PUNA BONNIEAE (CACTACEAE), A NEW SPECIES FROM ARGENTINA

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Summary. Described is a new species, *Puna bonnieae* Ferguson & Kiesling (Cactaceae), from Catamarca, Argentina. It is compared to the other two species of *Puna, P. clavarioides* (Pfeiffer) Kiesling and *P. subterranea* (Fries) Kiesling. The genus *Puna* Kiesling is compared with other opuntioid genera.

During a trip to Argentina in January-February 1990 by David Ferguson, Sean Hogan and Bonnie Brunkow, an undescribed cactus was discovered in the state of Catamarca. It was first noticed by Bonnie, who has a knack for finding great things while everybody else is side-tracked by something else. At first Dave took it for a *Tephrocactus* seedling; however, while Sean and Dave were looking at a tiny unidentified species of *Lobivia,* she discovered a specimen of the "seedling" in flower, and it was immediately apparent that this was something new—one of the nicest of many outstanding cacti known from Argentina. Once the seeds and fruit were found as well, we knew that this little plant was a new species of the opuntioid genus, *Puna* Kiesling.

During this first visit we were probably allowed to find this plant only through the kindness of the weather during the previous several weeks. Nearly every plant had flowers open, and once the main colonies were located, plants were visible from a great distance. The lovely pink flowers appeared to spring directly from the bare ground. Without the flowers, plants would have been nearly invisible, even though they were swollen and exposed at the surface.

The species was again visited by David in early February 1994, when several hours of searching revealed only two plants. Both of these were buried under about 1 cm of soil (one was slightly exposed by the erosion of the slope upon which it grew, otherwise it would not have been found). This was a very dry time, and the plants were all shrunken down and out of sight.

Roberto Kiesling visited the same area on three additional occasions. The type collection was made during the first trip with Omar Ferrari and Silvio Meglioli in November 1994, the holotype being prepared when these plants flowered in cultivation in December. During the second trip to the same locality no plants were seen, but on the third trip additional plants were located.

Observations on behavior at these times show that the plants are triggered to flower by spring or early summer rains, having been found in flower anywhere from November to February. The fruits ripen approximately four to five weeks after flowering. The presence of ripe fruit and buds at the same time on the date of the first collection indicates that the species is an opportunistic bloomer and can flower at least twice in one season. It likely does not flower at all in some seasons (as in 1993-1994).

The genus *Puna* was originally published by Kiesling (1982b). At that time only two species were known. *P. clavarioides* (Pfeiff.) Kiesl., the type species, occurs in Mendoza and San Juán, Argentina, and is the most widely cultivated and most familiar. *P. subterranea* (Fries) Kiesl. is known from the province of Jujuy, Argentina, and the department of Potosí, Bolivia.

These two species have had a chaotic taxonomic history, having been variously bounced around among the genera *Austrocylindropuntia* Back., *Cumulopuntia* Ritter (a synonym of *Maihueniopsis* Speg.), *Cylindropuntia* (Engelm.) Knuth, *Opuntia* Turn. ex Mill., and *Tephrocactus* Lem.; however, they are clearly distinct from all of these and constitute a distinctive group on their own merits.

Puna is characterized as follows: Plants are geophytic, possessing an enlarged tuberous root situated well below the soil-surface. From this arise the soft stems, formed of series of densely stacked segments. The youngest segments are held at or near the soil surface, with older segments pulled deeper underground each season. New stem segments are determinate (although they may become indeterminate under low light conditions) and are produced from the sides of older segments.

