

Observations and Comments on *Pediocactus sileri* in Arizona and Utah

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Editor's Note

In 1922, botanists N. L. Britton and J. N. Rose described a new species of cactus, *Utahia sileri*, in a monograph of the Cactaceae family published by the Carnegie Institution of Washington (Publ. 248. Vol. 2. P. 215). They attributed recognition of the species to George Engelmann, a St. Louis botanist who had been dead for a number of years. This was on the basis of their discovery in the dried plant specimens stored in the herbarium of the Missouri Botanical Garden one which seemed to be distinct from all others known at the time and upon which Engelmann had written the name "*Echinocactus sileri*." It was evident that had Engelmann lived longer he would have officially christened the new species with this name, thereby commemorating an early Mormon pioneer of southern Utah, Andrew Lafayette Siler, who lived from 1824 to 1898. But Britton and Rose thought that the plant was so different from other kinds of *Echinocactus* that they established the new genus *Utahia* for it in recognition of the location where they thought Mr. Siler had found it. At the time *Utahia sileri* was finally officially named and described in 1922 there was only one plant of the species known to science, the original dried specimen in the herbarium of Engelmann in St. Louis. Since the plant collector Siler lived in southern Utah, it was assumed by Britton and Rose that the type locality "Cottonwood Springs and Pipe Springs" from which the specimen came was in Utah. They recorded "*Distribution: Southern Utah.*" when the species was first described.

The species remained very poorly known and was supposed by many plant scientists to be rare or perhaps near extinction. Eventually it was realized that Pipe Springs (now a National Monument) was actually in Arizona rather than Utah. By the second edition of Lyman Benson's *Cacti of Arizona* (University of Arizona Press. 1950), Pipe Springs was the only locality definitely known for the species. In their book on the *Flora of Arizona* (University of California Press. 1951), Thomas H. Kearney and Robert H. Peebles stated that the plant was locally common in the vicinity of Pipe Springs and that it was known for certain only from northern Arizona. By the third edition of *Cacti of Arizona* (University of Arizona Press. 1969), Benson had seen specimens only from Arizona (not Utah), although he noted that the plant had been reported from Utah by others.

There have been widely divergent opinions on the correct name for this little cactus, Lyman Benson using *Echinocactus sileri* as the scientific Latin name and *Utahia* as the common English name. T. H. Kearney and R. H. Peebles retained *Utahia sileri* as the Latin name. Recent taxonomic opinion, based on reconsideration of the subject by Benson, is that the cactus is congeneric with *Pediocactus simpsoni* described by N. L. Britton and J. N. Rose nine years before they described *Utahia* and that it therefore should be called *Pediocactus sileri*.

The multiplicity of names tends to hide the fact that up until the studies reported here now by Ralph Gierisch, extremely little information was available concerning this species. The present article now finally reports the species from 11 study sites located in two counties of Arizona and two counties of Utah. Since *Pediocactus sileri* has now been officially listed in the Federal Register as an endangered plant species, the actual locations have been deleted from this article although they are present, together with map names and Section, Township and Range numbers in the copy present in the files of the Bureau of Land Management. By deleting the localities, *Desert Plants* is following the recommendation that the actual localities of endangered species not be revealed so as to discourage unlawful collecting of the plants by persons who might otherwise do so.

Introduction

Pediocactus sileri came under observation by the Bureau of Land Management in keeping with its policy to study plant species listed as candidate endangered or threatened under the Endangered Species Act. Subsequently the status of the species was modified in the Federal Register to fully endangered. The Bureau of Land Management in Arizona initiated a program of literature, herbarium, and field searches and studies in 1976 to obtain information needed for management planning requisite to conservation and protection of endangered plants. Field study information was obtained concerning *Pediocactus sileri* during the period 1976 through 1979. This information is summarized and presented under several topics.

