Duke, 1990; Iwa et al., 1999; Joyce, 1994; Moerman, 1986, 1996, 1996; Palaniswamy, 2003; Schultes & Raffauf, 1990; Taylor, 1998, 2004; Werbach & Murray, 1994), and their taxonomic position was determined. Only those plants were reported which were frequently mentioned in the literature. The genera were arranged alphabetically within families. The scientific and common names are provided that are generally associated with these plants. It is pointed out that common names are very imprecise and often assigned to completely different plants, so the scientific name should be used when looking for additional information concerning a plant. The paper also summarizes the therapeutic categories of the useful drug derivatives obtained from these plants. The nomenclature and classification followed Bailey & Bailey (1976), and author citations followed Brummitt & Powell (1992).

RESULTS AND DISCUSSION

The taxonomic position of 47 medicinal plants from tropical rainforests yielding clinically useful drug derivatives is presented in Table 1. It lists the more important medicinal species, including those from which many of our prescription drugs are derived. These species belong to 46 genera in 31 families of angiosperms and yield more than

Table 1. Taxonomy of plants from tropical rainforests yielding clinically useful drugs and their therapeutic categories.

Species	Common Name	Compound Derived	Therapeutic Category
MONOCOTYLEDONS			
Arecaceae (Palmae)			
Areca catechu L.	Betek-nut palm	Arecoline	Anthelmintic
DICOTYLEDONS			
Acanthaceae			
Andrographis paniculata (Burm. f.) Wall. ex Nees	Karyat	Andrographolide	Anti-bacterial
		Neoandrographolide	Anti-dysentery
Justicia adhatoda L.	Malabar nut	Vasicine (Peganine)	Oxytocic
Amaranthaceae			
Hebanthe eriantha (Poir.) Pedersen	Suma	Numerous including allantoin, sitosterol, daucosterol, pfaffosides, saponins, stigmasterol	Aphrodisiac, anti-cancer, immune enhancer
Anacardiaceae			
Schinus molle L.	Brazil peppertree	Calamenene, camphene, carvacrol, myrcene, pinene, quercitin, quercitrin,	Astringent, diuretic, urinogenital, venereal disease, viricide
Apiaceae (Umbelliferae)			
Centella asiatica (L.) Urb.	Indian pennywort	Asiaticoside	Vulnerary

Apocynaceae			
Catharanthus roseus (L.) G. Don	Madagascan periwinkle	Vinblastine	Anti-tumor agent
		Vincristine	Anti-cancer
Rauvolfia serpentina (L.) Benth. ex Kurz	Indian snakeroot	Ajmalicine	Circulatory stimulant
		Rescinnami	Anti-hypertensive
		Reserpine	Anti-hypertensive, tranquilizer
Rauvolfia tetraphylla L.	Snake root	Deserpidine	Anti-hypertensive, tranquilizer
Strophanthus gratus (Wall. & Hook.) Baill.	Twisted flower	Ouabain	Cardiotonic
Aquifoliaceae			
Ilex paraguariensis A. St.-Hil.	Yerba mate	Caffeine, theobromine, theophylline	Anti-hypertensive; cardiotonic, immunotonic, diuretic, stimulant,
Asteraceae (Compositae)			
Biden pilosa L.	Beggar's ticks	Esculetin, friedelin, limonene, lupeol	*Alterative, anti-fungal, anti-inflammatory, anti-rheumatic, styptic*
Stevia rebaudiana (Bertoni) Bertoni	Sweet herb; Ka'a He'e	Stevioside	Sweetener
Bigoniaceae			
Tabebuia impetiginosa (Mart. ex DC.) Standl.	Lapacho	Lapachol	Anti-tumor
Brassicaceae (Cruciferae)			
Lepidium meyeni Walp.	Maca	Saponins, sitosterol, stigmasterol	Anemia, aphrodisiac, menopause, tuberculosis
Rorippa indica (L.) Hiern	Nasturtium	Rorifone	Anti-tussive
Bromeliaceae			
Ananas comosus (L.) Merr.	Pineapple	Bromelain	Anti-inflammatory

