CACTI AND STEAK—THIS MUST BE ARGENTINA

JAMES D. MAUSETH
Department of Botany, University of Texas, Austin, TX 78713
ROBERTO KIESLING
Instituto Darwinion, Casilla de Correo 22, Labarden, 1642 San Isidro, Argentina

Part 1

There they are—an entire forest of *Oreocereus celsianus* (Fig. 1). More beautiful than ever imagined, their golden spines a brilliant halo around the long, snow-white hairs. A black, stormy sky as background. The temptation to run over to them, to touch them, to be surrounded by them is almost overwhelming. Almost. You must not forget that at an altitude of 13,000 feet, on this cold, high Andean plateau, there is not enough air to permit running. Altitude sickness—a sharp headache, even nausea—awaits anyone who forgets where they are. So, with more self-control than you think is possible, you just walk at a calm but deliberate pace. It is okay, you tell yourself, these magnificent plants have been here for millennia, and you have waited for so long to see them in their glory that a little patience now can be endured. But they are exquisite, tall and silent, swaying serenely in the chill wind. The sun will set soon and ominous storm clouds are coming up over the edge of the mountains that encircle us. It will soon be bitterly cold, but the oreocerei will probably delight in the low temperatures. It is late in the South American summer, almost the end of March, and an abundance of fruits adorns the tops of the stems that tower high—it has been a good summer here and there will be many seeds, ready to germinate when spring arrives. The experience is exhilarating and sobering at the same time—this is pure magnificence, but a fragile magnificence. How many more generations of people will be able to be rejuvenated by being part of natural beauty like this?

It is surprising that we can still be stunned by such beauty even after traveling thousands of miles through Argentina's wonderful deserts. We have encountered so many cacti, and even though some are old friends from the greenhouse, so familiar that we take them for granted, it is always a thrill to see them where they live naturally, at home in the desert. Harsh sun and meager rain do not produce grizzled plants—these are fresh, shiny, healthy green and do not seem to have a

Fig. 1. *Oreocereus celsianus.*

Fig. 2. *Austrocactus bertinii.*
Fig. 3. *Echinopsis leucantha.*

care in the world. Others are rare species, like *Maihuenia andicola* or *Soehrensia korethroides,* but now this story is getting ahead of itself.

This trip through the Andes has the purpose of collecting anatomical specimens to study cactus evolution. We are trying to understand how cacti, starting from ancestors that resembled *Pereskia,* evolved into things like *Gymnocalycium, Oreocereus, Pterocactus* and the rest. Certainly, they lost their leaves and developed succulent stems that store water. Spines that protect those juicy stems from thirsty animals are advantageous evolutionarily—plants whose water reserves are well-protected will probably survive long enough to produce seed and future generations; plants that lack spines may be eaten before they can reproduce and their spineless characteristic will perish with them. But there were many other evolutionary changes involving wood, epidermis and other tissues. With the aid of the Cactus and Succulent Society of America, the International Organization for Succulent Plant Study and the Institute of Latin American Studies at the University of Texas, an extensive collection of specimens has been amassed at the University of Texas in Austin. Now, with aid provided by the CSSA, we are traveling the length of Argentina, not looking for new species but trying to better understand known species.

After an overnight flight from Austin, we rendezvous at the airport in Buenos Aires and head west immediately. We are joined by Dra. Lucia Claps, a professor at the Universidad Nacional de Tucumán who is studying insects that attack cacti. The Instituto Darwinion has generously provided a new pickup for us and the road is good; we proceed quickly through farmland, which gives way to a drier region used for pastures. We reach the town of General Acha at the southwest corner of the pampas, near the border with Patagonia. The next day we will be in cactus country.