The plants shrink and contract downward from the soil surface during dormant periods, often being hidden from view for much of the year. It would appear that the root also pulls downward as the plant ages, resulting in the plant gradually moving downward as the top slowly grows at the soil surface. On an average mature plant there are three or more segments exposed at the soil surface, but many more are buried below-ground. The leaves are minute, lanceolate, appressed to the

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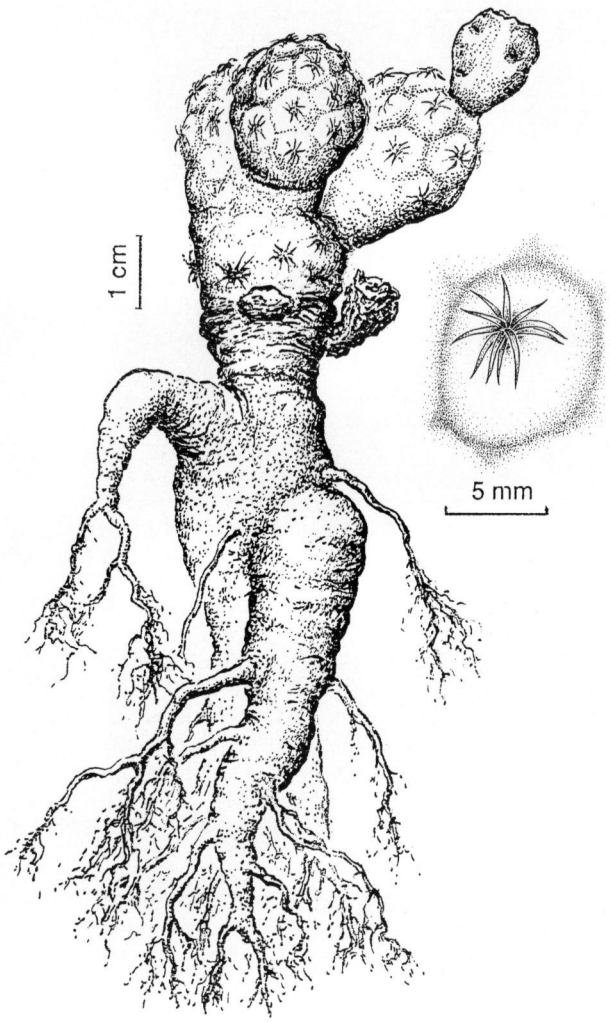

Fig. 1. *Puna bonnieae,* general aspect of a plant, with detail of a tubercle and areole. Note old, shriveled stems just above roots.

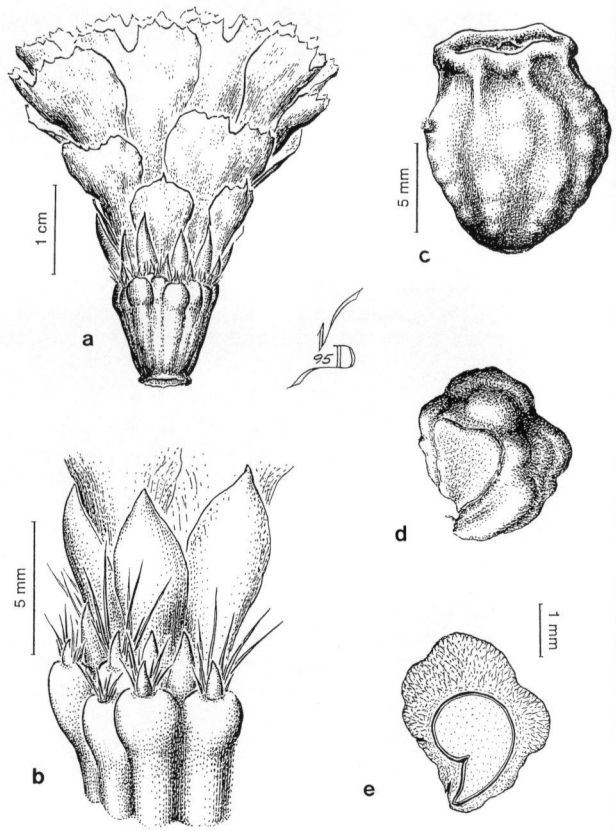

Fig. 2. *P. bonnieae.* **A.** flower exterior. **B.** apex of receptacle with elongated podaria, areoles, leaf and small spines. **C.** fruit. **D.** seed covered by aril. **E.** longitudinal section of aril and seed. Drawings by Vladimiro Dudas.