Caricaceae			
Carica papaya L.	Papaya	Chymopapain, papain	Proteolytic, mucolytic
Erythroxylaceae			
Erythroxylum coca Lam.	Coca	Cocaine	Local anesthetic
Fabaceae (Leguminosae)			
Crotalaria spectabilis Roth	Rattlebox	Monocrotaline	Topical
Lonchocarpus nicou (Aubl.) DC.	Cube root	Rotenone	Piscicide
Physostigma venenosum Balf.	Ordeal bean	Physostigmine	Anti-cholinesterase
Mucuna pruriens (L.) DC. var. *utilis* (Wall.ex Wight) Baker ex Burck	Velvet bean	L-Dopa	Anti-parkinsonism
Lauraceae			
Cinnamomum camphora (L.) J. Presl	Camphor tree	Camphor	Rubefacient
Ocotea glaziovii Mez	Yellow cinnamon	Glaziovine	Anti-depressant
Lecythidaceae			
Bertholletia excella Humb. & Bonpl.	Brazil nut	Cerium, cesium, europium	Emollient, insect repellent
Loganiaceae			
Strychnos nux-vomica L.	Nux vomica	Strychnine	CNS stimulant
Malvaceae			
Gossypium spp.	Cotton	Gossypol	Male contraceptive
Menispermaceae			
Chondrodendron tomentosum Ruiz & Pav.	Curare	Tubocurarine	Skeletal muscle
Monimiaceae			
Peumus boldus Molina	Boldo	Boldin, boldine, eugenol	Diuretic, laxative, liver tonic

Olacaceae			
Dulacia inopiflora (Miers) Kuntze	Muira puama	Many including ampesterol, coumarin, lupeol, muirapuamine, phlobaphene	Aphrodisiac, rheumatism, dysentery, paralysis, menstrual cramps, menopause
Passifloraceae			
Passiflora incarnata L.	Passion flower	Harman, niacin, riboflavin, thiamin	Anti-spasmodic, anodyne, hypotonic, sedative
Piperaceae			
Piper methysticum G. Forst.	Kava-kava	Kawaina	Tranquilizer
Rubiaceae			
Carapichea ipecacuanha (Brot.) L. Andersson	Ipecac	Emetine	Amebicide
Cinchona calisaya Wedd.	Yellow cinchona	Quinidine, Quinine	Anti-arrhytmic, Anti-malarial
Uncaria tomentosa (Willd. ex Schult.) DC	Cat's claw	Many including ajmalicine, akuammigine, , catechin, cinchonain, corynantheine, corynoxeine, mitraphylline, procyanidins, speciophylline, stigmasterol, strictosidines, uncarine	Immuno-stimulant, anti-cancer, anti-AIDS
Pausinystalia johimba (K. Schum.) Pierre ex Beille	Yohimbe	Yohimbine	Adrenergic blocker;, Aphrodisiac
Rutaceae			
Pilocarpus jaborandi Holmes	Jaborandi	Pilocarpine	Parasympathomimetic
Sapindaceae			
Paullinia cupana Kunth	Guarana	Caffeine, theophylline, theobromine, guaranine, tannins, saponins	Anti-pyretic, anti-neuralgic, anti-diarrhoeal

Simaroubaceae			
Simarouba glauca DC.	Paradise tree	Glaucarubin	Amebicide
Solanaceae			
Datura metel L.	Recurved thorapple	Scopolamine	Sedative
Duboisia myoporoides R. Br.	Australian cork tree	Atropine, Hyoscyamine	Anti-cholinergic
Nicotiana tabacum L.	Tabacco	**Nicotine**	Insecticide
Physalis angulata L.	Winter cherry	Ayanin, phygrine, physagulin, physalin, wthaglutin	Analgesic, depurative, diuretic, expectorant, sedative
Sterculiaceae			
Theobroma cacao L.	Cocoa, cacao	Theobromine	Diuretic; Vasodilator
Tropaeolaceae			
Tropaeolum majus L.	Common nasturtium	glucoaubrietin	Anti-septic, anti-scorbutic, decongestant, purgative
Zingiberaceae			
Curcuma longa L.	Turmeric	Curcumin	Choleretic

100 drug derivatives. Family Apocynaceae, Fabaceae, Rubiaceae and Solanaceae had four species each followed by Acanthaceae, Asteraceae, Brassicaceae and Lauraceae having two species each of medicinal plants. The remaining 23 families, including a monocotyledonous family (Arecaceae), had one species each of medicinal plants. This is by no means a comprehensive list of all of the plants, names of chemicals, or uses for those chemicals, but it should serve as a useful reference for further research. The plant parts used for medicinal purposes include bark, roots, stem, leaves, flowers, fruits and seeds. In general, medicinal plants are arranged according to their active principles in their storage organs, particularly roots, leaves, flowers, seeds and other plant parts. However,

medicinal plants are also classified according to their taxonomic position (Athar & Ahmad 2004; Athar & Nasir 2004; Athar & Siddiqi 2004; Duke 1997; Moerman 1986, 1991, 1996; Taylor 1998, 2004). Athar & Siddiqi (2004) described the taxonomy, distribution and flowering period of 95 species used as medicinal flowers in Pakistan. In another study, Athar & Ahmad (2004) studied the taxonomy of medicinal legume trees of Pakistan. In their most recent paper Athar & Nasir (2004) described the taxonomy of 78 plant species yielding vegetable oil used in cosmetics and skin and body care products.