From General Acha we drive to Parque Nacional Lihuel Calel. It is an interesting set of granite hills that arise out of dry grassland. *Wigginsia tephracantha* grows in narrow cracks in the boulders, and *Notocactus submammulosus* inhabits areas with more soil. Low mounds of *Trichocereus candicans* dot the hillsides. Continuing to the southwest, we stop periodically to examine the vege-

Fig. 4. *Maihuenia poeppigii* in fruit.

tation, encountering *Setiechinopsis mirabilis, Austrocactus bertinii* (Fig. 2), *Echinopsis leucantha* (Fig. 3) and the particularly striking *Cereus aethiops.* This last species is always beautiful, using a blue body to show off its jet black spines. For an added touch, their fruits are just the right shade of red. Plants of *C. aethiops* always look healthy, as if well-adapted to their habitat. But they are only rarely abundant; typically only one or two will be encountered in an area, widely separated from other individuals of their species. The stems are only temporary, dying back to a perennial root-

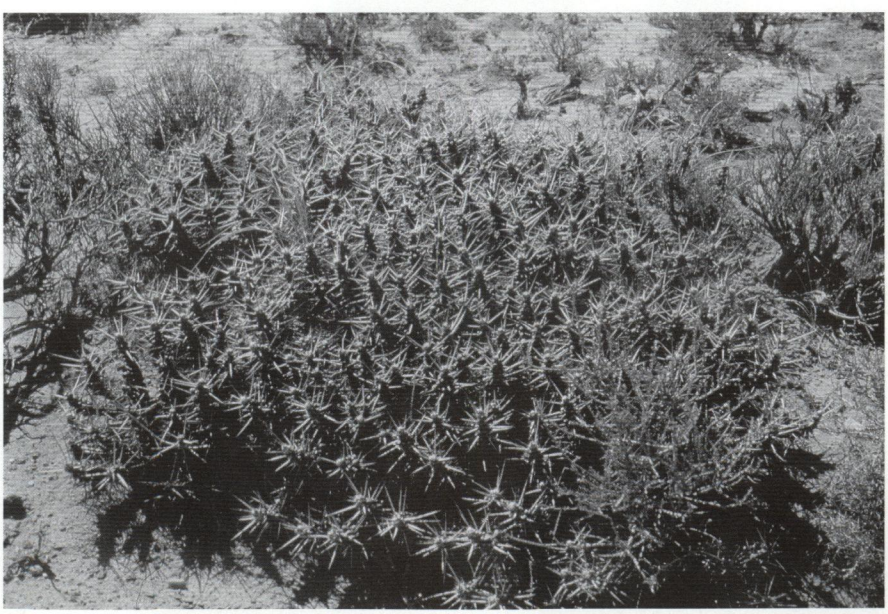

Fig. 5. *Maihuenia andicola.*

Fig. 6. *Pterocactus araucanus.*

stock which produces another stem when conditions become favorable. In three weeks of driving, we will see fewer than fifty plants, all isolated and widely separated but each looking robust enough to take over the entire landscape.

We arrive at Neuquen for the night. Dinner is—what else in Argentina? Steak! Being from Texas, it may be illegal to say this, but it is great steak. After dinner, work starts. Specimens that have been collected during the day are examined, measured, photographed and then dissected. Tissue samples of various parts are preserved in a chemical solu-

