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RARE PLANTS OF BRYCE CANYON NATIONAL PARK

A project funded by the Bryce Canyon Natural History Association

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INTRODUCTION

With the passing of the Endangered Species Act of 1973 (Public Law 23-205) it became imperative that lists of, and information about, rare, endangered and threatened species be prepared. This project lists the known rare plants of Bryce Canyon National Park and provides as much data as possible on each species. This information includes; photos, descriptions, references, drawings, ecology, and known locations for each species. According to the Endangered Species Act public land agencies must consider the effect on endangered and threatened species when planning any kind of land use. So the following information is vital to the future of Bryce Canyon National Park.

This project is divided into four parts; two booklets, a data base computer disk, and a location map. The first booklet contains specific information about twelve rare plants found in Bryce Canyon National Park. The second booklet covers general information about rare, threatened, and endangered species in Utah and the United States. The dBASE disc contains a number of files pertaining to specific information about the rare plants found in Bryce and some rare plants found in this area but not at Bryce yet. The map shows all known locations of the twelve plants in and around Bryce Canyon. The location data was gathered from specimens of the Bryce Canyon and the BYU herbariums, and from the data base of the Natural Heritage Program of the Nature Conservancy in Salt Lake City.

None of the twelve rare plants studied here are currently classified as Endangered or Threatened. But ten have been proposed for one of these ratings, and they all have such limited distribution that they should be monitored closely. Most of these plants are found in and around the unique "breaks" community of Bryce Canyon National Park. For a thorough discussion of this area and a description of its plant communities refer to the paper by Buchanan and Graybosch (1981) that is provided in the next section of this book.

On the following page is a list of the twelve rare plants, and their current status, studied in this project. It is not a final list, for undoubtedly more rare plants will be found, or more of the known plants will become rare in the future. This list was gathered with the help of the paper by Graybosch and Buchannan (1981) and by the recommendations of Larry England of the U.S. Fish and Wildlife service and Ben Franklin of the Natural Heritage Program of the Nature Conservancy.

RECOMMENDATIONS

This project is the first step in the process of understanding and protecting these rare species. It is hoped that other studies will be stimulated by this information.

The general biology and ecology of these plants is not adequately understood and studies of this nature will be of immense importance in the protection of each species.

Locating and mapping all the local populations of each species should also be done so that the land can be managed appropriately. This may include information on associated species and number of individuals per population.

Entering all this information into the GIS computer system would be invaluable. GIS could also be used to suggest possible locations of different species by entering known environmental factors that each species requires; such as soil type, elevation range, community type...etc. and going out in the field to check these areas.

The rare plant list of the Dixie National Forest is another good source of potential plants at Bryce. This list is included in the second booklet of this project.

Updating the database file is essential for effective research. Whenever new species are added to the list of rare plants, or when new rare specimens are added to the herbarium, it is imperative that this data be added to the database file. Most new informatin will go into the dBASE file: RAREPLAN.DBF.

FEDERAL RANKING SYSTEM

Two listing classifications are provided. The term Endangered is given to a species in danger of extinction through all or a significant portion of its range. The term Threatened is applied to species that are likely to become endangered in the forseeable future.

In December 1980 a review of plant taxa considered for listing as endangered or threatened species was published in the Federal Register by the acting director of the U.S. Fish and Wildlife Service. This publication placed species in catagories indicating their readiness for listing. Catagory 1 plants are those species for which the Service had sufficient information to support the appropriateness of their being listed as threatened or endangered. Catagory 2 plants are those species that require further biological research and field study to determine the appropriateness of their being listed. Category 3 plants are those species no longer being considered for listing as endangered or threatened. There are three subheadings in this catagory. 3A plants are taxa considered probably extinct. 3B plants were those with unsure taxonomic status. 3C plants are those taxa that have proven to be more widespread than originally believed, or that are no longer subject to any threats.

The global and state ranking system is explained on the next page. This system has been developed and maintained by the Nature Conservancy.

The Nature Conservancy Element Ranking System

The ranking system used by The Nature Conservancy assigns ranks to elements of natural diversity (that is, special plants, special animals, and terrestrial and aquatic ecosystems) according to their relative rarity and endangerment. Two parallel ranking methods are employed: The Global ranking system assigns a rank to the elements according to their status throughout their entire range, while the State ranking system assigns a similar rank that reflects the status of the element within a particular state.

The basic rank is a two-byte code with the first byte being either G or S, indicating a global or state rank, respectively. In some cases the first byte will be a T, which is used for subspecific taxa. The second byte is an integer from 1 to 5, or in somes cases, a letter. Definitions for global element ranks are listed below. Defintions of state ranks can be derived by substituting "in state" for "globally" or in those definitions in which range is specified, the range referred to would be the state range.

Global Element Ranks

G1= Critically imperiled globally because of extreme rarity or because of some factor of its biology making it especially vulnerable to extinction.

G2= Imperiled globally because of rarity or because of other factors demonstrably making it very vulnerable to extinction throughout its range.

G3= Either very rare and local throughout its range or found locally in a restricted range or because of other factors making it vulnerable to extinction throughout its range.

G4= Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.

G5= Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GU= Possibly in peril range-wide, but status uncertain; more information needed.

GH= Of historical occurrence throughout its range, i.e., formerly part of the native biota, with the implied expectation that it may be rediscovered.

GX= Believed to be extinct throughout its range.

STATUS OF THE RARE PLANTS OF BRYCE CANYON NATIONAL PARK

NAME	FEDERAL RANK	GLOBAL RANK	STATE RANK
Castilleja parrula var. revealii	2	G1	S1
Cryptantha ochroleuca	2	G3	S3
Draba subalpina	3C		
Eriogonum panquicense	3C		
Heterotheca jonesii	2	G2	S2
Lesquerella rubicundula	3C	G3	S3
Lomatium minimum	3C		
Oxytropis jonesii	3C		
Pediomelum pariense	2	G1	S1
Penstemon bracteatus	2	G1	S1
Silene petersonii var. minor	3B	G3	S1
Townsendia montana var. minima	3C		

DATA BASE OF RARE PLANTS

The computer disk included in the inside jacket of Volume 1 of this report contains all the dBASE files pertinent to this study. The following is a list of the various files and an explanation of their contents:

RAREPLAN.DBF - This is a master list of all the rare plants found in and around Bryce Canyon National Park. It also contains information on every rare plant that is in the Bryce herbarium.

RARE1.DBF - This file lists some rare plants that have been found in the surrounding area of Bryce but not in the park.

RARE2.DBF -This is a basic list of the rare plants of Bryce and their ranking.

RARNAME.DBF -This file contains the names and addresses of people to contact about rare plants at Bryce.

The file RAREPLAN.DBF is compatable with the information collected by The Nature Conservancy of Utah. It is recommended that whenever information comes in from The Nature Conservancy that it be entered into this file. And when providing information to The Nature Conservancy it would be advisable to use the information from this file.

VEGETATIVE TYPES AND ENDEMIC PLANTS OF THE BRYCE CANYON BREAKS

Robert A. Graybosch[1] and Hayle Buchanan[2]

ABSTRACT.— The scenic Bryce Canyon "breaks" constitute harsh and inhospitable habitats for plant life. The eroded pink cliffs and talus slopes are sites of some of the most rapid natural erosion on earth. This paper divides the plant life on the breaks of the main Bryce Canyon amphitheater into four vegetative types. A checklist of all plant species found in the main amphitheater is included. Many of the rare and endangered endemic species of the park are found in the *Pinus longaeva* vegetative type. Recommendations for managing the breaks to protect endemics are presented.

The breaks community is one of the six major plant communities of Bryce Canyon National Park as described by Buchanan (1960). It consists of a relatively narrow band of unvegetated or sparsely vegetated badlands formed by the red beds of Claron (Wasatch) formation along the eastern edge of the Pausaugunt Plateau. This paper represents the results of a study of the main amphitheater of Bryce Canyon to define the vegetative units.

Intricate erosional formations can be viewed from Sunrise, Sunset, Inspiration, and Bryce viewpoints. The diverse topography and beauty of the formations attract thousands of park visitors to the viewpoints and rim trails, although relatively few of them venture into the main amphitheater. The majority of hikers and horse riders who traverse the breaks remain on well-maintained trails, and thus have relatively little impact on the plant communities.

The flora of Bryce Canyon is rich in species endemic to the High Plateaus of southern Utah (Welsh and Thorn 1979, Buchanan and Graybosch 1981). Several of these threatened and endangered plant species have limited populations in the main Bryce Canyon amphitheater. Preservation of such species depends on recognition of preferred habitats and provision of means to protect them from visitor impact.

DESCRIPTION OF THE STUDY AREA

Bryce Canyon National Park is located on the eastern edge of the Pausaugunt Plateau in south central Utah. The Pausaugunt Plateau occupies a position midway between 37° and 39° north latitude 10 miles west of the 110th meridian. The boundaries of the main amphitheater circumscribe the drainage system of Bryce Wash, an intermittent tributary to the Paria River, an area 4.5 km^2. The boundaries differ somewhat from those considered by Lindquist (1977) and Buchanan and Graybosch (1981). Elevations within the study area range from 2,200 to 2,530 m (7,250–8,300 ft). The study area lies along the western border of the Kaiparowits Basin, the flora of which was reported by Welsh et al. (1978).

The geologic stratigraphy of the study area is reported by Brox (1961), Anderson and Rowley (1975), Doelling (1975), and Lindquist (1980). The Claron limestone, a Tertiary deposit, is divisible into Red Eocene beds and White Oligocene beds, which differ somewhat in presence or absence of pigmentation in the form of iron and manganese oxides, and in amounts of sand and conglomerates in the limestone. The Claron formation is characterized by a rapid rate of erosion, largely a function of creep resulting from winter freeze-thaw activity and wash-

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away by summer thunderstorm runoff. Freeze-thaw cycles are most pronounced on south-facing slopes. Soil development is limited.

Climatic features of the study area may be inferred from weather records kept at park headquarters, 2 km from the main amphitheater. The average annual precipitation is 41 cm, falling largely in the form of winter snow and late summer thunderstorms. Mean January maximum temperature is 20 C; mean July maximum temperature is 27 C. The mean January and July minimum temperatures are -13 and 7.6 degrees C, respectively. The main amphitheater is generally more xeric than these values indicate (Buchanan 1960), with higher temperatures and a greater evaporative capacity of the air prevailing. Water availability to plants is decreased on the predominantly dry substrates, which have low infiltration rates and high runoff. Ravines and north-facing slopes within the main amphitheater are probably more hydric than the adjacent plateau forest at park headquarters.

METHODS

The vegetation of the study area was surveyed by means of 100 × 100 m^2 plots. Plots were subjectively placed in areas of homogeneous vegetation among the clifflike formations. Within each plot, density and basal area of all mature trees (over 5 cm dbh) and density only of juvenile trees (less than 5 cm dbh) were recorded. An importance value was formulated for mature trees by summing the relative values of density and basal area. Understory vegetation was surveyed through the use of four 10 m line intercepts, placed at 2 m intervals. Importance values for understory herbs and shrubs were determined through the summation of the relative values of density, dominance, and frequency. Understory species present in plots but failing to contact the survey lines were recorded as being present and this information was used in determining the relative frequency values.

Using the importance values of dominant species, plots of similar composition were grouped together to define vegetative types. The mean importance values for all species in each type were determined, and comparisons were made between types for all species having a mean importance value of greater than 1.0 (all trees, five shrubs, and seven herbs) using Sorensen's Index of Similarity (Sorensen 1948).

All species present in the study area were recorded and assigned to vegetative types when possible. Voucher specimens are on file in the herbarium of Bryce Canyon National Park. Nomenclature employed is that of Welsh et al. (1981).

RESULTS AND DISCUSSION

A complete list of species occurring in the main amphitheater is presented in the Appendix. Two species, *Puccinellia nuttalliana* and *Schizachyrium scoparium*, are additions to the flora of Bryce Canyon as reported by Buchanan and Graybosch (1981). Additions to the flora of the Kaiparowits Basin, based on Welsh et al. (1978), are noted in the Appendix.

Data to be presented below allows the division of the breaks (as it occurs in the main amphitheater) into the following vegetative types. Some of these are variable and are further divided into phases. Each shall be discussed in turn.

1. *Pinus ponderosa—Arctostaphylos patula* type (Pipe-Arpa type)
2. *P. ponderosa—A. patula* type, *Cercocarpus montanus* phase (Pipo-Arpa type, Cemo phase)
3. *P. ponderosa—Pseudotsuga menziesii* type (Pipo-Psme type)
4. Mixed coniferous type, *Picea pungens* phase (MC type, Pipu phase)
5. Mixed coniferous type, *Abies concolor* phase (MC type, Abco phase)
6. *Pinus longaeva* type (Pilo type)
7. Washes, clay and talus slopes

Table 1 summarizes the dominant species of each vegetative type in terms of mean importance values. A similarity matrix is given in Table 2, comparing the various types and phases.

DESCRIPTION OF TYPES AND PHASES

1. Pipo-Arpa Type

Occurrence: Canyon bottoms and south-facing slopes between elevations of 2,200 and

TABLE 1. Dominant species (in terms of mean importance value) in each vegetative type and phase. Types and phases are given the numerical designation employed in the text.

Species	Type or phase 1	2	3	4	5	6
Trees						
Abies concolor mean					81.7	
s.d.					33.3	
Juniperus scopulorum	29.3	27.2	13.0	24.2	25.8	
	37.9	24.2	21.4	27.2	29.7	
Picea pungens	2.3			89.7	25.3	
	8.1			36.3	29.7	
Pinus flexilis	7.6		17.2	22.5	3.0	44.9
	23.6		23.1	31.5	6.6	48.4
Pinus longaeva	1.0			4.0		128.3
	5.9			19.2		71.3
Pinus ponderosa	158.8	172.8	102.1	35.2	35.5	8.6
	43.9	24.2	45.6	36.0	29.6	16.8
Pseudotsuga menziesii	1.0		67.6	25.9	28.8	
	4.4		48.1	25.1	24.9	
Shrubs						
Acer glabrum		3.2	19.4	19.1	19.8	
		7.9	29.8	25.9	23.9	
Amelanchier utahensis		20.2	1.3	1.8		
		31.3	4.7	5.1		
Arctostaphylos patula	85.6	14.1	70.9	57.9	19.7	76.8
	32.0	18.6	58.1	40.7	40.5	43.7
Ceanothus martinii	12.2	4.5	7.0	8.9	2.0	2.2
	13.0	7.3	7.9	9.2	4.5	7.3
Cercocarpus montanus	5.4	138.0		23.6	30.1	2.2
	13.8	49.7		50.2	46.8	7.2
Juniperus communis	2.1			19.1	34.4	4.4
	6.9			25.9	46.8	7.2
Mahonia repens	35.7	15.9	46.7	50.3	89.6	1.5
	27.3	26.2	39.6	40.5	60.1	3.3
Purshia tridentata	1.0	1.2		1.4	16.1	
	2.5	2.9		4.4	46.1	
Ribes cereum			1.7			
			5.6			
Xanthocephalum sarothrae	1.9					1.0
	4.9					1.7
Grasses and forbs						
Astragalus kentrophyta					1.0	
					1.7	
Cirsium arizonicum	6.4		3.9	4.0	1.4	3.9
	6.7		6.5	6.6	4.7	5.8
Clematis columbiana	1.9		2.1	4.0		
	4.4		3.3	6.6		
Crytantha abata	2.7	3.5				
	4.6	3.5				
Cymopteris purpureus						7.2
						7.4
Elymus salina	34.4	4.0	36.6	13.7		5.3
	34.8	9.9	32.9	19.7		10.5
Eriogonum panguicense						11.8
						10.4

Table 1 continued.

Species	Type or phase 1	2	3	4	5	6
Haplopappus armerioides	5.9	2.6	2.0	1.0		6.4
	11.0	6.2	7.1	2.6		8.8
Hymenopappus filifolius						7.9
						13.8
Ivesia sabulosa						14.2
						19.4
Linum kingii						17.9
						14.7
Lithospermum multiflorum	6.7	1.3	2.0			
	8.9	3.1	3.2			
Machaeranthera grindelioides						6.7
						7.0
Oenothera brachycarpa	4.4		1.5			
	4.4		2.5			
Oryzopsis hymenoides	13.6	1.7	4.8	11.1	1.0	10.7
	10.2	4.2	10.1	12.9	3.2	9.6

2,400 m, continuing to lower elevations outside the study area. Occurs on substrates derived from both the Claron formation and Quarternary alluvium.

Vegetation: The dominant tree is *P. ponderosa*, with *Juniperus scopulorum* and *Pinus flexilis* as common associates. Thickets of *Quercus gambelii* occur, although infrequently. The shrub layer is dominated by *A. patula*, with *Mahonia repens* and *Ceonothus martinii* of secondary importance. The most common herbs are *Elymus salina* and *Oryzopsis hymenoides*. In contrast to the ponderosa pine forests of the adjacent plateau, *Purshia tridentata* is rare. A total of 65 species occurs in this type, several being restricted to it. There are largely taxa (i.e., *Mahonia fremontii*, *Streptanthus cordatus*, and *Euphorbia fendleri*) that are nearing their upper elevational limits in the study area.

Relation to other types and phases: Closest resemblance is seen between this type and the Pipo-Psme type and the Pipo-Arpa type, Cemo phase. It forms ecotones with all other types, as well as with a woodland of *Juniperus osteosperma*, *Pinus edulis*, and *Quercus gambelii* at the lower elevational limits of the study area.

2. Pipo-Arpa type, Cemo Phase

Occurrence: Adjacent to washes, on alluvium, between elevations of 2,200 and 2,300 m.

Vegetation: The dominant trees are *P. ponderosa* and *J. scopulorum*, with an understory dominated by *Cercocarpus montanus*. *Amelanchier utahensis* is an additional frequently encountered shrub. *Arctostaphylos patula* is infrequent and variable in importance values. Herbaceous vegetation is uncommon.

Relation to other types and phases: This particular phase exists only in narrow bands adjacent to washes and is generally surrounded by the Pipo-Arpa type in its typical manifestation. Possibly recognized as a distinct type if more widespread, it is most closely related to additional types dominated by *P. ponderosa*. The importance values of *P. ponderosa* and *J. scopulorum* are nearly identical in plots assignable to this phase and those in the typical Pipo-Arpa type (Table 1). This phase probably exists as a result of periodic flooding, with subsequent alteration of the physical features of the substrate. This provides a microhabitat that evidently favors *C. montanus* over *A. patula*, but does not influence the nature of the canopy.

3. Pipo-Psme Type

Occurrence: North-facing slopes of the Claron formation between elevations of 2,285 and 2,380 m. Soil development is extensive due to limited winter freeze-thaw activity.

Vegetation: Dominance is shared by *P. ponderosa* and *P. menziesii*; *Pinus flexilis* is occasionally encountered. The principle

shrub is *A. patula*, with *M. repens* a common associate. In several plots, however, the density of trees was of sufficient magnitude to exclude most understory species. A significant increase in the abundance of more mesophytic species (i.e., *Acer glabrum*, *Clematis columbiana*) is noted when this type is compared to the Pipo-Arpa type. A total of 38 species was found in this type.

Relation to other types and phases: Most closely related to the Pipo-Arpa type, this type also shows affinities with the phases of the MC type. Ecotones are formed with these communities.

MC Type

Occurrence: Canyon bottoms and steep north-facing slopes; substrates occupied are derived from both Red and White members of the Claron formation. Elevational distribution is between 2,285 and 2,450 m; the lowest elevation corresponds to the furthest extension of hoodoos. Ill-defined and somewhat polymorphic, this type is best described in terms of its two phases. Fifty-five species occur within this type.

4. MC Type, Pipu Phase

Vegetation: This phase is recognized by the consistent dominance of *P. pungens* in either pure stands or in mixed associations with additional conifers, the most common of these being *P. ponderosa*, *P. menziesii*, *P. flexilis*, and *J. scopulorum*. The understory varies from sparse along washes (where both *C. montanus* and *C. ledifolius* are frequent) to dense in plots not subjected to inundation. In the latter, *A. patula*, *M. repens*, *Juniperus communis*, and *A. glabrum* predominate.

Relation to other types and phases: This phase is most similar to the MC type, Abco phase. The differences between the two lie largely in the paucity of herbs and grasses in the Abco phase. Both are characterized by a high diversity of conifers, the primary difference between the two canopies being the identity of the dominant tree. Ecotones occur with the Pipo-Arpa type, the Pipo-Arpa type, Cemo phase, and the Pipo-Psme type. On upper slopes this phase gradually thins to relatively isolated individual trees.

5. MC Type, Abco Phase

Vegetation: Consistent dominance by *A. concolor*, and lack of dominance by *P. pungens*, is the hallmark of this phase. Most of the other conifers are common. Table 1 indicates *P. ponderosa* as having the second highest mean importance value. However, this phase is present on the White limestone where *P. ponderosa* is infrequent. In such stands, *P. menziesii* and *P. pungens* are the most common associates. Dominant shrubs are largely those of the Pipu phase, although *P. tridentata* is more common.

Relation to other types and phases: This phase is most closely allied to the MC type, Pipu phase. The two are separated spatially; the Abco phase occurs only on north-facing slopes and canyons east and north of the Wall-of-Windows, with an isolated stand in the Queen's Garden. It is possible that the Pipu phase represents an early seral stage of the Abco phase, although no juveniles of *A. concolor* were found in plots assignable to the Pipu phase. More likely, the two phases represent points along a moisture gradient. *P. pungens* seems able to exist in situations that are too dry to allow growth of *A. concolor*. The two phases do not form ecotones, except in the Queen's Garden. Here, *A. concolor* is found in a nearly pure stand in the shade of some isolated hoodoos. On more exposed sites at higher elevations in the same canyon it is absent, the area being dominated by *P. pungens*. Ecotones are recognizable between this phase and both the Pipo-Psme and Pipo-Arpa types.

6. Pilo Type

Occurrence: This type is well defined only on badlands of the Claron formation, espe-

TABLE 2. Matrix comparing vegetative types and phases through use of Index of Similarity (Sorensen 1948). Consult text for information on the numbering system.

	1	2	3	4	5
1					
2	58				
3	70	40			
4	51	31.5	61		
5	32.5	31	42	60	
6	33	9.6	32	30	11

cially on the ridgeline dividing the drainages of Bryce Wash and Campbell Canyon. There is no soil development; the substrate is generally clay-limestone overlaid by gravels or larger particles. The type ranges in elevation from 2,200 to 2,400 m. Bailey (1970) reports the lowest elevational record of *P. longaeva* as being 2,200 m.

Vegetation: P. longaeva in open stands is the usual appearance of this type. *Pinus ponderosa* and *P. flexilis* may also occur, all trees being twisted and stunted. It should be noted that *P. longaeva* does not attain the wide girth that one usually associates with the species (the largest specimen had a dbh of 22 cm). Because of this it is doubtful that it reaches the extreme ages of 4,000–5,000 years that have been reported (Cronquist et al. 1972). LaMarche (1969) mentions that the oldest reported bristlecone pine in Bryce Canyon is 1,560 years of age; the number of trees and their exact location was not given.

Shrubs are uncommon; only *A. patula* is of any real abundance. Understory vegetation generally covers less than 10 percent of the plots. The forb component differs from that of all other types; *Linum kingii, Ivesia sabulosa,* and *Eriogonum panguicense* var. *panguicense* are the most common. A total of 48 species was recorded for this type, several of which are typical of subalpine zones. Based on the distributions given by Cronquist et al. (1972), Dixon (1935), Ellison (1954), Harrington (1954), and Welsh and Moore (1973), these are: *Agropyron scribneri, Aquilegia scopulorum, Aster glaucodes, Erigeron simplex, Monardella odoratissima, P. longaeva, Potentilla fruticosa, Senecio attratus,* and *Silene pettersonii.*

Relation to other types and phases: As seen from the similarity matrix, this type has little in common with any others, the highest IS being 33. Ecotones are formed only with the Pipo-Arpa type, which extends up narrow washes draining the badlands.

7. Washes, Clay, and Talus Slopes

Much of the main amphitheater is devoid of vegetation or contains only infrequently encountered individuals of numerous species scattered about the eroding Claron formation. Structured plant communities tend to cluster in canyon bottoms, on the slopes of the wider canyons, or on rolling badlands. Species found on these barren areas have been recorded and are cited in the Appendix. Most of these slopes are not easily accessible; hence, the list may be incomplete. Plots were not used to survey such areas; if any pattern exists in the distribution of species, it has not been determined. The White beds form only vertical cliffs in the study area; plots were placed only on the Red member.

TABLE 3. Distribution of trees as a function of moisture availability. Types and phases are given in order of most xeric to most mesic. A = Pilo type; B = Pipo-Arpa type; C = Pipo-Arpa type, Cemo phase; D = Pipo-Psme type; E = MC type, Pipu phase; F = MC type, Abco phase.

Mean i.v.	A B C D E F	A B C D E F	A B C D E F	A B C D E F	A B C D E F	A B C D E F	A B C D E F
0	+ + + + +	+	+	+ +	+	+ + +	+ +
1–10			+	+	+ +	+ +	+
11–20		+		+			
21–30		+ + + +	+	+			+ +
31–40						+ +	
41–50			+				
51–60							
61–70							
71–80							+
81–90	+		+				
91–100							
101–110						z	
111–120							
121–130					+		
131–140							
141–150							
151–160						+	
161–175						+	
Species	Abco	Jusc	Pipu	Pifl	Pilo	Pipo	Psme

Environmental Factors Influencing Distribution of Types

At this point, it can only be speculated as to which environmental parameters are most critical in determining distribution of species. Moisture availability and solar insolation may be critical, but variation in substrates may also warrant consideration. Based on topography, substrate, and exposure, it is believed that moisture availability in communities increases in the order presented in Tables 3 and 4. Mean importance values for all trees and the most common shrubs are plotted as a function of increasing moisture availability. Certain trees cluster at a given end of the spectrum; *A. concolor*, *P. pungens*, and *P. menziesii* are common only in moist situations. *Pinus longaeva* is restricted to the most arid sites. *Juniperus scopulorum* and *P. flexilis* occur at somewhat constant levels throughout, although both diverge from this pattern by decreasing in a given area. *Pinus ponderosa*, although uncommon in the most xeric area, generally decreases with increasing moisture levels.

For shrubs the pattern is similar though more complex. *Acer glabrum*, *J. communis*, and *M. repens* increase with moisture levels; *A. patula* decreases, *C. martinii* remains constant. However, *A. utahensis* and *C. montanus* both demonstrate substantial increases in the Pipo-Arpa type, Cemo phase, apparently at the expense of *A. patula* and *M. repens*.

From this it can be concluded that gradients of moisture availability are involved in sorting species into communities. However, moisture is not always the factor of paramount importance. Differences in substrate may be responsible for part of the pattern, especially in the increased abundance of *A. utahensis* and *C. montanus* in one given type. Only a complete ecological survey of the area will provide an answer to this question.

Distribution of Endemic Species

Species endemic to southern Utah and found within the main amphitheater are listed in Table 5, along with their ecological distribution within the study area. Also given for each species is its current status (Federal Register, 15 Dec. 1980, vol. 45, No. 242). No status is given for *E. panguicense* var. *panguicense*, which, although restricted in range (Reveal 1965), is apparently not rare (Welsh et al. 1975, Welsh and Thorne 1979). Status is defined by the following categories.

Category 1. Information is presently on hand to support listing as endangered or threatened species.

Category 2. Information is available that indicates a probable appropriateness of listing, but sufficient information is not yet available to support listing as endangered or threatened.

Table 4. Distribution of most abundant shrubs as a function of moisture availability. Types and phases given as in Table 3.

Mean i.v.	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F
0	+	+	·				+	+	+																+				+	+								
1-10		+								+	+					+			+	+	+	+	+	+			+	+			+					
11-20			+	+	+				+			+			+		+		+											+			+			
21-30																									+	+										
31-40																													+		+					
41-50																																			+	+
51-60																+																				
61-70																																				
71-80													+		+																					
81-90														+																						+
91-100																																				
101-110																																				
111-120																																				
121-130																																				
131-140																									+											
	Acgl						Amut						Arpa						Cema						Cemo						Juco						Mare					

Category 3c. Taxa proven to be more abundant or widespread than previously considered. Not under consideration at the present time.

From Table 5 it may be seen that 9 of the 11 species listed occur in the Pilo type, 3 are found in the Pipo-Arpa type, and 2 occur in the MC type. Two species, *Oxytropis jonesii* and *Psoralea pariensis*, were not found in a recognizable vegetative type. Species that occur only in the Pilo type have the narrowest geographic distributions, although *Eriogonum panguicense* var. *panguicense* is an exception. It evidently has broader ecological tolerance inasmuch as it has been observed in several additional portions of Bryce Canyon. The narrow distributions of most of these species is no doubt a function of the uncommon occurrence of *P. longaeva* communities or other similar habitat throughout the High Plateaus.

Within Bryce Canyon, most of these endemics are restricted to the Claron formation. In this study, however, *Draba subalpina*, *Lesquerella rubicundula*, and *Townsendia minima* were observed on Quarternary alluvium, a formation from which they have not previously been reported. *Oxytropis jonesii*, *P. pariensis*, and *E. panguicense* are not limited to the Claron formation throughout their geographic range. The remainder of the endemics have been reported only from the Claron formation.

The majority of the vast number of endemic species found in southern Utah are restricted to substrates derived from a specific geologic formation (Welsh 1979). Welsh notes that most of these taxa are found in areas of exposed parent material; soil development provides a barrier between plant and substrate. In the main amphitheater, soils are well defined only in the Pipo-Psme type. It is significant that no endemic species occur in this type.

The distribution of endemic species in Utah is not a random one; fine-textured substrates support more species than coarser

TABLE 5. Distribution of endemic species in the main amphitheater.

Species	Status[1]	Distribution in Utah (counties)[2]	Geologic distribution[3]	Ecologic distribution in main amphitheater
Castilleja revealii	1	Garfield	R; W	Pilo type; washes, clay-limestone slopes
Cryptantha ochroleuca	1	Garfield	R; W	Pilo type; clay-limestone slopes
Draba subalpina	3c	Garfield, Iron, Kane, Millard	R; W; QA	Pipo-Arpa type, Pilo type, MC type
Eriogonum panguicense var. *panguicense*	—	Garfield, Iron, Kane, Sevier, Washington	R; W[4]	Pilo type, clay-limestone slopes
Lesquerella rubicundula	2	Garfield	R; W; QA	Pipo-Arpa type, Pilo type, clay-limestone slopes
Lomatium minimum	1	Garfield, Iron, Kane	R; W	Pilo type, clay-limestone slopes
Oxytropis jonesii	3c	Emery, Garfield, Uintah	W; Flagstaff limestone, Green River shale	Sand-limestone slopes
Penstemon bracteatus	1	Garfield	R	Pilo type, clay-limestone slopes
Psoralea pariensis	1	Garfield, Kane	R; alluvium and sandy alluvium	clay-limestone slopes
Silene pettersonii var. *minor*	1	Garfield, Iron	R	Pilo type, clay-limestone slopes
Townsendia minima	2	Garfield, Kane	R; W; QA	Pilo type, Pipo-Arpa type, MC type

[1]See text for discussion.

[2]From: Reveal 1965, Welsh et al. 1975, Welsh 1978a, Welsh and Thorne 1979.

[3]Refers to the entire range of species. From: Welsh 1978a, Welsh and Thorne 1979, personal observations. R = Red beds of Claron formation; W = White beds, QA = Quarternary alluvium.

[4]Reveal (1965) defines the typical substrate of the species only by the designation "clay slopes." With its wide geographic range it probably occurs on substrates other than those derived from the Claron formation.

ones, and desert and foothill vegetation is richer in endemic species than montane communities (Welsh 1978b, 1979). Based on these observations, Welsh has developed a "predictive model for establishing priority areas for the study of endangered and threatened plants of Utah," in which the highest priority is assigned to fine-textured soils supporting pinyon-juniper or desert shrub vegetation. A similar model may now be established for endemics of the Claron formation. Outcrops of this formation supporting communities of bristlecone pine are most likely to contain endemic species. Based on this assumption, populations of these species have been found at several locations in Bryce Canyon. Species generally restricted to such habitat conditions are likely to be less widely distributed than those capable of invading other communities on the Claron limestone. Higher priority for listing as threatened or endangered species should be assigned to those taxa concentrating in such habitat. The protection of sites containing populations of bristlecone pine promises to be the most productive strategy for ensuring the continued survival of these plants.

Stands of *P. longaeva* within Bryce Canyon National Park are of critical importance to botanical science. In addition to representing the preferred habitat of several endemic species, they are of interest as subalpine vegetation found at atypical elevations. Additional investigation of such areas is likely to be fruitful in studies of the population biology of endemic species and the environmental factors that govern plant distribution.

Within the main amphitheater, the heavy use by visitors does not seem to present any danger to plant populations. The only activities are hiking and horseback riding, both restricted to established trails. Few seem to stray from the trails because the steep topography makes getting lost or injured a high probability. By preventing expansion of the existing trail system, park officials can likely maintain species populations at the present levels.

Summary

An investigation on plant community structure in the main amphitheater of Bryce Canyon National Park has shown that the vegetative community previously referred to as the "breaks" is divisible into discrete vegetative types. Although most of the area consists of sparsely vegetated cliffs and slopes, well-defined communities are found on gentle lower slopes, rolling badlands, and canyon bottoms. Four major types are recognized, some being further divided into phases. Each has been characterized as to canopy, understory vegetation, and relationship to other types. A checklist of all species found in the area is given in the Appendix.

The ecologic distribution of several endemic species of southern Utah is given. The *Pinus longaeva* type is shown to be the richest in rare plants. This habitat is also unique in that it contains species normally found at subalpine elevations. It is predicted that endemic species of the Claron formation will tend to cluster in similar habitat. Protection of bristlecone pine communities is urged as the simplest means of providing protection for these rare plants.

Appendix

Checklist of species and their ecological distribution in the main amphitheater, Bryce Canyon National Park. I = Pipo-Arpa type, II = Pipo-Psme type, III = MC type, IV = Pilo type, V = washes, clay and talus slopes. ° = additions to the flora of the Kaiparowitz Basin.

	Vegetative type				
Species	I	II	III	IV	V
ACERACEAE					
Acer glabrum Torr.	+	+	+		+
APIACEAE (Umbelliferae)					
Cymopterus purpureus Wats.	+	+	+	+	+
Lomatium minimum (Mathias) Mathias				+	+

Appendix continued.

Species	Vegetative type I	II	III	IV	V
APOCYNACEAE					
Apocynum androsaemifolium L.		+		+	+
ASCLEPIDACEAE					
Asclepias asperula (Decne) Woodson	+				
ASTERACEAE (Compositae)					
Aster glaucodes Blake	+	+	+		+
Chrysothamnus nauseosus (Pallas) Britt.	+				+
C. parryi (Gray) Greene	+				+
Cirsium arizonicum (Gray) Petrak	+	+	+	+	+
Erigeron simplex Greene*				+	+
Haplopappus armerioides (Nutt.) Gray	+	+	+	+	+
Hymenopappus filifolius Hook.	+	+	+	+	+
Hymenoxys acaulis (Pursh) Parker	+			+	+
H. richardsonii (Hook.) Cockerell					+
Leucelene ericoides (Torr.) Greene	+				
Machaeranthera grindelioides (Nutt.) Shinners	+	+	+	+	+
Petradoria pumila (Nutt.) Greene	+		+		+
Senecio attratus Greene*			+		+
S. multilobatus T. & G. ex Gray	+	+		+	
Solidago sparsiflora Gray	+	+	+		
Stephanomeria tenuifolia (Torr.) Hall	+				+
Tetradymia canescens DC.	+				+
Townsendia exscapa (Richards) T. C. Porter					+
T. minima Eastwood	+		+	+	+
Xanthocephalum sarothrae (Pursh) Shinners (= *Gutierrezia sarothrae* Pursh)	+			+	
BERBERIDACEAE					
Mahonia fremontii (Torr.) Fedde (= *Berberis fremontii* Torr.)	+				
M. repens (Lindl.) G. Don. (= *B. repens* Lindl.)	+	+	+	+	+
BETULACEAE					
Betula occidentalis Hook.			+		+
BORAGINACEAE					
Cryptantha abata Johnst.	+		+	+	
C. ochroleuca Higgins*				+	+
Lithospermum multiflorum T. & G.	+	+	+	+	
BRASSICACEAE (Cruciferae)					
Arabis pendulina Greene	+				
Descurainia sophia (L.) Webb. ex Engler & Prantl.					+
Draba subalpina Goodmn. & Hitchc.	+		+	+	
Lesquerella rubicundula Rollins	+			+	+
Physaria chambersii Rollins	+		+	+	
Streptanthus cordatus Nutt. ex T. & G.	+				
Thlaspi arvense L.					
CAPRIFOLIACEAE					
Sambucus caerulea Raf.	+	+	+		
Symphoricarpos oreophilus Gray	+	+	+		
CARYOPHYLLACEAE					
Arenaria fendleri (Rydb.) Fern.			+		
Silene pettersonii Maguire var. *minor* Hitchc. & Maguire				+	
CORNACEAE					
Cornus stolonifera Michx.*					
CUPRESSACEAE					
Juniperus communis L.	+	+	+	+	
J. osteosperma (Torr.) Little	+				
J. scopulorum Sarg.	+	+	+	+	

Appendix continued.

Species	Vegetative type I	II	III	IV	V
ERICACEAE					
Arctostaphylos patula Greene	+	+	+	+	+
ELAEAGNACEAE					
Shepherdia canadensis (L.) Nutt.		+	+		
EUPHORBIACEAE					
Euphorbia fendleri T. & G.	+				
E. lurida Engelmn. ex Ives*	+	+	+	+	+
FABACEAE (Leguminosae)					
Astragalus convallarius Greene*	+	+	+		
A. kentrophyta Gray			+		+
A. megacarpus (Nutt.) Gray	+		+		+
Oxytropis jonesii Barneby					+
Psoralea pariensis Welsh & Atwood*					+
FAGACEAE					
Quercus gambelii Nutt.	+	+	+		
GENTIANACEAE					
Gentianella tenella (Rottb.) Borner* (= *Gentiana tenella* Rottb.)		+		+	+
Swertia radiata (Kellogg) Kuntze*	+	+	+	+	
LAMIACEAE (Labiatae)					
Monardella odoratissima Benth.				+	+
LINACEAE					
Linum kingii Wats.	+		+	+	+
L. perenne L. var. *lewisii* (Pursh) Eat. & Wright	+		+		+
ONAGRACEAE					
Calylophus lavandulaefolia (T. & G.) Raven (= *Oenothera lavandulaefolia* T. & G.)	+			+	+
Oenthera brachycarpa (Gray) Britt.	+	+	+	+	+
PINACEAE					
Abies concolor (Gord. & Glend.) Lindl. ex Hildebr.	+		+		+
Picea pungens Engelmn.	+	+	+	+	+
Pinus edulis Engelmn. & Wisliz.	+				+
P. flexilis James ex Long	+	+	+	+	+
P. longaeva D. K. Bailey	+		+	+	+
P. ponderosa Dougl. ex Lawson	+	+	+	+	+
Pseudotsuga menziesii (Mirb.) Franco	+	+	+	+	+
POACEAE (Gramineae)					
Agropyron cristatum (L.) Gaertn.					+
A. scribneri Vasey*				+	+
A. trachycaulum (Linke) Malte					+
Calamagrostis scopulorum Jones			+		+
Elymus salina Jones	+	+	+	+	+
Oryzopsis hymenoides (R. & S.) Ricker ex Piper	+	+	+	+	+
Poa compressa L.*					+
Puccinellia nuttalliana (Schult.) Hitchc. ex Jeps.					+
Schizachyrium scoparium (Michx.) Nash ex Small*	+				
Sitanion hystrix (Nutt.) J. G. Smith	+				+
Stipa columbiana Macoun*	+				+
POLEMONIACEAE					
Phlox austromontana Cov.	+			+	+
POLYGONACEAE					
Eriogonum corymbosum Benth.					+
E. panguicense (Jones) Reveal var. *panguicense*				+	+
RANUNCULACEAE					
Aquilegia scopulorum Tidestr.	+		+	+	+
Clematis columbiana (Nutt.) T. & G. (= *C. pseudoalpina* (Kuntze) A. Nels.)	+	+	+	+	

Appendix continued.

Species	Vegetative type I	II	III	IV	V
RHAMNACEAE					
Ceonothus martinii Jones	+	+	+	+	+
ROSACEAE					
Amelanchier utahensis Koehn	+	+	+		+
Cercocarpus ledifolius Nutt.°			+	+	
C. montanus Raf.	+	+	+	+	+
Holodiscus dumosus (Nutt.) Heller			+	+	+
Ivesia sabulosa (Jones) Keck	+			+	+
Potentilla fruticosa L.°				+	+
Purshia tridentata (Pursh) DC.	+	+	+	+	+
SALICACEAE					
Populus angustifolia James ex Torr.			+		+
P. tremuloides Michx.					+
Salix exigua Nutt.					+
SAXIFRAGACEAE					
Ribes cereum Dougl.		+	+		+
SCROPHULARIACEAE					
Castilleja linariaefolia Benth. ex DC.	+	+			+
C. revealii N. Holmgren			+	+	
Pedicularis centranthera Gray ex Torr.	+	+	+	+	
Penstemon bracteatus Keck				+	+

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SCIENTIFIC NAME: Castilleja revealii N. Holmgr.

FAMILY: Scrophulariaceae

CITATION: Bull. Torrey Bot. Club 100: 83. 1973.

SYNONYMS: None

STATUS: Reviewed as endangered, Federal Register, 1 July 1975. Proposed as endangered, Federal Register, 16 June 1976. Recommended as endangered by S. L. Welsh, 1978.

COMMON NAME: Reveal paintbrush

KNOWN DISTRIBUTION: Garfield Co., Utah

HABITAT: Limestone outcrops, gravelly soil; ponderosa pine woodland

ELEVATION: 7800 to 8000 feet (2379 to 2440 m)

DESCRIPTION: Plants perennial; caudex soft woody above a cluster of roots; stems usually single, sometimes two rarely three, unbranched, erect, 0.8-1.5 dm tall, anthocyanous purple, glabrous becoming villous in the inflorescence; leaves 2-3.5 cm long, linear to lanceolate except at the base, mostly glabrous, sometimes glandular puberulent above, puberulent below; bracts broadly lanceolate to ovate rounded, glandular puberulent, magenta to rose; calyx 16.5-22 mm long, glandular hispid; corolla 19-25 mm long, anthers included in the galea; fruit a capsule.

TAXONOMIC PROBLEMS: Related to C. parvula, this plant can be distinguished by its strict habit, few stems, and longer corolla.

EXISTING OR POTENTIAL THREATS: Inadvertant highway realignment, construction or trampling are threats to this species.

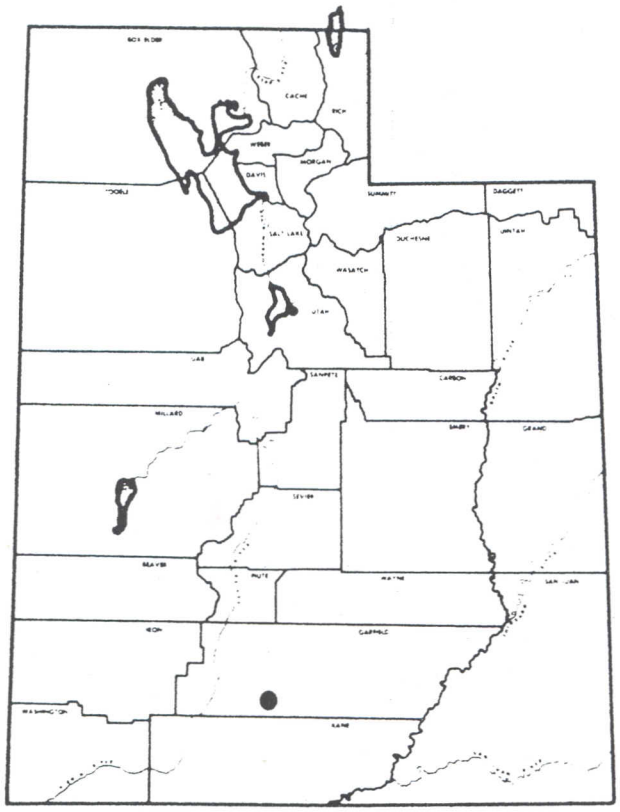
LAND OWNERSHIP/MANAGEMENT: National Park Service

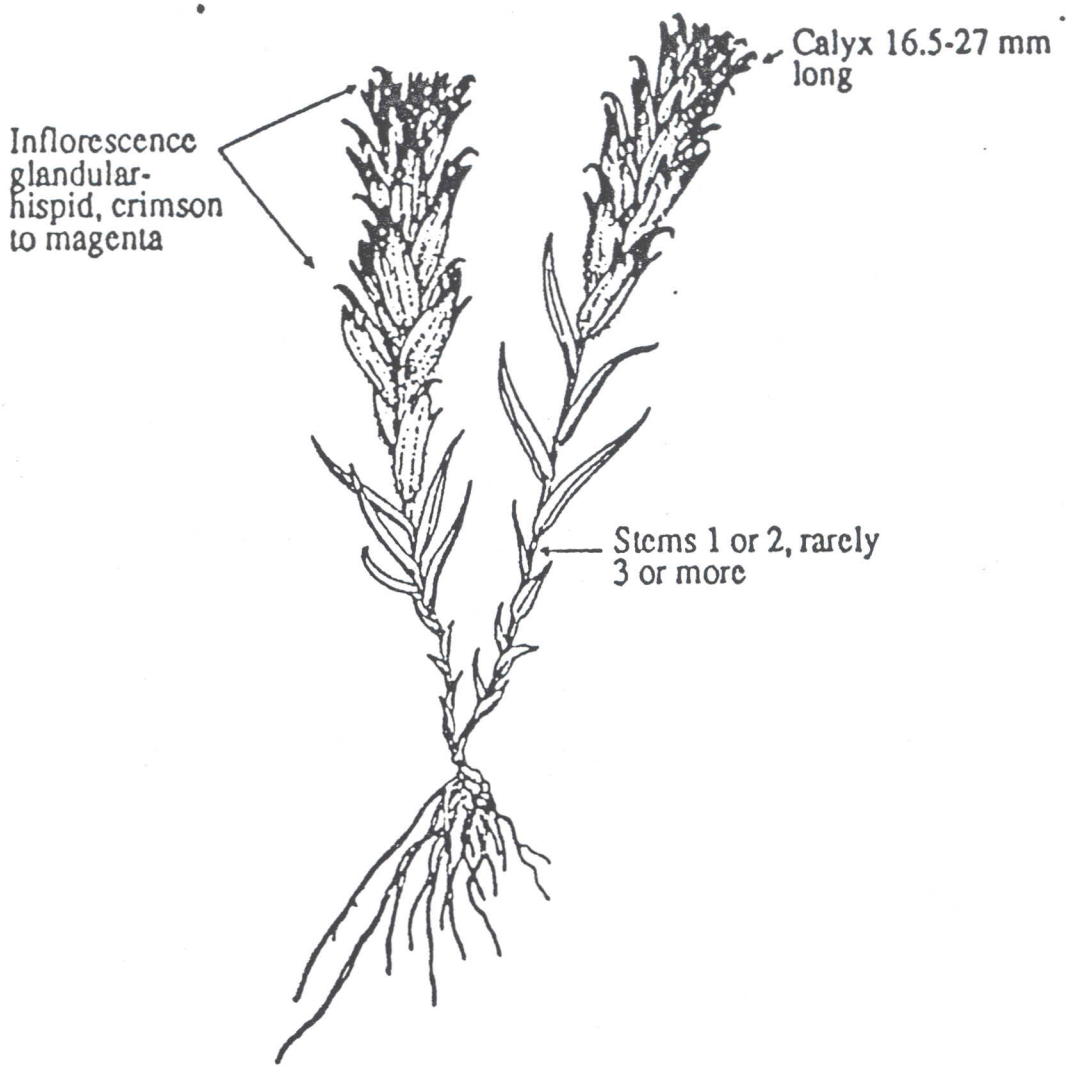
REMARKS: This plant is known only from the type locality.

RECOMMENDATIONS: The extent of the population should be determined and the relation of this plant to its environment should be investigated.

Castilleja revealii







CASTILLEJA PARVULA var. *REVEALII*

Scientific Name: *Castilleja parvula* Rydb. var. *revealii* (N. Holmgren) Atwood

Common Name: Reveal Indian paintbrush

Family (Common Name): Scrophulariaceae (Figwort Family)

Synonyms: *Castilleja revealii* N. Holmgren

Global and State Rank: G?T1/S1

Federal Review Status: C2

Global Distribution: Southwestern and southern Utah

State Distribution: Garfield, Iron, and Kane counties

Ownership: USDA FS and NPS

National Forest: Dixie

Habitat: Ponderosa pine/bristlecone pine community on gravelly soils of the Wasatch Limestone Formation between 7,500-8,300 feet elevation. Late June-August.

persisting; herbage scaberulous-puberulent with minute retrorse hairs often mixed with longer villous hairs near the inflorescence; leaves 1.5–3 (4) cm long, linear to narrowly lanceolate, entire, the lowermost small and scale-like; inflorescence glandular-pubescent and viscid-villous, crimson to magenta, apparently never yellowish; bracts broadly lanceolate, entire or with a short pair of lateral lobes near the apex; calyx 13–18 mm long, the primary lobes slightly more deeply cleft in front, 6–8.5 mm, than in back, 5.5–7.5 mm, the segments 1–3 (5) mm long, obtuse to rounded, sometimes acute; corolla 16–20 (23) mm long, the galea 5–8 mm long, the lower lip 1–2.5 mm long, the teeth ca 1–2 mm long, incurved, the tube 10–13 (15) mm long; capsule ca 9–11 mm long; $2n = 24$.

Alpine ridges, slopes, and meadows, 3000–3600 m elev.; Tushar Plateau along the Beaver-Piute Co. line, and a collection from the Aquarius Plateau (*Atwood 8174*; at NY), Garfield Co., Utah. Late July–Aug.

20. Castilleja revealii N. Holmgren

Castilleja revealii N. Holmgren, Bull. Torrey Bot. Club 100: 87, fig. 2. 1973. (*N. Holmgren & Reveal 2017*, along road to Bryce Point, near Inspiration Point turnoff, Bryce Canyon Natl. Park, Garfield Co., Utah, 24 June 1965; holotype at NY!)

Bryce Canyon paintbrush.

Perennial herb, 0.8–1.5 (2) dm tall; stems erect or ascending, sometimes decumbent, unbranched, usually single, sometimes 2 or 3; herbage glabrous or the leaves sometimes puberulent or glandular-puberulent on the upper surface, the stems anthocyanous-purple; leaves 2–3.5 (4.5) cm long, linear to narrowly lanceolate, entire, sometimes the uppermost with a small pair of lateral lobes near the apex, the lowermost leaves small and scale-like; inflorescence glandular-hispid, crimson to magenta; bracts broadly lanceolate to ovate, obtuse to rounded, with 1 (2) pair of narrow lateral segments near the apex; calyx 16.5–22 (27) mm long, the primary lobes (8) 10–15 (18) mm long, slightly more deeply cleft in front than in back, the segments (1.5) 3–6 (8) mm long, narrowly lanceolate to elliptic, acute to sometimes obtuse; corolla 19–25 (27.5) mm long, the galea 7–10 (11.5) mm long, the lower lip reduced, the teeth 0.6–1.4 mm long, usually somewhat incurved, the tube 12–16 mm long; capsule ca 10 mm long; $2n = 24$.

Limestone gravelly soil in ponderosa pine woodland at about 2500 m elev.; endemic to the Bryce Canyon-Red Canyon area of the Paunsaugunt Plateau, Garfield Co., Utah. June–early July.

21. Castilleja aquariensis N. Holmgren

Castilleja aquariensis N. Holmgren, Bull. Torrey Bot. Club 100: 87, fig. 3. 1973. (*N. & P. Holmgren 4726*, Aquarius Plateau, 35 km nnw. of Escalante, 2925 m, Garfield Co., Utah, 11 Aug 1970; holotype at NY!)

Aquarius Plateau paintbrush.

Perennial herb, 1.5–2.5 (3) dm tall; stems ascending to erect, unbranched, 1 to few; herbage stiffly hispid, becoming villous next to the inflorescence where often glandular-pubescent as well, the stems often anthocyanous-purple; leaves 2–3.5 (4) cm long, linear, entire, appressed-ascending; inflorescence villous and glandular-pubescent, pale yellow; bracts broadly lanceolate to ovate, the upper ones with 1 (2) pair of small lateral lobes departing from near the rounded apex; calyx (16) 18–22 mm long, the primary lobes (8) 9.5–12.5 mm long, slightly more deeply cleft in front than in back, the segments 0.5–5 (6) mm long, lanceolate to ovate, acute to obtuse; corolla 17–20 (23) mm long, the galea 6–8 (9.5) mm long, the lower lip reduced, with teeth 0.8–1.5 mm long, the tube 9–13 mm long; capsule ca 10 mm long.

Sagebrush-grass meadows surrounded by spruce-fir stands, ca 3000 m elev.; endemic to the Aquarius Plateau of sc. Utah. Late June–Aug.

22. Castilleja sulphurea Rydb.

Castilleja sulphurea Rydb. Mem. New York Bot. Gard. 1: 359. 1900. (*Rydberg & Bessey 4966*, Electric Peak, Yellowstone Natl. Park, 6500 ft, Park Co., Mont., 20 Aug 1897; holotype at NY!)

C. luteovirens Rydb. Bull. Torrey Bot. Club 28: 26. (31 Jan) 1901. (*Rydberg & Vreeland 5616*, West Spanish Peak, Sangre de Cristo Creek, 2400–2700 m, Costilla Co., Colo., 2 July 1900; holotype at NY!)

C. wyomingensis Rydb. Bull. Torrey Bot. Club 28: 502. (30 Sept) 1901. (*Tweedy 2341*, Big Horn Mts., 7200 ft, Sheridan Co., Wyo., July 1899; holotype at NY!)

C. brunnescens Rydb. Bull. Torrey Bot. Club 31: 643. 1904 [1905]. (*C. F. Baker s.n.*, Cameron Pass, 10,000 ft, Larimer-Jackson Co. line, Colo., in 1896; holotype at NY!)

C. septentrionalis of western authors, misapplied; not Lindl. 1825.

Sulphur paintbrush.