Rainforest plants are rich in secondary metabolites, particularly alkaloids. Biochemists believe alkaloids protect plants from disease and insect attacks. Many alkaloids from higher plants have proven to be of medicinal value and benefit. Currently, 121 prescription drugs currently sold worldwide come from plant-derived sources. And while twenty-five percent of western pharmaceuticals are derived from rainforest ingredients, less than one percent of these tropical trees and plants have been tested by scientists.

The US National Cancer Institute (NCI) has several collaborative programs that screen plants for the possibility of new drugs and active plant chemicals for cancer and AIDS/HIV. Because well over fifty percent of the estimated 250,000 plant species found on earth come from tropical forests, NCI concentrates on these regions. Plants have been collected from the African countries of Cameroon, the Central African Republic, Gabon, Ghana, Madagascar, and Tanzania. Collections are now concentrated in Madagascar (one of the most rapidly disappearing rainforest regions in the world), and collaborative programs have been established in South Africa and Zimbabwe.

In central and south America, samples have been collected from Belize, Bolivia, Colombia, the Dominican Republic, Ecuador, Guatemala, Guyana, Honduras, Martinique, Paraguay, Peru, and Puerto Rico. The NCI has established collaborative programs in Brazil, Costa Rica, Mexico, and Panama. Southeast Asian collections have been performed in Bangladesh, Indonesia, Laos, Malaysia, Nepal, Pakistan, Papua New Guinea, the Philippines, Taiwan, Thailand, and Vietnam. Collaborative

programs have been established in Bangladesh, China, Korea, and Pakistan. In each country, NCI contractors work in close collaboration with local botanical institutions. The NCI has identified 3000 plants that are active against cancer cells. Seventy percent of these plants are found in the rainforest. Twenty-five percent of the active ingredients in today's cancer-fighting drugs come from organisms found only in the rainforest (Taylor 1998, 2004).

Shanley & Luz (2003) indicate the impacts of forest degradation on medicinal plant use and implications for health care in eastern Amazonia. They mention that over the last three decades, forest degradation in the Brazilian Amazon has diminished the availability of some widely used medicinal plant species. Results of their 9-year market study suggest that forests represent an important habitat for medicinal plants used in eastern Amazonia: nine of the 12 top-selling medicinal plants are native species, and eight are forest based. Five of the top-selling species have begun to be harvested for timber, decreasing the availability of their barks and oils for medicinal purposes. Many of these medicinal plants have no botanical substitute, and pharmaceuticals do not yet exist for some of the diseases for which they are used (Ebadi 2002; Gaedcke et al. 2003; Palaniswamy 2003; Ross 2003). Market surveys indicate that all socioeconomic classes in Amazonia use medicinal plants because of cultural preferences, low cost, and efficacy (Shanley & Luz 2003; Taylor 1998, 2004; Vandebroek et al. 2004). Degradation of Amazonian forests may signify not only the loss of potential pharmaceutical drugs for the developed world but also the erosion of the sole health care option for many of Brazil's rural and urban poor (Newman 1994; Shanley & Luz 2003).

Plants have provided a good source of anti-infective agents; emetine, quinine, and berberine remain highly effective instruments in the fight against microbial infections (Iwa et al. 1999; Gaedcke et al. 2003). Phytomedicines derived from plants have shown great promise in the treatment of intractable infectious diseases including opportunistic AIDS infections. Plants containing protoberberines and related alkaloids,

picralima-type indole alkaloids and garcinia biflavonones used in traditional African system of medicine, have been found to be active against a wide variety of micro-organisms (Iwu et al. 1999). Some of the rainforest medicinal plants such as cat's claw, guarana, muira puma and suma (Table 1) provide more than one useful drug derivative that are used to cure diseases including AIDS/HIV, cancer and leukemia, while others possess aphrodisiac, diuretic, cardio-tonic and immuno-stimulant properties (Duke 1997; Iwu et al. 1999; Schultes & Raffauf 1990; Werbach & Murray 1994).