Fig. 7. A sempervivum-like species of *Viola.*

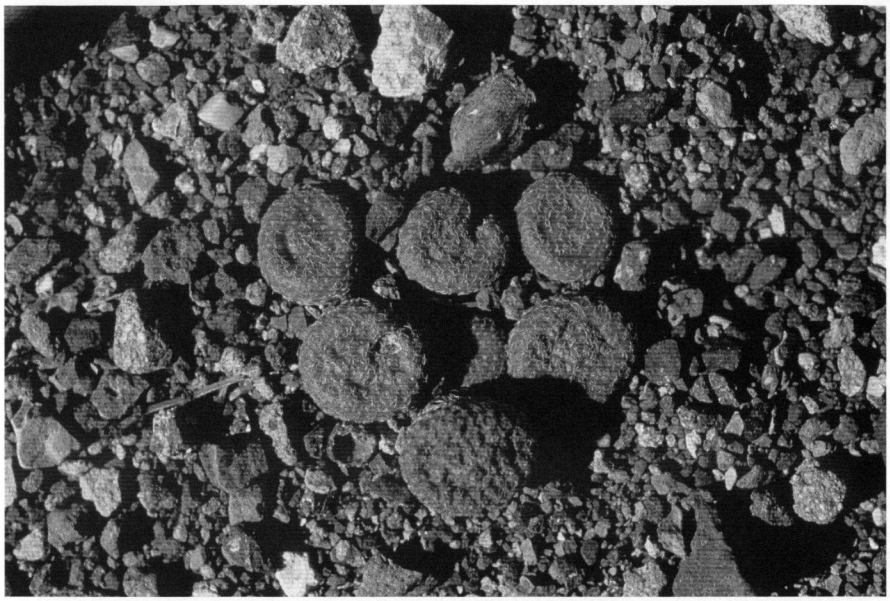

Fig. 8. *Puna clavaroides.*

tion in small bottles. Back in Austin, they will be processed further, cut into thin slices and studied anatomically. Fortunately, we are both workaholics—we often dissect until midnight, then get up at 5:00 A.M. (sometimes 4:00) and continue until everything is finished. We hate to lose valuable sunlight, but we also do not like to let specimens accumulate in the back of the truck.

From Neuquen we turn south and soon encounter one of the main objectives of this entire trip—*Maihuenia.* This is a small genus of low-growing plants. Although highly branched bushes, almost all branching occurs underground and just the branch tips emerge above the soil surface. They resemble small opuntias (*Maihueniopsis* is named for its resemblance to *Maihuenia*), having only tiny cylindrical leaves on short fat stems. But they have no glochids and their seed is like that of *Pereskia,* so they have been classified into subfamily Pereskioideae, not subfamily Opuntioideae. *Maihuenia poeppigii* (Fig. 4) is available from many nurseries (and is quite nice), but *M. andi-*

Fig. 9. *Soehrensia formosa.*

Fig. 10. *Trichocereus strigosus.*

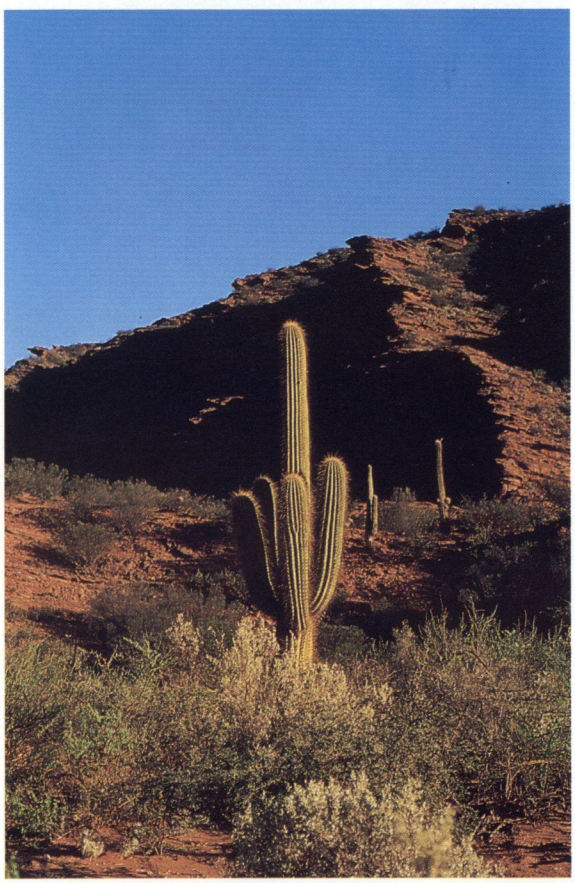

Fig. 11. *Trichocereus terscheckii.*

cola (Fig. 5) and *M. patagonica* are not often found in cultivation. Our objective is to obtain samples from the latter two species if at all possible, and our drive from Buenos Aires has been the most direct route possible to get here. We find plants of *M. andicola* and *M. patagonica,* both in their summer dormancy and looking much more dead than alive. This is Patagonian climate, with summer drought and winter rains. It probably has been months since they have received rain. Some of these plants form cushions over nine feet in diameter with a "trunk" almost two inches thick. *Maihuenia andicola* has such long, vicious spines it is almost impossible to get a sample with garden clippers. The tough stems of *Maihuenia patagonica* are so encrusted with dirt it is no easier to work with. As we dig up the deep roots and measure intact plants, carry heavy equipment to and from the pickup, photograph the plants from every angle—and the best angle always seems to involve laying on your belly in the sand, breathing in dirt—we agree that we are fortunate that it is not hot, only about 90 degrees in the shade. Unfortunately, there is no shade—these six-inch-tall maihuenias are the tallest plants around. At least it will later turn out that they are easy to handle anatomically—they cut easily into thin slices for microscopic examination and provide a wealth of information.