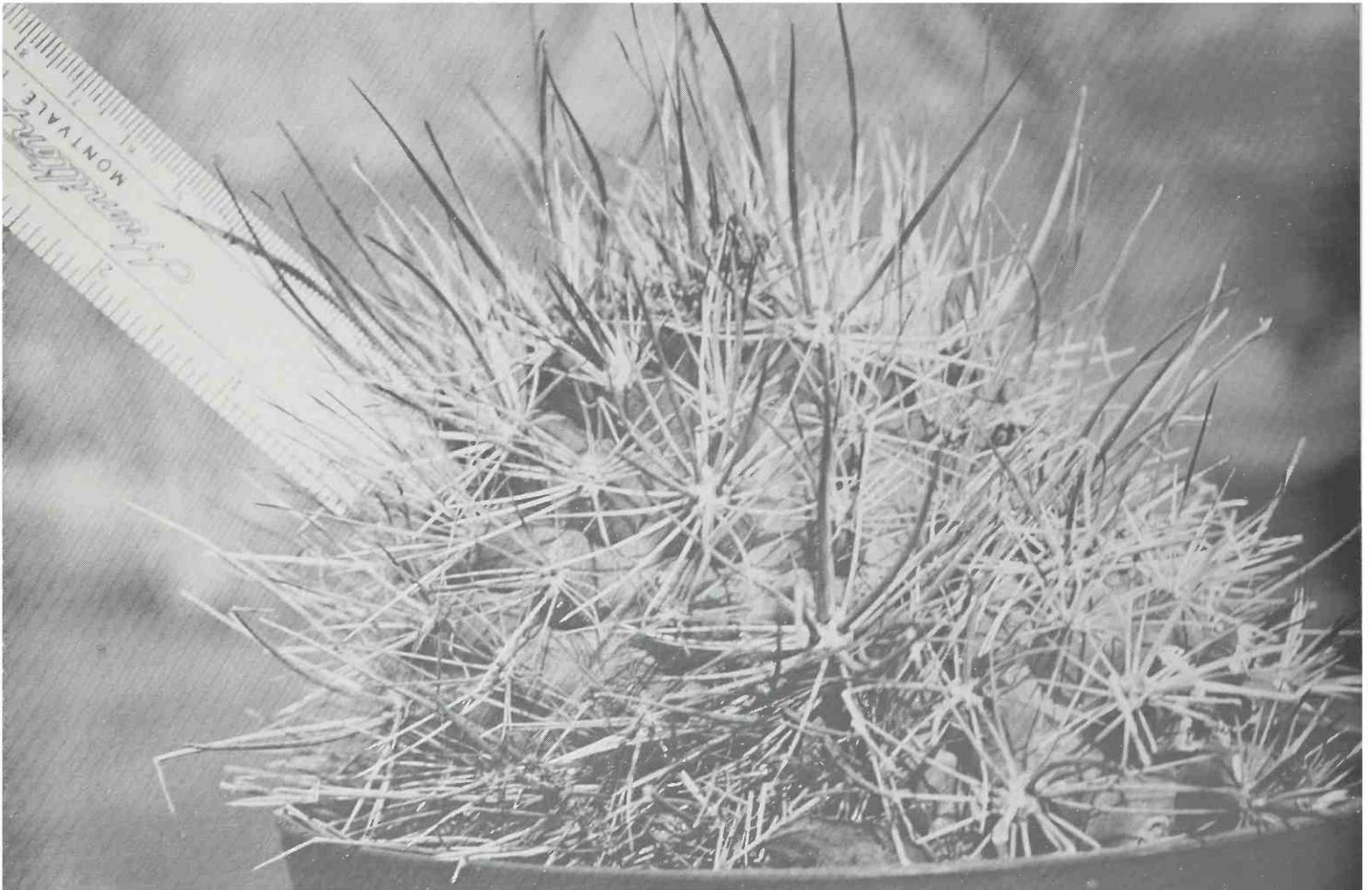
Studies during the four year period have shown that this cactus is considerably more common and less soil specific than previously supposed. Information obtained from the studies resulted in the conclusion that this cactus should be listed under the

Bureau of Land Management classification "sensitive" and, as such, would be considered in the Bureau's management planning to provide needed conservation and protection.