The isoquinoline alkaloid emetine obtained from the underground part of *Carapichea ipecacuanha* (= *Cephaelis ipecacuanha*), and related species, has been used for many years as an amoebicidal drug as well as for the treatment of abscesses due to the spread of *Escherichia histolytica* infections. Another important plant drug with a long history of use is quinine (Iwu et al. 1999). This alkaloid occurs naturally in the bark of Cinchona tree. Apart from its continued usefulness in the treatment of malaria, it can also be used to relieve nocturnal leg cramps. Currently, the widely prescribed drug chloroquine is analogs to quinine. Some strains of malarial parasites have become resistant to the quinines; therefore anti-malarial drugs with novel modes of action are required.

Higher plants have made important contributions in the areas beyond anti-infectives, such as cancer therapies. Early examples include the anti-leukemia alkaloids, vinblastine and vincristine, which were both obtained from Madagascan periwinkle (Nelson 1982). Vinblastine and vincristine, extracted from the rainforest plant periwinkle, are one of the world's most powerful anti-cancer drugs. These drugs have dramatically increased the survival rate for acute childhood leukemia since their discovery (Gaedcke et al. 2003; Nelson 1982; Taylor 1998, 2004). Vincristine is also used to treat diabetes, fevers, and malaria, to regulate menstrual cycles, to ease excessive menstrual bleeding and as a euphoriant (feeling of well-being) (Gaedeke et al. 2003; Nelson 1982; Taylor 1998, 2004). In 1983, there were no U.S. pharmaceutical manufacturers involved in research programs to discover new drugs or cures from plants. Today, over 100 pharmaceutical companies and several

branches of the US government are engaged in plant research projects for possible drugs and cures for viruses, infections, cancer and even AIDS.

All plant species contain poisonous, medicinal and nutritional compounds (Ross 2003; Schultes & Raffauf 1990). We credit our forefathers with the intelligence to have discovered which species around them were poisonous and which were edible. Yet we sometimes seem reluctant to credit them with discovering those intermediate properties we call medicinal activities. Our forefathers discovered many, if not most of the important medicinal species tabulated herein. Farnsworth (1988) calculated that seventy-four percent of 119 plant-derived drugs were discovered as a result of chemical studies to isolate the active substances responsible for their traditional use. In other words, we are indebted to our forefathers' empirical observations for about seventy-five percent of these currently used botanicals. We may expect new discoveries and uses among these same species very soon in the coming years (Iwu et al. 1999; Palaniswamy 2003).

Evolution argues quietly for the natural drug, while economics argues loudly for the unnatural drug. Pharmaceutical firms do actively study potential medicinal plants, discovering bioactive compounds, which, with some molecular modifications, become proprietary, enabling them to recoup their investment. Here are just a few reported new uses for compounds from well-known old medicinal species: anabasine as anti-fumitory, artemisinin for malaria, chymopapain for disc problems, colchicine for cirrhosis, cynarin for choleretic activity, huperzine for anti-cholinesterase activity, hypericin for anti-retroviral activity, gammalinolenic acid for atopic eczema, lobeline as an anti-fumitory, pilocarpine for xerostomia, polygodiol for anti-yeast activity, psoralen for leukemia, sanguinarine for anti-plaque activity, silymarin for hepatitis, taxol for anti-tumor activity, tetrahydrocannabinol for glaucoma, and yohimbine for serotinergic activity.

Somewhere in the tropics, there are probably compounds that will alleviate or correct every ailment known to mankind. Let us only hope someone finds them before the species and tropical medicine chest

become extinct (Newman 1994; Schultes & Raffauf 1990). The survival of mankind is intimately dependent on the survival of forests. The more diverse tropical floras, containing more biologically active compounds, are even more threatened than the better studied temperate floras.

ACKNOWLEDGMENTS

Special gratitude is expressed to Dr. Joseph H. Kirkbride, USDA, Agricultural Research Service, Beltsville, MD, for his help in checking the nomenclature and taxonomy of the plants. Thanks are due to Dr. M. Akmal Siddiqi, Marshfield Clinic Research Foundation, Marshfield, WI, for very constructive criticism, positive comments and valuable suggestions that improved the quality of the manuscript. Appreciations are extended to Dr. Ina Vandebroek, Ghent University, Ghent, Belgium for providing many references and original reprints that helped in the preparation of this paper.

REFERENCES

Allo, C.N. 1996. Rainforests Around the World. The University of Illinois, IL.

Arvigo, R. and **M.J. Balick.** 1993. Rainforest Remedies, One Hundred Healing Herbs of Belize. Lotus Press, Twin Lakes, WI.