Having met a critical objective so early in the trip, we turn north, feeling more confident. But not so confident that we would waste time stopping for lunch; instead, we feast on crackers, salami and cheese while driving. Even the most gar-

Fig. 12. *Tephrocactus geometricus.* All photos by author.

den-variety of *Opuntia* will entice us to stop, but lunch? Forget it.

This area also has several species of small opuntioid cacti: *Pterocactus araucanus* (Fig. 6) and *P. valentinii.* Samples of these too are collected. Before long we drive into the Andes and begin to gain altitude. The air is fresh and clean, the sky is brilliant blue. Not far from the border with Chile we encounter the first trees of *Araucaria araucana,* relatives of Norfolk Island pine and monkeypuzzle trees. Whole forests occur at higher elevations, but before then we find *Maihuenia poeppigii.* In this locality it is rare, and we find it only because R. K. knows the area well and we search carefully—it is hidden in the grass and is almost impossible to see. Exotic plants of *Mullinum, Azorella, Tropaeolum* and a little violet (Fig. 7) that resembles a sempervivum give us something to look at other than spectacular cacti in spectacular settings.

We return to the foothills and continue north, coming to Caviahue in the afternoon. Again we have reached an altitude that supports forests of *Araucaria* and as expected we encounter *Maihuenia poeppigii.* Here cushions easily reach a diameter of 6 feet; many plants appear ancient, growing out in a ring as the center dies away. Whereas we had searched long and hard for *M. poeppigii* earlier, here they are everywhere, showing off to us even as we zoom along the road. Unlike *M. andicola* and *M. patagonica,* these cushions are fresh and green, robust and covered with healthy bright-green leaves. Most plants have numerous large fruits. It is late afternoon, the wind becomes cold, and with the summit of the Andes to our west, the sun will set early and give us a long twilight. Our objective for the night, Chos Malal, is not near.

Driving from Chos Malal to Malargüe, we have Volcán Tromen in view much of the time and encounter more *Maihuenia patagonica.* Large plants of *Pterocactus fischeri* are abundant. Their roots reach over 3 inches long and up to 1.5 inches in diameter. One plant's root is 2.5 inches thick and more than 5 inches long; it breaks before we can find its tip. The above-ground portions are narrow and short, only about 1.5 inches in diameter, and most have the remains of fruits still attached. We decide to stop at Malargüe even though it is not yet late afternoon; the next town is far away and there are many plants to dissect. Besides, we have found a hotel with an airy colonnaded patio where, after a shower, and accompanied by cerveza fria, we can measure and dissect at leisure, looking out over tranquil mountain scenery. We have been traveling only five days and already have 18 species preserved for anatomy. Others are in boxes and bags in the pickup, awaiting our attention.

The next day starts with a good omen—having completed all our dissections the previous afternoon, it is not necessary to get up at 5:00. Sleeping in till 6:00 is luxurious. But even better, after just a short drive we come to Lago El Nihuil, formed by a dam across a canyon. As any cactus-lover knows, steep topography—such as a canyon—means cacti in abundance. Within the first miles we find *Denmoza rhodacantha, Pyrrhocactus strausii* and *Pterocactus kuntzei.* At the bottom of the canyon, *Trichocereus candicans* is everywhere; all the plants are low, only about one yard tall, and consist of clusters of lax stems lying on

the ground with their ends upturned. They have only a little wood, which cuts easily with a knife, very different from the hard trunks of *Trichocereus chilensis* near Santiago, Chile, and the *T. pasacana* we will encounter later. Continuing out of the Cañon del Atuel we find *Tephrocactus articulatus* (some with erect stems up to 8 joints tall), *Echinopsis leucantha,* and *Setiechinopsis mirabilis.* Fortunately, many have fruits with mature seeds. At Mendoza we turn west toward the summit and the border with Chile. After collecting specimens of *Denmoza,* we continue to Uspallata and spend the night at 6000 feet above sea level.

