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NOTES ON ERIOGONUM — III ON THE STATUS OF ERIOGONUM PAUCIFLORUM PURSH

James L. Reveal^{1, 2}

In 1814, Fredrick Pursh published in the appendix to his *Flora Americae Septentrionalis*, several interesting and new taxa that had been collected in North America by John Bradbury. Among the new species was *Eriogonum pauciflorum*. In the spring of 1966, for a history class, I reviewed Susan Delano McKelvey's book, *Botanical Exploration of the Trans-Mississippi West, 1790-1850*, and realized that the range of *E. pauciflorum*, as understood by the Great Plains and Rocky Mountain botanists did not get near the Missouri River, nor into North Dakota where Bradbury (1817) stated that he made his collection. To these botanists, the epithet *E. pauciflorum* referred to a plant of southeastern Wyoming and adjacent northern Colorado.

Through the kindness of Dr. A. E. Schuyler, I was able to study the holotype of *Eriogonum pauciflorum* in the Pursh Herbarium which is now deposited at the Academy of Natural Sciences in Philadelphia. The examination confirmed earlier suspicions that the name *E. pauciflorum* was misapplied. The plant that Bradbury had collected has been known for several years as *E. multiceps* Nees or *E. gnaphalodes* Benth. in Hook.

A RESUME OF THE DISCOVERIES

John Bradbury is a relatively unknown early botanist, although as an early writer on the area of the upper Missouri River, he is far better known. He was born near Salybridge in Lancashire, England, in 1768, but did not come to America until 1809 when he was 41. Following the suggestions of Thomas Jefferson, Bradbury went to Saint Louis where he established his headquarters rather than at New Orleans as he had originally planned. This change was fortunate as it certainly allowed him to gather a far more interesting and unknown flora under the auspices of the Liverpool Botanic Garden (Rickett, 1950).

Unknown to Bradbury, a fellow Englishman, Thomas Nuttall, was setting out to study the western flora at the same time. Nuttall was born in 1786 in the village of Long Preston in Craven, England, and came to America ". . . in the spring of 1807 or 1808, when he was twenty-one or twenty-two. . ." (Pennell, 1936). Almost as soon

1. The author wishes to thank the United States National Herbarium and the Smithsonian Institution which sponsored his Predoctoral Internship program in Washington, D.C., from September 1966 to February 1967 where this paper was basically prepared. He is grateful to C. V. Morton and S. H. Shelter for their many helpful suggestions and assistance in obtaining critical herbarium material. The assistance of Dr. C. L. Porter of the University of Wyoming on various aspects concerning the Wyoming taxa is gratefully acknowledged. The author also wishes to thank the curators whose facilities were visited or who kindly sent loan material. This paper has been submitted to the Department of Botany, Brigham Young University, as partial fulfillment of two credits of Special Problems given during the Summer Session of 1967.

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as Nuttall arrived, he became acquainted with Benjamin Smith Barton of Philadelphia. Nuttall, who had collected every curious plant that he saw walking into the city, had taken his unknown collection to Barton for determination. Barton's previous assistant, Fredrick Pursh, had recently left, and Barton must have been impressed by Nuttall for he soon hired the young man to collect plants for him.

In the year 1810, while Bradbury was busy collecting in the Saint Louis area, Nuttall was setting out to collect in the old "Northwest" under an exact set of directions given to him by Barton (Graustein, 1950). Nevertheless, Nuttall was soon to forget his directions.

How Nuttall and Bradbury met is not known, nor is it exactly known how the two men came to arrange to go up the Missouri River with the Overland Astorians. In a series of letters reprinted by Rickett (1950), Bradbury reveals that in late January the boat on which he had sent his 1810 collection to New Orleans had run aground below Saint Louis (in Bradbury's *Travels*, he says "autumn") and it was upon his return to the city following his investigation of the condition of the boat and his collection that he learned of the Astorians. Wilson Price Hunt, the leader of the Astorians, had been in the Saint Louis vicinity since September 1810, but to avoid the expense of over-wintering in the city, he had established a winter camp near St. Joseph, Missouri (Irving, 1836). Apparently Hunt returned to Saint Louis around the 20th of January, 1811, and no doubt it was at this time that Bradbury (no mention of Nuttall) was informed of Hunt's intention to ascend the Missouri River. On the first of March, Hunt returned to Saint Louis from his winter camp to make the necessary final arrangements for his fur trapping expedition into the Pacific Northwest (Bradbury, 1817).

The competition for the fur trade in the Oregon Country was intense between all companies engaged. The North West Company and the Hudson's Bay Company in Canada and in the Oregon Country were locked in bitter, and occasionally bloody, competition. Likewise, the Missouri Fur Company under Manuel Lisa and the American Fur Company under John Jacob Astor were rapidly becoming arch rivals. And in the middle of the American rivalry were two botanists, John Bradbury and Thomas Nuttall.

Hunt, during his trips to Saint Louis, was trying to obtain experienced men who had worked for the Missouri Fur Company in the past. At the same time, he was also attempting to purchase equipment for his trip. Manuel Lisa, the leader of the Missouri Fur Company, quickly realized that Hunt was causing a drain of men and equipment that could reflect in the fur take of his own company. One of the men that Hunt hired was Pierre Dorion, a half-breed who had been Lisa's interpreter. When Lisa found that Dorion was going to work for the Astorians, he had a warrant issued for Dorion's arrest as he had an outstanding liquor bill which had been incurred in the mountains. Bradbury and Nuttall, who had remained behind in Saint Louis for the last mail after Hunt had left, overheard the

sheriff's plans to apprehend Dorion at St. Charles. By leaving shortly after midnight on March 13th and traveling rapidly overland the two botanists, now turned spies, informed Hunt of the pending arrest, and Dorion with his wife and child fled into the woods and were not found by the sheriff. The incident involving Dorion has been interpreted in two ways. First, Irving suggests that Lisa's actions were to prevent Hunt from using the services of Dorion; Oglesby (1963), on the other hand, suggests that Lisa simply wanted to travel with Hunt and his large party in order to ward off Indian attacks.