Athar, M. and **Z. Ahmad.** 2004. Taxonomy, distribution and medicinal uses of medicinal legume trees of Pakistan. Sida 21 (2): In Press.

Athar, M. and **S.M. Nasir.** 2004. Taxonomic perspectives of plant species yielding vegetable oils used in cosmetics and skin care products. Int. J. Biol. Biotechnol. 1 (4): In Press.

Athar, M. and **M.A. Siddiqi.** 2004. Some reflections on the taxonomy of medicinal flowers of Pakistan. Sida 21:357-369.

Bailey, L. H. and **E.Z. Bailey.** 1976. Hortus Third: A Consise Dictionary of Plants Cultivated in United State and Canada. Revised. MacMillan, New York, NY.

Brummitt, K.R. and **C.E Powell** (eds.). 1992. Authors of Plant Names. Royal Botanic Gardens, Kew, UK.

Duke, J.A. 1997. The Green Pharmacy. Rodale Press, Emmaus, PA.

Ebadi, M. 2002. Pharmacodynamic Basis of Herbal Medicine. CRC Press, Boca Raton, FL.

Farnsworth, N.R. 1988. Screening plants for new medicines. In: E.O. Wilson (ed.), Biodiversity, pp 83-97, National Academy Press, Washington, DC.

Foster, S. and **J.A. Duke.** 1990. A Field Guide to Medicinal Plants: Eastern and Central North America. Houghton Mifflin Co., Boston, MA.

Gaedcke, F., B. Steinhoff, and **H. Blasius**. 2003. Herbal Medicinal Products. Medpharma Science Publishers, Stuttgart, and CRC Press Boca Raton, FL.

Iwa, M.M., A.R. Duncan, and C.O. Okunji. 1999. New antimicrobials of plant origin. In: J. Janick (ed.), Perspectives on New Crops and New Uses, pp. 457-462, ASHS Press, Alexandria, VA.

Joyce, C. 1994. Earthly Goods: Medicine Hunting in the Rainforest. Little Brown & Co., New York, NY.

Moerman, D.E. 1986. Medicinal Plants of North America. Museum of Anthropology, University of Michigan, Ann. Arbor, MI.

Moerman, D.E. 1991. The medicinal flora of native North America: an analysis. J. Ethnopharmacol. 31:1-42.

Moerman, D.E. 1996. An analysis of the food plants and drug plants of native North America. J. Ethnopharmacol. 52:1-22.

Nelson, R. 1982. The comparative clinical pharmacology and pharmacokinetics of vindesine, vincristine and vinblatine in human patients with cancer. Med. Pediatr. Oncol. 10:115-127.

Newman, E.B. 1994. Earth's vanishing medicine cabinet: Rainforest destruction and its impact on the pharmaceutical industry. Amer. J. Law & Med. 20:479-501.

Palaniswamy, U.R. 2003. A Guide to Medicinal Plants of Asian Origin and Culture. CPL Scientific Publishing Services Ltd., Newbury, UK.

Ross, I.A 2003. Medicinal Plants of the World - Chemical Constituents, Traditional and Modern Uses. Volume 1, Second Edition. Humana Press, Totowa, NJ.

Shanley P., and **L. Luz.** 2003. The impacts of forest degradation on medicinal plant use and implications for health care in Eastern Amazonia. BioScience 53:573-584.

Schultes, R.E. and **R.F. Raffauf.** 1990. The Healing Forest. Medicinal and Toxic Plants of the Northwest Amazonia. R.F. Dioscorides Press, Portland, OR.

Terborgh, J. 1992. Diversity and the Tropical Rainforest. Scientific American Library, New York, NY.

Taylor, L. 1998. Herbal Secrets of the Rainforest. Prima Publishing, Inc., Rocklin, CA.

Taylor, L. 2004. The Healing Power of Rainforest Herbs. Square One Publishers, Inc., Garden City Park, NY.

Vandebroek, I., P. Van Damme, L. Van Puyvelede, S. Arrazola, and **N. De Kimpe.** 2004. A comparison of traditional healers' medicinal plant knowledge in the Bolivian Andes and Amazon. Soc. Sci. Med. 59:837-849.

Werbach, M. R. and **M.T. Murray.** 1994. Botanical Influences on Illness - A Sourcebook of Clinical Research. Third Line Press: Tarzana, CA.

KEYS TO THE FLORA OF FLORIDA -- 11, *ELYTRARIA* (ACANTHACEAE)

Daniel B. Ward

Department of Botany, University of Florida
Gainesville, Florida 32611, U.S.A.