Our route from Uspallata takes us on a large loop back to Mendoza, by a different route than yesterday's. We stop frequently, looking for *Puna clavaroides* (Fig. 8). This is the southern extreme of its range; we find one or two plants at each stop, but only after careful looking, almost on our hands and knees. Most of the plant exists underground where it is cooler and moister; only about one inch or less pokes up above ground and carries out photosynthesis. Our high point, altitudinally, for today, is the pass which is over 9000 feet high, wind-swept, and rich in *Maihueniopsis glomerata* as well as *Ephedra andina.* Shortly after beginning our descent is a real show-stopper—*Soehrensia formosa* (Fig. 9). Not the little four-inch seedlings that come in the mail from a nursery but plants a bit taller—about four feet taller. Big columns standing on the side of a steep hill, looking east. The sky is gray, the wind is cold and it is not even autumn yet. What are cacti doing in a place like this? What is winter like here?

Descending below 6000 feet the temperature has warmed and suddenly *Trichocereus candicans* appears, then becomes abundant. At 4000 feet the sky has cleared and real desert conditions occur—*Trichocereus strigosus* (Fig. 10), *Tephrocactus aoracanthus, Cereus aethiops, Echinopsis leucantha.* We collect many fruits and seeds in addition to anatomical samples. Passing through Mendoza and continuing to San Juan, the road is filled with trucks carrying freshly harvested grapes to the wineries.

For the next few days we will be exploring not only through the Andes, which are the Cordillera de la Frontera or Cordillera de los Andes, but we will also traverse two ranges that lie to the east. The Cordillera Frontal is just to the east of the Andes, and the Precordillera is a set of very isolated mountains that are the easternmost of the set. The higher elevations of all three ranges have relatively cool moist conditions, so you might expect the same types of plants on each; after all, the three ranges are close together. But because they are surrounded by dry hot lowlands, it is difficult for species to "migrate" from one range to another—they can make the journey only if birds or wind carries seed from one to another. This is not too common, so the vegetation on each mountain range is distinct. Also, rain here comes sweeping in from the Atlantic to the east, unlike in the United States where it comes from the Pacific in the west. For us, the coastal ranges in California, Oregon, and Washington are very wet, then the Rockies are drier and by the time the wind gets to the center of the Great Plains states, it is pretty much rained-out and dry. But here in Argentina, the easternmost Precordillera receives the wind with most moisture, and the Andes receive the driest air. Over the next few days, the differences will be dramatic.

Speaking of drama. Plants of *Echinopsis leucantha* near Chilecito are hip-high. Many lean, but others grow perfectly upright. Hundreds occur in just a small area. The flowering season must be spectacular. And *Trichocereus terscheckii* (Fig. 11) is in splendid condition. The soil here is bright rust-red and *T. terscheckii* is emerald-green. The combination is outstanding.

Vegetation is often sparse in desert areas, but some of the Andean deserts are totally devoid of plants. One area that we visit is like that—so little sign of plant life you wonder if it is worth the bother to even explore this area. There are dry arroyos, so it obviously rains sometimes, but how often? Once a year? Once every tenth year? How can you tell? This is just a landscape of rocky hills. But this is also a cactus paradise—crawl on hands and knees and there is *Tephrocactus geometricus* (Fig. 12). A little more exploring is rewarded with a new, as-yet-unpublished species of *Puna.* A few plants of a thin form of *Lobivia famatimensis* also poke out. These are not shriveled and desiccated, barely eking out a meager existence—they are healthy and exquisite, obviously very happy where they are.

We find it impossible to be impartial scientists—measure, photograph, collect a sample and move on—that is just not possible. We stay for hours, just delighting in being part of this. The sky is crystal clear and the air hasn't a hint of pollution. If we are still, there is perfect silence. Once again the sun sets before we finish our work and we must drive hours in the dark, arriving late. Dinner at 10:00 P.M. again. What to eat? Oh yes, steak.