stem and early-deciduous. Glochids are mostly absent (although often produced under cultivation, particularly in *P. subterranea*). Spines are short and slender, several per areole, all similar, and are closely appressed to the stem. The flowers are of typical opuntioid form and are produced from the sides of the previous season's growth (or rarely from more recent stems), typically one or two per stem-segment. The areoles of the receptacle are reduced and are spineless, bearing only hairs and bristles, a common character in the Cereoideae but one that is unique in the Opuntioideae. Mature fruits are usually of a dull reddish or orange-brown hue and are thin-walled and fleshy, with juicy (almost watery) pulp. If not disturbed, the fruit dries and eventually ruptures through wear or disturbance. The seeds are teardrop-shaped and covered by a firm, tan to brownish aril. The aril is easily scraped away and appears to be composed of fused or tightly packed, elongated cells disposed radially. The surface of the aril is typically roughened at the surface by irregular projections; however, it is sometimes smooth in *P. bonnieae* and *P. subterranea.*

The relationships of *Puna* are rather hard to define with certainty, although the most obvious candidate would be *Pterocactus* Schum., which shares similar morphology in vegetative parts but which often has well-defined glochids and central spines. Fruit dehiscence in *Pterocactus* is circumscissile and the seeds have arils expanded into thin, wing-like margins.

Also similar is *Tephrocactus,* which differs in its deeply sunken, follicle-like areoles, the irregularly dehiscent dry fruit, and the aril of the seeds. This aril contains a network of open internal cells, giving it a puffed-up texture and an appearance something like popped corn.

Maihueniopsis has similarities to *Puna* in fruit and seed; however, the stem tubercles are usually ill-defined and somewhat elongate. Large areoles produce numerous glochids and usually well-developed central spines.

Fig. 3. *P. bonnieae* west of Fiambalá.
Fig. 4. A plant flowering a week after its collection.

The species of *Puna* may be characterized as follows:

Puna clavarioides is well-known in cultivation and is immediately recognizable by its numerous closely-set areoles and flat-topped obconical stem-segments. In appearance this species is reminiscent of *Epithelantha* Web. ex Britt. & Rose.

These segments typically have a thickness of

Fig. 5. A plant in flower west of Fiambalá.

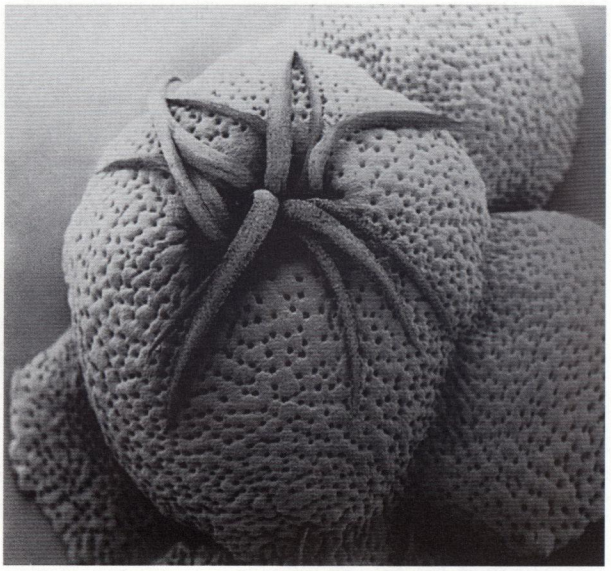

Fig. 6. Scanning electron microscope photo of tubercles and areole.

1.5–2 (0.8–2.8) cm. Areoles are tiny (less than 1 mm long) with obvious but short wool. On the upper side of the segments these are close enough for spines to interlock; on the lower portion they are further apart. Spines are very slender and bristle-like, radiating (usually with the fewest pointing upward), mostly under 2 mm long, and pale pinkish brown to white. The flowers are ca. 2.5 cm wide, dirty brownish to rusty yellow (rarely red), with yellow stigmas.