The slow trip up the Missouri River has been discussed at some length by various writers on both expeditions (Brackenridge, 1814, with Lisa; Bradbury, 1817, with Hunt), and by various authors afterwards (Irving, 1836; Oglesby, 1963). Parts of the expeditions have been discussed in the botanical literature by Pennell (1936), Rickett (1950), McKelvey (1955), and Stevens (1946, 1959).

It is obvious from these various authors that Nuttall and Bradbury remained distant. In only four places does Bradbury even mention his fellow naturalist in his *Travels*. Although the two men were both good botanists, they had widely different outlooks on their trip and what was necessary to observe. Irving, who unfortunately has been criticized as an historian, has written an excellent summary on the two men which is rather revealing:

Mr. Nuttall seems to have been exclusively devoted to his scientific pursuits. He was a zealous botanist, and all his enthusiasm was awakened at beholding a new world, as it were, opening upon him in the boundless prairies, clad in the vernal and variegated robe of unknown flowers. Whenever the boats landed at meal times, or for any temporary purpose, he would spring on shore and set out on a hunt for new specimens. Every plant or flower of a rare or unknown species was eagerly seized as a prize. Delighted with the treasures spreading themselves out before him, he went groping and stumbling along among a wilderness of sweets, forgetful of every thing but his immediate pursuit, and had often to be sought after when the boats were about to resume their course. At such times he would be found far off in the prairies, or up the course of some petty stream laden with plants of all kinds.

The Canadian voyageurs, who are a class of people that know nothing out of their immediate line, and with constitutional levity make a jest of any thing they cannot understand, were extremely puzzled by this passion for collecting what they considered mere useless weeds. When they saw the worthy botanist coming back heavy laden with his specimens, and treasuring them up as carefully as a miser would his hoard, they used to make merry among themselves at his expense, regarding him as some whimsical kind of madman.

Mr. Bradbury was less exclusive in his tastes and habits, and combined the hunter and sportsman with the naturalist. He took his rifle or his fowling piece with him in his geological researches, conformed to the hardy and rugged habits of the men around him, and of course gained favor in their eyes. He had a strong relish for incident and adventure, was curious in observing the savage manners, and savage life, and ready to join any hunting or other excursion.

Thus it was that much of their collection was duplicated, but it was also this desire of Bradbury's for adventure that set him out for Fort Lisa on horseback while Nuttall, certainly much less of an

adventurer, remained behind to go up the river by boat. It was this trip that possibly allowed Bradbury to discover *Eriogonum pauciflorum*, and for Nuttall to miss it.

On the 3rd of June 1811, Lisa, who had left St. Charles on April 2nd, finally caught up with Hunt just below the Arikara Villages. From now on the small flotilla of five boats moved upstream, but with Hunt always in the front so that Lisa could not pass him. The parties finally arrived at the Villages, which were located near present-day Wakpala, Corson County, South Dakota, on the west bank of the Missouri River some six miles above the mouth of the Grand River.

On the 19th of June, Hunt and Lisa settled some of their differences, and a trade of Hunt's boats for some of Lisa's horses had been arranged. It was decided that a party should be sent overland for the horses which were at the Missouri Fur Company's fort several miles upstream. When Bradbury learned of the pending trip, he ". . . declared to Mr. Hunt that, unless he absolutely refused me the privilege, I was determined to accompany them." Hunt gave his consent, and mounted on a bare wooden saddle on a poor horse, Bradbury set off, often collecting plants and putting them under his hat until he had a moment to dismount and press them. On the evening of the 22nd, the party reached the fort.

There has been considerable confusion in the botanical literature as to the locations of the forts and Indian villages on the upper Missouri River, and to some degree, this is due to a similar confusion in the historical literature on this period. While I certainly do not wish to proclaim to have the final word on this subject, some new and hopefully enlightening information can be presented.

In attempting to determine the exact localities mentioned by Bradbury, I wrote the State Historical Society of North Dakota³ at the suggestion of Dr. LeRoy R. Hafen, Professor of Far Western History, Brigham Young University. The information that was obtained from Sperry contradicts, to some degree, with the traditional data given as to the location of the forts and Indian villages, and this is presented here in some detail so that a clearer picture of their locations might be understood.

In 1804, Lewis & Clark built Fort Mandan where they overwintered in 1804-1805. Nevertheless, in 1811 this site was abandoned, for Lewis & Clark reported (1814) that when they returned in August 1806, they found that a large portion of the fort had been burned. Sperry believes that the site was probably still obvious when Bradbury visited the area. When Alexander Philip Maximilian, a Prussian soldier and scholar, later visited the area in the winter of 1883-1884 at Fort Clark, he mentioned (1841) that the river had changed its course and that the site of Fort Mandan was either on the opposite bank (the east bank) or in the middle of

3. In response to my letter, Mr. James E. Sperry, Research Archeologist, wrote on 19 January 1967 his reply which is the major basis for the discussion on the locations of the forts and Indian villages. His letter is deposited in my personal correspondence and in that of C. V. Morton's, Smithsonian Institution, Washington, D.C.

the river. Sperry comments that the exact site of Fort Mandan has not been discovered, but according to the maps of Lewis & Clark and of Maximilian, he believes that the fort was on the east bank of the river and about 15 miles northeast of the site of Fort Clark in present-day McLean County, North Dakota.

Sperry says that the site of Fort Lisa, which was later named Fort Vanderbaugh, also has not been definitely located. Bradbury (1817) indicated that after crossing the Knife River, they had "... seven miles still to travel in order to reach the Fort. . ." If his distances are correct, that would put the site of the fort just over a mile south of Mannheim on the west bank of the Missouri River in Mercer County.