(To be continued)

A BOOK ON *FEROCACTUS* NEEDS HELP

John Pilbeam and Derek Bowdery have nearly completed a book on *Ferocactus* to be published as one of the Cactus File handbooks. They urgently need good photos. As John puts it, "We invite any photographers to get in touch or just send me any photographs they have taken of ferocactus plants, preferably in the wild and in flower, preferably transparencies and with detailed information as to habitat, preferably close-up, but above all good and sharp to facilitate reproduction. Plants in cultivation with good provenance are also welcome."

John Pilbeam's address is 51 Chelsfield Lane, Orpington, Kent, BR5 4HG, England. Any photos used will be acknowledged and all submitted will be returned in good condition.

PUNA BONNIEAE (CACTACEAE), A NEW SPECIES FROM ARGENTINA

DAVID J. FERGUSON[1]* & ROBERTO KIESLING[2]

[1] Associate Curator, Rio Grande Botanic Garden, 2601 Central N. W., Albuquerque, NM 87104

[2] Member of the Carrera del Investigador del CONICET, Instituto de Botánica Darwinion, C.C. 22 (1642), San Isidro, Buenos Aires, Argentina

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

* Corresponding author.

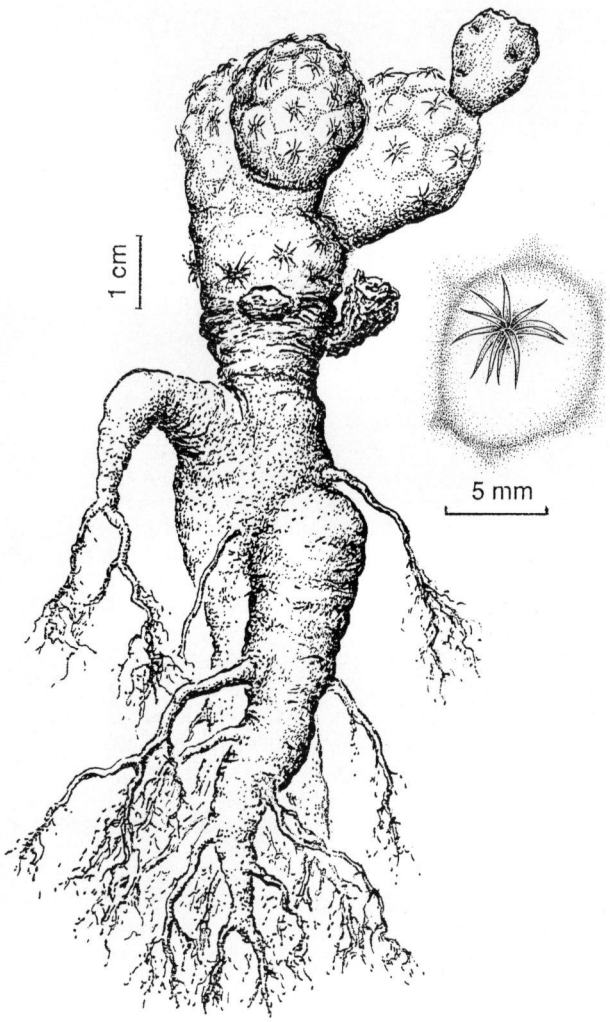

Fig. 1. *Puna bonnieae,* general aspect of a plant, with detail of a tubercle and areole. Note old, shriveled stems just above roots.

