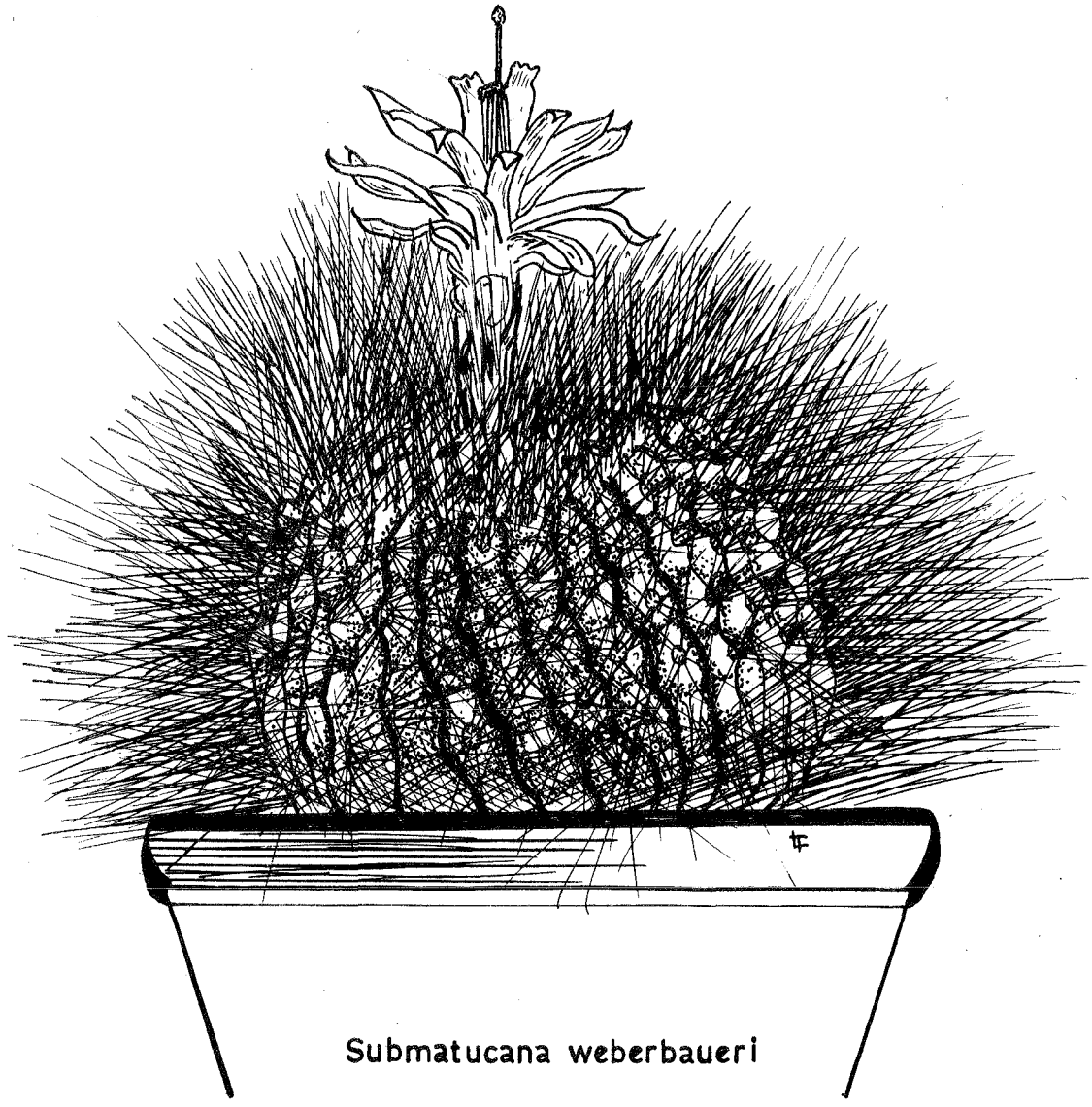
# THE CHILEANS '87

VOLUME 13 NUMBER 45



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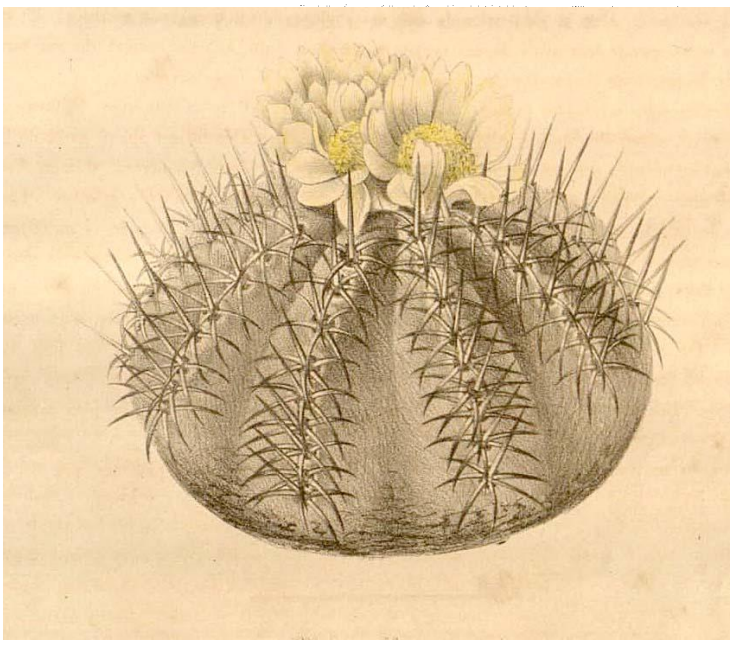


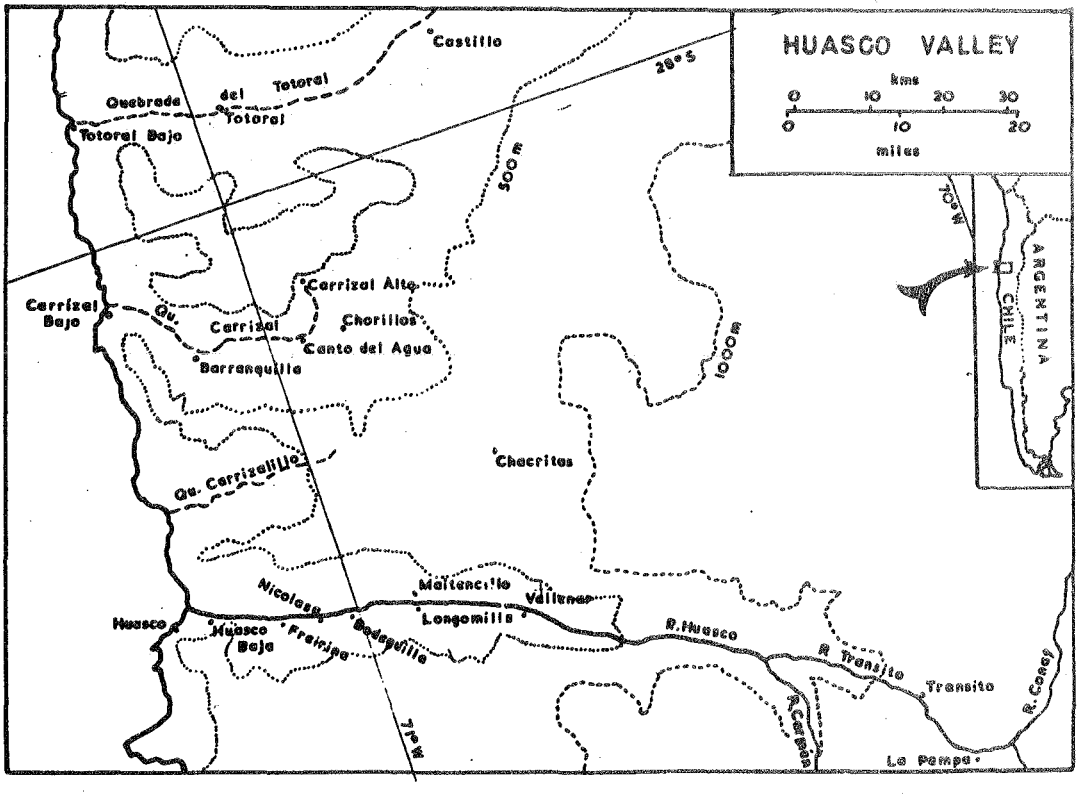
Pfeiffer - Abild. Besch. Cact, 2. 1847
PLATE 29

Britton & Rose The Cactaceae Vol.3 Fig. 100

In Quebrada Totoral

Photo - R Ferryman

## COPIAPOA ECHINOIDES Lemaire



## COPIAPOA ECHINOIDES — From R. Ferryman

On my two previous visits to Chile I had concentrated on the north, from Arica to Copiapo, in the company of the Chilean botanist Adriana Hoffmann. Travelling north via the Panamerican highway from Santiago there appear from time to time signposts directing one to areas all too familiar to Chilean cactus enthusiasts, their very names being synonymous with cactus. None more so perhaps than Carrizal Bajo. Time had not permitted us the opportunity on those previous visits to venture to this cactus haven for it is some hours drive from the Panamerican highway despite its relative close proximity — about 60km. In 1985 we would put this right and together with Adriana Hoffmann we worked out a schedule. For the first part of the trip we wanted to study the valley and mountains around Salamanca, heading north to Ovalle, turning again towards the mountains along the Rio Molles.

For the second stage we sought help at La Serena amongst the few botanists known to Adriana who work around there. Our aim was to travel from La Serena along the coast via Huasco to Carrizal Bajo and ultimately to Morro Copiapo. We were told that it would be possible provided we were not faint hearted, the vehicle robust enough, etc., etc. Upon reflection nobody seemed keen to join us and the prevailing attitude was "why don't you give it a try?" Well we were not faint hearted and our trusty steed a four wheel Land Rover had justified the utmost faith I placed upon it during some previous hazardous trips, so we set off in good heart. Leaving the Panamerican highway as it turns inland just north of La Serena we travelled along the coast via Cruze Grande, Choros Bajos, Carrizalillo and on to Sarco. The journey thus far had gone without serious incident but we were already in need of petrol; the distance from our last filling station at La Serena had failed to take into account the wanderings we had taken along various tracks in order to continue north and the amount of time we spent in four wheel drive. Sarco is a small fishing village and we were fortunate to be able to persuade some of the local fishermen to part with their stocks of petrol, delivered to the Land Rover in one litre Coca-Cola bottles.

They warned us not to attempt the journey north along the coast but we decided to give it a look, as Huasco was only 45km to the north. The warnings were well founded; the soft shifting sand that covers much of the Quebrada San Juan was impossible to travel through and there were no tracks to follow for, as the locals warned us, nobody had been this way before. We had no alternative but to head back to the Panamerican highway at Domeyko and on to Vallenar. At Vallenar the town was decked out with notices of a jeep rally the forthcoming weekend starting at Huasco and going on to Morro Copiapo, the same route that we intended to take. Surely then our chances of success were high. We sought more information; yes, a track existed and we could use it. In order not to get caught up in the rally we left early the following morning some two full days before the rally was due to commence.

Following the Huasco valley from Vallenar to Huasco the road is good standard as it is quite an important route. It is also the area for several well-known species such as Neoporteria vallenarensis, N. villosa; from the subgenera Neochilenia N. atroviridis, crispus, huascensis, duripulpa, lembckei and napina; and among the Copiapoa vallenarensis, fiedleriana, and alticostata. Whilst in my opinion not all these names indicate true distinct species it does nevertheless show how the area has been botanised. The valley bottom is very fertile being irrigated from the river throughout its length whereas the cactus are to be found higher in the surrounding hills. Upon reaching the coast at Huasco one bears north across a flat sandy plain. It is this area that is used by hundreds of Chileans at vacation time and represents a magnificent beach. We allowed ourselves a brief siesta during what was now the hottest part of the day.

Continuing our journey north we passed the spot where we got stuck during a previous visit in a more conventional vehicle. We had been told that Friedrich Ritter had attempted this coast route some years previously and he too had to turn back. And it was only a year or two since Fred Katterman was not able to get beyond this spot. The track never really climbed but the small upgradients consisting mainly of sand were the downfall of the Dodge camper we had used previously. The road hugged the shoreline wandering no more than 100 metres from the seashore. Having made camp for the night we searched a small sandy area and were surprised to find a Thelocephala species. Surprised because the sand was very loose and deep. Upon removing a plant it was clear that it had adapted to this over a period of time for the large tuberous root bore very etiolated heads that had continued to grow through the sand each time the wind had banked more sand upon it. In a number of cases these heads extended beyond 15cm. More typical representatives of this plant were to be found further away from the beach where the ground became firmed and thus the plant more compact. I gave this plant my reference number RMF 277 and it reminds me very much of the plant that is cultivated under the name 'reichei' i.e. long and straggly stems. At this stage I should say that the plant generally cultivated under this name is a rogue plant and bears little resemblance to the original description of E. reichei.

Isolated specimens of Copiapoa echinus started to appear. These sightings became more numerous as we travelled although the plant never appeared to be a dominant species largely on account of its small size. When we first met with these plants, we found some growing in a sandy grit that was so loose that there was no difficulty in scooping it out by hand. In this way we followed the roots down for up to half a metre. Copiapoa in general are very adaptable plants inhabiting a range of micro habitats — flat ground, rocky ground, or between rock crevices. This species was no different for although there appeared at first more by ratio in the flat grey sandy areas than in the rocks later (perhaps due to more competition on the flatter ground) the numbers seemed fairly well divided between sand and rocks.

Shortly we were to encounter one of nature's marvels, Copiapoa carrizalensis, without doubt one of the most impressive if not the most impressive plant I have ever seen. We were travelling at a modest speed, influenced as much by the terrain as by our intention to study the area as best we could, when this plant crept up on us! One is quite used to seeing outlying specimens before the population proper appears but here this remarkable plant dominated the landscape almost from its first appearance. Absolutely thousands of individual clumps could be seen erupting from every possible nook and cranny, clumps or more correctly mounds which grew to over two metres across and over a metre high possessing well over one hundred heads. The sheer magnificence that lay before me inspired me to run off three full reels of film (some 108 shots). Some of these plants had a dirty green epidermis, others were a silvery grey; sometimes the clumps were all of one colour, sometimes the other, whilst elsewhere both sorts grew alongside each other. There was nothing obvious which determined the colour of the epidermis — it seemed to depend upon neither the rockiness nor the sandiness of the ground, nor the

steepness of the slope, nor the shade or absence from Eulychnias. Many of these Copiapoa were in flower, but as usual the ants seemed to have rifled the fruit for the seeds. As indicated above, Copiapoa tend to inhabit quite a range of micro habitats, but here the plants were restricted to rock crevices and sloping ground. The slope only needed to be modest for the plants to appear but they were at their best as one climbed higher to reach the top of this small range of hills, little more than one hundred metres high. Dwarf woody bushes, shrubs and herbs, Copiapoa echinus and C. dura, as well as tall Eulychnia breviflora, accompanied Copiapoa carrizalensis, but all rarely so close together that one could not easily walk amongst and between them. Over the hill top, where the ground fell away somewhat, nothing grows. Is this where the coastal mists cease to provide any moisture? Unlike their relatives from further north (cinerea, haseltoniana, longistaminea) they did not grow close to the shoreline where herbs and shrubs of Frankiana, Euphorbia, and Calandrina took over from C. carrizalensis and dominated the shoreline vegetation. As we travelled along the coast this pattern of vegetation was not continuous, but disappeared then re-appeared for no obvious reason.

Amongst this mass of veritable giants our aim was to search for Ritter's Neoporteria laniceps. It had long been my belief that this "species" could not be separated from the older well known species from Huasco, Neoporteria villosa. We had not come across this plant anywhere since we left Huasco, despite stopping at many quebradas where we left the vehicle and climbed uphill to see what each held; but at this spot amongst rock crevices we at last came upon it. These plants had only small heads with a relatively large tap root, appearing to differ from those at Huasco simply in spination. Here the plants have a much finer and more hair like appearance. This simply is not sufficient to warrant two names and whilst I can not confirm my earlier beliefs that there was a continuation geographically from one to the other, the distance that separates them is modest. Neochilenia carrizalensis started to make an appearance here and again this appears to be a complex of names that are only determined by location. These plants which possess some of the most beautiful flowers of all the Neochilenia grow close to the ground with a well developed tap root. Only rarely can they be found among rocks and certainly their adaption appears to be more specialised or less varied than that of Copiapoa. Thelocephala glabrescens was also found; it is remarkable that in an area dominated by huge Copiapoa one is prepared to spend several hours stooping, eyes firmly fixed to the ground searching for semi-visible plants some 3cm in diameter!

From here we headed towards Carrizal Bajo, by now less than a km away. Now it is but a shadow of its former self and possesses about a dozen shanty houses and a church. There are obviously enough inhabitants to support a basic football team who were in action when we arrived! In Europe we can have little idea of the nature of south american football pitches of this type. Not a blade of grass can be seen, the pitch blending perfectly with the road and all its surroundings. Carrizal Bajo does offer a holiday retreat, or so one is led to believe. From the Panamerican highway a road of reasonable standard runs to here and just as wherever the Panamerican links with the coast one is directed to "Playa de la .....". It was by these very link roads that Alfred Lau had turned off at various places during his trip through Chile in order to reach spots on the coast. Pretty well the same route was followed by Ritter and Buining on their joint trip, really the last swansong for both collectors. Behind the village of Carrizal Bajo the foothills, 3/4km away, are still dominated by Copiapoa carrizalensis. In between there are few plants that survive domestication or the flatness of the terrain.

Heading north again towards Totoral we soon lost sight of Copiapoa carrizalensis mainly due to the flat, sandy terrain, a very difficult surface to travel along. Hugging the coast line we stopped at a small ravine; here there was no sign of C. carrizalensis but cactus were represented by Eulychnia, N. carrizalensis and a strange tall reddish Copiapoa that I took at first to be a very old specimen of Copiapoa dura. Certainly the name seemed to suit it as it really did appear durable. Further specimens were encountered around here, some more greenish and some clump forming. However the population was modest, no more than 20 plants including two very reddish-brown seedlings. I had encountered nothing similar further south other than the consistent form of dura i.e. flat, rarely as tall as wide.

These taller plants preferred to grow up against a vertical wall of rock, even if it was barely one meter high, so they were usually found against a rock outcrop in quebradas or gulleys, whereas carrizalensis took the slopes. After climbing a short way up this quebrada I was amazed at the relative wealth of small plants there so we stopped at this spot for a full day.

Continuing on to Totoral Bajo the cacti were not present on the flat coastal plain and it was only close to Totoral Bajo that they appeared in modest numbers. Here again the taller form of dura appeared in very restricted numbers. The dwellings at Totoral Bajo lie at the mouth of a broad and dry valley; Totoral Bajo is now almost deserted but at one time it must have supported a larger population; villages in the arid area of Chile could only survive where there was a regular water supply, hence the name of Totoral. Following the old river bed up to Totoral little was found in the way of plant life. Wild donkeys and goats roamed the area but I suspect that the lack of plants is not entirely down to them. At Totoral we were able to buy wine (by now much needed) but little else. From here we headed back to the coast to continue north. Travelling was extremely difficult; the sand was soft and shifting with small humps crossing our path continuously. These humps are usually the major obstacle; we encountered several on our journey up to this point but they were becoming too regular for comfort. Should our momentum be lost we would be stuck in the loose sand with no wheel grip; by now we were reaching the next hump before the vehicle had time to recover from the previous one. It would have been foolish to continue; nightfall would soon be upon us so we headed for an area that appeared firmer; those few kms had taken an hour. We made camp by torchlight and as the wine flowed we discussed our options. We had seen very few plants so far that day and none at all for the better part of the day. More importantly we had not seen any area where cactus might be — the hills were completely bare with many scars cut by the wind. What would lay further north? Would it be worth the effort? Should we go back inland and follow the route taken by the rally? This was further inland where we knew of no cactus. There was but one choice, to return to Carrizal Bajo only this time we would take the higher road.

Morning came and we left the campsite promptly. The return to Totoral appeared easier as we passed masses of Frankiana bushes strewn across the sand. We took the opportunity to look for Thelocephala fulva, which was supposed to be found "on hills in sight of Totoral", according to Ritter's travellogue so we scrambled up the hillside and on to the sloping ground above. It is a very tedious job to try and find these plants because they are level with the gritty surface of the ground, usually with several grains of grit lying on top of the plant as well. Sometimes you come to the conclusion that you

are looking in the wrong place altogether so you move on. It usually takes a long time to find the first plant; one or two hours is nothing for this sort of task. Once you have got your eye in then it becomes less difficult to see these plants. Among the herbs we came across specimens of Leonchira ovalli, which also grows from an underground tuber. This rare plant is only known from the area around Totoral and even here it is seen all too infrequently. One of the shrubs is Oxalis gigantea, which possesses a swollen underground tuber. This shrub puts out its flowers first and after flowering the leaves appear.

Travelling into the hills to the south of Totoral we encountered Copiapoa carrizalensis yet again. In a few ravines the columnar Copiapoa with the blackened stems clung to the vertical walls, some plants reaching a metre in height. Young seedlings appeared here and there, a clear sign of regeneration. But what was this plant? The seedlings had every appearance of Copiapoa dura, and the more typical forms of dura were evident on the flatter areas of ground — yet Ritter in his descriptions made no mention of plants growing to this height. As his description of dura does quote, they were grey green, sometimes brown, very hard, so are they simply old specimens that Ritter has either never seen or declines to mention? They are certainly not plentiful but also not rare. Why were these taller plants not found more frequently amongst the more typical dura? The typical taller forms were more often than not single, with very black base and lower growth, crown brownish, sometimes greenish. Ribs 13 to 17 very clearly defined at the top and becoming very obtuse lower down the stem. None of them were seen in flower or fruit. The typical C. dura was flattened globular and perhaps there was an in between form that clumped and reached 25cm maximum height.

Much later still I had a suggestion from H. Middleditch for the identity of this columnar Copiapoa with the black body. All told we expected that it would take a couple of weeks to make a thorough examination along this route. In the event our two weeks was up before we had reached the Copiapo valley.

. . . from H.Middleditch

The name of Thomas Bridges has appeared in the pages of The Chileans on several occasions when discussing cacti from the North of Chile. It seems to be quite possible that his name should also be linked with the initial discovery of Copiapoa echinoides. We now seem to have a fairly good idea of the basic route taken by Bridges on his collecting trip through this area, which probably started off from the Copiapo valley. Evidence for this is provided from several sources.

It may be advisable to consider the economic importance of this particular part of Chile at the time of Bridges' visit, which was undertaken in the period of around 1840-1844. In his "Desert Trails of Atacama" Isaiah Bowman reproduces a map made before 1835 of Copiapo and its surroundings. This map shows Port Copiapo at the mouth of the River Copiapo whilst on the coastline to the north of Port Copiapo it also marks Caldera, Obispo, Flamenco, and Chanaral, all of which handled some ship-to-shore traffic. In Darwin's "Journal of Researches" he records the three weeks which he spent in 1835 in and around Copiapo, towards the close of which "I heard of the Beagle's arrival at the port . . . The port consists of an assemblage of miserable little hovels, situated at the foot of a sterile plain. At present, as the river contains enough water to reach the sea, the inhabitants enjoy the advantage of having fresh water within a mile and a half. On the beach there were large piles of merchandise and the little port had an air of activity." At the time of Darwin's visit in 1835 most of the supplies for the inhabitants and mines around Copiapo would pass through this port; at that date it was probably handling more trade than all the rest of the mining ports in northern Chile put together.

This led to further economic development on that coast. In his "Reise nach der Wuste Atacama" undertaken in 1853-54, Philippi observes that the harbour of Caldera had already been inaugurated by the Decree of August 23rd 1842 and authorized for export trade. With still further increase in mining production around Copiapo, the second railway in South America was built between Caldera and Copiapo in 1848-51. This railway line was built by William Wheelwright who had previously established a regular sailing service between Panama and Valparaiso. When Bridges went to northern Chile in 1841 to collect plants he would be able to select one of the boats which traded regularly up and down the coast and so he would be able to travel the outward leg of his journey by sea, probably as far as the mouth of the river Copiapo.

With the facilities available in these parts of Chile at the present time, it is perhaps difficult to appreciate even the pioneering nature of Bridges' trek from Copiapo to Huasco; the practicalities of travel such as the absence of maps, the few places where provisions were available, must be related to 1841 and not to today's situation. Before setting out on his journey Bridges would be able to obtain mules, guides and provisions at Copiapo. To the north of Copiapo there was little population and certainly no commerce apart from the occasional settlement supporting either a family or a handful of Indians. To the north of Copiapo there was certainly nowhere that provisions for a southwards journey could be obtained. Thus under the circumstances reigning at the time, Copiapo was the northernmost point in Chile from which a cross-country journey could start out. By travelling southwards, Bridges would be daily coming nearer his home and he would gradually encounter less and less difficulty in obtaining water, food, and fodder — surely a prudent method of planning a journey starting off through wild, inhospitable, and almost unexplored territory.

Further evidence for the actual track of Bridges' journey is contained in the "Catalogue of Plants found in the Province of Coquimbo, Republic of Chile, Collected by Thomas Bridges 1841". The original manuscript in the British Museum (Natural History) was damaged by fire in the Blitz and some entries have been partially burnt away but the copy which is before me as I write still enables the finding place for the great majority of entries to be read well enough. Apart from the occasional place name not yet located on the map, those field locations which are included in this list all lie between Copiapo in the north and Illapel in the south. Thus for example entry 1382 is a plant "found along the coast in rocky places near the port of Copiapo". It would be hereabouts that Bridges collected plants which, upon their later arrival in Europe, were named Echinocactus (later Copiapoa) streptocaulon, marginata, columnaris, and bridgesii.

When Darwin rode north to Copiapo, his last leg started from Vallenar in the Huasco valley. From Vallenar "We rode all day over barren and sterile country. In the evening we arrived at a valley in which the bed of the streamlet was damp; following it up, we came to tolerably good water. It was a good place of bivouac for us but for the poor animals there was not a mouthful to eat. On June 11th we rode without stopping for twelve hours till we reached an old smelting furnace, where there was water and firewood; but our horses again had nothing to eat. The next day we reached Copiapo....I was

heartily glad of it for the whole journey was a continued source of anxiety.....the animals had had nothing to eat for fifty-five hours." It is quite probable that Bridges would be aware of the absence of animal fodder on this leg, so that animals would have to be kept moving all the time. In turn this would afford precious little time for botanising and he was probably aware that there was almost nothing to botanise. So what would he do?

We do know from R. Ferryman's account that there are a few houses at Totoral and that to have this name it must have had a reasonably good supply of water to support the reeds; so at this spot, roughly half way between the Copiapo and Huasco valleys, there would be water and fodder. In Bridges' Field list he records plants from "sandy plains between Huasco and Copiapo", "dry valleys and hills between Huasco and Copiapo", "in valleys near the coast between Huasco and Copiapo", and "along the coast near Huasco". These entries would suggest that he reached the Huasco valley at Huasco i.e. on the coast, not at Vallenar. His field number 1304 is "found near El Totoral between Huasco and Copiapo". So he probably travelled from the Copiapo valley to Totoral to obtain fodder and water; then went south from there, along or close to the coast, as far as Huasco. In the vicinity of Totoral he would come across the columnar Copiapoa seen there by R. Ferryman; these blackened columns could hardly have looked like a good sales proposition and he had to have something to send to europe to sell in order to recoup his outlay. Baggage capacity would also be at a premium. So what more likely than he would chop the presentable looking top few inches off some of these plants and just take that. If we compare the original illustration of Copiapoa echinoides which was published by Pfeiffer in 1847 with the slides taken by R. Ferryman near Totoral, (as we did at the Chileans' Weekend) the similarity immediately becomes obvious. The somewhat flattened crown, the broad ribs with a wide gap between the radial spines from adjacent ribs; the upright central spines; even the blackening of the columnar part of the body which starts immediately below the crown, is just shown by the artist at the base of the plant in Pfeiffer's sketch. So now we really do know where Echinocactus echinoides comes from.

. . from R.Ferryman

Following my return from Chile I showed slides of the tall Copiapoa to H.Middleditch. He suggested that the plant depicted in my slides showed a marked similarity to the illustration of Echinocactus echinoides in Pfeiffer, Abbild. Beschr. Cact. 2, Plate 29 and further copied in Britton and Rose The Cactaceae III p.88 Plate 100. The illustrations could in fact be of the uppermost part of the plant I found although on further studying the illustration it does appear that the nature of the base or stem of the plant is indicated by the way the bottom tends to fold inwards. The suggested identification from H.Middleditch is further advanced by N.Taylor's earlier statement in his treatment of Copiapoa (C & S J G B) Vol43, 49-60, 1981 that Echinocactus echinoides Salm Dyck is the same plant as that described by Ritter as Copiapoa dura. The original plant described by Salm Dyck and Pfeiffer appears to be a plant collected by Thomas Bridges during a visit to Totoral. From Totoral to the shore Bridges may well have followed the same quebrada that we travelled when he would indeed have come across the plant Ritter calls Copiapoa dura. He may well have come across the taller growing plants which grow high on the steep sides of the quebrada but if this is the case it is to my mind very strange indeed that he did not also collect the very abundant Copiapoa carrizalensis.

. . . from H.Middleditch

But with baggage space at a premium and with an eye for the market, surely Bridges would collect the rarities and not the "weeds". Nothing changes, does it?

. . . From F.Ritter — 40 Years' Adventuring

January 7th 1956 — I make a trip towards Totoral, an oasis with orchards in the middle of the desert. There are only a couple of shanties here. On the trip from here to Castilla I ran into sandy areas in which I continually got bogged down. I worked at it for half a day and then until after midnight, always about to become mobile once again and still just as fast, until in the early hours of the next morning a tractor from the railway station dragged me out.

December 27th 1957 — This morning I came with the lorry to the oasis of Totoral, where I searched the small hills for Thelocephala fulva upon the otherwise vegetationless gravelly hills. I then went again, anxiously, into the sandy desert of Castilla. Here I got stuck fast with the lorry. Only rarely do any vehicles come this way, so I must help myself with my mats since I have nothing else to put under the tyres. It did not help at all. After about five hours I had advanced about 30 metres, so I had to stop there all night.

. . . from H.Middleditch

Might this suggest that Ritter only undertook some limited collecting activity in this particular locality? And hence explain how he did not come across the columnar Copiapoa with the black stem?

. . . from A.F.H. Buining — A Cactus Trip through Chile with F.Ritter K.u.a.S.

[From the Panamerican highway to the north of Vallenar]..... on the next morning we reached the coast where we found the handsome white Copiapoa dealbata and Thelocephala nuda. Copiapoa echinata and Copiapoa carrizalensis grew facing the sea. Further to the north we took the wrong track, coming back to the coast again at a dead end. A breakdown en route, or a lack of petrol or water, might involve us in several days' trek inland where a jeep might pass once a month..... After due consideration we felt our position was satisfactory. So we went on to the location of the scarce Neoporteria laniceps and sociabilis. We came across Copiapoa carrizalensis and the variety gigantea, all glistening white and in huge mounds - a superb picture! Further finds were Copiapoa echinata var. borealis and Thelocephala glabrescens. At the end of this interesting day we had to overnight in the lorry. On the next morning, January 17th, after a few kms we came to our surprise to an indian hut. The youngster took us to a spring of water. It was undrinkable but we could have a wash, not permitted up to now as our water had to be kept for drinking and the radiator. Close besides this well was the location of Thelocephala fulva. We set away further inland, where in the higher hills Copiapoa dura occurred as a similarly clumping plant. Fortunately we reached the Panamerican highway and stopped at an hotel, not just to eat but also to scrounge ten litres of petrol otherwise we could not have got as far as Copiapo.

. . . from Cactus (France) Copiapoa dealbata sp. nov. F.Ritter.

Copiapoa dealbata is very caespitose, forming huge hemispherical tussocks, with innumerable heads, closely packed one against the other, epidermis most markedly pruinose, even whiter than Copiapoa cinerea, chalky appearance. Each head attains 6-12cm diameter with a flat crown, entirely padded with lead-grey wool, unarmoured. Areoles sunk into the

ribs. Spines black, centrals one, erect, rigid, 2-5cm long, occasionally with 2-3 smaller spines. Location 28°S latitude, coastal, Carrizal Bajo; FR 509.

. . . from Cactus (France) Copiapoa carrizalensis sp.nov. F.Ritter

Copiapoa carrizalensis is very caespitose, forming hummocks of almost 1m in height, in the shape of a quarter of a sphere, since the offsets develop exclusively on the side of the plant facing the Ocean; epidermis grey-green. Each head attains 8-12 cm diameter with a flat crown, almost unarmoured, covered with brown to orange wool. Areoles in a pit, inclined downwards, elongated. External spines 4-7, regularly disposed around the areole, 1-3cm long, slightly spreading, straight or slightly curved, the lower a little longer, only one central often absent, 2-4cm long, straight or slightly curved towards the base. All the spines black or brown becoming grey. Type locality Carrizal Bajo. Not encountered elsewhere. Copiapoa dealbata grows in the same area from which they are distinguishable at first sight by the greener colour of the epidermis and the more numerous spines.

. . . from H.Middleditch

At our 1985 Weekend we were shown slides by R.Ferryman of hundreds of hummock shaped plants growing alongside each other on the sloping hillsides not far from Carrizal Bajo. As reported above, body colour was either greenish or whitish, sometimes plants of all one sort together, sometimes both sorts growing side by side. Presumably the greenish bodied plants are Copiapoa carrizalensis and the whiter bodied plants are C.dealbata.

. . . from A.W.Craig

Fortunately I have several imported Copiapoa under the names of carrizalensis and dealbata. Some of these plants had already produced new growth in cultivation but without reproducing the original white body coating. Those which were covered with a white rime when they first came into my collection are likewise no longer producing this whitish coating on their new growth. The grooves between the ribs are not straight, but sinuous, so that the ribs are fairly wide around each areole and much thinner between areoles. Some imported plants look as if they never had any white rime coating the body; these have a hump below most areoles which is more evident at the shoulder. I have the impression that this feature can be used to identify carrizelensis. The spination is very open, almost all areoles on most plants having two or three central spines about 1in. to 2in. long, projecting, dark brown to black, often curved towards the end, occasionally with one or two shorter, paler, spines. If the names as received are accepted, then the variation in rib count and spination are pretty much alike for both species. None of the plants that I have possess the single centrals in accordance with Ritter's description.