Perennial herb, (2) 2.5–5.5 (7) dm tall; stems erect or ascending, often branched above, few to several to a cluster; herbage scabrid-puberulent, the hairs spreading to retrorsely curved; leaves 2–5.5 (8) cm long, entire, narrowly lanceolate to lanceolate, more or less spreading; inflorescence compressed at first, elongating in fruit, villous and glandular-puberulent, pale yellow; bracts broadly lanceolate to ovate, entire or with a pair of small lateral lobes near the apex; calyx 13–23 (28) mm long, the primary lobes more deeply cleft in front, (6) 8–13 mm, than in back, (5) 6–10 (11) mm, the segments 1–4 mm long, obtuse to acute; corolla 18–30 mm long, the galea 6–12 mm long, the lower lip 1–2.5 mm long, the teeth short and blunt, ciliate, the tube 10–20 mm long; capsule 9–11 mm long; $2n = 24, 48, 96$.

Moist subalpine meadows and exposed slopes, 2400–3400 m elev.; Rocky Mts. from B.C. and sw. Alta. through w. Mont. and adj. Idaho to Wyo., Colo., Utah, and n. N.M., also in the Black Hills of S.D.; in Utah in the Wasatch, Uinta, and LaSal mts. and Wasatch Plateau. Late June–Aug.

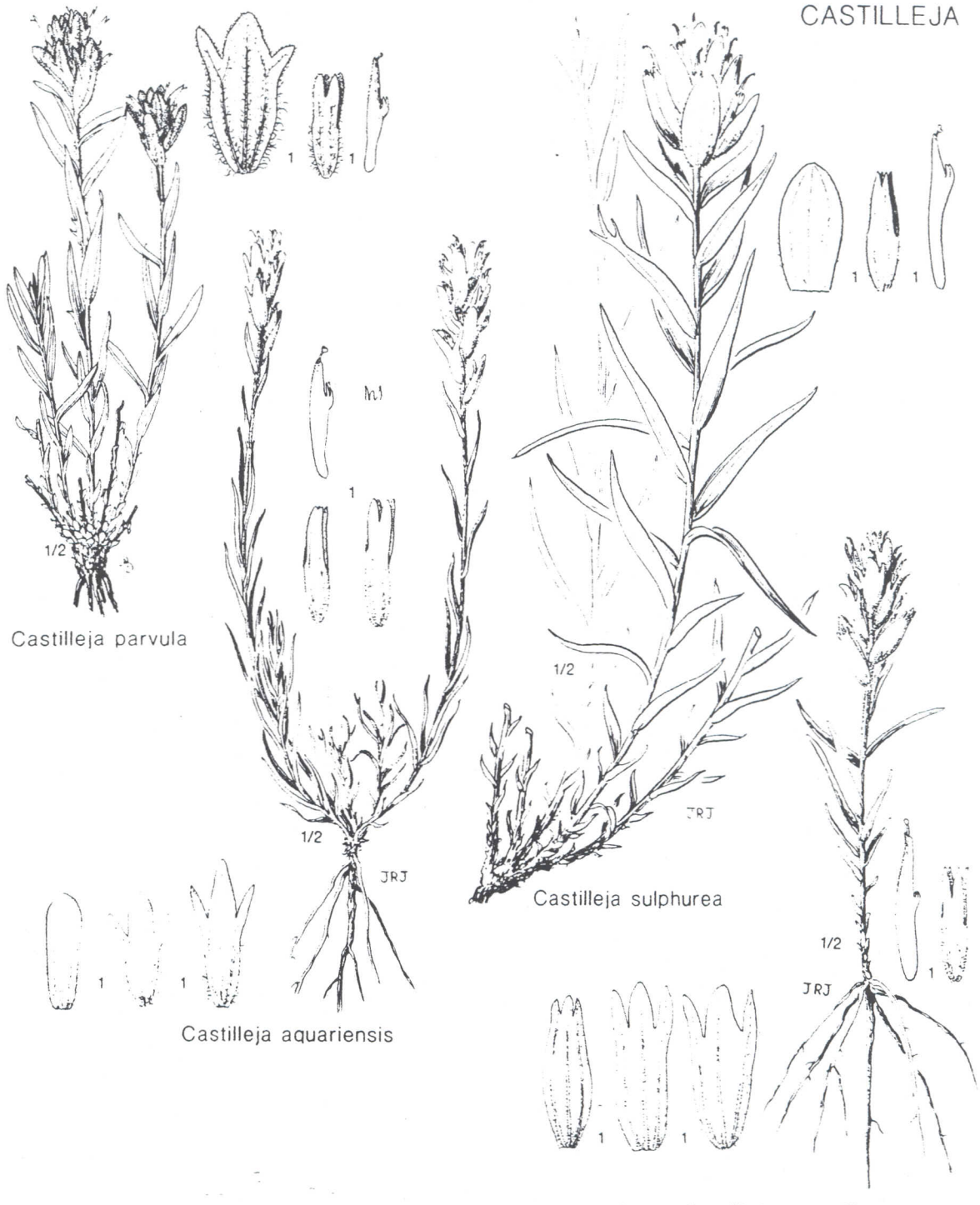
Castilleja sulphurea is very closely related if not conspecific with the northeastern *C. septentrionalis* Lindl. There is also a close relationship to the alpine *C. occidentalis* and *C. rhexifolia* (which see for discussion), but any revisionary treatment of these taxa should include a study of the group as a whole which includes the complex boreal *C. pallida* (L.) Sprengel.

23. Castilleja rhexifolia Rydb.

Castilleja oreopola var. *subintegra* Fern. Erythea 6: 45. 1898. (*Piper 2322*, "in meadows at 2300 m.," Powder River [Wallowa] Mts., Oregon, 25 Aug 1896; lectotype by M. Ownbey, Univ. Wash. Publ. Biol. 17(4): 320. 1959.)

C. rhexifolia Rydb. Mem. New York Bot. Gard. 1: 356. (15 Feb) 1900. (*Rydberg & Bessey 4951*, Cedar Mt., 10,000 ft, Madison Co., Mont., 16 July 1897; holotype at NY!)

C. lauta A. Nels. Bull. Torrey Bot. Club 27: 269. (26 May) 1900. (*A. & E. Nelson 6708*, higher slopes, Dunraven Peak,



Yellowstone Natl. Park, Wyo., 27 Aug 1899; holotype at RM!)

C. obtusiloba Rydb. Bull. Torrey Bot. Club 31: 644. 1904 [1905]. (*Cowan s.n.*, Leroux Park, 9000 ft, Delta Co., Colo., 19 July 1892; holotype at NY!)

C. leonardi Rydb. Bull. Torrey Bot. Club 34: 36. 1907. (*F. E. Leonard 151*, "in part." "Head of American Fork Cañon." Utah Co., Utah, 21 July 1885; holotype at NY!) The NY sheet includes three specimens which appear to be from two plants of *C. rhexifolia*, one with narrowly lanceolate leaves and the other with broadly lanceolate leaves. The latter is indicated as the type.

C. humilis Rydb. Bull. Torrey Bot. Club 34: 37. 1907. (*A. Nelson 7919*, "moist alpine woods." Medicine Bow Mts., Albany Co., Wyo., 2 Aug 1900; holotype at RM!)

C. oregonensis Gand. Bull. Soc. Bot. France 66: 217. 1919. (*Cusick 2443*, East Eagle-Cornucopia trail, Wallowa Mts., 7000 ft, Baker Co., Oregon, 16 July 1900; isotype at NY!)

***Castilleja parvula* Rydb.** Tushar Paintbrush. Herbaceous perennial, 0.9–2.1 dm tall; stems erect to ascending, 1 to several per cluster, old stems persisting, puberulent below to villous above; leaves entire, glabrous to retrorsely-puberulent, the lower leaves small and scalelike, linear, the main stem leaves narrowly lanceolate to broadly lanceolate; inflorescence dense, viscid-villous, crimson to magenta; bracts broadly lanceolate, entire or lobed near the tip; calyx 1.2–2.1 cm long, the lobes unequally cleft; corolla 1.5–2.5 cm long, the galea slightly shorter than the tube; capsule 1 cm long, glabrous. Two varieties are separable as follows:

1. Stems mostly solitary but sometimes 2–3 per plant, usually purplish; growing on the Wasatch Limestone Formation in Garfield, Iron, and Kane counties, rare . . . . . *C. parvula* var. *revealii*

— Stems mostly several, the old stems persisting, rarely purplish, usually growing on igneous gravel in Beaver, Garfield, and Piute counties, rare . *C. parvula* var. *parvula*

Var. *parvula* [C. *parvula* Rydb., type from the Tushar Mts., Piute County]. Alpine ridgetops and talus slopes above timberline on tertiary igneous sandy gravel at 3050 to 3584 m in Beaver, Garfield, and Piute counties; endemic; 10 (v).

Var. *revealii* (N. Holmgren) Atwood [*C. revealii* N. Holmgren, type from Bryce Canyon]. n = 12. Bristlecone and ponderosa pine communities on the Wasatch Limestone Formation at 2285 to 3050 m in Garfield Iron, and Kane counties; endemic; 5 (iv).

STATUS REPORT

Castilleja revealii

I. Nomenclature

A. Family name: Scrophulariaceae

Synonyms: None

Common name: Snapdragon family

B. Species name: Castilleja revealii N. Holmgren

Citation: Bull. Torrey Bot. Club 100: 87. 1973.

Synonyms: None

Common name: Reveal Indian paintbrush

II. Legal Status

A. Federal: Reviewed as endangered, Federal Register, 1 July 1975.
Proposed as endangered, Federal Register, 16 June 1976.

B. State: None

C. Other: Recommended as endangered by S. L. Welsh, 1978.

III. Description

A. Field identification features: Perennial plant with usually 1 or 2 unbranched stems, about 0.8-1.5 dm tall; the bracts are magenta to rose in color.

B. Brief description: Perennial; caudex soft-woody, elongate with age, surmounting a cluster of roots; stems usually single, sometimes 2, or rarely more, unbranched, 0.8-1.5 (2) dm tall, often anthocyanous-purple, glabrous below, viscid in the inflorescence; leaves entire, or the uppermost with small lateral lobes, scale-like below, linear to linear-lanceolate above; inflorescence

magenta to rose; bracts broadly lanceolate to ovate, obtuse to rounded, with 1 or 2 pair of narrow lateral lobes near the apex, glandular pubescent; calyx glandular pubescent, green at the base, magenta to rose above; corolla green and minutely glandular-puberulent on the back, glabrous and magenta to rose on the margins; anthers remaining included within the galea after anthesis.

C. Closely related species: Castilleja parvula; C. occidentalis; C. aquariensis

IV. Geographical Distribution

A. Past: Unknown

B. Present: Paunsaugunt Plateau, Bryce Canyon National Park, T37S, T4W, Sec. 1, Garfield County, Utah

C. Potential: Unknown

V. Taxonomic Problems

None

VI. Habitat Description

A. Plant community: Ponderosa pine community

B. Dominant plants: Pinus ponderosa; Arctostaphylos patula

C. Elevational ranges: 7800-8000 feet (2379-2440 m)

D. Exposure and slope: West to southwest, 0 to 5% slope

E. Edaphic features: Limestone, gravelly soil

F. Geology: Pink Limestone Member of the Wasatch Formation, tertiary

G. Other habitat features: Unknown

VII. Population Biology

A. Number of populations (est.): One

B. Number of individuals/population (est.): About 200

C. Reproduction methods: Unknown

D. Age classes: Young to mature

E. Time of flowering and fruiting: Mid-June to mid-July

F. Dispersal mechanisms: Unknown

G. Pollinators, if any: Unknown

H. Other biological factors: This plant is suspected of being a partial root parasite on some unknown plant.

I. Current population dynamics; trends and status: Unknown

VIII. Critical Habitat Recommendations

A. Geographic boundaries: Sec. 1, T37S, R4W, extreme southern edge of Sec. 1, along road from Inspiration Point to Bryce Point, Bryce Canyon National Park, Garfield County, Utah.

B. Physical attributes: Limestone gravelly soil in ponderosa pine and arctostaphylos patula vegetative type

IX. Threats to Survival

A. Nature of existing threats to survival:

1. Threatened destruction, modification, or curtailment of habitat or range, if any: Off-path use of the area in the Inspiration Point section of Bryce Canyon National Park.

2. Over utilization for commercial, sporting, scientific, or educational purposes, if any: None

3. Disease, predation, grazing or trampling, if any: Trampling could be a potential threat to the existence of this plant.

4. Inadequacy of existing regulatory mechanisms, if any: Unknown

5. Other natural or man-made factors reflecting continued existence, if any: Unknown

B. Potential threats in foreseeable future, as in IX-A: Possible future plans for the development of the national park is a potential threat to the existence of this plant.

X. Land Management or Ownership

National Park Service

XI. Management Implications

A. Suggest management actions which might best maintain the plant species: Location of all specimens in the population, and survey for additional ones, seems to provide the best means of perpetuating this species. Restriction of the area from off-path and off-highway use, might also be necessary.

B. Suggest suitable alternatives for recovery: NA

XII. Cultivation Potential

A. Present or potential cultivation potential: Unknown; but the problem of a host-parasite relationship is unresolved, and these plants are not easily transplantable.

B. Currently cultivated populations, if any, their location and condition: None

XIII. Potential Value

Aesthetic, ecological, economical, educational, evolutionary, medicinal, ornamental, recreational, and scientific value, as appropriate: These plants are aesthetically pleasing. They occupy a peculiar ecological and edaphic situation. The evolution of endemics could be sought in this peculiar plant, which has a purported relationship with another species as a root parasite. The plant, then, is valuable both from evolutionary and aesthetic aspects.

XIV. Specialist

Name: Noel Holmgren

Address: New York Botanical Garden
Bronx, New York 10458

XV. References

1. Holmgren, Noel H. 1973. Five new species of Castilleja (Scrophulariaceae) from the intermountain region. Bull. Torrey Bot. Club 100: 83-93.

2. Welsh, S. L. 1978. Endangered and threatened plants of Utah. Great Basin Naturalist 38: 1-18.

3. Welsh, S. L., N. D. Atwood, and J. R. Reveal. 1975. Endangered, threatened, extinct, endemic, and rare or restricted Utah vascular plants. Great Basin Naturalist 35: 327-376.

XVI. Appendices

A. Xerox copies of distribution maps, illustrations, original descriptions, floristic or monographic descriptions, magazine articles, newspaper clippings: See attachments.

B. Herbarium label data and location of herbaria:

1. Castilleja revealii (Isotype; 117891, BRY); N. Holmgren and Reveal 2017, Bryce Canyon National Park, along road to Bryce Point, 1/2 mile from Inspiration Point turnoff, T37S, R4W, Sec. 1, 8000 feet elev., Garfield County, Utah, 24 June 1965.

2. C. revealii (Paratype; US); Weight B-31/46, Bryce Canyon, Utah, 13 June 1931.

C. Map of distribution and critical habitat boundaries: Bryce Point, Utah USGS 7.5'

D. Photos or illustrations: See attachments.

XVII. Author of Statement

Name: Stanley L. Welsh

Address: 129 North 1000 East
Orem, Utah 84057

Date: 1 January 1978

XVIII. Other Sources

None



Critical habitat: Castilleja revealii

USGS - 7.5': Bryce Point

tion of *Melanospora destruens* Shear, and of some other Ascomycetes. Ann. Bot. London 50: 825–844.

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POLLOCK, R. T., and G. A. JOHNSON. 1972. The blackberry mutant of *Sordaria fimicola*. Can. Jour. Genet. Cytol. 14: 943–948.

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Five new species of *Castilleja* (Scrophulariaceae) from the Intermountain Region[1]

Noel H. Holmgren[2]

The New York Botanical Garden, Bronx, New York 10458

HOLMGREN, N. H. (New York Bot. Gard., Bronx, N.Y. 10458). Five new species of *Castilleja* (Scrophulariaceae) from the Intermountain Region. Bull. Torrey Bot. Club 100: 83–93. 1973.—*Castilleja salsuginosa, C. revealii, C. aquariensis, C. kaibabensis* and *C. christii* are described with discussions on relationships, with keys separating them from their nearest related species and with some phylogenetic speculations. All five species are illustrated and mapped.

The five new species described herein re narrow endemics in the Intermountain Region. Four of the species are from areas igh in endemism (Holmgren 1972). *Castilleja salsuginosa* is from the Calcareous Mountains section of the Great Basin division, the richest section for endemism in ne Great Basin; *C. revealii, C. aquariensis* nd *C. kaibabensis* are from the Colorado Plateau division, the richest area for endemism in the whole Intermountain Region. *Castilleja christii*, the fifth species, is in the northern end of the Bonneville ion, an area more interesting for its dis- than for endemic species.

Castilleja salsuginosa belongs to the Pilosae group; *C. revealii, C.* and *C. kaibabensis* belong to rionales group; and *C. christii* the Hispidae group. Although infrageneric categories have been by Rydberg (1918), Pennell (1951) Ownbey (1959), they have not been lished under any certain rank. I am not dy to commit myself to sectional circumscriptions at this point, so I refer to them species-groups.

PILOSAE

Castilleja salsuginosa N. Holmgren, sp. nov. Fig. 1

Calycis segmentis elongatis linearibus inter se subaequalibus, galea abbreviata, labiique inferioris valde saccati lobulis 3 petaloideis turma Pilosis pertinens; juxta *C. lapidicolam* A. Heller, sed caulibus elatioribus [0.5–] 0.8–1.4 [–1.8] (nec. 0.2–0.8 [–1]) altis, foliis carnosulis brunneo-purpureis (nec membranaceis purpureo-viridibus), calyce longiori 16–19 [–21] (nec 12–17 [–18.5]) mm longo, corollaque longiori 18–22 [–24] (nec 15–18) mm longa abstans.

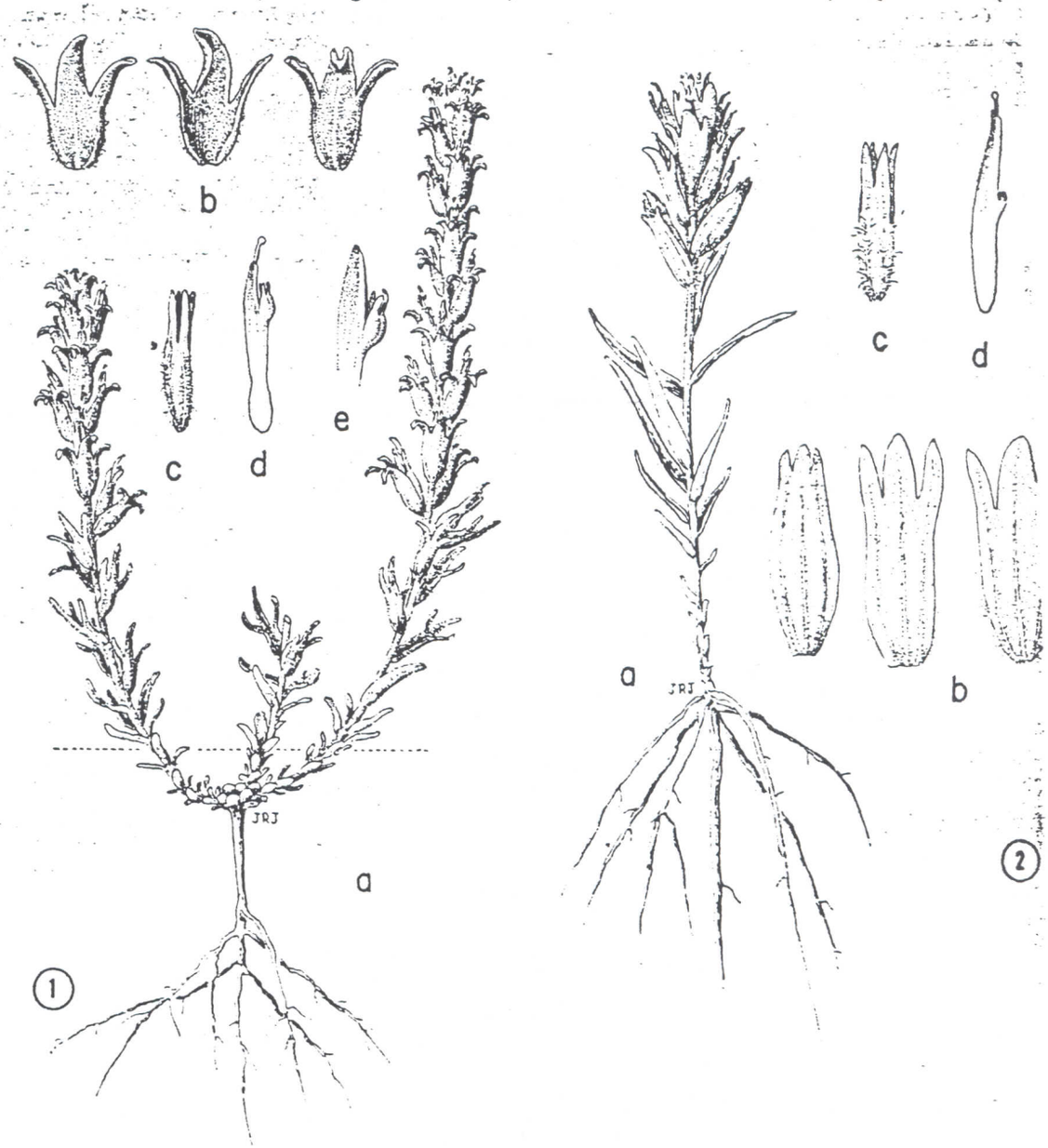
Perennial, (0.5–) 0.8–1.4 (–1.8) dm tall, with several decumbent stems arising from a compact, soft, scaly caudex, which surmounts a bright yellow taproot; herbage

[1] The work reported here was supported in part by National Science Foundation Grant number GB5361X3.

[2] I am grateful to Mr. Rupert C. Barneby for the Latin diagnoses and to Ms. Jeanne R. Janish for providing the illustrations. I also thank them and Doctors Patricia K. Holmgren and Paul A. Fryxell for helpful comments.

Received for publication February 21, 1973.

hispid with both gland-tipped and non gland-tipped hairs, with adhering soil particles and salt crystals giving the herbage a grayish cast to the purplish-brown color; leaves 1.5–2.4 (–3) cm long, fleshy, the lowermost leaves (below ground level) or cream-colored margins of the bra calyces, and teeth of the lower lip, and reddish margins of the galea; bracts shor than the leaves, 14–17 mm long, with rarely 4 lateral lobes, the middle lobe br and rounded or obtuse; calyx 16–19 (–



Figs. 1–2. New species of *Castilleja*.—Fig. 1. *C. salsuginosa* (*Holmgren & Reveal 3864*): a, hab (×0.5); b, bracts; c, calyx; d, corolla; (b–d, ×1); e, galea and lower lip (×2).—Fig. 2. *C. reveal* (*Holmgren & Reveal 2917*): a, habit (×0.5); b, bracts; c, calyx; d, corolla; (b–d, ×1).

scale-like, the middle ones linear to sometimes narrow-lanceolate, entire, and the upper narrow-lanceolate with 1 or rarely 2 pairs of lateral lobes; inflorescence coloration little different from the purplish-brown of the herbage except for the white mm long, glandular-pubescent, with longer non-glandular hairs copious on the vein and sparsely scattered between, the 4 segments subequal in length, 6–8.5 mm long linear, the tube 9.5–11 (–13) mm long corolla 18–22 (–24) mm long, the smal

tains (California and Nevada. Wassuk, Toquima, Toiyabe, Snake, Schell Creek, Ruby and East Humboldt ranges (Nevada) and the Deep Creek Range (western Utah) ..... *C. rubida* Piper, *C. lapidicola* Heller and *C. nana* Eastw.

2. Stems taller, 1.5–3.5 dm long, ascending to erect, rarely decumbent; bracts usually pale yellowish-green, sometimes with a purplish tinge ..... *C. pilosa* (S. Wats.) Rydb. and *C. longispica* A. Nels.

1. Herbage tomentose to arachnoid-lanate with woolly appressed hairs ..... *C. arachnoidea* Greenm., *C. nivea* Pennell and Ownbey and *C. lincata* Greene

SEPTENTRIONALES

Castilleja revealii and *C. aquariensis* form an alliance within the Septentrionales group with *C. parvula* Rydb. and *C. occidentalis* Torr. *Castilleja revealii* of the Paunsaugunt Plateau, *C. aquariensis* of the Aquarius Plateau and *C. parvula* of the Tushar Plateau (Fig. 6) are perched high on the upper elevations isolated from each other by low intervening valleys. These three species are 64 to 80 km apart; the nearest known station for the Rocky Mountain species, *C. occidentalis*, lies 240 km to the east in the La Sal Mountains (Fig. 6). The orogenic activities that formed the present barriers occurred in the Pliocene, allowing sufficient time for species differentiation to have occurred.

The third new species in the Septentrionales group, *C. kaibabensis*, is also an isolate on the Kaibab Plateau (Fig. 6), but it appears to be more closely related to *C. miniata* than to any of the four species of the "occidentalis" alliance. *Castilleja sulphurea* Rydb., *C. mogollonica* Pennell and *C. rhexifolia* Rydb. are included in the following key, because they seem to bridge the morphological gap between the "occidentalis" alliance and the *C. miniata–kaibabensis* alliance and are in the geographic vicinity. *Castilleja mogollonica* is endemic to the White Mountains of southern Apache County, Arizona (Fig. 6) and appears to be closely related to *C. sulphurea*. *Castilleja parvula*, *C. revealii*, *C. aquariensis*, *C. kaibabensis* and *C. mogollonica* are endemics in the Colorado Plateau region, an area well known for its high degree of endemism (Holmgren 1972, pp. 99–109).

The following key to the pertinent members of the Septentrionales group is provided to distinguish the three new species from their close relatives:

1. Bracts broadly lanceolate to ovate, entire or with 1 or 2 pairs of small lateral lobes inserted near the apex (rarely deeply divided).
   2. Plants dwarf, 0.8–1.5 (–2) dm tall.
      3. Bracts yellowish, often with brownish or purplish coloring basally (rarely reddish); stems usually numerous, clustered; alpine slopes in the La Sal Mountains of Utah, the Southern Rocky Mountains of Colorado and recurrent in the Northern Rocky Mountains in the vicinity of Glacier National Park, Montana and adjacent Alberta ..... *C. occidentalis* Torr.
      3. Bracts crimson to magenta, never yellowish.
         4. Stems 1 or 2, rarely 3 or more to a plant; calyx 16.5–27 mm long, the segments (1.5–)3–8 mm long; bare gravelly soil in a ponderosa pine woodland at 2400 m elevation, Bryce Canyon National Park, Garfield County, Utah ..... *C. revealii* N. Holmgren
         4. Stems numerous, clustered; calyx short, 12–15 (–18) mm long, the short segments 1–4 (–3) mm long; grassy alpine meadows of the Tushar Plateau, Piute County, Utah ..... *C. parvula* Rydb.
   2. Plants taller, (1.1–) 1.5–5 (–8) dm tall.
      5. Bracts yellow, sometimes with a purplish-brown tinge below or a reddish tinge above (in *C. mogollonica*).
         6. Calyx 13–17 mm long; grassy meadows from 2740 to 2900 m elevation in the White Mountains of southern Apache County, Arizona ..... *C. mogollonica* Pennell
         6. Calyx (15–) 18–22 mm long.
            7. Stems 1 to few to a cluster, 1.4–2.4 (–3) dm tall; leaves linear, appressed-ascending; corolla 17–20 (–27) mm long; subalpine sagebrush meadows on the Aquarius Plateau, Garfield County, Utah ..... *C. aquariensis* N. Holmgren
            7. Stems few to several to a cluster, (2–) 2.5–4 dm tall; leaves linear-lanceolate, ascending; corolla 20–30 mm long; meadows and slopes of higher elevations in the Rocky Mountains from southern Alberta, western Montana and adjacent Idaho south through Wyoming to Colorado and northern New Mexico, and also in the Black Hills of South Dakota and in the Uinta and Wasatch mountains and Wasatch Plateau of Utah ..... *C. sulphurea* Rydb.

5. Bracts crimson to purple, never yell... subalpine forests and meadows in the Rocky M... tains fro... Alberta and British Columbia, south through western Montana, Idaho, Wyoming, Colorado and northern New Mexico, and also in northeastern Oregon and in Utah in the Uinta, Wasatch and Oquirrh mountains and in the Wasatch Plateau ..... *C. rhexifolia* Rydb.

1. Bracts lanceolate to narrow-lanceolate, mostly deeply divided, the lateral lobes usually inserted near the middle (rarely entire).
   8. Galea 8–14 mm long; corolla 22–30 (–33) mm long; 1.5–3 (–4) dm tall; subalpine meadows on the Kaibab Plateau, Coconino County, Arizona ..... *C. kaibabensis* N. Holmgr.
   8. Galea (11–) 15–20 mm long; corolla (25–) 30–42 mm long; plants more than 2 dm tall; widespread in moist and often shaded situations in the mountains of western North America from southern Alaska, British Columbia and Alberta, south through all the mountain and Pacific states to northern New Mexico, northern Arizona and southern California ..... *C. miniata* Dougl. ex Hook.

Castilleja **revealii** N. Holmgren, sp. nov. Fig. 2

Foliis plerumque integris, calyce dorso ac ventre quam de latere profundius fisso, sinuque abaxiali quam adaxialem paullo profundius recesso turma Septentrionalibus pertinens; juxta *C. occidentalem* Torr. et quoad galeam brevem similis sed bracteis vermesino-magenteis (nec luteis vel lutescenti-brunneis), calycis lobis primariis plerioribus [8–] 10–15 [–18] (nec 6.5–10) mm longis, segmentisque suis longioribus [5–] 3–6 [–8] (nec 1.5–3 [–4]) mm longis abhorrens.

Perennial; caudex soft-woody, becoming elongate with age, surmounting a cluster of roots; stems usually single, sometimes 2, rarely 3 or more, unbranched, ascending or erect, 0.8–1.5 (–2) dm tall, often anthocyanous-purple, glabrous below, becoming villose in the inflorescence with long viscid hairs and short gland-tipped hairs; leaves 2–3.5 (–4.5) cm long, entire, except rarely the uppermost that may have a pair of small lateral lobes departing just below the apex, small and scale-like at the ground level, linear to linear-lanceolate above, mostly glabrous, except sometimes the uppermost becoming puberulent beneath (abaxially) and glandular puberulent above (adaxially); inflorescence magenta to rose; bracts broadly-lanceolate to ovate, obtuse to rounded, with 1 or 2 pair narrow lateral lobes near the apex, glandular puberulent; calyx 16.5–22 (–27) mm long, glandular-hispid, the coloration on all but the green or greenish-purple base of the tube, the primary lobes (8–) 10–15 (–18) mm long, slightly more deeply cleft abaxially than adaxially, the segments (1.5–) 3–6 (–8) mm long, narrow-lanceolate to elliptic, acute to sometimes obtuse; corolla 19–25 (–27.5) mm long, the galea 7–11 (–11.5) mm long, green and minutely glandular-puberulent on the back, glabrous and magenta to rose on the margins, the teeth of the reduced lower lip 0.6–1.4 mm long, usually somewhat incurved, the tube 12–16 mm long; anthers remaining included within the galea after anthesis, the upper pair 2–2.8 mm long and the lower 1.7–2.2 (–2.4) mm long; stigma 0.25–0.5 mm thick; capsule about 1 cm long, the seeds 2–3 mm long; $n = 12$.

TYPE: Utah, Garfield County, Paunsaugunt Plateau, Bryce Canyon National Park, along road to Bryce Point, 0.8 km from Inspiration Point turnoff, T.37 S., R.4 W., Sec. 1, elevation 2500 m, 24 June 1965, *Holmgren & Reveal 2017*. $n = 12$ (Holotype: NY; Isotypes: ARIZ, BRY, C, DAO, JEPS, KANU, NCU, RSA, TENN, US, UTC, WTU).

PARATYPE: Utah, Bryce Canyon, 13 June 1931, *Weight B-31/46* (US).

HABITAT AND DISTRIBUTION: Limestone gravelly soil in a ponderosa pine woodland at 2500 m elevation on the Paunsaugunt Plateau (Fig. 6).

I name this species for James L. Reveal, who first noticed this lovely paintbrush as we were driving away from Inspiration Point of Bryce Canyon National Park. His enthusiastic appreciation for this find had much to do with the fact that there are 35 isotypes.

Castilleja aquariensis N. Holmgren, sp. nov. Fig. 3

Foliis plerumque integris, calyce dorso ac ventre quam de latere profundius fisso, sinuque abaxiali quam adaxialem paullo profundius recesso turma Septentrionalibus pertinens; juxta *C. occidentalem* Torr. quoad galeam brevem similis sed caulibus paucis vel solitariis (nec ex multoribus) elatioribus 1.1–2.1 [–3] dm altis, foliorum [illegible]

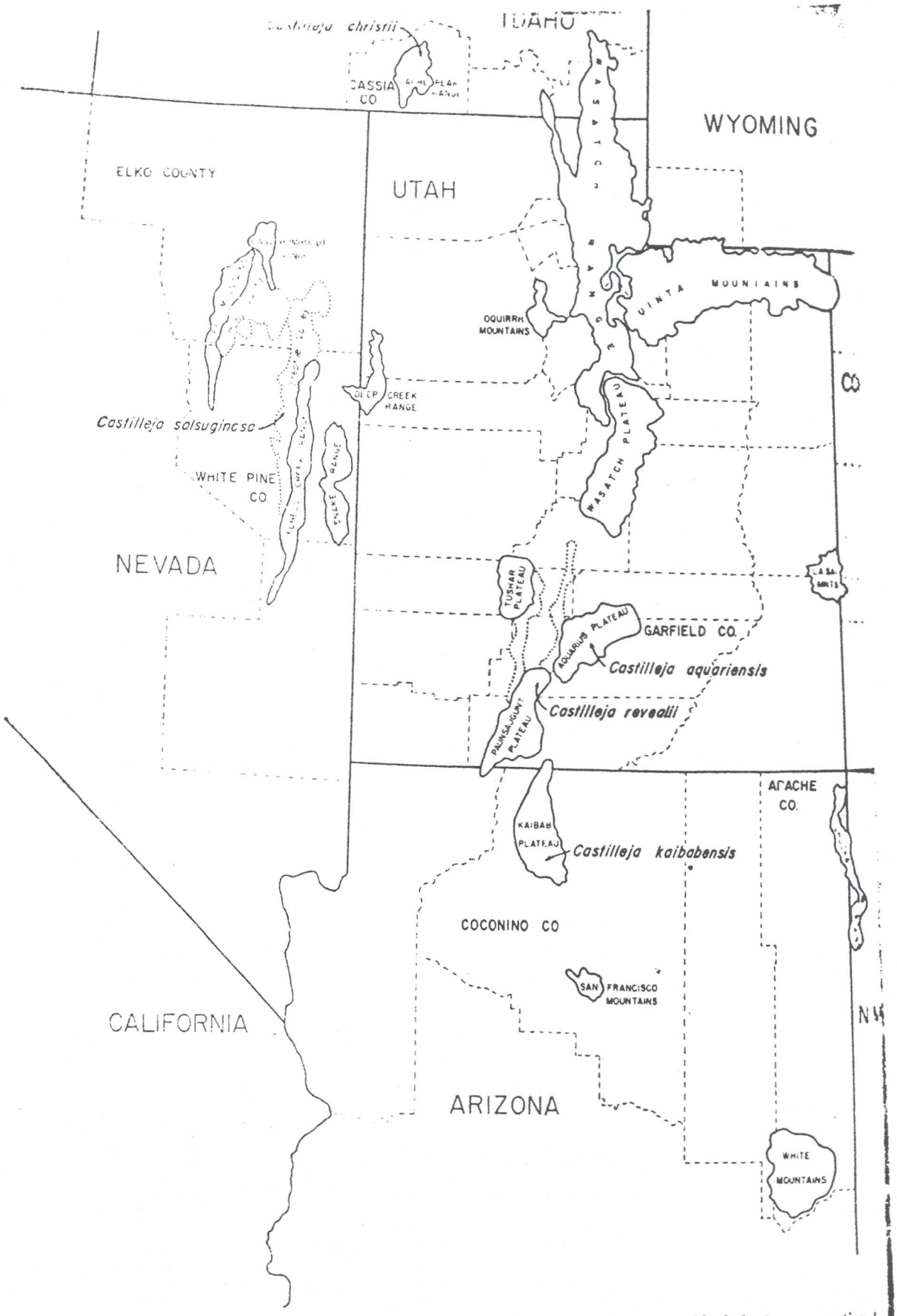


Fig. 6. Map showing type locations of the five new species and topographical features mentioned in the discussions.

probably has collected more plants in Idaho than any other botanist.

This southern Idaho endemic is most closely related to *Castilleja hispida* Benth., a species that has traditionally been aligned with *C. chromosa* A. Nels. and with *C. angustifolia* (Nutt.) G. Don. Rydberg (1918) called the group the Hispidae; Pennell (1951) called it the Chromosae; and Ownbey (1959) considered it a part of a large assemblage called the Parviflorae group. To me *Castilleja hispida* and *C. christii* appear to be more closely related to the Septentrionales group than to *C. chromosa* and *C. angustifolia*.

Castilleja christii and *C. hispida* are allopatric, separated by a distance of about 240 km. These two taxa may be distinguished by the following key characters:

1. Inflorescence yellow to yellow-orange; calyx relatively short, 17–22 (–27) mm long; galea 8–10 (–12) mm long; plants 1.2–2.5 (–3) dm tall; subalpine meadow on top of Cache Peak Range, Cassia County Idaho ..... *C. christii* N. Holmgr.

1. Inflorescence usually red, rarely yellow or yellow-orange; calyx (19–) 22–27 mm long; galea (8–) 10–17 mm long; plants 2.2–5 dm tall; foothills in the Coast Ranges of Oregon, Washington and southern British Columbia, extending inland to northeastern Oregon, the Rocky Mountains of Idaho, western Montana and southwestern Alberta ..... *C. hispida* Benth.

The Cache Peak Range is situated on the north end of the Bonneville Basin section (see Holmgren 1972, pp. 95–97) overlooking the Snake River Plains. I have searched in vain for this Harrison Mountain endemic in the neighboring mountain ranges as well as on other peaks in the same range. It is interesting that *C. christii* is most closely related to a Pacific Northwest species, because the Cache Peak Range harbors a disjunct species of lousewort, *Pedicularis contorta* Benth., that also has its distribution throughout the mountains of the Pacific Northwest.

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UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

SPECIES: CASTILLEJA REVEALII N. HOLMGREN SYNONYM(S): _____

FAMILY: SCROPHULARIACEAE STATE: UTAH

EL CODE: _____ HERBARIUM: BRYCE CANYON N.P.

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
CHAS. SCHELZ RECORDER 1.13.90	GARFIELD	R. GRAYBOSH / 792	209	DATE: 6.18.80 / T R S .5 mi EAST SUNSET POINT. STONEY WASH. TRIBUTARY TO BRYCE WASH. WASATCH FORMATION ASSOC: POTENTILLA EQUISETOSA, PONDEROSA PINE ELEV. 7300	
1.13.90 CHAS SCHELZ	GARFIELD	R. GRAYBOSH / 1343	209	DATE: 6.26.81 / T R S .5 KM. EAST OF SUNRISE PT. WASATCH FORMATION. IN WASH DISSECTING BRISTLECONE PINE COMMUNITY ASSOC: PINUS FLEXILIS, P. PONDEROSA, JUNIPERUS SCOPULORUM HAPLOPAPPUS ARMERIOIDES ELEV: 7675 FT.	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	

FIELD SURVEY REPORT OF SENSITIVE PLANT

ESCALANTE RD, DIXIE NF

JUN 22 1990

SURVEYED BY: Andrew Peters, FS Volunteer DATE: 6-13-90

SPECIES: *CASTILLEJA PARVULA VAR. REVEALII* COMMON NAME:

LOCATION: *T35S, R2½W, S 36 PROBABLY* QUADRANGLE: *TROPIC CANYON (MAP NOT AVAILABLE)*

AREA ON FS MAP KNOWN AS: *HENDERSON RIM (HENDERSON POINT)*

HABITAT - -

PLANT COMMUNITY: *KNIGHTSCHOOL, TIMBER*

SOIL: *CLAY GRAVEL*

GEOLOGY: *WHITE WASATCH LIMESTONE*

EXPOSURE/SLOPE: *S-SW-W STEEP*

ELEVATION: *EST. 8,000*

OTHER NOTES: *PLANTS IN UPPER SLOPE AND RIDGE TOP. ABUNDANT POPULATION MINIMUM IN AREA.*

LOCATION NOTE:
FROM RT. 22, ROAD APPROX FOLLOWS POWER LINE TO HENDERSON RIM PLANTATION. ROAD THEN CLIMBS THRU PLANTATION TOWARD TOP OF HENDERSON POINT. PART WAY UP, A CREST OF WHITE AND PINK WASATCH RUNS APPROX NE FROM HENDERSON POINT. VISIBLE ARE 3 FINGER RIDGES RUNNING NW FROM CREST. SURVEY AREA IS MIDDLE FINGER RIDGE.

PLANT DETAILS - -

TYPICAL HEIGHT: *6 cm* FLOWERING ?: *YES*

~~EXACT~~ FLOWER PETAL LENGTH: *12 cm, RANGE 7 mm* COLOR: *PINK TO MAGENTA*

LEAVES LENGTH: *16 mm* COLOR: *BROWN-GREEN TO GREEN*

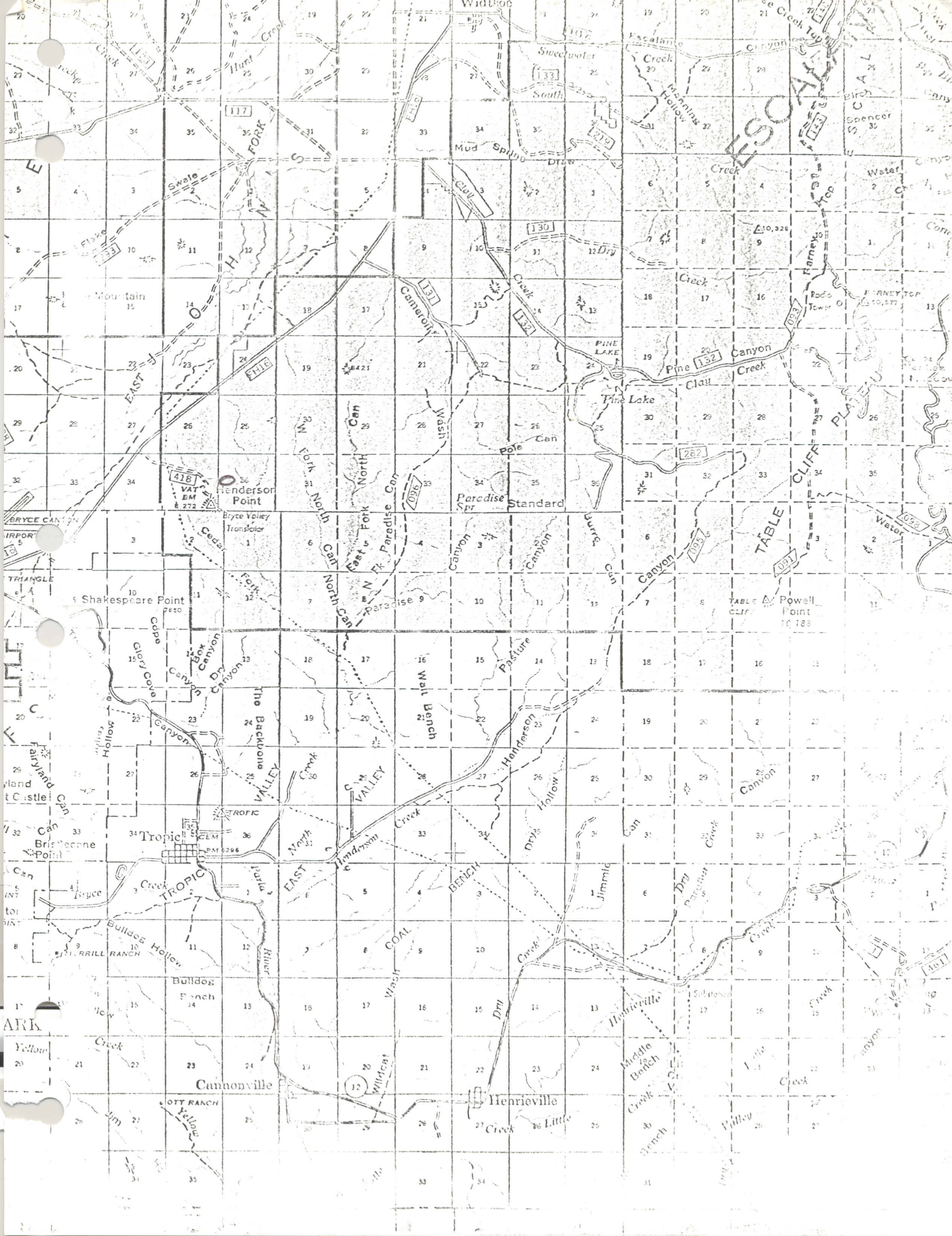
STEM LENGTH: *3 cm BASE TO BRACTS*

NUMBER OF PLANTS: *OVER 100*

OTHER NOTES: *PLANTS HAVE 1-3 STEMS. INFLORESCENCE CROWDED.*

THREATS/DISTURBANCE: *NONE*

OTHER COMMENTS: *LOCATION NOT IN FS RECORDS.*


Widtsoe
Escalante Canyon
Sweetwater Creek
Mud Spring Draw
Manning Hollow
Spencer Canyon
Birch Creek
Hurt Creek
Swale
Flake
Mountain
EAST FORK SEVIER
Clay
Dry Creek
Cameron
Pine Lake
Pine Canyon
Clay Creek
Barney Top
Radio Tower
Pine Lake
Wash
Pole Can
North Fork North Can
East Fk. Paradise Can
Paradise Spr.
Standard
Henderson Point
Bryce Valley Translator
BRYCE CANYON AIRPORT
TRIANGLE
Cedar Fork
North Can
Canyon
Burro Canyon
TABLE CLIFF PLATEAU
Water
Shakespeare Point
Powell Point
Cope
Glory Cove
Box Canyon
Dry Canyon
Pasture
Wall Bench
Fairyland Canyon
Hollow
The Backbone
VALLEY
Creek
Henderson
Tropic
CEM
Bryce Point
Bryce Creek
TROPIC
EAST
BENCH
Jimmie
Dry
Bulldog Hollow
Bulldog Ranch
COAL
Wash
Henrieville
Middle Bench
Cannonville
Yellow Creek
Little
Valley

FIELD SURVEY REPORT OF SENSITIVE PLANT

ESCALANTE RD, DIXIE NF

SURVEYED BY: Andrew Peters, FS Volunteer DATE: 6-13-90

SPECIES: *CASTILLEJA PARVULA VAR. REVEALII* COMMON NAME:

LOCATION: *T34S, R2W, S26* QUADRANGLE: *SWEETWATER CREEK*

AREA ON FS MAP KNOWN AS: *SOUTH CREEK*

HABITAT - -

PLANT COMMUNITY: *LIMBER, BRISTLECONE*

SOIL: *GRAVEL WITH ROCK*

GEOLOGY: *WHITE WASATCH LIMESTONE*

EXPOSURE & SLOPE: *SW-W-NW* *STEEP*

ELEVATION: *7,900 - 8,080*

OTHER NOTES: *ABUNDANT CASTILLEJA MINIMUM IN AREA.*

PLANT DETAILS - -

TYPICAL HEIGHT: *8 cm* FLOWERING ?: *YES*

~~FLOWER-PETAL~~ BRACT LENGTH: *15 mm, WIDTH 8 mm* COLOR: *PINK TO MAGENTA*

LEAVES LENGTH: *18 mm* COLOR: *GREEN TO BROWN-BLACK EARTH*

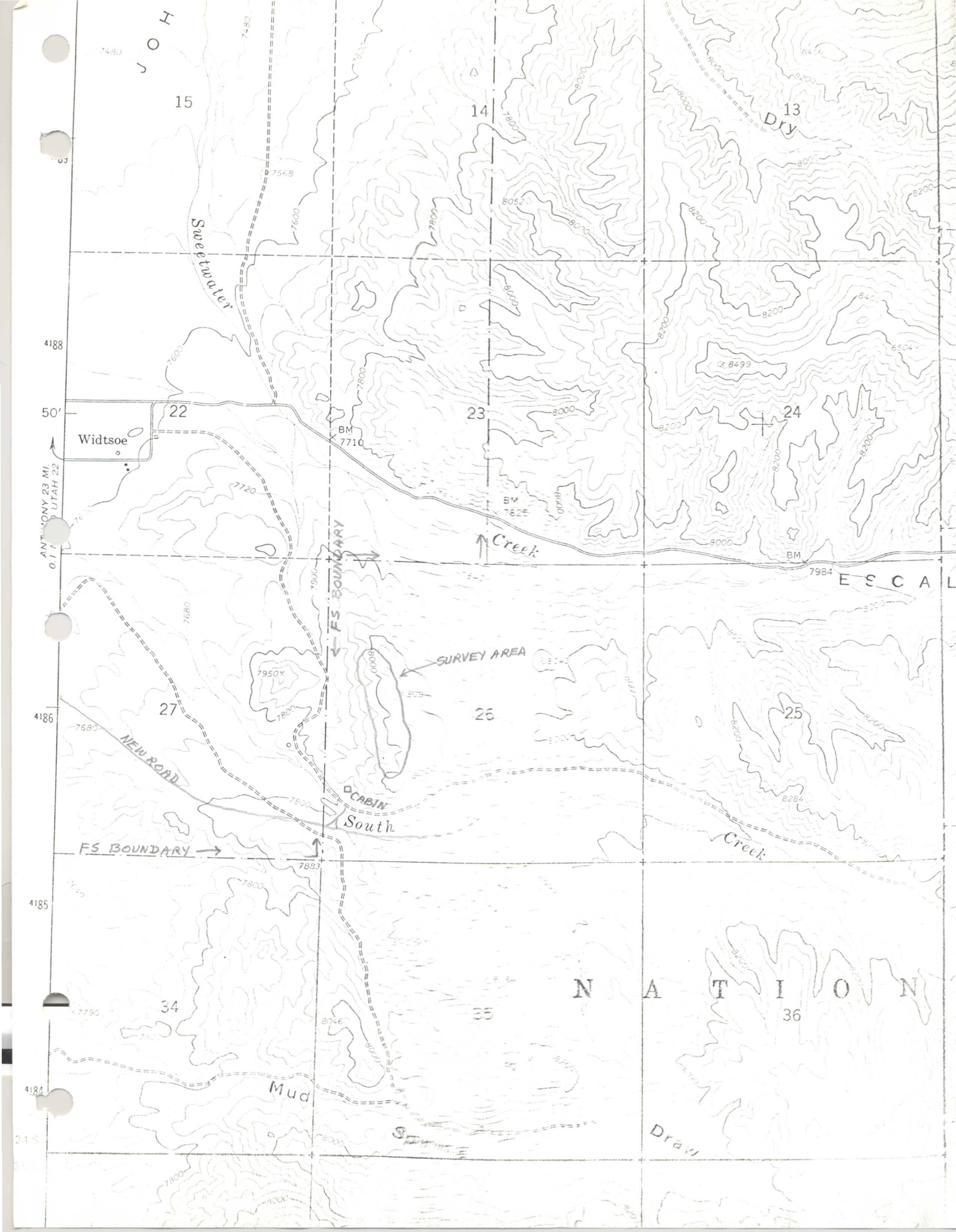
STEM LENGTH: *3 cm BASE TO BRACTS*

NUMBER OF PLANTS: *82*

OTHER NOTES: *PLANTS HAVE 1 STEM, SOME 2 OR 3 STEMS. INFLORESCENSE CROWDED.*

THREATS/DISTURBANCE: *NONE*

OTHER COMMENTS: *PHOTO TAKEN. LOCATION NOT IN FS RECORDS.*


15
14
13
Dry
Sweetwater
4188
50'
22
23
24
Widtsoe
BM
7710
BM
7825
Creek
BM
7984
ESCAL
ANTIMONY 23 MI.
0.1 MI. UTAH 22
FS BOUNDARY
SURVEY AREA
27
26
25
4186
NEW ROAD
CABIN
South
Creek
FS BOUNDARY
7883
4185
N A T I O N
34
35
36
4184
Mud
Draw

Cryptantha ochroleuca



SCIENTIFIC NAME: Cryptantha ochroleuca Higgins

FAMILY: Boraginaceae

CITATION: Great Basin Naturalist 28: 197. 1968.

SYNONYMS: None

STATUS: Reviewed as endangered, Federal Register, 1 July 1975. Proposed as endangered, Federal Register, 16 June 1976. Recommended as endangered by S. L. Welsh, 1978.

COMMON NAME: Yellow-white catseye

KNOWN DISTRIBUTION: Garfield Co., Utah

HABITAT: Pink Limestone Member of the Wasatch Formation, rocky outcrops; scattered ponderosa, bristle cone pine community

ELEVATION: 6500 to 8000 feet (1983 to 2440 m)

DESCRIPTION: Low growing perennial to 1 dm tall; stems several, strigose; leaves linear-oblanceolate to oblanceolate, apices usually acute, 1-2.5 cm long, 0.1-0.3 cm wide, densely strigose; petiole white-hairy; inflorescence narrow; calyx segments linear-lanceolate, setose; flowers pale yellow, tube 2-2.5 mm long, limb 4-5 mm wide; style included; nutlets 2.5-3 mm long, usually only one maturing, rugose.

TAXONOMIC PROBLEMS: C. ochroleuca is related to C. nana and C. caespitosa but differs from the former by its shorter calyx, pale yellow flowers and rugose seed, and from the later by its less caespitose habit and woody taproot.

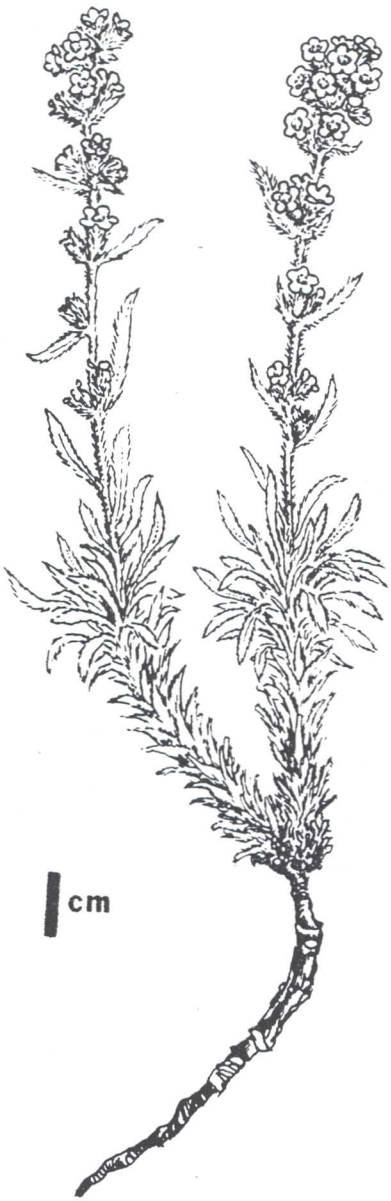
EXISTING OR POTENTIAL THREATS: Changes in the land use and limestone exploitation are potential threats to this species.