In cultivation, specimens of this species are often highly modified in stem-shape and often become somewhat cristate.

Puna subterranea is also relatively common in cultivation but is less well-known. It is a tiny plant, with stems typically 1 to 1.5 cm thick (often thicker in cultivation). The stem segments are globose to cylindrical, with the areoles widely spaced on top of flattened, inconspicuous tubercles. The areoles are mostly 0.5–1 mm long, with 4–6 spines, most of which point downward. The spines are very slender, to 6 mm long, and pale pinkish, orange-brown, or white, becoming white in age. The flowers are about 1.5 cm across and are pale salmon pink to brilliant orange-red and have pink stigmas.

Puna bonnieae D. J. Ferguson & R. Kiesling, sp. nov.

Holotype: *R. Kiesling 8710* (collected with Omar Ferrari and Silvio Meglioli), ca. 2000 m, Río Guanchín, near Loro Huasi, Dept. Tinogasta, Catamarca, Argentina, November 20, 1994 (SI). Flower produced in cultivation at the Instituto de Botánica Darwinion, December 10, 1994 (SI).

Paratypes: *S. Hogan 3755* (=*D. Ferguson 319*), January 24, 1990, near Loro Huasi, W of Fiambalá, Catamarca, Argentina (UC); plants of this collection were cultivated at the Botanic Garden, University of California, Berkeley (#90.1306). *O. Ferrari 16/94b,* same data as *R. Kiesling 8710* (SI).

Distribution: Known only from the vicinity of the type locality.

Puna sp. humilis, radice crassissima napiforme superne magis minusve ramosa. Caule basale subglobosa, cum articulis globosis vel obconicis crassis plerumque simplicibus, in juvenis conspicue tuberculatis, viridis. Tuberculi in parte superiore, 5-6-goni, isodiametrici. Areolae ± circulare, ca. 1.5 mm diametri, 1.5–2 mm longis. Spinulae 9–20, adpressae, 1–4 mm longae.

Flores ± campanulati vel rotacei. Receptaculum obconicum, striatum, viride. Areolae receptacularis parte supera disposita, circularis, ca. 1.5 mm diametri, cum spinulis rectis et tenuis, 1–3 mm longae. Petala exteriora carnosa, viridia; interiora delicata, 2 cm longa et lata, rosea vel alba. Stamina numerosi. Stilus claviformis; stigma rosea vel rubra, 4–6 lobata.

Fructus indehiscens, ovoideus vel obconicus, truncatus, initio succidus extremum sicus, ca. 1 cm longus, 1 cm diametri. Arillus biauriculatus, irregularis, ca. 3–5 mm longus et 2–3 mm latus, eburneus, cum sulci perimetralis circumdatus. Semina castanea, 2–3 mm longa et 2–3 mm lata.

P. subterraneo arcte affinis sed omniis tuberculo valde manifestus, quasi pentangularibus vel hexagonis sulcato-marginatibus, areolibus-majoribus, floribus majoribus (plus minusve 3.5 cm diam. vs. 1.5 cm diam.) saturate roseis non salmoneus vel rubris.

Plants small, geophytic, to 15 cm in diameter, but usually much smaller. Root thick, often branched, obconical, up to 30 cm long and 15 cm wide at top, also mostly much smaller.