In the story of *Eriogonum pauciflorum*, the locations of the Indian villages are also important. Sperry writes that in 1811 there were only two Minetaree Villages, both of which are still quite evident. These villages were simply called the upper and lower villages by Bradbury. The lower village was a small site about one mile north of the town of Stanton on the south side of the Knife River near the present-day Stanton Cemetery. The upper village, which was considerably larger, was located about 2.8 miles north of Stanton, or on the north side of the Knife River near the present site of the Olds School. Thus, the type area of *E. pauciflorum* appears to be north of Stanton, Mercer County, rather than south of Mannheim (or the location of Fort Lisa) as was stated by Stevens (1946).

From Bradbury's journal, it is apparent that he was in the vicinity of the Minetaree Villages on three different days of June: the 22nd when he rode through in the late evening; the 24th, at which time he collected on the bluffs north of the upper village; and the 28th when he was actually in and around the Minetaree Villages. While Bradbury might have been able to collect the *Eriogonum* on the 22nd, it seems unlikely as it was late in the evening and he knew that he was going to be in the area for a few days. The bluffs north of the upper village which he visited on the 24th are an excellent place for the *Eriogonum* to grow. However, Bradbury specifically stated that the *Eriogonum* came from near the Minetaree village, and it is assumed that the buckwheat was not collected on this date. Therefore, it would seem most likely that Bradbury collected the type of *E. pauciflorum* on the east facing slopes of the low hills northwest of the upper village when he visited it on the 28th of June 1811.

The discovery of *Eriogonum multiceps* by Alexander Philip Maximilian, Prince of Wied-Neuwied, can be traced with a little more exactness. The holotype deposited at Jardin Botanique de l'État, Bruxelles, Belgium, consists of two specimens, one simply says "Am uberen Missouri" while the other gives the same information, a collection number (#114), and a date, "6 July." On July 6th, Maximilian was at Fort Union, a post near the North Dakota-Montana state line, where he had been since the 24th of June 1833.

However, on the 6th, he reported that he was preparing to leave for Fort McKenzie further up the river, and probably the collection was not actually made on this day, but on a day before while still at Fort Union as he does mention collecting plants there. It seems likely from comparing recent specimens that have been collected in this area, that the Maximilian collection could have come from the Fort Union area, although in his book (1841), no mention of an *Eriogonum* is made.

The entire collection of some two hundred plants was turned over to Nees von Esenbeck of Poland, who prepared the botanical appendix which appears in Maximilian's book. When Nees described *Eriogonum multiceps*, he compared it with *E. pauciflorum*, and unlike Pursh, adequately described the species. Unfortunately, the publication *Reise in das innere Nord-America in den Jahren 1832 bis 1834*, was not seen by the American botanists until the middle of the century, and the name *E. multiceps* was not noted in print until Torrey & Gray's 1870 revision of Eriogoneae.

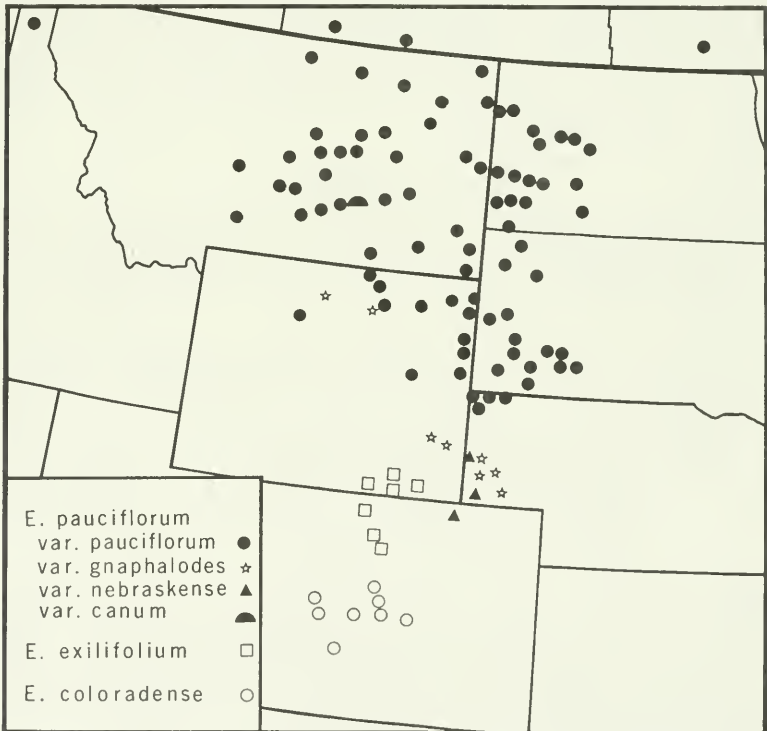
In the meanwhile, Bentham had named *Eriogonum gnaphalodes* which had been collected by Carl Andreas Geyer, a German collector, probably in the Guernsey area, Platte County, Wyoming, which is near Fort Laramie (Goshen County) which is the location given by Geyer (1845-1846) for this plant. When Torrey & Gray discovered that *E. gnaphalodes* and *E. multiceps* were basically the same kind of plant, they placed the Bentham name into synonymy, and their concept of *E. multiceps* for the Great Plains species has been followed since.

KEY TO THE SPECIES

- A. Perianth pubescent externally; leaves grayish or whitish tomentose on both surfaces, sheathing up the stems; common in eastern Wyoming and adjacent Nebraska northward to extreme southern Canada.
1. *E. pauciflorum*
- AA. Perianth glabrous externally; leaves densely tomentose below, subglabrous or glabrous above; southeastern Wyoming and Colorado.
- B. Leaves linear to linear-oblongate, less than 3 mm wide, tightly revolute; involucre usually glabrous externally; gumbo clay to granitic soils, mostly below 8,500 feet; Grand Co., Colorado northward to Albany and Larimer cos., Wyoming.
2. *E. exilifolium*
- BB. leaves oblanceolate to lanceolate or narrowly elliptic, 3-6 mm wide, not revolute; involucre usually tomentose externally; granitic talus or gravelly slopes and flats from 8,500 to 12,500 feet; El Paso Co. westward to Gunnison Co., Colorado.
3. *E. coloradense*

1. *Eriogonum pauciflorum* Pursh, Fl. Am. Sept. 2: 735. 1814.