Pediocactus sileri stems occur singly or in clusters. Clustering results from stem branching and multiple stems. Stems more than five inches in diameter have been found. Some stems are more than 10 inches long. The longest seen was approximately 18 inches. The longest stems are generally leaning or reclining. Central spines are generally less than 1¼ inches long. One specimen found near [location deleted] has spines more than 50 mm long.

Extent of Habitat, Population Estimates and Field Counts

The total area of habitat for this cactus is unknown. More than 400,000 acres of Moenkopi Formation surround the currently known natural habitat in Arizona. In addition, many thousand acres of Moenkopi Formation in northern Arizona may be



Pediocactus sileri. Central spines are usually less than 30 mm. Spines on this specimen exceed 50 mm.

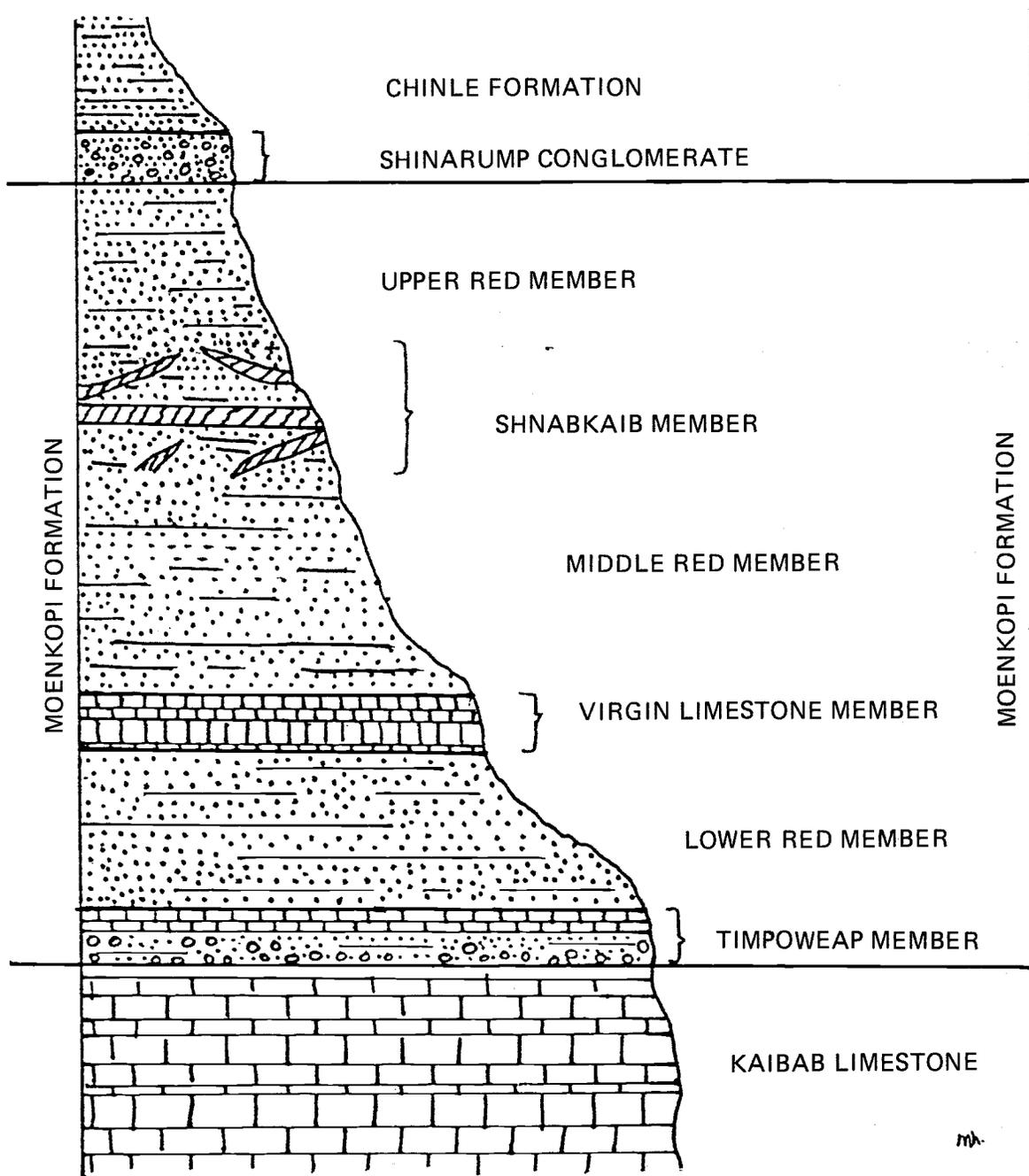


Diagram showing positions of the various members of the Moenkopi Formation and adjoining geologic strata in the study areas.

suitable habitat. The currently known natural habitat in Arizona is estimated at more than 50,000 acres as determined from field inspection and aerial photo studies. The currently known habitat in Utah is estimated at approximately 3,000 acres.