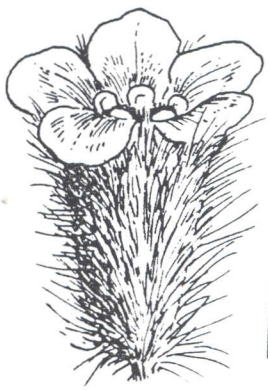
LAND OWNERSHIP/MANAGEMENT: National Park Service

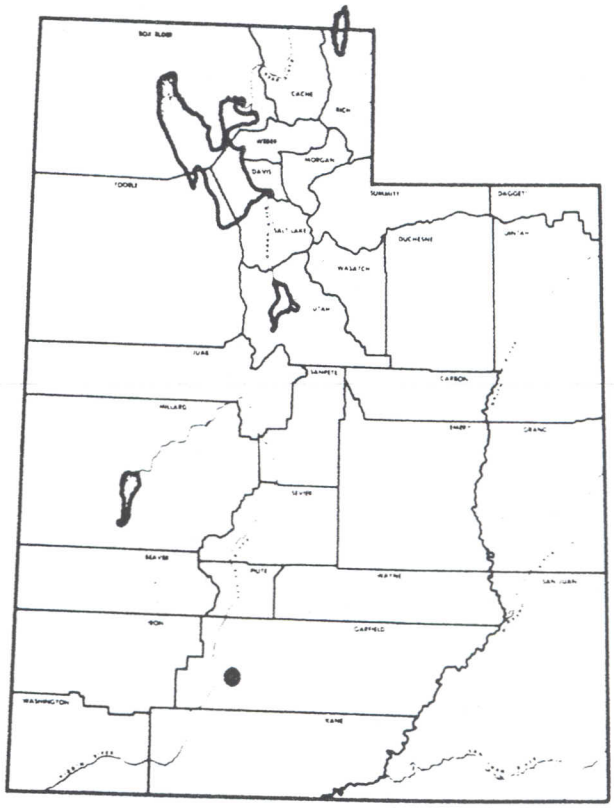
REMARKS: This local species is apparently confined to the Pink Limestone Member of the Wasatch Formation.

RECOMMENDATIONS: Portions of the Pink Limestone Member of the Wasatch Formation should be preserved as a natural area.

Cryptantha ochroleuca







SCIENTIFIC NAME: Cryptantha ochroleuca Higgins

FAMILY: Boraginaceae

CITATION: Great Basin Naturalist 28: 197. 1968.

SYNONYMS: None

STATUS: Reviewed as endangered, Federal Register, 1 July 1975. Proposed as endangered, Federal Register, 16 June 1976. Recommended as endangered by S. L. Welsh, 1978.

COMMON NAME: Yellow-white catseye

KNOWN DISTRIBUTION: Garfield Co., Utah

HABITAT: Pink Limestone Member of the Wasatch Formation, rocky outcrops; scattered ponderosa, bristle cone pine community

ELEVATION: 6500 to 8000 feet (1983 to 2440 m)

DESCRIPTION: Low growing perennial to 1 dm tall; stems several, strigose; leaves linear-oblanceolate to oblanceolate, apices usually acute, 1-2.5 cm long, 0.1-0.3 cm wide, densely strigose; petiole white-hairy; inflorescence narrow; calyx segments linear-lanceolate, setose; flowers pale yellow, tube 2-2.5 mm long, limb 4-5 mm wide; style included; nutlets 2.5-3 mm long, usually only one maturing, rugose.

TAXONOMIC PROBLEMS: C. ochroleuca is related to C. nana and C. caespitosa but differs from the former by its shorter calyx, pale yellow flowers and rugose seed, and from the later by its less caespitose habit and woody taproot.

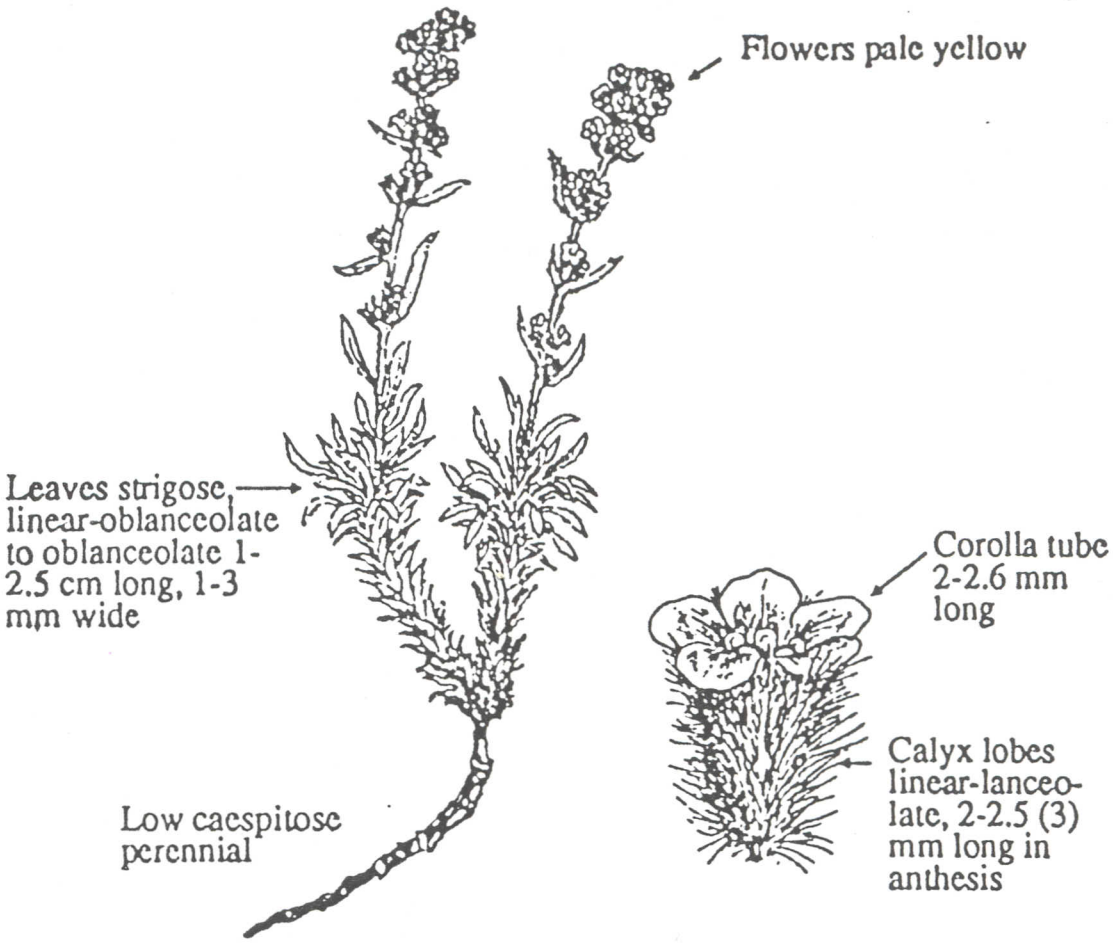
EXISTING OR POTENTIAL THREATS: Changes in the land use and limestone exploitation are potential threats to this species.

LAND OWNERSHIP/MANAGEMENT: National Park Service

REMARKS: This local species is apparently confined to the Pink Limestone Member of the Wasatch Formation.

RECOMMENDATIONS: Portions of the Pink Limestone Member of the Wasatch Formation should be preserved as a natural area.

Cryptantha ochroleuca **Higgins** Yellowish Cryptanth. Low caespitose perennial, 2–13 cm tall; stems several, 1–4 cm long, strigose and weakly setose; leaves linear-oblanceolate to oblanceolate, the apices acute or sometimes obtuse, 1–2.5 cm long, 1–3 mm wide; basal leaves cm long, setose with spreading hairs; leaves oblanceolate to spatulate, obtuse, 2.5–10 (15) cm long, 0.5–2 cm wide, the dorsal surface strigose and weakly appressed to spreading setose, pustulate, the ventral silky-strigose, lacking pustules or these very inconspicuous; inflorescence narrow to somewhat open, 5–32 cm long, setose-hispid, foliar bracts 2–5 cm long; calyx segments lanceolate, 2.5–4 mm long in anthesis, in fruit becoming 6–8 mm long; pedicels 0.5–1 mm long; corolla white, the tube 2.5–3.5 mm long, the crests at base of tube conspicuous; fornices yellow, broad, depressed, 0.5–0.6 mm long; limb 7–9 mm wide; nutlets lanceolate, 2.5–3.5 mm long, 1.5–2 mm wide, usually all 4 maturing, the margins acute or narrowly winged, in contact, dorsal surface with low rounded tuberculations, also somewhat rugulose and muriculate, the ventral similar but the markings less evident; scar straight, closed and without an elevated margin; style exceeding mature fruit 0.5–1.3 mm. Salt desert shrub, sagebrush, pinyon-juniper, mountain brush, aspen, and spruce-fir communities at 1700 to 2950 m in Carbon, Daggett, Duchesne, Grand, Rich, Summit, and Uintah counties; Wyoming and Colorado; 125 (x).



CRYPTANTHA OCHROLEUCA

Scientific Name: *Cryptantha ochroleuca* Higgins
Common Name: Yellow-white cryptanth
Family (Common Name): Boraginaceae (Borage Family)
Synonyms: None
Global and State Rank: G1G2/S1S2
Federal Review Status: C2
Global Distribution: South-central Utah
State Distribution: Garfield County
Ownership: USDA FS and NPS
National Forest: Dixie
Habitat: Pinyon-juniper, ponderosa pine, and bristlecone pine communities on the Pink Limestone member of the Wasatch Formation between 7,500 to 9,350 feet elevation. May to June.

STATUS REPORT

Cryptantha ochroleuca

I. Nomenclature

A. Family name: Boraginaceae

Synonyms: None

Common name: Borage family

B. Species name: Cryptantha ochroleuca Higgins

Citation: Great Basin Naturalist 28: 197. 1968.

Synonyms: None

Common name: Red Canyon catseye

II. Legal Status

A. Federal: Reviewed as endangered, Federal Register, 1 July 1975.
Proposed as endangered, Federal Register, 16 June 1976.

B. State: None

C. Other: Recommended as endangered by S. L. Welsh, 1978.

III. Description

A. Field identification features: Perennial plant; several stems; leaves linear-oblanceolate to oblanceolate, small, many basal leaves; inflorescence narrow; corolla pale-yellow.

B. Brief description: Low caespitose perennial plant; stems several, strigose and weakly setose; leaves linear-oblanceolate to oblanceolate, 1-2.5 cm long, 0.1-0.3 cm wide; basal leaves densely strigose, petiole white-hairy, cauline leaves strigose and with some setose-pustulate bristles; inflorescence narrow, weakly setose; calyx segments linear-lanceolate; corolla pale-yellow;

nutlets lanceolate, usually only one maturing, surface irregularly rugose (Higgins, 1968).

C. Closely related species: C. caespitosa (A. Nels.) Payson; C. humilis (Gray) Payson

IV. Geographical Distribution

A. Past: Unknown

B. Present: Limited to the red Wasatch Formation near Red Canyon campground in southwestern Garfield County, Utah.

C. Potential: Unknown

V. Taxonomic Problems

This plant is distinquished from C. caespitosa by its less caespitose habit, the slender, less-woody taproot, shorter calyx segments, shorter, pale yellow not white corolla, and smaller nutlets, which are more rugose. It is also distinguished from C. humilis by the shorter calyx segments, pale yellow corolla, and rugose nutlets.

VI. Habitat Description

A. Plant community: Pinus longaeva and ponderosa pine community

B. Dominant plants: Pinus longaeva; Pinus edulis; Juniperus scopulorum; Juniperus osteosperma; Pinus ponderosa

C. Elevational ranges: 6500 to 7000 feet (1983 to 2135 m)

D. Exposure and slope: Variable

E. Edaphic features: Grows in angular limestone gravel

F. Geology: Pink Member of the Wasatch Formation

G. Other habitat features: None

VII. Population Biology

A. Number of populations (est.): Four

B. Number of individuals/population (est.): About 100

C. Reproduction methods: Unknown

D. Age classes: Seedlings to mature

E. Time of flowering and fruiting: Flowering May to August

F. Dispersal mechanisms: Unknown

G. Pollinators, if any: Unknown

H. Other biological factors: Unknown

I. Current population dynamics; trends and status: Unknown

VIII. Critical Habitat Recommendations

A. Geographic boundaries: Pink Limestone Member of the Wasatch Formation, T35S, R4 1/2W, Sec. 25 and 26, in southwestern Garfield County, Utah.

B. Physical attributes: Pink to varied colored angular limestone gravel in sparse vegetation dominated by forest species.

IX. Threats to Survival

A. Nature of existing threats to survival:

1. Threatened destruction, modification, or curtailment of habitat or range, if any: The area is traversed by a main highway and Sec. 26 contains a picnic ground. There is considerable off-road vehicle and camping use of the area.

2. Over utilization for commercial, sporting, scientific, or educational purposes, if any: Unknown

3. Disease, predation, grazing, or trampling, if any: Trampling seems to represent an existing threat

4. Inadequacy of existing regulatory mechanisms, if any: None

5. Other natural or man-made factors reflecting continued existence, if any: None

B. Potential threats in the foreseeable future, as in IX-A: Industrial development, including expansion of a highway and development of a railroad in the Kaiparowits region pose a potential threat to this species. Increased use of the campground is also a threat.

X. Land Management or Ownership

U. S. Forest Service

XI. Management Implications

A. Suggest management actions which might best maintain the plant species: All future developments should take into account the presence of Cryptantha ochroleuca in the area, and no development should be allowed within Sec. 25 and 26 except in those areas demonstrated to be free of this species.

B. Suggest suitable alternatives for recovery: Unknown

XII. Cultivation Potential

A. Present or potential cultivation potential: Unknown

B. Currently cultivated populations, if any, their location and condition: None

XIII. Potential Value

Aesthetic, ecological, economical, educational, evolutionary, medicinal, ornamental, recreational, and scientific value, as appropriate: This low plant is one of the few species which tends to protect the surface of the Pink Limestone Formation in this area. It is therefore valuable as an erosion control plant even though it covers very little surface area. This micro-species has developed on a peculiar habitat remotely removed from its nearest relatives. The methods of dispersal and nature of evolutionary processes can be investigated by the use of this species and others like it.

XIV. Specialist

Name: Larry C. Higgins

Address: West Texas State University
Canyon, Texas 79015

XV. References

1. Higgins, L. C. 1968. New species of perennial Cryptantha from Utah. Great Basin Naturalist 28: 197-198.

2. Welsh, S. L. 1978. Endangered and threatened plants of Utah: a re-evaluation. Great Basin Naturalist 38: 1-18.

3. Welsh, S. L., N. D. Atwood, and J. L. Reveal. 1975. Endangered, threatened, extinct, endemic, and rare or restricted Utah vascular plants. Great Basin Naturalist 35: 327-376.

XVI. Appendices

A. Xerox copies of distribution maps, illustrations, original descriptions, floristic or monographic descriptions, magazine articles, newspaper clippings: Higgins, 1968; see attachments.

B. Herbarium label data and location of herbaria:

1. Cryptantha ochroleuca (holotype; BRY); Higgins 1788, an outcrop 100 meters S of Red Canyon Campground, Garfield County, Utah, 21 July 1968.

2. C. ochroleuca (105422, BRY); Reveal and Reveal 1031, Red Canyon, top of a ridge south of the campground, 8000 ft. elev., Garfield County, Utah, 25 May 1968.

3. C. ochroleuca (84700, BRY); Atwood 1879, rocky outcrops, 2.4 miles east of Red Canyon Campground on Hwy. 54, Garfield County, Utah, 20 June 1969.

4. C. ochroleuca (84693, BRY); Atwood 1891, 1 mile east of Red Canyon Campground, rocky outcrops, Garfield County, Utah, 20 June 1969.

5. C. ochroleuca (84694, BRY); Atwood 1890, rocky outcrop north of Red Canyon Campground, Garfield County, Utah, 20 June 1969.

C. Map of distribution and critical habitat boundaries: Wilson Peak, Utah USGS 7.5'

D. Photos or illustrations: See attachment

XVII. Author of Statement

Name: Stanley L. Welsh

Address: 129 North 1000 East
Orem, Utah 84057

Date: 1 November 1978

Reprint from Great Basin Naturalist
Volume XXVIII, December 31, 1968, No. 4

NEW SPECIES OF PERENNIAL CRYPTANTHA FROM UTAH

Larry C. Higgins[1]

utc

open, subulate to narrowly triangular, extending ⅔ the length of the nutlet, elevated margin lacking.

TYPE. Utah: Millard County, ca. 8 miles west of Desert Range Experiment Station Headquarters along hwy. 21, 100 m west of pass at the north end of Needle Range, June 18, 1968. *Larry C. Higgins 1613*. Holotype deposited at BRY. Isotypes will be distributed to CAS, GH, NY, POM, US, UTC, and other major herbaria.

DISTRIBUTION. Known only from southwestern Millard County, Utah, but to be expected from northern Beaver County, Utah, and perhaps in eastern Nevada. Flowering from May to July.

SPECIMENS EXAMINED. Utah: Millard County, north slope of Bull Grass Knoll, north end of Pine Valley, 9 miles north of Derest Range Experiment Station Headquarters, 6,500 feet, *R. C. Holmgren 521* (BRY); White Sage Valley, *Harrison 6371* (BRY); ca. 8 miles west of Desert Range Experiment Station Headquarters along hwy. 21, 100 m west of pass, *Higgins 1462* (BRY).

Cryptantha compacta is most closely related to *C. nana* (Eastw.) Payson but differs in its more compact and caespitose habit, smaller leaves, shorter calyx segments, and smaller corolla. This plant has been known for over thirty years, but has been placed with *C. nana* probably due to the immaturity of the specimens. In observing this species in the field it becomes even more apparent of its right to specific distinction due to its dense caespitose habit that more closely resembles *C. caespitosa* (A. Nels.) Payson than *C. nana*. At the type locality it is the most common plant, growing on shallow stony loam with *Sphaeralcea caespitosa* M. E. Jones, *Linum perenne* L. ssp. *lewisii* (Pursh) Hult., and *Cryptantha rugulosa* (Payson) Payson.

3. *Cryptantha ochroleuca* Higgins sp. nov.

Herba perennis humilis caespitosa, 0.2-1.3 dm alta; caules pluri, 0.1-0.4 dm longi, strigosi et setulosi; folia lineari-lanceolata vel oblanceolata, acuta vel obtusa, 1-2.5 cm longa, 0.1-0.3 cm lata, folia basiorum uniformiter et dense strigosorum, folia caulinum strigosorum et setosorum, pustulatorum; inflorescentia angusta, 0.2-0.7 dm longa, setulosa; sepala lineari-lanceolata, sub anthesi 2-2.5 (3) mm longa, sub fructibus 4-6 mm longa, setosa; corolla lutescens, tuba 2-2.5 mm longa, cristae basi tubae conspicuae, fornices flavi, rotundati, ca. 0.3 mm longi, limbus 4-5 mm latus; stylus vix excedens fructum; nuculae lanceolatae, 2.5-3 mm longae, 1.4-1.6 mm latae, vulgo non nisi unae maturescentes, margine acuto, dorso convexo, irregulariter curto ruguloso, pagina ventrali non nisi leviter aspera, sulco aperto anguste-triangulari, margine elevato destituto.

Low caespitose perennial, 0.2-1.3 dm tall; stems several, 0.1-0.4 dm long, strigose and weakly setose; leaves linear-oblanceolate to oblanceolate, the apices acute or sometimes obtuse, 1-2.5 cm long, 0.1-0.3 cm wide, basal leaves uniformly and densely strigose, sparsely setose, the petiole white-hairy, cauline leaves strigose and with some setose-pustulate bristles; inflorescence narrow, 0.2-0.7 dm long,

weakly setose; calyx segments linear-lanceolate, 2-2.5 (3) mm long in anthesis, in fruit 4-6 mm long, setose; corolla pale-yellow, the tube 2-2.5 mm long, crests at base of tube conspicuous, fornices yellow, rounded, about 0.3 mm long, limb 4-5 mm wide; style scarcely surpassing mature fruit; nutlets lanceolate, 2.5-3 mm long, 1.4-1.6 mm wide, usually only one maturing, margine acute, dorsal surface irregularly rugose with low rounded ridges, ventral surface only slightly uneven, scar open, narrowly-triangular, extending ¾ the length of nutlet, no elevated margin.

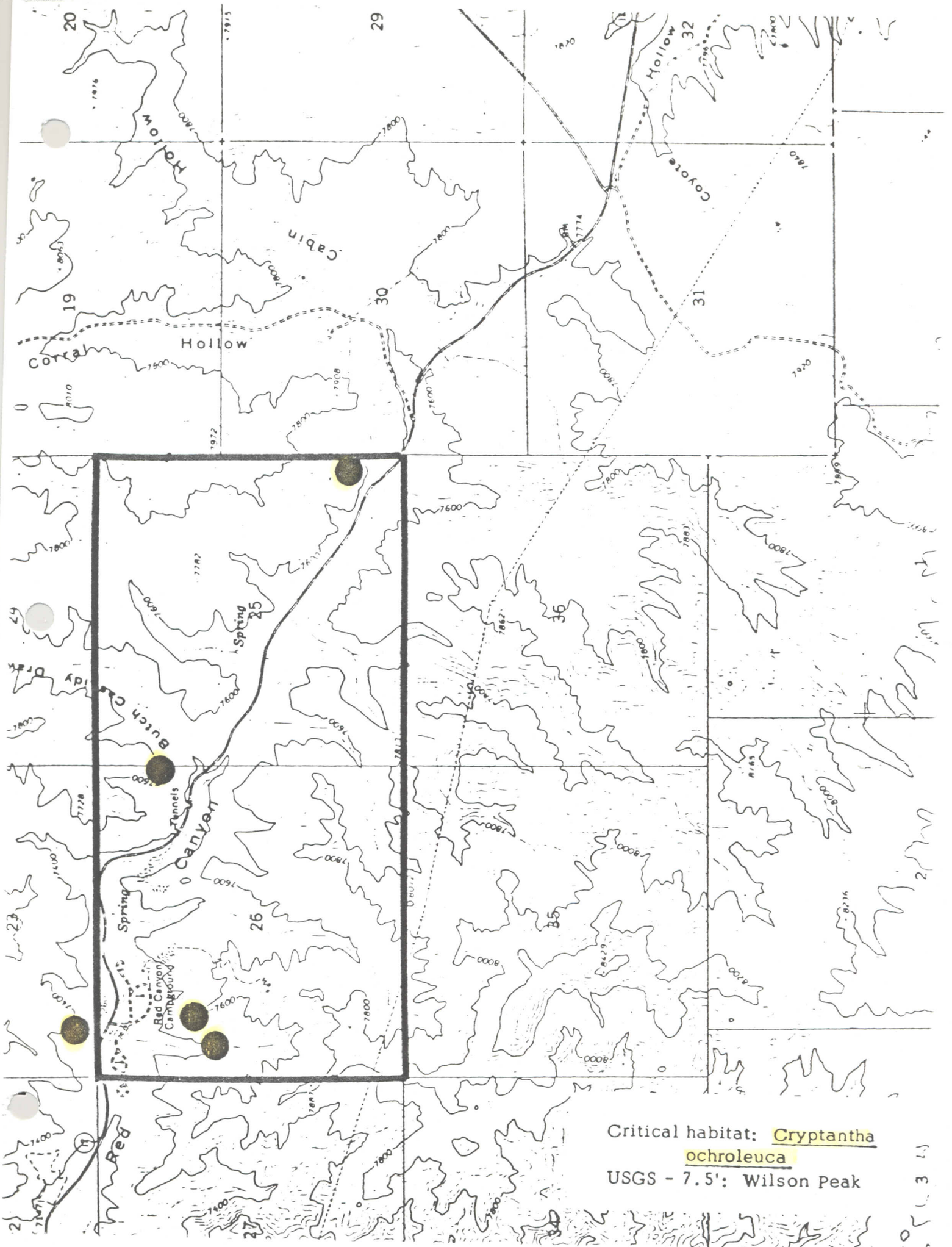
TYPE. Utah: Garfield County, on outcrop 100 m south of Red Canyon Campground along hwy. 12, 6,500 feet, July 21, 1968, *Larry C. Higgins 1788*. Holotype deposited at BRY. Isotypes will be distributed to GH, NY, US.

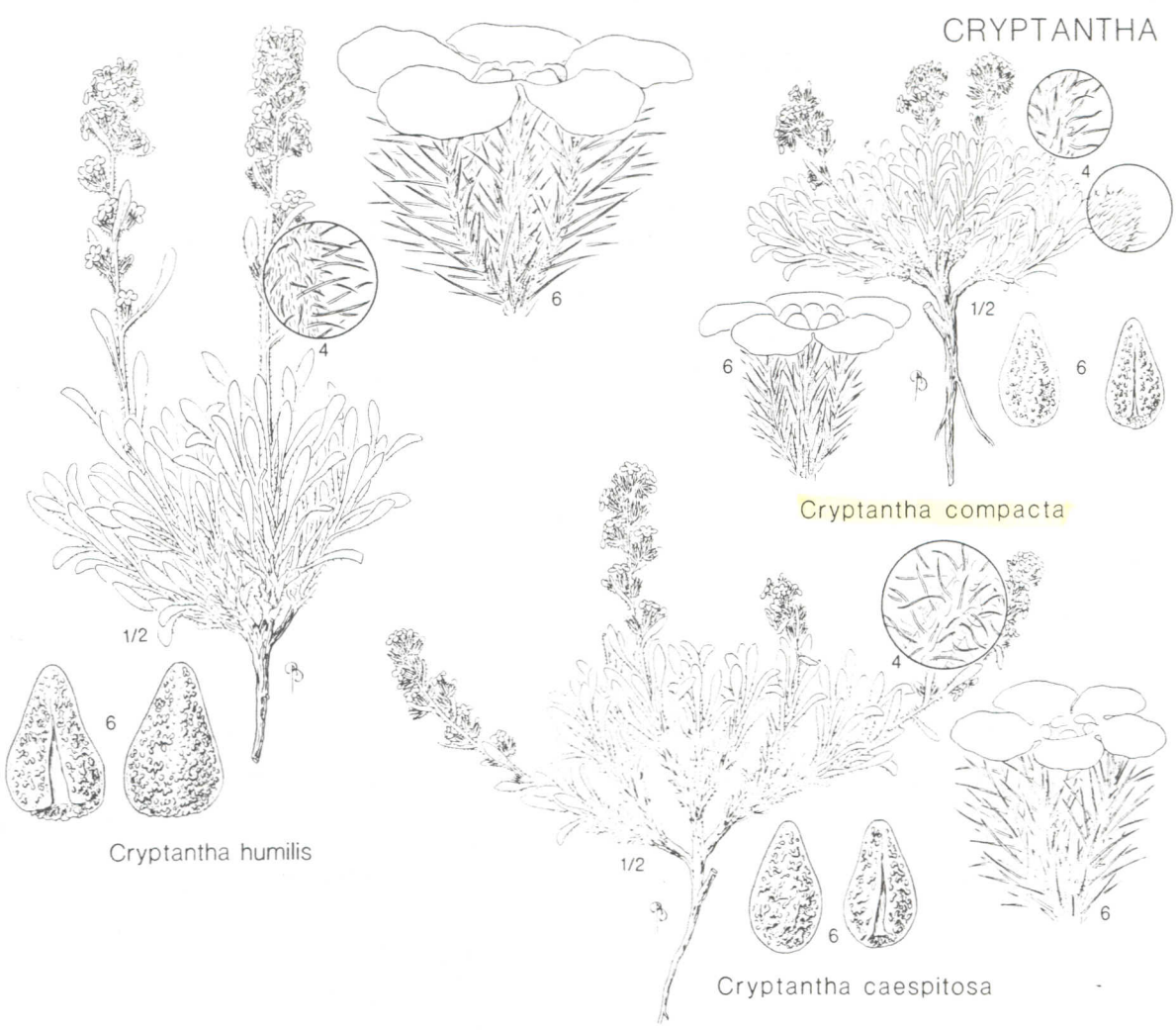
DISTRIBUTION. Limited to the red Wasatch Formation near Red Canyon Campground in southwestern Garfield County, Utah, 6,500 to 7,000 feet. Flowering from May to August.

SPECIMENS EXAMINED. Utah: Garfield County, top of ridge south of Red Canyon Campground in Red Canyon, May 25, 1968, *Reveal & Reveal 1031* (BRY).

This local species is apparently confined to the red Wasatch Formation in southwestern Garfield County, Utah.

Cryptantha ochroleuca is apparently most closely related to *C. caespitosa* of southwestern Wyoming, but also has some affinities with *C. nana*. The new species differs from *C. caespitosa* by its less caespitose habit, the slender, less woody taproot, shorter calyx segments, shorter, pale yellow instead of white corolla, and smaller nutlets which are more rugose. From *C. nana*, *C. ochroleuca* differs by the shorter calyx segments, pale yellow corolla, and the rugose nutlets.


Critical habitat: Cryptantha ochroleuca
USGS - 7.5': Wilson Peak



guish *C. caespitosa* from *C. humilis*, which is usually a little larger, with erect stems and somewhat larger flowers with a longer, more bristly calyx, and usually with a somewhat different ornamentation of the nutlets.

27. **Cryptantha compacta** Higgins

Cryptantha compacta Higgins, Great Basin Naturalist 28: 196. 1968. (*Higgins 1613*, 8 mi w. of Desert Range Experiment Station headquarters, Millard Co., Utah; isotype at NY!)
C. ochroleuca Higgins, Great Basin Naturalist 28: 197. 1968. (*Higgins 1788*, Red Canyon, Garfield Co., Utah; isotype at NY!)

Compact cryptantha.

Plants suggesting a dwarf, softly hairy, small-flowered form of *C. humilis* in aspect; pulvinate-caespitose perennial from a taproot and branching caudex, with numerous very short, apparently erect stems 2–10 (12) cm high; stem with loose to more or less spreading, soft, long and short hairs; leaves densely gray-hairy, with short, soft hairs and longer appressed bristles, those on the lower surface often inconspicuously pustulate at the base; basal leaves oblanceolate to spatulate, mostly (0.5) 1–2.5 cm long and 2–5 mm wide; inflorescence capitate to rather narrowly cylindric, often scarcely surpassing the dense cushion of basal leaves, densely gray-pubescent or white-pubescent with long, relatively soft, loosely appressed or ascending hairs, the pubescence evidently less spreading and less bristly than in *C. humilis*, and tending to be paler in aspect; flowers homostylic; calyx-segments 2–3 mm long at anthesis, elongating to 3.5–6 mm in fruit; corolla white or ochroleucous, with yellow fornices (these low and broadly rounded, ca 0.5 mm high or less), the tube about equaling the calyx, the flat, spreading limb mostly 4–6 mm wide; nutlets as in *C. humilis*, 2.5–3 mm long, varying from merely tuberculate or muricate-tuberculate to finely and densely rugose-tuberculate, usually only 1 or 2 maturing, tending to be only tardily deciduous; style about equaling the nutlets, or surpassing them by less than 0.5 mm.

In dry, open places, from the sagebrush plains to the ponderosa pine zone in the lower slopes of the mts., at elev. of mostly 1350–2300 m, variously on calcareous or sandy or gravelly soil or on barren clay, and sometimes at elev. up to 2900 m in rock-crevices; Juab, Millard, Beaver, San Pete, Sevier, and Garfield cos., Utah, and to be expected in adj. Nev. Apr–June.

It is clear that *C. compacta* forms a taxonomically significant population, but in the herbarium it is not always easy to distinguish from small forms of *C. humilis*. It remains to be seen whether there is real populational intergradation in the field.

FORM 1

UTAH

NOTICE OF SUMMARY DATA SHEET

Family Boraginaceae

Taxon Scientific Name *Cryptantha ochroleuca* Higgins

Common Name Red Canyon catseye

Status Recommended Endangered

Critical Habitat Yes

Brief Summary of Status: (Distribution and Actual or Potential Threats)

Cryptantha ochroleuca is limited to the Wasatch Formation near Red Canyon campground in southwestern Garfield County, Utah.

The species' habitat is threatened by recreation activities including both pedestrian traffic and off-road vehicle use. A main highway and campground traverse the species' critical habitat.

Reviewers: _____ Date: _____
Staff Botanist, Region 6

_____ Date: _____
Endangered Species Coordinator, Region 6

UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

SPECIES: CRYPTANTHA OCHROLEUCA SYNONYM(S): _____

FAMILY: BORAGINACEAE STATE: UTAH

EL CODE: _____ HERBARIUM: BRYCE CANYON N.P.

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
1.14.90 RECORDER CHAS SCHELZ	GARFIELD	R. GRAYBOSCH/891	209	DATE: 6.29.80 / T R S .25 mi. SOUTH OF INSPIRATION POINT IN ERODING LIMESTONE. ASSOC: LIMBER AND BRISTLECONE PINES, COMMON JUNIPER, MAHOGANY ELEV: 8200'	
1.14.90 CHAS SCHELZ		K.E. WEIGHT/B-32 210	211	DATE: 6.10.32 / T R S	
1.4.90 CHAS SCHELZ	KANE	K.E. WEIGHT/B-32 160	211	DATE: 6.16.32 / T R S PODUNK POINT	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	

SCIENTIFIC NAME: Draba subalpina Goodman and Hitchc.

FAMILY: Brassicaceae

CITATION: Ann. Missouri Bot. Gard. 19: 77. 1932.

SYNONYMS: None

STATUS: Reviewed as threatened, Federal Register, 1 July 1975.
Recommended as threatened by S. L. Welsh, 1978.

COMMON NAME: Subalpine whitlowgrass

KNOWN DISTRIBUTION: Iron, Garfield, Kane and Millard cos., Utah

HABITAT: Pink Limestone Member of the Wasatch Formation, gravel or clay loam; spruce, fir, Douglas fir or bristle cone pine woodlands

ELEVATION: 8000 to 11,315 feet (2140 to 3447 m)

DESCRIPTION: Perennial, caespitose, caudex simple or branched, with marcescent leaves, scapose; scapes to 1.2 dm tall, rarely with cauline leaf, glabrous or pubescent with simple or forked hairs, at least near the base; leaves 0.3-1.8 cm long, oblong to spatulate, surfaces glabrous or sparingly hirsute, ciliate with simple or forked hairs; racemes few to many flowered, somewhat elongated in fruit; pedicels 2-10 mm long; flowers white, 4-5 mm long; silicles 3-8 mm long, ovate to elliptic, glabrous; seeds 6-12.

TAXONOMIC PROBLEMS: D. subalpina is related to D. oreibata but differs by its larger leaves and ovate silicles.

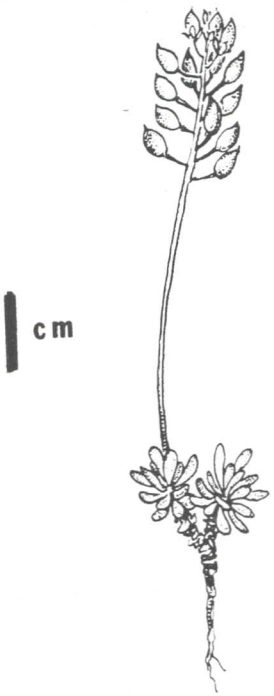
EXISTING OR POTENTIAL THREATS: Limestone exploitation, potential railroad construction and mineral exploration are potential threats to this species.

LAND OWNERSHIP/MANAGEMENT: National Park Service; U. S. Forest Service; Bureau of Land Management; private

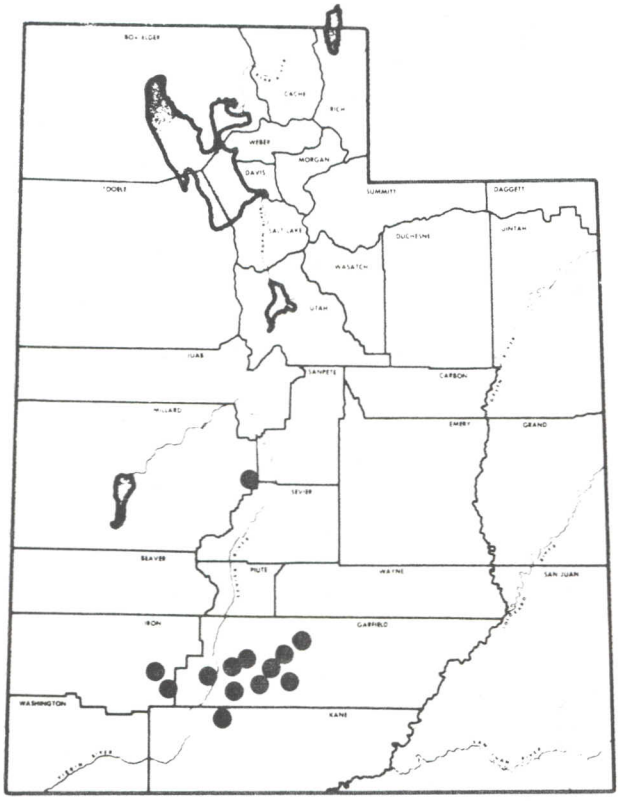
REMARKS: The species is apparently confined to limestone.

RECOMMENDATIONS: Although rather widely distributed, this plant occurs commonly with one or more other plants of narrow distribution. The plant should be regarded as threatened.

Draba subalpina







Draba subalpina **Goodman & Hitchc.** Breaks Draba. [*D. oriebata* authors, not Macbr. & Payson]. Perennial, caespitose, the caudex simple or branched, clothed with marcescent leaves, scapose; scapes 1–12 cm tall, rarely with one cauline leaf, glabrous throughout or pubescent with simple or forked hairs at least near base; leaves 3–18 mm long, 1–4 mm wide, oblong to spatulate, surfaces glabrous or sparingly hirsute, ciliate with coarse simple or less commonly forked or branched hairs; racemes few- to many-flowered, only moderately elongating in fruit; pedicels (1) 2–10 mm long, usually purplish, glabrous; petals 4–5 mm long, white, cuneate-spatulate, emarginate; silicles 3–8 mm long, 2–4 mm wide, ovate to elliptic, plane or more or less contorted, glabrous; style 0.6–1 mm long; seeds 6–12. Ponderosa pine, pinyon-juniper, Douglas fir, bristlecone pine, and spruce-fir communities, on the Pink and White Limestone members of the Wasatch Formation, from 2130 to 3295 m in Garfield, Iron (type from Cedar Breaks), Kane, and Millard counties; endemic; 42 (vi).

A NEW SCAPOSE DRABA FROM UTAH

GEORGE J. GOODMAN

Rufus J. Lackland Research Fellow in the Henry Shaw School of Botany of Washington University

AND C. LEO HITCHCOCK

Instructor in Botany, Pomona College, Claremont, California
Formerly Rufus J. Lackland Research Fellow in the Henry Shaw School of Botany of Washington University

Among the plants collected by the authors in the southwestern United States during the summer of 1930 is a *Draba* which, upon further study, seems to warrant specific recognition. It is described as follows:

Draba subalpina[1] Goodman and Hitchcock, n. sp. Caespitose perennial, the leaves forming rosettes; leaves linear-oblanceolate, entire, obtuse, 6–11 mm. long, midvein apparent, glabrous except for the setose-ciliate simple hairs on the margins; scapes solitary or few, glabrous, 4–6 cm. tall; fruiting inflorescence a lax raceme; pedicels ascending, 4–8 mm. long; siliques ovate to oblong-ovate, flattened, glabrous, 4–7 mm. long, 3–3.5 mm. broad, style 0.7 mm. long; ovary 6–8-ovuled; flowers unknown.—Utah: meadowland, Cedar Breaks, 3,000 m. alt., July 18, 1930, *Goodman & Hitchcock 1622* (Mo. Bot. Gard. Herb., TYPE); Cedar Breaks, July 17, 1922, *M. E. Jones* (Pomona Coll. Herb. No. 117158).

The nearest relative of this species probably is *Draba oreibata* Macbride & Payson, the type of which was collected in central Idaho. *D. subalpina* differs from Macbride and Payson's plant in the larger leaves and in the broader, ovate instead of elliptic siliques. A technical and anatomical difference between the two

[1] Draba subalpina Goodman et Hitchcock, sp. nov. Planta perennans caespitosa; foliis 6–11 mm. longis, rosulatis lineari-oblanceolatis, obtusis, integris, utrinque glabris, marginibus setoso-ciliatis, pilis simplicibus; scapis fructiferis 4–6 cm. altis, glabris, solitariis vel paucis; racemis laxis; pedicellis 4–8 mm. longis, ascendentibus; siliquis 4–7 mm. longis, 3–3.5 mm. latis, ovatis vel oblongo-ovatis, compressis, glabris, stylo 0.7 mm. longo; ovario 6–8-ovulato; floribus non visis.—Utah: meadowland, Cedar Breaks, 3,000 m. alt., July 18, 1930, *Goodman & Hitchcock 1622* (Mo. Bot. Gard. Herb., TYPE); Cedar Breaks, July 17, 1922, *M. E. Jones* (Pomona Coll. Herb. No. 117158).

Issued April 15, 1932.

species is to be found in the outline of the cells of the septum. In *D. oreibata*, as well as in *D. cyclomorpha* and *D. Lemmonii*, these cells are relatively small and in the first mentioned are irregular in outline, more or less straight-sided, and not more than twice so long as broad. In *D. subalpina* the cells of the septum are large, deeply tortuous in outline, and more than three times as long as broad.

Goodman and Hitchcock's No. 1622 was distributed as "*Draba Lemmonii* Wats." under which name it may be found in herbaria.

UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

SPECIES: DRABA SUBALPINA Goodman & Hitchc. SYNONYM(S): _____

FAMILY: ~~BRAS~~ CRUCIFERAE STATE: UTAH

EL CODE: _____ HERBARIUM: BRYCE CANYON N.P.

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
1·14·90 RECORDER CHAS. SCHELZ	GARFIELD	H. BUCHANAN/3051	210	DATE: 6·13·79 / T R S 4 mi. SOUTH OF INSPIRATION PT. JNCT. ASSOC: PONDEROSA PINE FOREST ELEV: 8100 FT.	
1·14·90 CHAS. SCHELZ	GARFIELD	R. GRAYBOSH/840	209	DATE: 6·22·80 / T R S RIM OF PLATEAU, BETWEEN LITTLE HENDERSON AND ~~TROPIC~~ TROPIC CANYONS ELEV: 7750' ASSOC: P. PONDEROSA FOREST - MANZANITA, ISITTERBRUSH	
1·14·90 CHAS SCHELZ	GARFIELD	R. GRAYBOSH/1325	209	DATE: 6·12·81 / T R S 1 KM. NE OF INSPIRATION POINT. WASATCH FORMATION ASSOC: P. PONDEROSA, JUNIPERUS SCOPULORUM, ELYMUS SALINA, BERBERIS REPENS, ARCTOSTAPHYLOUS PATULA ELEV: 7300'	
1·14·90 CHAS SCHELZ	GARFIELD	H. BUCHANAN/355	210	DATE: 6·12·58 / T R S IN RAVINE .5 mi. WEST OF FAR VIEW POINT. ASSOC: ASPEN, SPRUCE, FIR, + PINE - WET MEADOW ELEV: 8200'	
				DATE: / T R S	
				DATE: / T R S	

SCIENTIFIC NAME: Eriogonum panguicense (M. E. Jones) Reveal var. alpestre (S. Stokes) Reveal

FAMILY: Polygonaceae

CITATION: Proc. Utah Acad. Sci. 42: 292. 1966.

SYNONYMS: Eriogonum chrysocephalum Gray ssp. alpestre S. Stokes. (Gen. Eriog. 93. 1936.)

STATUS: Reviewed as threatened, Federal Register, 1 July 1975. Recommended as endangered by S. L. Welsh, 1978.

COMMON NAME: Panguitch buckwheat

KNOWN DISTRIBUTION: Iron Co., Utah

HABITAT: Volcanic gravel and limestone, whitish clay outcrops of rim rocks; spruce fir meadow community.

ELEVATION: 9500 to 11,000 feet (2898 to 3355 m)

DESCRIPTION: Low pulvinate to caespitose herbaceous perennial, forming mats 1-2 dm across; leaves narrowly oblanceolate, 0.5-7 cm long, 2-4 mm wide, white tomentose below, floccose to subglabrous and green above, margin mostly crenulate, occasionally inrolled; petiole 1-4 mm long; stems scapose, 2-30 cm long, glabrous; inflorescences capitate; involucres congested, turbinate, 2-3 mm long, glabrous, 5 teeth rounded; flowers white, 2-3 mm long, glabrous, tepals obovate; achenes light brown, 3-4 mm long.

TAXONOMIC PROBLEMS: None

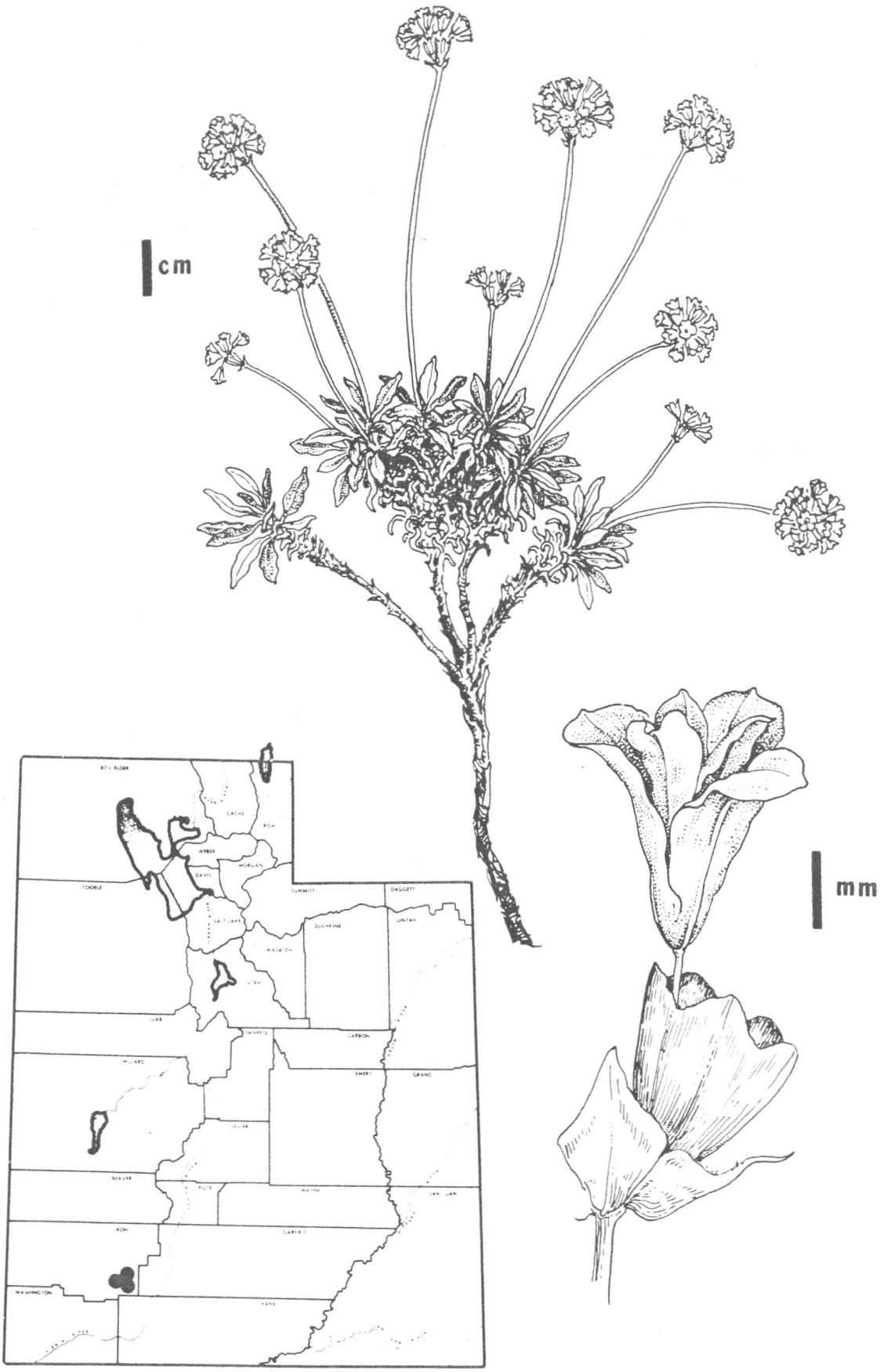
EXISTING OR POTENTIAL THREATS: Timber harvest, off trail and off highway use are threats to this species.

LAND OWNERSHIP/MANAGEMENT: National Park Service; U. S. Forest Service

REMARKS: The Panguitch buckwheat is endemic to the upper rim of Cedar Breaks.

RECOMMENDATIONS: This narrowly restricted plant should be regarded as threatened.

Eriogonum panguicense var. alpestre



***Eriogonum panguicense* (Jones) Reveal** Panguitch Buckwheat. [*E. pauciflorum* var. *panguicense* Jones, type from Panguitch; *E. spathulatum* var. *panguicense* (Jones) Stokes; *E. chrysocephalum* var. *alpestre* Stokes, type from Cedar Breaks; *E. panguicense* var. *alpestre* (Stokes) Reveal]. Pulvinate to caespitose perennial herbs, mainly 5–20 cm across; vegetative stems abbreviated, more or less clothed with ashy to black leaf bases and terminated by clustered leaves; flowering stems scapose, 2–30 cm long, glabrous; leaves 4–70 mm long, 2–8 (10) mm wide, linear to elliptic, oblanceolate, lanceolate, ovate, or obovate, obtuse to cuneate basally, plane or somewhat revolute; petioles 1–12 mm long; inflorescences glabrous, capitate or rarely branched; involucres sessile, several, obconic to campanulate, 2–3.7 mm long, the 5 teeth acute to obtuse; flowers white, often suffused with red, 2–3 mm long, glabrous, the segments oblong to lance-oblong; achenes 3–4 mm long. Pinyon-juniper, sagebrush, ponderosa pine, pygmy sagebrush, bristlecone pine, and spruce-fir communities, usually on limestone, at 1675 to 3355 m in Garfield, Iron, Kane, Millard, Sanpete, Sevier, and Washington counties; endemic; 48 (xi). This attractive buckwheat is closely allied to both *E. batemanii* and *E. spathulatum*, with whom it is partially sympatric. The species differs from both, however, in the usually unbranched inflorescences and smaller stature. It consists of a series of more or less disjunct populations growing on peculiar calcareous strata. Each population differs in subtle ways from all others, and if one is chosen for varietal status, the remainder require similar recognition. The overall status, as a mosiac of variation, seems to dictate against recognition of infraspecific categories.

shrub mostly under 8 dm high; white sandy soil, southeastern Utah and northeastern Arizona. var. *ramosissimum*

ERIOGONUM PANGUICENSE (M. E. Jones) Reveal, *stat. nov.* var. PANGUICENSE

E. pauciflorum Pursh var. *panguicense* M. E. Jones, Contr. West. Bot. 11: 9, 1903. [TYPE: *UTAH*: Garfield Co.: Panguitch, 24 June 1890, *M. E. Jones* s.m. Holotype POM!]

E. spathulatum A. Gray var. *panguicense* S. Stokes, Gen. Eriog. 71, 1936.

Representative Specimens:

UTAH: Garfield Co.: 2 mi. S of Museum, Bryce Canyon N. P., 18 July 1957, *Buchanan 206* (RSA, UT); Bryce Canyon, 11 July 1927, *Cottam & Hutchings 2762* (BRY, UT); Bryce Canyon, 19 July 1933, *Eastwood & Howell 732* (CAS); Red Canyon, 23 Sept. 1938, *Eastwood & Howell 7151* (CAS); Bryce Canyon, 24 Sept. 1938, *Eastwood & Howell 7238* (CAS, NY, POM, UTC); mouth of Escalante Canyon just above Widtsoe, 24 July 1965, *Holmgren, Reveal, & LaFrance 2255* (35 specimens will be distributed from UTC); Bryce Canyon, 9 July 1926, *Kraus s.n.* (WIS); 5 mi. S of Hatch, 15 June 1940, *Maguire 18723* (UTC); 1 mi. E of Pine Lake, Table Cliff Plateau, 26 June 1940, *Maguire 19130* (UTC); 5 mi. E of U.S. 89 in Red Canyon, 16 July 1940, *Maguire 19531* (UTC); Bryce Canyon, 18 July 1927, *Peirson 7462* (RSA); canyon above Tropic, *Ripley & Barneby 8587* (CAS); Red Canyon, *Ripley & Barneby 8549* (CAS, NY); near Bryce Canyon, 6 July 1938; *Rollins & Chambers 2452* (CAS, UTC); Bryce Canyon, 29 June 1931, *Weight B-31/101* (UT).

Iron Co.: Near Iron Point, 2 July 1936, *Gierisch 85* (UTC).

Kane Co.: Long Canyon above Orderville, 12 June 1929, *Cottam 4286* (BRY); 0.5 mi. S of Mt. Carmel Junction, 20 Sept. 1961, *Holmgren & Reveal 320* (CAS, UTC); 15 mi. N of Orderville, 15 June 1940, *Maguire 18783* (UTC); 1 mi. S of Mt. Carmel Junction, 20 June 1940, *Maguire 18892* (NY, UTC); 0.5 mi. S of Mt. Carmel Junction, 23 Sept. 1963, *Reveal & Reveal 589* (BRY, CAS, DS, GH, NY, RSA, UC, US UTC).

Sevier Co.: Richfield, 13 June 1899, *M. E. Jones s.n.* (POM); Pavant Range west of Richfield, *Ripley & Barneby 8620* (CAS).

Washington Co.: Head of Sleepy Hollow along the West Rim Trail, Horse Pasture Plateau, Zion N.P., 22 June 1965, *Holmgren, Reveal, & LaFrance 1997* (10 specimens will be distributed from UTC). This population has a chromosome number of n=20.