Low spreading leafy-stemmed perennial herbs which form loose mats up to 2 dm across; leaves linear-ob lanceolate to oblanceolate, 3-5 (8) cm long, (1) 2-6 mm wide, grayish to whitish tomentose below, less so to subglabrous and green above, sheathing up the stems 1-5 cm, tapering gradually to petioles (0.5) 1-2.5 cm long, the petiole-bases appressed and clasping, 1.5-3 mm wide; flowering stems 5-15 (20) cm long, tomentose; inflorescences single capitate cluster of several involucre or umbellate with rays simple and up to 5 cm long, the involucre or the first node subtended by a whorl of 2-6 linear to semifoliate lanceolate bracts, 1.5-20 mm long, the inflorescence head ca 1 cm broad; involucre narrowly turbinate, (3.5) 4-5 mm long, tomentose, the 5 acute teeth 0.5-0.8 mm long, triangular; perianth whitish-brown, cream, pink, or rose-tinged, usually densely pubescent on the lower half or rarely glabrous, 2-2.5 mm long, the calyx-segments similar, oblong, connate about $\frac{1}{4}$ to $\frac{1}{3}$ the length of the perianth, the bases rounded or slightly acute, the apices rounded; stamens 2.5-3 mm long, the filaments pilose at the bases, the anthers 0.3-0.4 mm long, oblong; achenes brownish, 2 mm long, the globose to subglobose bases tapering to scabrous 3-angled beaks.

Figure 1. Distribution of *Eriogonum pauciflorum* Pursh.

KEY TO VARIETIES

- A. Inflorescences capitate or nearly so, rays not compoundly divided nor subtended by bracts.
- B. Leaves tomentose below, somewhat less tomentose above, linear-ob lanceolate to oblanceolate, mostly 3-5 (8) cm long and up to 6 mm wide, not densely pubescent with long white, densely tangled and matted hairs; inflorescences ca 1 cm broad; south-central Canada south to eastern Wyoming.
- 1a. var. *pauciflorum*
- BB. Leaves densely matted with long white tangled hairs on both surfaces of the leaves, the leaves narrowly spatulate, mostly 2-3.5 cm long and up to 10 mm wide; inflorescences ca 1-1.5 cm broad; eastern Wyoming and adjacent western Nebraska.
- 1b. var. *gnaphalodes*
- AA. Inflorescences compoundly branched, cymose.
- B. Flowers white; extreme western Nebraska and adjacent northeastern Colorado.
- 1c. var. *nebraskense*
- BB. Flowers yellow; central Montana.
- 1d. var. *canum*
- 1a. *Eriogonum pauciflorum* var. *pauciflorum*

E. parviflorum Nutt., Journ. Phil. Acad. 1: 35. 1817, a superfluous substitute for *E. pauciflorum* Pursh.

E. dioecium Raf., Herb. Raf. 38. 1833, *nom. nud.*; New Fl. N. Amer. 4: 53. 1838. TYPE: On River Platte." *Bradbury s.n.* See comments below.

E. multiceps Nees in Wied-Neuwied, Reise Nord-Amer. 2: 446. 1841. TYPE: Fort Union, Williams Co., North Dakota, 6 Jul 1833, *Prince Alexander Philip Maximilian* 114. Holotype: BR!

E. depauperatum Small, Bull. Torrey Bot. Club 25: 40. 1892. TYPE: Hermosa, Custer Co., South Dakota, 23 Jun 1892, *Rydberg* 970. HOLOTYPE NY! ISOTYPES: NEB! US; A form with glabrous flowers.

E. multiceps ssp. *typicum* S. Stokes, Gen. Eriog. 94. 1936.

Low spreading leafy-stemmed, loosely matted, perennial herbs; leaves linear-ob lanceolate to oblanceolate, leaf-blades 1-4 cm long, (1) 2-6 mm wide, grayish to whitish tomentose below, less so to subglabrous and green above, gradually tapering to petioles 2-5 cm long; flowering stems 5-20 cm long; inflorescences loosely capitate and ca 1 cm broad or umbellate with simple rays up to 5 cm long.

TYPE: NORTH DAKOTA: Mercer Co.: About 2.8 mi n of Stanton, possibly on the east facing slopes northwest of the present site of

the Olds School. on the north bank of the Knife River, elevation about 1800 feet. 28 Jun 1811. *Bradbury s.n.* Holotype: PH! Isotype: GH!