Stem segments broadly obconical, globose, de-

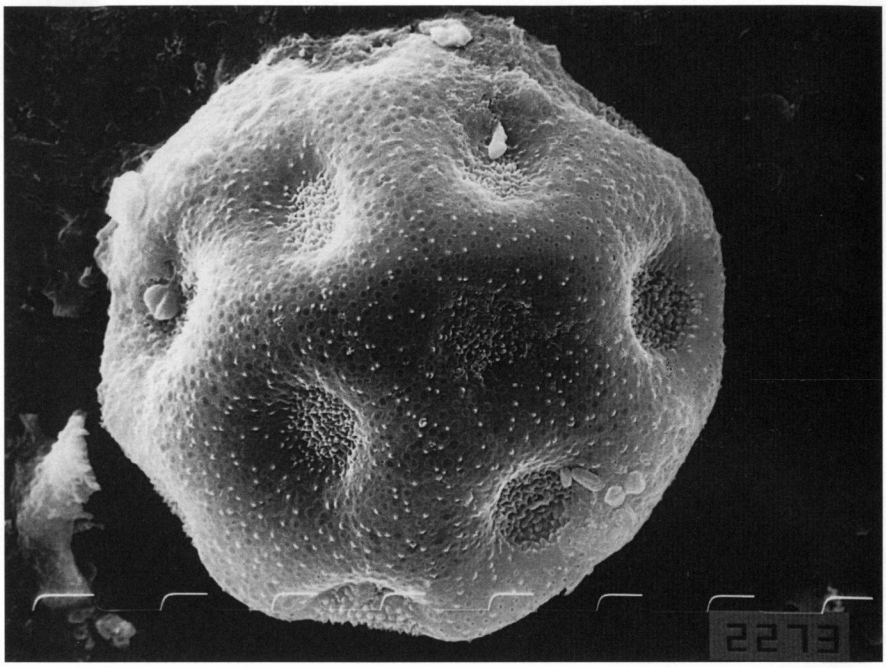

Fig. 7. Pollen grain with circular apertures.

pressed-globose or cylindrical, of a firmer texture than in the other two species, very broadly attached at base, 1.5–2 (1.2–2.5) cm in diameter, deep bluish green when young, ashy gray-green when mature, becoming purplish brown (sometimes nearly black) in winter. Tubercles low, flattened, ca. 3–6 mm in diameter, bounded by a groove, roughly pentagonal. Epidermis minutely verrucose, with stomata in depressions.

Areoles rounded, vertically elongate, small, ca. 1.5 (1–2.5) mm long, approximate in center of tubercle. Spines 9–20 per areole, 1–4 mm long, ap-

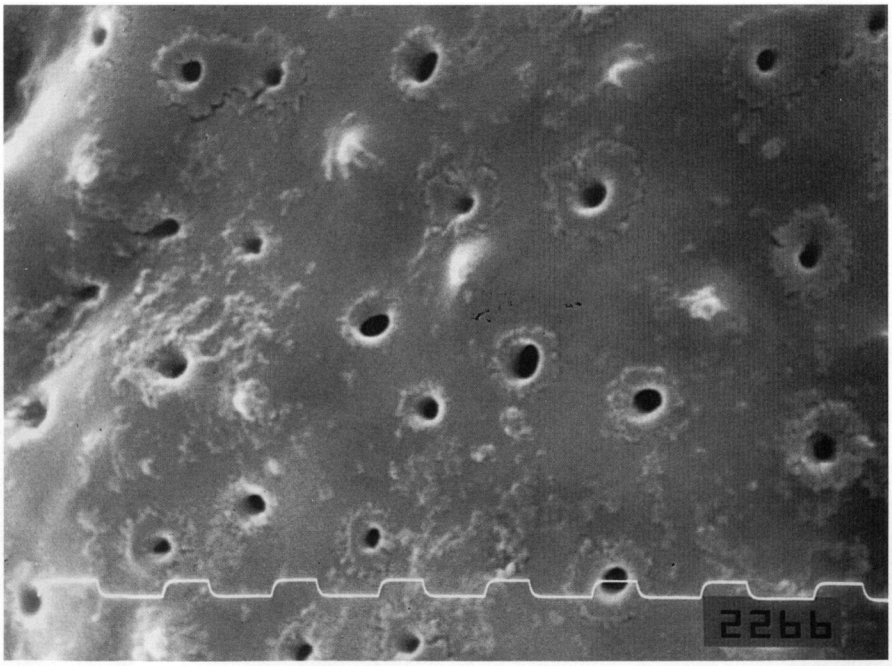

Fig. 8. Exine of pollen grain with perforations and several spinulae.