Realistic population estimates are difficult or impossible to obtain because of the extent of the habitat and the very high variability in density. In one high density area, 72 plants were counted from one spot. Conversely, many locations (at considerable distance from roads, stock water, etc., where man-induced factors have a minimum effect) were visited where many acres had to be inspected to find a few plants. The high variability in density (plants per unit area) of this cactus is similar to that of many other species of cactus.

Field counts of plant numbers of this species were made between November 27 and November 29 of 1979 on less than one percent of the currently known habitat. These counts were made at eight locations in Arizona. A total of 1,109 plants were counted in seven observer hours.

Altitude, Slope, Exposure, Geology and Soils

The known altitudinal range is approximately from 2,800 feet to 5,400 feet. The plant occurs on slopes from nearly level to very steep and has been found on exposures facing each of the four cardinal directions. This cactus may prefer northerly and easterly exposures at lower altitudes and southerly exposures at higher altitudes. This has not been studied.



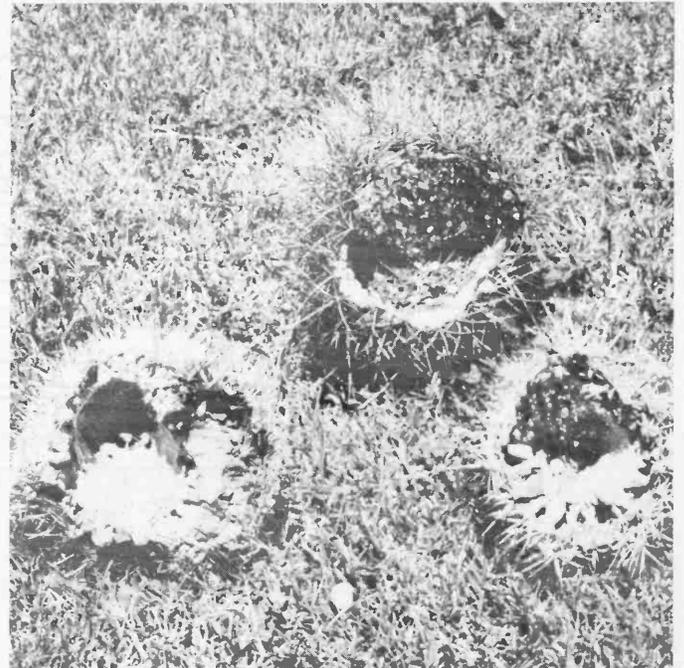
New stems produced by a plant of *Pediocactus sileri* which had been partly eaten, probably by rabbits.