Representative Specimens: CANADA: MANITOBA: La Riviere Dawson *s.n.* (GH, K, MO, UC, US). SASKATCHEWAN: Bracken, Campbell 38 (MONTU); Wood Mts., Macoun 12949 (NY). UNITED STATES: IDAHO: Bonner Co.: Kootenai, 1887, Sandberg *et al.* 997 (CAS, NY). MONTANA: Big Horn Co.: 23 mi n of Grassland, Anderson & Wright *s.n.* (MONT). Blaine Co.: 9 mi e of Zurich, Booth 57568 (MONT). Carter Co.: 2 mi s of Alzada, Booth 2664 (MONT); Box Elder Cr., Rose 395 (MONTU). Custer Co.: 9 mi w of Miles City, Hanna 2559 (MONT). Dawson Co.: Glendive, 1900, Blankenship *s.n.* (MONT, MONTU), 1903, Blankinship *s.n.* (MONTU, RM, UTC); Colgate, 1892, Sandberg *et al.* 997 (CAS, DS, GH, MO, NY, RM, UC, US). Fergus Co.: Big Snowy Mts., Canby *s.n.* (MO, NY, PH, US); 30 mi ne of Roy Mackie *s.n.* (MONT). Garfield Co.: Squaw Cr., Holmgren 2076 (MONT, NY, UTC); 30 mi e of Jordan, Ripley & Barneby 8243 (NY). Golden Valley Co.: 2 mi nw of Levina, Booth 55205 (MONT). McCone Co.: 20 mi w of Circle, Booth 57220 (MONT). Meagher Co.: 28 mi w of Harlowton, Booth *s.n.* (RM). Musselshell Co.: 10 mi nw of Roundup, Booth *s.n.* (MONT). Park Co.: White Beaver Cr., Tweedy *s.n.* (NY). Petroleum Co.: Mosby, Booth 57205 (MONT); 10 mi sw of Winnett, Cole *s.n.* (MONT); 15 mi ne of Grass Range, Kirsch *s.n.* (MONT). Phillips Co.: 14 mi sw of Malta, Atwater *s.n.* (MONT). Powder River Co.: 13 mi nw of Broadus, McVaugh 6465 (GH, UC). Roosevelt Co.: Culbertson, Coey 50 (NEB). Rosebud Co.: Forsyth, DeCock *s.n.* (MONT). Sheridan Co.: 1 mi ne of Plentywood, Booth *s.n.* (MONT). Valley Co.: Glasgow, Booth 57622 (MONT). Wheatland Co.: 3 mi nw of Shawmut, Booth 55305 (MONT). Yellowstone Co.: Billings, 1902, Blankinship *s.n.* (MONTU, RM), 1903, Blankinship *s.n.* (RM, UTC); Pompey's Pillar Butte, Wright 80 (MONT). NEBRASKA: Dawes Co.: 10 mi n of Crawford, Tolstead 952 (GH, NEB). Sioux Co.: Harrison, Bates *s.n.* (GH); Orella, Pool & Folsom *s.n.* (NEB); Hat Cr. Basin, Webber *s.n.* (CAS, NEB, US). NORTH DAKOTA: Billings Co.: Mendora, Larsen 184 (GH, MO). Bowman Co.: Rhame, Stevens *s.n.* (MONT, NDA, RM, US). Dunn Co.: Killdeer Mts., Stevens & Moir *s.n.* (NDA). Golden Valley Co.: Sentinel Butte, Stevens 2583, 2584 (NDA, UC). Grant Co.: sw of Shields, Bell 203, 1259 (NDA). McLean Co.: Elbowoods, Heidenreich *s.n.* (NDA, UC). Mercer Co.: near Mannhaven, Stevens 908 (NDA, UC). McKenzie Co.: North Roosevelt Park, Stevens *s.n.* (NDA); s of Williston, Waldron 2360 (NDA). Morton Co.: 6 mi e of Glen Ullin, Rollins & Muñoz 2813 (GH, US, UTC). Slope Co.: Marmarth, Brenckle & Stevens 39-377 (NDA). Stark Co.: Belfield, Bergman *s.n.* (NDA); Dickinson, Stevens 1503 (NDA, UC, US). Williams Co.: Fort Union, Hayden *s.n.* (GH, MO, NY). SOUTH DAKOTA: Fall River Co.: 18 mi w of Edgemont, Porter 6706 (RM); Hot Springs, Rydberg 971 (NEB, NY, US). Harding Co.: 4 mi s of Redig, Jones 36607 (COLO); Moreau, Visher 130 (RM). Hyde Co.: Peno Hills, Williams *s.n.* (US). Jackson Co.: Interior, Brenckle 40-43 (UTC); Cedar Pass, Palmer 37653 (A, MO, US). Lawrence Co.: Lawrence County, Over 13783 (US). Meade Co.: Fort Meade, Forwood 322 (US). Mellette Co.: Mellette County, Over 15920 (RM, US). Pennington Co.: 1 mi e of Wall, McIntoch 1389 (NY); se of Rapid City, Over 15921 (RM, US). Perkins Co.: Badlands, Goodman 3291 (GH, NY, UC), Hapeman *s.n.* (NY, UC, UTC). Shannon Co.: White River Valley, Visher 2183 (NY). Washabaugh Co.: Bear Cr., Over 2326 (COLO). WYOMING: Campbell Co.: 10 mi nw of Gillette, Pennell 21376 (PH, RM). Converse Co.: near Bill, Ownbey & Lang 1055 (RM). Crook Co.: Rockyford, A. Nelson 2215 (GH, MO, NY, RM, US); Sundance, A. Nelson 9600 (DS, GH, RM, US); 10 mi n of Devil's Tower, Seig 19 (RM). Johnson Co.: 10-12 mi n of Buffalo, Pennell & Schaeffer 24416 (PH). Niobrara

Co.: Lusk, *Osterhout* 7862 (RM); Cheyenne River, *T. A. Williams s.n.* (RM). Park Co.: Sage Cr., *T. A. Williams s.n.* (NY, RM). Sheridan Co.: Ucross, *A. Nelson* 9740 (MO, RM, UC); e of Sheridan, *Rollins* 559 (GH, NY). Weston Co.: Newcastle, *A. Nelson* 8429 (DS, GH, MO, NEB). NY, RM, US); 10 mi s of Newcastle, *Porter* 3401 (GH, RM, UC, US).

Eriogonum pauciflorum is a member of the section *Capitata* Torr. & Gray of the subgenus *Eucycla* (Nutt.) Kuntze in Post & Kuntze, and will be selected as the type of the section in a forthcoming paper on the subgenera of *Eriogonum* (Reveal, in press). The variation in *E. pauciflorum* is excessive, and the exact nature of the overall variation is still not entirely surveyed. Within var. *pauciflorum*, the degree of tomentum on the leaves is variable, but never is it as dense as in var. *gnaphalodes*. Although in the vicinity of Newcastle, Weston Co., Wyoming, the upper leaf surfaces are often totally glabrous, throughout most of the range of this taxon, the leaves are subglabrous to sparsely tomentose above. The inflorescence of var. *pauciflorum* varies from a fairly tight capitate cluster of involucre to one in which the peduncles have elongated and form umbellate heads. This latter condition is scattered throughout the range of the variety, and does not seem to be of any taxonomic significance. The species, *E. depauperatum* Small, was based on a form of var. *pauciflorum* with glabrous flowers. However, as nearby populations have pubescent flowers, and as this is the only differential character, it seems best not to recognize it as a distinct taxon.