In 1961, Noel H. Holmgren, now of the New York Botanical Garden, and I discovered an interesting *Eriogonum* from Kane County which, upon investigation, was found to have been given an herbarium name by Dr. Bassett Maguire of the New York Botanical Garden and formerly Curator at the Intermountain Herbarium, Utah State University, Logan. Maguire had recognized a large set of speci-

mens which he considered to belong to his new species, but one which Stokes had referred to *E. chrysocephalum* A. Gray ssp. *alpestre* or to *E. spathulatum* A. Gray var. *panguicense*. Recent fieldwork by Holmgren and myself have shown that Maguire's concept of this species was correct, but he was, apparently, unaware of Jones' earlier name.

var. ALPESTRE (S. Stokes) Reveal, *stat. nov.*

E. chrysocephalum A. Gray ssp. *alpestre* S. Stokes, Gen. Eriog. 93, 1936. [TYPE: *UTAH*: Iron Co.: Cedar Break N.M., 18 July 1930, *Goodman & Hitchcock 1601*. Holotype CAS! photograph BRY, UTC]

Representative Specimens:

UTAH: Iron Co.: all collections are from Cedar Breaks N.M.: 13 July 1955, *Bruhn H-131* (UT); 25 Sept. 1938, *Eastwood & Howell 7285* (CAS, POM); 24 Aug. 1940, *Harrison 9858* (BRY, US); 12 Aug. 1938, *Hitchcock et al 4585* (UTC); 23 June 1940, *Maguire 10943* (UTC); 13 Aug. 1939 *Maguire 17568* (UTC); 7 Aug. 1934, *Maguire & Richards 13290* (UTC); 11 Sept. 1963, *Welsh & Christensen 2657* (BRY).

E. panguicense var. *alpestre* is a distinct high alpine form that is, at present, known only from Cedar Breaks National Monument where it grows on the steep hillsides. Maguire had recognized this population as a variety of his new species which grows at a lower elevation, a concept with which I agree. These two taxa may be separated as follows:

Leaves 1.5-6 (-7) cm long with an indistinct expanded petiole base, this tomentose without; scapes 8-25 (-30) cm long; perianth 2-2.5 mm long; common on clayey hillsides below 9000 feet elevation, southern Utah. var. *panguicense*

Leaves 0.5-1-5 cm long with a distictly expanded petiole base, this glabrous without; scapes up to 7 cm long; perianth (2-) 2.5-3 mm long; known only from Cedar Breaks National Monument, over 10,000 feet elevation var. *alpestre*

UNIVERSITY OF UTAH LIBRARIES

UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

SPECIES: ERIOGONUM PANGUICENSE VAR. PANGUICENSE (M.E. JONES) REVEAL SYNONYM(S):

FAMILY: POLYGONACEAE STATE: UTAH

EL CODE: HERBARIUM: BRYCE CANYON NP.

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
1.14.90 RECORDER CHAS. SCHELZ	GARFIELD	R. GRAYBOSCH/766	209	DATE: 6.18.80 / T R S JNCT. OF LITTLE HENDERSON CYN AND HIGHWY. 54 WASATCH FORMATION ASSOC: PINYON - JUNIPER - PONDEROSA PINE FOREST ELEV: 6900 FT.	
1.14.90 CHAS SCHELZ	?	K.E. WEIGHT	215	DATE: 6.29.31 / T R S	
1.14.90 CHAS SCHELZ	GARFIELD	H. BUCHANAN/2992	210	DATE: 8.23.78 / T R S BETWEEN INSPIRATION POINT AND BRYCE POINT ON ECODED LIMESTONE. ASSOC: BRISTLECONE, LIMBER PINE, AND SPRUCE FOREST ELEV: 8300 FT.	
1.14.90 CHAS SCHELZ	GARFIELD	R. GRAYBOSCH/1342	209	DATE: 6.26.81 / T R S .25 KM. EAST OF SUNRISE POINT. WASATCH FORMATION ASSOC: OENOTHERA BRACHYCARPA, MACHAERANTHERA GRINDELOIDES HYMENOPAPPUS FILIFOLIUS. ELEV: 7800'	
1.14.90 CHAS SCHELZ	GARFIELD	H. BUCHANAN/206	210	DATE: 7.18.57 / T R S .25 mi. WEST OF ROAD - 2 mi. SOUTH OF MUESEUM ASSOC: PINE FOREST, ROCKY SLOPE ELEV: 7950'	
				DATE: / T R S	

Heterotheca jonesii





SCIENTIFIC NAME: Heterotheca jonesii (Blake) Welsh & Atwood

FAMILY: Asteraceae

CITATION: Great Basin Naturalist 35: 336. 1975.

SYNONYMS: Chrysopsis jonesii Blake. (Contr. U. S. Natl. Herb. 25: 536. 1925.)
Chrysopsis caespitosa M. E. Jones, not Nutt. (Proc. Calif. Acad. Sci. II 5: 694. 1895.)

STATUS: Recommended as endangered by S. L. Welsh, 1978.

COMMON NAME: Jones golden aster

KNOWN DISTRIBUTION: Garfield and Washington cos., Utah

HABITAT: Gravelly, sandy limestone outcrops; ponderosa, Arctostaphylos community

ELEVATION: 9000 feet (2745 m)

DESCRIPTION: The plant is a caespitose perennial from a woody much branched root forming a dense mat; leaves spatulate, about 12 mm long, clustered on short stems, 2.5-5 cm long, villous but not hispid, not apiculate; inflorescence heads about 6 mm high, sessile; involucre ashy green, linear, somewhat unequal, inner bracts with purple hyaline margins, ligules yellow to golden, tubular flowers golden; fruit an achene.

TAXONOMIC PROBLEMS: Obscure

EXISTING OR POTENTIAL THREATS: Road construction is a potential danger.

LAND OWNERSHIP/MANAGEMENT: U. S. Forest Service

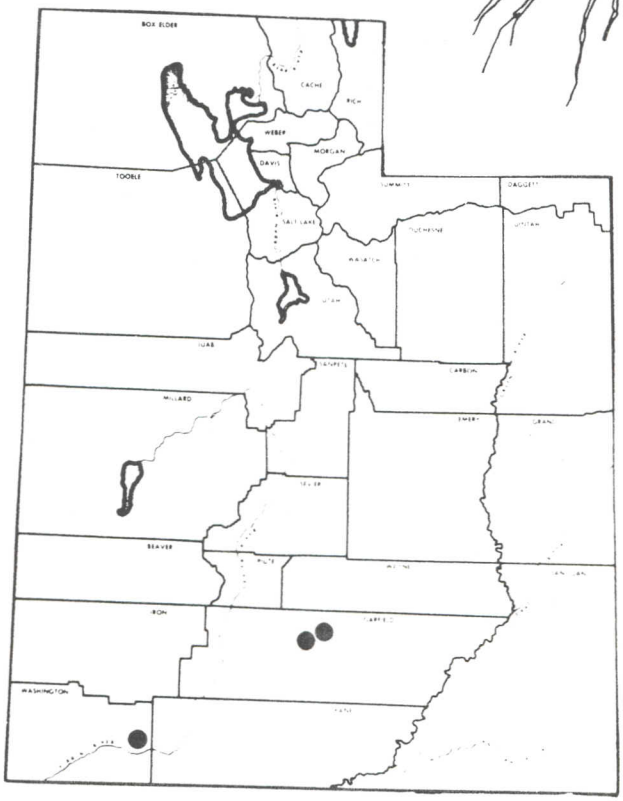
REMARKS: The Jones golden aster was previously known only from the type locality in Washington Co., but has not been collected there in many years.

RECOMMENDATIONS: The plant should be regarded as endangered, with one surviving population.

Heterotheca jonesii



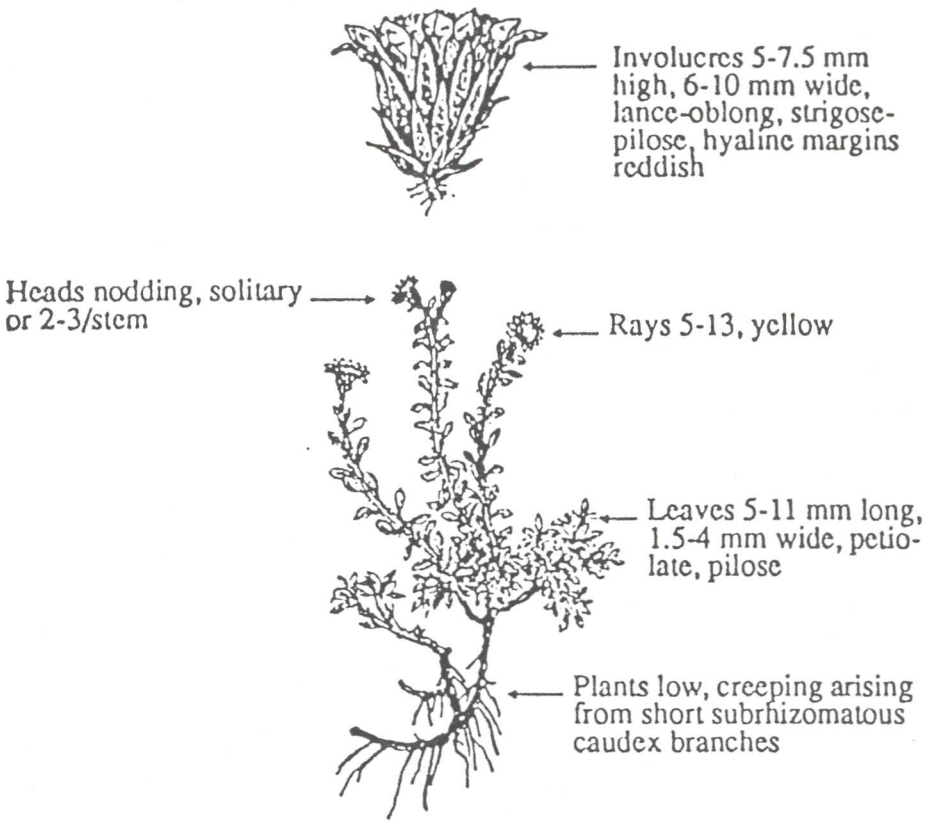
cm





mm

***Heterotheca jonesii* (Blake) Welsh & Atwood** Jones Goldenaster. [*Chrysopsis caespitosa* Jones, not Nutt.; *Chrysopsis jonesii* Blake]. Perennial caespitose herbs from a creeping subrhizomatous caudex; stems 4–8 cm tall, loosely villous; leaves 5–11 mm long, 1.5–4 mm wide, petiolate, the blades obovate to spatulate, pilose; heads solitary or 2 or 3; involucres 5–7.5 mm high, 6–10 mm wide, the bracts narrowly lance-oblong, strigose-pilose, the hyaline margins reddish; ray flowers 5–13, yellow, 4–6 mm long, 1.5–2.5 mm wide; pappus tawny; achenes 2–3 mm long, hairy. Ponderosa pine, manzanita, and Douglas fir communities, on sandstone or in sand, at 1580 to 2745 m in Garfield, Kane, and Washington (?) counties (the type presumably came from Springdale); endemic. S (iii).



HETEROTHECA JONESII

Scientific Name: *Heterotheca jonesii* (Blake) Welsh & Atwood

Common Name: Jones goldenaster

Family (Common Name): Asteraceae or Compositae (Aster or Sunflower Family)

Synonyms: *Chrysopsis caespitosa* Jones not Nutt., *Chrysopsis jonesii* Blake

Global and State Rank: G1/S1

Federal Review Status: C2

Global Distribution: Southwestern and South-central Utah

State Distribution: Garfield, Kane, and Washington counties.

Ownership: USDA, BLM and NPS

National Forest: Dixie

Habitat: Ponderosa pine, manzanita, pinyon-pine, and Douglas fir communities on sandstone or in sand between 4,000 to 9,450 feet elevation. May-September.

STATUS REPORT

Heterotheca jonesii

I. Nomenclature

A. Family name: Asteraceae

Synonyms: Compositae

Common name: Aster family

B. Species name: *Heterotheca jonesii* (Blake) Welsh and Atwood

Citation: Great Basin Naturalist 35:336. 1975.

Synonums: *Chrysopsis jonesii* Blake in Tidestrom

Citation: Contr. U.S. National Herb. 25: 537. 1925.

Basionym: *Chrysopsis caespitosa* M. E. Jones

Citation: Proc. Calif. Acad. Sci. II, 5:694. 1895.

II. Status

A. Federal: Proposed as endangered, Federal Register, 41(117): 24570 16 June 1976.

As of November 10, 1979, the proposed rulemaking was withdrawn as required by the 1978 amendments to the ESA.

B. State: None

C. Other: Recommended as endangered by S. L. Welsh, 1978.

This plant is recommended for inclusion on the U.S. FWS Notice of Review List as endangered, by the Utah Native Plant Society, 1980. Also on the Forest Service Region 4 Sensitive Plant List, 1980.

III. Description

A. Field identification features: Small yellow-flowered composite which is similar but smaller in all parts than *Heterotheca villosa*.

B. Brief description: Caespitose from a woody, much branched root forming a dense mat; leaves spatulate, about 12 mm long clustered on short stems, 2.5-5 cm long, villous but not hispid, apiculate; heads about 6 mm high, sessile; involucral bracts ashy green, linear, somewhat unequal, inner with hyaline margins and acute; flowers yellow (Jones, 1895).

C. Closely related species: None

IV. Geographical Distribution

A. Past: Included a population in Springdale, Washington County, Utah, but the plant is not known to occur there now.

B. Present: 25 miles NE of Escalante, in the vicinity of Hell's Backbone, Garfield County, Utah.

C. Potential: Unknown

V. Taxonomic Problems

None

VI. Habitat Description

A. Plant community: Ponderosa pine and manzanita community

B. Dominant plants: Pinus ponderosa; Arctostaphylos sp.

C. Elevational ranges: 9,000 feet (2745 m)

D. Exposure and slope: South and west-facing slopes

E. Edaphic features: On sandy limestone outcrops

F. Geology: Navajo Sandstone Formation

G. Other habitat features: None

VII. Population Biology

A. Number of populations (est.): Three to four

B. Number of individuals/population (est.): Unknown

C. Reproduction methods: Unknown

D. Age classes: Unknown

E. Time of flowering and fruiting: Flowering late July to mid-August

F. Dispersal mechanisms: Wind

G. Pollinators, if any: Unknown

H. Other biological factors: Unknown

I. Current population dynamics; trends and status: Unknown

VIII. Critical Habitat Recommendations

A. Geographic boundaries: Hell's Backbone, T. 33 S., R. 3 E., Sec. 5, Garfield County, Utah.

B. Physical attributes: Sandstone and sandy limestone

IX. Threats to Survival

A. Nature of existing threats to survival:

1. Threatened destruction, modification, or curtailment of habitat or range, if any: Roadbuilding poses a potential destruction of the population and/or the habitat.

2. Over utilization for commercial, sporting, scientific, or educational purposes, if any: None

3. Disease, predation, grazing, or trampling, if any: None

4. Inadequacy of existing regulatory mechanisms, if any: None

5. Other natural or man-made factors reflecting continued existence, if any: None

B. Potential threats in the foreseeable future, as in IX-A: Highway construction is a potential threat to this species.

X, Land Management or Ownership

U.S. Forest Service

XI. Management Implications

A. Suggest management actions which might best maintain the plant species: Monitor the population for any change due to current activities, and road construction through the area should be limited to areas not demonstrated to support this plant.

B. Suggest suitable alternatives for recovery: Unknown

XII. Cultivation Potential

A. Present or potential cultivation potential: Unknown

B. Currently cultivated populations, if any, their location and condition: Unknown

XIII. Potential Value

Esthetic, ecological, economical, educational, evolutionary, medicinal, ornamental, recreational, and scientific value, as appropriate: This plant is valuable in determining speciation in Heterotheca which has only a small number of species in the west, and those are widely distributed.

XIV. Specialist

None

XV. References

1. Jones, M. D. 1895. Contributions to western botany, No. VII. Proc. Calif. Acad. Sci. II, 5: 611-733.

2. Tidestrom, I. 1925. Flora of Utah and Nevada. Contr. U.S. Natl. Herb. 25: 1-665.

3. Welsh, S. L. 1978. Endangered and threatened plants of Utah: a re-evaluation. Great Basin Naturalist 38: 1-18.

4. Welsh, S. L., N. D. Atwood, and J. L. Reveal. 1975. Endangered, threatened, extinct, endemic, and rare or restricted Utah vascular plants. Great Basin Naturalist 35: 327-276.

XVI. Appendices

A. Xerox copies of distribution maps, illustrations, original descriptions, floristic or monographic descriptions, magazine articles, newspaper clippings: Jones, 1895; Tidestrom, 1925; Welsh, Atwood, and Reveal, 1975; see attachments.

B. Herbarium label data and location of herbaria:

1. Heterotheca jonesii (type) POM; M. E. Jones 5249, Springdale, Washington County, Utah, 4,000-foot elevation, 16 May 1894.

2. H. jonesii (BRY); (172972) E. Neese, S. White, 3942, SC Escalante, T. 33 S., R. 3 E., Sec. 5, 1 mile due SE of Hell's Backbone, 9,000-foot elevation, Ponderosa-Arctostaphylos community, sandy limestone outcrops, Garfield County, Utah, 3 August 1977.

3. H. jonesii (BRY) (90809); W. P. Cottam 9101, Hell's Backbone, Aquarius Plateau, Garfield County, Utah, Yellow-pine association, 20 July 1942.

4. H. jonesii (BRY) (43466); B. F. Harrison 12343, Hell's Backbone, 25 miles NE of Escalante, Garfield County, Utah, gravelly soil of roadside, 5 August 1954.

5. Garfield Co., Dixie National Forest, near Hell's Backbone, bare sandy soil, 9,000-foot elevation, 25 July 1979, Mont E. Lewis 6124 (BRY).

6. Garfield Co., Dixie National Forest, Hell's Backbone Ridge, T. 33 S., R. 3 E., NE1/4 of Sec. 4, 12 miles north of Escalante, Boulder Mountain, 9,000-foot elevation, Sandstone Ridge, 27 September 1979, S. Welsh 19333 (BRY).

7. Garfield Co., Dixie National Forest, Hell's Backbone Ridge, 11 miles north of Escalante, Boulder Mountain, 9,000-foot elevation, T. 33 S., R. 3 E., SE1/4 of Sec. 4, 27 September 1979, S. Welsh 19336 (BRY).

8. Garfield Co., Hell's Backbone, Aquarius Plateau, 10 August 1952, W. P. Cottam 13485 (BRY).

C. Map of distribution and critical habitat boundaries: Roger Peak, Utah USGS 7.5'

D. Photos or illustrations: See attachment

Slides - Elizabeth Neese

XVII. Author of Statement

Name: Stanley L. Welsh

Address: 129 North 1000 East
Orem, Utah 84057

Date: 1 December 1978

Updated May 1980 by Matthew Chatterley

XVIII. Other Sources

None

UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

SPECIES: HETEROTHECA JONESII (BLAKE) WELSH + ATWOOD SYNONYM(S): _____

FAMILY: COMPOSITAE STATE: UTAH

L CODE: _____ HERBARIUM: BRYCE CANYON N.P.

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
1.14.90 RECORDER CHAS SCHELZ	KANE	R. GRAY BOSCH / 924	209	DATE: 7.4.80 / T R S NE SLOPES OF BRIDGE CYN., NEAR JUNCTION OF PARK BOUNDARY AND KANE CO. LINE. DRIFTING SANDS OF KAIPAROWITS FORMATION ELEV: 8000' ASSOC: PONDEROSA - MANZANITA	
1.				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	

SCIENTIFIC NAME: Lesquerella rubicundula Rollins

FAMILY: Brassicaceae

CITATION: Contr. Dudley Herb. 3: 178. 1941.

SYNONYMS: Lesquerella hitchcockii ssp. rubicundula (Rollins) Maguire & Holmgren (Madroño 11: 175. 1951.)

STATUS: Reviewed as threatened, Federal Register, 1 July 1975. Recommended as threatened by S. L. Welsh, 1978.

COMMON NAME: Bryce bladderpod

KNOWN DISTRIBUTION: Garfield and Iron cos., Utah

HABITAT: White and Pink Limestone Members of the Wasatch Formation; limestone gravel, dry slopes, red chip talus; mixed conifer woodland

ELEVATION: 7300 to 10,000 feet (2227 to 3050 m)

DESCRIPTION: Perennial, loosely caespitose, not matted, caudex simple or few to several branches, branches with marcescent leaf bases, herbage with stellate pubescences; stems 0.1-0.5 dm tall, erect, simple; leaves mainly basal, 0.3-1.2 cm long, not differentiated into blade and petiole; pedicels 1-6 mm long, ascending; sepals 3.2-4.5 mm long; petals 4.5-7 mm long, yellow, spatulate; silicles (excluding style) 3-5 mm long, sessile to substipitate, ovoid, glabrous; style 2.8-3.5 mm long; seeds 2-4 per locule.

TAXONOMIC PROBLEMS: Related to L. tumulosa, L. rubicundula differs in its fewer stems, smaller clumps, and less dense habit.

EXISTING OR POTENTIAL THREATS: Limestone exploitation and industrial development pose potential threats to this species.

LAND OWNERSHIP/MANAGEMENT: National Park Service; U.S. Forest Service

REMARKS: The Bryce bladderpod occurs on limestone with several other unique species of restricted distribution.

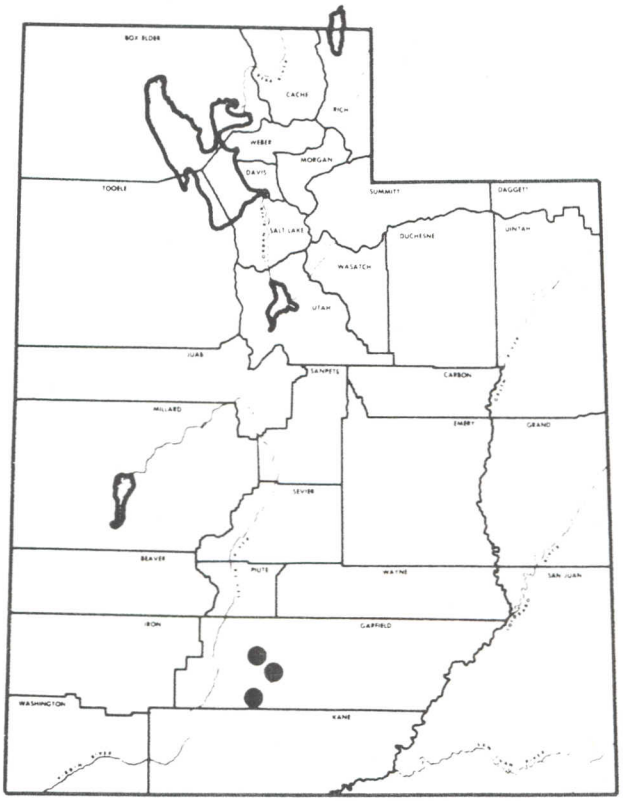
RECOMMENDATIONS: This species should be regarded as threatened.

Lesquerella rubicundula





cm



Lesquerella rubicundula **Rollins** Breaks Bladderpod. [*L. hitchcockii* ssp. *rubicundula* (Rollins) Maguire & Holmgren]. Perennial, loosely caespitose, not matted, the caudex simple or with few to several branches, clothed with marcescent leaf bases; herbage pubescent with stellate hairs; stems 1–5 cm tall, erect, simple; leaves mainly basal, 3–12 mm long, 1–2 mm wide, not differentiated into blade and petiole; pedicels 1–6 mm long, straight or curved, ascending; sepals 3.2–4.5 mm long; petals 4.5–7 mm long, yellow, spatulate; silicles (excluding style) 3–5 mm long, sessile to substipitate, ovoid; valves glabrous externally and within, style 2.8–3.5 mm long; ovules 2–4 per locule. Ponderosa pine, bristlecone pine, and spruce-fir communities on the Pink and White Limestone members of the Wasatch Formation, at 2350 to 3355 m in Garfield (type locality at Red Canyon), Iron, and Kane counties; endemic; 22 (i).

STATUS REPORT

Lesquerella rubicundula

I. Nomenclature

A. Family name: Brassicaceae

Synonyms: Cruciferae

Common name: Mustard family

B. Species name: Lesquerella rubicundula Rollins

Citation: Contr. Dudley Herb. 3: 178. 1941.

Synonyms: None

Common name: Red Canyon bladderpod

II. Legal Status

A. Federal: Reviewed as threatened, Federal Register, 1 July 1975.

B. State: None

C. Other; Recommended as threatened by S. L. Welsh, 1978.

III. Description

A. Field identification features: Perennial plant, caudex simple or with few to several branches, stems erect, simple; leaves mainly basal; petals yellow, spatulate; silicles glabrous.

B. Brief description: Perennial plant, loosely caespitose, not matted; caudex simple or with few to several branches, branches clothed with marcescent leaf bases; herbage pubescent with stellate hairs; stems 0.1-0.5 dm tall, erect, simple; leaves mainly basal, 0.3-1.2 cm long, 0.1-0.2 cm wide, not differentiated into blade and petiole; petals 4.5-7 mm long, yellow, spatulate; silicles sessile

to substipitate, ovoid, valves glabrous externally and within (Welsh and Reveal, 1977).

C. Closely related species: L. hitchcockii Munz; L. tumulosa (Barneby) Reveal

IV. Geographical Distribution

A. Past: Unknown

B. Present: Garfield and Iron Counties, Utah

C. Potential: Unknown

V. Taxonomic Problems

Differs from L. Hitchcockii in having much shorter styles; longer, linear (instead of obovate or spatulate) leaves; sessile (instead of subsessile), fewer silicles, and from L. tumulosa in the habit of growth.

VI. Habitat Description

A. Plant community: Spruce-fir-aspen-pine community

B. Dominant plants: Picea engelmannii, Abies lasiocarpa, Populus tremuloides, Pinus ponderosa, P. longaeva, Juniperus scopulorum.

C. Elevational ranges: 8000-10,000 feet (2440-3050 m)

D. Exposure and slope: Exposure variable, commonly on rounded knolls or breaks margins; slope 0-15%

E. Edaphic features: Clayey or gravelly loam

F. Geology: White and Pink Limestone Member of Wasatch Formation

G. Other habitat features: Unknown

VII. Population Biology

A. Number of populations (est.): Four

B. Number of individuals/population (est.): 10-50

C. Reproduction methods: Unknown

D. Age classes: All age classes are represented

E. Time of flowering and fruiting: May - July

F. Dispersal mechanisms: Unknown

G: Pollinators, if any: Unknown

H. Other biological factors: Unknown

I. Current population dynamics; trends and status: Unknown

VIII. Critical Habitat Recommendations

A. Geographic boundaries: Sections 23, 24, 25, and 26, T35S, R4 1/2W, Red Canyon, Garfield County, Utah.

B. Physical attributes: Pink Limestone Member of Wasatch Formation, on gravelly calciferous colluvium, in mixed coniferous woodland.

IX. Threats to Survival

A. Nature of existing threats to survival:

1. Threatened destruction, modification, or curtailment of habitat or range, if any: Impact of existing roads and campground.

2. Over utilization for commercial, sporting, scientific, or educational purposes, if any: None

3. Disease, predation, grazing, or trampling, if any: Some trampling near existing tourist facilities.

4. Inadequacy of existing regulatory mechanism, if any: Unknown

5. Other natural or man-made factors reflecting continued existence, if any: Unknown

B. Potential threats in foreseeable future, as in IX-A: Exploitation of limestone; railroad construction; transmission corridor construction; lumbering.

X. Land Management or Ownership

U. S. Forest Service; National Park Service; Utah State; private

XI. Management Implications

A. Suggest management actions which might best maintain the plant species: Disallow surface disturbance in areas known to support this plant.

B. Suggest suitable alternatives for recovery: Not applicable

XII. Cultivation Potential

A. Present or potential cultivation potential: Unknown

B. Currently cultivated populations, if any, their location and condition: None

XIII. Potential Value

Aesthetic, ecological, economical, educational, evolutionary, medicinal, ornamental, recreational, and scientific value, as appropriate: The relationship of the Red Canyon bladderpod might be investigated, resulting in increase in scientific knowledge. The plants grow in low-quality substrates, tending to stabilize the surface.

XIV. Specialist

Name: Reed C. Rollins

Address: Gray Herbarium, Harvard University
22 Divinity Avenue
Cambridge, Massachusetts 02138

XV. References

1. Rollins, R. C. 1941. Some New or Noteworthy North American Crucifers. Cont. Dudley Herb. 3: 174-184.

2. Rollins, R. C. 1973. The genus Lesquerella (Cruciferae) in North America. Harvard University Press, Cambridge. 288 pp.

3. Welsh, S. L. 1978. Endangered and threatened plants of Utah: a re-evaluation. Great Basin Naturalist 38: 1-18.

4. Welsh, S. L., N. D. Atwood, J. L. Reveal. 1975. Endangered, threatened, extinct, endemic, and rare or restricted Utah vascular plants. Great Basin Naturalist 35: 327-376.

5. Welsh, S. L. and J. L. Reveal. 1977. Utah Flora: Brassicaceae (Cruciferae). Great Basin Naturalist 37: 279-365.

XVI. Appendices

A. Xerox copies of distribution maps, illustrations, original descriptions, floristic or monographic descriptions, magazine articles, newspaper clippings: See attachments.

B. Herbarium label data and location of herbaria:

1. Lesquerella rubicundula (Type; NA, GH); Eggleston 8198', Red Canyon, 2300 m, Garfield County, Utah, 6 July 1912.

2. L. rubicundula (105313, BRY); Reveal 1011, east fork Sevier River road, 3.5 miles S Hwy. 12, T36S, R4W, Sec. 22, 8000 feet elev., Garfield County, Utah, 25 May 1968.

3. L. rubicundula (105322, BRY); Reveal 1037, low ridge NE Widstoe, 8000 feet elev., Garfield County, Utah, 26 May 1968.

4. L. rubicundula (173861, BRY); Neese, White 3833, Table Cliff Plateau, 9400 feet elev., T35S, R1W, Sec. 30, Garfield County, Utah, 28 July 1977.

C. Map of distribution and critical habitat boundaries: Sweetwater Creek USGS 7.5'; Bryce Canyon USGS 7.5'; Pine Lake USGS 7.5'; Wilson Peak USGS 7.5'

D. Photos or illustrations: See attachments.

XVII. Author of Statement

Name: Stanley L. Welsh

Address: 129 North 1000 East
Orem, Utah 84057

Date: 1 December 1978

XVIII. Other Sources

None

UTAH FLORA: BRASSICACEAE (CRUCIFERAE)

Stanley L. Welsh
James L. Reveal

Reprint from Great Basin Naturalist, Volume 37, No. 3
September 30, 1977

with stellate hairs; stems 0.3-2 dm long, rarely more, prostrate to erect; basal leaves 1-6 cm long, 0.4-1.5 (2) cm wide, blades elliptic to obovate, differentiated from long slender petioles; cauline leaves 0.4-2 cm long, 0.1-0.5 cm wide; pedicels 3-10 mm long, S-shaped; sepals 4.3-7 mm long; petals 5-10 mm long, yellow, spatulate; silicles (excluding style) 3-5.5 mm long, sessile or nearly so, ovoid, valves pubescent externally, glabrous within; styles 3-6.5 rm long; ovules 2-4 per locule.—Ridges and upper slopes from 1830 to 3050 m elevation in Cache, Davis, and Rich counties; Idaho, Wyoming.

Lesquerella occidentalis S. Wats. Perennial, cespitose, caudex simple or few-branched, more or less clothed with marcescent leaf-bases; herbage pubescent with stellate hairs; stems 0.2-1.5 dm long, rarely more, prostrate, decumbent, ascending or erect, usually simple; basal leaves 0.5-8 cm long, 0.3-1.5 cm wide, blades spatulate to oval or obovate, differentiated from petioles; cauline leaves 0.4-1.5 cm long, 0.1-0.8 cm wide; pedicels 3-10 mm long or more, sigmoid or straight, ascending; sepals 4-7 mm long; petals 6-10 mm long, yellow, spatulate; silicles (excluding style) 4-6 mm long, ellipsoid, usually compressed at apex, valves pubescent externally and usually pubescent within; styles 2-5 mm long; seeds 2-8 per locule.—Limestone cliffs and talus slopes from 1525 to 3660 m elevation in Box Elder and Juab (Mt. Nebo) counties; Idaho and Utah to California and Oregon.

Our material belongs to var. *cinerascens* Maguire and Holmgren [*L. occidentalis* ssp. *cinerascens* (Maguire & Holmgren) Rollins & Shaw].

Lesquerella prostrata A. Nels. Perennial, cespitose, caudex simple or few-branched, branches more or less clothed with marcescent leaf-bases; herbage pubescent with stellate hairs; stems 0.3-1.5 dm tall, decumbent to ascending, simple; basal leaves 1-5 cm long, 0.5-1 (1.5) cm wide, blades deltate to hastate, more or less angular, differentiated from slender petioles; cauline leaves 0.4-1.5 cm long, 0.1-0.5 cm wide; pedicels 4-10 mm long, curved to straight or S-shaped, spreading; sepals 5-6 mm long; petals 5-9 mm long, yellow, spatulate; silicles (excluding style) 4-7 mm long, sessile or nearly so, ovoid to ellipsoid, not flattened apically, valves pubescent externally, glabrous or sparsely hairy within; styles 3-6 mm long; seeds 2-4 per locule.—Sagebrush community, especially on dry shaly slopes from 1830 to 2440 m elevation in Rich (and to be sought in Summit) County; Wyoming and Idaho.

Lesquerella rectipes Woot. & Standl. Perennial, loosely cespitose, caudex simple or few-branched, branches more or less clothed by marcescent leaf-bases; stems 0.4-4 dm tall or more, decumbent to ascending or erect, simple or branched; basal leaves 1-8 (10) cm long, 0.3-1.2 cm wide, oblanceolate to elliptic, entire or toothed, tapering gradually to base; cauline leaves 0.6-3 cm long, 0.2-1 cm wide; pedicels 4-10 mm long or more, straight or S-shaped, spreading to ascending or recurved; sepals 4-8 mm long; petals 6-10 mm long or more, yellow, spatulate to obovate; silicles (excluding style) 4-7 mm long, substipitate to subsessile, ovoid to ellipsoid, pubescent externally and glabrous or pubescent within; styles 2-7 mm long; seeds 4-8 per locule.—Pinyon-juniper, grasslands, warm desert shrub, and ponderosa pine communities from 1220 to 2440 m elevation in Carbon, Emery, Garfield, Grand, Kane, San Juan, Uintah, Washington and Wayne counties; Utah and Arizona eastward to Colorado and New Mexico.

This is the most common of the tall species of *Lesquerella* in southeastern Utah.

Lesquerella rubricundula Rollins. [*L. hitchcockii* ssp. *rubicundula* (Rollins) Maguire & Holmgren] Plants perennial, loosely cespitose, not matted, caudex simple or with few to several branches, branches clothed with marcescent leaf bases; herbage pubescent with stellate hairs; stems 0.1-0.5 dm tall, erect, simple; leaves mainly basal, 0.3-1.2 cm long, 0.1-0.2 cm wide, not differentiated into blade and petiole; pedicels 1-6 mm long, straight or curved, ascending; sepals 3.2-4.5 mm long; petals 4.5-7 mm long, yellow, spatulate; silicles (excluding style) 3-5 mm long, sessile to substipitate, ovoid, valves glabrous externally and within; styles

2.8-3.5 mm long; ovules 2-4 per locule.—Mixed conifer woodlands, on White and Pink limestone member of the Wasatch Formation from 2440 to 3050 m elevation in Garfield (type locality at Red Canyon) and Iron counties; endemic.

Lesquerella subumbellata Rollins. Perennial, cespitose, caudex several-branched, branches clothed with marcescent leaf bases and often with leaves as well; herbage pubescent with stellate hairs; stems 0.1-0.8 (1) dm tall, ascending to erect, simple; basal leaves 0.8-3 cm long, 0.2-0.6 (1) cm wide, at least outer and usually most of them obovate-spatulate, gradually tapering to petiole; cauline leaves 0.3-2 cm long, 0.1-0.4 cm wide; pedicels 2-5 mm long, straight or curved, ascending; sepals 3-4.5 mm long; petals 5-6 mm long, yellow, spatulate; silicles (excluding style) 3.5-5 mm long, subsessile, ellipsoid, valves pubescent externally; styles 1.5-2.5 mm long; seeds 2-6 per locule.—Pinyon-juniper and sagebrush communities from 1680 to 1980 m elevation in Duchesne and Uintah (type locaity 18 miles north of Vernal) counties; Colorado, Wyoming.

Rollins and Shaw (1973) place this taxon within the range of variation of *Lesquerella alpina*. That disposition ignores the basic continuity of *L. subumbellata*, and likewise denies the apparent relationship of *L. alpina* in quite another direction, i.e., with *L. intermedia*. The uniformly broad blades of basal leaves, although tenuous as a diagnostic feature, are on the order of other diagnostic features in this critical genus.

Lesquerella tenella A. Nels. [*L. gordonii* var. *sessilis* S. Wats.; *L. palmeri* of Utah references, not S. Wats.] Annual, herbage pubescent with stellate hairs; stems 1-5 dm tall or more, spreading-decumbent to erect, simple or branched; basal leaves 1.5-6 cm long, 0.2-1.5 cm wide, blades elliptic, sometimes toothed, differentiated from petiole; cauline leaves 0.4-4 cm long, 0.2-1 cm wide; pedicels 4-12 (18) mm long or more, S-shaped, spreading to recurved; sepals 3.5-7 mm long; petals 5-10 mm long, yellow to orange, orbicular to obovate; silicles (excluding style) 3.5-5 mm long, sessile to substipitate, globose to obovoid, valves pubescent externally and internally; styles 2-4.5 mm long; ovules 2-6 per locule.—Blackbrush, cresote brush, and Joshua tree communities at lower elevations in Washington County (the type of var. *sessilis* is from St. George); Nevada and California south to Mexico.

Lesquerella tumulosa (Barneby) Reveal. [*L. hitchcockii* ssp. *tumulosa* Barneby] Perennial, pulvinate-cespitose, densely matted, caudex many-branched, branches clothed with numerous marcescent leaves and leaf bases; herbage pubescent with stellate hairs; stems 0.1-0.4 dm tall, erect, simple; leaves mainly basal, 0.2-1 (1.5) cm long, (0.07) 0.1-0.15 (0.2) cm wide, not differentiated into blade and petiole; pedicels 2-5 mm long, straight or S-shaped, spreading to ascending; sepals 2.8-4 mm long; petals 5-7 mm long, yellow, spatulate; silicles (excluding style) 2.7-3.8 mm long, substipitate, ovoid, valves glabrous externally and internally; styles 1.9-2.7 mm long; ovules 2-4 per locule.—White, bare shale knolls (Winsor Member of the Carmel Formation) among scattered juniper in a *Bouteloua* grassland, Kane County; endemic.

This plant was included with *L. rubicundula* by Rollins and Shaw (1973), but is distinct morphologically, spatially, and substrate-wise from that taxon as noted by Reveal (Great Basin Nat. 30:94-98. 1970).

Lesquerella utahensis Rydb. Perennial, cespitose, caudex usually simple, more or less clothed with persistent leaf-bases; herbage pubescent with stellate hairs; stems 0.2-1.5 dm tall or more, decumbent to ascending or erect; basal leaves 1.2-6.5 cm long, 0.1-0.5 cm wide; pedicels 3-10 mm long, sigmoid or curved, ascending; sepals 4.5-5.7 (7) mm long; petals 6.5-9 mm long, yellow, spatulate; siliques (excluding style) 3.5-4.5 (6) mm long, substipitate to sessile, globose-ellipsoid, compressed contrary to partition, valves pubescent externally, glabrous internally; styles 4-5.5 (6.5) mm long; seeds 3-6 per locule.—Openings among spruce-fir woodlands from 2600 to 3350 m elevation in Duchesne, Salt Lake, Summit, Uintah, Utah (the type is from American Fork Canyon), and Wasatch counties; endemic.

SOME NEW OR NOTEWORTHY NORTH AMERICAN CRUCIFERS

By Reed C. Rollins

The study of a quantity of miscellaneous material of the Cruciferae, chiefly from various correspondents, has elucidated a number of minor problems in several genera. In the present paper, these problems are dealt with briefly and some new entities in the family are described.

THELYPODIUM

The generic limits of *Thelypodium* are strained to include a newly discovered species from the desert region of California which seemingly must be associated with species usually placed in that genus. The plant, which I am calling *Thelypodium Jaegeri*, has flowers and fruits similar to those of *T. sagittatum*, but the caespitose habit and lack of basal leaves are not characteristic of *Thelypodium* as understood by Payson.[1] In these respects, our plant is somewhat like *T. linearifolium* Gray (*Sisymbrium linearifolium* [Gray] Payson), which was used as the basis for the monotypic genus *Hesperidanthus* by Rydberg.[2] The caespitose habit and lack of basal leaves of *T. Jaegeri* also fit *Glaucocarpum*, but the flowers and fruits are not in accord here.

In spite of the recent studies of Payson in *Thelypodium*[3] and certain North American species of *Sisymbrium*[3] where relatives of *T. Jaegeri* were treated, the generic disposition of a number of related species, placed in the segregate genus *Thelypodiopsis* by Rydberg[4] and Schulz,[5] seems not to have been established clearly. As data accumulate regarding imperfectly known species and new entities are discovered belonging to this alliance, the natural generic lines should become apparent. But, until a thorough, authoritative study of the several genera involved has been completed by some student of the group, it is deemed wise to use the broadly defined *Thelypodium* to include those species whose exact generic status must continue to be the object of careful study. Hence, the new plant is described in *Thelypodium* even though its position here may finally prove to be untenable.

I am indebted to Dr. P. A. Munz of Pomona College, who first perceived the novelty of this species and transmitted specimens to me for study, and to Mr. E. C. Jaeger, for whom the plant is named and who made a special trip to the site of his original collection to obtain more adequate materiel.

THELYPODIUM JAEGERI sp. nov.

Plate XLVI, fig. 3.

Herba perennis caespitosa multicaulis basi suffruticosa; caulibus erectis glabris gyrosis simplicibus vel rare superne ramosis 1-3 dm. altis;

[1] E. B. Payson, Annals of the Missouri Botanical Garden 9: 233-245. 1923.

[2] P. A. Rydberg, Bulletin of the Torrey Botanical Club 34: 434. 1907.

[3] E. B. Payson, University of Wyoming Publications in Science 1: 1-27. 1922.

[4] P. A. Rydberg, op. cit. p. 432.

[5] O. E. Schulz in Engler and Harms, Die Natürlichen Pflanzenfamilien 2 aufl. 17b: 582-583. 1936.

and leaves, *R. subumbellata* differs markedly in a number of characteristics. It has glabrous instead of hirsute siliques as in *R. calycina* var. *columbiae*, a tendency toward a subumbellate inflorescence in place of a much elongated raceme, an unexpanded rather than an expanded stigma and shorter styles than in *R. calycina* var. *columbiae*. Our plant is rhizomatous, usually having numerous connected, partially buried stems. From all appearances, it is adapted to loose or even shifting soil.

LESQUERELLA

LESQUERELLA RUBICUNDULA sp. nov.

Herba perennis humilis congesta; caulibus decumbentibus simplicibus 1-4 cm. longis; foliis linearibus vel lineari-oblanceolatis undique indumento argenteo-stellato tectis integris sessilibus 8-15 mm. longis, 1-2 mm. latis; sepalis cano-pubescentibus oblongis, 3-4 mm. longis, 1.5-2 mm. latis; petalis subluteis lineari-oblongis 4-5 mm. longis, 1-1.5 mm. latis; inflorescentiis congestis non elongatis; pedicellis 2-5 mm. longis; siliquis glabris subglobosis rubicundulis sessilibus 2.5-3.5 mm. longis; loculis ca. 4-ovulatis; seminibus immarginatis.

Diffuse perennial without a basal rosette of leaves; caudex highly branched and mat-forming; stems slender, numerous, spreading, densely crowded into a mat, scurfy-stellate, 1-4 cm. long; leaves crowded, linear to narrowly oblanceolate, encrusted with a stellate, silvery canescent pubescence, entire, non-petiolate, sessile, 8-15 mm. long, 1-2 mm. wide, often ciliate with a few simple trichomes near base; stellae peltate, small, rays distinct to base; inflorescence crowded; fruits clustered at apex of fertile stems; fruiting pedicels erect to widely spreading, straight to slightly curved, angular, densely pubescent, 2-5 mm. long; sepals oblong, tapering at apex, densely pubescent, scarious-margined, 3-4 mm. long, 1.5-2 mm. wide; petals pale yellow to nearly white, linear-oblong, not differentiated into blade and claw, 4-5 mm. long, 1-1.5 mm. wide; siliques glabrous, sessile, subglobose, crowded, 2.5-3.5 mm. long, nearly as broad as long, becoming reddish at maturity; styles 2-3 mm. long; stigma expanded; ovules usually 4 in each loculus, funiculi attached by about one-third their lengths; immature seeds orbicular, wingless, 1-1.5 mm. broad.

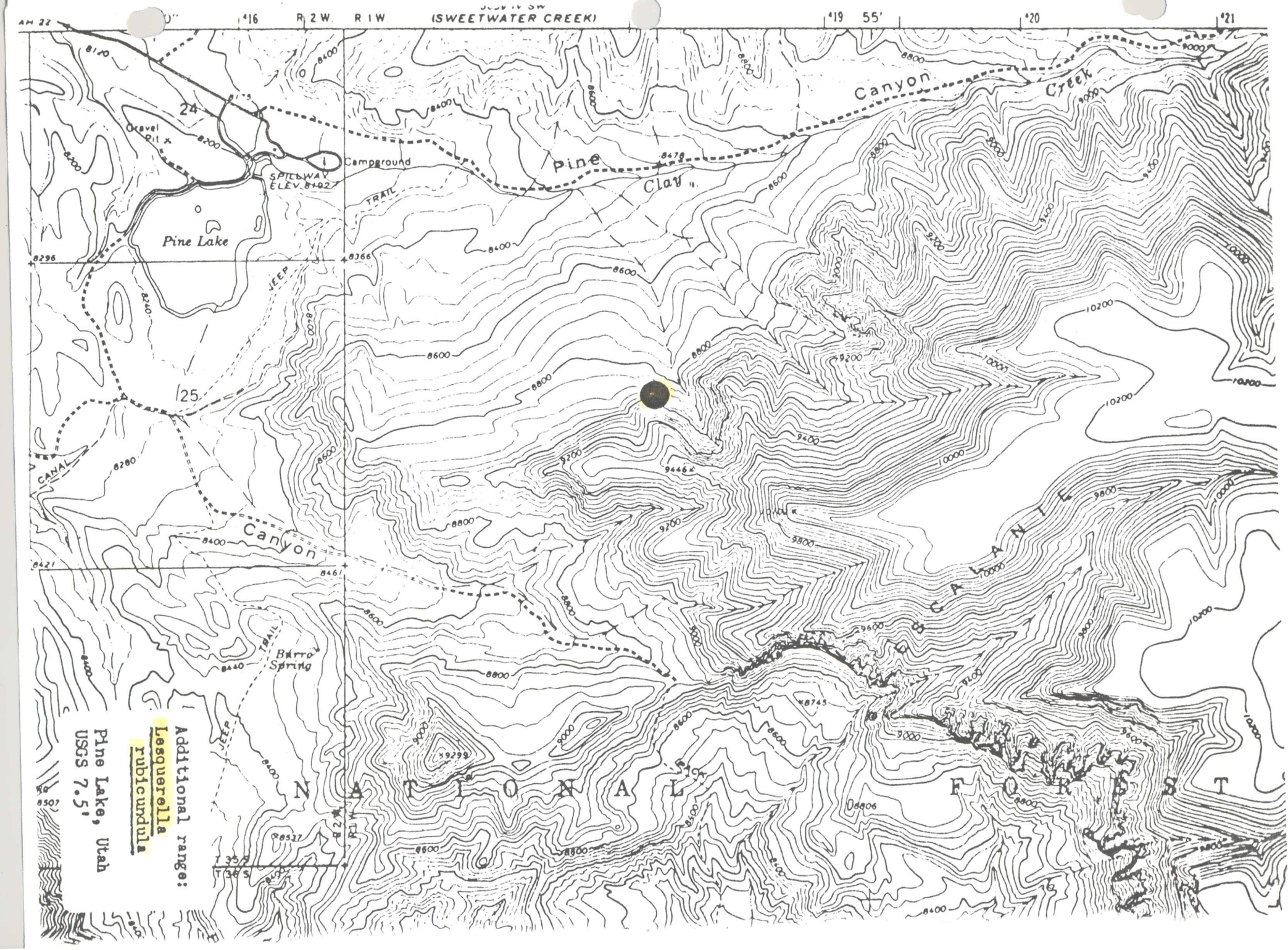
Type in the herbarium of the National Arboretum, collected at Red Canyon (about 12 miles east of Bryce Junction), Sevier Forest (now the Powell National Forest), Garfield Co., Utah, July 6, 1912, *W. W. Eggleston 8198*. A fragment of the type collection is in the Gray Herbarium.

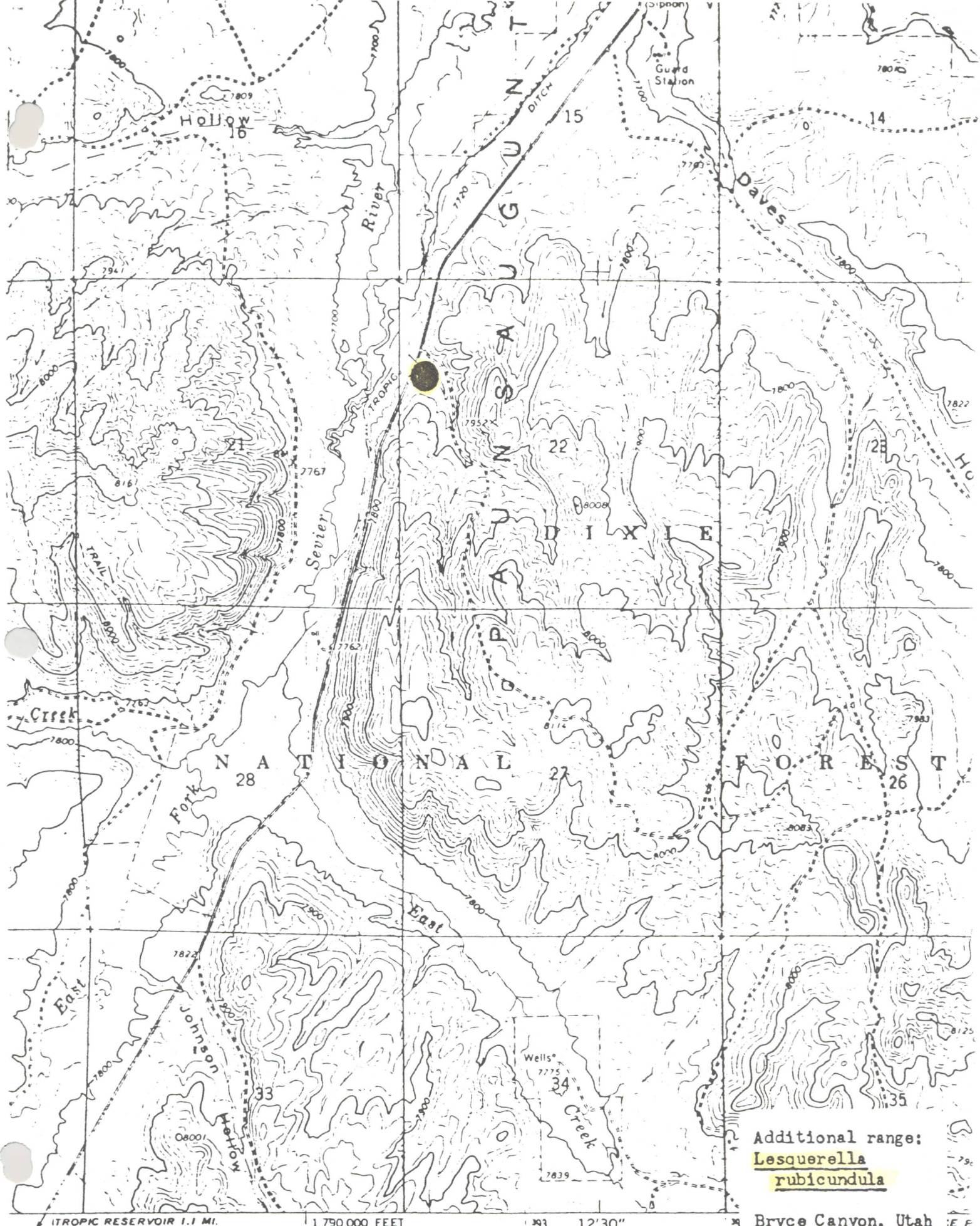
Lesquerella rubicundula is the second species of its type to be described in the genus. The other is the related *L. Hitchcockii*. These species are distinctive in *Lesquerella* because of their combined depressed matting habit, glabrous siliques and small short-rayed stellae. Our plant differs from *L. Hitchcockii* in having much shorter styles; longer, linear instead of obovate or spatulate leaves; and sessile instead of subsessile fewer siliques. The siliques of *L. rubicundula* are ruddy, but not a deep red as in *L. Hitchcockii*. The specimen, *M. E. Jones*, July 18, 1920, from Panguitch with "narrow leaves" mentioned by Kunz* probably belongs to our species, but if so it certainly is not conspecific with *L. Hitchcockii*.

*P. A. Kunz, Bulletin of the Torrey Botanical Club 56: 163. 1929.