Pediocactus sileri has been found on several geologic members of the Moenkopi Formation. Information on geology and soils obtained at eight study area locations is presented in a later section. No attempt was made to study all variations in geology and soils, nor to estimate the acreage of habitat applicable to a geologic entity or soil. The cactus occurs on red and gray (white) gypseous and/or calcareous soils and shales. Soil texture varies from very gravelly or shaly sandy loam through fine sandy loam to clay loam. In some areas the plants are growing on fractured shale with very little fine textured soil. Fine textured soil varies in depth from negligible to 22 or more inches. Soil pH, based upon studies made to date, ranges from 7.2 to 8.8.

Natural Enemies

Rabbits occasionally forage on *Pediocactus sileri*, consuming the apical portion of the stem, and may eat everything down to the ground line except the spine clusters. Some species of rodents seem to confine their foraging to the lower tubercles. A burrowing rodent approaches the plant from underground, eats the plant tissues, and leaves a "shell" of spine clusters. Insects are also injurious. One plant was found with a large white larva in a cavity in the cortical tissues. Number of plants damaged by insects and the degree of damage is not known.

A large number of dead plants seen may have died from disease. Accurate information concerning this factor is lacking. Geologic erosion is another factor. Many plants become established on steep, rapidly



Cactus "spine shells" may result from foraging by burrowing rodents. The two in the foreground are *Pediocactus sileri*. The third shell is *Neolloydia johnsonii*.



Pediocactus sileri growing on red gypseous soil from the Lower Red member of the Moenkopi Formation.



Pediocactus sileri growing with a dense crust of lichens on gray (white) gypsum soil from the Shnabkaib member of the Moenkopi Formation.

eroding slopes. Some reach maturity and apparently even old age. However, it is obvious that some succumb to erosion.

Associated Vegetation

Vegetation associated with *Pediocactus sileri* varies with changes in altitude, soil, exposure and other factors. Associated perennials noted at a few locations are listed in the section below. No attempt was made to record all variations occurring in the habitat, nor to estimate the acreage of habitat applicable to any of the associated vegetation types.

Characterization of Habitat

Area No. 1. Altitude approximately 5,400 feet. Geology transitional between the Upper Red member of the Moenkopi Formation and the Shnabkaib member. Soil moderately calcareous, pH 7.6, 0–12" deep, fine sandy loam. Vegetation consisting of *Pinus edulis*, *Juniperus osteosperma*, *Cowania mexicana*, *Yucca baccata*, *Y. angustissima*, *Chrysothamnus nauseosus*, *C. viscidiflorus*, *Ephedra* sp., *Artemisia bigelovii*, and *Hilaria jamesii*.

Area No. 2. Altitude approximately 5,200 feet. Geology identified as the Shnabkaib member of the Moenkopi Formation. Soil strongly calcareous, pH 8.2, 0–16" deep, fine sandy loam. Vegetation consisting of *Artemisia tridentata*, *Ephedra* sp., *Atriplex canescens*, *Gutierrezia sarothrae*, *Sporobolus* sp., *Oryzopsis hymenoides*, *Eriogonum corymbosum*, *Lepidium* sp., *Castilleja* sp., and a few scattered junipers (*Juniperus osteosperma*).

Area No. 3. Altitude approximately 3,200 feet. Geology identified as the Shnabkaib member of the Moenkopi Formation. Soil varying from a) strongly calcareous, pH 8.0, 0–2" deep, very gravelly fine sandy loam, to b) moderately calcareous, pH 8.0, 2–26" deep, fractured shale and gypsum. Vegetation consisting of *Eriogonum* spp., *Ephedra torreyana*, *Salvia dorrii*, *Prunus fasciculatus*, *Hymenoclea salsola*, *Atriplex confertifolia*,