From Chilean Impressions, K.Schreier and P.Weisser K.u.a.S 1975

[From near Vallenar] . . . our next objective was Canto del Agua, a previously inhabited spot on the road towards Carrizal Bajo. Around Canto del Agua it is quite dismal, with remnants of mining equipment. Some kms further on towards Carrizal in a rocky quebrada some brown spined heads of Neochilenia aerocarpa peeped out of the clefts. It penetrates up to 40cm into fissures in the rock. Several hours passed with photographs, astonishment, and digging. After some 10 km we reached the first hummock of Copiapoa carrizalensis — a clump forming version of C. cinerea. Photography had to done at a cracking pace, as the sun was getting close to the sea. After a long search we did find two smaller specimens. On account of important discoveries of iron ore there are earth moving machines nearby opening a road through the middle of a slope carrying these ancient clumps. It is sad to see the thousands of these magnificent clumps uprooted and covered with rubble up to the crown. Carrizal Bajo is a dead town which came to life again in the spring of 1974 when huge new deposits of iron ore were discovered. Under the Allende regime these were to be exploited with Polish help by laying a road to Chanaral.

. . . from F. Vandenbroeck

On our trip through this part of Chile we also followed the pan-american highway. From Vallenar we turned off down the Huasco valley as far as the coast and then returned to the main highway. We also turned off the panamerican to the north of Vallenar, passing through Canto del Agua, to reach Carrizal bajo To the east of Carrizal bajo the older clumps of Copiapoa dealbata are very impressive. From what we could see, the habitat area of this species seems to be very limited. Some heads were still in flower at the time of our visit - April 1983. Also Copiapoa carrizalensis occurs here. Around Carrizal bajo, close to the ocean spray, there occurs a small, clustering, densely spined Copiapoa, possibly C.echinata. We did not travel up or down the coast from Carrizal bajo, since there are no roads and these tracts are difficult of access. I would expect that an expedition on foot would be necessary if one wished to explore this area.

. . . from H.Middleditch

We are told by R.Ferryman that the large mounds of Copiapoa did not occur all the way along the hills immediately away from the shoreline, but that populations would come and go as they proceeded along the coast, for no evident reason. It is quite probable that F.Vandenbroeck encountered one population of these plants with bare ground beyond and no further population in view, and hence considered their numbers to be rather limited.

All enquiries made with the objective of finding a plant of the columnar black-stemmed C.echinoides in cultivation, have so far been unsuccessful. The Winter seed catalogues offered FR 205 as C.echinoides from Antofagasta but in the Ritter Kakteen in Sudamerika FR 205 was identified as C.boliviana.

## PERU 1986 — HUANCAYO By R.K. Hughes

During the course of 1986 I was fortunate to be able to undertake a further visit to Peru, this time in the month of April. My method of travel was similar to that adopted on previous visits, but on this occasion I made use of some on-the-spot guidance and this was certainly beneficial. Local trips were made from Lima, from Cuzco, from Arequipa, from Nazca, and also from Huancayo.

On my previous visit to Huancayo I had walked out of the town and up the mountainside. On this occasion I took a car from Huancayo, going south to Pucara with my local guide Luis Hurtado. From the small square there we made our way up a steep little street to leave the village. We crossed a road and made our way at first between fields of crops and then

along a rough track. It was very steep and under foot there were large rocks for maximum drainage and minimum erosion. There were dry stone walls at each side of the track around and out of which many bushes and wild flowers were growing. These included Opuntia exaltata and rosettes of bromeliads with spiny-edged leaves. We eventually climbed up past a rocky outcrop then turned past some large bushes of Opuntia exaltata to find a change in the terrain and the vegetation. Before us we had grassy fields and a less severe incline to climb. Among the grasses we saw alpine plants, the type with large yellow or white daisy like flowers that are stemless and flat to the ground. Now we were above the upper limit of cultivation, which would be between 3800 and 4000m.

It was to the far side of this area that we came across our first plants of Tephrocactus floccosus, at first only a few and also quite small plants. As we climbed higher the grassy area became broken up with rocks and some low thorn bushes. It was here that we found more plants of T.floccosus, now larger in size and in clumps. There were both the white hairy forms and the green, completely hairless, atroviridis forms, all growing happily alongside each other. The plants here all seemed to have many small heads tightly packed together. Most of the hairy forms were obvious because of their long white hair but some were less obvious. Like most of the green hairless forms these less hairy plants were rather flattened humps although not mat-like. The surrounding grass and other vegetation grew right up to the edge of the cacti, even intergrading with them so reducing the hummock effect even more. The green hairless forms were very difficult to spot from any distance, being a similar shade to the grass with yellowish spines also matching the dead grass.

We continued on our way through the low bushes and rocks of this area, passing more clumps of the white hairy T.floccosus, some being very white and very hairy. As we made our way to the top of the hill we came to a church or chapel to which the villagers carry religious articles on certain holy days. It was beyond this church that we expected to find the Oroyas that we were searching for. As we neared the spot it started to rain and soon after that we came across our first Oroya. Despite the gloom I tried to take photographs but the rain became too heavy and we had to seek shelter in the nearby church. We had become quite wet in the rain so this gave us some time to dry off. The rain then eased off sufficiently for us to continue our search and we soon found some more Oroyas. The first ones were comparatively and more or less disc-like flat to the ground. We then came across others that were quite large, depressed globular to short cylindrical. It was a great help when the rain stopped and a watery sun began to shine.

The flat disc like plants of Oroya were two to three inches in diameter and their robust spination hid the body below completely. The larger depressed globular plants were about five or six inches in diameter. These also had a very robust spination that was mainly yellow but could vary to an almost purple brown colour. The shape of the larger plants was not that obvious as they were growing out of the herbiage, often with grasses, rocks, or thornbushes alongside them. Even though there might be some cylindrical growth with old age, we did not see any plants with a height that approached their diameter. Despite the heavy spination the lower part of the plant body could still be seen due partly to their size and partly to their globular shape. There were up to 18 robust spines up to one inch long set along each side of the elongated areoles. Only some of the areoles possessed two or three outwardly directed central spines.

It was quite a while before some fruits were found on an Oroya. When the first fruits were seen there were three on the plant and another three close beside it on the ground, which had presumably come from an original ring of six fruits around the crown of the plant. Similarly another plant was found with five fruits on the plant and another five fruits lying close by on the ground. That the fruits were ripe could be seen from these fallen fruits and also the ease with which the remaining fruits would come away from the plant. The fruit were hollow elongated berries, a bronze red in colour except for the white to greenish-yellow base where one usually found a hole in the fruit. In picking up one of these fruits with a hole in the base, by means of the dead flower remains above, it was almost impossible not to loose some of the large shiny black seeds, if not a considerable number, nature having so managed affairs that the seeds loosely retained within the fruit dislodged themselves at the slightest vibration, to slide smoothly downwards and out of the basal hole. Most of the other fruits found during our brief visit to this site were found only in ones or twos on each plant. We soon had to return to the trail for a rapid descent; apart from the rain starting up again, my local guide had other things which he had to do during the afternoon. As we crossed the upper hillside again I was able to find ripe fruits on both the hairy and hairless forms of T.floccosus, which were full of seeds. I collected these fruits plus a sample joint from each plant for comparison.

A second site was visited from Huancayo, this time going north out of the town to Cochas. The mountains bounding the Mantaro valley were similar to those at the first site but were perhaps even higher. To reach this site and return was to take a full day so I met Luis Hurtado at 6 a.m. We took a local bus to get as close to Cochas as possible to start our walk and climb. The lower valley was of rich farmland between groves of eucalyptus trees. The damp areas at the lower parts became dryer as we climbed the mountain and farming ceased slightly below the half-way point where stone ruins were found overgrown with vegetation. These were built by the Huancas and used later by the Incas as storehouses at an altitude where they acted as a natural refrigerator. Beyond this point, where we had three eagles circling round us, there was a long exhausting climb through tall clumps of grass till we reached the alpine region of the mountain top with much gentler slopes.

Reaching a rocky rise where one might expect to find some Tephrocactus floccosus, we were disappointed. However there were many different species of alpine plants, many of them in flower. After a rest and then a photo-session with these plants, we took a gentle slope up to another rocky area and this time — there they were. On a more or less level area there were a number of plants of T.floccosus growing together with short grass and alpine vegetation. The otherwise level surface was only broken by a number of rocks and the odd clump of ichu grass, in addition to the clumps of T.floccosus. The plants were all of the lagopus or rauhii forms of this species. The broadest clump was two metres across in each direction, although among the actively growing parts of this large clump were many dead patches. Other smaller clumps were more representative of this plant, the stems usually taking up the form of a hemispherical hump, up to eighteen inches in diameter on average, whilst the maximum height was always no more than 9 to 10 inches.

The stems seemed very squat and cylindrical at two inches in diameter, although the ends appeared to be conical; they grew either close together or else formed a more open clump. All the stems had a covering of long dense white hair, which was up to nearly two inches in length; the hair covering was denser on some stems than on others. The stout and squat appearance of the stems was very probably due to it being the end of a longish rainy season. The green epidermis

between the areoles could be seen at the tops of the stems, where the coat of hair had not yet grown long and dense. The tops of all the stems also had shiny green leaves that were much fatter and longer than I had seen before; when I came across this plant on my previous visits it had been further into the dry season than on this occasion. On some plants the sharp spines were not hidden by the hair and protruded through it. Where the spines were yellow they could give a yellow look to the clump, whilst on other plants the hair looked yellowish. My guide had not previously seen any really yellow haired forms; he thought that the creamy yellow cast seen here was due either to the effect of the growing season or to the age of the plant.

. . . from L.v.d.Hoeven

I have also travelled through the high parts of Peru and found fields covered with Oroyas, all sizes from seedlings to plants over a foot in diameter, a truly fascinating panorama. During this visit, which took place in the last week of January, I never saw any flowers, but an abundance of fruits, which showed no sign of elongation at all.

. . . from P. Allcock

I have set fruits on several species of Oroya over the years; these fruits were irregularly shaped, not more than 10mm by 10mm in size, and green. Eventually they just shrivelled up and dried, turning a dirty brown colour and staying entangled in the spines until I removed them. But three or four years ago I had what I would call an extraordinary fruit on O.minima, because instead of drying up it grew bigger and turned a more pinky-brown colour. It stayed like this for weeks so shortly before Christmas I detached the fruit, not wishing either the fruit to go mouldy and spoil the plant or the seed to fall amongst the spines, but perhaps mostly because I could contain my curiosity no longer. It parted from the areole at a touch. The fruit was still turgid but quite hollow and the seeds were certainly ripe. As this was a very late season fruit there was the possibility that it could have been atypical. But in 1986 these bigger sort of fruit were produced by a large old habitat ex-KK plant of O. gibbosa, also by a couple of seed-raised plants of O.citriflora, as well as by three separate habitat plants of O.minima.

The largest fruit was removed from O.minima and measured 34mm high by 17mm in diameter. The fruit was rather like a hot-air balloon in shape but was not quite symmetrical, the flattening probably being due to the restricted space amongst the spines. The fruit wall was quite turgid and the seeds were all suspended in the top third of the fruit, not in a membranous sac but like Arequipa in a loose tangle of funicles. The bottom two-thirds of the fruit was quite hollow. There was a little hole at the base of the fruit and a small disc of fruit wall was left on the areole from which it was detached. The fruit was a deep pinkish red colour and on the plant it looked this colour all over, but the lowest part was in fact still green, which could only be seen after the fruit had been removed from the plant. When a fruit was sliced in two, the lower half of the wall tapered down to less thickness and at the very bottom it would be about one third as thick as it was at the top. From the change in colour and the thinning of the lower part of the fruit wall it looks as though the elongation takes place mainly in the lower part of the fruit.

. . . from W.Rauh Beitrag zur Kenntnis der peruanischen Kakteenvegetation.

The fruit of Oroya opens at the base in a similar manner to that of Islaya so that the seeds fall on to the crown of the plant.

. . . from H. Middleditch

There is no doubt that Backeberg clearly describes the fruit of Oroya as a hollow berry with the seeds loose within, similar to Neoporteria. However, it was only at our Chileans' 1986 Weekend when R.K.Hughes showed slides of Oroya fruits in the wild that I realised what these were really like. Within a month or two of seeing those slides, a print arrived from J.M.Chalet of a large plant of Oroya growing in the wild and alongside it were a dozen or more small-headed plants growing cheek by jowel against each other. It might be assumed that these seedling plants were from a fruit or fruits that had fallen off the mature plant. Because of the stones and the tufts of grass, a fruit could hardly get moved any further away from the parent plant either by the wind or by flowing water. So did R.K.Hughes find any seedlings growing closely alongside the large mature plants of Oroya which he saw?

. . . from A.W.Craig

On the colour print taken by Chalet of an Oroya in habitat, the small headed plants alongside the Oroya do not look like the seedling Oroyas which I raised. What else could they be?

. . . from R.K.Hughes

The photo from Chalet shows an Oroya and nestling alongside are short heads of a sparsely haired Tephrocactus floccosus, looking typical of many of the uneven clumps or mats that I saw. One must assume that because the Oroya, the T.floccosus and the grass all compete for the best or only practical growing situation that is available, they often have to share a patch of ground.

. . . from H.Middleditch

From the comment made by R.K.Hughes that spination on the Oroya was "mainly yellow but could vary to almost purple brown", I am not entirely clear if this is intended to refer to spine colour variation on one plant, or from one plant to another. If the latter is the case, than it matches the comments quoted above from Rauh's observations made to the north ' Oroya, as well as the comments made by Chalet about the variation in spine colour on Oroya from that same locality and also from Huayacachi. Indeed one of the abiding impressions of the slides shown to us at the 1977 Chileans' Weekend by J.M.Chalet of his trip to Peru, is of two large Oroya growing side by side with one plant having yellowish spines, the other with dark brown spines.

. . . from R.K.Hughes

The most common spine colour on the Oroya that I saw was yellow. There were plants with an overall purple-brown spine colour, and other plants with in-between spine coloration. In addition on any one plant the spines would not all be identical in colour; the plants with an overall yellowish spination would have some brownish or even reddish tinged spines and the plants with an overall purplish-brown spination would have some yellowish tinged spines, and so on.

. . . from W. Hoffmann Peruvian Diary KuaS 16.2.1965

On the scree by the river Mantaro we collected Oroya peruviana which, together with the form O.neoperuviana, grows in extensive populations here and on the surrounding mountains. The species is so fantastically variable that both forms, as well as all the intermediate forms, can be found at the same spot.

. . . from H.Middleditch

I tend to get the impression from the altitudes quoted by Rauh, by Chalet, and by R.K.Hughes, that Oroya are to be found growing at an altitude of between 3600m and 4100m. Perhaps the lower limit is due to it matching the upper limit of cultivation? From the faint recollection of the slides shown to the Chileans' Weekend by J.M.Chalet, together with the photographs published by Rauh and by Backeberg, as well as from the slides shown to the Chileans' 1986 Weekend by R.K.Hughes, I have the impression that Oroya, like Tephrocactus floccosus, is to be found growing on neither steeply sloping nor dead level ground, but on gently sloping ground. There usually seems to be a scattering of stones (which may from time to time be as large as boulders) on the surface, and the most prominent accompanying vegetation seems to be tufted grasses. Is this correct? I wonder how high were the "low thorn bushes" seen by R.K.Hughes growing at the same site as the Oroya? About as high as the grasses? Or higher? Or much higher? In addition there must be some reason why Tephrocactus floccosus is found at some places and Oroya at others when the available description of the surroundings suggests that there is no difference in the terrain or in the accompanying vegetation where each sort occurs. Was there any feature or features which could be said to differ between the two environments?

. . . from R.K.Hughes

The thorn bushes that were to be found in the vicinity of the Oroya, were of a similar height to the rocks; that is to say that many were only up to ankle height although there were also some which were taller and matched the height of the larger boulders. Although I did find plants of Tephrocactus floccosus before I came across Oroyas, it was no great distance before; then the two sorts would be growing together among each other. When I was at Sillustani (near Puno) on a previous trip I came across some dwarf globular plants which I took at first to be Oroyas because of the flowers, but then I was able to identify them as Lobivia maximiliana. Have any of the botanists commented that this may be parallel evolution?

. . . from P. Allcock (independantly)

Amongst some random observations, I was struck by the amazing similarity between the flowers of Lau 252 and Lau 254 (both forms of Lobivia maximiliana) and those of Oroya. Of course the Lobivias come from Peru, from (as far as I can gather) a completely different habitat. An indication of similar pollinators?

. . . from H. Middleditch

But I believe you will find that there are material differences in the internal construction of the two sorts of flowers despite their external similarities. On the other hand I would have thought that the environment where these two sorts grow are not that different. Lake Titicaca lies at 3809m elevation so the Lobivia maximiliana will occur upwards from this level, which is around about the mean altitude for Oroya. At this common altitude on the Puna, temperature regime will be rather similar. Annual rainfall at Jauja is about 600mm, mostly during December-March and sparse from May to August. Annual rainfall at Puno on Lake Titicaca is about 500mm, mostly during during December-March, again sparse from May to August. Being at a similar altitude and enjoying a similar temperature and rainfall regime, I would indeed expect the pollinating agents to be similar.

When different genera share a harsh environment the external vegetative growth often exhibits convergent evolution, whilst the flowers differ. But Lobivia maximiliana grows just beyond the southern limit of Oroya so there is no competition between them for pollinating agents. Is this an unusual example of convergent flower evolution under comparable external influences?

. . . from A.Hettner, A journey in Peru & Bolivia 1888

[Coming from Lake Titicaca]. At Santa Rosa we were at the last place in the highlands of Titicaca .... while on the other side of Santa Rosa we soon entered a landscape of quite different character

. . . from H.Middleditch

But at the other side of the La Raya pass the puna would be roughly the same altitude, and it would carry similar tufted grasses; in addition, T.floccosus does grow to the south of that ridge (surely?) although it is far more prevalent in Oroya territory to the north. But something must have struck this author as different to his eyes, when he crossed this pass. It is indeed around the phytogeographical boundary of 15°S latitude, discussed in Chileans No.44. Do these differences reflect the reason for the southern boundary of Oroya, and the northern boundary of the hummock forming Tephrocacti?.

. . . from J.Arnold

I now have between thirty and thirty five plants of Oroya, which have been acquired over the course of several years. I was quite pleased with the way these plants had flowered previously, but now I have found them even more inclined to flower even though they have only been in the new greenhouse for about a year. Some of my Oroya peruviana type of plants have even produced a second flush of flowers in one season, which is by no means usual. My KK1698 O.minima now has two rows of basal offsets and flowered prolifically from May onwards, starting with quite a flush of flowers followed alternately by a gap and then one or two flowers, right up until December. A seedling of O.peruviana v.depressa which is now five or six years old and six inches across, has now flowered for the first time. Repeating its usual flowering was O.borchersii which has bloomed for the past six years. The only one which did not flower when I expected it to do so was O.citriflora, of which I have several raised from a batch of KK seed. These do produce flowers either pink or red, or lime green with yellow tips, but no all-yellow flowers. All the flowers on my Oroyas last a good four or five days so they make a nice show.

My previous greenhouse was situated between two properties and only received about 3 to 4 hours of summer sunshine whilst the new greenhouse is in a more open location and has at least double the hours of summer sunshine, in fact about nine hours a day. My collection had always been housed in a glass glazed greenhouse but this time I have gone in for a tubular frame tunnel type covered with heavy gauge polythene sheeting. Once I started the gas heating for the winter there was a considerable amount of condensation on the inside of the polythene, until I put up the internal lining of bubble polythene. This seems to have cured the condensation.

At the same time I now have all my plants in my new compost. Originally I was using something like a 50-50 peat and grit mix. I was not too happy with the results from using this so I increased the amount of grit in the mix until I finished up using a compost which was nearly all grit. Once this compost had dried out completely it was very difficult to wet it again effectively. Now my compost is roughly equal parts of peat, loam (a locally made J.I. compost), and grit, with added bone

meal. This compost both drains itself of excess water and wets easily throughout. This is really important for the Oroya as I now aim to keep them moist (not wet) throughout the year. Feed is added for most waterings but not when watering the Oroyas in winter. There has been a distinct improvement in the growth of my Oroyas, especially in the spination, and flowering is also improved. This year my Oroyas are about a month early in showing buds, which might be the result of an extraordinarily mild winter or it might be the improved growing conditions which I have given them.

There seems to me to be very little problem in regarding the Oroyas as two major groups, the northern sort typified by O.borchersii and the southern sort typified by O.peruviana and neoperuviana. Having seen the slides of Oroya taken in Peru by R.K.Hughes which he showed us at The Chileans Weekend I still find it difficult to assign my own plants to one or other of the southern species. There certainly seems to be a fairly broad range of appearance in plants which come under the name of peruviana or neoperuviana. Perhaps this is not too surprising when we hear of the variation in both spine colour and body habit observed in one locality. The major challenge is to get these plants not just to grow well, but to flower well.

**THE GENUS OROYA** **By F.Vandenbroeck.**

Translated by H.Middleditch from Succulenta 4.60.1980

Most cactophiles know well the name Oroya as a genus of Peruvian globular cacti, which can attain appreciable dimensions and display a typical unmistakable habit. They are also well known as plants that do not always do so well in our collections. The flowers often fail to put in an appearance and in spite of this the plants are willing to flower but usually only rather sparsely.

The cause of the problem in regard to the flowering is not too far to seek: Oroyas are typical high mountain plants. They come exclusively from the so-called puna or high plateau of the Andes, where they are to be found between altitudes of 3500 to 4300m. It is clear that the plants are in climatic conditions and exposed to a light intensity there that cannot be equalled in western Europe. In regard to that, Prof. Rauh of the Botanical faculty of Heidelberg notes that during one of his study trips through Peru he made measurements of ground surface temperatures at a height of 4225m in the Cordillera Negra at the growing place of Oroya borchersii. These temperatures are clearly of prime importance for plant growth. Around midnight the the temperature was -3°C, at 7a.m. the mercury dropped to -7°C and at about 11a.m. it had climbed up to 38°C under the influence of the radiant sunshine. The plants are thus subject to a temperature range of 45°C; it is true that this is in the dry season which is also the coldest. The dry season falls in our summer.

The genus Oroya is endemic to the humid high puna of central Peru, also known as the grass-puna on account of the dominant occurrence of tussocks of ichu grass, tough grasses belonging to various genera such as Festuca, Calamagrostis and others. The flattened globular Oroyas grow between the grassy tussocks. The grass puna undergoes a dry season, a so-called winter season of four to five months (April — September) during which the grass leaves wither completely and the whole Puna takes on a yellowish brown colour. During the summer season (October -April) much rain falls on these heights and the temperature is higher. This is the growing season on the puna. The seeds then germinate and everything becomes green.

During a trip through Peru I had the good fortune to be able to observe a fairly large number of Oroyas at different locations. It may be supposed that should one travel through the puna of central Peru at a height ranging between 3800 and 4300m, one will generally be able to observe Oroyas. They sit everywhere like huge golden thistle heads between the tussocks of grass. The normally quite robust golden yellow spination is impressively handsome in comparison with the adjacent plant body.

In the vicinity of Huaraz in the Cordillera Blanca, we find flowering examples of O.borchersii at a height of 4200m. Notable with O.borchersii is the central inflorescence. The greenish yellow flowers. only partially opening, appear to be come up packed closely together at the centre of the globular plant body. It is indeed typical that the plants flower in the so-called winter period which at these altitudes is dry and sunny with extremely low night time temperatures. The seeds would then germinate in the subsequent moist summer season. The Oroyas are indeed not the only winter flowerers on the puna; we found a whole lot of flowering plants, composites and malvaceas as well as a splendid lupin (probably lupinus mutabilis).

In the same environment we also found various sorts of Tephrocactus, among which the most prominent sort was T.floccosus which formed cushions up to one metre across and bears woolly hairs varying from white to golden yellow. A group of T.hirschii flower pale red. As younger plants O.borchersii set close pressed against the ground and are depressed globular. The largest plant we saw had attained a diameter of around 25cm. The ribs are completely hidden behind the spines. As the plants become older, they exhibit a tendency to extend in height, whereby the bottom becomes more or less corky and the oldest spines become grey to black. The oldest plant that we saw had attained a height of about 20cm. Only a poor guess can be made at the age of these plants, especially since the climatic conditions at such high altitudes are very extreme and foreign to us. Thus we cannot easily form an idea as to the rate of growth of the plants. In any case I can point out with certainty that the bromeliaceae occurring at these altitudes (mostly belonging to the genus Puya) do grow extremely slowly. So does Puya raimondii, many of which occurred at the spot described above. It is the largest and most impressive representative of the family of the bromeliaceae and it comes into bloom at upwards of 50 to 70 years of age. They are a very large plant with intimidatingly barbed leaves, which dies after its one and only flowering. The sluggish growth and the fact that it flowers once in a lifetime are the cause, among others, of it seeming to face extinction. In a travellogue of a trip through Bolivia by the late A.F.H.Buining which was published in Succulenta (June 1975), mention was made of this remarkable plant together with an illustration. Near Huaraz we saw some dead ones with old flower stems that attained ten metres in height, with young plants besides them.

More to the south, between Tarma and Oroya, we had the good fortune to find specimens of O.peruviana sensu Rauh. The mode of growth in the environment of O.peruviana is closely in accord with that of O.borchersii; broad flattened globular plants between the puna grasses. The spination however seems to be more variable; thus I saw plants with a rather appressed or lighter spination, others had in addition long outstanding central spines or were darker spined. The colour of the spination seemed to be inconstant and is generally darker than that of O.borchersii. One striking difference is

also the mode of flowering. The rose-red open flowers do not stand centrally but spread over the plant body in abroad ring. The intensity of the flower colour is evidently extremely variable. At around 4600m altitude the plants are in bud. Some hundreds of metres below I had seen them flowering pale red.

Then I occupied myself with photographing some plants and among others came across a yellow flowering group of Tephrocactus atroviridis. Also I found an uprooted Oroya with almost no roots at all. As I judged this plant had little chance of survival I took it with me. Already after a week in the greenhouse to my astonishment this plant began to form buds and at intervals produced some fifty flowers. Probably the plant had already started into production of buds whilst at its habitat location. The flower colours of this plant were rather delicate, the outermost reflexed petals soft pink and the inner upright petals yellow.

I have already had grafted seedlings of O.peruviana v.neoperuviana in cultivation for several years, having obtained them here and there. Some of these seedlings have a rather open and weakly spination and seem less on these plants than on those I saw in habitat. Some bear species names like accolana and gigantea, invalid names which probably refer to varieties of one and the self-same species namely O.peruviana. Obviously on account of the lengthy cultivation in unnatural circumstances that these plants have had, which can stretch to as much as several generations, many of them have lost their natural habit.

. . . from W.Rauh Beitrag zur Kenntnis der peruanischen Kakteenvegetation.

During the dry season in the puna, clouds are few. Day after day blue skies predominate. Only around noon do clouds spring up, which can result in precipitation. The puna surface is an almost meter thick bed of humus, which dries out altogether in its uppermost layer. During the dry season most plants are found in a state of rest; by the end of the rainy season the large tufts of grass are already coloured autumnal yellow. Only the cacti belonging to the Puna zone have their principal flowering season during the rain-poor months when they are exposed to sharp night frosts.

. . . from A.B.Lau, South American Cactus Log, U.S. C & S.J. Vol.51 1979.

The next town was Abancay where we rejoined the main road from Huancayo to Cuzco. We decided to back-track to Andahuaylas in order to see the habitat of Oroya subocculta v.depressa Lau 131. As the name indicates, they are depressed to the point of being completely level with the grassy slopes and with flowers that looked like they protruded from the ground. The soil was a black humus, almost like peat moss.

. . . from R.K.Hughes

The time I had available when I was at the growing site of Oroyas was very limited, especially at Pucara where it was made much too short by the inopportune rainstorm, so that there was little or no opportunity for examining the nature of the ground. In addition, this question had not even been raised prior to that visit, so that I am not able to say positively what the nature of the soil was. However it was black and very wet and also spongy as one would expect with a peat soil. Although there were patches of bare earth among the surface rocks and boulders the overall colour was green. This shows that there must have been a sufficient thickness of soil upon the bedrock to support a rich carpet of grasses, herbs, and cacti. On the other hand at the time of my 1986 visit the normal three month rainy period had lasted five months, according to people in Huancayo.

. . . from J.Arnold.

I well remember that when R.K.Hughes talked about his trip to Peru at the Chileans' Weekend he mentioned that some of the Oroya he came across in Peru were growing in soil that was almost black and soggy. Yet I get the impression that the illustrations of Oroya in Backeberg's Die Cactaceae are of plants which are far from turgid, as if the soil that they are in has quite dried out. Does this peaty ground change from being soggy in the wet season to being quite dry in the winter?.

. . . from H.Middleditch

When the Pennine moors are dry there are many places where I can feel the peat springing under my feet. In really wet weather I would not dream of taking the chance of walking across one or two of these patches as they can be as lethal as quicksand. The sun is 20° of latitude from the Pennines in summer and 35° from the puna in winter but I suspect that because of the altitude of the puna the insolation may be comparable; the vegetation cover on the puna does not seem to be as good as that on the Pennines; and the puna rainfall is less than that on the Pennines. So I would not be at all surprised to find that the peaty ground really does dry out in the puna in winter.

. . . from F.Vandenbroeck

What struck me particularly at the time of my visit to Peru was the number of adult plants of Oroya borchersii lying on their side with roots broken off. Most of them were lying either at the foot of a hillside or would be lying in a little valley. Could they have succumbed under their own weight, perhaps because in the dry period the roots become brittle and easily break?

. . . from H.Middleditch

Or could it have been the combination of the nature of the ground and the shaking of an earthquake tremor?

The problems of persuading Oroya to flower in cultivation were discussed under the heading of "To water...or not to water" in Chileans No.43, where it was also suggested that most south american cacti probably flowered in the wild around the onset of the rainy season. We may now see that this is not the case with Oroya. When the cool dryness of their winter starts to give way to moist warmth, it is the end of the flowering period for Oroyas. If Oroyas in cultivation are given a generous watering at the onset of bright warm days after a cool dry winter, just as they are showing buds, they will expect that the rainy season has set in and so are likely to be discouraged from flowering.

If the plants flower before spring (October) and the seeds germinate in the rainy season from October to April, how was R.K.Hughes able to find fruit with ripe seed on plants of Oroya in April?

The plants seen in habitat by the author must have had the flowers disposed in the manner described. However, Fig.217 in Rauh's Beitrag zur Kenntnis der Peruanischen Kakteenvegetation is of O.borchersii with a ring of buds and flowers and a flowerless centre. whilst Fig.215 is of O.subocculta with the flowers and buds fairly crowded into the centre of the plant. Hence the flower disposition does not appear to be a constant feature.

**OROYA** **By Prof Werner Rauh.**

Abstracted and Translated by H.Middleditch from Beitrag zur Kenntnis der Peruanischen Kakteenvegetation, 1958.

For many years the only known Oroya was that collected by Weberbauer near Oroya and described by K. Schumann in 1903 as Echinocactus peruvianus. In 1935 Backeberg described a second species as O. neoperuviana, distinguished by a larger number of ribs, a denser spination and a flower of less height in cultivation. Since the original plant collected by Weberbauer and preserved in the Berlin-Dahlem Museum was destroyed during the war, any comparison is no longer possible. The red flowering species stretch from Oroya as far as towards Andahuaylas in the south. The yellow flowering Oroya borchersii is exclusively confined to the northern Corderilla Blanca and Cordillera Negra.

In 1954 the form of Oroya peruviana found in cultivation was collected by us on the Puna plateau near Andahuaylas, between Abancay and Ayacucho: Oroya peruviana v. depressa Rauh & Bkbg var. nov. The plants differ from O. peruviana by the much smaller flowers (1.5cm long, 1.5cm in diameter), the deeply-incised tuberculate ribs and the larger number of radial spines. This is the most southerly species of Oroya and grows about 500km to the south of the finding place of the Type. In 1956 we collected plants of O. peruviana under field no. K3 to the south of Oroya on terraces in the Mantaro valley.

At this same spot on the Mantaro terraces at 3600m we came across an Oroya growing among the boulders, in company with Tephrocactus atroviridis, which differed radically in habit and spination from O. peruviana, so much so that we describe it as Oroya laxiareolata Rauh & Bkbg Spec. nov, field number K4. These plants undoubtedly belong to Oroya despite the absence of flowers.

About 20-25km to the south of Oroya on terraces in the Mantaro valley formed of boulders and large stones, there occurred in great numbers an Oroya that differed both from O. peruviana and O. neoperuviana by its depressed globular form, dense spination, and having a thickened root-stock anchored well into the ground. The spine colour is very variable and ranges from white to reddish brown. These plants are described as Oroya subocculta Rauh & Bkbg spec. nov. field number K82 (1954), with varieties albispina and fusca.

To the north of Oroya, not far from the pass over into the valley of Tarma, there occurred such great numbers of O. peruviana together with Puna grasses that it can be spoken of as a cactus-rich phase of the puna grass formation. The spination and spine colour are extremely variable, but there are no depressed-globular bodies like O. subocculta although in old age they may even become somewhat cereoid and attain a height of 30cm. A thickened rootstock is never found.

. . . from P.Allcock.

In 1983 I had a consignment from Knize of over a hundred habitat plants of O.baumanii and O.laxiareolata forms. These had long tapering roots which meant that they had to be put into "Long Tom" pots. I do not think that I would have described these as tap roots, especially as a good proportion still had quite apparent areoles or areole sites so they were probably buried stems.

. . . from W.Clark

I find that Oroyas will only keep about six inches of body in a nice green colour with fresh spines. I have had two imported plants of Oroya for some fifteen years now, O.gibbosa and O.baumanii, both between four and five inches in diameter. Every so often I have to pot them down in order to cover up the corky lowermost part, otherwise they would be standing about a foot high.

. . . from H.Middleditch

Does the lower portion of the stem which remains exposed in cultivation become shrunken and drawn into the ground in habitat?