Critical habitat: Lesquerella rubicundula

USGS - 7.5': Wilson Peak

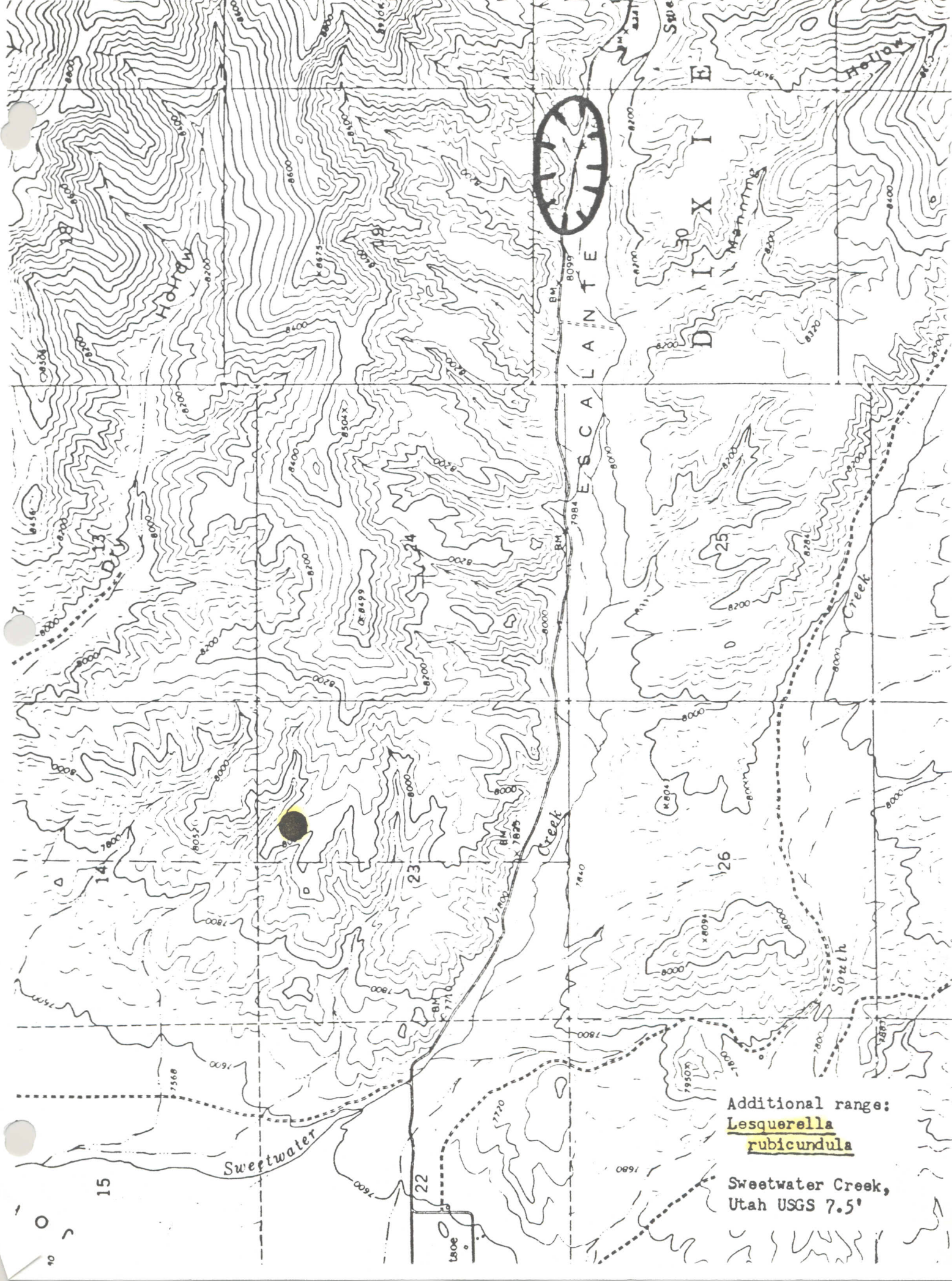

(SWEETWATER CREEK)
Pine Lake
Campground
SPILLWAY ELEV. 8402
Gravel Pit
TRAIL
JEEP
CANAL
Canyon
Pine Clay
Barro Spring
NATIONAL FOREST
SAN GABRIEL MOUNTAINS
Additional range:
Lesquerella rubicundula
Pine Lake, Utah
USGS 7.5'



Additional range:
Lesquerella
rubicundula

Bryce Canyon, Utah
USGS 7.5'

published by the Geological Survey
USC&GS



Additional range:
Lesquerella
rubicundula

Sweetwater Creek,
Utah USGS 7.5'

The Genus Lesquerella (Cruciferae) in North America

Reed C. Rollins and Elizabeth A. Shaw



Harvard University Press
Cambridge, Massachusetts
1973

plants, of drooping bud clusters. In this respect, and in the filiform pedicels, the species is similar to *L. recurvata* and very different from *L. angustifolia* and most populations of *L. gracilis*, where the bud clusters are usually erect and the pedicels are much stouter. In the "slender form" of *L. gracilis*, the bud clusters do tend to droop.

12. **Lesquerella rubicundula** Rollins

Plate 18, Figs. F–I. Plate 6; Map 9

Lesquerella rubicundula Rollins, Contrib. Dudley Herb. 3:178. 1941. Holotype: Utah. Garfield Co., Red Canyon (about 12 miles east of Bryce Junction), *Eggleston 8198* (NA), fragment (GH).

Lesquerella hitchcockii subsp. *rubicundula* (Rollins) Maguire & Holmgren, Madroño 11:175. 1951.

Lesquerella hitchcockii subsp. *tumulosa* Barneby, Leafl. West. Bot. 10:313. 1966. Holotype: Utah. Kane Co., 6.5 miles southeast of Cannonville, just south of the Garfield County line, *Barneby 14424* (NY); isotypes (BRY, CAS, GH, UC, US, UTC).

Lesquerella tumulosa (Barneby) Reveal, Great Basin Nat. 30:97. 1970.

Plants perennial, densely pubescent; trichomes on a short stalk, granular, the rays 4–6 and bifurcate near their bases and thus crowded; stems to 5 cm. long, numerous, even when fruiting usually buried among the densely crowded leaves, arising from the divisions of a woody caudex, this sometimes greatly enlarged and elaborately branched, the plants then cushionlike; leaves 3–15 mm. long, 0.5–2 mm. wide, linear or narrowly oblanceolate, entire and not clearly petiolate; inflorescences dense, the buds obovoid or ellipsoid; sepals 4–5.5 mm. long, oblong or elliptic, the lateral saccate, the median thickened at the apex and cucullate; petals 5–8 mm. long, 1.5–2.5 mm. wide, pale yellow or whitish, nearly linear with no distinction between blade and claw; filaments not dilated at the base, paired stamens 4–6.5 mm. long, single stamens 3-4.5 mm. long; glandular tissue hexagonal or pentagonal around the single stamens and subtending the paired stamens, sometimes developed between the latter; infructescences dense and compact, often subumbellate; pedicels 2–6 mm. long, straight or slightly curved and ascending; siliques 3–5.5 mm. long, sessile or substipitate, subglobose or ovoid and acute, reddish at maturity, the valves glabrous on the exterior and interior; septum usually entire and smooth, the

funicles attached about ⅓ their lengths; styles 2.5–4.5 mm. long, the stigmas slightly expanded; ovules 2–4 per locule; seeds 2–2.5 mm. long, flattened and suborbicular, reddish-brown, neither margined nor winged; cotyledons accumbent, longer than the radicle.

Flowering and fruiting from June into August at elevations of 5,700 to 7,300 feet in south central Utah. The plants occur on clayey slopes, on loose gravel or talus, or on white shale knolls, and the diversity in growth form reflects this diversity in habitat.

Additional specimens seen. **Utah: Garfield Co.,** Red Canyon, *Ripley & Barneby 7544* (CAS, NY, US); *Rollins 51203* (GH, MO, US), *57329* (GH); 3½ miles east of the mouth of Red Canyon, *Maguire 19075* (GH, NY, UTC, WS); north facing slope south of Red Canyon Campground, *Holmgren, Maguire & Maguire 10692* (NY, UTC); 1 mile east of Park boundary, near Tropic Road, Bryce Canyon National Park, *Buchanan 119* (GH); canyon above Tropic, *Jones 5302a* (US); Bryce Canyon, *Rollins 51300* (GH); 8 miles south of Hatch, *Ripley & Barneby 8528* (CAS, NY, US); **Kane Co.,** 6.6 miles southwest of the junction of the Cottonwood Wash Road and Utah Hwy. 54 at Cannonville, *Reveal, Gentry & Davidse 788* (BRY, GH, NY, UTC); **Iron Co.,** Cedar Breaks, *Eastwood & Howell 7292* (CAS, DS); half mile west of Lodge, Cedar Breaks, *Degener 16429* with Peiler (DS, RM).

The growth form of *Lesquerella rubicundula* is apparently very responsive to the substrate, and plants growing on loose, sliding surfaces develop slender elongated caudices which may be rather finely divided. The large mounded cushion plant form, which occurs at lower elevations near Kodachrome Flat below the Paunsagunt Plateau in northern Kane County, Utah, has been treated as a distinct subspecies (of *L. hitchcockii*) and, recently, as a species, but apart from this difference in growth form, we see nothing to separate it from the plants of the Bryce Canyon area.

Lesquerella rubicundula and *L. intermedia* occur together near Bryce Canyon and may be very much alike in habit. The species sometimes have been confused, but *L. rubicundula* is one of the species of Utah which has glabrous siliques, a character distinguishing it from *L. intermedia* as well as from *L.*

arizonica. There is a form of the glabrous-fruited *L. fendleri* which also resembles *L. rubicundula* in habit, but the former has fused trichomes and many more ovules per locule. It is tempting to see *L. rubicundula* as a derivative of an *L. fendleri*-like ancestor, but the species to which it seems most closely related is *L. hitchcockii* of the Charleston Mountains and the Quinn Canyon Range in Nevada. These species were united by Maguire and Holmgren (1951), who believed that *L. rubicundula* is only a narrow-leaved eastern form of *L. hitchcockii*. However, we consider them to be distinct (cf. discussion under *L. hitchcockii*). The differences in leaf-form of the two species are shown in Plate 18, Figs. H and M.

Since 1929, four named taxa have been proposed in this group. In addition to *Lesquerella hitchcockii* Munz and *L. rubicundula* Rollins, Maguire and Holmgren (1951) described *L. hitchcockii* subsp. *confluens* from Quinn Canyon Range and Barneby (1966) described a remarkably caespitose plant from Kane Co., Utah, as *L. hitchcockii* subsp. *tumulosa*. Recently Reveal (1970) has reached the conclusion, based on geographical isolation and disparity of life-forms, that each of these is a distinct species. We agree with him that the probability of gene exchange among these populations is slight, but that is the same as in different populations of many species of *Lesquerella*, and of other species of higher plants, which have remote populations. He also points out that characters of flowers and siliques are of little aid in delimiting taxa in this particular group and that vegetative characters must be used. However, even though the populations of the Quinn Canyon Range and the Kodachrome Flat area have begun some divergent tendencies, they do not merit a taxonomic status of their own and are included in, respectively, *L. hitchcockii* and *L. rubicundula*. Such a treatment is in line with our handling of similar situations throughout the genus.

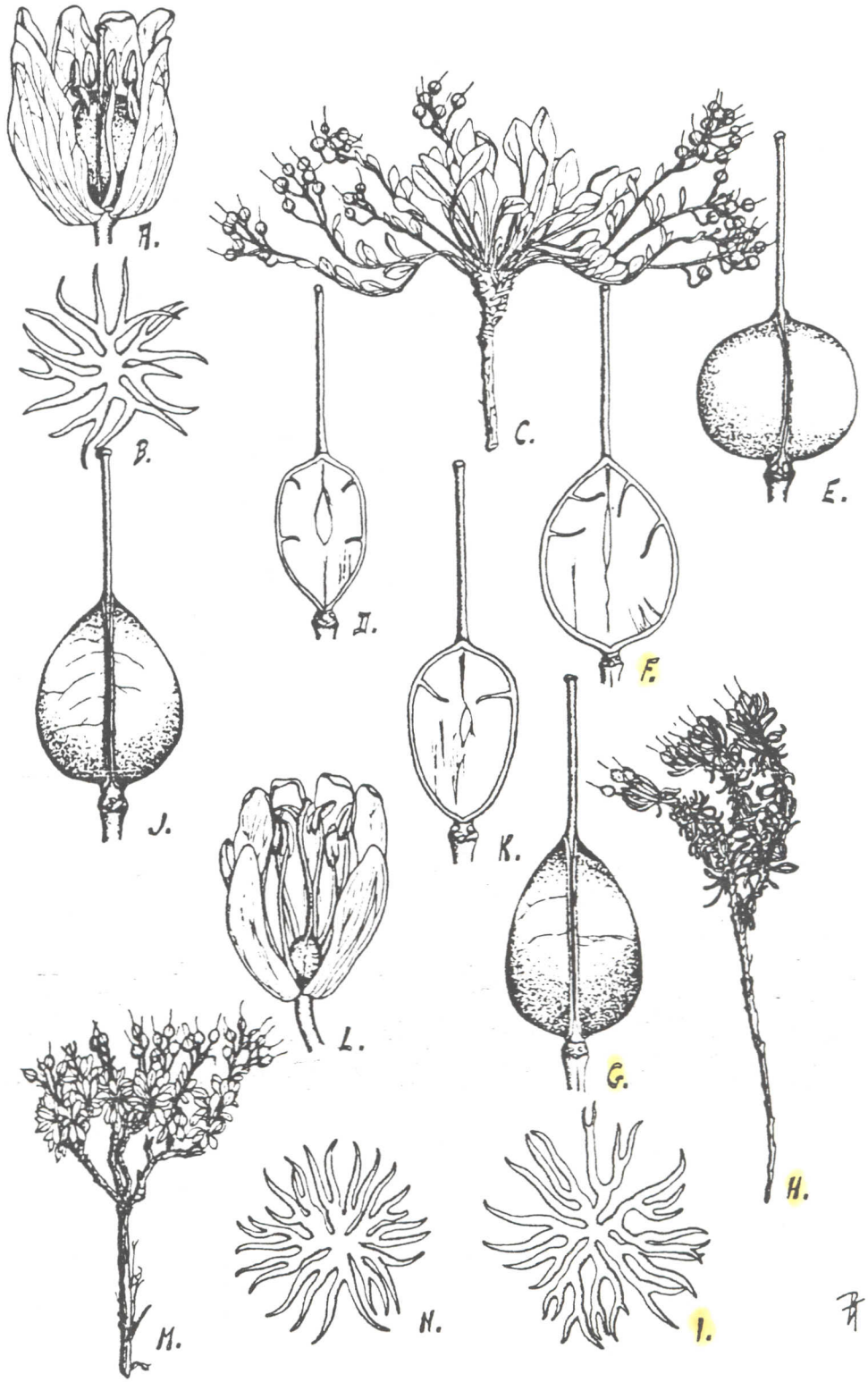
13. Lesquerella hitchcockii Munz

Plate 18, Figs. J–N; Map 9

Lesquerella hitchcockii Munz, Bull. Torrey Bot. Club 56:163. 1929. Holotype: Nevada. Clark Co., Charleston Mountains, *Jaeger & Hitchcock*, 1927 (POM).

Lesquerella hitchcockii subsp. *confluens* Maguire & Holmgren, Madroño 11:174. 1951. Holotype: Nevada. Nye Co., ridge north of Cherry Creek Pass,

Plate 18. Figs. A–E, *Lesquerella wardii,* Rollins 51221. Figs. F–I, *L. rubicundula,* Rollins 51203. Figs. J–N, *L. hitchcockii;* Fig. M, Alexander and Kellogg 1697; Figs. K–N excepting M, Clokey and Bean 5478. A, flower × 4; B, trichome × 80; C, habit × ½; D, replum × 5; E, silique × 5; F, replum × 5; G, silique × 5; H, habit × ½; I, trichome × 80. J, silique × 5; K, replum × 5; L, flower × 4; M, habit × ½; N, trichome × 80. Drawings by Miss B. Tugendhat.



UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

SPECIES: LESQUERELLA RUBICUNDULA ROLLINS SYNONYM(S): _____

FAMILY: CRUCIFERAE STATE: UTAH

EL CODE: _____ HERBARIUM: BRYCE CANYON N.P.

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
1.14.90 RECORDER CHAS. SCHELZ	GARFIELD	H. BUCHANAN/3125	210	DATE: 6.19.79 / T R S 1.5 mi. SOUTH OF INSPIRATION POINT JUNCT. ASSOC: EDGE OF PINE FOREST AND SAGE FLAT ELEV: 7950	
1.14.90 CHAS. SCHELZ	GARFIELD	R. GRAYBOSH/1335	209	DATE: 6.18.81 / T R S 0.8 KM NORTH OF BRYCE POINT. WASATCH FORMATION ASSOC: P. PONDEROSA, JUNIPER, WILD RYE, OREGON GRAPE, MANZANITA ELEV: 7600 FT.	
1.14.90 CHAS SCHELZ	GARFIELD	R. GRAYBOSH/747	209	DATE: 6.18.80 / T R S 0.5 mi. WEST OF SUNSET POINT ASSOC. MIXED CONIFEROUS FOREST OF PONDEROSA, LIMBER PINE, DOUG-FIR, JUNIPER, - BITTERBRUSH, POA FENDLERIANA ORYZOPSIS, SWERTIA ELEV: 8000'	
1.14.90 CHAS SCHELZ	GARFIELD	H. BUCHANAN/119	210	DATE: 6.15.57 / T R S 1 mi. EAST OF PARK BOUNDARY, NEAR TROPIC ROAD ON STEEP GRAVELLY HILLSIDE ELEV: 7300'	
				DATE: / T R S	
				DATE: / T R S	

Lomatium minimum (Mathias) Mathias Least Lomatium. [*Cogswellia minima* Mathias, type from Bryce Canyon]. Plants 2–12 (17) cm tall, acaulescent, glabrous or scabrous, from a branched caudex, the caudex branches clothed with persistent leaf bases; leaves once-pinnatifid or rarely trifid, with (3) 5–9 (13) segments; petioles to 2 cm long; blades 1–2.5 cm long, the segments 2–15 (20) mm long, 0.5–2 mm wide; peduncles to 10 (16) cm long; rays of the umbel 3–6, 0.3–2.3 (3.2) cm long; bractlets of the involucel 2–4 mm long, linear-subulate, separate; pedicels 1–3 mm long; calyx teeth to 0.6 mm long, acute, greenish or purplish in age with scarious margins; petals and stamens yellow, drying to cream; styles 1.5–2 mm long; fruit 4–7 mm long, 3–4 mm wide, the lateral wings 0.5–1 mm wide, the dorsal ribs mostly filiform. Forb-grass, ponderosa pine, and bristlecone pine communities, often on exposed ridges and raw escarpments, often on limestone at 2165 to 3170 m in Garfield, Iron, and Kane counties; endemic; 20 (0). This appears much like a diminutive form of *L. kingii*.

They show the characteristic pubescence of that species, while the leaves attached to the stems of the plant are apparently glabrous. The stem leaves are so badly withered that it is difficult to study them but the leaflets seem to be a somewhat different shape from those of the detached leaves.

44. Lomatium minimum Mathias, comb. nov.

Cogswellia minima Mathias, Ann. Mo. Bot. Gard. 19: 497. 1932.

Plants acaulescent, 1–3.5 cm. tall, glabrous or scabrous-puberulent; leaves narrowly oblong, the blades 0.5–2.5 cm. long, simply pinnate with 4–6 pairs of acute, distinct, entire or once-lobed leaflets, 2–10 mm. long, 1–1.5 mm. broad, the petiole 1–6 mm. long, entirely sheathing; peduncles equalling or slightly exceeding the leaves; umbels few-rayed, the rays unequal, 3–12 mm. long; involucel bracts subdimidiate, several, more or less distinct, narrow, acute, foliaceous, somewhat scarious-margined, shorter than to equalling the yellow flowers; umbellets few-flowered, the pedicels 1–2 mm. long; fruit oblong, 4–7 mm. long, 3–4 mm. broad, glabrous, the wings well-developed, about equalling the body, the oil tubes more or less obsolete.

TYPE: *Mathias 670*, near the hotel, dry slopes bordering Bryce Canyon, Utah, 8600 feet, 18 July 1929 (M).

DISTRIBUTION: Known only from the type locality and the Panguitch Plateau above Cedar Breaks, southwestern Utah.

SPECIMENS EXAMINED: UTAH: Cedar Breaks, *Jones* (Po); Panguitch, *Jones* (Po); on the edge of the Breaks, between the hotel and the camp ground, Cedar Breaks, near Cedar City, Iron Co., *Mathias 734* (M).

45. Lomatium oreganum Coult. & Rose, Contr. U. S. Nat. Herb. 7: 224. 1900.

Peucedanum oreganum Coult. & Rose, Rev. N. Am. Umbell. 64. 1888.
Cogswellia oregana (Coult. & Rose) Jones, Contr. Western Bot. 12: 35. 1908.

Plants very low, acaulescent, 2.5–6 cm. tall, villosulose throughout, from a multicipital woody caudex; leaves oblong, the blades 1–3 cm. long, bipinnate, the leaflets crowded, oblong, 2–3 mm. long, about 1 mm. broad, apiculate, the petioles 0.5–2 cm. long, sheathing below; peduncles exceeding the leaves; umbels greatly reduced, with one fertile umbellet, the fertile

UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

SPECIES: Lomatium minimum SYNONYM(S): _____

FAMILY: Umbelliferae STATE: Utah

EL CODE: _____ HERBARIUM: Bryce Canyon N.P.

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
1.14.90 RECORDER Chas Schelz	Garfield	R. Graybosch/1351	209	DATE: 6.26.81 / T R S 1 Km. East of Sunset Point. In gravels of streambed. Wasatch formation. Assoc: Lithospermum multiflorum, Arctostaphylos patula, Lesquerella rubicundula, Haplopappus armerioides Elev: 7400'	
1.14.90 Chas Schelz	Garfield	H. Buchanan/3359	209	DATE: 6.25.80 / T R S Sagebrush opening near head of East Creek.) 2 mi. South of Inspiration Pt. Junct. Assoc: Sagebrush Elev: 8000'	
1.14.90 Chas Schelz	Garfield	R. Graybosh/829	209	DATE: 6.22.80 / T R S NW end of Little Henderson Cyn. Gully in breaks community Assoc: Ponderosa, Bristlecone + Limber Pines, Juniper Mountain Mahogany Elev: 7500'	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	

***Oxytropis jonesii* Barneby** Jones Oxytrope. Acaulescent, densely pulvinate-caespitose; pubescence basifixed, villous-pilose; leaves 0.7–3 cm long; leaflets 1–7, 2–11 mm long, 1–3.5 mm wide, lanceolate to lanceoblong, pilose to strigose on both surfaces, quite sessile; scapes 0–3.5 cm long, villous-pilose; racemes 1– to 5–flowered, the flowers ascending at fruit; bracts pilose; flowers (11) 14–16.5 mm long, pink purple; calyx 7.5–9.5 mm long, the tube shortly cylindric, 4.5–7 mm long, the teeth 1.5–3 mm long, triangular to subulate; pods sessile or subsessile, erect, bladdery-inflated, 14–25 mm long, 8–13 mm wide (when pressed), semibilocular, villous-pilose. Ponderosa pine, western bristlecone pine, and mixed desert shrub communities on Flagstaff Limestone, Pink Limestone member of Wasatch Formation, and on Green River Shale, at 1930 to 2430 m in Emery, Garfield (type from Red Canyon), Grand, Iron, Sanpete, and Uintah counties; endemic; 27 (vi). The Jones oxytrope is probably better treated as a variety of *O. oreophila*, but no such combination is intended or implied herein.

Oxytropis jonesii





any one station show something of the same variation. Thus Mr. Howell's fine series from Mt. San Gorgonio *(J. T. Howell 23668*, CAS, RB) includes densely pulvinate mats as well as looser individuals with exserted peduncles. In the region of Bryce Canyon, Utah (Red Canyon, *Ripley & Barneby 8546)*, gnarled, woody-caudexed cushions were found on open gravel ridges which, seeding down into a wash among the yellow pines, gave rise to lax and slender tufts with obscurely developed caudex, longer and more ample leaves and larger flowers. The Charleston Mt. material, from "broken rock just below timberline," combines the condensed foliage and few-flowered raceme of the alpine state with scapes as long, though prostrate, as found in the mesophytic extreme. Conversely diminutive plants from Hatch, Utah *(Pierson 12606*, RB), are long-bracted and many-flowered. Since like diversity, little or not at all correlated with habitat or distribution, exists in length of calyx-teeth, length and width of petal, in outline of pod, and in other characters, it seems impossible to recognize in *O. orcophila* more than a single plastic species.

Oxytropis orcophila was described from Ward's Utah material and from two collections *(W. G. Wright in 1879*, GH; *Lemmon 1170*, GH) from the San Bernardino Mts., California. Wheeler (l. c., sub *Astragalo Munzii)* has designated *Ward 541* as lectotype, a choice that is readily accepted. Apart from a mistaken record from Idaho (Rydb., Fl. Rocky Mts., 520, 1917) there has been no confusion as to the range or identity of *O. orcophila*. Gray's "possible variety . . . or related species, with flowers immersed in the tufts of foliage" (Proc. Amer. Acad., 20: l.c.) alludes to *Ward 571* (GH, US), from Rabbit Valley, Utah, which represents the condensed form of low altitude (in this case about 6800 ft.) mentioned above. The specimens, to which Gray gave an unpublished varietal name with the pencilled query, "an *orcophila* pedunculis brevissimis?" have unusually small flowers and short calyx-teeth. Except for these characters, quite variable in the species, the material well matches *Ripley & Barneby 4753* from 6700 ft. in eastern Sevier County, Utah, about twenty miles north of Rabbit Valley.

The species closely resembles *O. Parryi*, which varies in parallel, though less extreme, fashion. The latter is distinguished by the narrow, coriaceous pod and constantly few-flowered raceme. A form of *O. Lagopus* var. *atropurpurea* with uncommonly short, subglobose and inflated pod bears a strong resemblance to some states of *O. orcophila*, but differs in the much larger corolla with dilated wing-petals.

8. Oxytropis Jonesii Barneby, new species

Oxytropis Jonesii, sp. nov. ex affinitate *O. orcophilae* Gray, cujus a formis et maxime congestis et pauciflоris corolla legumine necnon seminibus majoribus, foliolis paucis tantum 1–3-jugis, aliisque notulis diversa. — ? *O. multiceps* var. *minor* sensu Graham, Ann. Carn. Mus. 26:256. 1937; non Gray.

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Herba acaulescens densissime pulvinata, caudicis multicipitis lignei ramulis crassis 1–5 cm. longis stipulis marcidis arcte indutis columnaribus; foliis rosulatis 0.7–2 cm. longis suberectis, pilis argenteis patulis vel adscendentibus ubique sericeis; stipulis ad 6 mm. usque longis, petiolo brevissimo alte adnatis, extus pilosis vel laminis liberis deltoideis 1–1.5 mm. longis piloso-ciliatis dorso nonnumquam glabratis; foliolis 1–7 ellipticis obtusiusculis 2–5 (7) mm. longis, subpalmatim congestis vel rachi ad 6 mm. usque longo producto pinnatis; pedunculis piloso-hirsutis 0.3–1 (2.5) cm. longis folia rarissime superantibus; racemo 1–3 (5) -floro, subcapitato, fructifero haud elongato, floribus patulis; bracteis lineari-oblanceolatis 2–5 mm. longis, extus pilosis; pedicellis 0.5–2 mm. longis; calycis profunde campanulati pilis brevibus fuscis longisque argenteis commixtis dense piloso-hirsuti tubo (4.5) 5–7 mm. longo demum rupto, dentibus deltoideis vel ovato-subulatis 1.5–2.5 mm. longis; corolla violaceo-purpurea; vexillo late oblanceolato vel obovato 14.5–16 mm. longo, 6–9 mm. lato, emarginato; alarum 14–16 mm. longarum limbo oblique dilatato truncato vel leviter retuso 3.5–5 (6) mm. lato, auriculo (2 mm.) incluso 8–9 mm. longo; carinae 11–12.5 mm. longae laminis (appendiculo subulato subrecto circa 1 mm. long incluso) 6–7 mm. longis; legumine sessili vel subsessili (stipes saepissime obsoleta raro 0.6 mm. usque longa producitur) ovoideo vesicario-inflato, paullo obcompresso, 1.5–2.5 cm. longo, in rostrum conico-deltoideum compressum 2–4 mm. longum leviter declinatum abruptiuscule angustato, ventraliter sulcato, valvulis chartaceis, villis patulis pallidis (saepissime brevioribus pullis adspersis) hirsutulis, sceus suturam ventralem anguste inflexis ut alam intus productam 1.2–2 mm. latam efforment; ovulis numerosis; seminibus fusco-castaneis 2.8–3 mm. longis. *Type:* pink calcareous gravel benches, Red Canyon, Garfield County, Utah, alt. 7150 ft., 7 June 1947, fl. & fr., *Ripley & Barneby 8550,* in Herb. Calif. Acad. Sci. *No. 337311:* isotypes GH, NY, WYO.

Distribution: Bare gravelly knolls and ridges, on shale or limestone, alt. 6300–7750 ft., Paunsagunt and East Tavaputs plateaux, Utah, Map 4.

Specimens examined: UTAH. Red Canyon, 10 mi. w. of entrance to Bryce Canyon, *C. L. Hitchcock 2961* (WTU). 2 mi. w. of Bryce Canyon, *Degener 16412* (NY). Bryce Canyon, *M. E. Jones in 1919* (POM), *Eastwood & Howell 728* (CAS). Widtsoe, foothills of Escalante Range, *Ripley & Barneby 8572* (CAS). Watson-Ouray road, 5 mi. w. of Bitter Creek, Uintah County, *E. H. Graham 8989* (GH, US).

Oxytropis Joneesii is clearly related to, and perhaps derived from *O. orcophila,* the most dwarf and pulvinate, few-flowered states of which are similar in appearance. The greater size of the flowers and fruits, combined with leaves reduced both in amplitude and in number of leaflets, distinguish it immediately. It was at first suspected that the early collections represented no more than a modification of the plastic *O. orcophila* to the peculiar

environment of naked limestone benches on the Paunsagunt Plateau; but in Red Canyon a colony of typical *O. oreophila*, with well-furnished racemes of small flowers, developed peduncles and elongate 9-11-foliolate leaves, was found growing under apparently identical conditions a few paces from the group of plants from which the type of *O. Jonesii* was taken. In Garfield County, where *O. Jonesii* has been met with in half a dozen stations, the species is abruptly confined to ridges of the pink Wasatch limestone where it forms densely packed cushions of silvery foliage 1–3 dm. in diameter, liberally decorated with almost stemless violet flowers or the dusky bladders of the fruit. It is associated with several narrow regional endemics of other genera, such as *Lomatium minimum, Townsendia minima, Silene Petersonii* var. *minor, Eriogonum arctioides*, and *Draba subalpina*, and a distribution similar to theirs might be expected. It may be that the *Oxytropis* from the Green River shale in southern Uintah County belongs to a distinct race or species. The material is young and does resemble *O. multiceps* var. *minor* to which Graham referred it, but the broad floral bracts characteristic of *O. multiceps* are lacking. Apart from slightly more numerous (2–5) flowers to the raceme, the plants from this outlying station seem an excellent match for those to the west. Certain identification must await discovery of the fruit.

Oxytropis Jonesii is dedicated to the memory of Marcus Eugene Jones, pioneer botanist in the Great Basin and monographer of American *Astragalus*, who discovered the species in 1919.

9. Oxytropis Parryi Gray

Oxytropis Parryi Gray, Proc. Amer. Acad., 20:4. 1884. *Spiesia Parryi* (Gray) O. Kze., Rev. Gen., 206. 1891. *Aragallus Parryi* (Gray) Greene, Pittonia, 3:211. 1897. *Astragalus Parryanus* Tidestr., Proc. Biol. Soc. Wash., 50:19. 1941 (as "*parryanus*"); non *A. Parryi* Gray.

Low and densely cespitose, the several crowns clustered on a taproot, the branches of the caudex densely clothed with a thatch of persistent petioles and leaf-bases; herbage densely silky-pilose throughout, canescent or tawny in age, the hairs loosely to strictly appressed; stipules membranous becoming chartaceous, at first connate opposite the petiole but early ruptured, pilose dorsally, or the triangular to shortly acuminate ciliate free blades (2–4 mm. long), especially of those subtending secondary leaves, at length glabrate; leaves (1.5) 2.5–7 cm. long, somewhat dimorphic, erect or spreading, the petioles 0.5–2.5 (3) cm. long; leaflets 9–15 (17), narrowly oblong, elliptic or ovate, acutish or obtuse, 2.5–12 mm. long, flat or involute-conduplicate, commonly crowded and subcontiguous; scapes either strict, sigmoid-arcuate, ascending or prostrate, 2.5–7.5 (10) cm. long, equalling or surpassing the leaves, appressed-pilose but often bearing a few loosely ascending hairs, especially below the inflorescence; racemes subcapitately 1–3, usually 2-flowered, the flowers nearly erect; bracts lanceolate, acutish

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UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

PECIES: OXYTROPIS JONESII SYNONYM(S):

AMILY: STATE: UTAH

L CODE: HERBARIUM: BRYCE CANYON NP

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
1.14.90 RECORDER CHAS SCHELZ		K.E. WEIGHT/ B-31 102	215	DATE: 6.29.31 / T R S	
1-14-90 CHAS SCHELZ		K.E. WEIGHT/ B-31 36	215	DATE: 6.11.31 / T R S	
.14.90 CHAS SCHELZ	GARFIELD	R. GRAYBOSCH/813	209	DATE: 6.21.80 / T R S RIM OF PLATEAU AT TRAIL TO BOAT MESA. WASATCH FORM. ASSOC: BREAKS COMMUNITY OF PONDEROSA, JUNIPER, MAHOGANY ELEV: 7800'	
1.14.90 CHAS SCHELZ	GARFIELD	H. BUCHANAN/3114	210	DATE: 6.18.9079 / T R S RIM OF PLATEAU, SOUTH OF INSPIRATION PT. ELEV: 8000 FT.	
1.14.90 CHAS SCHELZ		K.E. WEIGHT/ B-31 125	215	DATE: 7.20.31 / T R S	
				DATE: / T R S	

Pediomelum pariense





SCIENTIFIC NAME: Psoralea pariensis Welsh and Atwood

FAMILY: Fabaceae

CITATION: Great Basin Naturalist 35: 353. 1975.

SYNONYMS: None

COMMON NAME: Paria breadroot

KNOWN DISTRIBUTION: Garfield and Kane cos., Utah

HABITAT: Wasatch Limestone Formation, alluvium or sandy alluvium; ponderosa pine woods community

ELEVATION: 5600 to 8000 feet (1700 to 2430 m)

DESCRIPTION: Acaulescent or subacaulescent, 2-9 cm tall, from slender subterranean caudex branches arising from deep-seated tuberous roots; stems lacking or with very short internodes above ground, strigose; leaves mainly 3-foliate, petioles 1.3-7 cm long, strigose; leaflets 9-25 mm long, 7-22 mm wide, obovate or orbicular, cuneate, rounded to truncate or emarginate apically, gray green, glandular, strigose beneath, yellow green, glandular and strongly strigose along the veins above; stipules scarious, 4-10 mm long; peduncles 0.5-2.8 cm long, hairs appressed; racemes 6- to 15-flowered; calyx 8.6-11.4 mm long, lower teeth to 6.8 mm long; pods included in the calyx, about 9 mm long.

TAXONOMIC PROBLEMS: P. pariensis is related to P. megalantha, but differs in the shorter flowers and showy white veins on the upper side of the leaves.

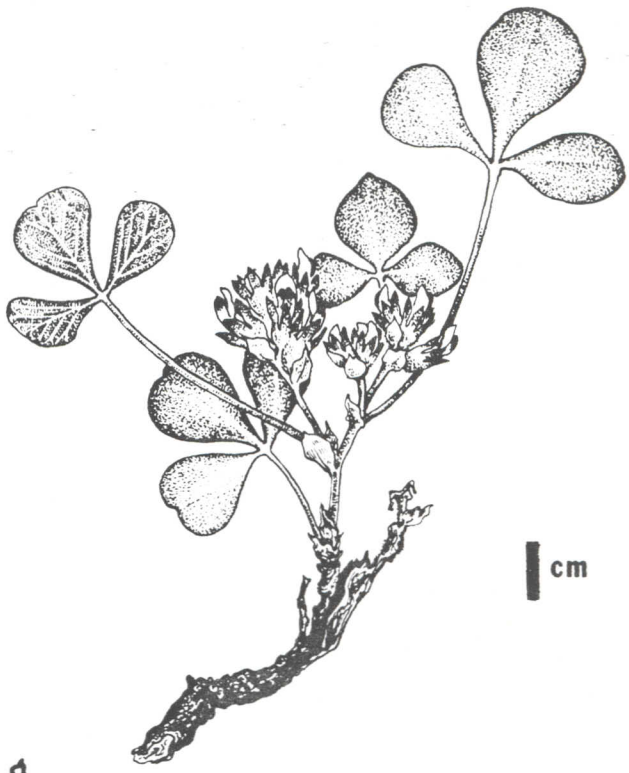
EXISTING OR POTENTIAL THREATS: Land management policy changes and potential construction threaten this species.

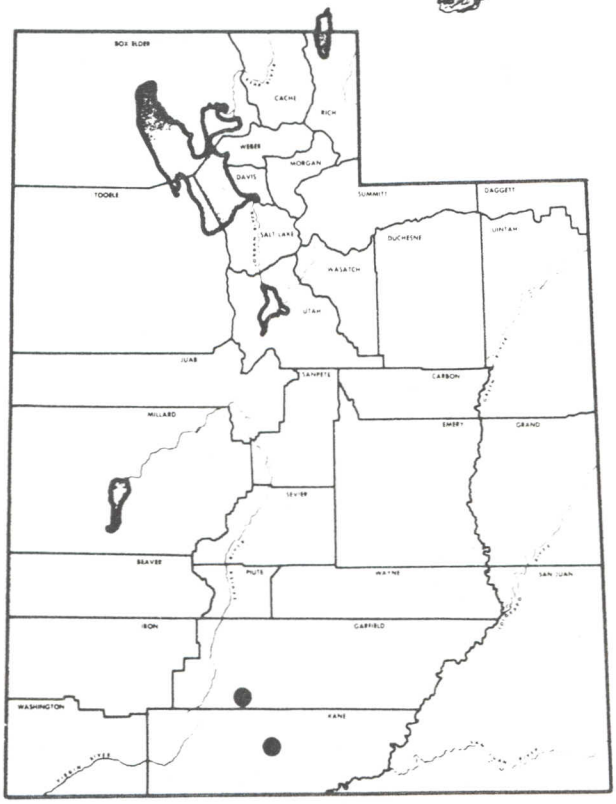
LAND OWNERSHIP/MANAGEMENT: National Park Service; Bureau of Land Management

REMARKS: Although known from several localities, the Paria breadroot is still imperfectly known taxonomically.

RECOMMENDATIONS: This plant should be regarded as threatened.

Psoralea pariensis





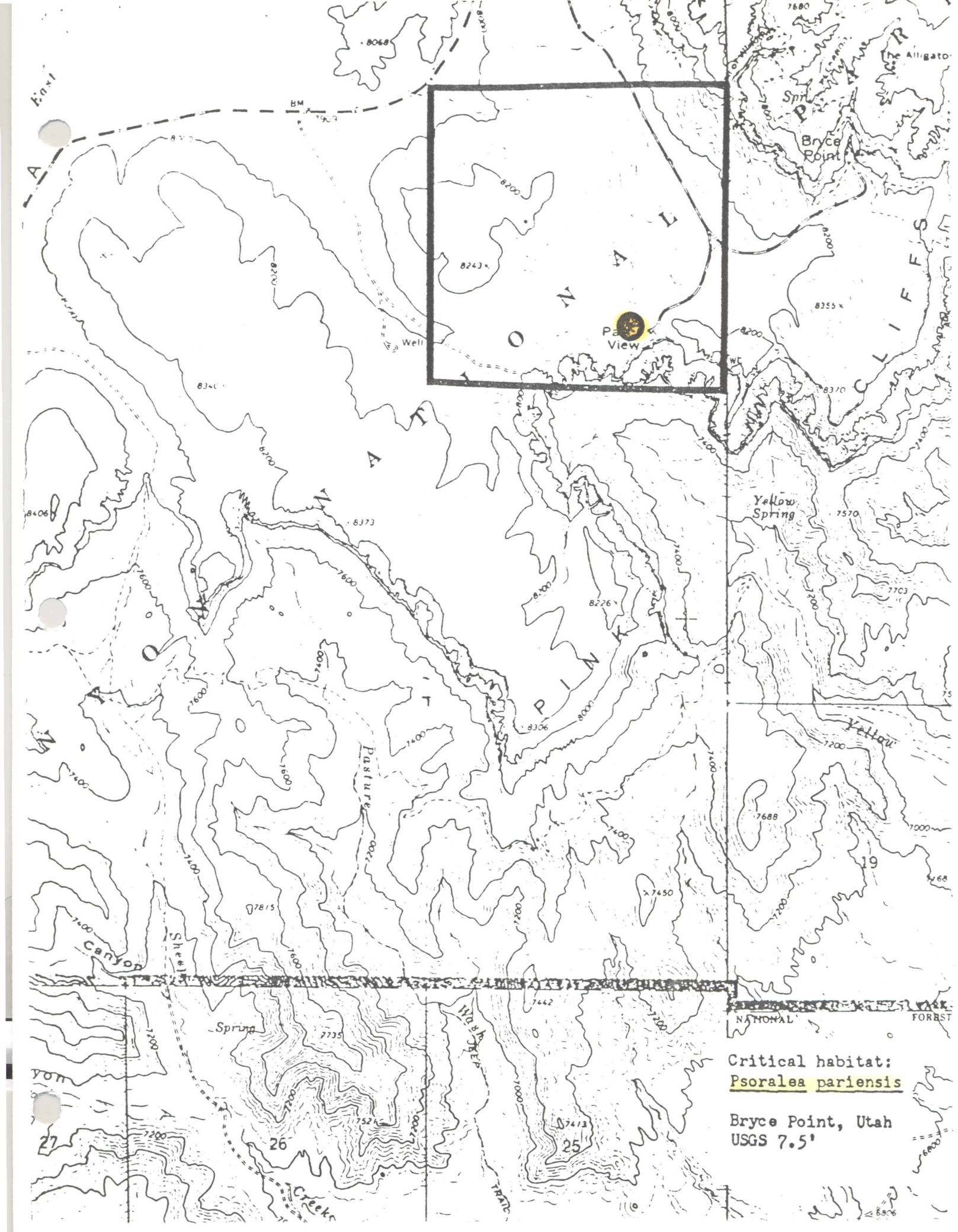
UTAH FLORA -- FABACEAE (LEGUMINOSAE)

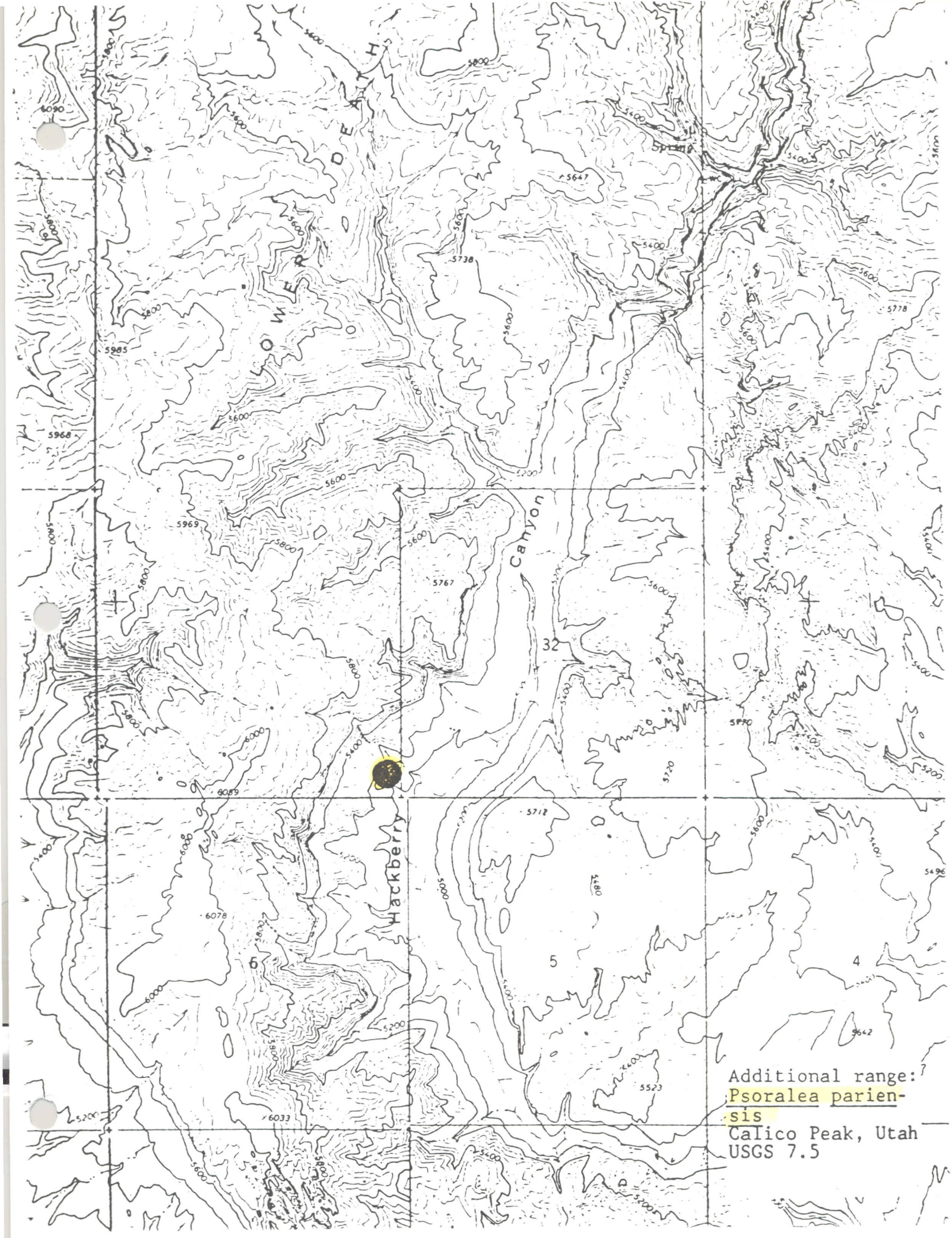
STANLEY L. WELSH[1]

[1] Department of Botany and Range Science, and Life Science Museum, Brigham Young University, Provo, Utah 84602

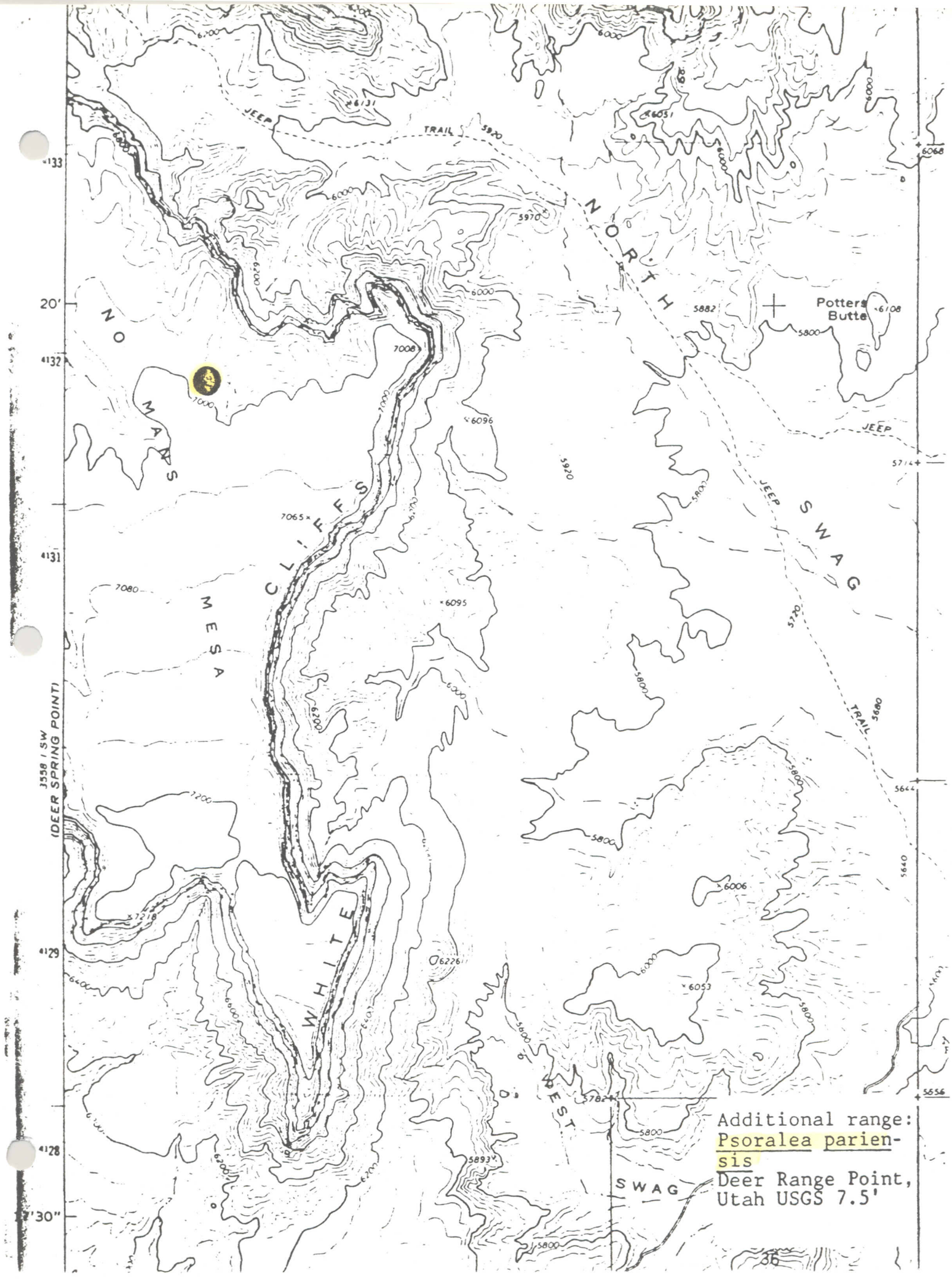
Abstract.-- A revision of the legume family, Fabaceae (Leguminosae), is presented for the state of Utah. Included are 243 species and 59 varieties of indigenous and introduced plants. A key to genera and species is provided, along with detailed descriptions, distributional data, and pertinent comments. Proposed new taxa are Astragalus lentiginosus Dougl. ex Hook, var. wahweapensis Welsh; Astragalus subcinereus A. Gray var. basalticus Welsh; Hedysarum occidentale Greene var. canone Welsh; Oxytropis oreophila A. Gray var. juniperina Welsh; and Trifolium andersonii A. Gray var. friscanum Welsh. New combinations include Astragalus bisulcatus (Hook.) A. Gray var. major (M. E. Jones) Welsh; Astragalus consobrinus (Barneby) Welsh; Astragalus pubentissimus Torr & Gray var. peabodianus (M. E. Jones) Welsh; Lathyrus brachycalyx Rydb. var. zionis (C. L. Hitchc.) Welsh; Lathyrus lanzwertii Kellogg var. arizonicus (Britton) Welsh; Lathyrus langwertii Kellogg var. laetivirens (Greene) Welsh; Lupinus argenteus Pursh var. moabensis (Dunn & Harmon) Welsh; Lupinus argenteus Pursh var. rubricaulis (Greene) Welsh; Lupinus caudatus Kellogg var. argophyllus (A. Gray) Welsh; Lupinus caudatus Kellogg var. cutleri (Eastw.) Welsh; Lupinus pusillus Pursh var. rubens (Rydb.) Welsh; Lupinus sericeus Pursh var. barbiger (S. Wats.) Welsh; Lupinus sericeus Pursh var. marianus (Rydb.) Welsh;

Psoralea pariensis Welsh & Atwood in Welsh, Atwood, & Reveal. Paria Breadroot. Acaulescent or subacaulescent, 2-9 cm tall, from slender subterranean caudex branches arising from deep-seated tuberous roots; stems lacking or with very short internodes above ground, strigose; leaves mainly 3-foliolate; petioles 1.3-7 cm long, strigose; leaflets 9-25 mm long, 7-22 mm wide, obovate or orbicular, cuneate, rounded to truncate or emarginate apically, gray-green, glandular, and strigose beneath, yellow-green, glandular and strongly strigose along veins above; stipules scarious, 4-10 mm long; peduncles 0.5-2.8 cm long, the hairs appressed to ascending; racemes mainly 6- to 15-flowered, 1-2.5 cm long; pedicels 1-3.8 mm long; bracts abruptly acuminate, 4-8 mm long; flowers 8.8-12.5 mm long, the banner cream to ochroleucous, the wings and keel purple or suffused with purple; calyx 8.6-11.4 mm long, the tube 3.3-4.6 mm long, more or less gibbous at the base, the lower calyx teeth 5.3-6.8 mm long, about twice broader than the others; pods included in the calyx, about 9 mm long. Ponderosa pine and juniper-pinyon woods at 1700 to 2430 m in Garfield (type from Bryce Canyon) and Kane cos.; endemic; 8 (ii).


Bryce Point
Yellow Spring
Yellow
Pasture
Canyon
Spring
Creek
NATIONAL
FOREST
19
26
25
27
Critical habitat:
Psoralea pariensis
Bryce Point, Utah
USGS 7.5'



Additional range:
Psoralea pariensis
Calico Peak, Utah
USGS 7.5



Additional range:
Psoralea pariensis
Deer Range Point, Utah USGS 7.5'

ENDANGERED FLORA PROJECT--SMITHSONIAN INSTITUTION

NAME *PSORALEA PARIENSIS Welsh-Atwood* | FAMILY *FABACEAE*

ORIGINAL LOCALITY *Utah: Garfield Co., Bryce Canyon Nat. Park.* | TYPE OF HABITAT *Ponderosa pine woods, as ground layer*

MAXIMUM KNOWN RANGE
BRYCE CANYON, GARFIELD CO., UTAH Also Kane Co. (Reveal)

PROBABLE PRESENT RANGE

WHERE AND WHEN LAST SEEN OR COLLECTED AND BY WHOM

PROBABLE PRESENT STATUS (Underline) INCREASING DECREASING STATIONARY RARE
VERY RARE UNCERTAIN PROBABLY EXTINCT THREATENED

REMARKS (Use Back If Necessary) *Endemic rare / thr. (Reveal, Harris?)*

REPORT BY:
REVEAL 17 DEC 75. Pl. of P. Gr. Basin Nat. 35(4): 353. 1975 (See for additional localities)

SI-3058
11-22-74

ANALYSIS OF COMMUNITY COMPOSITION AND HABITAT OF *PEDIOMELUM PARIENSE* (FABACEAE) IN BRYCE CANYON NATIONAL PARK

Gregory P. Hallsten[1,2] and David W. Roberts[1]

ABSTRACT - The distribution of *Pediomelum pariense* in Bryce Canyon National Park, Utah, and the vegetation and soils associated with it are described. Management suggestions are presented.

Information about the habitat of a plant species proposed for threatened or endangered designation is essential. A detailed habitat description provides guidance for the search for other possible locations to improve knowledge of the species' distribution and abundance, which can affect decisions about its status and identify areas where special protection may be warranted. A habitat description also provides information required for planning and executing recovery programs: selection of possible transplant sites; guidelines for vegetation manipulation to increase or improve habitat.

Paria breadroot, *Pediomelum pariense* (Welsh & Atwood) Welsh (=*Psoralea pariensis* Welsh & Atwood), is under consideration for Federal protection as a threatened species (Welsh and Chatterley 1985). The type specimen was collected in Bryce Canyon National Park, and this Utah endemic is known elsewhere only from two locations in Kane County. This paper describes the habitat of the Bryce Canyon population of Paria breadroot.