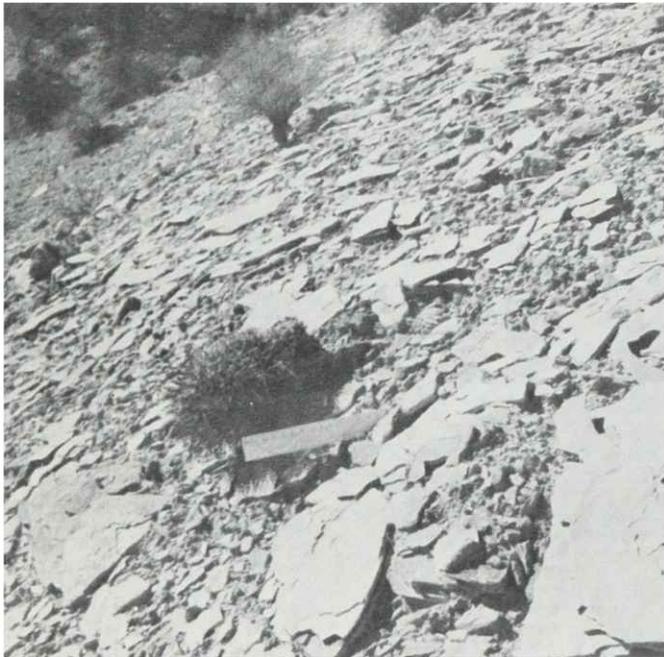
Psorothamnus fremontii, *Fallugia paradoxa*, *Cowania mexicana*, *Sphaeralcea* sp., *Lepidium fremontii*, *Physaria newberryi*, *Cryptantha* sp., *Castilleja* sp., *Hilaria jamesii*, and *Amsonia eastwoodiana*.

Area No. 4. Altitude approximately 2,800 feet. Geology identified as the Shnabkaib member of the Moenkopi Formation. Soil varying from a) strongly calcareous, pH 8.8, 0–4" deep, gravelly sandy loam, to b) strongly calcareous, pH 8.8, 4" deep and deeper, fractured shale and gypsum. Vegetation consisting of *Arctomecon humilis*, *Physaria newberryi*, *Hymenoclea salsola*, *Atriplex confertifolia*, *Ephedra torreyana*, *Lycium andersonii*, *Lepidium fremontii*, *Sphaeralcea* sp., *Eriogonum thompsonae* var. *albiflorum*, *Krameria parvifolia*, *Castilleja* sp., and *Delphinium* sp.

Area No. 5. Altitude approximately 4,600 feet. Geology identified as the Middle Red member of the Moenkopi Formation. Soil slightly calcareous, pH 7.8, 0–4" deep, silty clay loam. Vegetation consisting of *Eriogonum mortonianum*, *E. corymbosum*, *E. microthecum*, *E. thompsonae* var. *atwoodii*, *Artemisia bigelovii*, *Cowania mexicana*, *Ephedra* sp., *Chrysothamnus* sp., *Atriplex confertifolia*, *Salvia dorrii*, *Gutierrezia sarothrae*, *Hilaria jamesii*, *Oryzopsis hymenoides*, *Cryptantha semiglabra*, *Euphorbia fendleri*, *Stanleya* sp., *Sphaeralcea* sp., and *Thelesperma subnudum*.

Area No. 6. Altitude approximately 4,700 feet. Geology identified as the Virgin Limestone member of the Moenkopi Formation. Soil varying from a) moderately calcareous, pH 8.2, 0–3" deep, clay loam, to b) slightly calcareous, pH 8.0, 3" deep and deeper, weathered shale. Vegetation consisting of *Artemisia tridentata*, *A. nova*, *A. pygmaea*, *Eriogonum corymbosum*, *E. microthecum*, *E. shockleyi*, *Ephedra* sp., *Atriplex canescens*, *A. confertifolia*, *Chrysothamnus* sp., *Salvia dorrii*, *Gutierrezia sarothrae*, *Hilaria jamesii*, *Petradorea pumila*, *Cryptantha* sp., *Penstemon* sp., *Astragalus lancearius*, *Astragalus* sp., *Aster arenosa*, *Phlox* sp., *Castilleja* sp., and *Thelesperma subnudum*.