**PERU 1976** **By J.M. Chalet**

Translated from..... by H. Middleditch

In the evening of September 14th 1976, I make a landing at Lima after 16 hours of flying. After the customs formalities, I went into the airport lounge where my friend Carlos was waiting for me (he had been in Peru since August) together with his cousin. We had to make our way promptly to our hotel, because the government had proclaimed a curfew from 1 to 5 in the morning. The whole day following was devoted to visiting tourist attractions. At the same time we made enquiries about hiring a vehicle for our expedition into the Andes. It was the next day when we finally had a chance to hire a VW 1300. The choice was made promptly because there was only one vehicle. The general condition of the vehicle left something to be desired. Three out of the four tyres were almost smooth. We did not pay great attention to them, but that would play tricks with us in due course. In the morning we pay a visit to the brother of Carlos in the suburbs of Lima.

At 1330 hours we made a grand departure in the direction of Chosica (850m). On leaving the village we started to climb the first outlyers of the Andes. At 1050m — the moment so long awaited — we encounter the first Peruvian cacti. They are Neoraimondia roseiflora (Werd & Bkbg) Bkbg, Melocactus peruvianus Vpl, Tephrocactus kuehnrichianus (Werd & Bkbg) Bkbg, Haageocereus acranthus (Vpl) Bkbg. Continuing our ascent amidst the rubble, we come across Espostoa melanostele (Vpl) Bkbg. sporting a magnificent brown cephalium.

Friday 17th September: The mist is thick; departure at 0815 hours in the direction of Matucana. Just before reaching San Bartolome, we decide to cross the R. Rimac to explore the surroundings. We proceed carefully along a narrow mule track. The sun plays hide and seek with the clouds. At a bend in the trail Neoraimondia roseiflora (Werd & Bkbg) Bkbg, Espostoa melanostele (Vpl) Bkbg, Melocactus peruvianus Vpl, Haageocereus Choisicensis (Werd & Bkbg) Bkbg, and Loxanthocereus faustianus (Bkbg) Bkbg. greet us.

On leaving Matucana, we cross the Rio Rimac and park our vehicle in the dried up part of the river. We scale the very steep slopes. The rock is very friable. Our efforts are rewarded. Wedged in a cleft of the rocks, I find one, two, three Matucana haynei (O) Br. & R. at 2500m. Returning to the river bed we approach an indian occupied in repairing the embankment carried away by the last flood of the R. Rimac. Carlos asks him if the hill does not have an easier access. The old

man indicates a track which leads us to the flank of the hill. The soil constantly slides away from under our feet. On the way we come across Loxanthocereus acanthurus (Vpl) Bkbg, an Eriotrichus sp., Espostoa melanostele (Vpl) Bkbg, and some Matucana haynei (O) Br. & R. Hidden under a shrub, we find the same Matucana haynei, this time a specimen of 30cm in height. The lignified section which measures 20cm is buried in the gravel.

At 1430 hours we depart for Oroya. The wind freshens and at San Mateo the rain makes its appearance. We pause at the bridge of Infernillo. On leaving Tamboraque the road is in poor condition. At 1700 hours we reach Ticlio pass. (4843m, 8°C). Grey clouds loaded with snow are again hanging round the peaks which overshadow the pass. The sun shines on the snow which covers up the flanks of the mountains. A quilt is welcome, because in the bedroom of the hotel Inti the temperature does not rise above 12°C.

Saturday 18th September: The surrounding mountains are covered in fresh snow. We are anxious to leave La Oroya, mining centre where the noxious fumes choke us. A little way before Paccha we decide to explore the adjoining hills to search for Oroya. Breathing is difficult since we have ascended from 3800 to 4100m. After two hours of searching, we come across the rotted carcase of an Oroya. The cold and humidity together have taken their toll of these plants. Indeed, as in Europe, the seasons have a tendency to be displaced. Meanwhile we come across tufts of Tephrocactus floccosus (SD) Bkbg. A shepherd tells us to climb higher to find Oroya. In a half-hour we ascend 300m. After this fruitless effort, we once more take the road to Cerro de Pasco.

After several km we turn off in the direction of Tarma. Just before reaching the Cochas pass (4367m) we photograph tufts of Tephrocactus floccosus (SD) Bkbg., of which some are about 3m in diameter. On the other side of the pass, the sun shines brightly. After half an hour of travel, we decide to explore the surroundings. We climb up the rocks. After a half hour, we find Oroya neoperuviana Bkbg. (3500m) of which the spines vary from yellow to brown. This spot had already received a visit from collectors, since the freshly turned-over soil indicated that the large specimens had been dug up. In a cleft of rock, Carlos discovered a specimen of 20cm in diameter.

At 1330 hours we arrive at Tarma (3050m, 20°C) where we have lunch. We decide on an expedition in the direction of the virgin forest. Off and away for San Ramon, at 64km, 825m. After leaving Tarma, an xerophytic vegetation offers itself to our view. There was no way to resist the temptation. We came to a stop and decide to explore the hill. The area is very dry and the spiny bushes are very dense. It is extremely difficult to penetrate into this vegetation. Eventually we open out an entry. Trichocereus tarmaensis Rauh & Bkbg are covered with Tillandsia sp. At the foot of the spiny bushes we find Erdisia squarrosa (Vpl) Br & R (or Erdisia tenuicula Bkbg) in flower. After an hour of searching we find a group of Lobivia tegeleriana Bkbg. There are in all five specimens which we come across.

This diversion has taken much of our time and we are doubtful of being able to reach San Ramon before nightfall, on top of which the rain makes its appearance. Increasingly the asphalt road as far as Palca becomes less and less practical for cars. We pass lorries loaded with citrus fruits. The potholes in the highway become more and more numerous; we could almost take a bath in them. The valley drops away; the descent is vertiginous since the difference in level between Palca and San Ramon amounts to 1925m in 44km. The road becomes very narrow and the lorries leave deep furrows in the highway of beaten earth. With a sudden jab on the brakes, we come to a halt just before where the road has half fallen away. After getting out to size up the position, we go forward very carefully on the other side of the highway. Some hundreds of metres further on, it is a mire. The water runs over the ground and the ruts are 30cm deep. The floor of the car rests on the ground and the wheels turn in fresh air. Unfortunately we will not be able to get as far as the virgin forest, so we are obliged to retrace our steps and pass the night at Tarma.

Saturday 19th September: Departure at 0700 hours in the direction of Jauja. On leaving the town, we appraise our first puncture. The state of the road is deplorable. It is like the "corrugated iron" surface made famous by the travellers who cross the Sahara. The average speed is 30 km/hr. Carlos had to secure his door with some string. The road hairpins to cross hills covered with Austrocylindropuntia subulata (Muhlpfrdt) Bkbg. Towards 10.00 hours we reach the plateau located at 4000m. Suddenly an indian woman appears at a bend in the road. As soon as she sees us, she runs off crying in the direction of the village, and leaves her bundle on the edge of the road. To our amazement a huge Oroya is wrapped in a cloth. We want to ask her where she has found this plant, but in vain, she is only a point on the horizon. Some minutes later, the whole of the village rushes out in our direction, throwing stones at us. We leave sharply; alerted by the racket, some indians come close to the road again, but on the opposite side. Another halt; we talk to an indian woman who explains that they have got upset over a misunderstanding. The indians thought that we came to take a blood test; furthermore the indian women told the men of the village that we intended to molest her. Hesitantly the indians from the village approached our group. It all ended with explanations and plenty of laughs.

Carrying on in the direction of the hills, we first of all met up with one, two, and then dozens of Oroya neoperuviana Bkbg in flower. The spines vary from golden yellow to blackish brown. Some specimens are up to 40cm diameter and 20cm high. These plants possess a thickened rootstock very solidly anchored in the ground. After surmounting a pass at 4060m we arrive at Jauja. It is market day and we take advantage of it by shooting many photographs. We arrive too late at Huancayo to be at the famous sunday market. However an indian offered us some Oroyas which he had concealed in a basket. He sells them to be hung up above the entrance door in order to drive away the evil spirits. Going on the search for these plants in the neighbourhood of Huancayo we get a puncture so return to the town for a repair. We sleep at 3240m.

Monday 20th September: It is impossible to get to Ayacucho by the valley of the Mantaro in consequence of the torrential rains of 1974 causing a landslide and then in a few days a lake developed, as large as those of Annecy and Bourget put together. Since that time, the route has been completely blocked, which means we have to make a detour via Pampas, Cobriza, Mayocc, and Huanta in dreadful conditions — rain, fog, and snow — and with a road of compacted earth in appalling condition.

Leave at 0700 hours in the direction of Pampas. First stop at Huayacachi where it is market day. Not far off 4000m we talk to a young indian, 10 year old Prasiliano, who says that he is prepared to go with us to the spot where the "Angapanco" (Oroya) are to be found. On the far side of a hill, there is a feast for amateurs like ourselves. Hundreds of Oroya

neoperuviana Bkbg are strewn over the ground. The colour of the flowers varies from light orange to carmine red and that of the spines from golden yellow to blackish brown. The oldest plants attain 40cm in height and 20 to 25cm in diameter. Numerous tufts of Tephrocactus floccosus (SD) Bkbg — "Sancoquisca" are scattered like sleeping sheep.

After having surmounted a pass in the hail and mist at 4200m we undertook the vertiginous descent in the direction of Pampas. In the course of this the engine stopped and we reached Pampas (2200m) by freewheeling. A mechanic worked all afternoon to put our vehicle back in order. Departure for Cobriza at 1500 hours. At 1700 hours we came to a halt in the "restaurant" Huerfanito for a drink of tea. The snow starts to fall. From the terrace we see the mountain which has slid down into the Mantaro valley. At 1900 hours we reach Chota (3900m) after having rolled into a mire during a snowstorm. A meal of rice is our welcome. We shiver throughout he night because the windows of the loft have no glass. The wind howls like a lunatic and the temperature goes down as far as 4°C indoors. The following morning ten cm of snow cover the car and twenty cm over the ground.

Thursday 21st September: After having cleared a pass at 4200m in 20cm of snow, we start on the descent in the direction of Mayocc. We ford a river then it is only at the entry to Churcampa (3200m) that the tenacious mist disperses. Towards 3000m appears a vegetation with which we are quite familiar. The hills are clothed with an xerophytic flora among which we recognise Opuntia sp., Austrocylindropuntia cylindrica (Lmk) Bkbg, some Erdisia spp. which can attain 2m in height, of which one species possesses reddish-brown spines (Erdisia quadrangularis Rauh & Bkbg?) whilst the other has yellow spines (Erdisia maxima Bkbg?), Trichocereus tulhuayacensis Och. as well as a solitary specimen of Cleistocactus pungens Ritt.

Towards 2700m there appears the first cylindropuntia tunicata (Lehm) Knuth armed with potent spines, which I get closely acquainted with after planting one in my hand. Carlos came to my aid with a pair of scissors. However it is above Mayocc where we view one of the finest landscapes of our journey. In wild west scenery, the huge Azureocereus hertlingianus (Bkbg) Bkbg, raise their outlines 8-10m high. If the view is magnificent, the road on the other hand is in a sad state. Our car slides like a cake of soap so our tyres are enveloped in a layer of red earth. At the bottom of the valley curls the majestic R. Mantaro. After having taken refreshment at Mayocc (2700m) among the hens and pigs which ran unhindered round our feet, we cross the river. A puncture obliges us to change a tyre. The valley resembles on a small scale the Grand Canyon of Colorado, with its superimposed beds of earth, changing from yellow to ochre, from red to violet. On leaving Mayocc, the Azureocereus hertlingianus (Bkbg) Bkbg as well as the acacia spp. are most numerous. The area is very arid. It is 27°C in the shade. Compared with the 0°C of that morning, it is like a furnace. Cylindropuntia tunicata (Lehm) Knuth and other Opuntia spp. are equally in evidence. We also come across two columnar plants of 8-10m in height. It could be a question of Gymnocereus sp. It is 22.30 hours in the evening when we arrive, exhausted, at Ayacucho, in a tremendous downpour.

Wednesday 22nd September: Leave at 0800 hours in the direction of Castrovirreyna. Huge grey clouds part and give way to a little bit of blue sky. After two hours on the road, we decide to make a halt, because we are in the same sort of landscape that we had already met with before Jauja and after Huancayo. We have high hopes of finding some plants. Hurrah! After several metres of climbing we see fine Oroyas in Flower. Two species exist side by side. One sort are O. neoperuviana Bkbg and the other sort O. gibbosa Ritt. They are accompanied by Austrocylindropuntia subulata (Werd & Bkbg) Bkbg, by Tephrocactus floccosus (SD) Bkbg and its variety Tephrocactus aurescens Rauh & Bkbg, and Tephrocactus atroviridis (Werd & Bkbg) Bkbg. We are at 3700m.

The road climbs up to a pass which we cross at 3900m. On the other side, we again find Oroya laxiareolata Rauh & Bkbg, as well as Erdisia sp., Lobivia sp., and Trichocereus peruvianus Br. & R. The road is in a better condition and allows us to move at 60 to 70 km/hr. After descending into a valley (3200m) we make a fresh ascent. At noon we eat at the "restaurant" El Yanyito (3860m). The carcase of a recently slaughtered animal is hung from the kitchen ceiling. It is a thermal bath where the people come from Ayacucho for recuperation. Shortly after leaving there, another puncture. Herds of llama browse the scanty covering of herbiage.

The snow makes it appearance and it is in the storm that we cross a pass at 4660m. Some dozens of km further on, there arose a limestone pinnacle. At 6km from Pilpichaca, another puncture. With two holed tyres, there is nothing else to do but wait for another vehicle to come along. It is 1500 hours, the wind is fierce (4100m), and the night is nigh. Suddenly, the outline of a lorry detaches itself from the horizon. Fortunately the driver has some gum. With the help of a screwdriver we peel a patch off one tyre to close the hole in the other. The compressed air is obtained from the lorry compressor. At 1800 hours we stop at restaurant El Nino. A surprise awaits us. Whilst an old soldier strives to repair our second tyre with remnants of an old tyre, the owner of the house offers us two fine trout. What a repast at 4100m altitude!

But there is a long way to go before we eventually reach Castrovirreyna at 2100 hours, after having surmounted a pass at 4620m in the night and in a snowstorm. There is a glimmer of candlelight as we go into the "hotel" room located in an outhouse. There is no water, no electricity, no heating. We are at 3900m. It is 4°C in the room.

Thursday 23rd September: It is the hens and cock in the adjoining room which wake us up. The temperature is -1°C in the room. Hanging over the door of the hotel entrance, some Matucana sp. catches our attention. It is to ward away evil spirits. Fortunately the sun is shining and the atmosphere quickly warms up again. Departure at 0700 hours. After a few km, Carlos gives a shout; red flowers on the rocks which overhang the road. We stop to check. At the risk of breaking a neck, we clamber up the rocks to find Matucana cereioides Rauh & Bkbg. From 3200m the road cuts a passage in a canyon. On the steep sides grow Neoraimondia roseiflora (Werd & Bkbg) Bkbg and Matucana cereioides Rauh & Bkbg. A good alpinist could get up to them. Around 2900m Carlos' attention is caught by a new patch of red. This time it is Loxanthocereus piscoensis Rauh & Bkbg. The landscape becomes more and more arid. Towards 2600m there appears the first Weberbauerocereus rauhii Bkbg and two majestic Armatocereus arboreus Rauh & Bkbg. The ground is covered with spines. The Matucana cereioides = Matucana haynei (O) Br. & R. in flower are scattered among the columnar cacti. Loxanthocereus piscoensis Rauh & Bkbg is also present.

The Pisco valley really is a paradise for cactophiles. Between 2500m and 1000m there succeeds one

another, besides the species just quoted, Loxanthocereus brevispinus Rauh & Bkbg, Haageocereus acranthus (Vpl) Bkbg, Neoraimondia roseiflora (Werd & Bkbg) Bkbg, Melocactus peruvianus Vpl, and Armatocereus procerus Rauh & Bkbg. At 1715 hours, we come to a halt at the restaurant Estancia, 115km before Pisco. After another three hours on the road, in the night, we finally reach Pisco.

. . . from H. Middleditch

In a separate communication, J-M Chalet says that after stopping on the road between Ayacucho and Castrovirreyna, Oroyas were found not far from Camasacha at an altitude of 3700m. The site at Yanachu roughly half way between Huancayo and Pampas lay at 4200m; that between Tarma and Jauja lay at 4050m; and at the site beyond the Conchas pass the Oroya were found at 3550m. This would suggest an altitude band of about 3500 to 4200m in which Oroyas are to be found. At this sort of altitude the thinness of the air and the absence of airborn dust allows more of the heat in the sun's rays to strike the ground so that the ground can warm up quite rapidly by day; conversely it will also cool rapidly after nightfall. A number of writers mention hail and sleet at this sort of altitude in the Andes, so Oroya may well have to put up with these conditions.

. . . from J-M Chalet

Yes indeed it does get quite warm during the daytime at these sort of altitudes and the temperature does indeed drop below freezing point at night time. During the winter time the rain, or sleet, or snow, is not scarce, even if it is not generous. Oroyas are almost always found growing on more or less gently sloping ground, not on level plains nor on steep rocky slopes. There are frequently stones of various sizes scattered over the ground, but not large boulders. The accompanying vegetation is made up of dwarf shrubs, herbs, and tufts of grass; often these grow up against an Oroya, but mostly there is as much bare ground amongst the plants as there is covered by the vegetation.

. . . from W.Rauh Beitrag zur Kenntnis der peruanischen Kakteenvegetation

The Puna is not only the characteristic but at the same time the most extensive and the predominating plant formation over broad stretches of the landscape of the high Andes. Its principal area of distribution is the high plateaus between the mountain ridges up to as far as 4300 or even 4600m. Here the maximum rainfall occurs in the period from December to March. It may be gathered from the figures for monthly rainfall that even the winter months of May to October, which are regarded as the dry season, are not entirely lacking in precipitation. Thus in the month of June 1954 on Nevado Salcantay we often experienced falls of snow between 1600 and 1800 hours, similarly at the end of July in the Cordillera Blanca.

Data is tabled for the relative humidity for 19th/20nd August 1954, also at the end of the coldest season of the year, taken on the Cordillera Negra at 4225m altitude at the high pass of Punta Caillan, the habitat location for Oroya borchersii and numerous Tephrocacti. [Relative humidity ranges from 40% at 11.00 a.m. to 100% during the night. Daytime temperature 38°C max, night time temperature -7°C min.] The change in relative humidity is proportionately similar to the changes in temperature. The dryness of the air by day is enhanced by the effect of the wind.

. . . from A. Weberbauer Die Pflanzenwelt der peruanischen Anden 1911

Around the south peruvian town of Urubamba (2987m, 13° 20'S) in the valley of the river of the same name, during a stay of 20 days in the month of June, I found the fields covered in hoar frost almost every morning. At that time the sky was clear and only on a few days when heavy clouds appeared did hoar frosts not occur. The boundary of frost falls to a lower altitude in south than in central Peru and this is attributable not only to the greater distance from the equator but also to the increased winter dryness, which favours night time radiation.

**OROYA — DISTRIBUTION.**

The distribution of the genus Oroya occupies two separate areas in Peru, one of relatively compact extent in the north where O.borchersii is to be found, and secondly a more extensive area of the high Andes which stretches from Oroya to Cuzco. No Oroya have been reported from the stretch of about one hundred miles which separates these two areas. The southern limit for Oroya lies not far from the line of 15°S latitude, which has already been shown (Chileans No.43) to be a boundary for a surprising range of Flora.

At the northern end of the accompanying map will be found Recuay and Huaras which lie within the distribution area for O.borchersii. Most of the place names mentioned in the foregoing articles, and below, may be located on the accompanying map. The following locations for Oroya have also been reported:—

| | | | |
|---|---|---|---|
| KK 370 | peruviana | Tarma | 3000m |
| KK 371 | peruviana v. | Oroya | 3000m |
| KK 372 | neoperuviana | Mantaro | 3000m |
| KK 373 | laxiareolata | Oroya | 3500m |
| KK 374 | laxiareolata v.pluricentralis | Huancayo | 3500m |
| KK 375 | neoperuviana v.depressa | Andahuaylas | 3500m |
| KK 376 | subocculta | Andahuaylas | 3500m |
| KK 379 | subocculta v.multicostata | Andahuaylas | 3500m |
| KK 380 | baumanii | Yauyos | 3800m |
| KK 380a | baumanii v.rubrispina | Yauyos | 4000m |
| KK 381 | gibbosa | Mantaro | 3000m |
| KK 382 | subocculta v.fusca | Andahuaylas | 3500m |
| KK 383 | neoperuviana | Huancavelica | 3800m |
| KK 384 | neoperuviana | Acobamba | 3800m |
| KK 385 | subgibbosa | Anta | 4200m |

| | | | |
|---|---|---|---|
| KK 386 | subgibbosa v.citriflora | Anta | 4200m |
| KK 387 | gigantea | Apurimac | 3800m |
| KK 388 | baumanii v.aureispina | Yauyos-Tomas | 3500m |
| KK 389 | neoperuviana | Pampas | 3500m |
| KK 390 | subocculta v. | Pampas | 3500m |
| KK 578 | acollana | Acolla | 3800m |
| KK 579 | accolana v.luteispina | Acolla | 4000m |
| KK 647 | subocculta | Abancay | 4000m |
| KK 735 | peruviana | Oroya | 4000m |
| KK 1463 | citriflora | Cocharcas | 3800m |
| Lau 130 | subocculta | Oroya | |
| Lau 131 | subocculta v.depressa | Andahuaylas | |
| Lau 201 | neoperuviana | Oroya-Tarma | 4000m |
| Lau 202 | laxiareolata | Oroya | |
| Lau 203 | peruviana v.conaikensis | Conaika | |
| Lau 277 | subocculta v.baumanii | Huancayo | |
| FR 143b | laxiareolata v.pluricentralis | above Pampas | |

**FRUIT of WEINGARTIA and SULCOREBUTIA** **By K.Augustin and G.Tyrasseck.**

Translated by H.Middleditch from K.u.a.S 38.3.1987

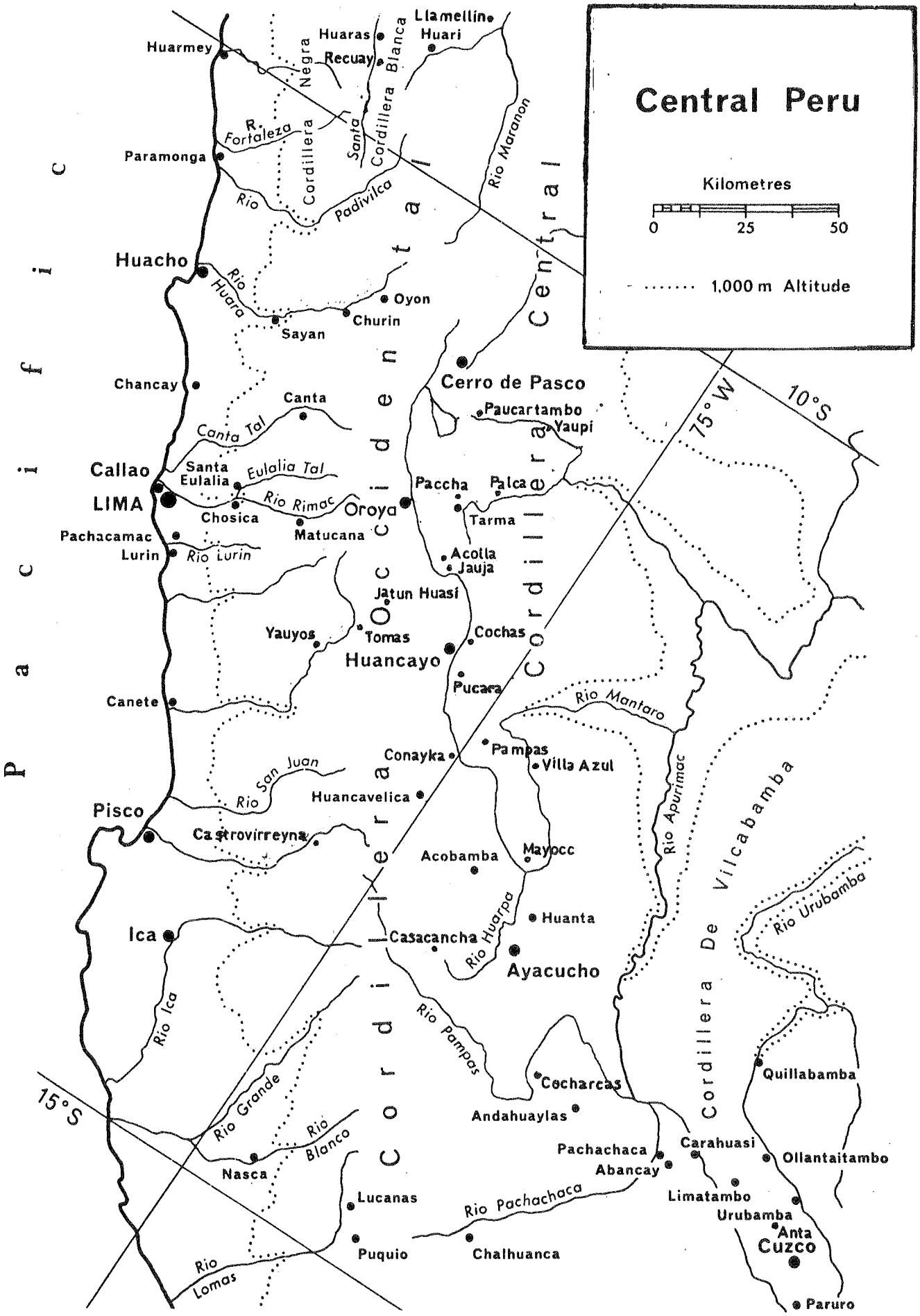
If the descriptions of the species of the genera Weingartia and Sulcorebutia are studied it is noticeable that most of them lack detail about the fruit or have only taken superficial note of them. The reason for that can perhaps only lie in that the authors attribute little significance to this organ or they simply had no data of that sort before them at the time they were undertaking the description. From 54 first descriptions within the genus Sulcorebutia, in 36 of them nothing is really mentioned about the fruit, twice "fruit unknown" is recorded and only 16 times is rudimentary information provided about the fruit. The situation is similar with Weingartia, so that we wondered whether the fruits of both genera often showed similar or the same characteristics, which in fact is not the case as we demonstrate below.

The most frequently used definition for the fruit of Sulcorebutia and Weingartia is probably that which speaks of a berry drying up as the degree of ripeness increases. Information about size, shape, colour, and mode of dehiscence is scarcely ever published. Since the fruit is such an important organ and has a quite specific function to fulfill in the life cycle of the plant, we will proceed with some general remarks about their origin, purpose, and behaviour. In the case of Angiosperms, to which the cacti belong, the fruit is formed from the ovary of the flower and it produces an appropriate number of seeds, enclosed within the fruit wall until they are ripe. As soon as a specific degree of ripening has taken place, the fruit opens up and the seeds are released. In addition there are fruits whose function is extended and contributes to the distribution of the seed.

The fruit are assessed according to their form e.g. berry or capsule, according to the method of dehiscence e.g. spreading or splitting fruit, or by other particular criteria. Frequently the criteria for assessment are not immediately or clearly evident, there are many transitions and mixed forms that make correlation difficult. Eventually however the most significant and predominant characters and criteria become evident. This is the case with the genera Sulcorebutia and Weingartia in that they display both the character of a capsule as well as of a berry, but since those of the berry predominate we are of the opinion that it can be correctly spoken of in this way.

We have over a period of time observed several hundred fruits and counted out the seeds. The outcome of our studies was unexpected and should significantly influence the continuing discussions over this genera — one genus or two? For the purpose of obtaining some valid cross-sectional evidence we have drawn upon 200 fruits from each genus for the work submitted here; in doing so the number arose intuitively and no selection was intended. With Sulcorebutia it was fruits of 82 species, varieties, or forms and with Weingartia 29 species, varieties, or forms. The table summarises the results. In addition there are still further differentiating features: thus we have been able to establish that Weingartia seed or more specifically the fruit wall (Pericarp) is always more or less tacky - which it has never been possible to observe in Sulcorebutia.

| | **Sulcorebutia** | **Weingartia** |
|---|---|---|
| Form | Depressed, broader than tall | Elongated raindrop shape |
| Size | Up to 7mm broad, up to 5mm high | Up to 10mm broad, up to 14mm tall |
| Colour | Greenish to reddish brown when ripe | Yellowish to greenish brown to dark brown when ripe |
| Fruit wall | Thin, parchment like | More hard shelled than Sulcorebutia |
| Dehiscence | Transverse split | Lengthwise split |
| Bristles/hairs behind scale axils | Yes | No |
| Highest seed count | 88 | 241 |
| Lowest seed count | 4 | 11 |
| Average seed count | 31 | 73 |


Central Peru
Kilometres
0
25
50
1,000 m Altitude
Pacific
Cordillera Occidental
Cordillera Central
Cordillera De Vilcabamba
Huarmey
Huaras
Recuay
Llamellin
Huari
Negra
Blanca
Santa
Paramonga
R. Fortaleza
Rio Padivilca
Rio Maranon
Huacho
Rio Huara
Oyon
Churin
Sayan
Chancay
Canta
Canta Tal
Callao
LIMA
Santa Eulalia
Eulalia Tal
Rio Rimac
Chosica
Matucana
Pachacamac
Lurin
Rio Lurin
Cerro de Pasco
Paucartambo
Yaupi
Paccha
Palca
Oroya
Tarma
Acolla
Jauja
Jatun Huasi
Yauyos
Tomas
Cochas
Huancayo
Pucara
Canete
Rio Mantaro
Conayka
Pampas
Villa Azul
Rio San Juan
Huancavelica
Pisco
Castrovirreyna
Acobamba
Mayocc
Rio Apurimac
Rio Urubamba
Huanta
Ica
Casacancha
Rio Huarpa
Ayacucho
Rio Ica
Rio Pampas
Cocharcas
Quillabamba
15°S
Rio Grande
Rio Blanco
Andahuaylas
Pachachaca
Carahuasi
Ollantaitambo
Abancay
Nasca
Limatambo
Lucanas
Rio Pachachaca
Urubamba
Anta
Cuzco
Puquio
Chalhuanca
Rio Lomas
Paruro
75°W
10°S

For completeness we took into account the mode of release of the fruit from the plant body (areole) as well as the distribution of the seed. With the genus Sulcorebutia, the fruit ripened completely, split open, but released itself from the areole only after a very long interval. According to our observations this first took place in the subsequent growing season. The distribution of the seeds also apparently resulted from the detachment of the whole berry but principally by means of weather influences such as wind and rain, or by animals such as birds and insects. This is likely to be the reason for their frequent clump forming occurrence.

With the genus Weingartia on the other hand the fruit generally ripens more rapidly (on average 4 to 8 weeks) and the detachment of the fruit is already effected in the course of the ripening process, in addition to drying out itself. Of course the Weingartia berry also splits when ripe, although the seed dispersion is hardly achieved by effects of weather but mainly by animals and then usually by removal of the complete fruit. So here the tacky seeds or the tacky fruit wall have an additional significance.

Finally we will still consider two points. Firstly, up to now much too little importance has generally been accorded to the fruit organ, which for us is just as essential as the great number of seed studies which have been pursued in recent years. One is jumping from the flower to the product, so to speak, without paying attention to the seed producing organ. This proceedure has however not been confined only to the genera considered here. Secondly we can certainly state that Sulcorebutia and Weingartia fruits display quite definate and even genetic supporting differences. So we also hope here that with future first descriptions the appropriate importance will be accorded to the fruit organ. As a suggestion for such applications the features in the appended table ought to be of use. For species already described, such data should be undertaken by competent experts who also have at their disposal authentic plant material. We ourselves will also strive in every instance to complement the appropriate first descriptions of Sulcorebutia and Weingartia with such data.

. . . from P.Allcock

I have a particular interest in collecting seed from plants which I have cross-pollinated by hand with a view to obtaining true seed. As a consequence I tend to take rather close notice of fruit characters because I want to avoid the seed being spilt by a fruit, because then it can be quite difficult to recover. One or two of the comments made about Weingartia fruit do not match my own experiences. What I describe as the northern group of Weingartia have fruit which are green one day and a few days later they are brown and dry. I can leave the fruit on any of the northern Weingartia for several weeks during which time they have every chance to split; but they do not do so. The dry fruits can be removed unbroken from the plant if done with care; they are pointed at the bottom and round at the top. At the time of writing I have 14 fruits of W.hediniana KK 1308 of which only two have a small split or damage at the side, the rest are unbroken; also 14 dry fruits of W.lanata, unbroken; and 19 of W.platygona also unbroken. As I demonstrated to H.Middleditch, any one of these fruit can be burst open by gentle pressure with the fingers and the seeds will immediately spill out. Neither the seed nor the fruit wall is tacky, as this article suggests.

The fruits on the southern Weingartia are different. For a start they are fairly close to the crown of the plant whereas on the northern Weingartia they are more around the shoulder of the plant. In addition the southern Weingartia have fruit which is somewhat larger in size and also almost spherical in shape. As they ripen these fruits go from green to yellow before becoming brown and dry. When the fruit has reached the yellow stage and the fruit wall is still turgid, it will split longitudinally as indicated in the K.u.a.S. article. But it does not release the seed out of the fruit. Then after a lengthy period the fruit will detach itself completely from the plant. At this stage the fruit is not completely dried out; it only dries out after it has been collected and stored. Even then the seeds do not fall out of the fruit readily; there are still traces of tacky material present in the fruit so the seed has to be persuaded to part from the broken fruit. In this respect the fruit is rather like Sulcorebutia, but the seeds will come out of Sulcorebutia fruit rather more easily. For practical purposes this happens in a similar manner with my W.neumanniana, W.kahgliana, and W.lecoriensis. Thus I would draw a clear distinction between the fruit characteristics of the northern and southern Weingartias and not just between the fruit of Sulcorebutia and Weingartia.

. . . from A.W.Craig

My Weingartia tend to set fruit regularly without any help from me. I was able to take a fruit off a W.pilcomayensis which had a dry, brown wall, without having to tug or twist at all. The fruit was turnip shape, complete and without any split or fracture in the wall. This is typical of the fruit on northern Weingartias. There was also a fruit on W.riograndense which was still green and this was removed with some difficulty by grasping the withered flower remains and twisting and pulling. The fruit was then burst by hand pressure and the seed inside was very nearly ripe. This would suggest that the seed is ripe before the fruit wall starts to dry up and turn brown.