STUDY AREA

The study area is located in Bryce Canyon National Park on the canyon rim on the east edge of the Paunsaugunt Plateau in southern Utah. Surficial geology consists of Wasatch Formation limestones derived from Tertiary fresh-water sediment depositions (Hintze 1973, Lindquist 1977). The soils are fine-

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textured with varying amounts of coarse fragments, and the surface is often covered with a stony pavement. The terrain is flat to slightly undulating with occasional draws. Elevation is about 8000-83000 feet.

The vegetation is open forest, consisting largely of the Pinus ponderosa/Arctostaphylos patula (PIPO/ARPA) habitat type with pockets of the Abies concolor/Arctostaphylos patula (ABCO/ARPA) habitat type, especially in the draws (Youngblood and Mauk 1985).

METHODS

Areas where Paria breadroot is known to occur were searched for the plants and mapped (Fig. 1). Other portions of the Park having similar combinations of forest habitat and soils, based on U.S. Soil Conservation Service soils maps, were also searched.

Eight 0.1 acre macroplots were located subjectively to describe areas where the species occurs. Each macroplot had a 100-foot line-intercept transect, randomly oriented, running through its center. Ten 20 X 50 cm quadrats were placed at 10-foot intervals along the right side of the transect, and perpendicular to it, beginning at the 10-foot mark. Understory cover was estimated from the quadrats (Daubenmire 1959), and frequency and density were estimated from the transect. Trees within the macroplot were measured for breast-height diameter (dbh) to determine basal area.

After vegetation sampling, ten samples of the surface 10 cm of mineral soil were taken at 10-foot intervals, beginning at the 10-foot mark of the transect, air dried, pooled by macroplot, and analyzed for pH, percent organic matter, P (sodium carbonate solution), and Ca, Mg, and K (sodium acetate solution).

Taxonomic nomenclature follows Welsh et al. (1987).

RESULTS

The observed distribution of Paria breadroot is shown in Fig. 1. No other populations were found.

Macroplots 2 and 6 were located in the ABCO/ARPA habitat type, the rest were in the PIPO/ARPA habitat type. Average cover, frequency, and density of understory species by macroplot are shown in Table 1. Tree diameter class and basal area estimates by macroplot are given in Table 2.

Arctostaphylos patula was constant throughout and was the dominant shrub, in terms of cover, frequency, and density, in all macroplots except macroplot 6, which was located in the ABCO/ARPA habitat type. There it had the same density as Mahonia repens, but occurred more frequently. Mahonia repens had a greater estimated coverage but this may be an incorrect assumption since it did not occur in any of the quadrats and its cover was estimated from the line-intercept transect.

Carex rossii was the only graminoid to occur in all macroplots and was generally dominant. In macroplot 1, Elymus elymoides had greater density than C. rossii, but accounted for less cover and frequency. Macroplots 3 and 6 were dominated in all respects by Stipa hymenoides.

No single forb species, other than P. pariense, was universally constant among macroplots. The most common forbs were Arenaria fendleri, Hymenoxys acaulis, and Petradoria pumila. Dominance of the three species varied among the five macroplots in which they were found together such that no one species can be considered to be dominant among forbs for the study area.

Shrubs were the dominant understory morphological class, followed closely by forbs. Graminoids were relatively unimportant. In general, the understory vegetation with which P. pariense is associated is dominated by A. patula and a

mixture of forbs and graminoids, especially A. fendleri, H. acaulis, P. pumila, and C. rossii.

In the overstory, the macroplots in the PIPO/ARPA habitat type were dominated by the signature tree except macroplot 4 where the only measurable tree was Juniperus scopulorum. Pinus ponderosa was incidental in the occurrence of young trees too short for dbh measurement. The distribution of diameter classes of P. ponderosa in the six PIPO/ARPA macroplots indicates that vegetation in this habitat type is at or near climax, and approximates the description of this type given by Youngblood and Mauk (1985).

In the two macroplots in the ABCO/ARPA habitat type, A. concolor is associated with other, less shade-tolerant, trees and is not dominant, indicating that these sites are in an early seral stage. Continued development of A. concolor on these sites will probably lead to additional crown closure and loss of some or all of the associated tree species.

When the macroplots are lumped according to the habitat types, P. ponderosa dominates in terms of basal area in both types: about 70% (25 ft^2/ac) in the PIPO/ARPA type and about 45% (33 ft^2/ac) in the ABCO/ARPA type (Table 3). Pediomelum pariense was found in measurable quantities in all PIPO/ARPA marcoplots except macroplot 7, a harsh site dominated by Pinus longaeva. Of the ABCO/ARPA macroplots, only macroplot 2 had measurable quantities of P. pariense. This species was incidental on macroplot 6 which had the greatest tree basal area of all macroplots.

The results of the soil analysis are presented in Table 4. The most noticeable feature is the wide fluctuation in the Ca:Mg ratio. These fluctuations did not seem to affect the presence of P. pariense, however, as the sites with the highest and lowest ratios were similarly endowed with this species.

CONCLUSIONS

The results of this study indicate that Pendiomelum pariense is an element of open-growth climax PIPO/ARPA type forests on Wasatch Formation limestone soils, with dominant understory species consisting of Arctostaphylos patula, Arenaria fendleri, Hymenoxys acaulis, Petradoria pumila, and Carex rossii. It may also appear in early seral stages of other forest habitat types on these soils, associated with climax PIPO/ARPA, when the crown canopy is still open. Crown closure would probably eliminate the species from these types.

Until the status of Paria breadroot is determined, the sites where it occurs should be protected from disturbance. One small patch of the species is near the trail between the Paria View overlook and a parking lot. Any development there should be pursued very carefully to avoid damaging or destroying the site. Because the species grows quite close to the rim of the canyon to the south of Paria View, any hiking trail or other tourist facility development there should also be planned with care or avoided.

Other sites in the Park, and elsewhere in southern Utah, with similar vegetation and soils characteristics should be carefully searched for other populations of Paria breadroot.

Vegetation manipulation to improve the habitat of the species is an option to be considered. This could consist of the removal of more shade-tolerant tree species from stands where P. pariense occurs and where P. ponderosa dominates, thus reducing tree basal area and maintaining an open canopy. This is probably a relatively short-term aid to the survival of the species and great care must be exercised to avoid damaging breadroot plants and disturbing the understory unduly.

Seeding or transplanting may be possible to increase the distribution and abundance of Paria breadroot. To be safe, only sites closely approximating

those described here should be used for such exercises. Because of the limited number of plants available seeding should be considered first to avoid loss of existing plants. Transplanting from less-than-optimum seral sites should be the next method to be considered. In any case, attempts to introduce the species on other sites should be preceded by studies of its reproductive biology so that existing populations will not be depleted needlessly.

ACKNOWLEDGMENTS

We thank Linda Kerr, Bryce Canyon National Park, for her administrative and field assistance. This work was funded by National Park Service Research Cooperative Project.

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Table 1. Cover, frequency, and density of plant species.

Macroplot number	1	2	3
Location:			
Quarter quarter	SENW	SENW	NWSW
Section	13	13	13
Township	37S	37S	37S
Range	4W	4W	4W
Topographic position:			
Slope (percent)	5	20	5
Aspect (degrees)	65	145	345
Elevation (feet)	8240	8200	8280
Bearing (degrees)	328	122	164
Cover/Frequency/Density			
Trees			
Abies concolor	-	*	-
Juniperus osteosperma	*	-	-
Juniperus oscpulorum	-	(1.7)/10/2	*
Pinus longaeva	-	-	-
Pinus ponderosa	*	*	*
Pseudotsuga menziesii	-	*	-
Shrubs			
Arctostaphylos patula	3/30/4.1	12.8/100/51	7.9/100/33.7
Ceanothus martinii	-	0.4/40/14.3	(7.4)/20/3.3
Cercocarpus ledifolius	*	-	-
Chrysothamnus depressus	-	-	*
Chrysothamnus parryi	*	*	*
Gutierrezia sarothrae	-	*	0.5/(20)/-
Juniperus communis	-	*	*
Mahonia repens	-	-	-
Ribes cereum	-	-	-
Symphoricarpos oreophilus	*	*	*
Tetradymia canescens	(0.2)/10/1.4	*	(0.7)/10/1.1
Graminoids			
Carex rossii	2/30/5.5	(1.3)/20/6.1	0.3/20/5.4
Elymus elymoides	0.3/20/6.8	-	0.3/10/1.1
Elymus lanceolatus	-	-	-
Elymus salinus	-	-	-
Muhlenbergia montant	-	-	*
Poa fendleri	*	*	-
Stipa comata	-	-	0.8/10/1.1
Stipa hymenoides	-	*	(0.9)/60/7.6
Forbs			
Arbis demissa	0.5/30/5/5	*	-
Arenaria fendleri	(1.2)/30/4.1	-	*
Astragalus sp.	-	-	-
Astragalus convallarius	0.3/20/2.7	*	0.3/20/2.2
Astragalus humistratus	*	-	-
Astragalus kentrophyta	(0.1)/10/1.4	-	-
Astragalus megacarpus	-	-	-
Castilleja linariifolia	(0.1)/10/1.4	-	0.3/(10)/-
Cirsium sp.	-	*	*

Clematis columbiana	-	-	-
Cryptantha sp.	*	-	*
Draba subalpina	-	-	-
Erigeron canus	*	-	-
Eriogonum alatum	*	(0.1)/10/2	*
Eriogonum racemosum	(0.8)/10/1.4	-	*
Euphorbia brachycera	-	(0.4)/10/2	*
Gilia aggregata	*	*	*
Haplopappus armerioides	-	-	-
Hymenoxys acaulis	1/40/20.5	0.5/20/8.2	0.3/10/1.1
Hymenoxys richardsonii	0.3/20/2.7	-	0.5/30/3.3
Linum kingii	-	-	2.3/40/5.4
Linum perenne	-	-	(0.2)/10/1.1
Machaeranthera canescens	-	*	-
Machaeranthera grindelioides	0.3/10/1.4	-	0.5/30/5.4
Oenothera howardii	-	-	0.5/50/6.5
Pediomelum pariense	(0.8)/30/4.1	0.5/30/12.2	0.8/80/17.4
Penstemon sp.	(2.1)/10/2.7	-	-
Penstemon caespitosus	(0.5)/10/1.4	-	-
Petradoria pumila	5/80/32.9	0.3/10/-	*
Phlox sp.	-	-	-
Senecio multilobatus	*	*	(0.5)/10/1.1
Stempanomeria tenuifolia	*	-	-
Streptanthus cordatus	-	*	-
Yucca angustissima	-	-	(1.9)/10/3.3
unknown forb	-	0.3/10/2	-
forb 1	-	-	-
forb 2	-	-	-

Cover was estimated using quadrat frames. Where this figure is presented in parentheses, the species did not occur in a quadrat and cover was estimated from the line-intercept transect.

Frequency and density were estimated using line-intercept transects. Where the frequency figure is presented in parentheses, the species did not occur on the transect and frequency was estimated from quadrats. Where a dash occurs in the density position, the species did not occur on the transect. Density was not recorded in the quadrats so no figure can be given.

* indicates occurrence within the macroplot but not on the transect or in the quadrats.

Taxonomy follows A Utah Flora.

4	5	6	7	8
NWSE	SWSW	NESW	SWSE	SWSW
13	13	13	13	13
37S	37S	37S	37S	37S
4W	4W	4W	4W	4W
10	10	25	10	15
255	315	70	305	325
8220	8240	8160	8220	8290
358	246	62	96	294
-	-	(0.5)/10/3.8	-	-
-	-	-	-	-
*	6.3/(10)/-	-	*	-
-	-	-	*	-
*	(1.7)/10/1.7	*	*	*
-	-	*	-	-
8.5/80/44.1	3.5/50/22	3/40/23.1	5.8/60/4.29	6.5/70/44.4
*	0.3/10/1.7	*	-	0.8/20/5.6
-	*	-	-	-
-	-	-	-	-
*	-	-	-	*
-	-	-	-	-
-	(10)/10/3.4	-	-	*
-	-	(5.4)/30/23.1	-	-
*	-	-	-	-
-	-	(0.8)/10/3.8	-	-
-	*	-	*	*
0.5/70/11.9	0.5/30/10.2	(0.1)/10/3.8	(2.9)/30/9.5	0.5/30/11.1
-	-	-	-	*
-	-	-	-	*
-	-	-	*	(0.1)/10/2.8
-	-	-	-	-
*	-	0.3/10/3.8	-	-
-	-	-	-	-
0.3/(10)/-	-	(0.4)/30/15.4	-	*
-	-	-	-	-
0.5/10/1.7	0.8/40/10.2	*	0.5/40/16.7	0.5/20/5.6
-	(0.2)/10/1.7	*	-	0.3/(10)/-
0.3/10/1.7	-	*	-	0.3/10/2.8
-	-	-	-	-
0.3/20/8.5	-	-	-	-
(0.5)/10/5.1	-	-	-	-
-	0.3/(10)/-	-	-	(0.1)/10/2.8
*	(0.7)/20/3.4	-	*	*

-	-	(1)/10/3.8	0.3/(10)/-	0.5/30/8.3
*	0.3/(10)/-	-	0.3/20/4.8	0.5/20/5.6
-	-	0.3/10/3.8	-	-
-	-	-	-	-
*	*	-	-	-
*	-	-	-	-
(0.4)/20/3.4	0.3/(10)/-	-	*	0.5/(20)/-
-	-	-	-	-
*	-	-	*	-
0.5/30/8.5	0.8/60/11.9	-	(0.3)/20/7.1	0.5/10/2.8
*	(0.4)/10/1.7	-	(0.2)/10/2.4	*
*	0.8/60/18.6	-	*	*
*	-	-	-	-
-	-	-	-	-
*	0.5/10/1.7	-	*	0.3/(10)/-
-	0.3/20/3.4	*	(0.3)/10/4.8	0.3/(10)/-
0.8/30/8.5	0.3/20/3.4	*	*	(0.3)/10/2.8
-	-	-	-	-
(2.3)/20/3.4	-	-	-	-
1.8/20/3.4	0.8/10/5.1	-	0.3/20/4.8	0.3/20/5.6
-	-	-	*	-
*	-	*	-	*
-	-	-	-	-
-	-	-	-	-
*	*	(3.6)/10/3.8	*	*
-	-	(1.6)/10/7.7	-	-
-	-	-	(0.5)/20/4.8	-
-	-	-	(0.3)/10/2.4	-

Table 2. Diameter classes and basal areas of trees.

Species	Basal Area (ft^2/ac)	Diameter (dbh) Class in Inches 0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24
Macroplot 1													
Pinus ponderosa	42.3					1		2			1		
Total	42.3												
Macroplot 2													
Abies concolor	0.07	1											
Juniperus scopulorum	0.03	1											
Pseudotsuga menziesii	0.5		1										
Total	0.6												
Macroplot 3													
Juniperus scopulorum	7.6						1						
Pinus ponderosa	19.3	1									1		
Total	26.9												
Macroplot 4													
Juniperus scopulorum	0.1	2											
Total	0.1												
Macroplot 5													
Juniperus scopulorum	0.3	4											
Pinus ponderosa	29.2	1		1									1
Total	29.5												
Macroplot 6													
Abies concolor	12.9				2		1						
Juniperus scopulorum	10.8	3				1	1						
Pinus ponderosa	67.3	1	1						1	1	2		
Pseudotsuga menziesii	52.6	2	1						1	1		1	
Total	143.6												
Macroplot 7													
Juniperus scopulorum	14.5									1			
Pinus longaeva	38.3					1	1		1	1			
Pinus ponderosa	19.5										1		
Total	72.3												
Macroplot 8													
Pinus ponderosa	40.6		1	3	1	2	1	2					
Total	40.6												

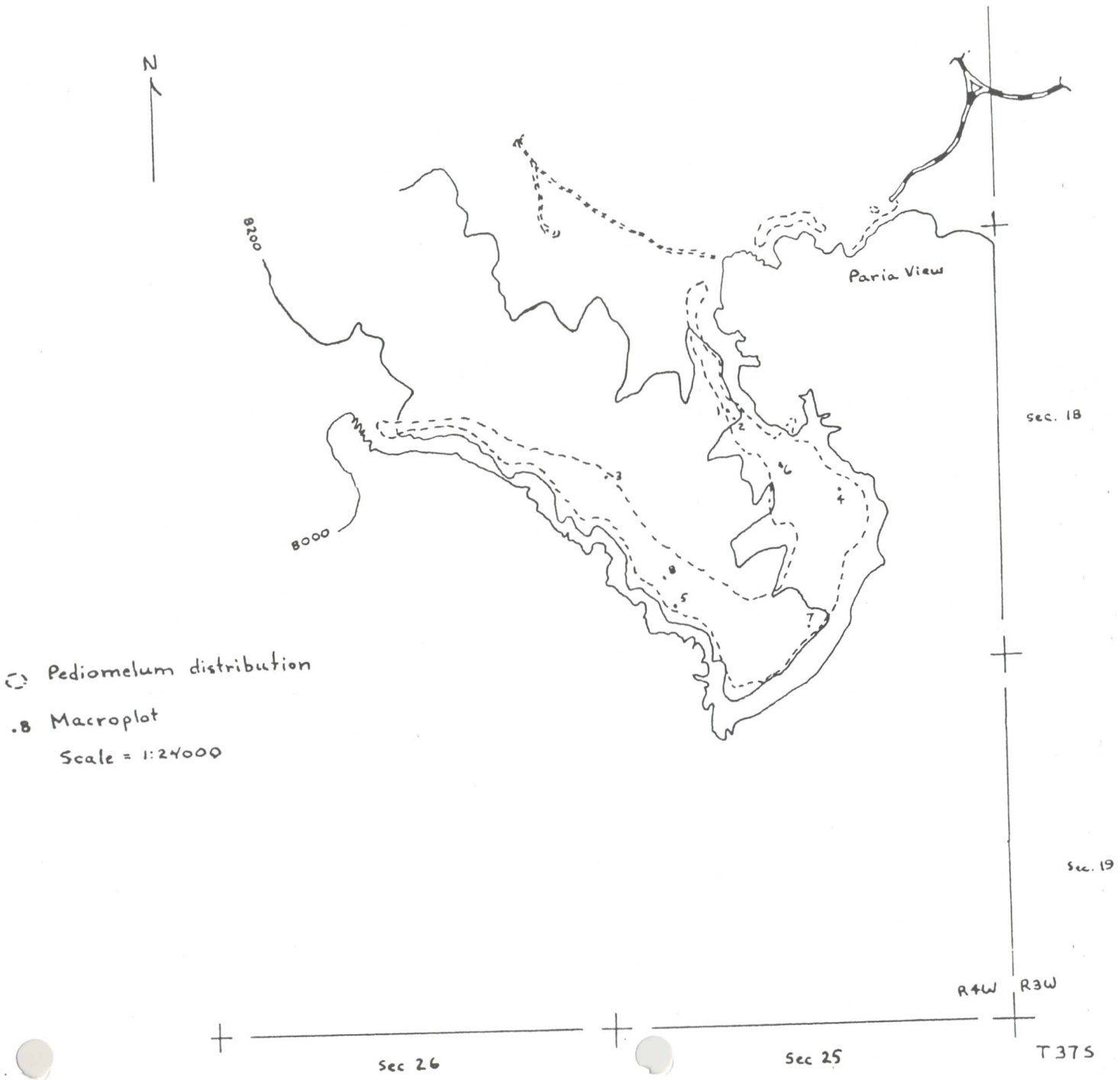
Table 3. Basal area by habitat type.

Species	Habitat Type: PIPO/ARPA (n=6) Total	$\bar{x}$	% of Total	ABCO/ARPA (n=2) Total	$\bar{x}$	% of Total
Abies concolor				12.97	6.49	8.99
Juniperus scopulorum	22.5	3.8	10.6	10.83	5.42	7.51
Pinus longaeva	38.3	6.4	18.1			
Pinus ponderosa	150.9	25.2	71.3	67.30	33.65	46.67
Pseudotsuga menziesii				53.10	26.55	36.82
Total	211.7	35.4		144.20	72.11	

Table 4. Soil analysis.

Macroplot	pH	Organic Matter (%)	P (mg/ kg)	K (meq/ 100g)	Ca (meq/ 100g)	Mg (meq/ 100g)	Ca:Mg
1	7.7	8.7	5.0	1.97	101.6	14.21	7.2
2	7.7	13.0	7.8	1.93	158.7	9.88	16.1
3	7.9	6.3	3.3	1.41	75.1	7.01	10.7
4	7.6	12.0	7.1	1.31	125.6	7.26	17.3
5	7.8	13.5	4.8	1.54	148.8	17.61	8.5
6	7.8	14.1	6.1	1.78	126.4	9.12	13.9
7	7.9	17.6	5.3	1.03	126.1	13.50	9.3
8	7.8	15.3	5.6	1.34	135.1	18.30	7.4
$\bar{x}$	7.8	12.6	5.6	1.54	124.7	12.11	11.3
SE	0.1	3.6	1.4	0.33	26.3	4.45	4.0

Fig. 1. Study area.



UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

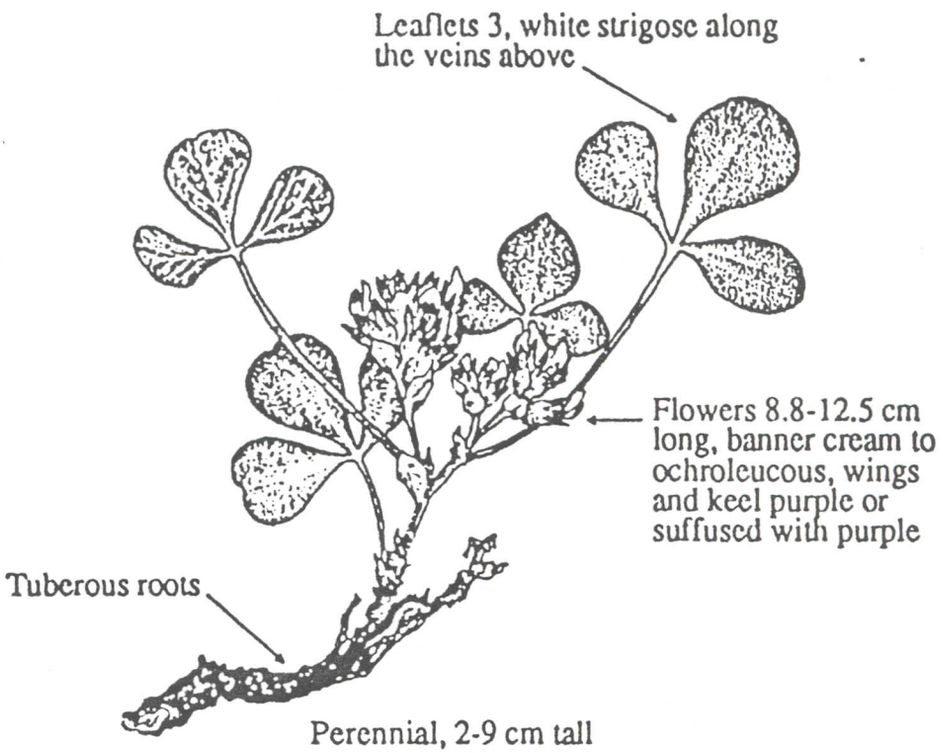
SPECIES: PEDIOMELUM ~~PE~~ PARIENSE (WELSH + ATWOOD) SYNONYM(S): WELSH

FAMILY: LEGUMINOSAE STATE: UTAH

EL CODE: HERBARIUM: BRYCE CANYON N.P.

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
1.14.90 RECORDER CHAS SCHELZ		K.E. WEIGHT/B-31 6-305	215	DATE: 6.9.31 / T R S	
1.14.90 CHAS SCHELZ	GARFIELD	H. BUCHANAN/2979	210	DATE: 8.22.78 / T R S NEAR RIM OF PLATEAU, SOUTH OF PAKIA VIEWPOINT ELEV.: 8000'	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	

***Pediomelum pariense* (Welsh & Atwood) Welsh** Paria Breadroot. [*Psoralea pariensis* Welsh & Atwood, type from Bryce Canyon]. Acaulescent or subacaulescent, 2–9 cm tall, from slender, subterranean caudex branches arising from deep-seated tuberous roots; stems lacking or with very short internodes above ground, strigose; leaves mainly 3–foliolate; petioles 1.3–7 cm long, strigose; leaflets 9–25 mm long, 7–22 mm wide, obovate or orbicular, cuneate, rounded to truncate or emarginate apically, gray green, glandular, and strigose beneath, yellow green, glandular, and strongly strigose along veins above; stipules scarious, 4–10 mm long; peduncles 0.5–2.8 cm long, the hairs appressed to ascending; racemes mainly 6– to 15–flowered, 1–2.5 cm long; pedicels 1–3.8 mm long; bracts abruptly acuminate, 4–8 mm long; flowers 8.8–12.5 cm long, the banner cream to ochroleucous, the wings and keel purple or suffused with purple; calyx 8.6–11.4 mm long, the tube 3.3–4.6 mm long, more or less gibbous at the base, the lower calyx teeth 5.3–6.8 mm long, almost twice broader than the others; pods included in the calyx, ca 9 mm long. Ponderosa pine and juniper pinyon woods at 1700 to 2430 m in Garfield (type from Bryce Canyon) and Kane counties; endemic; 8 (ii).



PEDIOMELUM PARIENSE

Scientific Name: *Pediomelum pariense* (Welsh & Atwood) Welsh
Common Name: Paria breadroot
Family (Common Name): Fabaceae or Leguminosae (Pea Family)
Synonyms: *Psoralea pariensis* Welsh & Atwood
Global and State Rank: G1/S1
Federal Review Status: C2
Global Distribution: Southern Utah
State Distribution: Garfield, Washington, and Kane counties
Ownership: USDA FS?, BLM, NPS, and private
National Forest: Dixie?
Habitat: Ponderosa pine and pinyon-juniper communities on calcareous or sandy soils between 5,575 to 8,000 feet elevation. June-July.

STATUS REPORT

Psoralea pariensis

I. Nomenclature

A. Family name: Fabaceae

Synonyms: Leguminosae

Common name: Pea family

B. Species name: Psoralea pariensis Welsh and Atwood

Citation: Great Basin Naturalist 35: 353. 1975.

Synonyms: None

Common name: Paria breadroot

II. Legal Status

A. Federal: None

B. State: None

C. Other: Recommended as threatened by S. L. Welsh, 1978a.

III. Description

A. Field identification features: Acaulescent or subacaulescent, from slender subterranean caudex branches arising from deep-seated tuberous roots; stems lacking or with very short internodes above ground, strigose; leaves mainly 3-foliolate; petioles strigose; leaflets obovate or orbicular, cuneate, rounded to trancate or marginate apically, gray-green, glandular, and strigose beneath, yellow-green, glandular, and strongly strigose along veins above.

B. Brief description: Acaulescent or subacaulescent, 2-9 cm tall, from slender subterranean caudex branches arising from tuberous roots; stems lacking or with very short internodes above ground,

strigose; leaves mainly 3-foliolate; petioles 1.3-7 cm long, strigose; leaflets 9-25 mm long, 7-22 mm wide, obovate or orbicular, cuneate, rounded to truncate or marginate apically, gray-green, glandular, and strigose beneath, yellow-green, glandular and strongly strigose along veins above; stipules scarious, 4-10 mm long; peduncles 0.5-2.8 cm long, the hairs appressed to ascending; racemes mainly 6- to 15-flowered, 1-2.5 cm long; pedicels 1-3.8 mm long; bracts abruptly acuminate, 4-8 mm long; flowers 8.8-12.5 mm long, banner cream to ochroleucous, wings and keel purple or suffused with purple; calyx 8.6-11.4 mm long, the tube 3.3-4.6 mm long, about twice borader than the others; pods included in the calyx, about 9 mm long (Welsh, 1978b).

C. Closely related species: P. megalantha Wooton and Standl.

IV. Geographical Distribution

A. Past: Unknown

B. Present: Garfield and Kane Counties, Utah

C. Potential: Unknown

V. Taxonomic Problems

This breadroot has close affinity to P. megalantha, but the flowers are shorter and the veins on the upper side of the leaves are white-strigose.

VI. Habitat Description

A. Plant community: Ponderosa pine and juniper-pinyon woodlands

B. Dominant plants: Pinus ponderosa, Juniperus osteosperma, and Pinus edulis

C. Elevational ranges: 5500-8000 feet (1700-2440 m)

D. Exposure and slope: Exposure variable; slope from 0-10%

E. Edaphic features: Calcareous or sandy soils

F. Geology: Pink Limestone Member of Wasatch Formation, Navajo Sandstone, and Quaternary alluvium

G. Other habitat features: Unknown

VII. Population Biology

A. Number of populations (est.): Three

B. Number of individuals/population (est.): More than 20

C. Reproduction methods: Unknown

D. Age classes: Juvenile to mature

E. Time of flowering and fruiting: June and July

F. Dispersal mechanisms: Unknown

G. Pollinators, if any: Unknown

H. Other biological factors: Unknown

I. Current population dynamics; trends and status: Unknown

VIII. Critical Habitat Recommendations

A. Geographic boundaries: Sec. 12 of T37S, R4W, Bryce Canyon National Park, Garfield County, Utah.

B. Physical attributes: Ground layer in open ponderosa pine woodlands at about 8200 feet elevation.

IX. Threats to Survival

A. Nature of existing threats to survival:

1. Threatened destruction, modification, or curtailment of habitat or range, if any: Off-highway use of Bryce Canyon National Park, and potential mineral exploration and industrial development in the remainder of the range.

2. Over utilization for commercial, sporting, scientific, or educational purposes, if any: None

3. Disease, predation, grazing, or trampling, if any: Some trampling potential, especially in Bryce Canyon National Park.

4. Inadequacy of existing regulatory mechanisms, if any: Unknown

5. Other natural or man-made factors reflecting continued existence, if any: Unknown

B. Potential threats in foreseeable future, as in IX-A: Industrial development of southern Utah is a potential threat.

X. Land Management or Ownership

National Park Service; Bureau of Land Management

XI. Management Implications

A. Suggest management actions which might best maintain the plant species: Survey the area generally to determine the extent of the populations and restrict future activities which modify surface vegetative cover to those areas demonstrated not to support this plant.

B. Suggest suitable alternatives for recovery: None

XII. Potential Value

Aesthetic, ecological, economical, educational, evolutionary, medicinal, ornamental, recreational, and scientific value, as appropriate: This plant forms a protective layer of vegetation on the ground in areas which are otherwise thinly vegetated. It is of importance from an ecological standpoint. The plant is likewise important evolutionarily as a part of a complex of several species of Psoralea with taberous roots. This plant has near congeners of Psoralea megalantha, Psoralea epipsila, and Psoralea mephitica, all present in Utah.

XIII. Cultivation Potential

A. Present or potential cultivation potential: Unknown

B. Currently cultivated populations, if any, their location and condition: None

XIV. Specialist

Name: Stanley L. Welsh

Address: Rm. 378 MLBM, Brigham Young University
Provo, Utah 84602

XV. References

1. Welsh, S. L. 1978a. Endangered and threatened plants of Utah: a re-evaluation. Great Basin Naturalist 38: 1-18.

2. Welsh, S. L. 1978b. Utah Plants - Fabaceae (Leguminosae). Great Basin Naturalist 38: 225-367.

3. Welsh, S. L., N. D. Atwood, and J. L. Reveal. 1975. Endangered, threatened, extinct, endemic, and rare or restricted Utah vascular plants. Great Basin Naturalist 35: 327-376.

XVI. Appendices

A. Xerox copies of distribution maps, illustrations, original descriptions, floristic or monographic descriptions, magazine articles, newspaper clippings: See attachments.

B. Herbarium label data and location of herbaria:

1. Psoralea pariensis (Holotype; 128561, BRY); Welsh, Murdock 12859, Paria View vicinity, ca. 8000 feet elev., Bryce Canyon National Park, Garfield County, Utah, 26 June 1975.

2. P. pariensis (Paratype; 128563, BRY); Welsh and Welsh 12810, Bryce Canyon National Park, ca. 8000 feet elev., Garfield County, Utah, 12 June 1975.

3. P. pariensis (Paratype; 126863, BRY); Buchanan 1494, East Creek, 3 miles south of Inspiration Point, 8000 feet elev., Bryce Canyon National Park, Garfield County, Utah, 11 June 197C.

4. P. pariensis (Paratype; 108099, BRY); Atwood 3684, T40S, R1W, ca. Sec. 31, Hackberry Canyon in Cottonwood Wash, ca. 10 miles north of Hwy. 89, Kane County, Utah, 26 April 1972.

5. P. pariensis (129481, BRY); Murdock, Bryce Canyon National Park, ca. 8000 feet elev., Garfield County, Utah, 25 June 1975.

6. P. pariensis (164456, BRY); Atwood 6782, No Man's Mesa, T40S, R3W, northwest of Nipple Ranch and Nipple Lake, Kane County, Utah, 15 June 1976.

C. Map of distribution and critical habitat boundaries:
Calico Peak, Utah USGS 7.5'; Bryce Point, Utah USGS 7.5';
Deer Range Point, Utah USGS 7.5'.

D. Photos or illustrations: See attachments

XVII. Author of Statement

Name: Stanley L. Welsh

Address: 129 North 1000 East
Orem, Utah 84057

Date: 1 January 1979

XVIII. Other Sources

None

Endangered species

Welsh, S. + D Atwood. 1975. Great Basin Natur. 35: 353

Psoralea paricnsis Welsh & Atwood, spec. nov. *P. megalanthae* Wooton & Standley proxime affinis sed floribus brevioribus et venas supra valde albo-strigosas.

Plantae habentes caudices bene-evoluti et radices tuberosae, 2-8 cm altae; caules 0.5-3 (4.5) cm longi, internodiis 1-3 elongatis, strigosi; stipulae 4-7 (10) mm longae, ovatae vel obovatae, strigosae; foliola 3-5, 9-23 (25) mm longa, 7-22 mm lata, obovata vel orbicularia, cuneata, rotundata ad truncata vel emarginata apicaliter, utrinque glandulifera; petioli 1.3-6.3 (7) cm longi, strigosi, pilis appressis vel adscendentibus; pedunculi 0.5-2.2 (2.8) cm longi, pilis appressis vel adscendentibus; bracteae 4-6 (8) mm longae, ovatae vel obovatae, acuminatae abrupte, pilosae rigide; pedicelli (1) 2-3.8 mm longi, pilis adscendentibus; calyces plus minusve gibbosi basim, tubus 3.3-4 (4.6) mm longus, dentes inaequales, infimis 5.3-6.8 mm longis, circa duplo latioribus quam lateralibus; corolla 8.8-10.5 (12) mm longa, dente infimo calycis leviter longioribus; alae vexillo subaequalis, purpureo-maculatae ad apicem; fructus usque ad 9 mm longum et seminum usque ad 5.2 mm longum.

TYPE: UTAH: Garfield Co.: Bryce Canyon National Park, in ponderosa pine woods, as ground layer, at ca 8,000 feet elevation, 26 Jun 1975, *Welsh & Murdock 12859*. Holotype, BRY. Isotypes to be distributed.

ADDITIONAL SPECIMENS EXAMINED: UTAH: Garfield Co.: East Creek, 3 miles south of Inspiration Point, Bryce Canyon N.P., in black sagebrush area, 11 Jun 1970, *Buchanan 1494* (BRY, WSCO); Paria View, Bryce Canyon N.P., in open ponderosa pine woods, ca 8,000 feet elevation, 12 Jun 1975, *S. L. & S. L. Welsh 12810* (BRY); East Creek, 9 Jun 1931, *Weight B-31/6-305* (BCNP, US). Kane Co.: Hackberry Canyon in Cottonwood Wash, ca 10 miles north of U.S. Highway 89, sec. 31, T. 40S., R. 1W., 26 Apr 1972, *Atwood 3684* (BRY).

STATUS: Endemic, rare and threatened.

DISTRIBUTION: Kane and Garfield counties, Utah.

Penstemon bracteatus



SCIENTIFIC NAME: *Penstemon bracteatus* Keck

FAMILY: Scrophulariaceae

CITATION: Leafl. W. Bot. 1: 82. 1934.

SYNONYMS: None

STATUS: Recommended as threatened by S. L. Welsh, 1978.

COMMON NAME: Red Canyon beardtongue

KNOWN DISTRIBUTION: Garfield Co., Utah

HABITAT: Pink Limestone Member of the Wasatch Formation in stone slides, gravelly soil; mixed ponderosa pine and pinyon pine communities

ELEVATION: 7800 to 8000 feet (2379 to 2440 m)

DESCRIPTION: Perennial herb, 6-18 cm tall; rhizomes slender from a stout caudex; stems few, erect, terminal; herbage glabrous and glaucous throughout; basal leaves with an oval or rotund blade and petiole as long, 2-3.5 cm long, cauline leaves lanceolate to lanceolate-linear, 1-1.8 cm long, equally spaced up the stem; bracts of the inflorescence conspicuous, cordate amplexicaul; inflorescence about one-half the stem height; corolla purple-blue, 12-20 mm long, glabrous; anther sacs widely divaricate.

TAXONOMIC PROBLEMS: This beardtongue may be distinguished from its near relative, *P. acuminatus*, by the smaller flowers, ovate basal leaves, slender stem, and geographical distribution.

EXISTING OR POTENTIAL THREATS: Recreation and the increased pressure of tourists on the habitat of this plant are threats.

LAND OWNERSHIP/MANAGEMENT: U. S. Forest Service; National Park Service

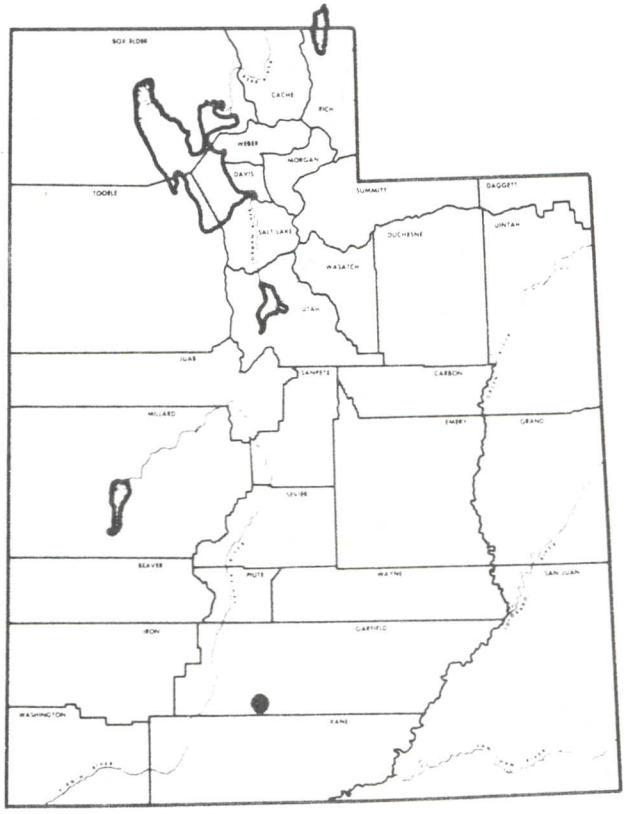
REMARKS: The nearest relative to *P. bracteatus* is in northern Nevada while less related species are geographically closer. Thus it becomes important in distribution and speciation studies within the genus.

RECOMMENDATIONS: A detailed survey of this area is needed to determine location and aquire population data of this beardtongue and other endemic species.

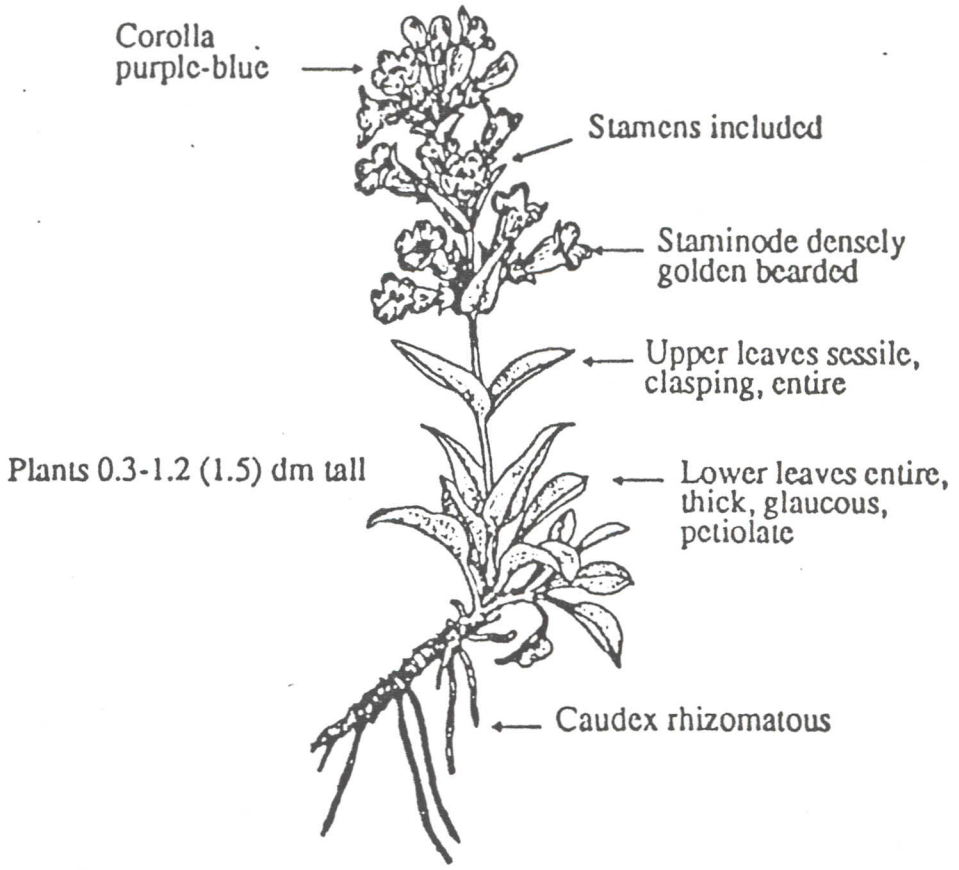


Penstemon bracteatus

cm



***Penstemon bracteatus* Keck** Platy Penstemon. Dwarf perennial herb 0.3–1.2 (1.5) dm tall; herbage and inflorescence glabrous; stems 1 or few from a rhizomatous caudex, ascending to erect; leaves 0.3–4 cm long, 1.5–12 (15) mm wide, entire, thick, glaucous, spatulate to (ob)ovate or broadly (ob)lanceolate, the lower narrowed to a petiole, the upper sessile and clasping; inflorescence secund, of 1–4 (6) verticellasters, the cymes 1– to few-flowered; calyx 3–5 (6) mm long, the lobes ovate to broadly lanceolate, glabrous, entire, scarious-margined; corolla (12) 14–17 (19) mm long, moderately ampliate, blue to blue violet, the lobes spreading, glabrous externally, the palate sparsely white-bearded; stamens included, the sacs 0.8–1.2 mm long, glabrous, dehiscing the full length and across the connective, not explanate; staminode included or reaching the orifice, densely golden bearded in the distal third. Pink and White Limestone members of the Wasatch Formation, in ponderosa pine, limber pine, or bristlecone pine-manzanita communities at 2105 to 2535 m in Garfield (type from Red Canyon) County; endemic; 13 (i). The species is endemic to the Bryce Canyon-Red Canyon vicinity.



PENSTEMON BRACTEATUS

Scientific Name: *Penstemon bracteatus* Keck

Common Name: Red Canyon beardtongue or Platy penstemon

Family (Common Name): Scrophulariaceae (Figwort Family)

Synonyms: None

Global and State Rank: G1/S1

Federal Review Status: C2

Global Distribution: South-central Utah

State Distribution: Garfield County

Ownership: USDA FS and NPS

National Forest: Dixie

Habitat: Ponderosa pine, pinyon-juniper, limber pine, and bristlecone pine-manzanita communities on the pink and white limestone members of the Wasatch Formation between 6,900 to 8,320 feet elevation. May-July.

STATUS REPORT

Penstemon bracteatus

I. Nomenclature

A. Family name: Scrophulariaceae

Synonyms: None

Common name: Snapdragon or Figwort family

B. Species name: Penstemon braceteatus Keck

Citation: Leafl. W. Bot. 1: 82. 1934.

Synonyms: None

Common names: Red Canyon beardtongue

II. Status

A. Federal: Not listed in Federal Registers

B. State: None

C. Other: Recommended as threatened by S. L. Welsh, 1978.

Recommended for inclusion on the U.S. FWS Notice of Review List as threatened, by Utah Native Plant Society, 1980, on the Forest Service Region 4 Sensitive Plant List, 1980.

III. Description

A. Field identification features: Stems slender, spreading from the primary caudex by slender rootstocks up to 12 cm long; leaves dimorphic, basal rosette present at flowering; basal leaf blades oval to rotund; petiole from 2-3.5 cm long; cauline leaves 1-1.8 cm long; corolla 12-15 mm long; bracts cordate amplexicaul.

B. Brief description: Perennial herbs, 6-18 cm tall; sub-rhizomatous; stems erect, slender glaucous, entire, 10-27 mm long, 5-12 mm wide, the basal oval-rotund, petiolate, the cauline sessile, spatulate to oblong; inflorescence contracted of two or more whorls; pedicels slender, slightly longer than the calyx; calyx 3.5-4.5 mm long, the lobes

ovate-lanceolate, obtuse or acute; corolla purplish blue, 12-20 mm long, the lobes rotund; staminode yellow barbellate; capsules glabrous (Keck 1934).

C. Closely related species: The Red Canyon beardtongue is apparently related to P. acuminatus Dougl. and P. arenicola A. Nels.

IV. Geographical Distribution

A. Past: Unknown

B. Present: Garfield County, Utah

C. Potential: Unknown

V. Taxonomic Problems

None

VI. Habitat Description

A. Plant community: Ponderosa pine and pinyon-juniper communities

B. Dominant plants: Pinus ponderosa, Pinus longaeva, Juniperus scopulorum; Pinus edulis

C. Elevational ranges: 7800 to 8000 feet (2379 to 2440 m)

D. Exposure and slope: Variable as to exposure and slope

E. Edaphic features: Calcareous gravel

F. Geology: Pink Limestone Member of Wasatch Formation

G. Other habitat features: Unknown

VII. Population Biology

A. Number of populations (est.): Three

B. Number of individuals/population (est.): Fewer than 50

C. Reproduction methods: Unknown

D. Age classes: Mostly mature plants are known.

E. Time of flowering and fruiting: June to July

F. Dispersal mechanisms: Unknown

G. Pollinators, if any: Unknown

H. Other biological factors: Unknown

I. Current population dynamics; trends and status: Unknown

VIII. Critical Habitat Recommendations

A. Geographic boundaries: All of sections 22, 23, 24, 25, 26, and 27, T. 35 S., R. 4 1/2 W., at Red Canyon, sec. 1, T. 37 S., R. 4 W., Bryce Canyon National Park, and sec. 5, T. 35 S., R. 4 W., near Tropic Reservoir, Garfield County, Utah

B. Physical attributes: Calcareous gravelly colluvium of Pink Limestone Member of Wasatch Formation in ponderosa pine-spruce-fir communities

IX. Threats to Survival

A. Nature of existing threats to survival:

1. Threatened destruction, modification, or curtailment of habitat or range, if any: Existing highways, visitor use, potential logging, highway realinement, campground enlargement and oil and gas exploration and development.

2. Over utilization for commercial, sporting, scientific, or educational purposes, if any: None

3. Disease, predation, grazing, or trampling, if any: Trampling is a problem near campground and other recreational areas.

4. Inadequacy of existing regulatory mechanisms, if any: No existing state or federal regulations to protect until listed.

5. Other natural or man-made factors reflecting continued existence, if any: Unknown

B. Potential threats in foreseeable future, as in IX-A: Increased recreation use and potential for future cutting of ponderosa pine.

X. Land Management or Ownership

U.S. Forest Service; National Park Service; State (?); private (?)

XI. Management Implications

A. Suggest management actions which might best maintain the plant species: Designate Red Canyon as a Research Natural or Unique Botanical Area on the basis of the high degree of endemic plants.

B. Suggest suitable alternatives for recovery: Detailed survey of area is needed to determine locations of all endemic or other unique species present and determine degree of existing impacts, potential impacts and acquire population data on each population.

XII. Cultivation Potential

A. Present or potential cultivation potential: Unknown; although other species of Penstemon grow with some ease when transplanted or propagated from seed.

B. Currently cultivated populations, if any, their location and condition: None

XIII. Potential Value

Aesthetic, ecological, economical, educational, evolutionary, medicinal, ornamental, recreational, and scientific value, as appropriate: This is an attractive dwarf beardtongue, with pleasing qualities of a rock garden plant. It aids in stabilization of poorly vegetated harsh sites on the Wasatch Formation.

XIV. Specialist

Name: Noel Holmgren

Address: New York Botanical Garden
Bronx, New York 10458

XV. References

1. Keck, D. D. 1934. A new Penstemon from Utah. Leafl. W. Bot. 1: 82-83.

2. Welsh, S. L. 1978. Endangered and threatened plants of Utah: a re-evaluation. Great Basin Naturalist 38: 1-18.

3. Welsh, S. L., N. D. Atwood, and J. L. Reveal. 1975. Endangered, threatened, extinct, endemic, and rare or restricted Utah vascular plants. Great Basin Naturalist 35: 327-376.

XVI. Appendices

A. Xerox copies of distribution maps, illustrations, original descriptions, floristic or monographic descriptions, magazine articles, newspaper clippings: See attachments.

B. Herbarium label data and location of herbaria:

1. Penstemon bracteatus (Type, CAS); Eastwood, Howell 783, Red Canyon, Garfield County, Utah, 20 June 1933.

2. P. bracteatus (170616, BRY); Foster and Foster 4389, T. 37 S., sec. 5, Garfield County, Utah, 30 June 1977.

3. P. bracteatus (57246, BRY); Holmgren et al. 2018, T. 37 S., R. 4 W., sec. 1, Bryce Canyon National Park, Garfield County, Utah, 24 June 1978.

C. Map of distribution and critical habitat boundaries: Wilson Peak, Utah USGS 7.5'

D. Photos or illustrations: See attachments.

3 x 5 - Bob Thompson

XVII. Author of Statement

Name: Stanley L. Welsh

Address: 129 North 1000 East
Orem, Utah 84057

Date: 1 February 1979

Updated May 1980 by Matthew Chatterley

XVIII. Other Sources

From N. D. Atwood (U.S. Forest Service, Provo, Utah) records:

1. Penstemon bracteatus (UC, UT, UTC); Pennell and Schaeffen 21891, stone slide below red cliff, 7200-7500 feet elevation, Route 12, Red Canyon NW of Bryce Canyon, Garfield County, Utah, 17 June 1938.

2. P. bracteatus (NY, UTC) N. Holmgren, J. Reveal and C. LaFrance 2018, north point, 8000 feet elevation, Bryce Canyon National Park, Utah, 24 June 1965.

3. P. bracteatus (UT); Weight B-32, Bryce Canyon, 10 June 1932.

4. P. bracteatus (UTC); B. Maguire 19080, in sparse yellow-pinyon pine community, frequent on dry gravelly slopes, 3 1/2 mi. E of mouth of Red Canyon, 7000 feet elevation, 25 June 1940.

blossom in search of the rich store of honey concealed within the recesses of the calyx-cup. As one looks at these creatures enlivened by the warmth of a bright sunny day, one cannot but admire the exquisite beauty of the ball room that nature thus provides for an insect festival."

The following four are hybrids which, with the exception of *E. langleyensis*, have been recently introduced in California and may be represented only in Golden Gate Park. One parent is *E. Philippiana*.

4. x ESCALLONIA LANGLEYENSIS Vilm. & Bois. Figured in the Gardeners' Chronicle 22:15 (1897). This lovely hybrid was produced in the Veitch Nursery at Langley. It has long downwardly arching branches covered with rosy-crimson flowers forming wreaths of great beauty. It is recommended as a covering for unsightly objects, fences, etc.

5. x ESCALLONIA, C. F. BALL. Similar to the preceding but less drooping, with large rosy-crimson flowers.

6. x ESCALLONIA, DONARD'S SEEDLING. A vigorous growing shrub with flowers flesh-pink in bud, opening white.

7. x ESCALLONIA EDINENSIS Hort. This was produced in the Edinburgh Botanic Garden. It is a floriferous hybrid of neat habit attaining a height of four to six feet. Flowers bright rosy-pink.

The descriptions of the last three have been taken from the catalogue of Hillier & Sons, Winchester, England.

A NEW PENSTEMON FROM UTAH

BY DAVID D. KECK

Carnegie Institution of Washington, Stanford University, California

Miss Alice Eastwood and Mr. J. T. Howell made many collections of Penstemon in the Great Basin region during the summer of 1933 that were turned over to me for determination. One of these appears to be of an hitherto undescribed species that the collectors have graciously permitted me to publish.

Penstemon bracteatus Keck, spec. nov. Herba perennis, 6-18 cm. alta; rhizomatibus prostratis gracillimis ad 12 cm. longis facile fractis; radicibus fibrillatis; caulibus erectis herbaceis simplicibus strictis ad 2.5 mm. crassis glaberrimis cœruleo-glaucis; foliis coriaceis glaucis integerrimis 10-20 mm. longis 5-12 mm. latis, radicalibus plerisque rotundis flavo-viridibus, petiolis æquilongis, caulinis sessilibus spathulatis vel oblongis cœruleo-glaucis internodiis longitudine æqualibus, floralibus conspicuis cordato-ovatis amplexicaulibus plus minusve obtusis gradatim reductis; thyrso stricto contracto; cymis (4-7 geminis) subsessilibus multifloris; pedicellis gracilibus calyce haud longioribus; calyce 3.5-4.5 mm. longo, lobis ovato-lanceolatis obtusis vel acutis integris inferne scarioso-marginatis; corolla purpureo-cœrulea 12-15

mm. longa glabra, tubo angusto, fauce parum ampliata 4.5 mm. crassa, limbo 3-4 mm. longo fere æqualiter 5-lobo, lobis rotundatis patentibus; staminibus fertilibus inclusis glaberrimis, filamento sterili vix dilatato sub apice hinc moderato flavo-barbato; capsula ignota.

Spreading from the primary caudex by very slender rootstocks; stems few, terminating the rootstocks; herbage glabrous and glaucous throughout; leaves above the basal rosette equally spaced up the stem, the bracts of the inflorescence prominent, often quite concealing the pedicels; thyrsus about half the height of the stem; anther-sacs widely divaricate, 1.5 mm. long, oblong, distinct, dehiscent from end to end.

Known only from the type collection, taken on a talus of small rocks and soil in Red Canyon, west of Bryce National Park, Garfield County, Utah, by *Alice Eastwood and John Thomas Howell No. 783*, June 20, 1933. Type in the Herbarium of the California Academy of Sciences, No. 207933.