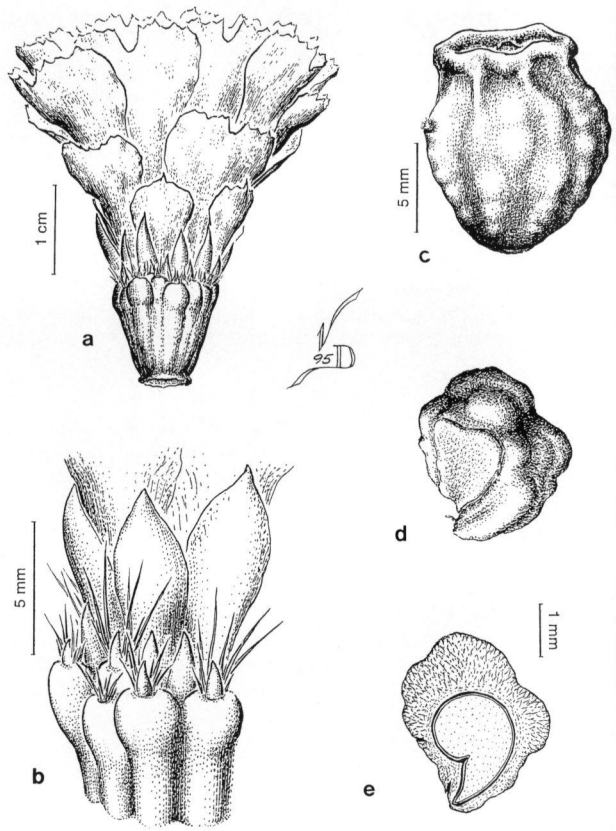

Fig. 2. *P. bonnieae.* **A.** flower exterior. **B.** apex of receptacle with elongated podaria, areoles, leaf and small spines. **C.** fruit. **D.** seed covered by aril. **E.** longitudinal section of aril and seed. Drawings by Vladimiro Dudas.

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.

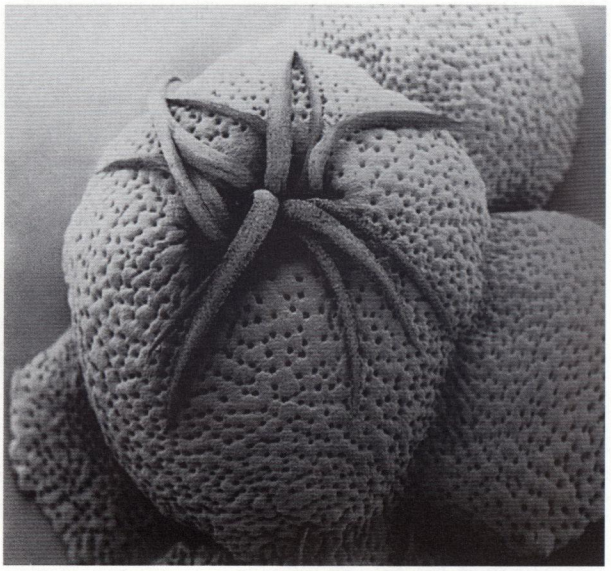

Fig. 6. Scanning electron microscope photo of tubercles and areole.

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-

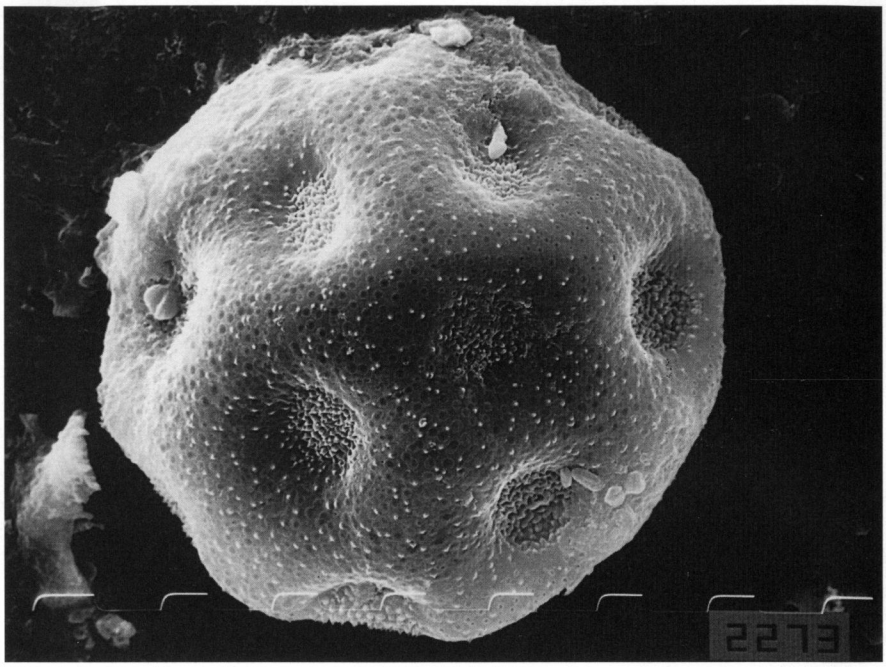

Fig. 7. Pollen grain with circular apertures.