. . . from J.D.Donald

I believe the paper by Augustin & Tyrasseck to be an important contribution to the study of the two genera, and does demonstrate some of the differences between them. It must be remembered, of course, that the study of the fruit is only one of the many aspects of comparative morphology that has to be considered, weighed, and analysed in the determination of the taxonomic distance between the reputed genera concerned. The ultimate importance of the study depends upon the weighting that the analyst gives to the whole or parts of the organ observed to provide his discriminating units.

In this study there are six units of which I find as significant: 1.form; 2.fruit wall; 3; presence or absence of trichomes in the scale axils; 4;dehiscence. The other two characteristics viz: size and colour, are too plastic for meaningful acceptance and too dependant upon culture. Seed count is certainly of some interest, particularly if it suggests a substantial difference in the number of ovules present in the ovary of a typical taxa within each separate genus. It seems to suggest here that there are double the number for Weingartia than for Sulcorebutia. There are some problems of course in the setting of the seed, that can affect the number produced in one capsule or berry. One of these is the vitality of the pollen and ovules; another factor is their compatability, often depending upon the genetic separation of the partners, which is not always certain in cultivation where strict clonal separation is not observed or not realised. Today's expertise in vegetative propogation of these plants and the rapid dissemination of the products frequently leads to loss of clonal identity. I am sure the authors were

well aware of this and they both possessed study collections of good provenance both in original collected material and in diversity.

The study could have been improved if Weingartia had been studied in two parts; the southern group based upon W.fidaiana the type species and the northern group based upon W.neocummingii (the lanata subgroup belongs to the neocummingii group on phylogeny). There are some interesting differences that might suggest that the northern group shows some affinity with Sulcorebutia, whereas the southern group is more isolated.

One character not included in the study which may be of some discriminatory significance is the ease of detachment of the fruit capsule. In Sulcorebutia the fruit rarely if ever detaches itself spontaneously during the first season of maturity. In Weingartia, the northern group always detach themselves (even if still buried in the areolar wool) upon maturity; the southern group also do so but are generally delayed. Another feature of the northern group is the production of several fruits in one areole, rarely seen in the southern group if at all, and I only know of one report in Sulcorebutia for such a phenomenon. The dehiscence occurs transverse laterally on the still attached fruits upon Sulcorebutia, but only on detached fruits vertically with Weingartia (northern group); I have observed the southern group showing either transverse or vertical dehiscence of the mature fruit.

The mention of tacky fruits is very interesting but I do not find this consistent. I have observed tackiness in immature fruits of Sulcorebutia and even a reluctance for seed spill from mature fruits, rather like certain species of Lobivia, to which Sulcorebutia is related more so than to Rebutia!

I endorse the authors' plea that all new taxonomic descriptions must contain adequate descriptions of the fruit. It is a nonsense to describe a plant without knowing its totality of expression.

This paper is certainlv of great taxonomic value and does allow some distinction to be made between the two supposed genera, but it is not wholly useful in isolation. A study to support it must be made similarly with all the sections of Rebutia, Lobivia and Echinopsis. Strict comparison between Sulcorebutia and Lobivia and Rebutia sensu lat. and Weingartia is of immediate importance in view of the recent implications of the I.o.S. Consensus of Acceptable genera in the Cactaceae, with its dubious conclusions regarding the fate of the genera Sulcorebutia and Weingartia.

. . . from P.Allcock

Yes indeed it is only in the northern Weingartias (not in Sulcorebutia or the southern Weingartia) where it is possible to have not only two flowers, but two fruits at one areole. I have seen this in my own collection during 1987.

. . . from H.Middleditch

I seem to recollect a comment from G.Rowley to the effect that there is no need to include in a first description those details which are common to the genera, since it is merely repetitious. Thus if the fruits in one genera are identical, you do not inciude the fruit details in the species description.

. . . from G. Rowley

There are no rules that I know of for what you do or do not include in first descriptions of new taxa. It is really just common practice and common sense to say that there is no point in repeating characters common to all species of a genus. For instance it would be wasteful of precious latin to start describing a new cactus as "Perennial, with spines associated in areoles...." when they all are. Similarly, if it were assumed that all new Sulcorebutias and Weingartias had similar non-juicy berry fruits then that fact would not be worth mentioning — it only becomes so when fruits are found to be useful criteria for distinguishing species. Pre-1900 descriptions of mesembs merely said "fruit a capsule" if they mentioned it at all.

I was interested to read the Augustin & Tyrasseck article, which suggests that the two genera are not so closely related as has been put forward elsewhere. It makes one wonder about the various borderline species that have been shuttled from one genus to the other; on their criteria a study of the fruit could settle the issue. I look forward to further offerings from them!

**ACROSS THE PAMPAS By F.B.Head 1828**

The great plain, or Pampas, on the east of the Cordillera, is about 900 miles in breadth. The part which I visited is divided into regions of different climate and produce. On leaving Buenos Aires, the first of these regions is covered for 180 miles with clover and thistles. The second region, which extends for 150 miles, produces long grass. And the third region, which reaches the base of the cordillera, is a grove of low trees and shrubs. The second and third of these regions have nearly the same appearance throughout the year, for the trees and shrubs are evergreen and the immense plain of grass only changes its colour from green to brown. The region of wood is extraordinary, for the trees are not crowded, but in their growth such beautiful order is observed that one may gallop between them in every direction.

The climate of the Pampa is subject to great differences of temperature in winter and summer, though the gradual changes are very regular. The winter is about as cold as our [U.K.-H.M.] month of November. The ground at sunrise is then always covered with white frost but the ice is seldom more than one tenth of an inch thick. In summer the sun is oppressively hot. The difference between the atmosphere of Mendoza, San Luis, and Buenos Aires, which are nearly all under the same latitude, is very extraordinary. In the regions of wood and grass, the air is extremely dry: there is no dew at night, but in the region of thistles and clover, vegetation clearly announces the humidity of the climate. In sleeping out at night I have found my poncho nearly wet through with dew, and my boots so damp that I could scarcely draw them on. The only irregularity in the climate is the pampero or southwest wind which, generated by the cold air of the Andes, rushes over these vast plains with a velocity and violence. The south part of the Pampas is inhabited by the Pampas indians, who have no fixed abode but wander from place to place, as the herbage around them is consumed by their cattle.

We departed from Santiago at midnight on December 31st...got to Uspallata late in the evening...being anxious to get on to Mendoza, three of us rode all night....rested at Villa Vicenzio, and got fresh horses.....we galloped across the plain....got to Mendoza and went to bed. In the evening some of the miners strolled about with their guns and procured us a supper of roasted parrots. We found these birds there in great numbers. The plumage of their breasts is always of the most gaudy and brilliant description but their backs are invariably the colour of the country they inhabit. In the region of wood, the

bark of which is generally green, and bright yellow, they are of those hues; in the plains of grass, their backs are of brown and green.

I overtook the coach just as it had reached the banks of the R.Desaguadero, which was unusually deep and rapid. The stage to San Luis is really one of the most singular examples of South American travelling which I have witnessed. The country was all hot sand, covered with trees and brushwood. The trees were principally the Algarrobo; they were about the size and shape of apple trees and were sufficiently high to hide the horses.

**TRAVELS IN CHILE AND LA PLATA By J.Miers 1826**

[The coach journey commenced at Buenos Aires]. We left San Luis and soon entered a woody district which presents many novelties to the botanist. The road to Repressa lies through beautifully wooded country. On several occasions the bed of the fore-axle of our coach struck forcibly against some stumps of trees which had been carelessly felled in making the road. At the post house of Repressa a fresh water lake has been made by an embankment. This pond has recently been filled from an annual swelling of the great Bebedero lake, which lies a little to the southwards, wherein the rivers of San Juan and Mendoza empty themselves. Owing to the unusual quantity of snow which fell last winter in the Cordilleras, they swelled to an unusual degree. The Bebedero has recently been increased by the addition of the waters of the R.Tunuyan, which this year changed its course, having in former seasons flowed into the R.Diamante. The rivers which flow from the Cordillera proceed only from the melting of the winter's snow and bring down with them an amazing quantity of fine alluvial sand. In their passage through the mountains and for some distance after leaving them, the descent is so rapid that the great quantity of matter held in suspension cannot subside. This immense bulk of alluvial matter must deposit itself in the long and almost imperceptible descent of the country to the southward.

For the first league from Repressa we rode through the same beautiful wooded country seen about San Luis. At about three leagues from Repressa we ascended the gentle rise of a long sandy ridge, the Alto de Yeso, which terminates at the angle where the Desaguadero empties into the Bebedero lake. The summit of the ridge is covered with trees of Chanar, of different Algarrobo and of Mimosa; bushes of retamo, atamisque, jarilla, xume, vidriera, etc., and with numerous novel plants. At intervals the shrubbery is intersected with extensive patches of scanty pasturage. No water is met with all the way. After descending the opposite side of the ridge, we reached the level sandy travesia, covered with thorny trees. At half past two we reached the banks of the Desaguadero. The river was considerably lower than the surface of the country. At the fording place the banks were cut in a slanting direction so as to admit of the passage of carts and coaches. When I passed this place in January 1825 the river was unfordable; the current very slow, the water muddy, fresh tasted, and at least fifteen feet deep. The stream is of this depth for three months in the year.

After crossing the river we travelled over the travesia, with not the least trace of vegetation excepting the few thorny bushes and saline plants which grow over the desert. The travesia extends all the way to Mendoza and beyond it to the foot of the Cordillera. The thorny trees are a little more numerous to the westward; the sandy plain, wholly devoid of pasture, is thickly covered with low bushes of various lyciums, verbenas, and saline plants, xume, and vidriera. Barilla plants were in great abundance. Two leagues beyond Tortugas we met a company of Mendoza carts, eighteen in number, laden with wine and figs, bound for Buenos Aires. At the posthouse of Coral de Cuero the temperature at noon was 56°F. We travelled along the banks of the R.Tunuyan all the way to Retamos, the roads passing through a grassy district every now and then. The river banks are nearly perpendicular to a depth of twenty to thirty feet, the whole soil being loose and sandy. At half past two the thermometer rose to 70°F; the day continued cloudy. During the day I observed numerous flights of small green parrots, very common over this immense travesia. On the stage between Dormidas and La Catitas our road continued over the same kind of travesia. Thorny trees of Chanar and Algarrobo abounded. The xume, vidriera and retamo, which in most parts of the desert are mere bushes, here attain the height of trees and acquire a central thickly wooded stem.

From the stage from Las Catitas to Rodeo de Chacon, the desert continues to be covered, only more thickly than usual, with the same kind of wood-trees. At half past two the thermometer was 92°F. At a distance of fifteen miles from Rodeo de Chacon, for a short space, the soil possessed a quantity of granite grains, mixed with the sand. We met a troop of Mendoza mules consisting of 48 loads of wine, destined for Buenos Aires. About a league before we reached the posthouse at Retamo, we were gratified with the sight of rich verdure and enclosed grounds of pasturage; this was owing to irrigation. For the first six miles from Retamo the country on both sides of the road was brought into cultivation. Soon after crossing the river of Mendoza we continued to cross the desert with not a single blade of grass, nothing but thorny trees and bushes. Before we arrived at the post house of Rodeo del Enmedio we again passed by cultivated grounds. We left Rodeo del Enmedio and soon again entered the travesia. Cultivated enclosures occurred at intervals in the barren travesia. At length we entered the town of Mendoza and stopped at the door of the inn a few minutes before six o'clock in the evening of April 25th, 1819.

. . . from H.Middleditch

The capital city of Argentina, Buenos Aires, lies on the Atlantic coast backed by a huge expanse of plain, or pampas, which was originally covered by grass. "...the country was smooth, covered with fine short grass, and had the appearance of an interminable bowling green" — Miers, 1826. Here the east winds drop a great deal of their moisture and so the rainfall gradually decreases as one travels inland from Buenos Aires, whether to the south, southwest, west, or northwest. Gradually the grass becomes less green, then it changes from a cover to a partial cover and eventually the bushes appear. Thus before reaching Rio Quarto "we were surprised by what must appear a merest trifle — a bush, about four feet high. This was the first shrub growing wild which we had seen since leaving Buenos Aires" — Miers 1826. With further distance the bushes increase until they become predominant and the grass eventually becomes insignificant, all sprinkled over bare ground. Finally even the bushes are confined to the better patches of ground or very scattered over otherwise bare ground, with vegetationless terrain predominant. The desert has arrived.

. . . from J.Lambert

Parrots are indeed quite common in western Argentina. They belong to a medium sized species (small as compared with macaws), of a greenish colour and are called loros, hence "Barranca de los Loros". I did not get the

impression that they were especially numerous around Mendoza; they are to be found nearly everywhere, as long as there are some bushes where they can shelter.

**PROVINCE OF THE MONTE** **By L.Haumann**

Translated by H.Middleditch from Geografia Republica Argentina 1947 (8)

What are the constant ecological characteristics of this quite extensive territory? Firstly the scarcity of rain which in some truly desert areas in San Juan, La Rioja, and Catamarca does not exceed 100m per annum. The number of occasions on which rain falls are few. The second characteristic is a moderately hot climate. The winters are mild, their average minima are between 0° and 5°, with average maxima of 13° to 21°. Snow falls only in the south and southeastern limits of the province, but small in amount and short in duration. On the other hand summers are fairly intense with average maxima, from south to north, getting up to 25° to 34° and average minima from 12° to 19°.

The surface of this immense territory exhibits great diversity. In some very extensive parts it is mountainous with an abundance of surface rocks and stones; in the great central plain relatively coarse particles almost always predominate on the surface which accentuates the effects of the dryness. On the other hand sandy ground occurs in many places, often forming dunes.

In such ecological conditions we encounter only an intensely xerophytic vegetation and among spp of the formation may be found examples of extreme xeromorphism: reduction of the transpiration surfaces (leaves small, rolled up, or absent; numerous bushes and shrubs are leafless); development sometimes enormous, of the cuticle of the leaves (which turn rigid) and of the branches, with the consequence that the stomata lie at the base of more or less deep cavities; epidermis covered with hairs, with wax, or with resin; accumulation of water reserves (frequency of succulent plants); a notable abundance of spiny plants; and finally scarcity of annuals.

As a result of this the typical aspect of the Monte is a thicket, more or less dense, of bushes and shrubs with diminuitive leaves or without them, more or less spiny, without or mixed with trees of low height and of the same ecological type. Herbaceous species are equally xeromorphic, forming individual tussocks, between which is bare ground, in consequence of the scarcity of water which does not admit of great vegetational development.

The Cactaceae are represented by numerous spp, different from one district to another, forming another important feature of the Monte, surely the formation richest in this odd vegetation. The genera Cereus and Opuntia are very well represented (except in the extreme south and at high altitudes) by species often large, even aborescent, whilst those of Echinocactus and Echinopsis, with low, rounded stems, are frequent principally in the mountainous parts.

The southern part of the Monte covers the immense plain which stretches from the foot of the cordilleras, the province of Mendoza, the south of San Luis, east of Neuquen, west and south of La Pampa province, the province of Buenos Aires to the south of the R.Colorado, the N.E. part of Rio Negro province and the N.E. corner of Chubut. The climate is generally drier but above all decidedly colder; annual average between 16° and 13°, winter average between 9° and 7°, winter average minimum between 3° and 1°, which implies a number of days of frost. On this account the flora becomes modified. Among the patagonian and subandine elements may be mentioned Chuquiraga erinacea, the cats-claw, a social composite subshrub, forming bristly shrubs with pointed cylindrical leaves, covered in summer with golden flowers.

The transition from Monte to the patagonian steppe takes place gradually and a fairly broad transition zone exists in which a mixture of elements from both formations are encountered.

**SOME RESULTS of an ARGENTINIAN EXPEDITION to the RIO NEGRO** **By G.Niederlein**

Translated by H.Middleditch from Zeitschrift der Gesellschaft fur Erdkunde zu Berlin XVI 1881

A brief description is given here of the desert which in one direction lies between 34° and 38° latitude and in the other direction extends from a transition to the Pampas in the east and as far to the west as the Sierra Nevados, Sierra Payen, and Sierra Chachahue, in a continental climate with poor rainfall. It should be regarded as a shallow basin which contains accumulated fine grit and loose sand with a mixture of salts, brought down from the Andean cordillera and other mountain systems above. The sand is either raised into compact, elongated lines of dunes (Medanos) or disposed in corrugated plains, in which case it is not at the whim of the wind. In the western half of this area of sedimentation, in the direction of the above-mentioned mountains which constitute one of the largest zone of volcanoes on our planet, basalt hills and granite occur in several places.

The Rio Salado is the only river which penetrates deeply into the rugged desert-like terrain in great volume. Partly it runs between steep porous banks and in these places, as is reported in its lower course, at a breadth of about 25m by 1m deep; or it runs, as was observed further upstream, as a broad and shallow current. This latter comes out from among an extensive formation of lagoons and marshes in the rainy season, whilst in the rainless season it diminishes into some tiny, extremely salty streams, which do not get as far as the extensive and partially marshy Urre lauquen (Bitter Lake). Recently however an outflow to the Rio Colorado has been reported at a time of high water. It receives its water from far to the north via the salt river Desaguadero and the Lagoon Bebedero, also from the west out of the Andes via the R. Tunuyan and the rivers Diamante and Atuel, which likewise flow across the Travesia de Tunuyan, which is partially considered to be an extension of the central sand region. All other mountain streams and subterranean watercourses peter out.

It is worthy of mention that travel through this desert is fatiguing and not infrequently the rider's mounts are up to the fetlocks in loose sand. Then one observes great stretches of sterile terrain with sparse growth of scattered sand dune grasses, compositae, euphorbiaceae, asclepidacae, malvaceae, solanaceae and onagrariae bushes. There are also woodlands of Algarrobo and Caldene standing above the thorny mimosas, Chanar, and other thornbush thickets, with Jarilla, the Quebracho flojo, the Piquillin, and Molle. These usually extend for only a few leagues upon often rough and frequently salt rich ground, now dense, now open, but equally displaying a severely desolate character with the positive impression of inhospitality. As a rule these patches are separated by long miles of barren terrain. Only a few hollows and isolated parts of these woodlands are covered with moderately good growth of grass. Finally in the whole territory only armadillos, partridges,

and ostriches are the representatives, not rare, of the higher animals. Thus the picture of the Argentine desert. Displaced from here are the now exterminated natives. No longer do they hunt the ostriches with their bolas, collect the fruit from the Chanar and Algarrobal, tend their small herds on the scanty grass, or ride daringly across this great territory.

. . . from H.Middleditch

Within the extensive area occupied by the desert there are places with a totally different character.

. . . from "In the wilds of south america" by L.E.Miller 1921

Leaving San Juan we reached a station at Media Agua two hours later. We loaded the wagon and and started on the long drive across the cold, barren country. The wagon jolted along over the rocks or dragged through deep sand. The cold was intense; we wrapped up in heavy indian blankets which, however, did not give us complete protection from the stinging blasts. We spent the night at a lonely hut...early next morning we were off again. We now passed through large irrigated fields where wheat was grown, and alsc a good deal of maize. Then the desert began again and from appearances there was not a drop of water for miles. Suddenly we saw a shimmer of placid water ahead.

All the surrounding country is windswept desert, there being no trees but a few thorny bushes. In spots the sand and alkali dust is several feet deep. There lay the glistening sheet of water, as far as the eye could see. Along the edge were vast, shallow marshes covering hundreds of acres. Half a mile from the bank stood great clumps of totora reed rearing their tough, slender stems to a height of seven or eight feet above the water. The whole surface of the lake, from its marshy edge to the rows of totoras fading away into the distance, was teeming with water birds. The natives use reed rafts. They cut quantities of totora, binding them into long, thin bundles and lashing several of them together form a craft that will support a man.

Next morning a furious wind was blowing. The air was so filled with dust that one could not see anything more than a few yards away and huge waves rolled in from the lake and tore hungrily at the banks. These storms are very common during the winter months and blow up several times a week. The third day of a our visit was beautiful. We pushed the boat out of the tangle of sedges. The tall, graceful stems of the reeds swayed gently with the swell made by the passing boat. Presently we emerged into the open lake. We continued paddling through the open water to a large mudflat in search of the flamingoes. The water became so shallow that the boat could not proceed, so there was nothing to do but wade, not an altogether pleasant experience, as it was bitter cold and sheets of thin ice floated about everywhere. When we moved, the flamingoes stood stock still and looked at us. When we stood motionless, they lowered their heads, dabbled in the mud, and walked about.

. . . from F.A.Roig, Vegetation of Mendoza province, Bol. Soc. Arg. Bot. Vol 13 (Supp) 1972

Marshes and Lakes

The rivers of Mendoza have given rise to extensive marshes and lakes in the course of their wanderings. The city of Mendoza was founded on the edge of these marshes, which extended 100km northwards. The complex included the lateral marshes of the Leyes and the Tulumanga. Nowadays the waterlogged areas in the vicinity of Mendoza have been reclaimed and are almost entirely under cultivation. The river waters are directed into hundreds of irrigation canals which use the greater part of its volume so that little is left to join up with the R. San Juan. This entire river system discharged its waters into the Desaguadero and maintained a good permanent flow in that river. Today, as we know, the Desaguadero is dry and carries a miserable amount of water.

. . . from H.Middleditch

At various places in the desert smaller or larger patches of monte, or open woodland, occur.

. . . from F.Kurtz, Viajes Botanicos al Rio Salado superior. Boletin de la Academia Nacional de Ciencias Exactas Cordoba, XIII 1893

The Medanos

[Sand dunes] When the medanos exhibit the character of the travesia, as for example between Medanos Colorado and Chichaca Grande, entirely lacking in trees, occasionally a poor small Chanar is to be seen, the only woody plant of some frequency being one sort of Solupe (Ephedra ochreata) which forms circular groups. Otherwise the vegetation is made up of some grasses, some composites and verbenas. However, the medanos generally carry groups or isolated patches of monte which may be seen on the plain and which in the vicinity of the rivers sometimes looks more or less like extensive woodlands. The elements of these isolated patches of monte are the same over the whole of the region, viz: Atamisque emarginata, Tricomaria usillo, Larrea divaricata, L.cuneata, Bulnesia retamo, Codolia lineata, Schinus dependens, Gourliea decorticans, etc. Only three of these are to be found in the form of trees — Chanar, Calden, and Retamo.

. . . from F.A. Roig. Vegetation of Mendoza province, Bol. Soc. Arg. Bot. Vol.13 (Supp) 1972

The Algarrobal formation

This occupies the greater part of the province from app. 580m above sea level down as far as the R. Desaguadero. We have studied it in detail at Nacunan where the provincial forest and parks commission has established a forestry reserve. It consists of an arboreal strata of Prosopsis flexuosa, usually as isolated individuals, 10-20m from each other; a bushy strata basically of Larrea divaricata and Atriplex emarginata, Lycium chilense, etc.; and a herbaceous strata, fundamentally of tall grasses. The grassy strata developes best in the open spaces between the trees. Underneath the trees the pasture almost disappears, where there are some broad leaved herbs such as Solanum atriplicifolium, etc. At places with silt in the surface but not excessively claylike ground, with sand below, is to be found the Chanar, Geoffroea decorticans. At the north-east corner of the province there are numerous scattered elements of the chaco vegetation.

. . . from H.Middleditch

Some of the tallest trees to be found at occasional spots in the desert are evidently the Chanar, Geoffroea decorticans. According to Morello, Phytogeography of the Monte, 1958, the southern limit of the Chanar lies at 38° 20'S in Neuquen province and at 41°S nearer the lower reaches of the R. Negro; i.e. a limit roughly half way between the courses of the R.Negro and R.Colorado.

. . . from J.Frenguelli, Phytogeography of Argentina, 1980

The zone between the R.Negro and R.Colorado is where the patagonian bush steppe gradually passes into the Caldene Monte. The bushes become taller and denser, between which appear scattered little groups of Chanar, steadily broader and taller, and finally bushes, trees, and small trees of Caldene, in progressive numbers until they form the predominant element. Along the track from Choele-Choele to Pichi-Mahuida, among the typical bushy patagonian steppe and jarillas, first appears the Chanar and then the Caldene, more or less at the altitude of station Zorilla.

. . . from H.Middleditch

The trees become taller as one travels from the R.Negro to the R.Colorado as a result of moving into an area of moderate east winds and away from the dominance of the very strong winds that sweep over Patagonia.

. . . from N.E.West, Temperate Deserts and Semi-deserts.

All of Patagonia falls within the realm of strong prevailing west winds which blow throughout the year and present the most obvious feature of the Patagonian climate. These west winds are very moist over the Pacific but lose their moisture over the Andes. As a result, precipitation decreases very rapidly to the east of the Andes. The dryness of the Patagonian semi-desert is caused not so much by high temperatures during the summer as by the strong wind, which causes high evaporation rates.

. . . from H.Middleditch

Patagonia consists essentially of an elevated plateau, sloping gradually from the foot of the Andes to the Atlantic coast, still at a height of two or three hundred feet as it approaches the edge of the ocean. The few rivers which traverse the plateau from Andes to ocean run in fairly deep and steep sided valleys but the plateau is dissected by many other similar valleys, called canadons or canadas, mostly waterless. Here and there depressions, large or small, shallow or deeper, are also a feature of the landscape. But once on the plateau, the impression is of a continuous plain. Each level crown is called a meseta. The valley sides are steep and the edge of the meseta is often a harder rock which forms a vertical wall at the rim of the valley.

. . . from J.Beerbohm, Wanderings in Patagonia 1881

We struck off at a gallop, but had not gone far before the plain over which we were riding suddenly terminated, descending into a steep ravine. The descent was rather steep, then we had a hard climb up the opposite side, rendered still more arduous by the loose nature of the pebbly soil. On reaching the top, we found ourselves on another plain, intersected a little further on by another ravine similar to the one we had just crossed. So we continued, now scrambling up and down the canyons, now trotting over short plains.

. . . from C.Skottsberg, The Wilds of Patagonia 1911

From the Mayo valley we climbed to the meseta Chalia, a plateau extending in front of us as level as a floor. For the most part there was no vegetation, only meagre heath. Suddenly we found ourselves on the edge of a ravine, so steep that we had not observed it till we were close on it. Every small brook, fed by the snowdrifts, has cut a deep canyon in the sides, which are clad with thickets of nire, dense as a hawthorn hedge. But we must go down it. The next morning we first worked our way out of the canyon and finally stood on the plateau again.

. . . from H.Middleditch

The steep sided canyons obviously offer welcome shelter from the fierce winds that sweep the plateau so that the sides are often sprinkled with a growth of bushes that attain a goodly height compared with the vegetation on the mesetas.

. . . from J.Frenguelli, Phytogeography of Argentina 1980. Translated by H.Middleditch from Revista del Museo de la Plata, New Series, Vol.3. Botanica. No.13 1940.

The bushy steppes occupy the most arid regions of the Argentine territory. They may be divided into two major associations: the Patagonian steppe and the Puna steppe, both with sparse bushes, intermingled with herbaceous spp. — usually sparse, lacking trees. The vegetative cover is interrupted by numerous bare spaces, small to large, often extensive, grading into subdesert or even to desert areas. Between the vegetation the soil in all parts appears rocky or debris covered, sandy, gritty, or stony.

The Patagonian formation is a mixture of herbaceous plants, of bushes and of trees, but in which the woody vegetation is composed of thickets of the height of a man or of a carraige, almost all of them spiny and twisting, and characterised by the restricted development of the leaves, which occasionally are entirely absent. Hauman, like Holmberg, accords to the Patagonian steppe the vast territory occupied by a semidesert whose vegetation is reduced to some subshrubs with coriaceous and diminuitive leaves, to a few xerophyllous grasses and to a series of plants hugging the ground and rising up only as few mm, one sort herbaceous, the majority woody, being dwarf bushes with tiny leaves, forming dense cushions or carpets. All further subdivisions possess local value and can depend solely on the morphology of the terrain and the composition of the soil — that is, features which change from place to place but which keep repeating over the whole of Patagonia. Thus for example the five types of Kuhn and Hauman, which are: the barrancas, the mesetas, the meadows and valleys, the banks of rivers and lagoons, and the halophytic flora.

The essential characters of the meseta vegetation were synthesised by Hauman: "on top of the meseta, almost perfectly horizontal, with stony soil and swept by continuous winds often of extraordinary violence, rarely showered by rains, only able to develope an exceedingly dwarf vegetation not only xerophyllous but in addition most commonly hugging close to the ground or on the other hand with extremely reduced or very coriaceous leaves". Without doubt the small cushions predominate.

The vegetation of the valleys generally consists of taller and often denser bushes. In the more stony spots, occasionally almost pure associations of tall clumps of Nassauvia glomerulosa. In the more sheltered depressions, the bushy steppe now and again alternates with limited steppes of grasses, especially of Coirones (Stipa) in conical clumps of slender leaves, stiff and pointed.

Mention must be made of the mallines, distributed throughout most of Patagonia and really very characteristic of the region. They form flat bottoms and marshes in large or small depressions in the basins and vallies where the nature of

the soil and the presence of groundwater allow of an abundant herbaceous vegetation with a predominance of small reeds, mixed with Ciperaceae, Dicotyledons and various grasses.

. . . from H.Middleditch

The elevated Patagonian plateau together with its characteristic vegetation extends northwards as far as the rivers Negro and Colorado. Here the mesetas give way to extensive plains and isolated mountainous hills. Just as the trees get taller and broader in a day's ride from the Negro to the Colorado, so do the mesetas diminish in stature and extent. The boundary between the fierce patagonian westerly winds and the moderate easterlies happens to coincide with the northern limit of the Patagonian plateau. Separating the Patagonian plateau from the fertile pampa plain lies the arid desert-like zone, which sweeps right up to the foot of the Andes in the provinces of Mendoza and San Juan. Once the traveller leaves the arid plain of Mendoza and enters the mountains then a change takes place in the face of the landscape. The hilly and mountainous areas generally rise pretty abruptly from the desert plain; so much so, that valleys are usually the only practical method for ascent.

. . . from J.Miers, Travels in La Plata and Chile 1826

One of the most singular peculiarities of the Mendoza district is the extreme dryness of the atmosphere, there being no perceptible dew at night. On leaving Mendoza, the route leaves the suburbs and cultivated grounds over the same description of travesia which lies between Mendoza and the Desaguadero, already described. At a distance of five leagues the road divides, at a low range of mountains which juts out into the plain. It is a limestone formation and hence is called Calera. Two leagues further along the road to Villa Vicenzio we approached a detached low series of hills called Los Cerrilos. The road thus far is sandy, but about a league before the Cerrilos it begins to be stony and continues more or less so till we reach the Cordillera. The currents of water flowing from the extensive ravines of Villa Vicenzio, of the Higuera, and of Canota, have spread over its whole surface immense quantities of the sharp angular fragments of stone that accompany the alluvial matter brought down from the hills by the torrents during the rainy season.

At a small spring of water, called El Coral Viejo, we now enter a ravine. The hills on either side are at first of inconsiderable height, but as we advance, the valley becomes narrow and more stony; its bed is covered with bushes of jarilla, retamo, verbena, etc. Higher up this narrow ravine, the mountain ranges are of considerable height; at a distance of fifteen leagues from Mendoza, we reach the post house of Villa Vicenzio. The hills here are of hornblende slate. Following the course of this branch of the ravine we find, at a distance of a mile and a half, the hot springs of Villa Vicenzio. The intermediate ravine is narrow and enclosed on each side by very lofty hills; its tortuous bed is filled by a kind of tufa, an alluvial deposit of sandy marl. In the month of October, when the thermometer in the shade stood at 66°F, the water temperature of the hottest spring was 96°F. Snow generally falls here during the winter months.

From Villa Vicenzio the road continues to wind along the narrow bed of the valley, which is covered with bushes of jarilla, retamo, verbenas, algarrobas, lyciums, etc. and is bounded by lofty impending rocks, partly bare, but mostly covered with soil thinly scattered over with bushes, cacti, and many plants deserving of notice. One spot on the road is remarkable for the abundant growth, on the hills as well as in the valley, of a dipsacus, which resembles our common teazel; the spot in consequence is called the cardonal by the muleteers. Here, as well as at many intervals of a mile or two, are found on the sides of the hills a little pool of water, supplied from a diminuitive but never failing spring. The hills are pretty well covered with pasture, which in these mountains must not be supposed to mean those beautiful grassy swards with which our hills at home are covered, but to signify plants of many kinds. In many places among the hills we perceive many herds of cattle. The mountains are so steep and lofty that the sun which rises in the plains at five o'clock does not shine in the valleys till nearly eight in the morning.

. . . we begin to ascend the long narrow mountain ridge lying between the plain of Uspallata and Mendoza. The path up the ascent is gradual and winding. The breadth of the summit is several leagues in extent and is broken into numerous undulating rises and descents. I have crossed this ridge four times and on every occasion I have met with squall weather. Hardly a day passes without rain, though it be but a few drops, and wind is never wanting on this inhospitable spot.

. . . from H.Middleditch

From San Luis to Mendoza the route followed by Miers first crosses a low ridge and then traverses an arid plain, in which no hilly or mountainous area occurs. To the north of this arid plain there lies a series of mountainous ridges, outlyers from the main mass of the Andes, all of which are bounded or surrounded by the northward extension of the Mendoza desert.

When he leaves the sandy desert of Mendoza and starts to ascend, Miers mentions that the foot of the Sierra is covered with stones brought down when the streams are in spate. The action of the torrents in transporting this material was noted by Charles Darwin; he also noted the results, but apparently did not specifically connect the two observations.

. . . from Charles Darwin, Journal of Researches

[Whilst crossing the Andes from Santiago to Mendoza]. The rivers which flow in these valleys ought rather to be called mountain torrents. Their inclination is very great, and their water the colour of mud. The roar which the Maypu made, as it rushed over the great rounded fragments, was like that of the sea. Amidst the din of rushing waters, the noise from the stones, as they rattled over one another, was most distinctly audible even from a distance. This rattling noise, day and night, may be heard along the whole course of the torrent. The sound spoke eloquently to the geologist; the thousands and thousands of stones, which, striking against each other, made the one dull uniform sound, were all hurrying in one direction.

The features in the scenery of the Andes which struck me most were ..... and lastly the smooth conical piles of fine and bright coloured detritus which sloped up at a high angle from the base of the mountains, sometimes to a height of more than 2000 feet.