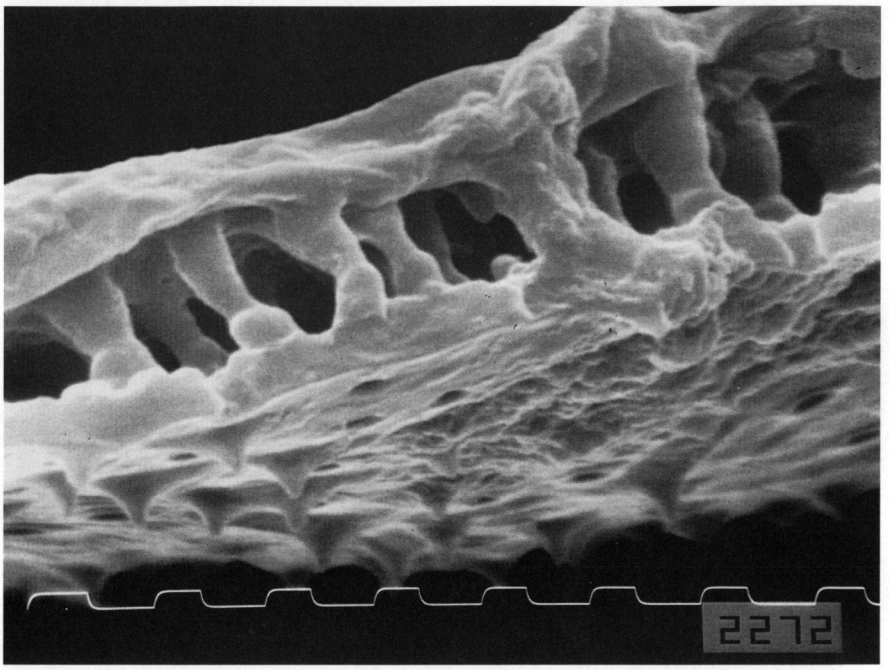

Fig. 9. Cross-section of pollen-grain wall with columellae supporting the tectum. Photos: Figs. 3, 4 by R. Kiesling, Fig. 5 by D. Ferguson, Figs. 6–9 by D. Rodríguez.

pressed to stem and radiating more or less evenly around areoles (with fewest at top), pinkish brown, reddish brown, or orangey brown to blackish when young (contrasting beautifully with the young stem), sometimes with one lower spine much darker; all becoming white to pale grayish with age. Central and radials not clearly distinguishable.

Flowers from upper lateral areoles, ca. 1–3 per stem segment, proportionately large (ca. 3–4 cm across), with numerous tepals giving a double-ruffled appearance. Receptacle obconical, 1–1.5 cm long, 0.7–1 cm in diameter, smooth, areoles few, reduced, mostly near apex of receptacle, ca. 1.5 mm in diameter, naked or with fine bristle-like brown spines to 3 mm long, these subtended by a small, lanceolate, usually brown bract. Outer tepals fleshy, reddish or brownish green, grading into delicate, mucronate inner tepals to ca. 2 cm long and wide and pinkish white to rich light pink. Stamens numerous, 9–13 mm long; filaments light yellowish green near base, white to pale pink near apex; anthers ca. 3 mm long by 0.7 mm wide, pale yellow, with yellow pollen. Stigma positioned at approximately same level as anthers. Style narrow-clavate, to 3 mm thick, ca. 15 mm long, pale pink. Stigma pale pink to deep rose-pink, papillose, clavate, with 4–6 lobes.

Pollen globose, perforate, 50–60 in diameter. Exine ca. 3 thick, with tectum and columellae. Surface spinulose-perforate. Spinulae conical, 0.5 high. Perforations areolate. Aperture circular, 0.2 in diameter, covered by a membrane ornamented with spiniform or mamilliform processes.