Area No. 7. Altitude approximately 4,700 feet. Geology identified as the Lower Red member of the Moenkopi Formation. Soil



Rapid geologic erosion has resulted in loss of surface soil and has exposed the roots of some plants of *Pediocactus sileri*.



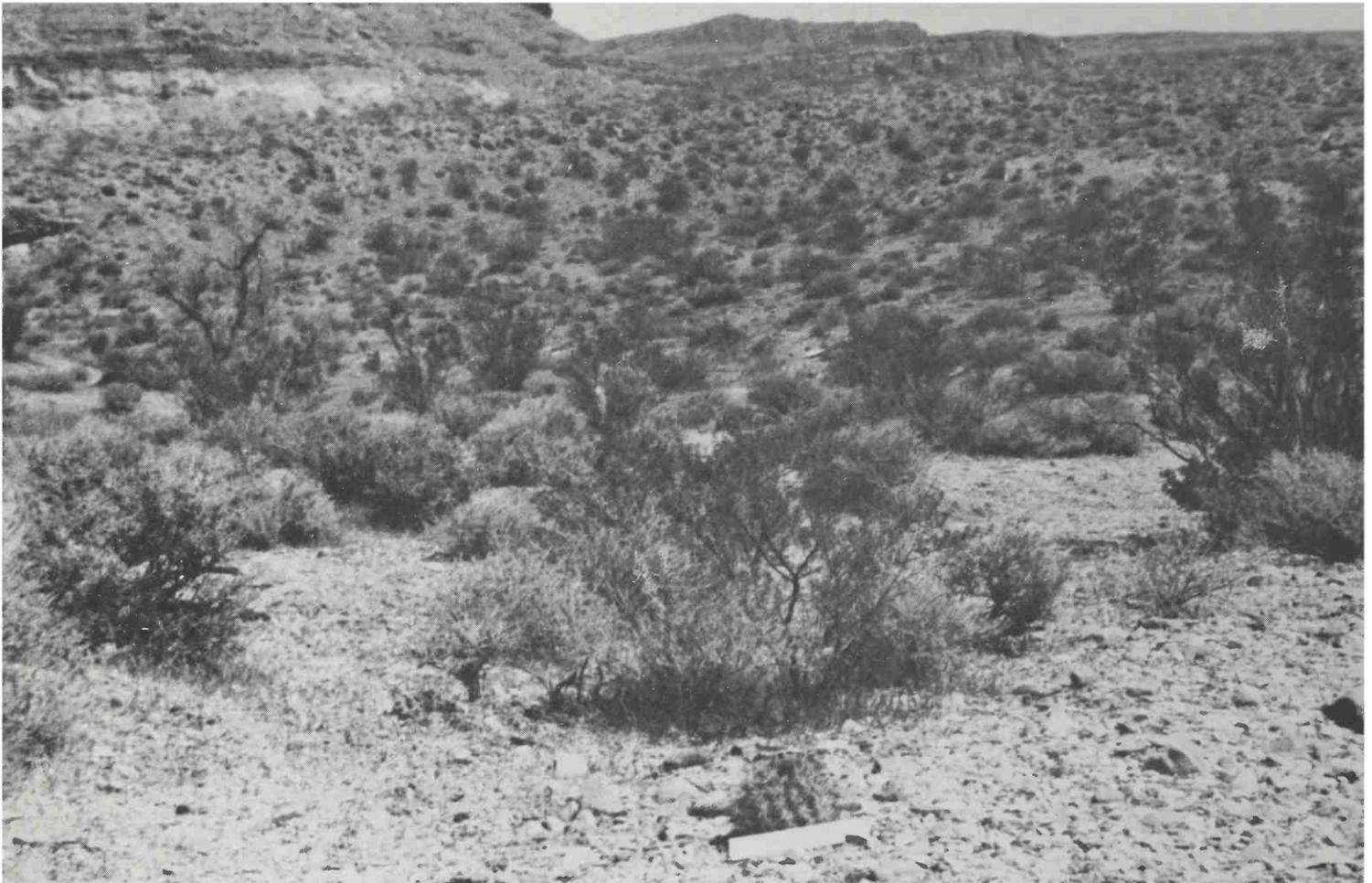
Pediocactus sileri associated with *Arctomecon humilis*.