In 1838, Rafinesque published *Eriogonum dioecium*. The only *Eriogonum* specimen of the Bradbury collection, which was cited as the type, that could fit the species description is the type collection of *E. pauciflorum*. H. W. Rickett of the New York Botanical Garden (1950; per. comm.) has indicated that possibly some of the Bradbury specimens were distributed by William Roscoe of Liverpool who Bradbury had originally sent his collection, and that some duplicates may have come into the possession of Rafinesque. Rafinesque states that as early as 1833 he had obtained some Bradbury specimens, although he made no reference as from whom he had received them. Rickett indicated that the Pursh collection which was originally part of the Lambert Herbarium in England, was not sold until 1842, and as this collection did not come to Philadelphia until some years after that, it seems impossible that Rafinesque could have seen the holotype of *E. pauciflorum*. He might have seen another duplicate, but this I have been unable to locate. The Rafinesque collection was sold after his death to Elias M. Durand, then the botanist of the Academy of Natural Sciences in Philadelphia, but whether or not Durand discarded the collection as he did with so much of the Rafinesque collection, or kept it and is now deposited in Durand's personal collection which he gave to the Museum National d'Historie Naturelle in Paris, France, has not been determined. The name, *E. dioecium*, is therefore questionably referred to *E. pauciflorum* until the type can be seen.

The one problem in referring *Eriogonum dioecium* to *E. pauciflorum* is the supposed location of the collection site given by Rafinesque. Bradbury collected only two *Eriogonum* species, and the only two known to grow in the area, *E. flavum* Nutt. in Fras. and *E. pauciflorum*. Both came from near the Minetaree Villages. Rafinesque gave the location of his specimen as coming from the Platte River, but as Bradbury usually only gave the location as the "Upper Louisiana" on his specimens, it may have been that Rafinesque was simply guessing a more exact locality in order to be more specific.

The transfer of the concept of the name *Eriogonum pauciflorum* away from the type to that of a plant in Wyoming and Colorado may have been due to John Torrey's misidentification of an Engelmann collection of Albany Co., Wyoming, that was made in 1856, and a Parry collection from Middle Park, Colorado made a few years later. When Pursh described the Bradbury collection, he did not indicate that the flowers were pubescent, and as the collection was of a series of immature specimens, it is possible that Pursh never knew of this condition. Pursh must have hoarded nearly the entire collection as according to Rickett (1950), there are no specimens in European herbaria, and the only collection in the United States was deposited in the Pursh Herbarium in Philadelphia. Later, a single plant specimen was cut from the Philadelphia sheet and sent to Asa Gray at Harvard University by Durand in 1866. It was on this specimen in the Gray Herbarium that Torrey wrote that the Bradbury, Engelmann, and the Parry collections were all the same, and thus the concept of *E. pauciflorum* was transferred. This interpretation which appeared in the Torrey & Gray 1870 revision has been followed since.

- 1b. *Eriogonum pauciflorum* var. *gnaphalodes* (Benth. in Hook.)
Reveal, stat. & comb. nov.

E. gnaphalodes Benth. in Hook., Journ. Bot. & Kew Misc. 5:
263. 1853.

Low-spreading leafy-stemmed, densely matted, perennial herbs; leaves narrowly spatulate to elliptic. the leaf-blades 1-2.5 cm long, 4-10 mm wide, densely white-tomentose on both surfaces with long tangled and matted hairs, the leaf-blades usually abruptly tapering to petioles 1-3 cm long; flowering stems 3-10 (15) cm long; inflorescences densely capitate, mostly 1-1.5 cm broad.

TYPE: WYOMING: Platte Co.: near Guernsey on cliffs which are west of the type locality of Fort Laramie, Goshen Co., which was cited by the collector, Jul 1843, *Geyer* 150. Holotype: K! Isotype: K!

Representative Specimens: NEBRASKA: Without definite locality: Between Pole Cr. and Cedar Bluffs, *Engelmann s.n.* (GH, MO, NY). Cheyenne Co.: Bayardito, *Baker s.n.* (MO); Courthouse Rock, *Rydberg* 334 (NY, US). Morrill Co.: Chimney Rock, *Hapeman s.n.* (CAS, MO, NY, RM, UC). Scotts Bluff Co.: Scotts Bluff, *Rydberg* 334 (NY); WYOMING: Converse Co.: Bed Tick Cr., *E. Nelson* 5040 (MONT, RM).

Big Horn Co.: Trapper Basin, *Finley* 31 (RM); Clark, *Pearson* 224 (RM). Johnson Co.: Buffalo, *Tweedy* 3265 (NY, RM). Platte Co.: Lake Guernsey State Park, *Porter* 3989 (DS, RM), *Porter* 4317 (GH, RM, UC, US). Washakie Co.: Spring Cr., s of Ten Sleep, *Gooding* 354 (DS, GH, NEB, NY, RM, UC, US).

The var. *gnaphalodes* may be distinguished by its greater reduction and compaction of the mat, and by its leaves which are wider and more densely tomentose than in var. *pauciflorum*. The inflorescence is correspondingly more compacted and the involucre are always tightly held together and not at all umbellate as in var. *pauciflorum*. As the var. *gnaphalodes* tends to occur on the western and southern edge of the distribution of the species, and is rather distinctive in the field it is now recognized as a variety.

The placement of *Eriogonum gnaphalodes* under *E. multiceps* by Torrey & Gray (1870) must have come without a chance to see the type of *E. multiceps*, or additional material from the upper Missouri River basin where the type of *E. multiceps* was collected. As the Geyer collection and the Maximilian collection are similar in several general features, Torrey & Gray must have been working only with the description of *E. multiceps* which compares somewhat favorably with the type of *E. gnaphalodes* which Gray had seen in the Bentham collection in England.