This member of the section Acuminati is most closely related to *P. acuminatus* Dougl. (including its probable synonym *P. nitidus* Dougl.) and *P. arenicola* A. Nels. These may be distinguished as follows:

Stems stout, 4-10 mm. thick, tufted from a simple or somewhat branching central caudex: leaves not dimorphous or with definite basal rosette at time of flowering; basal linear-oblanceolate to narrowly spatulate, 4-8 cm. long; cauline 2.5-8 cm. long.

Corolla 15-20 mm. long; bracts cordate-amplexicaul.....*P. acuminatus* (and *P. nitidus*)

Corolla 10-15 mm. long; bracts broadly lanceolate.....*P. arenicola*

Stems slender, not over 2.5 mm. thick, spreading from the primary caudex by very slender rootstocks up to 12 cm. long: leaves dimorphous, with a definite basal rosette at time of flowering; basal with oval or rotund blade and petiole as long, 2-3.5 cm. long; cauline 1-1.8 cm. long: corolla 12-15 mm. long: bracts cordate-amplexicaul.....*P. bracteatus*

Penstemon bracteatus is separated 250 miles from the nearest stations for *P. acuminatus* in northern Nevada, and somewhat farther from the Red Desert region in southwestern Wyoming inhabited by *P. arenicola*. The species of the Acuminati that are closer to *P. bracteatus* geographically, such as *P. pachyphyllus* Gray and *P. lentus* Pennell, are considerably further separated from it morphologically.

the orifice, expanded and uncinate distally, bearded with relatively short brownish-yellow hairs, these 0.5–1.0 mm long; fertile stamens included, the anther-cells 0.7–1.0 (1.1) mm long, dehiscing the full length, becoming opposite but not explanate, glabrous except for the papillate-toothed sutures; capsule ca 8–10 mm long.

Dry juniper and pinyon-juniper woodlands, 1700–2100 m elev.; e. end of the Uinta Mts. of ne. Utah, nw. Colo., and adj. Wyo. May–June.

Vegetatively *P. mucronatus* resembles *P. cyathophorus* Rydb. and *P. harringtonii* Penl. from further east in central Colorado and adjacent Wyoming.

55. Penstemon bracteatus Keck

Penstemon bracteatus Keck, Leafl. W. Bot. 1: 82. 1934. (*Eastwood & Howell 783*, "on a talus of small rocks and soil in Red Canyon," w. of Bryce Canyon Natl. Park, Garfield Co., Utah, 20 June 1933; isotype at GH!)

Perennial herb, 0.3–1 (1.5) dm tall; stems erect or decumbent at the base, relatively small, single or few arising from a spreading rhizomatous caudex; herbage glabrous and glaucous; leaves entire, fleshy, the basal and lower cauline (1) 2–3 (3.5) cm long, 5–15 mm wide, obovate, rounded to obtuse, petiolate, the upper cauline ones 1–2.5 cm long, 5–10 mm wide, ovate, mucronate, sessile; thyrse of 3–5 contracted verticillasters, the cymes few-flowered, glabrous; calyx (3) 4–5.5 mm long, the segments lanceolate to ovate, obtuse to acute, glabrous, becoming ribbed with age, the margins scarious, entire; corolla 14–16 mm long, moderately ampliate, the lobes spreading, the limb blue-violet, the tube violet, glabrous externally, the palate sparsely bearded; staminode included, yellow-brown- or golden-yellow-bearded; fertile stamens included, the anther-cells 0.8–1.2 mm long, dehiscing the full length, becoming opposite but not explanate, essentially glabrous; capsule 5–6 mm long.

Dry gravelly slopes and talus in ponderosa woodland, 2100–2500 m elev.; endemic to the Paunsaugunt Plateau in the region of Red Canyon and Bryce Canyon Natl. Park, Garfield Co., Utah. June.

56. Penstemon utahensis Eastw.

Penstemon utahensis Eastw. Zoe 4: 124. (July) 1893. *P. eastwoodiae* A. A. Heller, Muhlenbergia 1: 4. 1900, intended as a new name for *P. utahensis* Eastw., presumably due to a concept that *P. utahensis* (S. Wats.) A. Nels. (1899) invalidated it. (*Eastwood s.n.*, "betw. Hatch's Wash & Monticello," San Juan Co., Utah, 28 May 1892; isotypes at GH!, PH!, POM!, RM!, US!)

Utah penstemon.

Perennial herb, 1.5–5 dm tall, with well developed basal leaves; stems erect or ascending, usually few arising from a branched caudex; herbage glabrous and glaucous; leaves entire, relatively thick and fleshy, often folded, the basal and lower cauline ones 3.5–8 (10) cm long, 5–20 mm wide, oblanceolate, tapering to a winged petiolar base, the upper cauline ones 1.5–5.5 cm long, 4–10 mm wide, narrowly elliptic to lanceolate, sessile; thyrse elongate, of 5–15 verticillasters, the cymes 1–3-flowered, often loosely divaricate-branched, glabrous, tending to be secund; calyx 2.5–4 (5) mm long, the segments broadly ovate and often mucronate-tipped, glabrous, the margins broadly scarious-margined, erose, often anthocyanous; corolla 17–22 (25) mm long, tubular-salverform, the limb slightly oblique with the lower lip projecting and the upper reflexed, obscurely bilabiate, true red to crimson, sometimes deep pink or pink-purple, glandular-pubescent within and externally; staminode included, glabrous or with short, papillate hairs at the apex; fertile stamens included in the tube, the anther-cells 0.6–1.1 mm long, dehiscing the full length and becoming peltately explanate, essentially glabrous; capsule ca 7–10 mm long; seeds 3–3.5 mm long.

Sagebrush and pinyon-juniper communities, often in sandstone derived soils, 1200–2000 (2500) m elev.; Canyon Lands of Utah from s. Emery and s. Grand cos., s. and w. across the s. Utah and the Grand Canyon plateaus to the Basin Ranges in Clark Co., Nev. and adj. San Bernardino Co., Calif. (Kingston and New York Mts.). Apr–June.

The geographical distributions of *P. utahensis* and the closely related *P. confusus* overlap in the Pine Valley Mountains of Washington Co., Utah, where intermediate forms predominate.

Red coloration in *Penstemon* is usually associated with the loss of a landing platform, an adaptation for hovering hummingbirds, but the brilliant red-colored *P. utahensis* has a very prominent, projecting lower lip.

57. Penstemon confusus M. E. Jones

Pentstemon confusus M. E. Jones, Zoe 4: 280. (Oct) 1893. (*M. E. Jones 1819*, Detroit, Millard Co., Utah, 26 May 1891; lectotype by Pennell, Contr. U.S. Natl. Herb. 20: 337. 1920, at GH!, POM!)

Perennial herb, 0.6–3 (4) dm tall, with well developed basal leaves; stems erect, tall, single to few arising from a thick crown or short-branched, woody caudex; herbage glabrous and glaucous, often turning dark on drying; leaves entire, relatively thick and fleshy, often folded and arched, the basal ones (2.5) 3–6 cm long, 5–10 (14) mm wide, oblanceolate, tapering to a petiolar base, the cauline ones 1.5–4 (5.5) cm long, 2–8 mm wide, linear to lanceolate, sessile; thyrse of 3–8 verticillasters, the cymes 1–5-flowered, glabrous, symmetrical to subsecund; calyx (3.5) 4–6 mm long at anthesis, to 8 mm in fruit, the segments broadly ovate, acuminate, glabrous, the margins scarious, often anthocyanous; corolla 14–18 (20) mm long, tubular-salverform to slightly ampliate, the throat rounded to somewhat 2-ridged ventrally, the lobes subequal, spreading, the upper spreading forward and the lower reflexed, the limb violet to magenta, the throat pale pink to white inside with red or violet guide-lines, glandular-puberulent inside the limb and the throat and on the outside or glabrous; staminode included, expanded distally and uncinate, white to pale yellow, glabrous or with short golden-yellow-papillate hairs at the apex; fertile stamens included, the anther-cells 0.9–1.2 mm long, dehiscing the full length and becoming opposite, not or only slightly explanate, essentially glabrous; capsule 8–12 mm long.

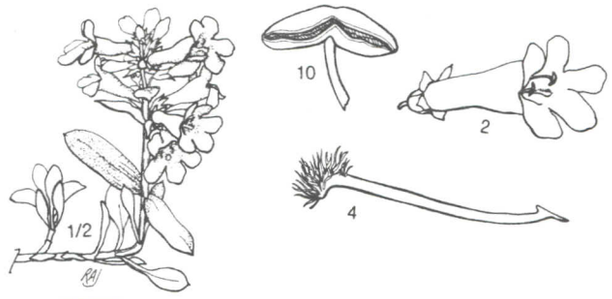
Usually with sagebrush in pinyon-juniper woodlands in dry, gravelly (often limestone) soils, 1700–2200 m elev.; e. Nev. in w. Nye, White Pine, Lincoln, and Clark cos., and sw. Utah from Juab to Washington Co. e. to Utah, Piute, and Sevier cos. Apr–June.

Collections from the Pine Valley Mountains and the mountains to the west in Washington Co., Utah and adjacent Lincoln Co., Nevada are intermediate between *P. confusus* and *P. utahensis*. Either these collections are hybrids in an area of overlapping distributions, or they represent an undescribed variety that would justify reduction of *P. confusus* to varietal rank under the older name *P. utahensis*.

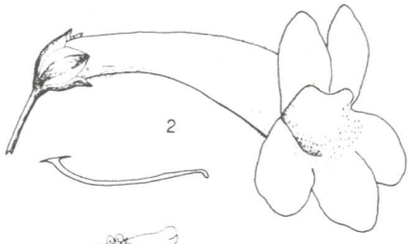
58. Penstemon patens (M. E. Jones) N. Holmgren

Penstemon confusus var. *patens* M. E. Jones, Contr. W. Bot.

PENSTEMON



Penstemon bracteatus





Penstemon patens



Penstemon confusus



Penstemon utahensis

UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

SPECIES: PENSTEMON BRACTEATUS KECK SYNONYM(S):

FAMILY: SCROPHULARIACEAE STATE: UTAH

EL CODE: HERBARIUM: BRYCE CANYON N.P.

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
1·13·90 RECORDER CHAS SCHELZ	GARFIELD	R. GRAYBOSH / 791 B	209	DATE: 6·19·80 / T R S .5 mi. EAST OF SUNSET POINT, STONY WASH TRIBUTARY TO BRYCE WASH. WASATCH FORMATION ASSOC: P. PONDEROSA, ARCTOSTAPHYLOS PATULA, POTENTILLA ELEV: 7300 FT.	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	

Silene petersonii





SCIENTIFIC NAME: Silene petersonii Maguire var. minor Hitchc. and Maguire

FAMILY: Caryophyllaceae

CITATION: Univ. Wash. Publ. Biol. 13: 38. 1947.

SYNONYMS: None

STATUS: Recommended as threatened by S. L. Welsh, 1978.

COMMON NAME: Red Canyon catchfly

KNOWN DISTRIBUTION: Garfield and Iron cos., Utah

HABITAT: Pink Limestone Member of the Wasatch Formation on bare gravelly clay and eroding slopes; mixed ponderosa pine, fir and western bristle cone pine communities

ELEVATION: 7000 to 10,400 feet (2135 to 3172 m)

DESCRIPTION: Plant perennial, deep set taproot giving rise to several rhizomes; stems simple, 5-10 cm tall, pubescence rarely glandular, harshly pubescent; leaves oblanceolate, 2-3 cm long, 4-6 mm wide, 1-nerved, harshly pubescent, upper cauline leaves somewhat reduced; flowers 1-3, seldom 1; calyx campanulate, harshly pubescent, 1-2 cm long; petals 12-15 mm long, blades 5-7 mm long, broadly cuneate, variously toothed or shallowly lobed, but not cleft, pink to rose-purple; capsule ovate, shorter than the calyx, opening by six smooth valves.

TAXONOMIC PROBLEMS: None

EXISTING OR POTENTIAL THREATS: Off-road trail use, industrial expansion, and timber harvest are threats to this species.

LAND OWNERSHIP/MANAGEMENT: National Park Service; U. S. Forest Service; Utah State; private (?)

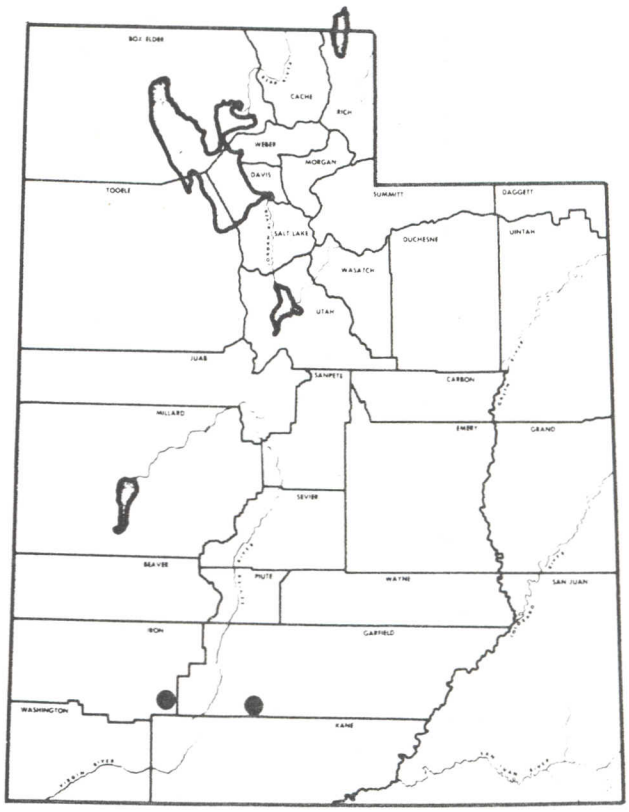
REMARKS: This is a remarkably beautiful plant in its setting of orange-pink limestone gravels.

RECOMMENDATIONS: The population sizes and numbers should be surveyed, and a monitoring program established.



Silene petersonii var. minor

1 cm



***Silene petersonii* Maguire** Maguire Campion. Perennial, soboliferous herbs, from creeping, subrhizomatous caudex branches and taproot; stems 3–15 cm tall, erect or ascending, retrorsely puberulent and more or less glandular; leaves mainly cauline, 2–6 pairs, lanceolate to elliptic or oblanceolate, obtuse to acutish, hairy like the stems or glabrous above, 1–5 cm long, 2–10 mm wide, subsessile to sessile, 1–veined, reduced upward; flowers irregular, the upper petal reflexed, 1–5 in open cymes, nodding in bud and at anthesis; pedicels 5–25 mm long; calyx turbinate-campanulate, 13–19 mm long, glandular-villous with multicellular hairs, 10–veined, the veins broad, green or purplish, the lobes 3–6 mm long; petals 15–35 mm long, pink to purplish, the claws subequal to the calyx or shorter, the appendages very small or lacking, the blades 5–15 mm long and as broad, irregularly toothed, lobed, or 4–cleft; capsules included in the accrescent calyx; styles usually 3; seeds 2–2.5 mm wide, brown, tuberculate marginally. Ponderosa pine, aspen, and spruce-fir communities at 2135 to 3450 m in Garfield, Iron, Sanpete (type from Wasatch Plateau) and Sevier counties; endemic; 24 (iii). Specimens from Red Canyon, Garfield County (type locality) have been segregated as var. *minor* Hitchock & Maguire. They were said to differ in lower stature [5–10 (12) cm vs 10–15 cm], shorter petals (1.5–2 cm vs 2–3 cm), and degree of lobing of the petal blade. Increased harshness of pubescence rounded out the list of supposed diagnostic features of the variety. The characteristics fail singly and in combination. There is a complete transition with the typical material. Short petals are found on short plants within the range of typical specimens and the reverse is true, also. Degree of lobing of petals varies on a single sheet of specimens collected at the same locality. Harshness of pubescence, whose interpretation is tenuous at best, fails as a diagnostic tool. Recognition of infraspecific taxa seems moot.

STATUS REPORT

Silene petersonii var. minor

I. Nomenclature

A. Family name: Caryophyllaceae

Synonyms: None

Common name: Pink family

B. Species name: Silene petersonii Maguire var. minor Hitchc. and Maguire

Citation: Univ. Wash. Publ. Biol. 13: 38. 1947.

Synonyms: None

Common names: Red Canyon catchfly

II. Legal Status

A. Federal: Not listed

B. State: None

C. Other: Recommended as threatened by S. L. Welsh, 1978.

III. Description

A. Field identification features: Tufted perennial, 0.5-1.5 dm tall, opposite oblanceolate to spatulate or oblong leaves; flowers pink to rose-purple, large and showy, nodding at anthesis.

B. Brief description: Perennial, from a deep-seated taproot and elongated subrhizomatous caudex branches, clothed with scale-like leaves; stems 5-15 cm tall, densely pubescent; leaves oblanceolate to elliptic, gradually reduced upwards, 0.5-4 cm long, 2-8 mm wide; flowers 1-5 (7), nodding at anthesis; pedicels 0.3-3.2 cm long; calyx 1-1.5 mm long, the lobes 3-5 mm long; petals

pink to rose-purple, 1.5-2.5 cm long, inserted, the blade 5-13 mm long, toothed, lobed, or cleft; stamens included; capsule shorter than the calyx; carpophore 1-2 mm long; styles commonly 3; seeds 2-2.5 mm long (modified from Hitchcock and Maguire 1947).

C. Closely related species: Silene clokeyi Hitchcock and Maguire

IV. Geographical Distribution

A. Past: Unknown

B. Present: Iron and Garfield Counties, Utah

C. Potential: Unknown

V. Taxonomic Problems

None

VI. Habitat Description

A. Plant community: Ponderosa pine - Rocky Mountain juniper, spruce-fir, and aspen-sagebrush communities

B. Dominant plants: Pinus ponderosa, Juniperus scopulorum, Picea engelmannii, Abies lasiocarpa, Populus tremuloides, and Artemisia sp.

C. Elevational ranges: 7000 to 10,450 feet (2135 to 3172 m)

D. Exposure and slope: Variable as to exposure and slope

E. Edaphic features: Calcareous and igneous gravels

F. Geology: Pink Limestone Member of the Wasatch Formation, and Tertiary Igneous gravels

G. Other habitat features: Unknown

VII. Population Biology

A. Number of populations (est.): Three

B. Number of individuals/population (est.): 10-50

C. Reproduction methods: Unknown

D. Age classes: Mainly mature plants are known.

E. Time of flowering and fruiting: July and August

F. Dispersal mechanisms: Unknown

G. Pollinators, if any: Unknown

H. Other biological factors: Unknown

I. Current population dynamics; trends and status: Unknown

VIII. Critical Habitat Recommendations

A. Geographic boundaries: Sections 22, 23, 24, 25, 26, 27, T35S, R4 1/2W, Red Canyon, Garfield County, Utah

B. Physical attributes: Varicolored, calcareous, angular gravels of the Pink Limestone Member of the Wasatch Formation in ponderosa pine - mixed conifer community

IX. Threats to Survival

A. Nature of existing threats to survival:

1. Threatened destruction, modification, or curtailment of habitat or range, if any: Existing highway and attendant impacts; campgrounds and their impacts.

2. Over utilization for commercial, sporting, scientific, or educational purposes, if any: None

3. Disease, predation, grazing, or trampling, if any: Visitor use at both Cedar Breaks and at Red Canyon

4. Inadequacy of existing regulatory mechanisms, if any: Unknown

5. Other natural or man-made factors reflecting continued existence, if any: Unknown

B. Potential threats in foreseeable future, as in IX-A: Increased activities of all kinds; visitor use, off-highway use, industrial expansion, lumbering operations, etc.

X. Land Management or Ownership

U. S. Forest Service, National Park Service

XI. Management Implications

A. Suggest management actions which might best maintain the plant species: Populations should be surveyed, their extent and sizes determined and a monitoring program should be established. All future development should be excluded from population areas.

B. Suggest suitable alternatives for recovery: Not applicable.

XII. Cultivation Potential

A. Present or potential cultivation potential: Unknown

B. Currently cultivated populations, if any, their location and condition: None

XIII. Potential Value

Aesthetic, ecological, economical, educational, evolutionary, medicinal, ornamental, recreational, and scientific value, as appropriate: This is a beautiful flowering plant of varicolored calcareous gravels. It is capable of growing on harsh substrates, on which few other plants grow. It tends to add a degree of stability to easily erodable slopes.

XIV. Specialist

Name: None

Address:

XV. References

1. Hitchcock, C. L. and B. Maguire. 1947. A revision of the North American species of Silene. Univ. Wash. Publ. Biol. 11: 1-132.

2. Welsh, S. L. 1978. Endangered and threatened plants of Utah: a re-evaluation. Great Basin Naturalist 38: 1-18.

3. Welsh, S. L., N. D. Atwood, and J. L. Reveal. 1975. Endangered, threatened, extinct, endemic, and rare or restricted Utah vascular plants. Great Basin Naturalist 35: 327-376.

XVI. Appendices

A. Xerox copies of distribution maps, illustrations, original descriptions, floristic or monographic descriptions, magazine articles, newspaper clippings: See attachments.

B. Herbarium label data and location of herbaria:

1. Silene petersonii var. minor (Type; UTC); Maguire 19550, Red Canyon, 5 miles E of US Hwy. 89, Garfield County, Utah, 16 July 1940.

2. S. petersonii var. minor (174503, BRY); Higgins, T35S, R4W, Sec. 27, Red Canyon near campground, 7000 feet elev., Garfield County, Utah, 16 August 1977.

3. S. petersonii var. minor (16626, BRY); Harrison, Carter 9860, 2 miles N of Cedar Breaks Lodge, eroding slope below rim of Cedar Breaks, 10,500 feet elev., Iron County, Utah, 24 August 1940.

4. S. petersonii var. minor (172065, BRY); Foster, Foster 4758, T35S, R6W, Sec. 31, S end of Hancock Mt., 9025 feet elev., Garfield County, Utah, 27 July 1977.

5. S. petersonii var. minor (174890, BRY); Higgins 11217, T36S, R9W, Sec. 24, Cedar Breaks, 10,450 feet elev., Iron County, Utah, 20 August 1977.

C. Map of distribution and critical habitat boundaries:
Wilson Peak, Utah USGS 7.5'; Cedar Breaks, Utah USGS 15'; Panguitch Lake, Utah USGS 15'

D. Photos or illustrations: See attachments.

XVII. Author of Statement

Name: Stanley L. Welsh

Address: 129 North 1000 East
Orem, Utah 84057

Date: 1 February 1979

XVIII. Other Sources

None

QK
1
U6
V. 13

UNIVERSITY OF WASHINGTON PUBLICATIONS

IN

BIOLOGY

A

Volume 13

July, 1947

A REVISION OF THE

NORTH AMERICAN SPECIES OF *SILENE*

By

C. Leo Hitchcock and Bassett Maguire

208N32

SEATTLE
UNIVERSITY OF WASHINGTON PRESS
1947

cluded; capsule ovoid-oblong, somewhat shorter than the calyx; carpophore 1-2 mm long, glabrous; styles 3 (sometimes 4 or 5); seeds 2-2.5 mm broad, laterally compressed, brown, with a conspicuous broad marginal crest of bullate tubercles.

Key to the Varieties of *Silene Petersonii*

Stems usually 10-15 cm tall; petals 2-3 cm long, blade 10-15 mm long, usually deeply lobed ..... 35. *S. Petersonii* var. *typica*

Stems 5-10 (12) cm tall; petals 1.5-2.0 cm long, irregularly toothed, rarely deeply lobed..... 35a. *S. Petersonii* var. *minor*

S. Petersonii Maguire var. *typica* var. nov.

S. Petersonii, *loc. cit.*, as to type.

TYPE: *Maguire* 20000, common on steep, loose, bare, calcareous slopes at 10,900 feet, Skyline Drive, one mile above Baldy Ranger Station, Manti National Forest, Sanpete County, Utah, August 8, 1940. Deposited at Utah State College.

Apparently confined to south-central Utah, this attractive species occurs only on eroded and mostly loose calcareous slopes at high altitudes from 10,000 to 11,000 feet. At lower elevations, but on likewise bare, eroded slopes, notably in the frequently collected Red Canyon, Garfield County, Utah, on the approaches to Bryce National Park, *S. Petersonii* becomes somewhat smaller in stature, but differs particularly in the increased harshness of pubescence, sparsity of glandulosity and the shorter, broader, mostly not lobed but variously toothed petal blades. This population represents the:

35a. S. Petersonii Maguire var. *minor* var. nov.

Generally similar to the species, but pubescence denser, harsher, less glandular; petals 12-15 mm long, blades 5-7 mm long, broadly cuneate, variously toothed or shallowly lobed, but infrequently cleft.

Planta a *S. Petersonii* Maguire var. *typica* hoc modo differens; pilis densioribus, asperioribus, minus glandulosis; petalis 12-15 mm longis; laminis 5-7 mm longis, late cuneatis, cum dentibus vel lobis tenuibus, raro cum fissura.

TYPE: *Maguire 19550*, frequent on bare gravelly clay, rapidly eroding slopes, Red Canyon, five miles south U. S. 89 junction, Garfield County, Utah, July 16, 1940. Deposited at the Utah State College. Known only from Red Canyon, but presumably more widespread in similar habitats.

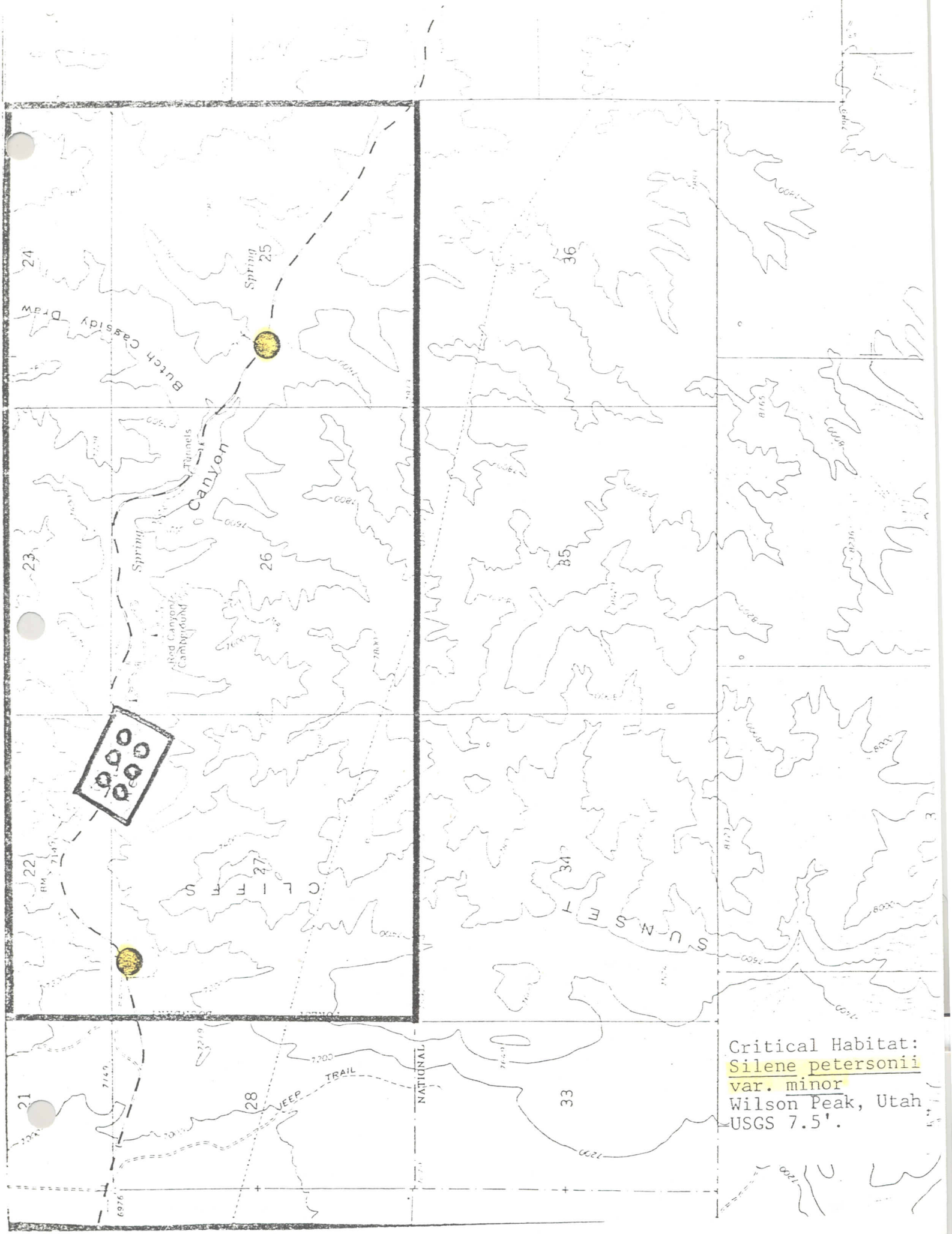
S. Petersonii seems to have no close relatives among the Rocky Mountain species, but rather to be connected with *S. Clokeyi*. (For further discussion of possible relations see under *S. Clokeyi*.)

36. Silene Clokeyi sp. nov. Fig. 41; map 2.

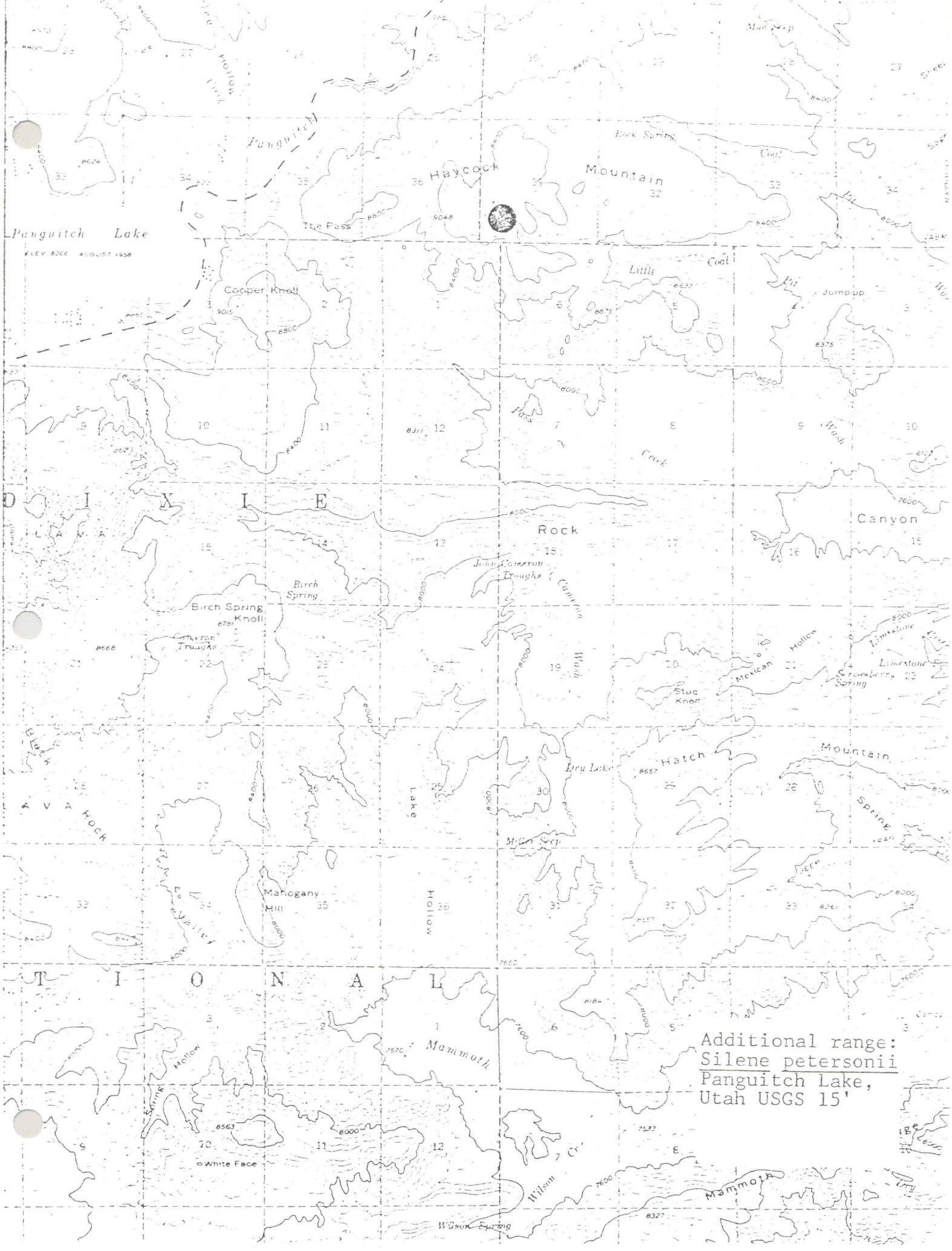
Perennial, from a deep-seated taproot, giving rise to several branching rhizomes, each of which produces a single stem or becomes multicipital; stems simple, 5-12 cm tall, thinly to moderately glandular-puberulent; leaves of the innovations somewhat longer than those of stem, narrowly oblanceolate, obtuse; cauline leaves 3-4 pairs (the upper remote and reduced) 1-2.5 cm long, 2-4 (5) mm wide, linear-oblong or somewhat lanceolate, obtuse, glandular-puberulent or nearly glabrous, dried basal leaves of previous season usually adhering; cymes mostly 1-flowered, flowers apparently nodding during anthesis; calyces 12-15 mm long, campanulate, somewhat inflated at maturity, with 10 green nerves, intercostal region membranous, rather densely glandular-puberulent, lobes ovate-lanceolate to obovate-reniform, the margins broadly scarious, glandular-ciliolate, 2-3 mm long; corollas pink to rose-purple, claws narrow, exceeding the calyx by 2 mm, inconspicuously nerved, scantily puberulent near base, at the summit broader than the blade, auricles conspicuous, appendages 2, 2 mm long, broad, erose at tips, blades 5-8 mm long, narrow, bilobed 1/3 to 2/3 to base, the lobes narrowly linear-oblong; stamens exserted by 2 mm; carpophore 2.5 mm long, thinly short-pilose; capsule not equaling the calyx; styles normally 3; seeds not seen.

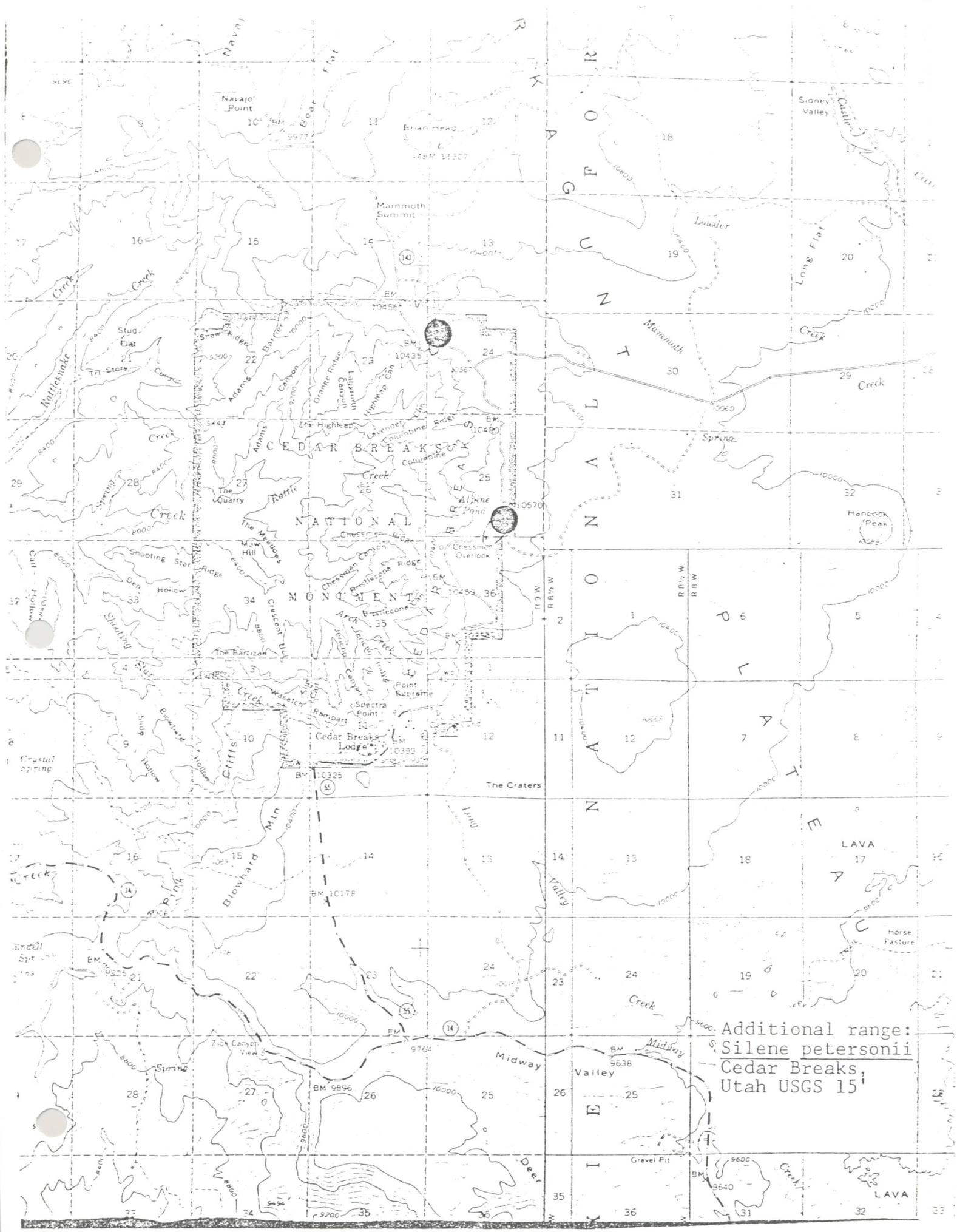
Planta perennis; rhizomatibus gracilibus; caulibus solitariis vel laxe multicipitalibus, 5-12 cm altis, simplicibus, tenue vel moderate glanduloso-puberulentis; foliis innovationum 3 cm longis, foliis caulinis 3-4 jugis (superioribus remotis et deminutis), 1-2.5 cm longis, 2-4 (5) mm latis, lineari-oblongis vel lanceolatis, obtusis, glanduloso-puberulentis vel subglabratis, submarcescentibus; floribus fere 1, nutantibus; calycibus 12-15 mm longis, campanulatis aliquantum inflatis, conspicue 10-nervis viridibus, dense glanduloso-puberulentis, lobis ovato-lanceolatis vel obovato-reniformibus, 2-3 mm longis; corollis roseis vel roseo-purpureis, unguibus angustis nervis inconspicuis, exsertis, infra tenue puberulentis, supra lationibus quam laminis; auriculis conspicuis, appendicibus 2, 2 mm longis, latis, erosis; laminis 5-8 mm longis, bilobatis 1/3–2/3 ad basim, lobis anguste lineari-oblongis; filamentis exsertis; carpophoris ca. 2.5 mm longis, pilosulis; stylis 3; capsulis sine dissepimentis; seminibus ignotis.

TYPE: *Clokey 7511*, among rocks at timberline, 3400 m., Charleston Peak, July 23, 1937, Clark County, Nevada. Deposited in the Clokey collection at the University of California. Isotypes at the University of Washington and Utah State College. Habitally similar, this Charleston Mountains endemic was earlier interpreted as a part of *S. Petersonii*. From this, however, *S. Clokeyi* differs mostly in the character of pubescence and in the corolla. In corolla character it is similar to *S. Sargentii*, but lacks the lateral corolla lobes prevailing in this latter species. It thus seems to occupy an intermediate position between the more western *S. Sargentii* and the more eastern *S. Petersonii*. Characters distinguishing the three species follow:



Critical Habitat:
Silene petersonii
var. minor
Wilson Peak, Utah
USGS 7.5'.


Panguitch Lake
ELEV. 8208 AUGUST 1958
Haycock Mountain
The Pass
Cooper Knoll
Little Coal Pit
Jump-up
Rock Spring
Coal Pit
Canyon
Birch Spring Knoll
Birch Spring
Stuc Knoll
Hatch Mountain
Mahogany Hill
Mammoth
White Face
Wilson Spring
Mammoth
Additional range:
Silene petersonii
Panguitch Lake,
Utah USGS 15'



Additional range:
Silene petersonii
Cedar Breaks,
Utah USGS 15'

UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

SPECIES: Silene petersonii var. minor SYNONYM(S):

FAMILY: Caryophyllaceae STATE: Utah

EL CODE: HERBARIUM: Bryce Canyon N.P.

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
1.14.90 RECORDER Chas Schelz	Garfield	R. Graybosch/804	209	DATE: 6.19.80 / T R S .5 mi. SE of Queens Garden, gravelly slopes Wasatch Formation Assoc: Oak, Ponderosa, Agropyron, Manzanita Elev: 7300'	
1.14.90 Chas Schelz	Garfield	R. Graybosch/1360	209	DATE: 6.26.81 / T R S Along Peek-A-Boo Trail, 1 km. East of Inspiration Point. Wasatch Formation Assoc: Clay slopes overlain by gravel, Hymenopappus filifolius, Elymus salina, Cirsium, Monardella odoratissima Elev: 7800'	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	
				DATE: / T R S	

SCIENTIFIC NAME: Townsendia minima Eastw.

FAMILY: Asteraceae

CITATION: Leafl. W. Bot. 1: 206. 1936.

SYNONYMS: None

STATUS: Recommended as threatened by S. L. Welsh, 1978.

COMMON NAME: Least townsendia

KNOWN DISTRIBUTION: Garfield and Kane cos., Utah

HABITAT: Pink Limestone Member of the Wasatch Formation, dry open slopes and rocky outcrops, rocky soil; scattered ponderosa, white fir, and bristle cone pine community

ELEVATION: 7000 to 9196 feet (2135 to 2806 m)

DESCRIPTION: Low mat forming plant, caudex branching underground from a straight tap root; leaves in rosettes surrounding and almost concealing the small sessile heads, spatulate to oblanceolate, rather thick, appressed pubescence; heads about 4 mm in diameter, 8 mm high, bracts of the involucre in 3-4 series, obtuse, membranously margined, ciliate; receptacle honey-combed; rays light rose, sterile with outer pappus half as long as the inner, the latter equaling the pappus of the fertile disk-flowers which surpasses the tubular 4-toothed corolla; achenes oblanceolate with some sparse, fine spreading hairs.

TAXONOMIC PROBLEMS: None

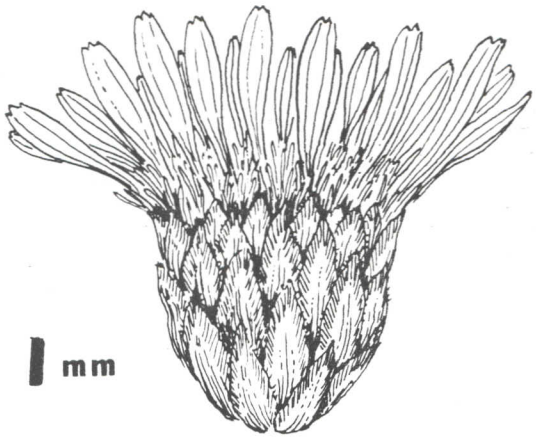
EXISTING OR POTENTIAL THREATS: Limestone exploitation and industrial development are threats to this species.

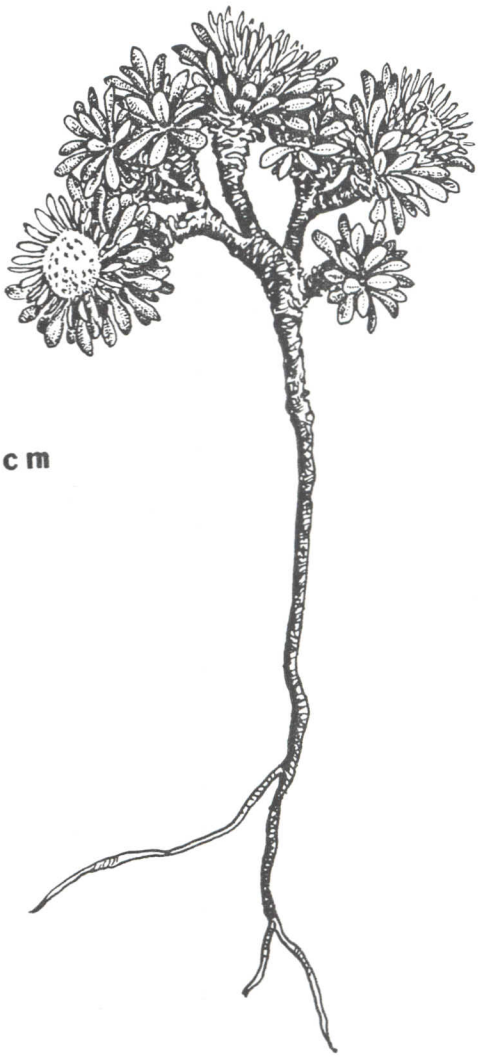
LAND OWNERSHIP/MANAGEMENT: U. S. Forest Service; Bureau of Land Management; National Park Service

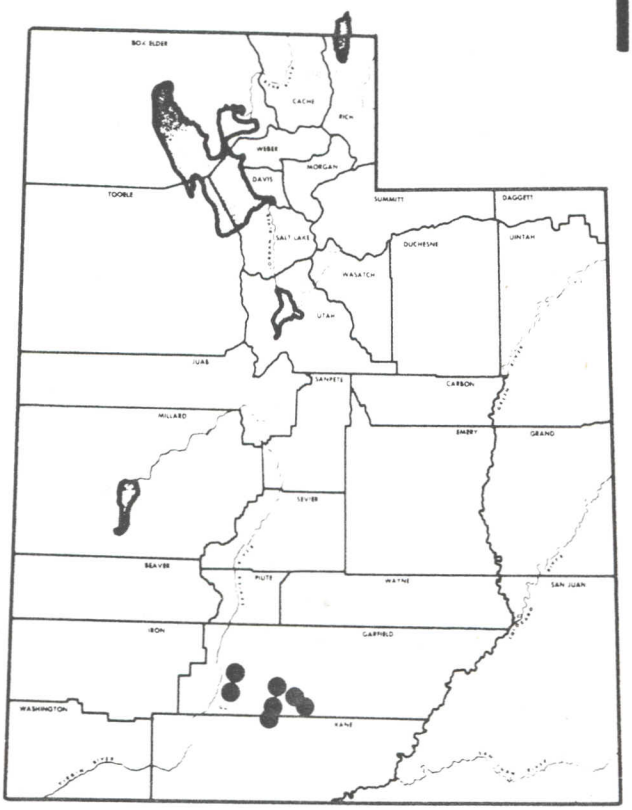
REMARKS: The least townsendia is a obligate calciphile.

RECOMMENDATIONS: The species should be regarded as threatened even though it is more widely distributed than other endemics with which it is partially sympatric.

Townsendia minima







Townsendia montana **Jones** Perennial acaulescent or rarely subcaulescent herbs from a simple or branched caudex, sometimes with soboliferous rhizomatous branches, from a taproot, 2–6 cm high; herbage glabrate to strigose; leaves 5–40 mm long, 2–8 mm wide, spatulate, thickish; involucres 6–12 mm high, 8–20 mm wide, bracts in 3–6 series, oblong, obovate, oblanceolate or lanceolate, glabrous or sparingly strigose, the margins scarious, ciliate, often suffused with purple; rays 12–30, the corollas blue, pink, lavender, or white, 6–12 mm long, 1–3.5 mm wide, achenes 3.7–5.2 mm long, glabrous or sparingly pubescent with bifurcate or glochidiate hairs; ray and disk pappus alike, 3–5.5 mm long. Three more or less distinctive varieties are present.

1. Heads usually sessile; leaves mainly 1–3.5 mm wide, rather abruptly obtuse apically; plants of Garfield and Kane counties ..... *T. montana* var. *minima*

— Heads usually at least shortly pedunculate; leaves mainly broader (at least some), rounded to obtuse; plants not of Garfield or Kane counties 2

2(1). Leaves rounded apically, broadly spatulate; plants of calciferous outcrops in southern Duchesne, Wasatch, and Sanpete counties ..... *T. montana* var. *caelilinensis*

— Leaves obtuse to subacute apically; plants of various substrates in the Uinta and Wasatch mts. ..... *T. montana* var. *montana*

Var. *caelilinensis* Welsh Pinyon-juniper, spruce-fir, and limber pine communities on Flagstaff Limestone and Green River formations at 2135 to 3735 m in southern Duchesne, Wasatch, and Sanpete counties; endemic; 13 (i).

Var. *minima* (Eastw.) Beaman [*T. minima* Eastw., type from Bryce Canyon; *T. alpigena* var. *minima* (Eastw.) Dorn]. Ponderosa pine, western bristlecone, limber pine, and Douglas fir-white fir communities, on white and pink members of the Cedar Breaks Formation, at 2375 to 3115 m in Garfield and Kane counties; endemic; 14 (i).

Var. *montana* [*T. dejecta* A. Nels., type from Dyer Mine]. Spruce-fir and lodgepole pine communities at 3050 to 3510 m in Cache, Juab, Salt Lake (type from Alta), Summit, and Uintah counties; Idaho, Montana, and Wyoming; 3 (0).

Townsendia montana var.minima



STATUS REPORT

Townsendia minima

I. Nomenclature

A. Family name: Asteraceae

Synonyms: Compositae

Common name: Aster family, Sunflower family, Composite family

B. Species name: Townsendia minima Eastw.

Citation: Leafl. W. Bot. 1: 206. 1936.

Synonyms: None

Common name: Bryce Canyon daisy

II. Legal Status

A. Federal: None

B. State: None

C. Other: Recommended as threatened by S. L. Welsh, 1978.

III. Description

A. Field identification features: Plants low growing forming mats, caudex branching underground, from a tap root; leaves in rosettes, spatulate to oblanceolate, thick often concave above, petioles long, broad, ciliate; flowers both ray and disk, few; rays light rose color, sterile.

B. Brief description: Low plants forming mats, the caudex branching underground from a straight tap root; leaves in rosettes surrounding and almost concealing the sessile heads, spatulate to oblanceolate, thick, often concave above, appressed-pubescent to almost smooth, 1-15 mm long, 1-2 mm wide; petiole long broad,

ciliate; heads about 4 mm in diameter, 8 mm high; flowers both ray and disk, few; rays light rose color, sterile, with outer pappus half as long as the inner, the latter equalling the pappus of the fertile disk-flowers which surpasses the tabular, 4-corollas; achenes oblanceolate (Eastwood, 1936).

C. Closely related species: Townsendia montana Nutt.

IV. Geographical Distribution

A. Past: Unknown

B. Present: Garfield and Kane Counties, Utah

C. Potential: Unknown

V. Taxonomic Problems

None

VI. Habitat Description

A. Plant community: Douglas fir-white-fir ponderosa pine and western bristlecone pine woodlands

B. Dominant plants: Pinus ponderosa, Pseudotsuga menzeisii, Abies concolor and Pinus longaeva.

C. Elevational ranges: 7000-9200 feet (2135-2806 m)

D. Exposure and slope: Exposure variable; slope 0-20%

E. Edaphic features: Gravelly and clay calcareous soils

F. Geology: Pink and White Limestone Members of the Wasatch Formation

G. Other habitat features: None

VII. Population Biology

A. Number of populations (est.): More than 6

B. Number of individuals/population (est.): Greater than 50

C. Reproduction methods: Unknown

D. Age classes: All ages represented

E. Time of flowering and fruiting: April to June

F. Dispersal mechanisms: Unknown

G. Pollinators, if any: Unknown

H. Other biological factors: Unknown

I. Current population dynamics; trends and status: Unknown

VIII. Critical Habitat Recommendations

A. Geographic boundaries: All of sections 26, T35S, R4 1/2W, Garfield County, Utah

B. Physical attributes: This is a shallow calcareous gravel over Pink Limestone Member of the Wasatch Formation in sparse coniferous woodland.

IX. Threats to Survival

A. Nature of existing threats to survival:

1. Threatened destruction, modification, or curtailment of habitat or range, if any: See below.

2. Over utilization for commercial, sporting, scientific, or educational purposes, if any: None

3. Disease, predation, grazing, or trampling, if any: Unknown

4. Inadequacy of existing regulatory mechanisms, if any: Unknown

5. Other natural or man-made factors reflecting continued existence, if any: Unknown

B. Potential threats in foreseeable future, as in IX-A: Potential lumbering operations, mineral exploration and exploitation, railroad construction, power transmission corridors, modification of campground facilities, and realignment of existing highway are all possible threats in this area.

X. Land Management or Ownership

Bureau of Land Management; National Park Service; U. S. Forest Service; private; Utah State

XI. Management Implications

A. Suggest management actions which might best maintain the plant species: This species should be surveyed to find the extent of its populations, and all future development which requires surface disturbance should be relegated to areas where this plant does not occur.

B. Suggest suitable alternatives for recovery: Not applicable

XII. Cultivation Potential

A. Present or potential cultivation potential: Unknown

B. Currently cultivated populations, if any, their location and condition: None

XIII. Potential Value

Aesthetic, ecological, economical, educational, evolutionary, medicinal, ornamental, recreational, and scientific value, as appropriate: This low plant produces very showy flowers, much larger than the stature of the plant would indicate. The plant is aesthetically pleasing. They grow on poor-quality soils, where few other plants provide surface cover. It is a valuable soil erosion control plant. This daisy is one of several narrowly restricted plants within the genus Townsendia, and might serve as an example in determining speciation within that genus.

XIV. Specialist

Name: John Beaman

Address: Herbarium, Michigan State University
East Lansing, Michigan 48823

XV. References

1. Eastwood, A. 1936. A New Townsendia from Utah. Leafl. W. Bot. 1: 206-267.

2. Reveal, J. L. 1970. Revision of Townsendia in Utah. Great Basin Naturalist 30: 23-52.

3. Welsh, S. L. 1978. Endangered and threatened plants of Utah: a re-evaluation. Great Basin Naturalist 38: 1-18.

4. Welsh, S. L., N. D. Atwood, and J. L. Reveal. 1975. Endangered, threatened, extinct, endemic, and rare or restricted Utah vascular plants. Great Basin Naturalist 35: 327-376.

XVI. Appendices

A. Xerox copies of distribution maps, illustrations, original descriptions, floristic or monographic descriptions, magazine articles, newspaper clippings: See attachments.

B. Herbarium label data and location of herbaria:

1. Townsendia minima (Type); Eastwood, Howell 727 (CaS), Bryce Canyon, Garfield County, Utah, 19 June 1933.

2. T. minima (105484, BRY); Reveal, Reveal 1010, East fork of the Sevier River road, 3.5 miles south of Utah Hwy. 12, T36S, R4W, Sec. 22, ca. 8000 feet elev., Garfield County, Utah, 25 May 1968.