ABSTRACT

Elytraria (Acanthaceae) is represented in Florida by a single species, *E. caroliniensis* (Gmel.) Pers., which in turn is here treated as of three varieties, with var. *vahliana* recognized as a new combination. An amplified key is given to the Florida taxa.

KEY WORDS: *Elytraria*, Acanthaceae, Florida flora.

The recognition by M. L. Fernald (in Robinson & Greenman, Bot. Gaz. 22:169. 1896) of a linear-leaved *Elytraria* (Acanthaceae) from Dade County, Florida, was the first departure in American literature from the concept of a uniformly broad-leaved species in the southeastern United States. Fernald saw this South Florida plant as "an extreme form, hardly worthy of specific rank," and was joined in placing it at varietal level by S. F. Blake (Rhodora 17:131. 1915) and R. W. Long (J. Arnold Arbor. 51:279. 1970). Yet the strikingly narrower leaves and the geographic discontinuity from the typical form led J. K. Small (Flora of Miami. 1913; Man. S.E. United States. 1933) and E. C. Leonard (J. Washington Acad. Sci. 24:445. 1934) to treat it as a distinct species.

Examination of a series of specimens (FLAS, FSU, USF) more extensive than those available to the above workers, while confirming the presence of a modestly distinct series of populations in South Florida, has also disclosed the existence largely in the Florida panhandle of a third variant that is intermediate in form and speaks for the treatment of the southeastern complex as a single species. Although overlooked by American workers (e.g., A. F. Clewell, Guide to the Vasc. Flora of

the Florida Panhandle. 1985; R. P. Wunderlin, Guide to the Vasc. Flora of Florida. 1998), it had been recognized and described in 1847 by the German student of the Acanthaceae, C. G. Nees von Esenbach. Use of his epithet requires the following combination.

Elytraria caroliniensis (Gmel.) Pers. var. ***vahliana*** (Nees.) D. B. Ward, **comb. nov.** Basionym: *Elytraria virgata* Michx. var. *vahliana* Nees in DC., Prodr. 11: 63. 1847.

Although *Elytraria caroliniensis* extends from southern South Carolina into peninsular Florida, in its typical form it does not appear to occur west of the Suwannee River. All collections seen from the Florida panhandle, as well as others from several counties in northern peninsular Florida, differ from the typical form in leaf shape and pubescence, as noted in the accompanying key. These differences were concisely stated by Nees in characterizing his new variety as "foliis oblongis glabris." His citation of a F. Rugel collection, "ad margines paludum et in pinetis," St. Marks, Florida, corresponds to several recent collections from the low hammocks and pine flatwoods of Wakulla County where this variety is of frequent occurrence.

Elytraria Michx. [1]

1. Leaves broadly obovate to elliptic, less than 3x longer than wide; lower surface mostly softly pubescent. Moist hammocks. Peninsular Florida (Columbia, Alachua Cos., south to Charlotte, Highland Cos.); infrequent. May - August. [*E. virgata* Michx.; *Tubiflora caroliniensis* (Walt.) Gmel.]

E. caroliniensis (Gmel.) Pers. var. **caroliniensis**

The "amplified key" format employed here is designed to present in compact form the basic morphological framework of a conventional dichotomous key, as well as data on habitat, range, and frequency. This paper is a continuation of a series begun in the 1970s (vide Phytologia 35:404-413. 1977). I wish to thank David W. Hall and Kent D. Perkins for constructively reviewing the manuscript.

1. Leaves narrowly obovate to linear, more than 3x longer than wide; lower surface glabrous.

    2. Leaves narrowly obovate, less than 15x longer than wide. Flatwoods, hammocks, river bottoms. Panhandle Florida (Holmes Co.) eastward, to northeast (Nassau Co.) and the northern peninsula (Levy Co.: Gulf Hammock); infrequent. May - August. [*E. virgata* Michx. var. *vahliana* Nees in DC.]
    E. caroliniensis (Gmel.) Pers.
    var. **vahliana** (Nees in DC.) D. B. Ward

    2. Leaves linear, more than 15x longer than wide. Pinelands, open marl prairies. Endemic to South Florida (north to Lee and Martin Cos.; absent from Keys); rare. All year. [*E. virgata* Michx. var. *angustifolia* Fern.; *Tubiflora angustifolia* (Fern.) Small]
    E. caroliniensis (Gmel.) Pers.
    var. **angustifolia**(Fernald) S. F. Blake

NEW VARIETAL COMBINATIONS IN *PHYSARIA* (BRASSICACEAE)

B. L. Turner

Plant Resources Center, University of Texas, Austin, Texas 78712, U.S.A

The following new varietal combinations are made in accordance with the precepts of Turner and Nesom (2000):

Physaria arenosa (Richardson) O'Kane & Al-Shehbaz var. **argillosa** (Rollins & E. A. Shaw) B. L. Turner, **comb. nov.**

Based upon *Lesquerella arenosa* var. *argillosa* Rollins & E. A. Shaw, Lesquerella North America. 178. 1973.