Pediocactus sileri growing on fractured shale of the Shnabkaib member of the Moenkopi Formation.



Pediocactus sileri associated with Pinyon (*Pinus edulis*) and Juniper (*Juniperus osteosperma*). Note the Shinarump Conglomerate ledges in the right background.



Pediocactus sileri associated with Creosotebush (*Larrea tridentata*), White Bursage (*Ambrosia dumosa*), Four-Wing Saltbush (*Atriplex confertifolia*), *Lycium andersonii*, and other species of low elevation desert.

varying from a) strongly calcareous, pH 8.2, 0–7" deep, loam, to b) strongly calcareous, pH 8.2, 7–15" deep, sandy loam. Vegetation consisting of *Atriplex canescens*, *Ephedra* sp., *Lycium* sp., *Sporobolus* sp., *Chrysothamnus viscidiflorus*, *Lepidium* sp., *Eriogonum kearneyi*, *E. inflatum*, *Hilaria jamesii*, *Gutierrezia sarothrae*, *Sphaeralcea* sp., and *Opuntia* sp.

Area No. 8. Altitude approximately 4,400 feet. Geology identified as the Lower Red member of the Moenkopi Formation. Soil slightly calcareous, pH 8.2, 0–22" deep, fine sandy loam. Vegetation consisting of *Atriplex confertifolia*, *Ephedra* sp., *Gutierrezia sarothrae*, *Chrysothamnus nauseosus*, *Sporobolus airoides*, *Sporobolus* sp., *Hilaria jamesii*, *Lepidium* sp. and *Suaeda torreyana*.

Area No. 9. Altitude approximately 5,200 feet. Geology identified as the Shnabkaib member of the Moenkopi Formation. Soil strongly calcareous, pH 8.2, fine sandy loam. This appears to be a relatively poor quality site. Vigor of *Pediocactus sileri* is poor and few other plants inhabit the site. Vegetation consists of *Atriplex*

confertifolia, *Sporobolus* sp., *Lepidium* sp., *Opuntia* sp., and *Ephedra* sp.

Area No. 10. Altitude approximately 5,200 feet. Geology identified as the Shnabkaib member of the Moenkopi Formation. Soil strongly calcareous, pH 8.4, loam. Vegetation consisting of *Artemisia tridentata*, *Gutierrezia sarothrae*, *Opuntia whipplei*, *Opuntia* sp., *Oryzopsis hymenoides*, *Chrysothamnus* sp., *Ephedra* sp., *Hilaria jamesii*, *Sitanion hystrix*, *Calochortus* sp., and *Delphinium* sp.

Area No. 11. Altitude approximately 2,900 feet. Soil is from Moenkopi Formation mixed with some alluvial outwash and colluvial material from sandstone, limestone and basalt. The soil is strongly calcareous, pH 7.2, gravelly loam. Vegetation consists of *Larrea tridentata*, *Ambrosia dumosa*, *Atriplex confertifolia*, *Lycium andersonii*, *Ephedra torreyana*, *Opuntia echinocarpa*, *Hilaria rigida*, *Yucca baccata*, *Eriogonum inflatum*, *Gutierrezia sarothrae*, *Echinocereus engelmannii*, *Sporobolus* sp., *Krameria parvifolia*, and *Ceratoides lanata*.