Fruit turbinate to broadly obovoid, 1–1.5 cm long, ca. 1 cm in diameter, soft, fleshy, later dry, thin-walled, usually dull reddish brown, pulp juicy, usually browsed by animals, but sometimes drying on plant and sometimes splitting irregularly upon drying. Umbilicus slightly conical-concave to flat. Areoles inconspicuous, usually near fruit-apex, with minute, white to brown hairs and a few bristles.

Seed aril pale yellowish brown, ca. 3–5 mm long and 2–3 mm wide, surface smooth to strongly and irregularly tuberculate, with a groove around the margin. Seeds tear-drop-shaped, brown to near black, 2–3 mm long, 2 mm wide, testa shiny, with elongated cells.

This beautiful and charming little plant is named in honor of the discoverer, Bonnie Brunkow. It is a creature of severe desert conditions, superbly adapted to its environment. The small stems are held level with the soil surface and are remarkably well-camouflaged among the stones of the desert pavement on hilltops.

The native habitat is particularly stark, with little vegetation other than a few other geophytic cacti and an occasional shrub. One of us (D. F.) saw *Pterocactus gonjianii* Kiesl. and *P. kuntzei* there and, nearby, were *P. reticulatus* Kiesl., *P. megliolii* Kiesl., *Tephrocactus geometricus* (Britt. & Rose) Back. (a variant of *T. alexanderi* (Britt. & Rose) Back.), *Maihueniopsis boliviana* (S.-D) Kiesl., *Echinopsis leu-*

cantha (Gill.) Walp. and a tiny unnamed *Echinopsis* (*Lobivia*) species which is highly reminiscent of a slender-stemmed *Epithelantha greggii* (Engelm.) Orc. Woody plants include *Larrea divaricata* Cav., *Lycium* sp., *Atriplex* sp., and *Grahamia bracteata* Gill. ex Hook. Any additional vegetation is almost exclusively restricted to nearby arroyo channels and the banks of the Río Guanchín.

The closest relationship of this species is with *P. subterranea*. The most obvious distinctions of *P. bonnieae* are the larger flowers and stems, the somewhat differently colored and more strongly tubercled stems, and the more numerous spines.

This species is occasionally seen in cultivation, particularly in Europe, under the name, "*Puna rugosa*" (nom. nud.).

Acknowledgments

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A special thank you goes to Dr. Silvio Meglioli of San Juán, Argentina. Don Silvio passed away at the age of 69, a few months after the collection of the holotype of this species.

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CD-ROM REVIEW

***The Plant Finder* reference library**. 1997-1998 edition; The Plant Finder, Freeport, Lewes BN7 2ZZ, England; CD-Rom, £26 postpaid (about $42) (VISA accepted).

It's inevitable that succulent-oriented material will end up on CD-roms, which store enormous amounts of text and illustrations. We received one the other day that, while of a more general nature, includes information on succulents and their sources. Many succulent collectors also grow other plants as well, and they will find this disk even more useful.

Published (if that's the word) by *The Plant Finder*, an annual British reference work, this CD-Rom contains a wealth of material. First, the Royal Horticultural Society Plant Finder lists 70,000 plants and where to buy them. Similar are The Seed Search (33,000 entries), The Fruit & Veg Finder (1500 fruits, 3000 vegetables), and Plant Photo Finder (30,000 plants). Some of the other data-rich bases included are Dictionary of Common Names (40,000 names), Arboreta & Gardens Guide (15,000 entries), Authors & Genera, UK & International Garden Societies, Lexicon of Latin Names, and Internet Directory for Botany. By paying an additional $30 you can "unlock" at least eight more extensive data-bases on the disk.

The information is easy to access, but the main problem is that it will date rather quickly. I assume that periodic updates will be issued.

Myron Kimnach

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