. . . from H.Middleditch

The conical piles of detritus are alluvial cones, which are a major feature of the landscape to the north of the Mendoza desert, and an important habitat for many cacti

. . . from J.Frenguelli, Phytogeography of Argentina

**The Bolsons**

This is a region extending from the central and northern Sierras to the foot of the Cordillera, running north between the high mountains as far as the Puna, blending gradually with Patagonia to the south, It is an extensive area of arid plains consisting of the greater parts of the provinces of Mendoza, San Juan, La Rioja, and Catamarca as well as adjacent parts of San Luis and La Pampa, covered almost exclusively with Jarillas, Algarrobos, Chanaras, Breas, Quebracho blanco, thin and twisting, among numerous cacti, with extensive tracts of bare ground, among spiny bushes and "thickets-.....pretentiously called forests" (Burmeister).

The basins or valleys are more or less surrounded by elevated mountain blocks, whose slopes rise round about them usually in the form of cliffs. The depressions and blocks represent fragments of an ancient peneplain riven into pieces by huge faults and uplifts of tremendous proportions. The raised parts form the spine of the mountains, on whose high crown we see the evolvment of the Puna steppe. The profoundly subsided parts whose original surface has disappeared under a thick cover of detritus sediments coming from the disintegration, defoliation, and the erosion of their side walls, constitute the floor of the bolsons. In the large bolsons the detritus which descends the flanks of the mountains in the form of scree, or alluvial cones, builds deep deposits all round the basin which start at a high altitude and descend towards the bottom of the depression more or less in the form of an inclined plane. Along the length of the inclined plane, the debris is distributed in accordance with its weight and size: in the higher parts the larger boulders, then the cobblestones, still lower down the rubble, and so on, after which, towards the centre of the depression, there follows successively small stones, gravel, sand, silt and finest silt. Often the wind will shift the sediments from the bottom, lifting up the finer granules and accumulating them in the form of sand dunes.

The flora of the basins does not form an association which stretches in a continuous fashion over a delimited area, but an association which is divided into numerous basins, large and small, distributed among the mountains of the arid region. The north of Mendoza province, the eastern part of San Juan province, the greater parts of La Rioja and Catamarca provinces, together with the zones of the provinces of San Luis, Cordoba, Tucuman and Salta which are located within the frontal sierras -in all these areas, the floral associations evolve under analagous climatic, morphological, and ecological conditions.

The climate is extremely warm and dry, with winter climate mild and summers hot, but always with diurnal variations very wide and very sudden, especially in winter when at sundown, with a sudden change of irridation, the temperature drops quickly as far as several degrees below zero. Rain - less than 250mm annually, in summer. Its annual average differs greatly from one place to another, in accordance with the exposure in respect to the east winds, which are those which bring virtually all the rainfall

. . . from H.Middleditch

The floor of the bolsons or basins in Catamarca, La Rioja and San Juan are arid areas containing extensive sand dunes and some patches of trees on favourable sites, just like the desert of Mendoza. On leaving the desert to travel into the mountains it is not only the terrain which changes, but the face of the vegetation also alters. In particular, when coming out of the desert of Mendoza into the Andes, the vegetation differs both from that found on the patagonian steppe to the south and on the margins of the bolsons to the north.

. . . from L.Hauman, Province of the Monte; the western subandine district.

The same species which on account of their hardiness become predominant in the southern Monte, are able to extend up into the precordillera of the provinces of Mendoza, San Juan and La Rioja. But other features of the climate: hot summers, even more accentuated aridity (less than 200mm, occasionally down to 100mm annually), together with the different ground conditions, always mountainous here and in consequence very variable from place to place, explain why the flora of this district, although very similar to that of the southern district, is notably richer, on account of the presence of many elements coming from the central district and, above all, by numerous endemic species. Thus a catalogue of the subandine flora of Mendoza, despite its poor and stunted appearance, extends to an impressionable total.

The families most represented are the grasses, the legumes, the cacti, the verbenas and the composites. Among the most notable elements should be indicated a series of bushes and shrubs without leaves or with ephemeral, deciduous, reduced leaves. Also notable is the richness of the cacti in the region, all of low height, with a predominance of the genus Opuntia, with species having cylindrical or flattened segments, and Echinopsis, with short stems, more or less spherical and with pretty large flowers.

In the crevices of the rocks are some ferns, equally xeromorphic, which are entirely absent from the Monte of the plains.

. . . from H.Middleditch

Apart from the Opuntia and the Echinopsis, are there any other sort of cacti in this district? And what sort of terrain do they inhabit?

. . . from F.A.Roig, Vegetation of Mendoza province

Bush formation — Badlands up to 1100m

Found on terrain difficult for travelling, greatly dissected by a complex network of dry river valleys or ravines, hillocks or low ridges without any soil and into which the water drains rapidly, accumulating in the watercourses now crammed with sand and gravel. The extreme aridity is reflected in a sparse and stunted vegetation. This terrain has its greatest extent in the bad-lands of Rivadavia, San Carlos, and San Rafael. So complex are the surroundings in the badlands, that it is almost normality to lose one's way and the almost complete absence of water is one of its characteristics.

Three distinct aspects of the vegetation may be distinguished:

1. In the level parts, Larrea divaricata predominates, joined above 800m altitude by Gochnatia glutinosa and Zuccagnia punctata. 2. On the slopes and summits with greatest drainage, communities of Chuquiraga erinacea and Cercidium praecox. 3. On the geologically recent deposits in the watercourses, communities of Larrea cuneifolia, L.divaricata,

Bulnesia retamo and Geoffroea decorticans.

It is of interest to note the conduct of the retamo, Bulnesia retama. To the north and east of the badlands the spurs rise gently up to 750m and it is on these slopes where the Bulnesia retamo predominates, over a breadth of 5 to 15km, producing retamales which cannot be regarded as woods but as isolated plants regularly dispersed over the terrain. On the other hand there are occasionally almost vertical cliffs in these same hills on which this is the only plant to be seen. Most notable examples of these cliff retamales can be seen along the R. Mendoza before Uspallata and in the Sierra de Marquesado in San Juan province. It is difficult to find an explanation for the ability of this plant to populate such ecologically disparate locations.

On the badlands immediately west of Mendoza city — the parts which still maintain a steady incline and the two terraces corresponding to the two interglacial periods — are found arid jarrilales of Larrea divaricata together with Gochnatia glutinosa. On the other hand the hills and valley sides diversify widely in appearance, above all in accordance with orientation. Now appears Cercidium praecox on very well drained slopes, especially those facing north, abundant cacti on stony slopes and increased frequency of Trichomaria usillo

Bush formation — Jarrilal, up to 1300-1400m

These steppes display the same vegetation that is to be seen on the more level parts of the badlands. Predominant are Larrea divaricata, Prosopsis flexuosa — always in bush form, and the presence of Gochnatia glutinosa. The badlands differ in having an abundance of Cercidium praecox and the presence of notable communities of Chuquiraga erinacea. Steppes of typical jarrilal occupy by preference alluvial ground and the foot of the mountains. Within the jarrilal there are variations. With ground thickly covered with stones, Larrea divaricata is predominant; on the other hand on sandy silt or claylike ground it is Larrea cuneifolia. For example, in the jarrilal of the Pampas de Uspallata, we see that on its upper part, with alluvial ground, L. divaricata predominates, whilst downhill the plants increase in size as the ground changes, becoming richer in silt. Larrea divaricata slowly gives way to L.cuneifolia until the latter predominates in the lowermost deposits in the valley.

In addition, along the whole of the length of the foot of the mountain, a dense jarrilal follows the sierra, very rich in Monttea aphylla, Gochnatia glutinosa, and Fabiana denudata, occasionally accompanied by Neosparton ephedrioides as at San Isidro, facing Mendoza city, and along the R.Mendoza on leaving Uspallata. This belt is very rich in Acantholippia eriphioides and Gymnocalycium catamarcensis [sic]. All this vegetation is heavily browsed by goats and in consequence there exists an introduced vegetation largely of Lycium tenuispinosum and Opuntia aorocantha.

. . . from H.Middleditch

So now we discover that Pyrrhocactus catamarcense is to be found in association with this dense belt of Larrea bushes, which grows on the spurs and slopes at the foot of the mountains, by preference on alluvial ground, between about 1100 and 1400m above sea level. This particular vegetation belt is only located with certainty at the very foot of the Andes to the west of Mendoza city, from where the desert stretches eastwards to the Sierras of San Luis. For almost fifty miles to the north of Mendoza city, towards San Juan, and for eighty miles or more to the south of Mendoza city, beyond San Carlos, the Andean foothills similarly arise abruptly from the desert. Does the dense belt of Jarrilal exist at the foot of the mountains over all of this length? Does it contain Pyrrhocactus catamarcense over this whole stretch?

. . . from F.Kurtz, A trip to the frontier of Chile, 1886

After leaving the cultivated plain around Mendoza, we first encountered a monte of sparse trees and a little further on, a fair stretch of shifting sand. Once again we came into monte and there came into view the the first slopes of the Cordilleras and some valleys which appeared to confined within the mountains which surrounded them. The vegetation took on another face; composite trees and spiny plants predominated such as the Altepe - Proustia ilicitifolia, the two species of Larrea, Zuccagnia punctata which mimics perfectly Larrea nitida, and shrubs of Atriplex. But by their cheerful colours of red and orange a Loranthus and Mutisia rosea gave a somewhat more lively character to a vegetation with pretty gloomy tints of grey and green.

On entering the cordillera we observed among the characteristic types an Artemisia, Colliguaya integerrima, Tetraglochin alatus and a species of very spiny Berberis with bluish green foliage.

. . . from H.Middleditch

In the review of Mendoza vegetation by F.A.Roig, these last four spp. are included in the vegetation zone above the jarillal. Does the belt of jarrilal, with its accompanying P. catamarcense, not occur in the foothills at this point? Is there some variation in environment which might account for this?

. . . from F.A.Roig, Vegetation of Mendoza

The general aridity of the precordillera at the altitude of Villa Vicencio becomes altered in a S.E. direction, nearly opposite Mendoza city, from the cerro Aspero as far as the chain of the Alto de Los Manantiales. It appears that the rains from the Atlantic unload a greater amount of water in this part. There the steppe of Senecio uspallatensis reaches a vigorous development, always accompanied by Adesmia horrida in dense and vigorous thickets.

. . . from H.Middleditch

Pyrrhocactus is reported from the southern end of the Sierra Paramillos, near Cacheuta and near Potrerillos; these locations may possibly fall within this somewhat more humid area west of Mendoza city. Are there any other similar more humid patches in the foothills of the Andes in Mendoza province? Does P.catamarcense and its associated band of vegetation extend northwards from Mendoza city, perhaps as far as San Juan?

. . . from F.A. Roig, Vegetation of Mendoza

Copses of Maytenus boaria and of Escalonia mirtoidea are to be found in quite rocky quebradas in the department of San Carlos forming small bodies in the lower part of the quebradas or climbing up steep slopes. These quebradas, such as the Alvarado, or the Rosario, are quite humid and support streams with permanent water in their beds. The dominant community in these is a bushy strata of Colliguaya integerrima, sometimes quite dense, and other trees of Mayten, and Chacaya trinervis. In the quebrada Alvarado is the only known Argentine location of Solanum maglia from the maritime littoral of Chile. It is also remarkable to see on the shaded cliffs, thickets of Ribes punctatum, which gives an idea of

the special ecological conditions in these quebradas.

In other quebradas, more humid just like the foregoing, such as the arroyo Manzano there are galleries of Escalonia mirtoidea, The presence of this species in these vallies could not be floristically more interesting. Escalonia mirtoidea grows happily in the forests of Chile in the province of Talca, with Buddleia globosa, Nothofagus, etc. It is considered to be an element of the antarctic vegetation which, like others, only appears in our country at favourable places.

. . . from H.Middleditch

Roughly 30km to the north of Agua del Toro a ridge of hills juts out from the Andes in the direction of San Rafael; behind this range lies an extensive elevated basin, the Campos del Piedras Afilar, bounded on one side by the Andes and on the other side by the Sierra Nevados. Both the R.Atuel and R.Diamante cross this basin and cut through the enclosing ridge. The vegetation belt with a predominance of jarillal (Larrea) follows the face of this enclosing ridge and the lower eastern slopes of the Sierra Nevados.

. . . from F.A.Roig, Vegetation of Mendoza. 1972

The R.Diamante was the southern limit of Mendoza province up until the campaign against the indians. But it is also a vegetational divide. South of the river the annual rainfall of 198mm distributed throughout the year, without any seasonal preponderance, is explained by its being a region of transition between the major rainfall systems of the north and the south. The bushy Larrea steppe becomes substantially modified. We have undertaken a study in the Campo del Piedras Afilar between the R.Atuel and R.Diamante where three zones can be distinguished following one another from W. to E. as the nature of the soil alters; 1. To the west of Route 40 [Sosneado to Malargue — H.M.], a bushy steppe composed predominantly of Larrea nitida, Prosopsis flexuosa, Ephedra ochreata together with a lower strata of herbs and grass. Ground with a thick cover of gravel, sandy in parts.

2. To the east of route 40, on a belt of sandy ground, a herbaceous steppe, at times formed exclusively of Grindelia chiloensis, such as that which occurs on the campos between El Sosneado and La Junta.

3. To the east of the herbaceous steppe, the bushy steppe reappears with Solupe but which changes to communities entirely of halophytes. In the lowest part of the campo the soil is very fine, silty, rich in salts.

. . . from F.Kurtz, Viajes Botanicos al Rio Salado superior.

Translated by H.Middleditch from Boletin de la Academia Nacional de Ciencias Exactas Cordoba Vol.X111 1893.

[Follcwing the R.Atuel across the Campos de Piedras Afilar and then just to the south of Sosneado...] Following the R. Salado upstream from its confluence with the R.Atuel the subandine vegetation is found among the first hills and spurs of the mountains, in the vicinity of the mouth or exit of the river from the hills. We have been able to study this narrow zone between San Carlos in the north and as far as to the south of Malal-hue [Malargue — H.M.] which is occupied by a vegetation that combines the elements of the Monte — Molle, Piquilin, Algarrobo — with other species. As such may be considered Ephedra ochreata (Solupe), Verbena aphylla, Tricycla spinosa, Larrea nitida, Colliguaya integerrima,and Colletia doniana — the Chanay. The Chanay is a fine tree, the last one to be seen when following the arroyos into the cordillera, usually in association with Colliguaya integerrima, a bush with bright shiny green branches. With increasing altitude all the woody plants such as Molle, Lena Amarilla, etc., are in the form of bushes which do not reach above 2.5m in height.

These subandine species put in an appearance suddenly on the slopes of the cordillera, an unusual feature where they exist, only to disappear very soon a little higher up. It is possible to fix the upper limit of this zone quite simply with the appearance of the lower limit of the Lena Amarilla (Adesmia pinifolia) since at the same time as this bush, there also appears a series of other plants not observed until then.

. . . from H.Middleditch

In the 1972 review of the vegetation of Mendoza by F.A.Roig, the Jarrilal containing P.catamarcense is stated to extend "up to 1300-1400m where it is replaced by the mountain flora". In this same work, under the general heading of the mountain flora, a bushy vegetation of the precordillera is discussed. This extends up to about 2250m, where Adesmia pinifolia, the Lena Amarilla, puts in an appearance. Thus when Kurtz describes his subandine vegetation as a narrow belt extending up to the Lena Amarilla, presumably only the lower part of this narrow belt will be occupied by P.catamarcense. The western margin of the Campos de Piedras Afilar lies just above the 1500m level; are the Pyrrhocactus growing on the foothills to the west of Malargue on the upper margin of their existance? Roig also observes that "More to the south of Malargue the face of the landscape changes and the upper vegetation levels of the foothills disappear. Going further south it is a countryside of mountains and high valleys". So the Pyrrhocactus near Malargue seems to lie at about the southern limit of its associated vegetation.

In addition to visiting the upper R.Salado, Kurtz also had a look at the ridge rising behind San Rafael

. . . from F.Kurtz, Botanical trip to the upper R. Salado

The Cerro La Guardia to the south of San Rafael, like the whole of the sierra of San Rafael, of which it forms a part, is only the border of the altiplano which extends between the Cerro Nevados and the Cordillera. The Cerro La Guardia exhibits the same flora as the arid hills at the foot of the Cordillera, e.g. in the hills of Tunuyan, characterised by the same subandine spp which are to be found in the adjacent monte and which follow the valleys and arroyos uphill. In addition there is found here Larrea nitida and Gochnatia glutinosa.

. . . from F.A.Roig, Vegetation of Mendoza

To the north of the huge altiplano of Piedras de Afilar rises the peak of Diamante, a magnificent volcano visible throughout the basin. Botanically the peak is very interesting. The plain which surrounds it has an average altitude of 1300m and the peak rises 1000m above that. All this part of the basin of Piedras de Afilar has a loose sandy surface and its extremely homogeneous vegetation is composed of Grindelia chiloensis, Junellia juniperina and Stipa. The vegetation on the mountain is quite different from that in the plain. Predominant is the Larrea divaricata accompanied by bushes such as Salvia gilliesii, Gochnatia glutinosa, Schinus polygamus, Prosopsis alpataco, Neosparton aphyllum, etc.

As we climbed the peak, the diversity of exposure, the diversity of the surface, partly broken basalt flows, partly ejected volcanic debris, erosion gulleys, etc., presented a heterogeneous vegetation in which were to be found in curious mixture almost all the elements of the bad-lands of the subandine Monte. Here is something that we should think

about. The plain is occupied by communities with patagonian elements and appearance, then above that, from 1300 to 2300m, appears the Monte with species characteristic of the mountainous districts such as Salvia gilliesii, Denmoza rhodocantha, Diostea scoparia, Buddleia mendozaensis, etc. There is then a distribution in curious zones when the Monte vegetation is to be found above that which we consider patagonian, which is not normal in Mendoza. It is an inversion of the zones due to factors of exposure, greater humidity, etc.

. . . from H.Middleditch

From the foregoing accounts it appears that the band of vegetation at the eastern foothills of the Andes not only differs from the vegetation of the desert and Monte to the west and northwest, and of Patagonia to the south, but also includes some unexpected elements. Are there any climatic factors which might account for this?

**Geomorphology and Climate of Mendoza Province By R.Capitanelli.**
Translated by H.Middleditch from Boletin Sociedad Argentina de Botanica Vol 13(Supp.) 1972

Atmospheric circulation and the masses of air which act in Mendoza are those typical of the temperate zone, with changes produced by geographic factors of prime magnitude (distance, relief, etc.).

The primary influence is excercised by the subtropical anticyclone permanently situated over the Atlantic which sends out masses of hot humid air which come from the north-east and are dominant over the whole of the plains. Its significance varies with the season of the year and the rains are in summer. As a consequence of the distance from the source and geographic factors, the rainfall in mendoza reduces from E. to W., whilst the piedmont produces effects which bring about an increase in rainfall.

The depression over NE Argentina extends considerable influence over the climate of Mendoza, as far as the northern limit of the Payun. It brings fine, clear, dry weather, hot in summer and temperate in winter. At the end of its development it does not produce any increase in cloudiness or rainfall as it does in the provinces of the north-west, but brings complete dryness.

The action of the Pacific anticyclone is much more complicated than the foregoing. Its effect depends upon the time of year, the direction from which the air masses reach Mendoza, and the relief they encounter. It dominates the climate of the cordillera and imposes the winter regime of snowy precipitation. In crossing the mountains the air masses undergo appreciable modification and the plains receive warm dry winds of the fohn type (Zonda). Even the eastern margin of the mountains displays special climatic features arising out of this effect.

The air masses crossing the cordilleras from the Pacific can bring winter snow down to as far as 1800 to 2000m altitude. Together with the influence of the air masses from the north-east, this forms the basis for defining a transition zone between the climate of the grand mountains to the west and that of the plains to the east.

. . . from H.Middleditch

The maps accompanying the foregoing article demonstrate clearly the four major climatic areas in Mendoza viz:- the eastern plains with summer rain; the high Andes with winter rain; the high ground south of San Rafael (the Payun) i.e. the Serra Nevado and outlyers, predominantly influenced by westerly winds; and lastly a narrow band where the Andes meets the plain which enjoys rain both in summer and winter. This narrow band extends from Malargue in the south, northwards up to the border with San Juan and presumably continues some way into San Juan province. It is coincident with, and probably the prime cause of, the somewhat richer band of vegetation that follows the foothills of the Andes and includes Pyrrhocactus as a component.

There do not appear to be any rainfall figures available for the transition zone of climate and vegetation but the following figures in mm are taken from Capitanelli (above); Preston James "South America"; and A.N.Schuster "Argentinien":-

| | J | F | M | A | M | J | J | A | S | O | N | D | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | | | | | | | | | | | | | |
| La Rioja | 66 | 69 | 56 | 20 | 13 | 5 | 3 | 5 | 5 | 20 | 36 | 46 | 344 |
| Jachal | 62 | 47 | 52 | 3 | 1 | 2 | 7 | 5 | 0 | 15 | 16 | 21 | 231 |
| San Juan | 20 | 18 | 10 | 3 | 0 | 0 | 8 | 3 | 3 | 5 | 5 | 10 | 84 |
| Mendoza | 23 | 33 | 28 | 13 | 10 | 10 | 5 | 8 | 13 | 18 | 18 | 18 | 196 |
| San Carlos | 41 | 34 | 28 | 18 | 25 | 16 | 12 | 19 | 22 | 43 | 37 | 31 | 331 |
| San Rafael | 34 | 38 | 37 | 8 | 1 | 1 | 0 | 6 | 13 | 13 | 26 | 30 | 207 |
| Malargue | 10 | 22 | 19 | 13 | 15 | 20 | 32 | 36 | 10 | 8 | 8 | 6 | 199 |
| Anelo | 5 | 4 | 9 | 6 | 14 | 20 | 6 | 5 | 6 | 2 | 3 | 4 | 84 |

The northern boundary of the Patagonian vegetation lies nominally on the R.Atuel. Malargue, which lies to the south of the R.Atuel, receives rather more rain during the cold winter than in the warm summer. The same pattern is evident further south at Anelo, near Neuquen. The other locations in Mendoza have a predominance of summer rainfall, typical for the plains, as exemplified by the figures for La Rioja. As all the above rainfall record stations (with the exception of Malargue) are on the plain and not on the lower mountain flanks, it does seem to be probable that the richer belt of vegetation which includes Pyrrhocactus will enjoy a better annual rainfall than would be indicated by the above table.

To the north of the desert of Mendoza there lies the area of mountain ranges rising above arid basins. In this area most of the cacti occur on the erosion debris at the base of the mountain flanks or on the alluvial fans, which sometimes cover huge areas. Alluvial fans are associated with arid, tropical, mountainous terrain where daytime temperatures are higher than at the equator. Alluvial fans of significant size would not be expected to occur as far south as Mendoza province and none of the foregoing descriptions of landscape or geography place any alluvial fans in Mendoza province.

In all the basins surrounded or filled by these alluvial fans, Frenguelli tells us that the vegetation grows under analogous conditions. But the cacti are not distributed equally over these mountain foothills. Parodia, Gymnocalycium, and columnar Cerei are found on the margins of the Pipanaco basin, at the foot of the eastern flanks of Sierra Famatina, Sierra Sanagasta, and Sierra Malanzan, in the Sierra San Luis, and as far west as the eastern foot of the Sierra de Valle Fertil. Where alluvial fans are no longer significant, at the foot of the Andes in Mendoza and San Juan, there are no Gymnocalycium, Parodia, or columnar cerei, but instead we meet here with Denmoza, Soehrensia, and Pyrrhocactus.

All three of these genera do occur at the feet of the mountains further to the east, but only as very isolated populations. Pyrrhocactus andreaeanus is reported from Sierra Famatina, both by Rausch and by Vandenbroeck. Well known are the Pyrrhocactus populations covering a limited area near Mazan and near Los Colorados, which appear to be confined to outcrops of bedrock. Equally well known are the Pyrrhocactus from near Marayes where P.bulbocalyx, P.marayense and P.megliolii are reported to grow. At Barranca de los Loros in La Pampa province, well away from any mountains, is an isolated population of P.strausianus.

The main distribution zone for Pyrrhocactus lies in a narrow belt at the foot of the Andes on the edge of the desert which occupies much of Mendoza and San Juan provinces. To the south this distribution zone extends westwards along the ridge separating the lowland desert from the elevated Campos de Piedras Afilar, with another isolated population near Malargue. It appears that Spegazzini was aware of the existence of Pyrrhocactus to the west of Mendoza city and northwards from there, where a fore-range of the Andes is separated from the main chain by the Uspallata valley and its northward extension. Hence in describing P.catamarcense, Spegazzini gave its distribution as the "very arid rocky pre-andine hills in Mendoza, San Juan ...". With present knowledge this distribution belt can be probably be extended at least as far to the south as Manzano Historico.

It is highly unlikely that there will be a continuous belt of Pyrrhocactus from Manzano Historico to Huaco. It is probable that disjointed populations will occur here and there in this stretch, at favourable locations on slopes and in valleys, separated by greater and lesser distances. But even this represents a concentration of plants by comparison with the very isolated populations on Sierra Famatina, Mazan, Los Colorados, Marayes, Barrancas de los Loros, and Malargue.

The distribution of Pyrrhocactus is limited to the south by climatic conditions which give rise to vegetation typical of Patagonia. To the northeast it is limited by conditions which support Parodia, Gymnocalycium, and columnar Cerei. It does not occupy the huge areas of lower lying, more or less level, arid desert or semi-desert. It appears to prefer sloping terrain more cr less occupied by broken rock, within a band of approximately 900 to 1500m altitude. It enjoys a transition climate between that of Patagonia, the lowland Monte, and the more elevated mountains. Geographically and climatically it occupies an in-between position and it is in consequence hardly surprising that present indications are that these plants also occupy a position in between that of Austrocactus, of Neoporterianae, and possibly of Acanthocalycium.

## THE ARGENTINIAN PYRRHOCACTUS From R.Ferryman

In the course of four visits to Chile I have been able to cover much of the cactus-growing parts of that country. Almost all the travelling which I have done there has very fortunately been in the company of other collectors who were already familiar with sources of provisions, with the roads, and with much of the countryside where cacti grew. As a result of this, the time I spent in Chile was very productive. Before my first first visit to Chile, I had made a pretty thorough study of the volume of Ritter's "South American Cacti" which deals with the cacti of Chile. One of my objectives was to try and find as many as possible of Ritter's species of Neoporteria, Thelocephala, and Pyrrhocactus in the wild. With few exceptions, I have now been able to visit almost all the locations recorded by Ritter and see for myself what each of his species looks like in habitat. At the same time I have also looked at Rodentophilla and Eriosyce at many of their habitat locations.

Ritter goes to some lengths in Volume 2 of his "South American Cacti" to explain why he encompasses both Horridocactus and Neochilenia within his genus Pyrrhocactus. From the broad range of species which I have been able to see for myself in Chile, I feel that Ritter's arrangement seems to be suitable for this group of plants, which are obviously quite closely related. On the other hand, I have had no opportunity to see any of the Argentinian Pyrrhocacti in their homeland. For these plants, I have to rely on specimens which I have acquired over the years, on slides, and upon available literature — just like most other collectors. There is still very little in print about the flowers, fruit, and seeds of these plants.

The appearance of a plant can be influenced to a considerable extent by its environment, which can also affect things like flower colour and size. So I would be inclined to place more emphasis upon the importance of the fruit. Most of us will be familiar with the fleshy, pinkish, elongated fruit that appear on the Chilean group of Neoporteria, Thelocephala, Islaya, and Pyrrhocactus sensu Ritter. None of my Argentinian Pyrrhocacti produce fruits which elongate and retain fleshy walls. For the record these plants include: P.andreaeanus (6 plants) L 582; bulbocalyx (numerous plants, with and without location data); spec. ST 128 Cacheuta (3); strausianus; umadeave v.marayensis; Rausch 555; R 562. The fruit on these is always small, globular, darkish green to blackish purple.

In the fruits of Pyrrhocactus bulbocalyx, strausianus, and marayensis, the outer wall appears to be sticky and pulpy and in trying to remove the fruit it simply stretches into a sticky mess. If left on the plant it just disintegrates; this seems unlikely to happen in the wild and one must assume that the fruit is removed in the sticky state, perhaps by ants. These sticky fruits are best likened to say Notocactus horstii. The other fruit type I have set on P.andreaeanus and catamarcense are very similar in shape i.e. globular, but the outer wall is thicker and remains intact allowing the seeds to fall out readily after the fruit is taken off the plant. Little appears to have been written regarding the fruit of the Argentinian plants although in Die Cactaceae III p.1573 Backeberg quotes Voll as describing the fruit of a plant which Backeberg called sanjuanensis thus: "fruit resembling a gooseberry, 1.5cm broad, with flower remains; when ripe the fruit bursts open at the base (the opening ring-like), the upper cup shaped section falls off and scatters the seeds". But my slide of a dry-walled fruit of P.marayense shows clearly that it opens by a vertical split to release the seed.

Of plants described by Rausch, P.megliolii and P.villicumensis are stated to have fruits "globular", 10 and 12mm in diameter respectively; whilst P.pachacoensis is quoted as having fruits "barrel shaped, 8mm long and 5mm in

diameter". My own plant of R.556 has a fruit 7mm high and 6mm in diameter. I am most anxious to obtain further information on this group of Pyrrhocacti; in particular I am very keen to try and obtain collected seed so that I can raise reliable material. I have heard from Fred Kattermann, who has visited the Pyrrhocactus habitat in Argentina and collected material there, so I may be able to look forward to the possibility of obtaining some seed with definate habitat locations.

. . . from J. Lambert

On the occasion of my second visit to Argentina in 1983 I chose to prospect the more central west regions. My route took me this time through the Provinces of La Rioja, San Juan, Mendoza, Neuquen and La Pampa. Starting once again from Cordoba, a diversion was first of all made to the Sierra Velasco. From there I travelled south via Los Colorados and the Sierra Malanzan, then westwards, over a broad plain some 50km across, to Marayes. Over this plain it is rare to encounter stones of any size — the ground is mainly sand and grit, supporting a scattering of bushes and low trees; there is very little grass to be seen. No permanent river flows here. Near Marayes the railway and the main road from Cordoba to San Juan cross a long mountain ridge which runs southwards from Sierra Valle Fertil. The hills around Marayes are composed largely of broken angular rock together with occasional outcrops of solid rock, the ground between consisting of smaller stones and grit. No streams exist on these hillsides. There is an occasional tall bush two meters or more in height but for the most part the bushes and shrubs are about half a meter to a meter high. These hills are the undisputed kingdom of Trichocereus, of which they harbour numerous populations belonging to the species T. strigosus. Scattered here and there over the hillsides are plants of Tephrocactus alexandri and also at least two nice forms of Pyrrhocactus are found quite abundantly. I say at least two, because I suspect that there are actually three different forms of Pyrrhocacti to be found at Marayes viz;- P. megliolii, P. umadeave v. marayensis, and also some specimens of P. bulbocalyx. On the other hand, when one compares P. umadeave v. marayensis with the real P. umadeave from Puerta Tastil in the Quebrada de Toro, Salta province, it seems very doubtful that both forms should be varieties of one and the same species. Many of the Pyrrhocacti were in flower (late November) and there were flowers on the Tephrocacti too.

At San Juan the river of the same name emerges from the fastness of the main mountains on to a broad sandy plain which stretches some 70km to Marayes. At San Juan the river waters are used for irrigation, for vinyards and other agriculture. Our route now followed the dry valley to the north of San Juan which separates the outlying Sierra Villicun from the foothills of the Andes. On these slopes, right opposite Talacasto, we came across Trichocereus strigosus, Denmoza erythrocephala and P. villicumensis. It should be noted that the name of the Sierra is spelt with an 'n' so that the species should have been called P. villicunensis. However, once a name has been validly given, according to the rules of botanical nomenclature it cannot be changed, except for more serious reasons.

This Pyrrhocactus was found not on the slopes of the Sierra de Villicun, but in the hills on the other side of the road from San Juan to Jachal i.e. on the slopes which face generally to the east. Here, too, the hillsides were very stony with gritty ground between the stones, but in comparison with the habitat at Marayes there was very sparse vegetation; there were some Deuteroconias together with a very few scattered bushes that are usually about a meter high. The dwarf P. villicumensis grew between the rocks and on the gritty ground, bearing lovely brownish orange flowers with a green heart. The Pyrrhocacti were exceedingly sparse but the Denmozas were rather abundant.

The route now turned into the mountains, via Hualilan to Iglesia, where the Llanos de Chita forms a typical flat upland in front of the mountains at some 2300m elevation. It is possible to see for several kms in every direction over the almost level ground, which has a monotonous uniformity of surface and vegetation. The ground is covered with sandy grit or stones up to fist or even head size; some patches are more stone than sand, other patches are very sandy. Here and there arose groups of silvery-grey leaved herbs, mostly only some 100mm high. Dwarf bushes grow between a meter and a stone's throw apart. Because of the altitude and exposure the bushes of Larrea, probably L. cuneifolia, grow with their branches almost horizontal, close to the ground, seldom rising more than 150 to 200mm above the surface, but they may extend to a meter or more across. These bushes were full of yellow flowers at the time of my visit. The Pterocactus and the Puna clavarioides blend into their surroundings and are very difficult to find. Some Pyrrhocactus with light, straw-coloured spines, growing in these very dry surroundings, may well be P. sanjuanensis. These were in full bud, but none were seen in flower.

Travelling from Uspallata towards Mendoza city, we approached the Sierra Paramillos and on these slopes we came across a plant of P. strausianus in full bloom, near Cacheuta. The slopes here carried some large lumps of rock but in between there was the usual gritty material. At the foot of the slope there was a pretty dense belt of bushes — but as usual, not so dense that you could not walk between them. The bushes thin out higher up the slope where the Pyrrhocactus was found. On the following day we found a somewhat darker-spined form at about 1200m altitude on the road to Tupungato, probably P.atrospinosus, growing on a stony hillside in the company of bushes around a metre high; also at this locality were an Opuntia sp., an Echinopsis sp., Maihueniopsis glomerata and Cereus aethiops.