Physaria argyraea (A. Gray) O'Kane & Al-Shehbaz var. **diffusa** (Rollins) B. L. Turner, **comb. nov.**

Based upon *Lesquerella diffusa* Rollins, J. Arnold Arb. 21: 395. 1940.

Rollins and Shaw (1973) treated this mainly Mexican taxon as a subspecies of *P. argyraea*, but Rollins (1993) subsequently reduced this to varietal rank. Al-Shehbaz and O'Kane (2002), however, opted to reaffirm its subspecific status. More detailed examination of populations in the field might show that it is deserving of specific rank; at least I have been unable to detect intermediates between the two taxa among herbarium specimens (LL, TEX), nor were these called to the fore by Rollins and Shaw (1973) or Rollins (1993).

Physaria gordonii (A. Gray) O'Kane & Al-Shehbaz var. **densifolia** (Rollins) B. L. Turner, **comb. nov.**

Based upon *Lesquerella gordonii* var. *densifolia* Rollins, Cruciferae Continental N. Amer. 621. 1993.

Al-Shehbaz and O'Kane (2002) recognized this taxon as a subspecies of *P. gordonii* without comment.

Physaria gracilis (Hook.) O'Kane & Al-Shehbaz var. **repanda** (Nutt.) B. L. Turner, **stat. et comb. nov.**

Based upon *Vesicaria repanda* Nutt. in Torrey & A. Gray, Fl. N. Amer. 1: 101. 1838.

Rollins and Shaw (1973) treated this as a subspecies of *Lesquerella gracilis* (= *Physaria g.* subsp. *nuttallii*), as did Al-Shehbaz and O'Kane (2002). If treated as a variety, however, it must take the earliest name at that rank (*Lesquerella gracilis* var. *repanda* [Nutt.] Payson).

Physaria hemiphysaria (Maguire) O'Kane & Al-Shehbaz var. **lucens** (S. L. Welsh & Reveal) B. L. Turner, **stat. nov.**

Based upon *Lesquerella hemiphysaria* var. *lucens* S. L. Welsh & Reveal, Great Basin Naturalist 37: 338. 1977.

Rollins (1993) maintained this taxon at the varietal level; Al-Shehbaz and O'Kane (2002), however, treated it as a subspecies.

Physaria hitchcockii (Munz) O'Kane & Al-Shehbaz var. **rubicundula** (Rollins) B. L. Turner, **stat. et comb. nov.**

Based upon *Lesquerella rubicundula* Rollins, Contr. Dudley Herb. 3: 178. 1941.

Rollins (1993) maintained this taxon at the specific level, *Lesquerella rubicundula* Rollins (=*Physaria rubicundula* (Rollins) S. L. Welsh); Al-Shehbaz and O'Kane (2002) presented a more detailed account of the species, reducing it to subspecific rank.

Physaria kingii (S. Watson) O'Kane & Al-Shehbaz var. **bernardina** (Munz) B. L. Turner, **stat. et comb. nov.**

Based upon *Lesquerella bernardina* Munz, Bull. S. Calif. Acad. Sci. 31: 62. 1932.

Both Rollins & Shaw (1973) and Al-Shehbaz and O'Kane (2002) treated this taxon at the subspecific level, as did Munz some 26 years after proposing the taxon.

Physaria kingii (S. Watson) O'Kane & Al-Shehbaz var. **cobrensis** (Rollins & E. A. Shaw) B. L. Turner, **comb. nov.**

Based upon *Lesquerella kingii* var. *cobrensis* Rollins & Shaw, *Lesquerella* in N. Amer. 255. 1973.

Al-Shehbaz and O'Kane (2002) treated this taxon as a subspecies; Rollins and Shaw (1973) treated it as one of two varieties in the subspecies *kingii*.

Physaria kingii (S.Watson) O'Kane & Al-Shehbaz var. **diversifolia** (Greene) B. L. Turner, **comb. nov.**

Based upon *Lesquerella diversifolia* Greene, Pittonia 4: 309. 1901.