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-

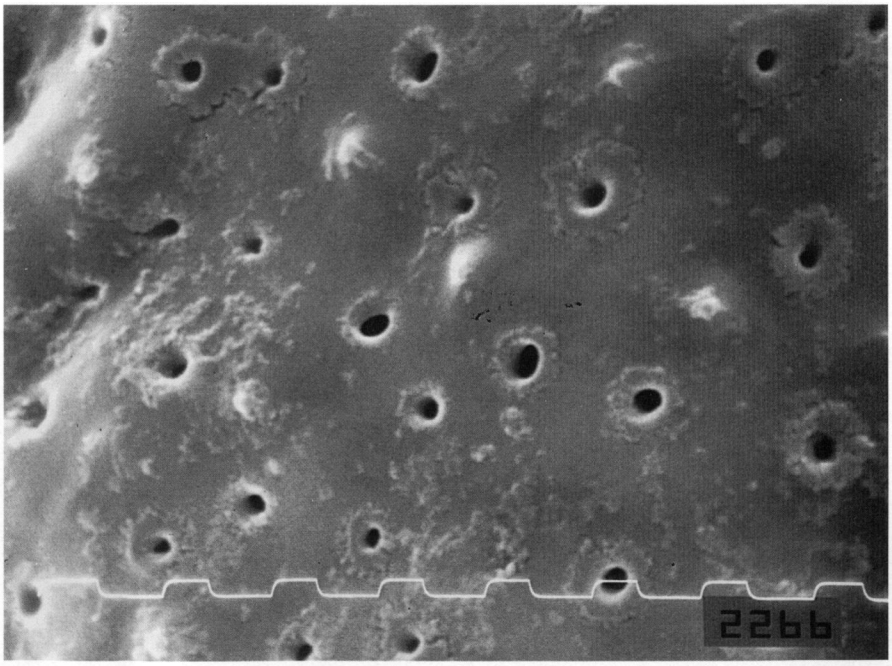

Fig. 8. Exine of pollen grain with perforations and several spinulae.

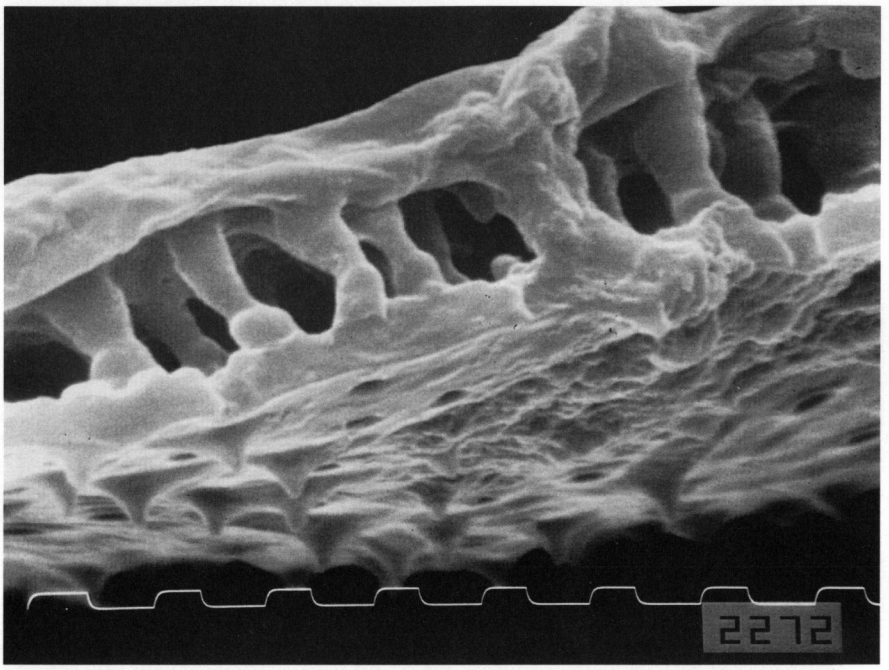

Fig. 9. Cross-section of pollen-grain wall with columellae supporting the tectum. Photos: Figs. 3, 4 by R. Kiesling, Fig. 5 by D. Ferguson, Figs. 6–9 by D. Rodríguez.

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.).

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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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