From Tunuyan a short excursion was made towards the west, to Manzano Historico at 1400m altitude. The amount of vegetation here suggested that the locality was markedly less arid, although most of the bushes were still about a metre high. The different shades of green betokened a variety of species of bushes, amongst which I noticed a dog rose, together with lots of grass and flowering herbaceous dicotyledonous plants. In many places the bushes grew not just side by side but interwoven, so one had to pick a way around the clumps of vegetation to get uphill. The ground surface was still either stony or gritty, but in looking up the hillside patches of bare ground could be seen among the low bushes, shrubs, and grasses. On a dry hill slope, laterally from the side valley we came across more Pyrrhocacti, not so far identified. One of these plants had half a dozen open flowers as well as a further dozen flowers which were just withering. Elderly plants became columnar, up to 25cm high. They were growing together with Pterocactus kuntzei; rather unexpectedly we also came across Notocactus submammulosus at this spot.

On the road between Agua del Toro and San Rafael were found plants of P.strausianus JL92, accompanied by Denmoza, Pterocactus Kuntzei and Trichocereus candicans. The slope was steeper, more exposed and with more sparse accompanying vegetation than on the Cuesta de los Terneros. From San Rafael we took the road towards Sosneado, climbing the Cuesta de Terneros where we find a nice specimen of P. atrospinosus JL94. On this climb the road took a southwesterly direction, so that the slope on one side faced more or less south-east and on the other side of the road the

slope faced northwest. The Denmoza, Pyrrhocactus, and Echinopsis leucantha together with some scattered shrubs and bushes thrived pretty well equally on both sides.

Further southwards, at the Rio Malargue, at 1400m, we came across more fine specimens of P. strausianus, several of these plants already carrying fruit. The town of Malargue is situated on a broad plain of rather sandy ground with a meagre vegetation of herbaceous plants. Some way from the town the ground rises in slopes of red stones which are covered with scattered bushes and harbour several cacti: Maihueniopsis ovatus and Pterocactus fischeri, as well as Pyrrhocactus. From there, and on my route through the Province of Neuquen, no further Pyrrhocacti were seen.

From Neuquen, we start on our way back to the north, and soon cross the Rio Colorado at 25 de Mayo, bringing us into the province of La Pampas. Only a few miles further on, the hills of Barrancas de los Loros offer an environment which seems worth exploring. And indeed a number of cacti shelter under the bushes. First there are a couple of P. strausianus of which the type was described from this locality. A little further on we collect a fine specimen of P.atrospinosus. The last spot where I observed any Pyrrhocacti was near Puelen, about 12km north of Barrancas de los Loros. After that one enters the pampas district where the ground is made of fine sandy earth without stones, the bushes decline and virtually disappear, to be replaced by grasses. Here cacti are very poorly represented.

I have compared flowers, fruit, and seeds from several species of Argentinian Pyrrhocacti with some Chilean species such as Horridocactus tuberisulcatus from Coquimbo, Horridocactus taltalensis, and Neochilenia huascensis and found no difference whatsoever which would justify a separate generic status. I am thus in full agreement with Ritter as far as genera are concerned. There is but one single genus, Pyrrhocactus, extending on both sides of the Andes, and including the Chilean species referred to Horridocactus and Neochilenia by Backeberg. However, among the Argentinian species, I cannot agree with Ritter when he considers P.catamarcensis and P.atrospinosus only two varieties of the same species. I have observed and collected both forms, and apart from the fact that their closest finding places are at a distance of at least 500km, they are so different that they definately belong to separate valid species. The difference between the two is much more pronounced than between P. atrospinosus and P.strausianus. I have discussed these views with Dr. Silvio Meglioli whom I believe has the best knowledge of Argentinian Pyrrhocacti these days, and he agreed fully with me.

. . . from R.Ferryman

From my own experience in growing P.bulbocalyx and P.marayense, I am quite convinced that these two are fairly closely related: furthermore, I would quite agree that the so-called P.umadeave v.marayes has nothing at all to do with P.umadeave and would be much better regarded as just P.marayense. Indeed it may well only be a form of P.bulbocalyx.

. . . from H.Middleditch

As far as I am aware this is the first time that Pyrrhocactus have been reported from Manzano Historico and from the general area of San Rafael. There could well be yet other locations on record for Pyrrhocacti.

. . . from C.Backeberg, Die Cactaceae Vol.6

It looks to be this species [P.setosiflorus], according to the apparently somewhat styalised flowers, of which Castellanos says in "Opuntiales vel Cactales" 99,1943:- "Austrocactus sp., Mendoza, from Tupungato as far as the Cordillera, Media Luna, at 1400-1500m; this habitat location established by Ruiz Leal is the first one for a species of the genus Austrocactus growing at so high an altitude." From Castellanos' inadequate key no satisfactory reference to a genus is possible. The flower sketch (loc. cit. XXXII:a-b) is a typical Pyrrhocactus.

. . . from W.Rausch Field Number List

| | | |
|---|---|---|
| R 549 P.villavicentia | R554 P. 542 Maradona | R 560a P. 542 Penarsquito |
| R 550 P. 542 Uspallata | R 560 P. 542 Huaco | |

. . . from H.Middleditch

It would appear that Rausch is effectively saying that four of these plants are the same as his R 542 which he calls strausianus. The original description for Echinocactus catamarcense gives the distribution as the "very arid rocky pre-andine hills in Mendoza, San Juan, and Catamarca". Immediately to the west of Mendoza city lies the Serra de los Paramillos which runs north and south parallel to the main cordillera but separated from it by a long, broad valley. The northward extension of the Paramillos runs into San Juan province, where R 554 was found which was classed by Rausch as similar to the plants from the Serra Paramillos. If the "very arid rocky pre-andine hills" includes the Serra Paramillos then it would seem to be more logical to class Rausch R542 and equivalents as P.catamarcense.

. . . from J.Lambert

In his Nuevas Notas Cactologicas 1925, Spegazzini also cited Los Barros as a locality for Malacocarpus strausianus. This place lies about 27kms to the south of San Juan.

. . . from F.Kattermann

When attending the I.o.S congress in Salta I added several weeks of travel to and from Salta and during that trip I was able to collect several forms of Pyrrhocactus. These included:

FK.572, between Uspallata and Potrerillo.

FK 576 south of Potrerillo, quite different to the foregoing in spination and general plant appearance but the flowers make them just forms of each other.

FK 582 on the road to Pachaco; which is not P.pachacoensis according to Dr.Meglioli

FK 583 Zonda

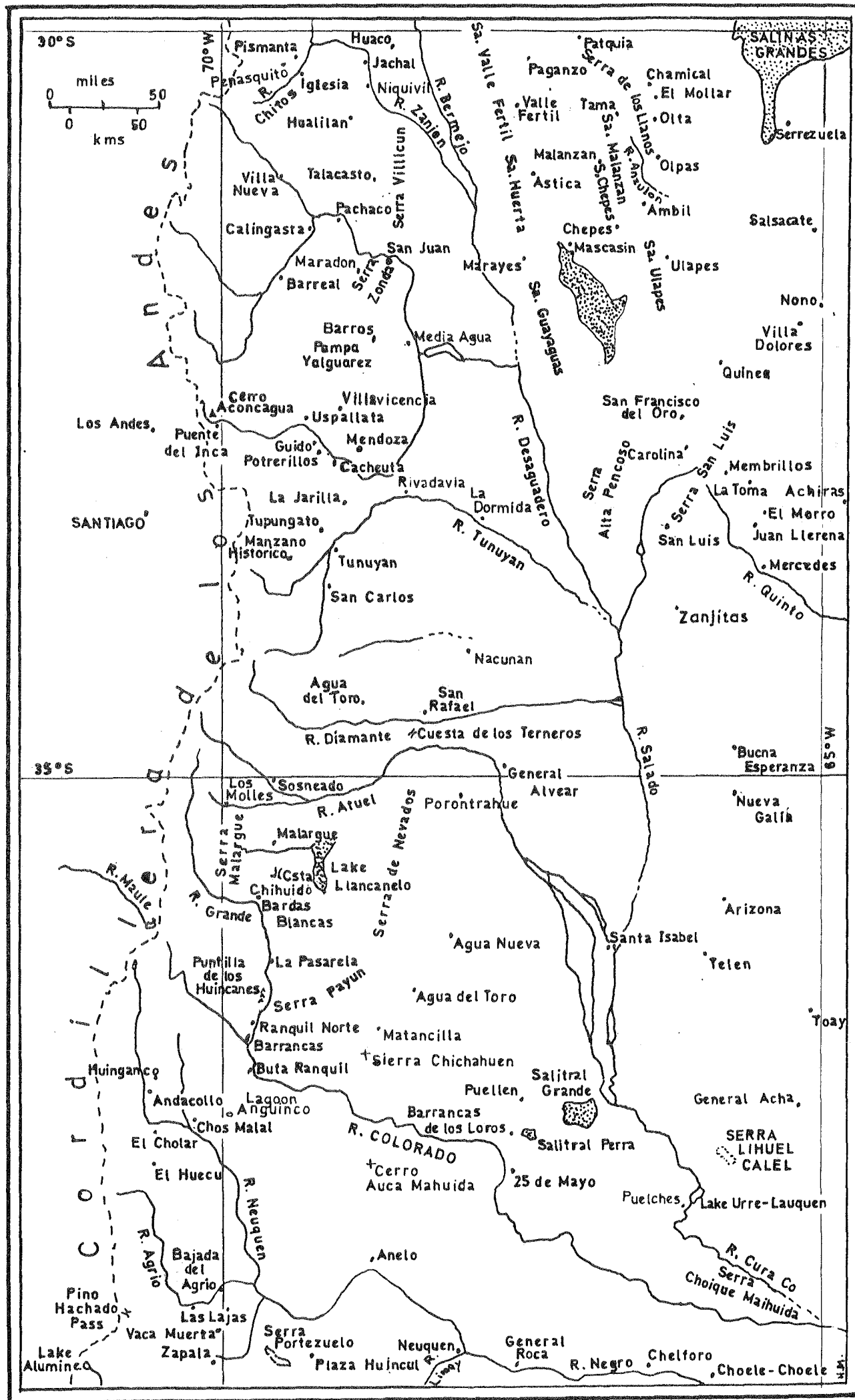
FK 593 west of Chilecito, according to Lau the same locality as his P.andreaeanus

FK 706 Los Colorados, which is P.bulbocalyx according to Dr.meglioli.

In addition, I am aware of Pyrrhocactus ME 740 collected by Dr. Meglioli on the route between Jachal and Huaco.

. . . from R.Ferryman

There is also an ST 128 from Cacheuta, which has been long cultivated as P.catamarcense. From this same


30° S
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Pismanta
Huaco
Jachal
Penasquito
Iglesia
Niquivil
Chitos
Hualilan
Villa Nueva
Talacasto
Pachaco
Calingasta
Maradon
Barreal
San Juan
Barros
Pampa Yalguarez
Media Agua
Cerro Aconcagua
Villavicencia
Uspallata
Los Andes
Puente del Inca
Guido
Potrerillos
Mendoza
Cacheuta
Rivadavia
La Jarilla
SANTIAGO
Tupungato
Manzano Historico
Tunuyan
San Carlos
Nacunan
Agua del Toro
San Rafael
R. Diamante
Cuesta de los Terneros
35° S
Los Molles
Sosneado
R. Atuel
Porontrahue
General Alvear
Malargue
Lake Llancanelo
Chihuido
Bardas Blancas
R. Grande
R. Maule
Punfilla de los Huincanes
La Pasarela
Serra Payun
Agua del Toro
Ranquil Norte
Barrancas
Buta Ranquil
Matancilla
Sierra Chichahuen
Huinganco
Andacollo
Lagoon Anguinco
Chos Malal
El Cholar
El Huecu
Barrancas de los Loros
R. COLORADO
Salitral Perra
Puellen
Salitral Grande
Cerro Auca Mahuida
25 de Mayo
Puelches
Lake Urre-Lauquen
R. Neuquen
Bajada del Agrio
R. Agrio
Anelo
Pino Hachado Pass
Las Lajas
Vaca Muerta
Zapala
Lake Alumine
Serra Portezuelo
Neuquen
Plaza Huincul
General Roca
R. Negro
Chelforo
Choele-Choele
Valle Fertil
Sa. Valle Fertil
Sa. Huerta
R. Bermejo
R. Zanjon
Serra Villicun
Patquia
Paganzo
Chamical
El Mollar
Olta
Tama
Sa. Malanzan
Malanzan
Astica
S. Chepes
R. Anzulon
Olpas
Ambil
Chepes
Mascasin
Sa. Ulapes
Ulapes
Marayes
Sa. Guayaguas
SALINAS GRANDES
Serrezuela
Salsacate
Nono
Villa Dolores
Quines
San Francisco del Oro
Carolina
Serra Alta Pencoso
R. Desaguadero
Serra San Luis
La Toma
Achiras
Membrillos
El Morro
San Luis
Juan Llerena
Mercedes
R. Quinto
Zanjitas
R. Tunuyan
La Dormida
R. Salado
Bucna Esperanza
Nueva Galia
Arizona
Santa Isabel
Agua Nueva
Telen
Toay
General Acha
SERRA LIHUEL CALEL
Serra Malargue
Serra de Nevados
Cordillera de los Andes
Cordillera del Viento
Cordillera del Colorado

general area near Mendoza comes Ritter's FR 9 which he originally called P.strausianus yet in his Kakteen in Sudamerika 2 he calls it P.catamarcensis.

. . . from H.Middleditch

Between FR9 first appearing in the Winter catalogue and the publication of his Kakteen in Sudamerika, it appears that Ritter came to the conclusion that the Serra Paramillos did form one of the "very arid rocky pre-andine hills" that Spegazzini quoted for the habitat of P.catamarcense.

. . . from F. Ritter, Kakteen in Sudamerika Vol. 2

I would question whether Pyrrhocactus catamarcensis really spreads into province Catamarca, since I have found no Pyrrhocactus there. In the zone of the Andean forehills in northern Mendoza only one species of Pyrrhocactus was found by me, and on account of their abundance this could not be missed by a cactus collector. It continues across San Juan [province] at least as far as the Famatina mountains in La Rioja (FR9a). Since Spegazzini stated that his species is common in the pre-andean hills of Mendoza, the name catamarcensis Speg. has to be applied to the species I have noted. It is possible that Spegazzini did not differentiate one or more other sorts from other areas and had included them within this name. Thus according to a brief communication from W. Rausch he found a Pyrrhocactus in the area of Patquia, province La Rioja, which conforms better with Spegazzini's statement about the size of the body, so that Rausch believes that he recognises Echinocactus catamarcensis Speg. again in this sort. However Patquia lies firstly outside the pre-andean territories and secondly this habitat is confined to a restricted locality, whilst Spegazzini, who was in his time the cactus collector with the most travelling experience around Argentina, indicated a much more extensive and westerly distribution.

Spegazzini gave a height of 10-50cm; however this species usually attains only up to about 20cm tall. Whether a specimen up to 50cm tall really exists in Nature, I very much doubt. The thickness attains about 8cm, Spegazzini quotes 8-12cm; whether this species reaches 12cm thick in the wild appears equally dubious. If a species is poorly described, the result is that later either it is incorrectly understood, as in the case of Britton & Rose and of Berger, or it becomes described as a new discovery, such as Backeberg's P.setosiflorus and P.atrospinosus. The type locality for the latter is Potrerillos, about 40km west of Mendoza city, where only the P.catamarcensis as I understand it grows, and abundantly too.

As Backeberg states in his Kakteen-lexikon, P.setosiflorus likewise emanates from the area of Mendoza. The plant in Fig 3399 in his Vol.6 from the commercial nursery of Saint-Pie would appear to be grown from seed, which I had collected at the same finding place as P.catamarcensis and was obtained by this firm from the seed distribution of H.Winter. The prominence of the bristliness of the flower [tube] is very variable, as I was able to establish and as even a comparison of the photographs of P.setosiflorus (Vol.6 Fig 3399) with P.atrospinosus (Fig 349, Kakteen-lexikon) will show. Fig 1510 in Vol.3 of Backeberg is likewise the same. Pyrrhocactus catamarcensis from the mountains of Mendoza has my number FR9; it occurs at around about 2500m altitude. (The statement "4000m, Chile" in the Winter 1955 catalogue is changed).

Pyrrhocactus platyacanthus grows at Malargue, province Mendoza, along with a Pyrrhocactus that may be a regional variety of P.strausianus (K.Sch)Berg, without hybridising between them. Discovered by me 1955, FR 448. A living specimen as well as a herbarium specimen of FR 448 were sent by me to the City Succulent collection at Zurich in April 1955.

In Neuquen Territory I saw from a moving vehicle a dark green Pyrrhocactus at a spot between Rio Barrancas and Chos Malal. It was similar to P.platyacanthus, but taller, thicker and with longer, denser, golden-yellow spines. This may possibly be a further new species.

. . . from D. Hunt

After participating in the I.o.S. meeting in Salta in 1986, I was able to drive back from there to Buenos Aires via Belen, Mazan, and Cordoba. Not far from Los Calorados we came across a population of Pyrrhocacti on the hillside there. We were working to a very strict timetable and we did not have time to make a particular study of the extent or distribution of any of the individual species. There were indeed hardly time to photograph all the species, let alone make observations! From my photograph, I estimate the diameter of the plants of Pyrrhocactus in all, most of them subglobose and about this size. This being the dry season (April), the plants were not in flower, and there were no fruits. The plants were growing at about 700m altitude on gently rising grounds, in the pebbly skeletal soil around the red sandstone outcrops, and presumably enjoying more rapid drainage than the flatter sites preferred by Gymnocalycium stellatum, which was also present. General ground cover was sparse. Associated cacti included Echinopsis leucantha, E.mirabilis, E.strigosa, G.stellatum, Opuntia articulata, O.sulphurea and Pterocactus kunzei. In that the habitat-type covers many kilometers, I would expect the population to be an extensive one, with the plant frequent, but not abundant in, sites similar to those we visited.

. . . from H.Middleditch

This may well be the Pyrrhocactus which Ritter notes above that Rausch had found "near Patquia". It is indeed a good day's walk from Patquia to Los Colorados but the two places are quite close when looking at a map of Argentina.

. . . from W.Knoll. GOK Newsletter, October 1974

Arriving in Los Colorados I understand why this town is so-called (Los Colorados = the reds). To the south of the town there stretches a lengthy extended rock-wall which is coloured red-brown. Here and there I was able to collect Pyrrhocactus bulbocalyx, about whch a remarkable fact is that the large-growing plants of this species cling in the truest sense of the word to the rocks, often only a small crack offers room for the roots and naturally there is virtually no soil to speak of. As I was hoping to reach a particularly fine specimen a stone slab gave way under me and I experienced free flight. Arrived at the bottom, my hand was torn and my knee sprained. In the following days I had nothing to smile about. I was less annoyed over my mishap than over the fact that P.bulbocalyx also occurs in thousands on the extensive gravel beds at the foot of the Sierra where I could have collected it completely without risk. Unfortunately I noticed this too late.

. . . from J.Piltz

When travelling south towards Patquia there is a low range of hills called Cerro Los Colorados. The rock of which they are composed may be a red sandstone — it is certainly red in colour. The outcrops of this rock form tall vertical cliffs with steep slopes of broken rock lying at their feet. There were scattered bushes on the plain stretching away from the

foot of the rocky scarp, as well as on the fairly level crown; the red cliffs were absolutely bare of vegetation whilst your eyes had to search the fallen rocks and sandy gravel at the base of the cliffs and along the gulleys to find a very occasional bush. But it was on this almost lifeless ground that we found Pyrrhocactus growing, near Cuelvas del Chaco. We came across Pyrrhocactus P78 in a steep sided gulley where the ground was still made up of red gritty sand and red stones. We were given to understand by R.Kiesling that these would be P.bulbocalyx. We did not find any plants in flower or fruit at the time of our visit.

In the course of our travels in Argentina we visited the area around Mazan on more than one occasion. After crossing the tail of the Sierra Ambato by the Cuesta Sebila the road descends towards a sandy plain in which lies the bed of the R. Salado. On the far side of the plain the ground rises with increasing steepness and merges into the bare rocky slopes of the Sierra Mazan, which runs almost due north and south over a length of about 30 km. At the northern end the highest point is about 350m above the surrounding plain.

When viewed from the descent from the Cuesta Sebila, the Sierra Mazan presents a pretty uniform flank over the whole of the length that is in view. The vegetation cover is likewise fairly uniform. On the floor of the almost level plain which lies in front of the Sierra there are scattered bushes which attain perhaps a meter and a half in height. At the very foot of the Sierra these are interrupted by a bank of sand which forms a pale strip that extends a short way up the slope but almost as far along the slope as one can see. On the slightly steeper ground behind the sand bank the bushes are joined by cereiform cacti and further up on an even steeper slope there are globular cacti. The bushes and globular cacti continue to occur on the low outlyers of the Sierra towards Santa Teresita. We found some Pyrrhocactus growing here on the more rocky parts where the slope would be about 45° and the ground was largely solid rock outcrop with some loose surface rubble. Here and there in the vicinity was a plant of Gymno. mazanense but there were no bushes in that immediate locality. We took this species to be Pyrrhocactus catamarcensis.

. . . from J. Lambert

During my 1981 trip to Argentina I visited the Sierra Mazan and searched unsuccessfully near Santa Teresita for Gymnocalycium ferrarii. However there were plants which I took to be P.catamarcensis and I was able to bring back with me two young and remarkably spiniferous examples. Unfortunately these both failed to become established in cultivation and eventually died. These plants grew on slopes consisting of a mixture of sand and pebbles, together with very sparse small bushes.

. . . from F. Vandenbroeck

During our visit to western Argentina we were taking the road from Aimogasta to Mazan across the Sierra Mazan, where we came across several Pyrrhocacti which were quite different from those which grow more to the north in Serra Famatina. The plants from Mazan grow quite large, they have a low columnar greyish-blue body of about 30-40cm in height, about 12 cm thick with a dense upcurved spination. In my view these plants correspond to P.bulbocalyx.

The rocks and soil around Mazan have a typical brownish red colour. The lower parts of the slopes at the foot of the Sierra Mazan are fairly well covered with bushes but these thin out as you climb the mountainside until the ground becomes very bare. Here we found Pyrrhocactus growing not far from the top of the ridge, where it may give the impression of being largely solid rock but the plants were growing on gravel with big fragments of rock here and there. The Pyrrhocacti grew between a metre and a stone's throw away from each other. Apart from an occasional clump of Tephrocactus bruchii the hillside was bare of other vegetation. Some slopes were full of Pyrrhocactus but most plants were difficult to get at because of the steepness of the slope and the coarse, loose gravel. Past Mazan, on the other side of the Sierra, at a lower altitude, we found more Pyrrhocactus together with sparse bushes, Gymnocalycium mazanense, Echinopsis leucantha, Tephrocactus bruchii and Tephrocactus articulatus, some mesembryanthemum and a few herbs. The plants growing at this lower level were somewhat less densely and less strongly spined but on the whole looked very much the same as those on the higher parts of the Sierra.

At the Cuesta Miranda, crossing the ridge of mountains at the the south end of the Sierra Famatina, we came across more plants which bore a strong likeness to Pyrrhocacti. Further to the north, near Angulos on the lower slopes of the Sierra Famatina which we approached from Belen, we found one solitary similar looking plant with a flattish, dark green body and a more open spination. These may correspond to the description of P. catamarcensis. The vegetation in the immediate vicinity was very poor.

From the city of San Juan we followed the valley of the river San Juan in the direction of Pachaco. It is a huge deep canyon-like valley of somewhat eerie appearance because of its grey bareness and desolation. The road winds along the steep side of the valley and is sometime hewn out of the rock. Beyond the military post of Pachaco the valley widens out somewhat and here we stoppped and searched the surrounding slopes with binoculars. In the valley bottom close to the river grew a fairly dense vegetation of bushes and low trees. Scattered bushes grew here and there on the valley sides but on the bare ground above we noticed some dark dots amidst the bare grey stones. Arriving there we found some Pyrrhocactus which we took to be P.pachacoensis. They were growing on a huge sloping bed of big broken stones with no other vegetation in the immediate vicinity.

As we came nearer to the city of Mendoza, following the valley of the R.Mendoza between Potrerillos and Cacheuta we came across some Pyrrhocactus growing on steepish slopes in the company of bushes, herbs and Denmozas. The spines on these plants are not really black looking but rather greyish brown, although from the location they would be P.atrospinosus which are probably synonymous with P.catamarcense. To the south of San Rafael we climbed the Cuesta de los Terneros where we saw both Pyrrhocactus and Denmoza. At that spot there were some sparsely scattered bushes and tufts of coarse grass growing together with the cacti.

Further south still we came across more Pyrrhocactus near Malargue. The town of Malargue lies on a fairly level but arid plain, whilst to the west the undulating hills rise in long, steady barren slopes. Bushes grow on the sandy gravel stretching away from the bottom of the slopes. We found the Pyrrhocactus on one rocky hillside growing between large broken rocks. Most of the hillside was bare, solid or broken rock or stones and some gravel. Two or three metres of bare rock separated each tuft of grass and the other low-growing plants were equally sparse. We searched some other similar hills in

the neighbourhood but the plants seemed to be concentrated on this particular hill. It was difficult to search more than a relatively small patch of these apparently endless undulating hills so it is impossible to say how far the distribution extends in this area.

At the time we took these to be Ritter's P.platyacanthus, which he reports from this location. However in his Kakteen in Sudamerika Vol.2 Ritter speaks of slightly columnar plants with strongly flattened spines. In addition he states that these plants grow together with a form of P.strausianus. On the other hand, the plants we found near Malargue displayed rather flattened bodies of about 10cm in diameter with dense needle-like spines. The spines were somewhat reddish-brown but not distinctly flattened. It is possible that the plants I found there have either been unknown or undescribed up to the present time.

. . . from Markus & Rausch, reported in G.O.K. Journal

They came to Famatina... it is the locality of Echinocactus reichei....high up on the mountains above Famatina occurred Lobivia famatimensis.... On the neighbouring Sierra Velasco at a height of 3200 feet there occurred Neochilenia reichei and Neochilenia flandreaeana, the latter very rare at that locality.

. . . from H.Middleditch

I am suspicious that this report misquotes the location for Pyrrhocactus andreaeanus, which Lau states he found in the Sierra Famatina (Lau 582). The plants found by Vandenbroeck at Angulos and near Cuesta Miranda may possibly be P.andreaeanus since these places lie on the slopes of Sierra Famatina. There are evidently different ideas on what to name the plants from Mazan and from Los Colorados. It might possibly be of assistance for identification to know something about the flowers on the plants growing at these two places in particular, and on other Pyrrhocactus.

. . . from R.Ferryman

There are really two basic flower forms in Pyrrhocactus, the typical bulbous form of bulbocalyx, which is shared by umadeave and v. marayense and the wider opening type similar to Neochilenia typified by (say) P.andreaeanus. There is a problem in establishing the flower shape for the oldest two names, strausianus and catamarcense. Now the distribution for catamarcense was given as Mendoza, San Juan, and Catamarca; but it is important to note that Rose collected strausianus from Mendoza, his number 21019. Therefore it would appear that the habitats overlap, but they can be distinguished by their flowers. Study the descriptions in Britton and Rose and you will note that catamarcense is reported to have 4.5cm tall flowers and strausianus 1.5cm, which tie in with the original descriptions.

. . . from H.Middleditch

Yes indeed the original description for Echinocactus catamarcense in Spegazzini: Cactacearum Platensium Tentamen gives flowers 45mm tall, not under the diagnosis but in the Observations. This description is repeated, correctly, in Kiesling's compendium of Spegazzini's works on cacti. Also Britton & Rose do indeed give 1.5cm as the flower height for strausianus. In the original description in the supplement to Schumann's Gesamtbeschreibung under Echinocactus strausianus we find "Bluten in einigen Knospen am Scheitel erst 1.5cm lang" i.e. Flowers with several buds in the crown initially 1.5cm long. A check of a number of other descriptions in the same publication has not yet found a similarly worded phrase including reference to buds, it is always flower size that is specifically quoted, and also not restricted by the use of the word 'initially'. It would thus appear from Schumann that the buds were initially 1.5cm long on P.strausianus so the flowers would doubtless be longer.

. . . from A.W.Craig

You will find that Backeberg, in Vol.3 of his Die Cactaceae, has already told us about the misinterpretation by Britton & Rose of the flower size of P.strausianus as 1.5cm high.

. . . from H.Middleditch

There appears to be very little guidance from the original descriptions of either flower size or shape. The original collector of P.strausianus was Hammerbacher who found these plants "20 hours on the road" after crossing the middle reaches of the river Colorado, according to Schumann's Gesamtbeschreibung. This is confirmed by reference to Hammerbacher's own account of his trip. Taking Hammerbacher's general line of travel together with those places where it was practicable to cross the R. Colorado, he would probably cross at 25 de Mayo with his mule train. This is where J.Lambert more recently crossed the R. Colorado and shortly thereafter found Pyrrhocactus near Barranco de los Loros and also nearer Puelen. Unfortunately not in flower.

Rose decided to call the plant which he found near to Mendoza city by the name P.strausianus, although Mendoza city is not only at the foot of the "very arid rocky pre-andine hills" viz: within the distribution area for P. catamarcense, but also well away from Barranca de los Loros, the original finding place for P.strausianus. It may be that Rose was not aware of the exact location of Barranca de los Loros and believed that the "valley of the parrots" was not too far from Mendoza city. How many of our readers know where this place is? Do you know where it is? You will do when you have looked at the map of western Argentina in this issue, but that place is absent from almost every map of Mendoza that I have consulted. Is there any reason why Rose could have been better served by those maps he viewed? The references for Britton & Rose's "The Cactaceae" were compiled from existing literature by the New York Botanic Garden staff, not by consulting authorities from Germany. No wonder it took Ritter quite a few years between his first encountering P.catamarcense in the "mountains of Mendoza" and the time of publishing his Kakteen in Sudamerika to satisfy himself on the correct identity for these plants.

In his Nuevas Notas Cactologicas 1925, Spegazzini cites Malacocarpus strausianus (Sch) Br.& Rose, found at Los Barros which lies at the foot of the northern extension of the Serra Paramillos. In this way he abandoned his own name of P.catamarcense for the plants he himself had found in the "very arid rocky pre-andine hills in Mendoza, San Juan,...", and adopted instead the species name mistakenly selected by Britton and Rose. If this had been the only occasion when Spegazzini took his copy of Britton & Rose off the shelf and used their nomenclature instead of his own, it might well be difficult to substantiate that sequence of events, but a similar event must have taken place with Lobivia andalgalensis Br.& Rose.

On account of the same Britton and Rose mistake, not only does Rausch describe his finds from the Serra Paramillos as P.strausianus, as noted above, but Lambert also considers certain plants from the Mendoza area to be P.strausianus. In addition, Lambert considers that P.catamarcense "grows 500km away" from Mendoza, quite possibly following Kiesling who gives P.catamarcense = P.bulbocalyx in his commentary on Spegazzini's works. I have not been able to consult the original description for bulbocalyx but it would appear that no habitat location is quoted. However the urn shaped flower with straw yellow petals and red throat, quoted by later authors for bulbocalyx, would appear to match the flower on plants found at Marayes. On the other hand, from all available indications, the Pyrrhocactus from both Mazan and Los Colorados lack a valid name. The first step in providing them with an identity is details of the flowers and seed. Which comes back to the question, what are the flowers like on Pyrrhocactus?.

. . . from J.Lambert

In his 1925 "Nuevas Notas Cactologicas", Spegazzini says that the flowers of Malacocarpus (—Pyrrhocactus) strausianus are relatively small; Spegazzini speaks of 25-28mm in length at the time of anthesis.

. . . from H.Middleditch

As noted above, it appears to have been the influence of Britton & Rose that led Spegazzini to class this plant as P.strausianus, instead of following his own original name of catamarcense. Spegazzini says "I am going to give a new description of this species, particularly of its flowers which have some differences between my specimens and those described by Schumann.....[full description given]. Malacocarpus catamarcensis (Speg)Br.& Rose as well as M.sanjuanensis speg., are perhaps no more than varieties of this species, which differ from it by thinner spines and larger flowers." Unfortunately the description does not tell us if the flowers are urn-shaped or funneliform, but it does say that the "numerous stamens cover the whole of the internal surface of the short tube". This can be compared with a sketch of a flower cross section entitled P.catamarcense in Buxbaum-Krainz Die Kakteen, which shows a slightly urn-shaped flower with stamens inserted over most of the tube height. But does this really represent P.catamarcense, or is it P.andreaeanus, or pachacoensis, or sanjuanensis? In Ritter's flower section of P.catamarcense from Potrerillos the stamens do not cover all the internal surface of the tube.

. . . from P.H.Sherville

My plant of Pyrrhocactus umadeave v. marayesensis was obtained as graft from De Herdt. Although it is only a young plant, about 3 inches across, the body is pretty well enveloped by the mass of lengthy, upward-curving pale spines, just like the large imported specimens of P. umadeave that have been around. It produced only two flowers — they were quite small being only 16-18mm tall. You will see that the tube is completely covered by white wool. The golden-yellow petals are very slender and very numerous - you would think that there were four rows of petals. In section the flower has a most conspicuous urn shape. The wall of the tube is very thick for the size of flower; the exterior is a greenish brown, but most of the thickness is a reddish colour. Below the lowermost stamens there is a short, narrow, and almost cylindrical gap between the style and the tube wall — presumably this is the nectar chamber with what looks like protruding nectar glands. The lowermost filaments start just where the tube widens out abruptly; the filaments are packed tightly alongside each other from there to half way up the wall of the tube; the outermost filaments are probably somewhat shorter than those in the middle, because the majority of the anthers are all at a similar level, whilst the anthers on the innermost stamens are at a distinctly lower level. The stigma lobes are very long for the length of style, being clasped tightly together and held above the lower anthers.

. . . from D.W.Whiteley

The slides of P.Sherville's "P.marayesensis" is not this species, but I believe that it is the P.bulbocalyx/strausianus of cultivation. I had what I believe was a P.marayesensis and it had pitch black spines like the photo in Backeberg's Kakteen Lexikon.