1c. *Eriogonum pauciflorum* var. *nebraskense* (Rydb.) Reveal, stat. & comb. nov.

E. nebraskense Rydb., Fl. Rocky Mts. 224, 1061. 1917.

Low spreading, leafy-stemmed, perennial herbs, 2-3 dm high; leaves oblanceolate, the leaf-blades 1.5-3.5 cm long, 3-5 mm wide, densely white-tomentose below, grayish-tomentose above, gradually tapering to short petioles 0.5-1.5 (2) cm long; flowering stems 1-2 dm long; inflorescences compoundly branched, cymose; perianth rose to dark red or brown.

TYPE: NEBRASKA: Kimball Co.: prairies in Kimball County, 12 Aug 1891, *Rydberg* 337. Holotype: NY! Isotype: US!

Representative Specimens: COLORADO: Hugo Co.: Pawnee Buttes, *Johnston* 111 (RM). Weld Co.: Keota, *Osterhout* 5928 (RM, UC), *Osterhout* 6037 (RM). NEBRASKA: Scotts Bluff Co.: Scotts Bluff County, *Winter* 93 (NEB).

The var. *nebraskense* is a narrowly restricted population that is readily distinguished from the rest of the section *Capitata* by its compound cymose inflorescence.

The reduction of *Eriogonum nebraskense* to a variety under *E. pauciflorum* comes somewhat as a reluctant move. The only distinguishing characteristic that separates the umbellate forms of var. *pauciflorum* from var. *nebraskense* is the compound cymose inflorescence. However, in reviewing the associated species in the area where var. *nebraskense* occurs in part, it is possible that var. *nebras-*

kense may represent a population that has been genetically influenced by *E. effusum* Nutt. so that the distinct inflorescence was introduced. Until detailed field work can be carried out, I am following what the gross morphology dictates, and that is to treat *E. nebraskense* as a variety of *E. pauciflorum*.

- 1d. *Eriogonum pauciflorum* var. *canum* (S. Stokes) Reveal, stat. & comb. nov.

E. multiceps Nees ssp. *canum* S. Stokes, Gen. Eriog. 94. 1936.

Low spreading, leafy-stemmed, perennial herbs, 1.5-2.5 dm high; leaves narrowly oblanceolate to lanceolate, the leaf-blades 1.5-3 cm long, 2-4 mm wide, densely white-tomentose on both surfaces, gradually tapering to short petioles 0.5-1.5 cm long; flowering stems up to 1 dm long; inflorescences compoundly branched, cymose; perianth yellow.

TYPE: MONTANA: Treasure Co.: Custer, 6 Jul 1890, *Blankinship* 113. Holotype: UC! Isotype: US! Stokes cites the date as 30 Jun 1890, but as no sheet at UC with this date has been found, it is assumed that she made an error in citing the date of the collection.

Representative Specimens: MONTANA: Without definite location: Montana, 1873, *Allen s.n.* (US). Treasure Co.: Custer, *Brenckle & Stevens* 39-371 (A, GH, NDA).

The var. *canum* differs from var. *nebraskense* in its yellow flowers and distinct distribution.

Like var. *nebraskense*, the var. *canum* tends to suggest the effects of possible hybridization, but this time with *Eriogonum brevicaulis* Nutt. However, as *E. brevicaulis* is not known to be from this area, considerable field work is necessary on this taxon, and the present taxonomic arrangement merely reflects the morphological relationships.

2. *Eriogonum exilifolium* Reveal, spec. nov.

E. pauciflorum of authors, not Pursh.

A Eriogonum coloradense Small foliis linearibus vel lineari-oblancoelatis, revolutis, inflorescentiis pro parte maxinis compactis cymosis, bracteis membranaceis in scapis 3-10 cm longis, involucris saepe glabris, perianthiis 2-3.5 mm longis differt.

Planta pulvinata perennis; caules basi per 1.5 cm foliosi; laminae foliorum lineares vel lineari-oblancoelatae, revolutae, (2) 3-5 (6) cm longae, 1-2 (3) mm latae, subtus dense albo-tomentosae, supra subglabrae vel glabrae, petiolis brevibus, 5-15 mm longis, basi membranacea, 5-10 mm longa et 3-5 mm lata, glabris vel pubescentibus; scapi 3-10 cm longi, glabri vel tomentosi; inflorescentiae cymosae subcapitatae, brevibus radiis 1-4 mm longis, vel capitatae involucris 3-6 dense compactis, bracteis ternatis, semifoliaceis, membranaceis, glabris vel parce tomentosis. 3-5 mm longis, 2-3 latis; involucria

campanulata, 2.5-3.5 (4.5) mm longa, 2-3 mm lata, 5-lobata; perianthia alba vel rosea, 2-3.5 mm longa, segmentis similibus, ellipticis; stamina 2-2.5 mm longa, filamentis basi pilosis, antheris 0.3 mm longis, oblongis; achaenia brunnea, 2-3.5 mm longa, ovata.⁴