3. T. minima (119242, BRY); Atwood, Trotter 5327, ca. 1 mile NW of Panguitch Fish Hatchery, Garfield County, Utah, 9 June 1973.

4. T. minima (105459, BRY); Reveal, Reveal 1018, East fork of the Sevier River road along Utah Hwy. 12, T35S, R4W, Sec. 2, 7800 feet elev., Garfield County, Utah, 25 May 1968.

5. T. minima (128817, BRY); Welsh, Murdock 12876, summit of Canaan Peak, Wasatch Formation, ca. 9196 feet elev., Garfield County, Utah, 28 June 1975.

6. T. minima (14540, BRY); Cottam 5672, Bryce Canyon along trail from Sunrise Point, 7000 feet elev., Garfield County, Utah, 6 April 1931.

7. T. minima (84534, BRY); Atwood 1885, 2.4 miles east of Red Canyon Campground on Hwy. 54, Garfield County, Utah, 20 June 1969.

8. T. minima (105485, BRY); Reveal, Reveal 1027, Red Canyon, top of a ridge south of Red Canyon Campground, about 8000 feet elev., Garfield County, Utah, 25 May 1968.

C. Map of distribution and critical habitat boundaries: Bryce Canyon USGS 7.5'; Hatch USGS 7.5'; Canaan Peak USGS 7.5'; Wilson USGS 7.5'.

D. Photos or illustrations: See attachments

XVII. Author of Statement

Name: Stanley L. Welsh

Address: 129 North 1000 East
Orem, Utah 84057

Date: 1 January 1979

XVIII. Other Sources

None

Am. 2:21 (1834); *Chrysopsis canescens* DC.,[15] Prodr. 5:328 (1836); *E. filifolius*, vars. α and β T. & G., Fl. N. Am. 2:177 (1841); *E. lincaris* Piper, Contrib. U. S. Nat. Herb. 11:567 (1906), not *Diplopappus lincaris* Hook.

ERIGERON LINEARIS (Hook.) Piper,[16] l. c. *Diplopappus linearis* Hook., l. c.; *E. peucephyllus* Gray, Proc. Am. Acad. 16:89 (1881); *E. ochroleucus* Gray, Syn. Fl. N. Am. 1, pt. 2: 213 (1884), in part not Nutt.; *E. luteus* A. Nels.,[17] Bull. Torr. Club 27:33 (1900); *E. filifolius* Piper, l. c., not *Diplopappus filifolius* Hook.

ERIGERON LINEARIS var. ELEGANTULUS (Greene) J. T. Howell. *E. elegantulus* Greene, Erythea 3:65 (1895).

ERIGERON SONNEI Greene, Pitt. 1:218 (1888). *E. nevadensis* var. *Sonnei* (Greene) Smiley, Univ. Calif. Publ. Bot. 9:373 (1921).

A NEW TOWNSENDIA FROM UTAH

BY ALICE EASTWOOD

Townsendia minima Eastwood, spec. nov. Herba nana, cæspitosa, caulibus subterraneis ramosis; foliis rosulatis circumdatis et superantibus capitulos sessiles, spathulatis vel oblanceolatis subcrassis, adpresso-pubescentibus vel subglabris, 10-15 mm. longis, 1-2 mm. latis, petiolis longis, ciliatis; capitulis 4 mm. diametro, 8 mm. altis, bracteis involucralibus 4-5-seriatis, obtusis, margine membranaceis et ciliatis; floribus radiatis sterilibus, rosaceis, pappi setis barbatis, exterioribus 4 mm. longis, longioribus interioribus; floribus disci femineis, tubulosis, apice 4-crenatis, pappi setis æqualibus, flores superantibus; acheniis oblanceolatis, tenuiter pubescentibus, pilis divaricatis, non glochidiatis.

Low plants forming mats, the caudex branching underground from a straight tap-root; leaves in rosettes surrounding and almost concealing the small sessile heads, spatulate to oblanceolate, rather thick, often concave above, appressed-pubescent to almost smooth, 10-15 mm. long, 1-2 mm. wide, with long broad ciliate petioles; heads about 4 mm. in diameter, 8 mm. high, bracts of the involucre in 3-4 series, obtuse, membranously

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15 A collection by Douglas "in Amer. boreal. occid. ad flumen Columbiæ" was the type of this species. A photograph of the type which is in Herb. DeCandolle, was seen at Herb. Gray, and it is clear that the plant represented is *E. filifolius*, to which species it has been referred without question for many years.

16 *Erigeron linearis* Spreng. in DC., Prodr. 5:474 (1826), was not validly published since it was "merely cited as a synonym" (Intern. Rules Bot. Nomen., 1930, Art. 40).

17 See also Bot. Gaz. 54:413-416 (1912), where A. Nelson in a discussion of this problem follows Piper's lead and states that if *E. luteus* "is ever reduced it will be to . . . varietal rank under *E. filifolius*"!

margined, ciliate; receptacle honey-combed; flowers of both ray and disk few; rays light rose-color, sterile, with outer pappus half as long as the inner, the latter equalling the pappus of the fertile disk-flowers which surpasses the tubular, 4-crenate corollas; achenes oblanceolate, with some sparse fine spreading hairs.

Type: No. 206955, Herb. Calif. Acad. Sci., collected on the rim of Bryce Canyon, Utah, June 19, 1933, by Alice Eastwood and John Thomas Howell, *No. 727*; also No. 206961, collected in the adjacent Red Canyon, the next day, *No. 785*. This species belongs to the same group as *T. scricca*, but is quite unlike that species and is the smallest so far known.

THE MOST MINUTE MIMULUS

BY ALICE EASTWOOD

Mimulus minutissimus Eastwood, spec. nov. Annuus, glandulosopilosus, minutus, circa 1 cm. altus; floribus sessilibus, solitariis, circumdatis foliis; foliis anguste oblongis vel oblanceolatis, 5 mm. longis, 1 mm. latis; calyce 4 mm. longo, segmentis inæqualibus, medio longissimo, tuba 1 mm. longa; corolla lutea, infundibulare, 6 mm. longa, tuba gracili, longiore calyce, segmentis obtusis; staminibus inæqualibus, antheris minutis; stylo glabro, stigmate lato; capsula ovato-oblonga, sulcata, 2 mm. longa, inclusa in calyce.

Type: No. 229256, Herb. Calif. Acad. Sci. This tiny Mimulus was collected by Miss Vesta Holt, May 18, 1934, on the road to Chester, Plumas County, California. It grew about two miles west of Lake Almanor near the junction of the Longville road with the Chester-Greenville highway.

These minute almost imperceptible plants are only about 1 cm. high, with one sessile flower. The calyx-divisions are very unequal, the middle lobe of the upper lip longest, surpassing the two lower, the tube about 1 mm. long. The whole plant is minutely glandular-hairy. The trumpet-shaped corolla is yellow with the two lower divisions red-dotted, the tube is slender and the throat about 3 mm. long. The style is glabrous, the anthers minute, anthers of longer stamens and the broad stigmas reach the top of the corolla but are not exserted. The ovary is enclosed in the calyx and has a line down the middle. It grew in a damp place in company with *Mimulus Pulsiferæ* and some species of Allocarya too young for identification.

A REVISION OF THE UTAH SPECIES OF TOWNSENDIA (COMPOSITAE)

James L. Reveal[1]

In 1957, Beaman published his monumental and classical monograph on the genus *Townsendia* Hook. (Compositae, Astereae) which has become a model for several recent taxonomic studies. Beaman commented on several occasions that a critical lack of specimens hindered his research on a few of the species restricted to, or commonly associated with, the Utah flora. With the discovery of a new species in this genus by Welsh and Reveal (1968), it became obvious that since 1957 a great deal of new material had come into herbaria from this area, and with my location at that time at Brigham Young University, it was felt that a revision of the genus was not only in order but could be easily supplemented by additional field work both by myself and my associates at the University.

This revision is based, to a large degree, on Beaman's monograph. I have attempted to supplement his study not only by an examination of newer material, but also by a reexamination of many of the specimens studied by Beaman as well. I have assumed that his concepts of the taxa with regards to their typification is correct although it is necessary now to typify a few names not handled by him in accordance with the International Code of Botanical Nomenclature (Lanjouw, 1966).

I would like to acknowledge the assistance of Dr. Stanley L. Welsh, Curator of the Herbarium, Brigham Young University, who arranged for me to see material from the following herbaria.

A	Arnold Arboretum, Harvard University, Cambridge, Massachusetts.
BRY	Brigham Young University, Provo, Utah.
CAS	California Academy of Sciences, San Francisco, California.
DS	Dudley Herbarium, Stanford University, Stanford, California.
GH	Gray Herbarium, Harvard University, Cambridge, Massachusetts.
MO	Missouri Botanical Garden, St. Louis, Missouri.
MSC	Michigan State University, East Lansing, Michigan.
NA	United States National Arboretum, Washington, D.C.
NY	New York Botanical Garden, Bronx Park, Bronx, New York.
POM	Pomona College Herbarium, Rancho Santa Ana Botanic Garden, Claremont, California.
RSA	Rancho Santa Ana Botanic Garden, Claremont, California.
UC	University of California, Berkeley, California.
US	United States National Herbarium, Smithsonian Institution, Washington, D.C.
UT	University of Utah, Salt Lake City, Utah.
UTC	Intermountain Herbarium, Utah State University, Logan, Utah.

Specimens cited from other herbaria in discussing type material is taken from Beaman's paper in order to make the type citations

[1]Department of Botany, University of Maryland, College Park, and U.S. National Herbarium, Smithsonian Institution, Washington, D.C. 20560. This study was completed in large part at Brigham Young University.

complete. It should be noted, however, that type material from all of the above herbaria was seen in this study.

I would like to thank Dr. Stanley L. Welsh for reviewing this paper.

Townsendia in Utah

The members of the genus *Townsendia* are small and inconspicuous in the Utah flora: They occur among pinyon-juniper and sagebrush early in the spring of the year; later in the year, *Townsendia* flowers on high alpine ridges and slopes in the mountains where it is difficult to collect as well as find. Sereno Watson, with the King expedition in 1868, was the first collector to discover species of this genus in Utah, although to the north in Wyoming, Thomas Nuttall had found several of our species during his trans-continental trip in 1834. Lester Ward, a plant collector hired by John Wesley Powell, gathered specimens in southern Utah in 1875, but in Utah the most active collector of *Townsendia* was Marcus E. Jones. In the last fifty years a great many botanists have been collecting *Townsendia*: P. A. Rydberg, A. O. Garrett, W. P. Cottam, B. F. Harrison, and B. Maguire were early collectors who actively botanized in the state. They were followed by A. H. Holmgren, D. W. Ripley and R. C. Barneby, A. Eastwood and J. T. Howell, J. H. Beaman, S. L. Welsh, L. C. Higgins, N. D. Atwood and J. L. Reveal. All of these people have added many new collections to the various herbaria, and many of these more recent specimens were not available to Beaman.

The genus is primarily found in the Rocky Mountains of the United States. The species extend from the southern part of the Yukon to the central part of Mexico, and from the Columbia River Plateau of central Oregon and Washington to the Great Plains in northeastern Nebraska. Beaman (1957) recognized twenty-one species in the genus, but from the present study, I would recognize twenty-four, with Utah having more species (twelve) than any other state.

Narrow endemism is a common feature in the genus. In many instances, such as in *Astragalus* (Barneby, 1964) and *Eriogonum* (Reveal, 1969), edaphic factors have played a major role in speciation. I agree with Beaman (1957, p. 10) when he wrote: ". . .it may be stated that the acaulescent, rosulate forms require more highly specialized edaphic situations than do the caulescent types." *Townsendia aprica*, *montana*, *minima*, *mensana*, and *jonesii* are all highly specialized in particular edaphic situations in Utah while the remaining species of Utah *Townsendia* are generally found in a wider variety of habitats and on a great range of soil types.

The species concept in *Townsendia* is complicated by two rather intricate and possibly related problems—hybridization and apomixis. That both occur in a single species does not reduce the taxonomic status of the species, nor does the fact that the various species tend to overlap in flowering time reduce the possibilities of recognition of species. Even so, for the most part, the degree of hybridization is limited and hybrids do not seem to occur over large geographical regions so that no question of specific distinctiveness needs to be

raised. The fact that no possible hybridization can occur due to some taxa's geographical isolation has caused me to elevate two varieties recognized by Beaman to the species rank as they express a far greater degree of morphological difference than that found in other variants in the genus. In both cases, it is possible to demonstrate a distinction in morphology as well as edaphic and geographical isolation—features which as Cronquist (1968) has stated allows for the recognition of a species as ". . .the smallest population which is permanently (in terms of human time) distinct and distinguishable from all others."

The role of apomixis has been discussed at great length by Beaman (1957). He points out that in the long-lived, high montane species, they are nearly always apomictic, and in many cases are nearly identical so that the various species may be extremely difficult to distinguish even by the experts. It is suggested that the user of this key to the species be keenly aware of both the morphology and the geographical location of his unknown plant.

The morphological characteristics used to distinguish species in the Utah *Townsendia* are not unique, but rather those frequently used in Compositae. The plants from Utah may be spreading annuals or biennials or highly reduced and compacted perennials. The roots are thick and woody in the perennials, but thinner in the annual plants; all have taproots. The caudices are branched, more or less woody, and often invested with old leaf-bases. The variation in leaf-shape in the genus is of little help in distinguishing species except for the fact that the leaf shape can separate large groups of species. There is a gradual modification of the blade into the petiole, with the variously pubescent leaf-bases clasping the stems. The margins of the leaves are entire; however, the degree of revoluteness varies between and within some species. In general, thickened leaves are found in the plants of higher elevations. Stem and leaf pubescence is essentially strigose and the amount of pubescences is an important taxonomic criteria. The involucres are campanulate to obconical with the phyllaries varying in both length-width ratio and the amount of pubescence. The margins of the phyllaries are usually ciliated.

The color of the ray-flowers vary from white to pink or blue except in *Townsendia aprica* which has distinctly yellowish rays (the rays of *T. jonesii* may dry yellowish on some plants). The adaxial surface is glabrous, but the abaxial surface varies from glabrous to densely glandular. The disk-flowers are yellowish except for the tips which may be reddish to purplish or greenish tinged. Achene shape and pubescence are important taxonomic features in the genus. The shape varies from narrowly oblanceolate to obovate and they are variously compressed with ribbed or callous-thickened margins. The pappus has been widely used in the genus as a key character, but it seems to be of limited value except in separating major groups of species. The length of the ray and disk pappus may be equal or different in the same species although it is not too uncommon to find

some diversity in a single plant. The bristles are always free on the disk-flowers, but they may be connate on the rays so as to become a ring of coroniform squamellae around the apex of the achenes.

Systematic Treatment

Townsendia Hook., Fl. Bor.—Am. 2: 16. pl. 119. 1834.

Annuals or fore frequently biennials or perennials, caulescent or acaulescent herbs from taproots, these terminated by suberect, decumbent or rosulate woody caudices; leaves alternate, spathulate to linear, entire, glabrate to densely pubescent with few- to many-celled trichomes; heads pedunculate or terminal on stems or sessile and submerged in tufts of basal leaves; involucres campanulate to obconical, the phyllaries imbricated in 3-7 series, linear to obovate, ciliated along the margins, glabrous to pubescent; ray-florets pistillate, fertile, uniseriate, mostly 13-40, the ray-corollas broadly linear to oblong-linear, blue, whitish, pink, or yellowish on the adaxial surface, darker on the abaxial surface, glabrous or glandular; disk-florets hermaphroditic, numerous, the disk-corollas yellow and frequently pink- or purplish-tipped or tinged, glabrous or slightly glandular; achenes oblanceolate to obovate, compressed, 2-ribbed, glabrate or more frequently pubescent with simple, bifurcate hairs with prongs of an unequal length, or glochidiate with recurved prongs of essentially equal length; disk-pappus uniseriate of terete or obcompressed, plurisetose, barbellate bristles; ray-pappus similar to that of the disk or variously reduced or squamellae; x = 9. Type species: *Aster exscapa* Richards. [= *Townsendia exscapa* (Richards.) Porter.] Named for David Townsend (1787-1858), an amateur botanist of West Chester, Pennsylvania, and a botanical associate of William Darlington.

Key to the Species

1. Plants long-lived perennials.
   2. Phyllaries broadly lanceolate to ovate or elliptic, in 2-5 series.
      3. Plants acaulescent, rosulate-pulvinate.
         4. Corolla-rays yellowish to golden-yellow, densely grandular on the abaxial surface; leaves strigose; rare, Sevier Co. 1. *T. aprica*
         4. Corolla-rays white, pink or blue, or if drying yellowish, then plants not from Sevier Co.
            5. Leaves linear, with dense tufts of long, simple trichomes at the base; Uinta Basin, Duchesne and Uintah cos. 4. *T. mensana*
            5. Leaves oblanceolate to spathulate.
               6. Achenes glabrous; leaves glabrous or only slightly strigose in some; high mountains in northern Utah above 9000 feet. 2. *T. montana*
               7. Achenial hairs simple or unevenly bifurcated with one prong exceeding the other, rarely truly glochidiated; leaves glabrous or sparsely strigose, thickened; Bryce Canyon area, Garfield Co. 3. *T. minima*
               7. Achenial hairs mainly glochidiate, rarely with scattered

unevenly pronged hairs in *T. jonesii;* leaves moderately to densely strigose.

8. Phyllaries glabrous or the outer ones only slightly pubescent; ray-corollas densely glandular; western Utah. 5. *T. jonesii*

8. Phyllaries conspicuously strigose; ray-corollas glabrous to lightly glandular; eastern and southwestern Utah. 10. *T. incana*

3. Plants caulescent with spreading-suberect stems; achenial hairs unevenly branched, not glochidiate; deserts of western Utah. 9. *T. florifer*

2. Phyllaries linear to narrowly lanceolate, in 5-7 series.

9. Phyllaries with a tuft of tangled cilia at the apex, linear, acuminate at the apex; leaves linear or narrowly oblanceolate, involute, sericeous-canescent; Carbon, Duchesne, and Daggett cos., rare. 7. *T. hookeri*

9. Phyllaries without a tuft of tangled cilia at the apex, narrowly lanceolate, acute at the apex.

10. Ray-corollas densely glandular on the abaxial surface; leaves linear with dense tufts of long, simple trichomes at the base; Uinta Basin, Uintah and Duchesne cos. 4. *T. mensana*

10. Ray-corollas glabrous or only sparsely pubescent.

11. Disk-pappus 3-6 mm long; leaf midveins not conspicuous; mountains of northern Utah. 6. *T. leptotes*

11. Disk - pappus 6-11 mm long; leaf midveins conspicuous; low mountains of southern Utah. 8. *T. exscapa*

1. Plants annuals or biennials.

12. Disk-pappus as long as or longer than the disk-corollas.

13. Achenial hairs unevenly branched, not glochidiate; plants caulescent with spreading-suberect stems; deserts of western Utah. 9. *T. florifer*

13. Achenial hairs glochidiate; eastern and southwestern Utah.

14. Stems among the leaves gray-white with a dense canescent pubescence; phyllaries strigose on the outer surface; eastern and southwestern Utah. 10. *T. incana*

14. Stems merely lightly to moderately strigose with the red stems among the leaves obvious; phyllaries moderately strigose on the outer ones, slightly so if at all on the inner ones; northeastern Utah. 11. *T. strigosa*

12. Disk-pappus shorter than the disk-corollas; phyllaries glabrous to moderately strigose-pilose, elliptical, obovate, or ovate to obtuse; southeastern Utah. 12. *T. annua*

Description of the Species

1. Townsendia aprica Welsh and Reveal

Townsendia aprica Welsh & Reveal, Brittonia 20: 375. 1968. Type: Ca. 6 mi S of Fremont Jct., Sevier Co., Utah, along Utah Hwy. 72, on low rolling gray clay slopes, among scattered igneous boulders, associated with *Juniperus* and *Castilleja*, at ca. 6500 ft., 1 May 1966, *Reveal & Welsh 721*. Holotype, BRY! Isotypes, CAS, GH, MSC, NY, UC, US, UTC!

Rosulate-pulvinate caespitose perennial herbs from a much-branched partially subterranean caudex arising from a thin taproot,

3. Townsendia minima Eastw.

Townsendia minima Eastw., Leafl. West. Bot. 1: 206. 1936. *T. montana* var. *minima* (Eastw.) Beaman, Contr. Gray Herb. 183: 85. 1957. Type: Bryce Canyon, Garfield Co., Utah, 19 Jun 1933, *Eastwood & Howell 727*. Holotype, CAS!

Rosulate-pulvinate caespitose perennial herbs from a much-branched, elongated, subterranean caudex arising from a wood taproot, the upper branches of the caudices clothed with persistent leaf-bases for 1-5 cm so as not to expose the leaf-scars, the plants up to 15 cm across and 5 cm high; leaves narrowly spathulate or oblanceolate, entire, the apex obtuse or more commonly acute, often mucronate, thinly strigose (especially in young plants and on new growth) becoming glabrous or nearly so on the adaxial surface, (3) 4-8 mm long, 1.2-3 mm wide, the blades tapering gradually onto the petioles, these 5-9 mm long, strigose especially along the margins, the leaf-bases not often antrocynsis; peduncles lacking; involucres obconical at the base, 6-10 mm across, 5-8 mm high; phyllaries in 3-4 series, oblanceolate, mostly acute at the apex, with red-scarious ciliated margins, strigose abaxially, 3-7 mm long, 0.9-2.1 mm wide, the inner ones the longest; ray-florets 13-21; ray-corollas pink to light blue, sparsely glandular on the abaxial surface, the rays 4-8 mm long, 1.5-2.1 mm wide, the tubes 1.8-2.5 mm long, pinkish; disk-corollas yellow, tinged pink to purplish at the tip, 3-4 mm long; achenes oblanceolate, compressed, 2-ribbed, those of the rays rarely 3-ribbed, long pubescent with fine unequally forked hairs, 2-3 mm long, 0.9-1.4 mm wide; pappus of the ray-flower of 15-30 plurisetose barbellate bristles, 3-5 mm long, rarely shortened, free; disk-pappus similar to the ray-pappus. 2n = 18 (Beaman, 1957).

Distribution: Endemic to the Red Canyon and Pink Cliffs area near and in Bryce Canyon, and southward to near Orderville, Garfield and Kane cos., Utah. Flowering from April to June.

Representative Specimens: Garfield Co.: 2 mi E of Jct. of U.S. Hwy. 89 and Utah Hwy. 54, 21 Jul 1954, *Beaman 823* (GH, MSC); S of garbage dump, Bryce Canyon, 8 Jun 1958, *Buchanan 349* (UT); above Tropic, 29 May 1894, *Jones 5312ar* (NY, POM, US); Paria River, Pink Cliffs, 25 Jun 1940, *Maguire 19099* (NY, UTC); 1 mi E of Pine Lake, Pink Cliffs, 26 Jun 1940, *Maguire 19120* (GH, NY, UTC); E fork of Sevier River, 3.5 mi S of Utah Hwy. 12, 25 May 1968, *Reveal & Reveal 1010* (BRY, US); low ridge N of E Fork of the Sevier River Road, N of Utah Hwy. 12, 25 May 1968, *Reveal & Reveal 1018* (BRY, US); top of ridge S of Red Canyon Campground, 25 May 1968, *Reveal & Reveal 1027* (BRY, US); do, *N. D. Atwood 1885* (BRY) 20 Jun 1869; NE of Widtsoe, 26 May 1968, *Reveal & Reveal 1035* (BRY, US); Red Canyon, 7 Jun 1947, *Ripley & Barneby 8540* (CAS, NY). Kane Co.: 15 mi NW of Orderville, 17 Jun 1940, *Maguire 18807* (UTC).

Townsendia minima was described as a distinct species by Eastwood in 1936, but reduced to a variety of *T. montana* by Beaman

some twenty years later. In the present paper, I am proposing that Eastwood's original desposition for the population be retained. I certainly agree with Beaman (1957) that this species is related to *T. montana*, but morphologically the two differ in leaf and achene pubescence, the size of the leaves, the degree of persistence of the leaf-bases and—for the most part—the color of the rays. The two species differ greatly in ecological and particularly in the type of soils on which they grow. *Townsendia minima* occurs at lower elevations than *T. montana*, in open exposed sites on heavy soils of the Wasatch Formation. This combination of features has led me to consider the two entities as distinct species.

This species is common in Red Canyon, a well known area for its interesting botanical endemics. The canyon, part of the Dixie National Forest, is now heavily used by recreation visitors, and is in danger of being so over-used that these unique and usually exceedingly rare species may be lost. *Eriogonum arctioides* Barneby is known from only a few plants in about three scattered locations. *Silene petersonii* Maguire and *Townsendia minima* are only occasionally found as is *Lesquerella rubicundula* Rollins and the recently described *Cryptantha ochroleuca* (Higgins, 1968). *Oxytropis jonesii* Barneby is locally encountered, but it is never abundant. These interesting species, all of which occur on the lower slopes and in the bottom of the canyon, are often subjected to destruction by nature as well as by man, and some control of the Red Canyon area will have to be made if this canyon is to remain a pleasant and attractive recreation site.

4. Townsendia mensana M. E. Jones

Townsendia mensana M. E. Jones, Contr. West. Bot. 13: 15 1910. Type: Benches of the Uintas near Duchesne [then called Theodore], at about 7500 ft elev, Duchesne Co., Utah, 14 May 1908, *M. E. Jones s.n.* Holotype, POM!

Rosulate-pulvinate caespitose perennial herbs from a much-branched short, woody subterranean caudex arising from a well-developed woody taproot, the upper branches of the caudices often clothed with persistent leaf-bases, the plants up to 1 cm across and 5 cm high; leaves narrowly oblanceolate to linear, entire, the apex acute, mucronate, evenly strigose on both surfaces, involute, (4) 6-14 mm long, 0.8-1.3 mm wide, the blades tapering inperceptably to the leaf-base, the abaxial surface of the leaf-base densely woolly with long, white, multicellular trichomes; peduncles lacking; involucres obconical at the base, 6-9.5 mm across, 5-9 mm high; phyllaries in 4-5 series, lanceolate, acute at the apex, margins ciliated, green and glabrous to sparsely glandular or lightly strigose-pilose on the outer surface, 3.5-8 mm long, 1.2-1.8 mm wide, the longer inner ones often reflexed; ray-florets 13-21; ray-corollas whitish or pinkish, often with pale pinkish streaks and fine brownish lines abaxially, glandular on the abaxial surface, the rays 5-7.5 mm long, 0.9-1.4 mm wide, the tubes 3-3.8 mm long, whitish; disk-corollas

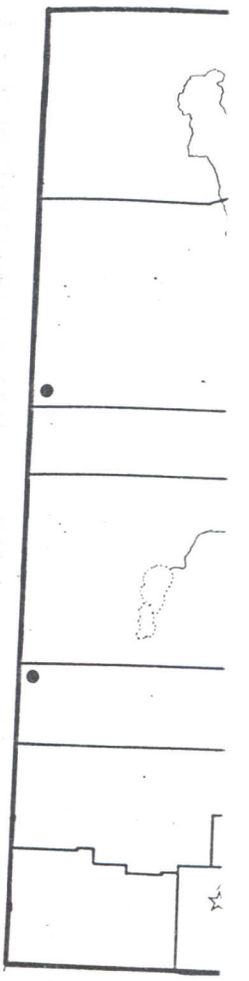


Fig. 1. Distribution of *T. minima* (open stars) *leptodes* (half circles); (squares).

yellow, often tinged lanceolate, compress with glochidiate hai tose barbellate bristl the ray pappus only

Distribution: F Utah in Duchesne a mesas in rocky place

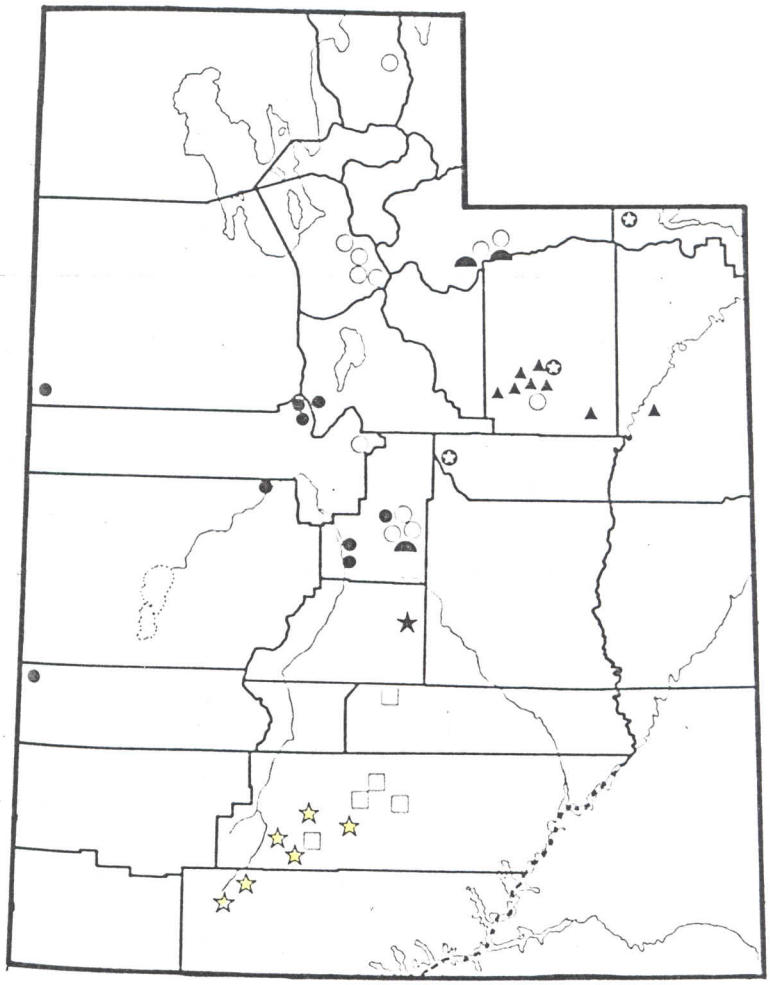
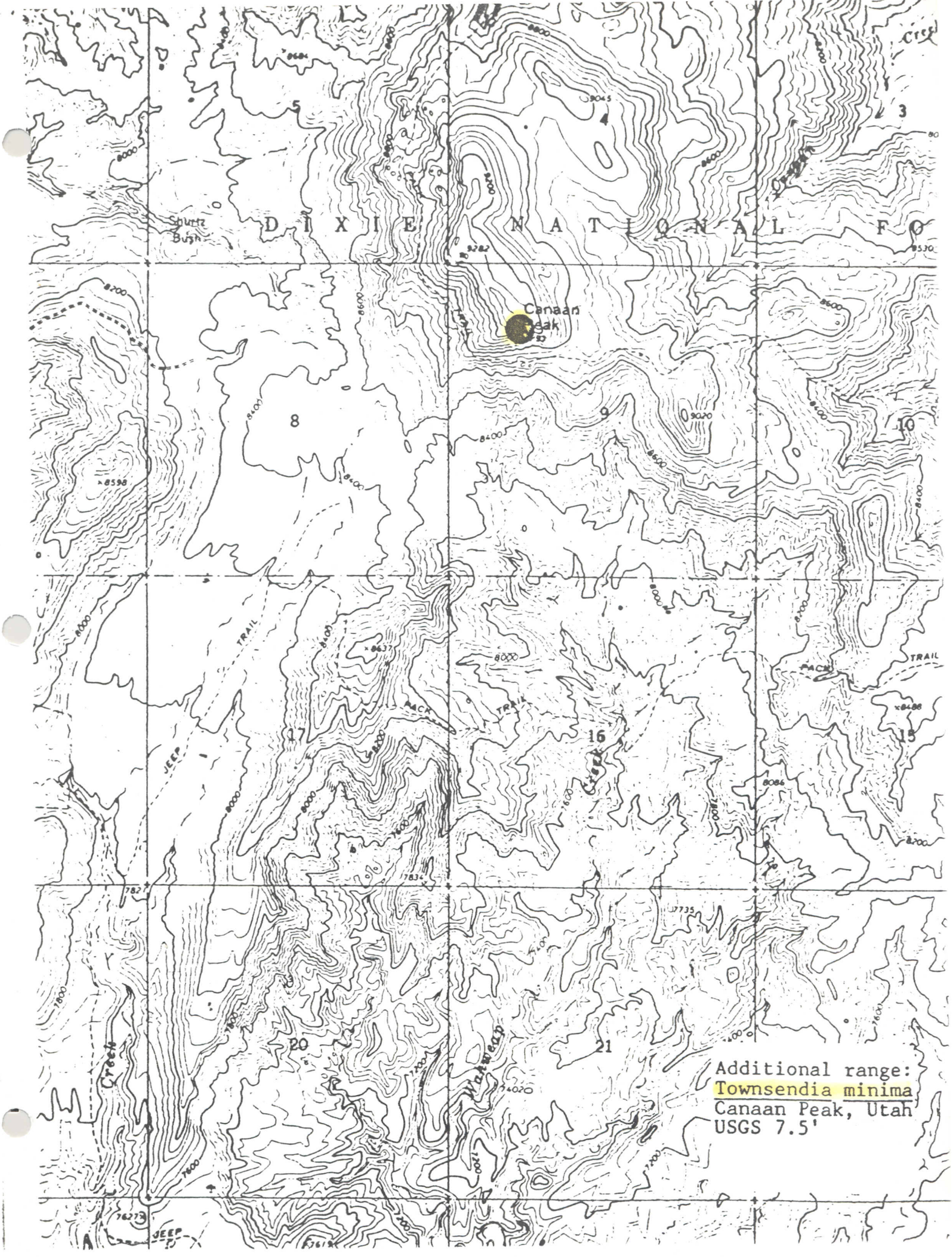


Fig. 1. Distribution of *Townsendia aprica* (star); *T. montana* (open circles); *T. minima* (open stars); *T. mensana* (triangles); *T. jonesii* (closed circles); *T. leptodes* (half circles); *T. hookeri* (circles with star in center); and *T. exscapa* (squares).

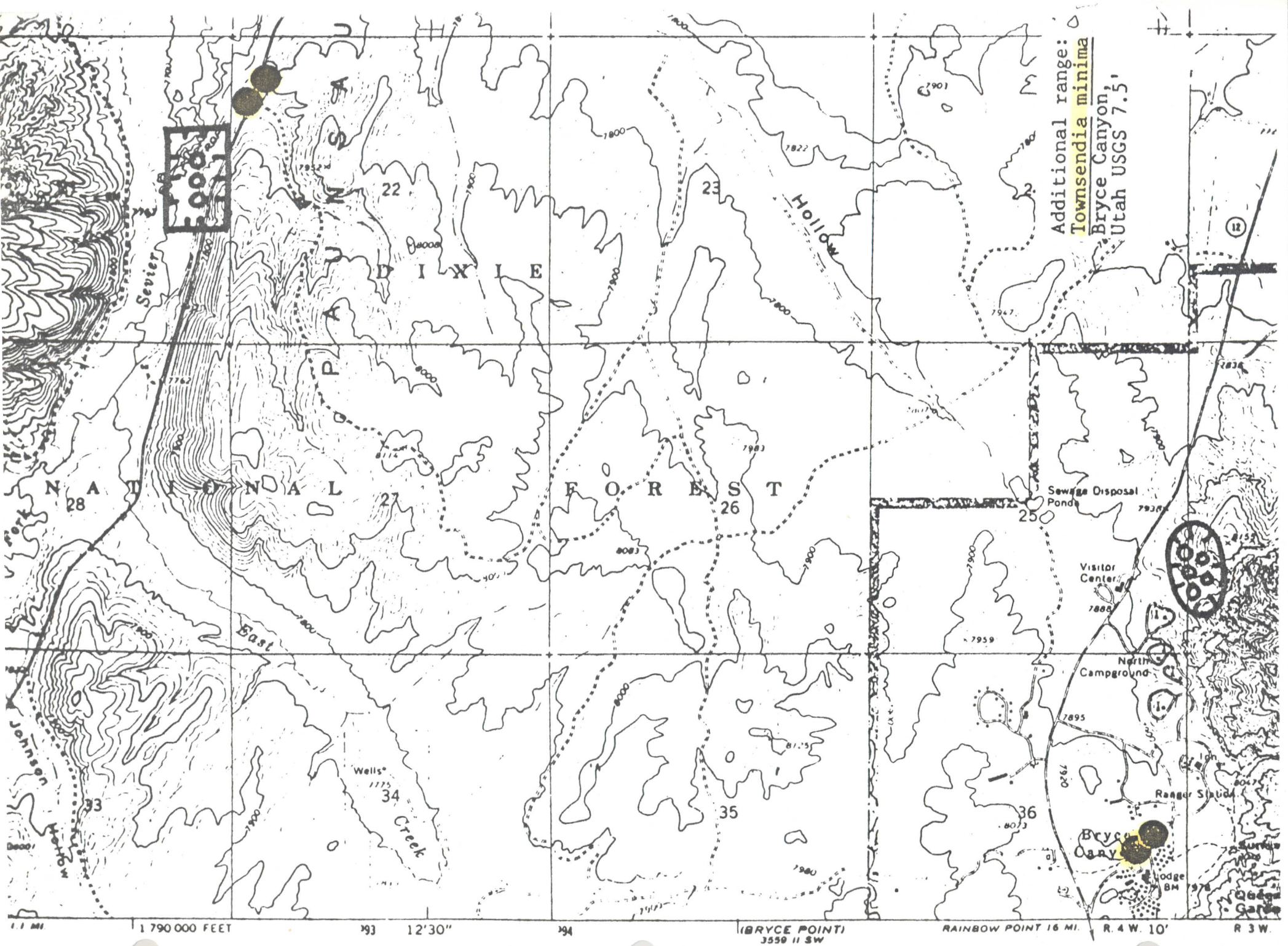
yellow, often tinged pink at the tip, 3.5-4.8 mm long; achenes oblanceolate, compressed, 2-ribbed, densely pubescent on all surfaces with glochidiate hairs; pappus of the ray-flowers of 15-35 plurisetose barbellate bristles, 2.5-4 mm long, free; disk-pappus similar to the ray pappus only 5-6.5 mm long.

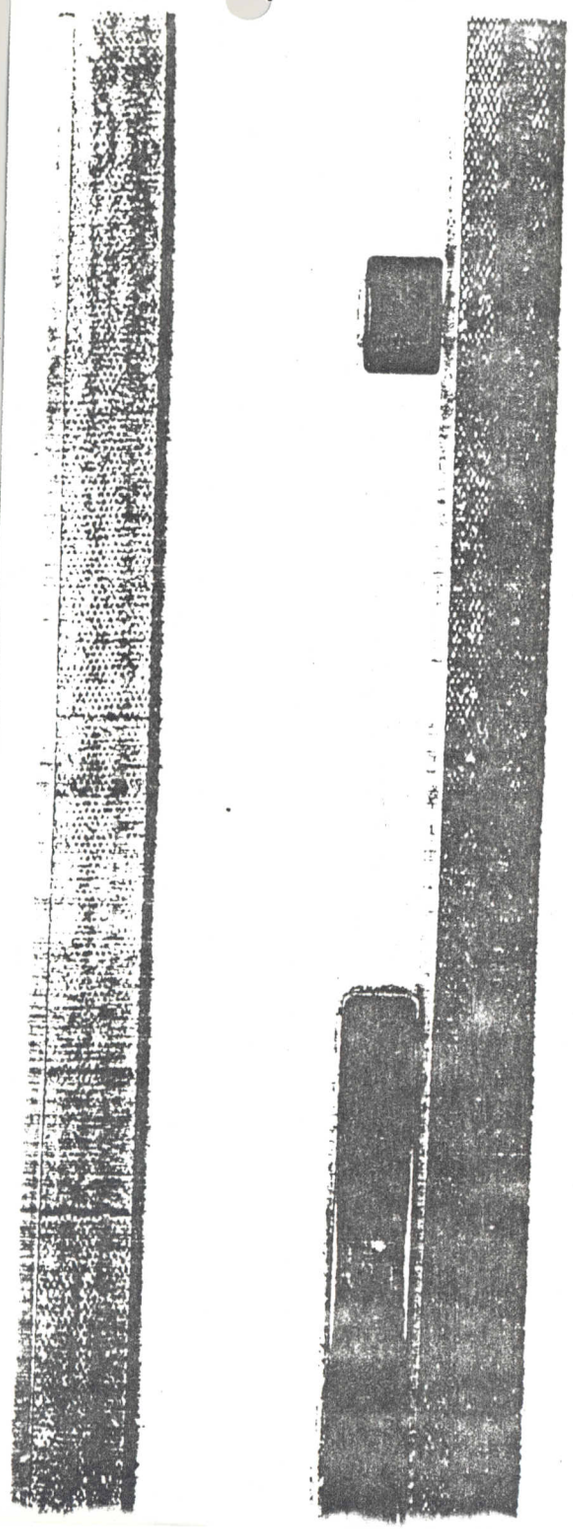
DISTRIBUTION: Endemic to the Uinta Basin of northeastern Utah in Duchesne and Uintah counties mainly on pinyon-juniper mesas in rocky places. Flowering from late April to June.

Critical Habitat:
Townsendia minima
Wilson Peak, Utah
USGS 7.5'



Additional range:
Townsendia minima
Canaan Peak, Utah
USGS 7.5'


Additional range:
Townsendia minima
Bryce Canyon,
Utah USGS 7.5'
NATIONAL FOREST
DIXIE
PAUNSAUGUNT
Sevier
East
Johnson
Wells
Creek
Hollow
Sewage Disposal Ponds
Visitor Center
North Campground
Ranger Station
Bryce Canyon
Lodge
Lodge Gardens
22
23
26
25
27
28
33
34
35
36
7895
7959
7983
7947
7822
7901
1 790 000 FEET
12'30"
(BRYCE POINT)
3559 II SW
RAINBOW POINT 16 MI.
R. 4 W.
R 3 W.



ENDANGERED FLORA PROJECT--SMITHSONIAN INSTITUTION

NAME TOWNSENDIA MINIMA Eastw. | FAMILY Asteraceae

ORIGINAL LOCALITY Bryce Canyon, Garfield Co. Utah | TYPE OF HABITAT

MAXIMUM KNOWN RANGE
GARFIELD CO., UTAH Also Kane Co. (Reveal)

PROBABLE PRESENT RANGE

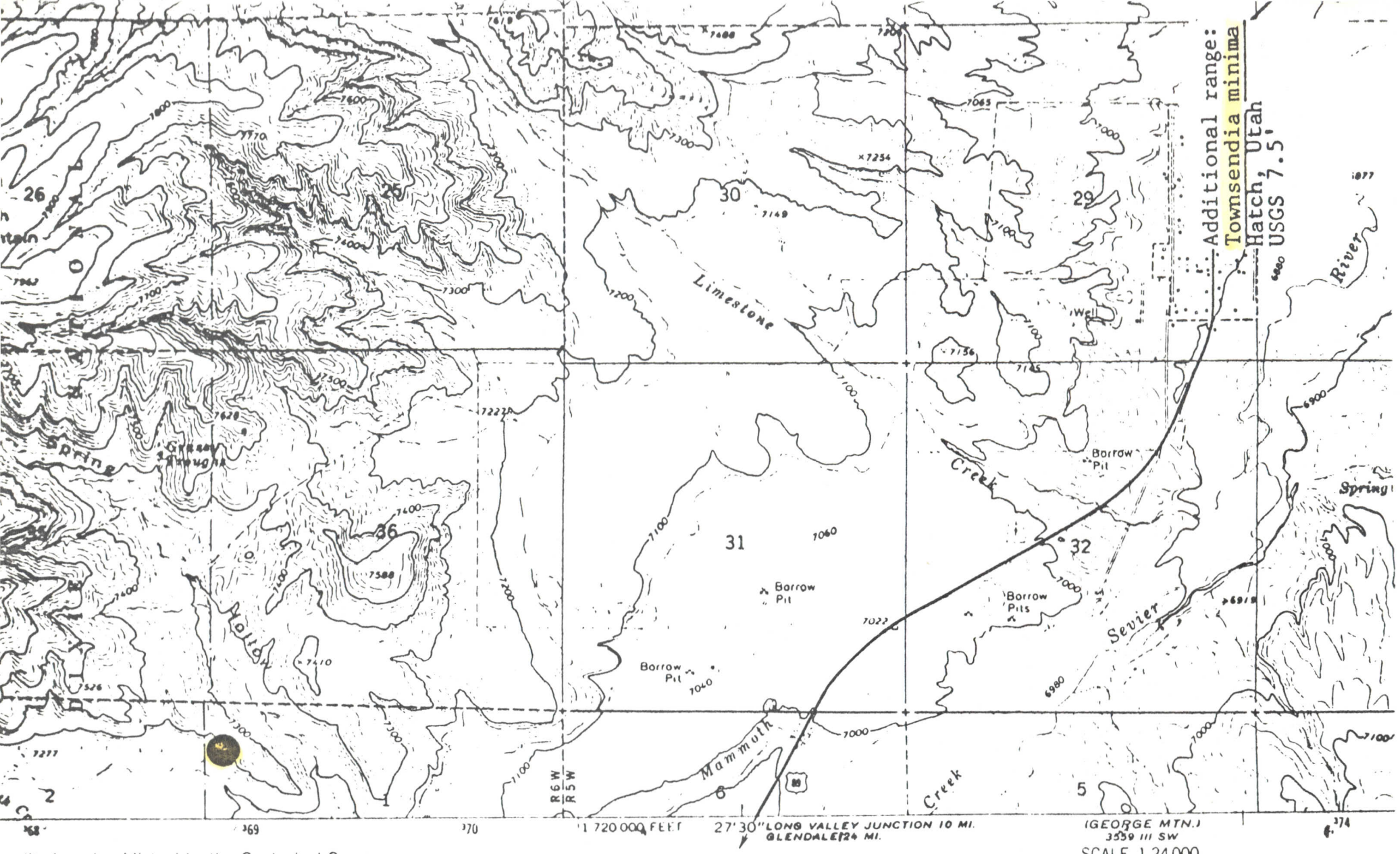
WHERE AND WHEN LAST SEEN OR COLLECTED AND BY WHOM

PROBABLE PRESENT STATUS (Underline) INCREASING DECREASING STATIONARY RARE
VERY RARE UNCERTAIN PROBABLY EXTINCT T

REMARKS (Use Back If Necessary) Local and Restricted
Endemic, edaphically restricted, pass. Th. (Reveal, Utah List)

REPORT BY:
Barneby 17 Dec 75 Leaf. W. Bot. 1:206. 1936 (P. of P.)

SI-3053
11-22-74



. edited, and published by the Geological Survey

y USGS and USC&GS

phy by photogrammetric methods from aerial
phs taken 1964 Field checked 1966

c projection 1927 North American datum
ool grid based on Utah coordinate system, south zone
eter Universal Transverse Mercator grid ticks.
shown in blue

SCALE 1:24 000

0 1000 2000 3000 4000 5000 6000 FEET

0 1 MILE

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

PECIES: Townsendia montana var. minima SYNONYM(S): _____

AMILY: Compositae STATE: Utah

L CODE: _____ HERBARIUM: Bryce Canyon N.P.

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
1·14·90 RECORDER HAS SCHELZ	GARFIELD	R. GRAYBOSCH/746	209	DATE: 6·17·80 / T R S .5 mi. WEST OF SUNSET POINT IN MIXED CONIFEROUS FOREST OF PONDEROSA, LIMBER PINE, DOUG-FIR, JUNIPER ASSOC: PURSHIA, POA, ORYZOPSIS, SWEETIA, MANZANITA ELEV: 8000'	
1·14·90 HAS SCHELZ	GARFIELD	R. GRAYBOSCH/1338	209	DATE: 6·23·81 / T R S NEAR CHINESE WALL, 1 KM. EAST OF SUNRISE PT. BADLANDS OF WASATCH FORMATION. ASSOC: P. LONGAEVA, P. FLEXILIS, PHLOX AUSTROMONTANA JUNIPERUS COMMUNIS, ARCTOSTAPHYLOS PATULA ELEV: 7600'	PT.
1·14·90 HAS SCHELZ	GARFIELD	H. BUCHANAN/3111	210	DATE: 6·18·79 / T R S ECKOED LIMESTONE, SOUTH INSPIRATION PT. ASSOC: PINE - JUNIPER FOREST ELEV: 8000'	
1·14·90 HAS SCHELZ	KANE	H. BUCHANAN/422	210	DATE: 7·13·59 / T R S NEAR UNNAMED VIEWPOINT SOUTH OF PONDEROSA CANYON ON RIM OF CANYON NEAR RAINBOW POINT ROAD IN OPEN FOREST. ELEV: 8900'	
				DATE: / T R S	
				DATE: / T R S	

UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

CHAS SCHELZ
JANUARY 15, 1990

SPECIES: PLANTS AT BYU HERBARIUM FROM BRYCE. SYNONYM(S): _____

FAMILY: _____ STATE: UTAH

EL CODE: _____ HERBARIUM: BRIGHAM YOUNG UNIVERSITY

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
RECORDER PEDIOMELUM PALIENSE	—	NOTHING IN BRYCE 3 BY MUNROE IN	P. PO WOODS 8000 FT.	DATE: / T R S	
OXYTROPIS OREOPHILA JONSII.	①	WELSH 1706	5.5.62 ✓ ①	DATE: / T R S SUNSET POINT AT CREST OF BREAK	
SILENE PETERSONII VAR. MINOR	①	GRAYBOSH.	7.7.80 ✓ ①	DATE: / T R S ALONG CAMPBELL CYN TRAIL 1/2 mi WEST OF TOWER BRIDGE	MC comm
TOWNSENDIA HAMMONDII MONTANA minimis	① ② ③ ④ ⑤	COTTAM REVEAL NEESE GRAYBOSH Reveal 1010	4.6.31 5.25.68 ② 6.9.86 ③ 6.29.81 ④ 5.25.88 ⑤	DATE: / T R S ALONG TRAIL FROM SUNRISE POINT. North OF UT 12 ALONG E. FORK OF SEVIER RIVER ROAD. 1.5 W OF ALTROOT 1/4 MILE SOUTH OF INSPIRATION PT. - 8200 ft. E. FORK OF SEVIER RIVER ROAD 3.5 SOUTH OF UT 12 sec. 22 T36S, 124W	
HETEROTHECA JONSII		NOTHING IN BRYCE.		DATE: / T R S	
				DATE: / T R S	

UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

SPECIES: PLANTS AT BYU HERBARIUM FROM BRYCE CANYON N.P. SYNONYM(S): CHAS SCHELZ JANUARY 13, 1990

FAMILY: STATE: UTAH

EL CODE: HERBARIUM: BRIGHAM YOUNG UNIVERSITY

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
RECORDER PENSTEMON BRACTEATUS	(1) (2) (3) (4)	N. HOLMGREN " 8452 GRAY BOSH 791B - FOSTER 4389	JUNE 1980 6.77	DATE: 6-18 77 / T R S (1) DAVES HOLLOW - 2 mi WEST OF RUBYS INN T36S, R4W, S14 (2) ALONG ROAD TO BRYCE POINT - ½ m. FROM INSP. POINT TURNOFF T37S R4W SEC 1 (POND. AM) (3) ½ mi E. SUNSET POINT, SMALL TRIBUTARY TO BRYCE WASH - WASATCH FORMATION (4) T37S, R4W, SEC 5, NW END OF TROPIC RES. WASATCH FORMATION.	
CASTILLEJA PARVULA VAR.	REVEAL	(1) ELIZ. NEESE/A. TALNR 17566 (2) HOLMGREN GRAYBOSH	6/86 7/80	DATE: / T R S (1) T36S, R4W, S1 1.5 mi W. OF AIRPORT - BASE OF PINE HILLS (2) ALONG CAMPBELL CYN. TRAIL, ½ mi WEST TOWER BRIDGE	
CRYPTANTH OCREALENTA — NOTHING.					
LESQUERELLA RUSICUNDULA	(1) (2) (3) (4) (5)	ELIZ NEESE K. WHITE ATWOOD 7634 GRAYBOSH 892 REVEAL 1011	6/85 6.28.85 5.18.81 6.21.80 6.29.80 5.25.68	DATE: / T R S (1) T36S, R4W, S1 1 mi. W. AIRPORT (2) TRAIL TO BRYCE POINT NEAR YOVIMPA POINT - (3) T37S, R4W AT SWAMPY POINT 4 ¼ mi S OF INSP. POINT - WHITE WASATCH 5 E. FORK OF SEVIER RIV. RD. 3.5 mi S. UT. HIGHWAY 12 SEC 22 T36S	R4W (COMMON ON EAST SIDE OF ROAD)
PARRYA SUBALPINA	(1) (2) (3) (4) (5)	NEESE 17127 REVEAL WELSH ATWOOD GRAYBOSH	6.28.85 5.25.68 5.29.75 6.21.80 6.17.80	DATE: / T R S (1) 1 mi. W OF AIRPORT (6) REFER TO LESQUERELLA # 5 (3) PARIA VIEW - PIPO WOODS (4) HILLS NW OF TROPIC RES. 5 ½ mi W SUNSET POINT MC TYPE	
ERIOGONUM PANGUICENSE	(1)	CONCYBOSH 766	6.18.80	DATE: / T R S INTERSECTION OF LITTLE HENDERSON CYN + ROAD TO TROPIC 6900 FT. - PIPO-ARPA	
LOMATIUM MINIMUM	(1) (2) (3) (4)	TUHY REVEAL ATWOOD 7635 GRAYBOSH 829	7.3.83 5.25.68 6.21.80	DATE: / T R S (1) SLOPE SEVERAL HUNDRED METERS ABOVE HENDERSON CYN. OVERLOOK SW¼ SEC 32, T 35S, R1W 11 mi NE TROPIC (2) E. FORK OF SEVIER + HIGHWAY 12 (NORTH OF THIS) EXPOSED SLOPES (3) T37S, R4W, AT SWAMPY POINT. (4) UPPER DRAINAGE OF LITTLE HEND. CYN - BELOW RIM,	NOT IN PARK

UTAH NATURAL HERITAGE PROGRAM COLLECTION LOG SHEET

SPECIES: _____ SYNONYM(S): _____

FAMILY: _____ STATE: _____

EL CODE: _____ HERBARIUM: _____

SEARCH DATE	CO.	COLLECTOR/#	ACCESSION #	OTHER LABEL AND LOCALITY DATA/ANNOTATION HISTORY	SOURCE CODE/EO #
_____ RECORDER				DATE: / T R S	
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FAMILY: _____ STATE: _____

EL CODE: _____ HERBARIUM: _____

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