. . . from J.Lambert

The plant which P.Sherville obtained under the name of P.(umadeave v) marayesensis definately does not belong to this species. Indeed he describes "upward curving pale spines" and "golden yellow petals". The true P.marayesensis has black to violet spines. You may indeed recollect that at the Chileans' Weekend when I showed a slide of this species, I called it a "black beauty". And the flowers are pinkish white. So that the Sherville plant is probably P.bulbocalyx. This sort of thing does happen and plants are often offered under incorrect names in nurseries. I myself bought a plant under the label "P.umadeave v. marayesensis" at Hovens at Lottum, only to find out afterwards that this one, too, was P.bulbocalyx!

. . . from R.Ferryman

If you care to look at Fig.352 on p.685 of Backeberg's Kakteenlexikon you will see a plant with a heavy armament of greyish black spines together with what appears to be a pinkish white flower, which is called Pyrrhocactus umadeave v.marayesensis.

. . . from H.Middleditch

Most fortunately I have not only flowered three different sorts of Pyrrhocactus but I have also taken slides of the flowers and flower sections. My plant of P.bulbocalyx was obtained from the Dodonaeus and is still on a graft; but I am astonished by the general similarity of the flowers on my own plant and those of his P.umadeave v. marayesensis put on slide by P.H.Sherville. On my plant the large number of petals make it look like a "double-double" flower; it is extraordinarily difficult trying to count the number of petals but there are about eighty. On one flower they have got a most peculiar swirl to them. Only the outermost petals are fully reflexed, the next ones less so, the innermost being but partially reflexed. Stamens and stigma are basically as described by P.H.Sherville.

However, it is possible to pick out certain differences between my own flower sections and those taken by P.H.Sherville. On my flowers the tube is still a very distinctive urn shape but just slightly less pronounced than the flowers on P.Sherville's plant; the flower section for P.bulbocalyx in Buxbaum's Die Kakteen is a good match for the flower section on my P.bulbocalyx, whilst the flower section for P.strausianus (Ibid) is a good match for the flower section of P.Sherville's "P.umadeave v. marayesensis". On my flower the tube wall is not quite as thick and is more pinkish than reddish, compared with P.Sherville's flower; also there is rather less wool on the outside of the tube - it is more like Fig.271 in Vol.2 of Ritter's

South American Cacti. The flower on P.Sherville's P.umadeave v. marayesensis is possibly even more woolly than that of P.bulbocalyx Fig.3398 Backeberg Die Cactaceae (also reproduced in his Kakteen-lexikon); it is probably comparable in woolliness with Fig I "P.bulbocalyx" in Buxbaum's Die Kakteen. But without the labels and with the flowers you would be excused for taking my P.bulbocalyx as identical to the Sherville umadeave v. marayense.

Also coming from the Dodonaeus was a plant labelled P.dubius. The intercostal grooves are quite acute and markedly sinuous, but there is no cross groove between areoles and only a slight saddle to the ribs. From above, the flower has a quite orthodox appearance. The inner petals are creamy yellow, the outer row also being the same colour but with a brownish-red midstripe fusing sideways into the yellow. All with a blunt, faintly denticulate top, with a very small point. The transition sepals are brownish-red with margins tinged yellow, the lowermost having a slender, tapering point. Including the short outer sepals, there must be a total of well over eighty petals altogether. These may be seen before the flower opens as a mass of overlapping pinky-brown sepals with pale margins which cover the top of the bud.

The tube and scales are a very dark green against which the little slim, pointed, pink tip to the scales stands out very clearly. On the tube there are about seven scales to a spiral and about seven or eight spirals, so it is hardly surprising that the tube looks as if it is generously furnished with scales. There is some short white wool in the axils of the scales; only at the top of the tube are some of these woolly hairs long enough to reach to the adjacent scale. The wispy hairs in the axils of the transition scales are not bristly. The flower section is urn-shaped but not very pronounced. In consequence the filaments are inserted on a steeply-sloping wall and as they are also much of a similar length, there is a funnel of anthers. The stigma is not immersed in the anthers and the stigma lobes are loosely clasped together. The interior wall of the tube is entirely creamy-yellow.

This plant flowers pretty regularly and often sets fruit without help from me, but probably small flying visitors do help. The fruit is orange-shaped, about 8mm across, almost black in colour, smooth and shiny, with a few tiny areoles. No elongation whatsoever takes place and eventually the fruit dries up. If this sort of fruit is indeed typical of Pyrrhocactus then it is certainly distinct from that on Neochilenia. I also have the impression that the number of scales and petals exceeds that found on any Neochilenia.

Yet another Pyrrhocactus from The Dodonaeus came as Sp San Juan. I had my suspicions about this plant for quite some time. because quite a number of the 40mm long black spines had a sharp curve or hook at the end. Again the flower is more funneliform but still slightly urn-shaped. The wall of the tube is yellowish, only the lower half being green externally. The petals are a pale yellow, the upper parts of the exterior petals also having a central pinky brown infusion, all blunt, denticulate, with a tiny pointed pink tip. The outermost sepals are shorter, narrower, still yellow with a pinky-brown midstripe. There could be about thirty petals and about fifteen sepals, distinctly less than the two foregoing spp. There are very few elongated, brownish, upper scales; most of the scales on the tube and ovary are small (as on the two foregoing spp) slim, pointed, brown, with an emerald-green stripe below each scale, whilst on the upper half of the tube this stripe is yellowish-green. Lower scales with short buff coloured wool in axils, less woolly above but with long wispy brown hairs, longest at the top. Lowermost areoles on tube and ovary very definately have short, bristly, projecting spines. Filaments inserted roughly up to half way up the wall of the tube, anthers form a funnel; upper part of tube bare of filaments. Stout style, stigma lobes carried above anthers, long, spreading half open, twisting somewhat.

The form of the stigma on this flower was rather surprising as it was somewhat reminiscent of the spreading stigma lobes on an Eriocactus, or Notocactus horstii, or Gymno. lafaldense. Although I had no recollection of seeing a stigma like this on any of my Neoporterianae, they carried plenty of flowers through the season so they were examined in turn to see if any of them did sport lengthy,spreading stigma lobes. On Thelocephala the stigma lobes do not remain bunched tightly together, but on none of the Neochilenia did I find stigma lobes other than bunched either very closely together, or standing only just apart, loosely, in a club shape.

What really surprised me was the differences in these flowers for a genus with so few reported species. Are there variations in the fruits too? And what about the seeds?.

. . . from R. Ferryman

The flower formation on your Pyrrhocactus sp. San Juan is not unusual amongst Pyrrhocactus sensu Backeberg. The concept of a short, squat, bulbous flower as being typical of Pyrrhocactus is probably based upon those such as P.bulbocalyx which are more common in cultivation. The Pyrrhocactus sp. San Juan in question probably falls within the compass of the type species i.e. P.strausianus; or if one wishes to take a narrower concept of a species it corresponds well with Backeberg's P.sanjuanensis. Personally I regard these two as one and the same and would also include under P.strausianus the names of P.pachacoensis R556 and P.villicumensis R555, together with the plant which has come into cultivation as Pyrrhocactus ST128 from Cacheuta. All these "species" are from San Juan, whilst P. strausianus also comes from Mendoza. The stigma formation on the plant flowered by H.Middleditch is very interesting. I can not recall ever seeing this feature amongst the Neoporterianae. A quick but fairly thorough check through some slides does indicate that this is very uncommon.

. . . from J.Lambert

Most certainly I cannot agree with the suggestion by R.Ferryman that P.villicumensis should only be a form of P.strausianus! (I would not know about P.pachacoensis, but this also seems doubtful), As I said before, P.villicumensis is a dwarf species, which does not become columnar with age as does P.strausianus; its flowers are less beaker-shaped and more funnel-shaped, and its seeds are not coated with a wrinkled cuticle. On the other hand, a Pyrrhocactus ST-128 from Cacheuta may well be either P. strausianus or P.atrospinosus. These two species are very closely related and sometimes difficult to distinguish. The spination of P.strausianus is of a lighter pinkish grey, as opposed to the blackish grey spines of P.atrospinosus; also on P.strausianus the scales on the floral tube are hyaline to yellowish, with a red tip, as against the dark green with a brownish tip in P.atrospinosus.

. . . from H. Middleditch

I must admit to being rather puzzled by the comment from R.Ferryman that both P.pachacoensis and P.villicumensis could be accomodated under the old name of P.strausianus. Perhaps a comparison of some features from the original Rausch descriptions may be advisable?.

. . . from K.u.a.S 25.12.1974

P.pachacoensis; body 100mm tall and 80mm diameter, pale grey-green. Flower 35mm tall by 35mm across; ovary green with small green scales and pale brown hairs. Tube broad funnelform, yellow-green with yellow-green scales that end in a brown papery like tip; the scale axils carry pale brown wool and long brown bristles. Outer petals lanceolate, curved outwards, pale yellow with reddish brown midstripe. Inner petals lanceolate, denticulate, dirty pale yellow with wine-red midstripe and tips. Throat, filaments, stout style and 8 stigma lobes all yellow. Fruit barrelloid, 8mm tall by 5mm across, reddish brown.

. . . from K.u.a.S. 26.4.1975

P.villicumensis; depressed globular body up to 70mm diameter with a short post-like root. Epidermis pale grey with pronounced coat of rime. Flower 35mm tall by 30mm across. Flower tube at first narrow then broadening out like a goblet, orange brown with red scales, white wool and brown bristles; outer petals narrow lanceolate with long slender tips, brownish pink with darker tips, inner petals narrow lanceolate, pale ochre colour with pink midstripe. Throat about 10mm long, brownish, of which about 3mm forms a pink nectar chamber. Fruit spherical, 12mm diameter, dark brown, occasionally with white dots.

. . . from H.Middleditch

From these two descriptions we appear to have a distinct difference in body size at maturity, a difference in habit, together with a funneliform flower on P.pachacoensis and an urn shaped flower on villicumensis. These differences alone would make it difficult to put P.pachacoensis and P.villicumensis under one species name, even without worrying too much about the differences in petal colour. Now as to my Pyrrhocactus sp. San Juan, this has a funneliform flower and can thus be compared with P.pachacoensis. It would be possible to claim that the inner petals on my flowers were without a reddish midstripe, or that Rausch does not mention any very short projecting bristly spines on the lowermost areoles. But it must be accepted that this Rausch description for P.pachacoensis is not a bad fit for the flower on my own plant of P.San Juan. Without any contrary evidence, it is difficult to disagree with the observation by R.Ferryman that P.sanjuanensis and P.pachacoensis are virtually indistinguishable.

It is interesting to see that in his description for P.megliolii R359, Rausch states that the body has a pronounced waxy bloom. It also has an urn-shaped flower and from the photograph in K.u.a.S it can be seen to have a fair number of narrow, pointed, petals rather similar to the flower in the original Rausch publication of P.villicumensis. Certainly P.megliolii grows elongated whilst P.villicumensis remains small, but on the basis of the urn-shape flowers and the waxy bodies I would have thought that P.villicumensis had more in common with P.megliolii than with P.pachacoensis.

In the original description for Echinocactus sanjuanensis, Spegazzini states that the body is subglobose, dark dull green at first then becoming dingy grey. The body is further stated to be 80-90mm diameter and height but the "habit of the species nothing like approaches E.cinereo Ph."; this is followed immediately by details of the spination. From this comment it may be inferred that it is the spination which differs between Copiapoa cinerea and Spegazzini's E.sanjuanensis, whilst presumably the body will have a waxy coating similar to C.cinerea - or otherwise why did Spegazzini refer to this name in relation to the habit of his Echs.sanjuanensis? Of course my own plant of sp. San Juan is not likely to produce a wax coating in cultivation, but the spines are too long (not just too long) to meet Spegazzini's description for E.sanjuanensis.

Here we have Spegazzini laying emphasis on the waxy coated body of species sanjuanensis. The body of P.villicumensis is not just stated by Rausch to be glaucous but to have a pronounced waxy bloom; similarly for P.megliolii. This is a feature I would not normally associate with Pyrrhocactus from Argentinia, nor the thick post-like root quoted for P.villicumensis. Then there is the question of the maximum height to which the columnar spp grow — Ritter suggests that Spegazzini's figure of 50cm tall for P.catamarcensis is not found in the wild. Might we obtain some advice on these points from those who have collected a number of these plants in the wild?.

. . . from J.Piltz

The tallest plants of Pyrrhocactus that we have seen were at Cuevas del Chaco on the Cerros Colorados, where they would be up to about 50cm high.

. . . further from J. Lambert

There are indeed more greyish forms like P.villicumensis, P.megliolii or even P.atrospinosus which do have a pruinose epidermis, but rather moderately so in my opinion. They are not as heavily pruinose as Rausch's descriptions would lead one to suppose. As to the columnar shape of adult plants, this is observed in most southern spp., (a feature which links them to Austrocactus) whilst the northern forms — P.umadeave, P.catamarcense, P.bulbocalyx - remain globular, even at an advanced age. The dwarf P.villicumensis also never becomes columnar. Heights which I observed in the wild were 25cm in the case of P.sp.JL-89 and 50cm in the case of P.megliolii.

I have not sliced any flowers yet, but it is indeed correct that they vary from urn-shaped e.g. P.bulbocalyx to campanulate or funnel-shaped. Some of the latter open quite broadly, e.g. P.villicumensis, which links them more to the Chilean forms. It is also correct, as stated by Ritter, that the tube of the southern spp bears more bristles than the northern spp. I did not study the fruits in detail. However, they are generally subglobose to barrel-shaped, green at first, then becoming more reddish, brownish, or purplish on ripening. Quite typical is their basal annular dehiscence i.e. they burst open through a ring at the bottom (again a character that they share with Austrocactus).

It would appear that we must now accept that Spegazzini mixed up two different species under his Echinocactus catamarcensis (not an infrequent occurrence in early descriptions); the northern species with the light green epidermis and heavy spination, which he called var. pallida, and the southern species with the darker body and less spination, which he called var. obscura. The mistake made by Ritter was that he did not recognise the existence of these two different

spp and hence followed Spegazzini by continuing to consider them as only two varieties. For geographical reasons it seems appropriate to apply the name P.catamarcensis to the northern species, which is also justified by the fact that the var.pallida is the first named. The variety obscura then becomes invalid, and would be put into synonymy with the later described P.atrospinosus. However, if one refers to the rules of nomenclature I believe that the southern species would have to be named P.obscura! (See article 53.1 for the retention of P.catamarcensis and recommendation 61.A.3 for the use of P.obscura). When Ritter says that the name catamarcensis was ill-chosen because "there are no Pyrrhocacti in Catamarca" this is a bit of pettifoggery. Indeed, Santa Teresita, where both J.Piltz and myself found P.catamarcensis, lies practically on the border between La Rioja and Catamarca, whilst the location given by Vandenbroeck i.e. the lower slopes of the Sierra Famatina when coming from Belen, is also very close to the border between these two provinces.

. . . from H.Middleditch

It is quite possible that the Pyrrhocactus found near Mazan are something other than P.catamarcense, since this is probably outside the distribution area of the "pre-andean arid rocky hills" given in the original description for this species by Spegazzini.

. . . from Britton & Rose "The Cactaceae" III p.197

"Echinocactus catamarcensis Spegazzini. We know this species chiefly from the original description and photograph obtained by Dr. Rose in 1915 from Dr. Spegazzini. To it we have referred a living plant collected by Dr.Ales Hrdlicka in Argentina in 1910, which has flowered with us on one or two occasions.

. . . from H.Middleditch

The plant living in 1910 is hardly likely to be around today, but the New York Botanic Garden may have put flowers or other material into their herbarium. This may help to determine whether the flower is funneliform or urn-shaped (not covered by the original description) and also afford amplification of other features.

. . . from New York Botanic Garden

I checked our herbarium and found no specimens of this species, just some old photographs of plants in pots that are not good enough to answer any of the questions you posed. I then asked the people in charge of living collections if they had any plants of this species that were still alive from Britton's day. They checked their records and came up with nothing under this name or under any of the synonyms they could come up with.

. . . from H.Middleditch

Very fortunately I have in my possession a set of notes used by J.Lambert to present the slides of his trip to mid-west Argentina to our Chileans' Weekend, as well as a JL Field number list. It is rather puzzling to find one or two instances of the selfsame field number for a Pyrrhocactus with one species name in the travellogue notes and a different species name in the field number list. Is there some reason for this? For example it is quite puzzling to see that JL-104 is not named P.strausianus even though it comes from Barrancas de los Loros which is probably the Type locality for this species.

. . . from J.Lambert

The discrepancy between the names used in my lecture and those given in my field number list is due to corrections which were brought about after observing flowers on collected plants in my greenhouse. Some plants which I had taken at first to be P.melanacanthus did indeed prove to be atrospinosus; I did not find any melanacanthus at all. In the case of JL-104 I decided in favour of the name P.atrospinosus not because of the flower shape, but on the fact that the scales of the floral tube were dark green with a brownish tip, instead of hyaline to yellowish with a red tip. I do have some plants which I consider to be P.strausianus but although they are the same size as my atrispinosus, they have not flowered so far. Of course, this means that I have not had an opportunity to check the colour of the tube scales!

Here is a list of all the species of Pyrrhocactus which I collected, with their field numbers and origins:-

| | | | |
|---|---|---|---|
| atrospinosus | JL86 Near Tupungato | strausianus | JL92 Nr. San Rafael |
| | JL88 Near Tupungato | | |
| | JL94 Cuesta de los Terneros | | JL96 Rio Malargue |
| Terneros | JL104 Barrancas de los Loros | umadeave | JL153 Puerta Tastil |
| sp | JL72 Marayes | villicumensis | JL77 Termas de Talacasto |
| catamarcensis | JL17 Santa Teresita | | |
| megliolii | JL73 Marayes | sp. | JL89 Manzano |

Pyrrhocactus sp. JL-89 was considered different because it bore some hooked spines; however, this may be a juvenile characteristic so that it may turn out to be another P.atrospinosus. This plant has not flowered up to the present time. Besides the foregoing, I observed and photographed a couple of forms which I did not collect, namely P.(umadeave var.) *marayesensis* at Marayes, and a *P.cf.sanjuanensis* on the Llanos de Chita.

I have collected seeds from three species of Pyrrhocactus so far. All these seeds have the typical shape of a small snail. One of these, JL-77 P.villicumensis, presents a black, more or less shining, verrucose testa, whilst in JL-86 P.atrospinosus and JL-104 P.strausianus the seeds are covered by a wrinkled, chocolate to greyish-brown envelope. Slides of these seeds have been made by F.Fuschillo. Both JL-86 and JL-104 bear a resemblance to the seeds of Austrocactus patagonicus collected by L.Theys between Puerto Madryn and Trelew. In his descriptions, Rausch mentions "remnants of an arillus" in several species, thus for example in P.pachacoensis: "Seminibus.... atro-fuscis, tunica arillosa relique tectis". In other species, as P.megliolii, the seeds are said to be "a shiny violet-black".

. . . further from H.Middleditch

A few years ago I showed several slides of Pyrrhocactus seed at the Chileans' Weekend. The seed had come from various sources, supposedly from cultivated plants. None of this seed matches the samples of seed collected by J.Lambert and put on slide by F. Fuschillo, so I came to the conclusion that the original slides would have to be written off as incorrect material.

The seed of Argentine Pyrrhocacti JL-86, JL-104 and JL-153 are, as J.Lambert observes, like a snail; to be precise, they are like a snail shell i.e. with a very oblique hilum. On the samples photographed there is usually some degree of ammonite-like undulation of the testa. None have a shiny testa. The hilum area is not as wide as the seed and occupies about two-thirds of the length of the "base" of the seed, or put another way, the length of the hilum area is about one third the length of the seed. The micropyle is separate from, but immediately adjacent to, the hilum. About one third of the base of the seed at the nose end is covered with testa; a keel is in evidence. The seed is very thin. All these characteristics are also to be found in Austrocactus seed, so much so that at first sight of seed from these Argentine Pyrrhocacti anyone could be excused for thinking that it was Austrocactus seed. But a check on available seed slides gives a length to thickness ratio of 3 to 1 for Austrocactus seed and 2.5 to 1 for the JL Pyrrhocactus seed.

There are some good sketches of seed in the Buxbaum-Krainz Die Kakteen; those of Neoporteria, Neochilenia, Thelocephala and "Pyrrhocactus" from Chile are, not surprisingly, a pretty good match for the Neoporterianae seed collected by R.Ferryman. The great majority of the Buxbaum sketches of Neoporterianae seed have an oblique hilum whilst there is only one with hilum basal; these relative proportions match the RMF samples of Neoporterianae seed from Chile. The Buxbaum sketches of seed of Argentinian Pyrrhocacti are a good match for the JL-86, JL-104 and JL-153 specimens collected by J.Lambert, in virtually all respects.

However, the seed of JL-77 P.villicumensis does not fall into this pattern, because the hilum is far less oblique than on the three foregoing JL Pyrrhocactus seed. In addition the testa on JL-77 is not an obscure grey-brown but lustrous black in colour with plainly humped testa cells, reminiscent of the Rausch description of the testa on P.megliolii. In addition, the hilum on JL-77 is circular with a large funicular aperture, similar to many of the RMF Neoporterianae seeds in tidiness of shape. It is quite evident that further seed specimens of Argentine Pyrrhocacti are an urgent necessity in order to establish whether we do indeed have two readily distinguishable forms.

. . . from R.Ferryman

I have one or two samples of Pyrrhocactus seed which I can send to F.Fuschillo for photographing. Of P.strausianus one sample was collected by and received from F.Katterman; another sample was collected by W.Jung; whilst that of Rausch 542 was brought by Vasquez when he came to the U.K.

. . . from H.Middleditch

It is just as well that I did not throw away my old original slides of seed of Pyrrhocactus Berger. They do have an affinity with the seed held by R.Ferryman. In comparison with the JL collected seed, the R 542 P.strausianus has a far more well-rounded outline, length only some one-third more than thickness, the testa is black, fairly glossy, with distinct outlines of individual testa cells, without wrinkles, a relatively large hilum area, and only a vestigial nose. There is a band of finer-meshed testa cells immediately above the hilum area and I am very suspicious that the portion of the seed so enclosed is a hollow strophiole. The seed of P.bulbocalyx has much in common with the R542 but displays a more distinct keel and lacks the hollow strophiole.

Different yet again is the seed of P.andreaeanus which appears to have a glossy black testa with a reticulate cell pattern, almost entirely covered by a thin grey membranous coating. The hilum is only slightly oblique, the hilum occupying barely one third of the length of the base of the seed.

It probably needs to be emphasised that there is a far greater range of variation of seed form within Pyrrhocactus Berger than in Echinopsis, or in Lobivia, or in Notocactus, or in Matucana. Indeed there is as wide a variation in seed form within this compact group of Pyrrhocactus as there is to be found in Gymnocalycium or in Parodia.

. . . from Prof. Dr. W.Barthlott

We have analysed several species of Pyrrhocactus and found that their seed coat micromorphology and general seed morphology is most close to Austrocactus. Indeed your own seed slides of Austrocactus and and Pyrrhocactus JL-104 demonstrate that they are of the same type. Doubtless also the seed coat microstructure is identical; heavy cuticular fold patterns.

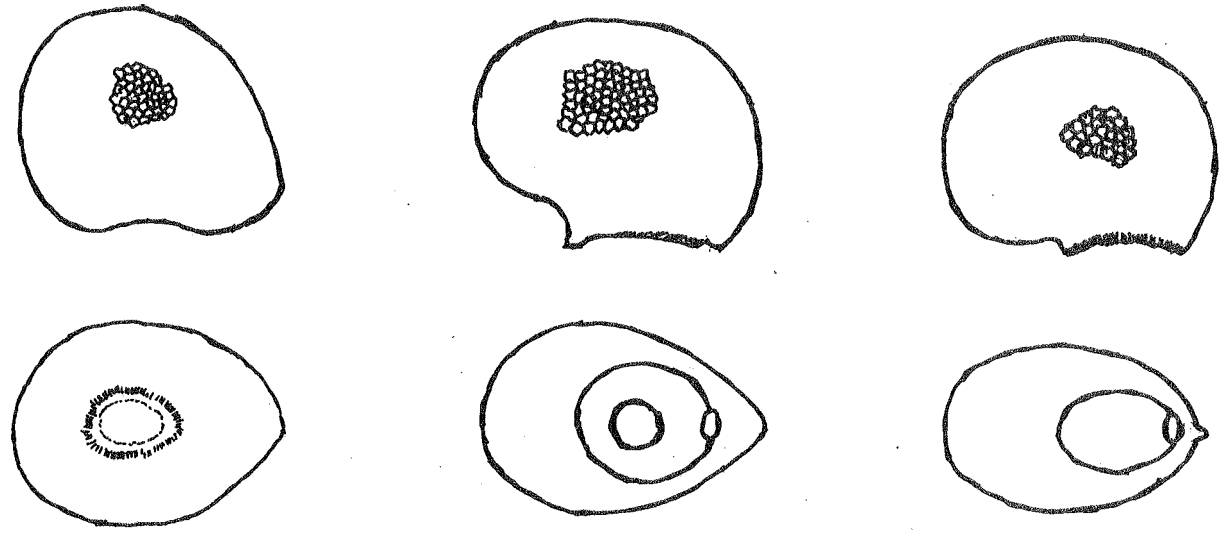
I may add that Austrocactus, Neowerdermannia, and Neoporteria together with Eriosyce form a most closely related group of plants with the same seed type, although naturally there are some variations.

. . . from H.Middleditch

Very fortunately I also have 104 slides of seeds collected by R.Ferryman of Neoporteria, Thelocephala, and Neochilenia which enables these to be compared with the selection of seeds of Argentinian Pyrrhocacti. The seeds of Neoporterianae from Chile range from hilum almost basal (or seed symmetric in side view, which is the same thing) to an occasional example with hilum so oblique that it is almost on the "side" of the seed; the great majority lie between these extremes, but not close to the extremes. Many, but not all, have a prominent keel. None are shiny, so it is reasonable to assume that they would exhibit a wrinkled cuticle under an electron microscope. Quite a number exhibit a multiple hump-back or ammonite-like wrinkling of the testa coat. Virtually all specimens have a hilum area which is shorter and narrower than the "base" of the seed. The hilum, the scar at the previous place of attachment of the funicle, is separate from the micropyle but immediately adjacent to it; this distinction is quite clearly visible, in contrast to the majority of south american cactus seed.

Of the RMF Neoporterianae seed collected in Chile, none display a glossy black testa like andreaeanus. bulbocalyx, or R542. nor could they be mistaken for "Austrocactus" seed like JL-86, JL-104, or JL-153. If all these seeds were shaken up together, then from the Pyrrhocactus Berger only JL-77 P.villicumensis might be difficult to separate from the Neoporterianae.

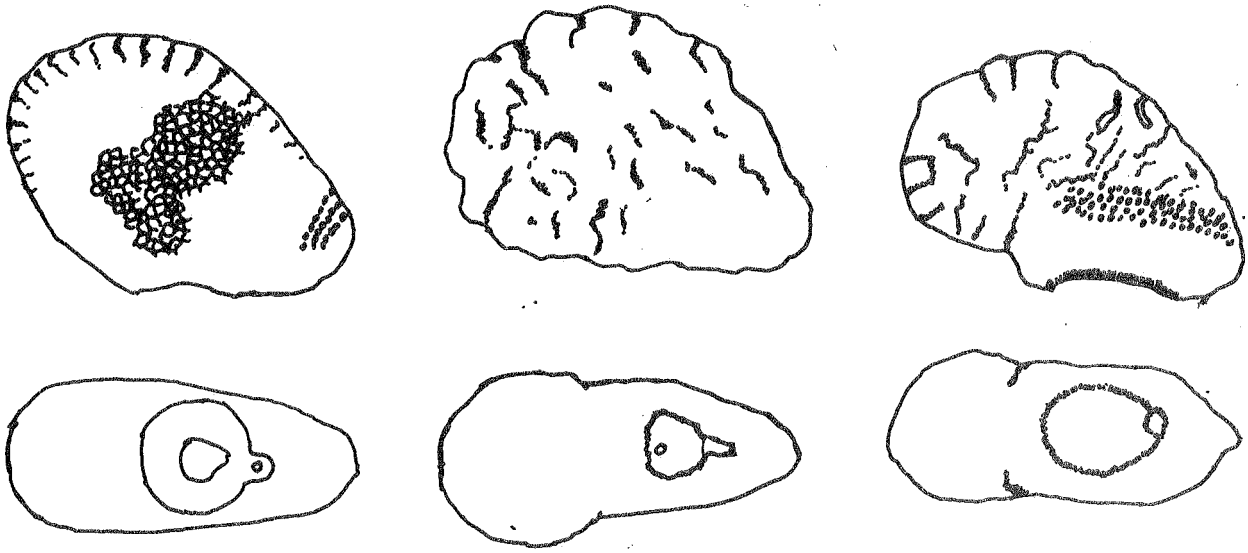
In addition there is no problem in separating the seed of P.andreaeanus (at least, the sample which I have seen) from the general run of Acanthocalycium seed, although it would be reasonable to suggest that of all Pyrrhocactus seed seen to date, that of P.andreaeanus most closely approaches that of Acanthocalycium. Of all reported locations of Pyrrhocactus, that of P.andreaeanus most closely approaches Acanthocalycium geographically, just as the southern Pyrrhocactus which are geographically closest to Austrocactus have seed like Austrocactus. Hence on the evidence which I currently have available to me, only some of the seed of Pyrrhocactus is similar to that of Austrocactus in general seed morphology and possibly in seed coat micromorphology. Most Pyrrhocactus seed does not match Austrocactus seed. To



P. ANDREAEANUS

P. STRAUSIANUS

P. BULBOCALYX



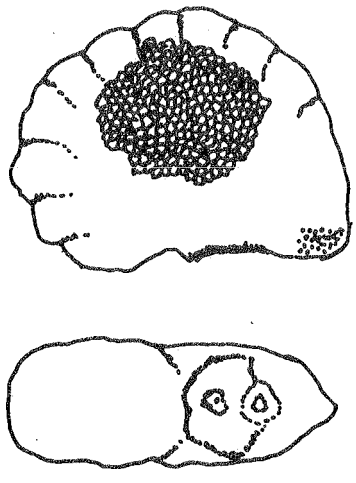
JL 77
Talacasto

P. UMADEAVE JL 153

P ATROSPINOSUS JL 86

PYRRHOCACTUS Berger

SEED




AUSTROCACTUS
PATAGONICUS

provide an even firmer basis for challenging the foregoing observations by W.Barthlott, it would be advisable to examine further examples of Pyrrhocactus seed,

. . . from R.Zahra

You would be able to obtain seed of eight different species of Pyrrhocactus out of the latest catalogue from Mesa Garden.

. . . from H.Middleditch

But would these be greenhouse produced, or habitat collected? And if the latter. would the P.catamarcense be from "the foothills of the Andes" sensu Spegazzini and Ritter, or would they be called P.strausianus sensu Rausch? Then we are still left with the many problems in associating a flower morphology with a specific name. The flowers of Pyrrhocactus Berger appear to have filaments inserted either in the lower third of the tube on urn-shaped flowers; or in the lower half of the tube on less markedly urn-shaped flowers; or (according to Spegazzini) for the full height of the tube. This is a fairly wide range of variation for a group of plants containing so few species.

The flower of P.catamarcense from Potrerillos, behind Mendoza, as illustrated in Fig.270 Ritter Vol.2, is similar to that on JL-89 from Manzano Historico in outline shape, number of scales, and tube wool. Do the flowers on JL-89 carry filaments only in the lower part of the tube, or almost throughout the length of the tube? Does Ritter's Fig.270, or JL-89, produce seed similar to Austrocactus, like the JL-86 from behind Tupungato, which is roughly half way between the two foregoing locations? Or do they produce glossy black bulbous seed like R542, possibly from Cacheuta-Quebrada del Toro? Is there a specific association between seed type and stamen disposition here?.

. . . from R.Ferryman

Not only the seed of Rausch 542 from the Quebrada del Toro, but samples obtained from this same locality by two further collectors, are all of the "bulbocalyx" type of seed. This location is quite close to Potrerillos from where Ritter shows us a flower which is certainly not the bulbocalyx type. This might suggest that there is not a specific association between seed type and flower type.

. . . from H.Middleditch

In dealing with Pyrrhocactus Berger in his Kakteen in Sudamerika, Ritter carefully avoids any reference to stamen disposition. Rausch is equally reticent over his P.pachacoensis. How are the stamens inserted in the Pyrrhocactus collected and now in cultivation by J.Lambert? The Buxbaum-Krainz "Die Kakteen" illustrates a slender urn-shaped flower for P.catamarcense with stamens inserted almost the whole way up the tube. Is this P.catamarcense sensu Spegazzini and Ritter, from northern Mendoza and San Juan? Or from another geographical location? Of the urn-shaped flowers of P.strausianus illustrated in Buxbaum-Krainz and in Backeberg, were any of them taken off plants collected at or near the original type habitat just NE of 25 de Mayo on the R.Colorado; or were they taken off the P.strausianus sensu Britton & Rose and sensu Rausch from the foothills of the Andes behind Mendoza?.

. . . from R.Mottram

Bear in mind that the sketches in Buxbaum-Krainz Die Kakteen were very probably made from specimens sent to him either press-dried or preserved in spirit. I am pretty certain that I have read somewhere a comment by Buxbaum that he received specimen flowers in spirit. It is difficult to avoid some degree of distortion when examining and sketching from such material. In any case, if this sketch of the flower section of P.catamarcense is examined very carefully, I think you will find that the stamens are inserted over about two thirds of the height of the tube. Both in this feature and also in the height at which the stigma is carried above the anthers the Buxbaum flower section of P.catamarcense is remarkably similar to Ritter's flower section of P.catamarcense from Potrerillos, Fig.270 In his Kakteen in Sudamerika.