Perennial herbs with strong taproots and branched woody underground caudices up to 8 cm long, forming densely pulvinate mats up to 2 dm across, sparsely tomentose to glabrous throughout; leaves numerous, linear to linear-oblongate, tightly revolute, (2) 3-5 (6) cm long, 1-2 (3) mm wide, densely white-tomentose below, less so to glabrous and green above, basal or sheathing up the stems 1.5 cm, the apices acute, the bases long-cuneate, gradually tapering to short petioles 5-10 mm long, the petiole-bases membranaceous, light brown to tan, expanded and elongated, 5-10 mm long, 3-5 mm wide, glabrous without, pubescent with long dense white hairs within and along the margins; scapes 3-10 cm long, glabrous or sparsely tomentose, \pm wiry; inflorescences compact cymose-umbels of 3-7 subcapitate involucre with the short stout rays 1-4 mm long, the inflorescences subtended by 3 semifoliateous membranaceous, glabrous or sparsely pubescent at the bases and within, triangular bracts, 3-5 mm long, 2-3 mm wide at the bases, connate; involucre campanulate, 2.5-3.5 (4.5) mm long, 2-3 mm wide, glabrous without except for small patches of cottony tomentum at the base of the lobes in some. 5-lobed, the lobes 1-1.5 mm long, rounded, truncate or triangular, distinctly margined with thin membranaceous margins. erect or more often spreading and reflexed; perianth white to rose, 2-3.5 mm long, glabrous within and without except for a few scattered hairs on the lower half within on some, the segments nearly equal, oblanceolate to elliptic, connate $\frac{1}{4}$ to $\frac{1}{3}$ the length of the perianth. the perianth tubes dark red to brown, occasionally angled; stamens exerted. 3-4 mm long, the filaments pilose at the bases, anthers 0.3 mm long, oblong; achenes brown, 2-3.5 mm long, ovate, the globose bases tapering to 3-angled beaks.

TYPE: WYOMING: Albany Co.: 2 mi n of Laramie, 21 Jul 1945, C. L. Porter 3706. Holotype: RM! Isotypes: DS, GH, MO, NY, UC, US.

Representative Specimens: COLORADO: Grant Co.: Middle Park, Parry s.n. (GH, NEB, NY, US); nw of Tabernash, Ripley & Barneby 10489a (CAS, NY). Jackson Co.: North Park, Crandall 133 (GH, MO, NY); Lake John, Ramaley & Johnson 890 (CAS, COLO, MO). WYOMING: Albany Co.: From Laramie River along the Medicine Bow Mts., Engelmann s.n. (GH, MO, NY); Red Buttes, Greene s.n. (NY); Laramie Plains, A. Nelson 2794 (GH, MONT, NY, RM, US); Laramie, A. Nelson 7637 (COLO, GH, NEB, NDA, NY); Laramie River, E. Nelson 3385 (BM, MO, NY, RM, US). Larimer Co.: North Fork, Goodding 1924 (COLO, NY, UC, US).

This taxon has long been recognized as an excellent species, and the naming of it as such after so many years is simply due to the misapplication of the name *Eriogonum pauciflorum* for it. The new species is closely related to *E. coloradense* from which it differs

⁴The author is grateful to C. V. Morton for his assistance with the Latin description.

mainly in its leaf-shape and general size of its parts. The distinct ecological requirements also differ. The plants in Wyoming are found mainly on hard gumbo clay hills, but in Colorado, they are often found on rolling granitic sand hills below 8,500 feet elevation.

The species name is selected to denote the narrow leaves.

3. *Eriogonum coloradense* Small, Bull. Torrey Bot. Club 33: 53. 1906.

E. multiceps Nees ssp. *coloradense* S. Stokes, Gen. Eriog. 94. 1936.

Perennial herbs with strong taproots and branched woody underground caudices up to 4 cm long, forming loose pulvinate mats up to 1.5 dm across, tomentose or glabrous almost throughout; leaves few to many, oblanceolate to lanceolate or narrowly spathulate, not revolute but the margins sometimes thicker than the blades or crisped, 1-4 (5) cm long, 3-6 (8) mm wide, densely white-tomentose below, lightly floccose to glabrous and green above, basal or sheathing up the stems 1 cm, the apices acute to rounded, the bases long-cuneate, gradually tapering to short petioles 2-8 mm long, the petiole-bases membranaceous, light tan, expanded and elongated, 2-4 mm long, 1-1.5 (2) mm wide, sparsely to densely tomentose without, densely tomentose within; scapes 3-5 (6) cm long, glabrous or densely matted tomentose; inflorescences capitate or nearly so, 3-4 involucre on short rays up to 1 mm long, subtended by 3 semi-foliaceous membranaceous, glabrous or tomentose, triangular bracts, 1.5-3 (4) mm long, 1-1.5 mm wide at the bases, connate; involucre turbinate-campanulate, 2-3 mm long, 1.5-2.5 (3) mm wide, glabrous without except for small patches of cottony tomentum at the base of each lobe, 5-lobed, the lobes 0.3-0.7 (1) mm long, mostly acute and triangular, margins membranaceous, erect or reflexed; perianth white to rose, 2.5-3.5 mm long, glabrous within and without, the segments nearly equal, oblong to ovate, connate about $\frac{1}{4}$ of the length of the perianth, the perianth tube dark brown to red-brown, occasionally angled; stamens exserted, 3.5-4 mm long, the filaments pilose at the bases, the anthers 0.3 mm long, oblong; achenes brown, 2.5-3.5 mm long, ovate, the globose bases tapering to 3-angled beaks.

TYPE: COLORADO: Chaffee Co.: Mt. Harvard, 1896. *F. E. Clements* 66. Holotype: NY!

Representative Specimens: COLORADO: El Paso Co.: Pikes Peak, *Snow s.n.* (PH). Gunnison Co.: Virginia Basin, *Langenheim* 285 (UC), *Langenheim* 1062 (COLO); nw of Castle Peak, *Ewan* 11750, 11757 (COLO); North Pole Basin, *Weber & Barclay* 9184 (COLO); 2 mi ne of Gothic, *Wherry s.n.* (GH). Park Co.: South Park, *Canby s.n.* (GH, NY, PH); 2 mi sw of Glentivar, *Iltis & Iltis* 18830 (COLO, WIS); 6 mi n of Fairplay, *Penland* 1320 (CAS); between Red Hill Pass and Como, *Weber* 8758 (COLO); Sulphur Spr., South Park, *Wolf & Rothrock* 27 (DS, PH, US). Saguache Co.: Cochetopa Pass, *Weber* 5795 (COLO), *Weber* 9419 (DS); 9 mi se of the Flying-M-Ranch, *Wherry s.n.* (A). *Eriogonum coloradense* is a high alpine species that is most

closely related to *E. exilifolium*, which is found to the north and at a much lower elevation.

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