This taxon has been validly treated as both a variety and subspecies of *Lesquerella occidentalis*; Rollins and Shaw (1973) treated it as a subspecies of *L. kingii*, this subsequently recognized at the varietal level by Rollins (1993); Al-Shehbaz and O'Kane (2002) treated it as a subspecies of *Physaria kingii*.

Physaria ovalifolia (Rydb.) O'Kane & Al-Shehbaz var. **alba** (Goodman) B. L. Turner, **stat. nov.**

Based upon *Lesquerella ovalifolia* var. *alba* Goodman, Rhodora 38: 239. 1936.

Rollins and Shaw (1973), Rollins (1993), and Al-shehbaz and O'Kane (2002) treated this taxon as a subspecies of *P. ovalifolia*; the

former two authors suggested that the two taxa perhaps intergrade in western Oklahoma.

Physaria purpurea (A. Gray) O'Kane & Al-Shehbaz var. **foliosa** (Rollins) B. L. Turner, **comb. nov.**

Based upon *Lesquerella purpurea* var. *foliosa* Rollins, Contr. Dudley Herb. 3: 180. 1941.

Rollins and Shaw (1973) recognized this weakly differentiated taxon as a subspecies of *Lesquerella purpurea*, but Rollins (1993) chose not to recognize infraspecific taxa under *L. pupurea*. Al-Shehbaz and O'Kane (2002), however, treated this mostly Mexican taxon as a subspecies. Rollins and Shaw (1773) noted that it seems to grade into the typical variety in Trans-Pecos, Texas, which seems to be the case.

Physaria reediana O'Kane & Al-Shehbaz var. **spatulata** (Rydb.) B. L. Turner, **comb. nov.**

Based upon *Lesquerella spatulata* Rydb., Contrib. U. S. Natl. Herb. 3: 486. 1896.

Al-Shehbaz and O'Kane (2002) treated this taxon as a subspecies of *P. reediana*, but noted that Rollins (1993) treated at as a variety of *Lesquerella alpina.*

Physaria rosei (Rollins) O'Kane & Al-Shehbaz var. **perotensis** (Rollins) B. L. Turner, **stat. nov.**

Based upon *Lesquerella rosei* var. *perotensis* Rollins, Contrib. Gray Herb. 214. 23. 1984.

Al-Shehbaz and O'Kane (2002) treated this Mexican taxon at the subspecific level.

ACKNOWLEDGEMENTS

I am grateful for the time and helpful suggestions of Guy Nesom and James Reveal, who reviewed the paper.

LITERATURE CITED

Al-Shehbaz, I.H. and **S.L. O'Kane**. 2002. *Lesquerella* is united with *Physaria*. Novon 12: 319-329.

Rollins, R.C. 1993. The Cruciferae of Continental North America. Stanford Univ. Press, Stanford.

Rollins, R.C. and **E.A. Shaw**. 1973. The genus *Lesquerella* (Cruciferae) in North America. Harvard Univ. Press, Cambridge.

Turner, B.L. and **G. L. Nesom**. 2000. Use of variety and subspecies and new varietal combinations for *Styrax platinifolius* (Styracaceae). Sida 19: 257-262.

INDEX TO NEW NAMES AND COMBINATIONS IN PHYTOLOGIA 86(3)

SUBSCRIPTION INFORMATION

PHYTOLOGIA is published three times a year, P.O. Box 2012, Sam Houston State University, Huntsville, TX 77341-2012. Annual domestic individual subscription (3 issues): $30.00. Annual domestic institutional subscription (3 issues): $90.00. Foreign and/or airmail postage extra.

INFORMATION FOR AUTHORS

Articles from botanical systematics and ecology, including biographical sketches, critical reviews, and summaries of literature will be considered for publication in *PHYTOLOGIA*. Authors should arrange for two workers in the appropriate field to review the manuscript before submission. Copies of reviews should be forwarded to the editor with the manuscript. Additional review may occur for articles proposing significant nomenclatural changes and or revisions to established taxa. Effort will be made to locate a reviewer for author(s) if he/she desires. Articles should be submitted digitally, either by disk, CD or email. Language of manuscripts may be either English or Spanish. Format of articles should follow past issues of *PHYTOLOGIA* (preferably single spaced and Times New Roman in 10 point font.)

Cost of publication is currently $13.00 US per page for publication without reprints. PDF files of reprints will be made available to authors upon request. Page charges are due with manuscripts. No extra charges are made for line drawings or grey scale photos. Extra fees will be charged for color photos, the charge will be determined on an individual basis.