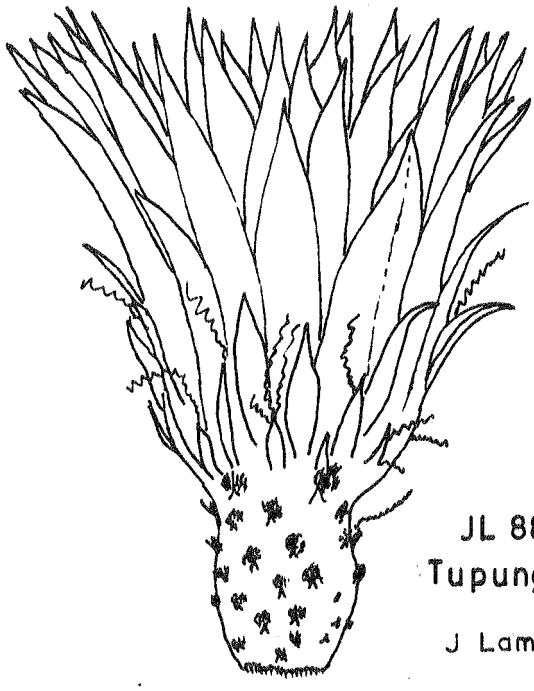
. . . from H.Middleditch

Do the flowers on the Chilean Neoporterianae have a consistent mode of stamen insertion? How does this compare with the variety of stamen insertion that occurs in Pyrrhocactus Berger? The relationships between Pyrrhocactus Berger on the one hand, and Austrocactus, Neoporterianae, and Acanthocalycium on the other, which can be discerned from the above appreciation would not appear to have been reviewed in previous literature. For any member with a flowering plants of these genera in their collection, there is a wide open opportunity here for making potentially valuable observations on flowers, stamen disposition and seed.

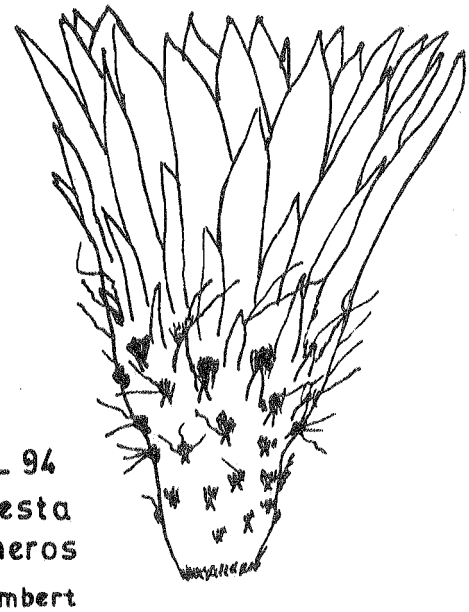
## MATUCANA WEBERBAUERI FLOWERS — From J. Arnold

When I lived further south, prior to 1972, I made frequent visits to Denis Sargant when he lived at Ventnor in the Isle of Wight. I must have gone every year between 1969 and 1972. It was during this time that he was receiving plants from Alfred Lau in south america and a lot of my more interesting plants were acquired at this time. On several occasions I was there as plants were being newly set out on the benches for sale — a quite remarkable sight. I would of course have bought many more plants had I both realised how interesting they really were and of course had I had the necessary resources.

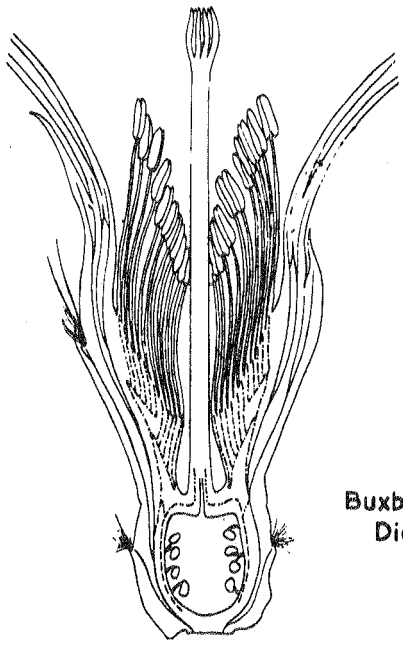
My Matucana weberbaueri Lau 218 was acquired during my visit I believe in 1970. The label had on it *Matucana weberbaueri Lau 218 Carrizal, Balsas, 1,200m.* The plant would have been about 2" in diameter then and densely yellow spines, becoming black at the base. There was no evidence of it having flowered in the wild. It took about five years for it to flower for the first time at about 4" in diameter. Certainly since then it has not proved difficult to flower. A year or two after the first flowering it put out offsets from just below shoulder level. As the main stem continued to grow, so did these side branches. In addition the main stem very gradually shrank in height below its junction with these branches, so that the plant now looks as though the three side branches have offset from nearly soil level. The main stem is still larger in diameter than the branches, but not markedly so. This mode of branching has also occurred one or two of my orange flowering weberbaueri, the v.flammea. My impression is that among the Matucana this form of branching is unique to these two species.



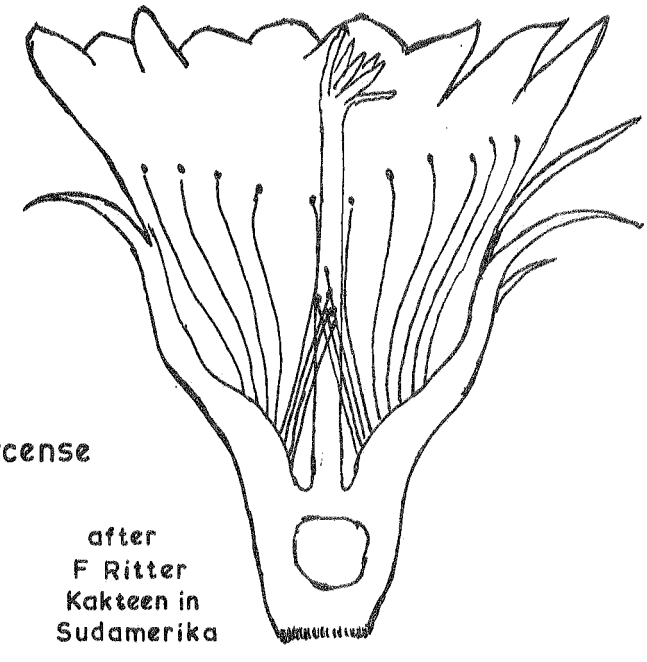
JL 88
Tupungato
J Lambert



JL 94
Cuesta
Terneros
J Lambert

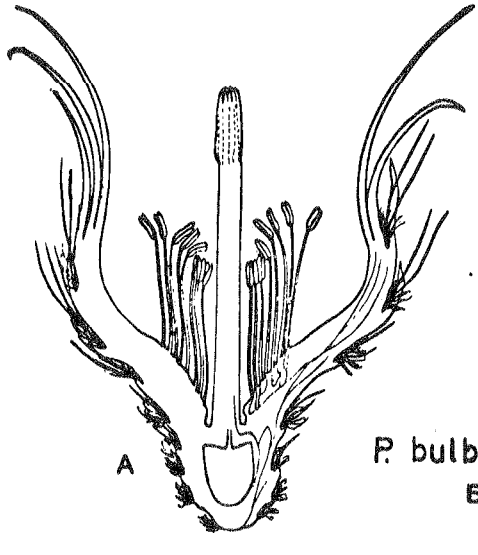


Buxbaum-Krainz
Die Kakteen



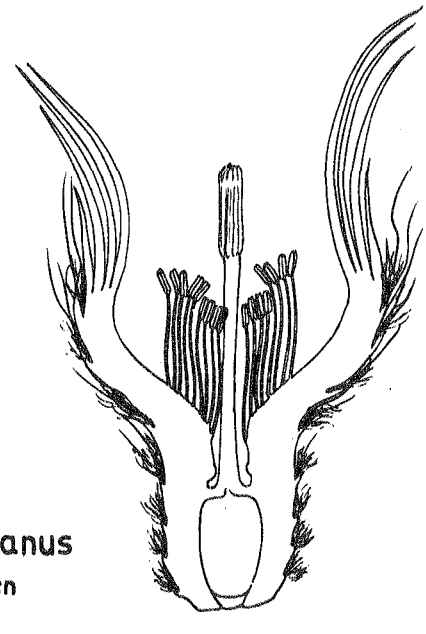
P. catamarcense

after
F Ritter
Kakteen in
Südamerika



A

P. bulbocalyx



P. strausianus

Buxbaum-Krainz Die Kakteen

For some years this plant has flowered on all four heads. Generally speaking flowering occurs from late June onwards until September or October and there can be several flushes. After the first flush of flowers it is usually about five or six weeks before the next ones appear. The flowers generally appear in groups from newish areoles, still developing, just away from the centre. It is usual (or average?) to produce four or five flowers at once although on one occasion I have had fourteen flowers open at once. The flowers are a lovely clear yellow without a trace of orange such as that found in Sulcorebutias. It is also not tinged by the orange or orange red that is to be seen in M.weberbaueri v.flammea. The flowers have a satiny sheen in full sun. They do not seem to be orientated in any particular direction and if there are a number of flowers out at once they usually face outwards all around the crown.

The flowers are quite large, held on a long medium to strong tube. The tube is yellow almost throughout its length, only where it joins the plant body is it more greenish. The spines on my plant are 1- to 2" in length, but despite this the flower itself is held well above the spines as the tube is quite long. The flower is zygomorphic, the petals at the back standing upright and those at the front folding downwards, which is of course the most common form in Matucana, Arequipa, Oreocereus, etc. When there are a number of flowers out together, they all face outwards so that the upright petals are towards the centre of the plant.

There is an excellent photograph of Matucana weberbaueri Lau 218 on p.101 of Ashingtonia and this shows a plant very similar to my own. As my plant is not in flower at the present time I have had a look at my slides of the flowers; these show the stigma lobes remarkably clearly. The stigma lobes are light green and short, I would say only 2mm long or even less. My slide shows them all to be bunched up together and not opened out to any degree at all. The photograph in Ashingtonia also shows this to be the case. The stigma lobes are only a mm or two above the level of the stamens. In fact the top surface of the anther seems to almost rest on the lowest part of the stigma lobe where it joins the style. In describing the v.flammea in Ashingtonia, John Donald says "The style is initially orange in colour becoming orange-rose or pink with a pale green 5-6 lobed 2mm long stigma just excerted beyond or level with the uppermost rose-pink anthers filled with yellow pollen" Much of this sentence would appear to apply equally to my var.weberbaueri.

Despite the closed stigma lobes I have set seed on my plant without difficulty so it is obviously no barrier to fertility. The fruit are a typical berry, drying out to a cage-like structure which allows the seed to escape. For very many years my yellow flowered plant was the only one that I had with that flower colour. It seemed that the yellow flowered one was uncommon and I saw very few on my travels. I was anxious to acquire another and over a period of about ten years I both purchased and grew from seed around about a dozen further plants under the names of M.weberbaueri or M.myriacantha, all of which eventually flowered orange and thus were v.flammea. However, some have only flowered in the last two years and are from seed from De Herdt. As they reach flowering size these have started to flower yellow — the same clear yellow, untouched by orange. I have seen the plants which produced the seeds in De Herdt's nursery and they are plants that he obtained from Alfred Lau as Lau 218. Of course De Herdt also imported plants from Lau and sold them. I can recollect his visit to Chatham in about 1971 when he brought with him for sale many fine plants, mostly from Lau and including many Matucanas and Oroyas. It seems therefore that as these seedlings become old enough to flower we may once again be able to acquire plants of M.weberbaueri which will produce this somewhat unusual pure yellow flower.

In my view Lau is the only person who has made this plant available commercially. The plants that Karel Knize has sent as M.weberbaueri under his field number KK.779 are all the v.flammea. I have several of these habitat plants and know of many more and they are all orange flowered. I do not therefore think that he has ever found the true weberbaueri. I do believe that Ritter came across the yellow flowered plant and possibly Munter as well. Both the orange and yellow flowering forms do flower easily and regularly which is more than can be said for some Matucanas.

. . . from Mr. & Mrs. T.Lavender

The plant on the front cover was in our collection for several years and flowered pretty regularly. The flowers were fairly slender, both tube and petals a pure yellow all the way up with a possible tinge of green at the foot. In a good year it would produce three lots of flowers. When it was in flower and there were two or three buds these would rarely grow and open together, and the flowers opened in turn over a period of several days. The flowers usually lasted for more than one day so that sometimes one flower would still be out when the next one opened.

Unfortunately this plant was one of the casualties when we moved our collection from Billingham and we were not able to provide a greenhouse for the plants for a few months.

. . . P.Allcock

Submatucana weberbaueri do bloom with uniformly pure lemon coloured flowers. To my eye the half-opened flowers look much more strongly zygomorphic than fully opened flowers, on account of the mouth of the flower being very oblique when it is half open; in that condition the petals at the bottom of the mouth of the flower are fully reflexed and the upper petals are either standing upright or initially even curved forward somewhat. The petals at the top of the mouth of the flower then become reflexed and the flower looks almost rotate. The flower tube does not stand straight upright but is slightly curved, which also helps to give the flower a partially zygomorphic appearance

The flowers on M.weberbaueri regularly come later in the season than weberbaueri v. flammea; they are often in bloom in August. Because there is more chance of dull weather later in the season the flowers on M.weberbaueri can stand for a day or two in the partly open condition, when they appear to be quite zygomorphic, and this can lead to the impression that the flowers are commonly of this form. It is also possible to get uncommonly short flowers when these appear very late in the season, say October time. The number of flowers that appear on Matucana does depend a great deal upon the age of the plant. Older plants produce many more flowers and M.weberbaueri is no exception to this.

At first glance the flower tube looks bare but if it is examined carefully it will be found that there are a few wispy hairs in scale axils. Internally the nectar chamber has prominent nectar glands, like those I first discovered on a flower of Arequipa, but I only found them in Matucana flowers after I started looking for them. They are also present in M.weberbaueri v. flammea. As usual in Matucana/Submatucana the lowermost filaments are fused into a diaphragm, but in weberbaueri it is a rather unusual cone-shape. In the v.flammea it is shaped more like an annular dish. Naturally the stamens overtake the

stigma during the life of the flower in the typical Matucana fashion.

The fruits are quite typical of those on other Submatucana. When it first sets the fruit is rather fatter than it is tall, the outside being what I would feel inclined to call corrugated rather than ribbed. By the time it has ripened the fruit is taller than it is fat, having taken on a rather inverted pear shape. It will then split down one or more of the corrugations. If an attempt is made to remove the fruit, the seed will spill out at a touch and even with an aspirator it is almost impossible to retrieve the seed from amongst the dense mass of spines.

. . . from H.Middleditch

There is an account by Lau in the U.S. Cactus and Succulent journal of his rediscovery of Matucana weberbaueri. He describes his descent into the Maranon valley towards Balsas from the east, during the course of which he also came across plants with a weberbaueri-like spination but with flowers of orange colour. These were subsequently named M.weberbaueri v.flammea. A day or two later Lau undertook a journey by mule along part of the old trail running from Balsas to Chacapoyas, when he found M.weberbaueri with the clear yellow flowers near a locality known as Carrizal.

The original descriptions of both M. weberbaueri and M.myriacantha were published in Engler's Botanical Yearbook, Supplement 3 for 1913, and I have these before me as I write. For the finding place of M.weberbaueri Vaupel gives: Department Amazonas, Province Chacapoyas, on the eastern valley side of the Maranon, above Balsas, at 2000-2100m, in a grassy steppe, here free of bushes, there with scattered bushes, in which only two sparsely occurring cacti were observed; Echinocactus weberbaueri Vaupel and Echinocactus myriacantha Vaupel. Weberbauer no. 4271. With flowers and fruit on the 25 June 1904. For the finding place of M.myriacantha Vaupel gives: Department Amazonas, Province Chacapoyas, on the eastern valley side of the Maranon above Balsas, at 2200m altitude, in a grass steppe poor in cacti. Weberbauer no.4272. With flowers on the 25 June 1904.

The description by Vaupel for the flower of M.weberbaueri states that "the flowers are from the vicinity of the crown, in large numbers, with a complete length of 5.5cm, tube and ovary being 3.5cm long, hairless tube with not many lanceolate scales. Filaments numerous, somewhat shorter than the body of the flower, anthers elongate, a good 3mm long. Style slender, as long as the stamens. Stigma lobes 5, barely 2mm long. Fruit oval, 13mm long, 7mm in diameter, furnished with small lanceolate scales. Seeds matt black, in shape somewhat comparable to a phrygian cap. Flower colour citron yellow."

On reading these details I am struck by the rather short height of the flowers. Are they like this in cultivation? At 3mm long the anthers seem to be pretty large, or perhaps I have gained this impression only because I have not yet put a ruler over any anthers on Matucana. To have stigma lobes shorter than the anthers does strike me as being rather unusual. And what shape were the caps worn by the Phrygians? Having a look at some seed of Matucana weberbaueri might answer that question. Or will it?

. . . from P.Allcock

I must say that I find a length of 3.5cm for tube and ovary to be very, very short indeed. Something like 5cm would be more like what I would have expected, unless it was a late season flower. Also the 2mm long stigma lobes does seem to be quite ridiculous; 5 to 6mm long is much more like the normal length. But again if it is a very late flower that is being described with an abnormally short tube, then possibly the stigma lobes may also be reduced. But having said that I must admit that I have not looked at this specific feature on late flowers.

. . . from P.A. Smart

Not long ago I came into possession of a plant of M.weberbaueri which I had ogled at each visit to the owner's collection and I was delighted to inherit it. The plant is an original Lau import, purchased I believe from Sargant. The height of the plant at about 9 inches or so is only attributable to its age. My other plants of Matucana weberbaueri will have to be of a similar appreciable age before they attain this height to judge by their very clow rate of growth. The tall plant certainly does have a flower of a clear yellow colour which stands almost an inch clear of the spines. When it was out in flower early in June I cut off one of the flowers and sliced it in half. I would say that the stigmata would be normal(ish) length for the genus, nothing like so short as to be shorter than the anthers. A stigmata of only 2mm in length would suggest a distorted or abnormal flower. My other plants of M.weberbaueri have similar pale yellow flowers, almost rotate, with light green buds and outer petals. The flowers are only very slightly bent on all the plants. The spination on my plants varies from ¾in. to 1in. in length.

. . . from H.Middleditch

It is most remarkable how similar to our front cover is the photograph of M.weberbaueri in Ritter Kakteen in Sud-amerika fig.1399, with its apparently rotate flower just proud of the spination and the short stigma held above the tips of the petals. Ritter observes that " Vaupel quotes petal colour as citron yellow, a change in colour on account of herbarium preparation?; my flowers had orange yellow petals with a tinge of purple at the margin and tip through which corresponding intermediate colours arise. There are also flowers with pretty similar coloration to M.myriacantha. Grows several hundred metres below the latter, in the same area, just as stated by Vaupel. The flower examined by me was 55mm long; the length of 35mm quoted by Vaupel will be an exception or refers to a dried flower. Vaupel states that the flower is hairless; that is not always the case, often some tiny white hairs are to be seen on the pericarpell and tube."

Contrary to Ritter's observation, Vaupel gave the length of pericarpell and tube as 35mm and the flower length as 55mm as may be seen from the original description, reproduced above. Before this particular point became quite clear to me I certainly had to read Vaupel's wording carefully, twice, but time can be at a premium when undertaking a four-volume cactus book. The flower colour quoted by Ritter seems to be more like that which we would associate today with the v.flammea, so it would appear that Ritter has not come across the clear-yellow flowered sort. Would "intermediate colours...between orange-yellow..and purple" include the "pinkish" flower colour given by Vaupel to myriacantha? Did Ritter indeed find Vaupel's original myriacantha?

Now Vaupel, again from the original description, gives for weberbaueri spines 4cm long on flowering crowns, older spines 2cm long; thus we have 4cm long spines with a 5.5cm long flower i.e. only the petals above the spines. For

myriacantha Vaupel gives uppermost radials up to 13mm long, centrals up to 8mm long, flower 6cm long, and in addition Vaupel briefly observes that the spination is shorter and less robust on myriacantha than on weberbaueri. This conveys an impression for myriacantha of spines two or three times shorter than the flower; this relationship is very clearly reflected by Ritter's photographs of myriacantha in Kakteen in Sud-amerika (Figs 1395 & 1396) where the flower stands tube and petals above the spination.

. . . from P.Allcock

The flower in Ritter's Fig.1396 is what I would expect to see on both weberbaueri and v.flammea, with a curved tube. I would also say that the flower in Fig.1399 is abnormally small. If it was the usual height then it would make the areoles huge and very widely spaced. Although the length of spination on both species and variety is very variable, I must admit that I have never seen any plants with spines as short as those in Ritter's Fig.1396.

. . . from A.W.Craig

The plants of M.weberbaueri that I have acquired have all turned out to be v.flammea when they flowered. However I have acquired from J.D.Donald the plant which I understand he used as a basis for his redescription of M.myriacantha. Certainly the plant is densely covered with spines round about half inch long and the flower is definately pinkish as opposed to orange, so in those respects it can be said to fall in line with the original description of this species by Vaupel; but the location given by J.Donald for this plant is hundreds of miles away upstream from the site of M.weberbaueri. I feel we have to look elsewhere for Vaupel's myriacantha. If there are plants with yellow flowers and with brownish-orange flowers from the same area, and Ritter says there are also purple-tinged flowers as well as "in between shades", what prevents Vaupel having described one of these as pink?

. . . from P.Allcock

I am quite certain that Vaupel's myriacantha is not at present in cultivation and has never been rediscovered. Ritter's so-called myriacantha is weberbaueri v. flammea. Even the clear lemon-flowered weberbaueri has been rediscovered by very few collectors. It looks as though Knize never found it, since his so-called weberbaueri are the v.flammea, one and all have brownish-orange flowers with no hint of yellow. The account given by J.D.Donald in Ashingtonia has never really been satisfactory to me.

. . . from H.Middleditch

In regard to M.myriacantha the pink colour of Vaupel's flower might just be acceptable on the evidence of Ritter's comments on flower colour; the hairyness of the tube could be regarded as over-emphasis by Vaupel of a character which appeared to be lacking in weberbaueri. By comparison, it is decidedly difficult to accept that Vaupel made an error in stating (not just once) that both weberbaueri and myriacantha grew fairly close to each other.

## LOOKING for WHICH TEPHROCACTUS? from R.K.Hughes

During my trips to Peru I was able to visit the town of Puno which lies on the westernmost shore near the northern end of Lake Titicaca. From here my method of looking for cacti was quite simple - just a matter of walking out of the town to the south and going uphill, between the cultivated fields on the lower parts of the slope, then following the rocky outcrops up the steeply sloping hillside, There were clumps of Lobivia with some mounds of Tephrocacti among them scattered across the hillside, which blended in with the low rocks, the low tufts of grass, and the dwarf bushes which were only about six inches high. The Tephrocacti increased in numbers where the ground was much flatter beyond the top of the sharp drop which fell to the level of the shore.

The clumps of Tephrocacti were mostly between one foot and 1½ft. in diameter, with the segments tightly packed in a roughly hemispherical mound. Individual segments were more ovoid than spherical, with a matt grass-green epidermis, with upward and outward pointing spines, but with no spines on the lower areoles. There were fruits on some of these plants which were similar to the segments except for the hollow top instead of a growing tip. There was a large clump high up on the hillside which was about two feet in diameter, the segments being 3in. to 4in. long and 1-in. in diameter, with brown spines about 1in. long on the upper areoles only, pointing upward and outward.

Only a short journey from Puno across undulating country brought me to Sillustani, the site of a pre-Inca burial tower. This fairly level hilltop site was on a peninsula jutting out into Lake Umayo. It had the appearance of an island connected by a causeway and was largely covered with grass which was grazed by cattle. Here again there were clumps of Lobivia and Tephrocactus similar to those found near Puno. The smaller clumps of Tephrocactus were hemispherical but the larger clumps were rather more flattened to almost mat-like. The segments were tightly packed, about 1in. in diameter by about 3in. to 4in. long, with upwardly pointing sharp yellowish spines some 1- to 2in. long. Several plants carried orange flowers; there was a single red flowered plant. Some yellow segments without a growing tip proved to be fruits, which had thick walls and a dry interior with seed closely packed. There was one plant with heavier brown spines rather than yellow, also the seed pod was reddish. I removed a fruit, cut it into half section vertically and took a slide of it. From the seed brought back with me on my first visit there, when I knew almost nothing about Tephrocacti, I had 14 germinations that developed into plants. Two have since been lost and one seems reluctant to grow but the rest fill 3- and 4- inch square pots.

From Puno I travelled over to Arequipa from where I took a trip by minibus to the upper reaches of the R.Colca, right in the heart of the mountains. After passing between the volcanoes Chachani and El Misti at about 4,200m, the road continued across the Pampa de Canahuas. The vegetation here in the form of tussocks of grass and small bushes was about waist height, all sprinkled over bare earth which was dry, pale grey, and very light in weight - probably volcanic dust. The early morning sun caught splashes of a brighter colour amongst the otherwise dark grey puna vegetation. They were Tephrocacti, a mass of yellow to red-brown spines about two feet in diameter. These clumps were closer to being spherical in shape rather than hemispherical. The somewhat eggshaped segments were about 1in. in diameter by 2in. to 2-in. long, with a blue-green shiny skin. The outermost segments were closely packed and all radiated outwards as if from some central point. The areoles at the outer end of each segment carried spines that were roughly equal in length to the segment and also radiated outwards. This armament of strong, slender, outwardly directed spines was backed up by tufts of long, fine, glochids

in the areoles, making them quite hazardous and only to be tackled with caution. There were some joints with a depression in the crown and few spines, which were recognised as fruits, the hollow being the floral scar. With difficulty some joints were collected as well as some fruits and seed was extracted from the fruits. The interior of the fruit was dry, just the same as that on the plants from Puno and Sillustani.

Going further north along the same road it crosses the Arequipa-Juliaca railway line between Pampa de Arrieros and Sumbay. The road then starts to rise to an even harsher climate, very bleak, with large bright green rounded hummocks of the Yareta, a resinous plant used as fuel by the local inhabitants. On the descent towards the Colca canyon we stopped where a lookout had been constructed for tourists to get a view of the heavily terraced valley and the town of Chivay at its centre. The steep slopes around the lookout had a covering of shrubs, grasses and herbaceous plants together with some bushes of Opuntia exaltata. Walking among this vegetation I came across a small Platyopuntia and another Tephrocactus. This Tephrocactus formed a very irregular and straggling clump half-hidden in the undergrowth. Again the joints were elongated egg-shape but larger than those seen on the Pampa, and this time with a matt grass-green skin and virtually spineless. The tufts of glochids were even larger and of course appeared far more prominent. The fruits were similar in cross section to those from Puno and Sillustani, dry internally.

As to identification I would regard all these plants as forms of T.dactylifera or as pentlandii v. dactylifera.
. . . from H.Middleditch

Considering the identity of the Tephrocacti found by R.K.Hughes to the north of Arequipa; under the title of Opuntia (Tephrocactus) ignescens (Englers' Botanical Yearbook 1913, repeated in M.f.K. No.24 1914) Vaupel describes a cushion-like plant formed of numerous branches, hemispherical to spherical, up to half a metre high. Although I have not read every line of every description of Tephrocactus spp., I have looked at quite a few and so far I have not come across any other Tephrocactus which is described as having a clump or cushion of spherical (or globular) shape. The photograph which I have before me was taken by R.K.Hughes on the Pampa Canahuas; it is of a Tephrocactus hummock which is broader at a point some way above ground level than it is right at its base. This habit is apparently characteristic of the plants in that locality.

Vaupel goes on to say that the segments of T.ignescens are pretty robust, usually pointed-eggshape, up to 8cm long and up to 5cm at their largest diameter, with tile-like furrows in the upper part. Areoles not very numerous, especially in the lower part of the segment, pretty large, up to 5mm in diameter, furnished with some wool and numerous upright glochids. Spines only in the younger areoles, but very numerous, up to 15 and more, upright, projecting well above the crown; they are not all the same, some thinner, flexible, shorter and yellowish, mostly rigid, strong, red-brown and up to 8cm long. [Flower described]. Fruit with numerous, long, flexible, upright spines at the margin. So I wonder if the plants found by R.K.Hughes did have this rather larger number of spines in each areole? And were there quite a few flexible spines around the periphery of the flower scar on the fruit?

We are then told by Vaupel that he found this plant along the railway line from Arequipa to Lake Titicaca, near Sumbay at 3830m altitude. Vaupel did not record anything about the epidermis on his T.ignescens. But in his Die Cactaceae Vol.1 Backeberg says that the segments are bluish-green to yellowish-green; also that he found this species between Uyupampa and Pampa de Arrieros. The road taken by R.K.Hughes from Arequipa to Chivay appears to cross the same general area as the other habitat locations given for T.ignescens.

In the account of the Cactus vegetation of Peru by Werner Rauh, it was Backeberg who undertook the systematic description of the field collected specimens. Here, T.ignescens is stated to be the most widely distributed species of Tephrocactus in southern Peru; it forms cushions up to 80cm high and up to one metre in diameter at the foot of mount Chachani near Arequipa, at 3800m altitude, where it grows in association with tola bushes and the puna grasses. The hummock of T.ignescens depicted in Fig.97.1 of Rauh's book once again seems to be slightly stouter just above ground level than it is right at its base. Rauh does not state in his book whether this location is at the north, south, east, or western foot of Chachani, but from the phytogeographical section of this book it is clear (pp 134, 171) that the tola heath lies to the north of the peaks of Misti and Chachani. Hence the location quoted by Rauh for this "globular" hummock cannot be far from that noted by R.K.Hughes. In any case there is no great choice of roads for driving north out of Arequipa.

In his account of this journey, written for Cactus France (No.53 1957 p.134) Rauh says that "the [Tola] region around Chachani, covered with bushes of Lepidophyllum quadrangulare, appears to be poor in cacti. The genus Tephrocactus, limited to elevated tracts, is represented by Tephrocactus ignescens whose compact cushions, bristling with bronze colour spines resemble glowing balls in the setting sun". I am prepared to believe that these plants could look similar to W.Rauh in the setting sun and to R.K.Hughes in the rising sun. There could be some poetic licence in Rauh's account in Cactus France of the spine colour, as in his Peruvian Cacti book (p.171) he describes the spines as fox-red to amber yellow. All in all I am prepared to identify RKH 128 as Tephrocactus ignescens. How did the seed germinate?
. . . from R.K.H.Hughes

From the seed which I brought back with me I had two successful germinations from RKH 128 from the Pampa de Canahuas and also 2 successful germinations from RKH 129 from Chivay.

Sumbay lies on the railway line from Arequipa to Juliaca and is barely ten kms in a direct line from Canahuas. About 15kms in a direct line from Canahuas in the opposite direction is Pampa de Arrieros whilst Uyupampa is a further 20kms down the railway line towards Arequipa. All these places lie not far from 4000m altitude. There is only one road running north out of Arequipa in the direction of Canahuas and Chivay, passing through a gap between the peaks of Misti and Chachani. For practical purposes this would probably be the road used by Rauh when he came across the "globular" mounds of Tephrocacti. This means that the locations for T.ignescens quoted by Vaupel, by Backeberg and by Rauh are in the same general area in which I saw the globular mound of Tephrocactus.
. . . from F.Ritter Kakteen in Sudamerika Vol.3

Cumulopuntia ignescens (Vpl) Ritter forms dense hemispherical or flatter cushions, without an enlarged rootstock. Spines only in the upper half of the uppermost quarter of the stem; mostly in dense tufts of 6-20, standing upright broom-like or even sloping outwards, standing away from the segment; needle-like, straight, pretty stiff, occasionally even bristle-like thin and somewhat curved, usually 3-8cm long, often with some shorter fine ones. Spine colour usually golden

yellow to orange red or reddish brown, not shiny, the finest ones paler to white. Type location, Sumbay on the railway line from Arequipa to Juliaca.

The principal distribution area of this species is in Chile, in the higher Andes, northwards from round about 23°S latitude. In the southern parts it grows between 3300 to 4300m altitude, and from 3600 to 4500m altitude near the boundary with Peru. At these high locations it displays a quite typical habit throughout the whole area from the south to the Peruvian department of Puno in the north. Along the border between Chile and Bolivia, Cumulopuntia ignescens crosses over into Bolivian territory. To the north of Colchac it is found together with Cumulopuntia pentlandii v. colchana [Tephrocactus chichensis v. colchanus Card.]. Both are to be found there side by side, from which it follows that despite their similarity they are to be regarded as separate species.

In the high Andes of the Departments Tacna and Moquega in southern Peru in addition to the typical spination are occasionally to be found spineless plants of Cumulopuntia ignescens, a parallel to the spineless T.pentlandii of Bolivia and Argentina. In these cases the glochids are developed to a particularly marked degree.

. . . from H.Middleditch

Somewhat similar to the plant photographed by R.K.Hughes, a hummock with its greatest diameter a few inches above ground level, is Ritter's Fig 723, also named ignescens. This is at 4000m altitude to the east of Arica, so it is in the same general area as the similar shaped plant photographed by R.Ferryman near Chucuyo, carrying flame-coloured flowers.

. . . from R.K.Hughes

Although Ritter regards T.ignescens as a species in its own right, if Kiesling is followed then dactylifera and ignescens would be considered the same and the former name has priority in publication. It was on this basis that I suggested dactylifera for the plants near Pampa Canahuas.

The shiny blue-green to grey-green skin of the plants from Pampa de Canahuas soon lost this coloration after cultivation of the joints I brought back with me. This suggests to me that the difference between the colouring and large globular shaped mounds of the plants at the foot of Chachani compared with the hemispherical mounds of the plants near Puno is due to habitat conditions. The area around Chachani is on the edge of the coastal desert zone, very arid with a fine soil of volcanic ash and hence uninhabited, unfarmed, and unfrequented. At a lower altitude to the south of the twin peaks of Misti and Chachani lies Arequipa, very much an oasis city in the middle of a desert, relying on irrigation by the water of the R.Chili.

In comparison with the Pampa de Canahuas the area around the Titicaca basin seems to be moister and more fertile. On the flood plain of Lake Titicaca between the large towns of Juliaca and Puno (just 30km apart) there are many farms which spread out to the surrounding hills and up their slopes, where animals can be found grazing on the hilltops. Much of the area is occupied by a sparse but extensive rural population housed in the numerous small hamlets that are scattered all over this area. So apparently the more mat-shaped hummocks here with green, rather than blue-green, epidermis, are the result of growing under moister conditions than at Chachani.

. . . from H.Middleditch

The annual rainfall at Puno is about 500mm and at Arequipa it is about 100mm. But in addition to that the contrast between the rainy summer season and the dry winter is quite pronounced. There was no rainfall at all recorded at Arequipa for the months of May to November inclusive over a period of thirty six years. On the other hand the rainfall at Puno is less than 25mm only for the months of May to August inclusive. As observed by Weberbauer "On the northern margin of the Titicaca basin clouds appear for a short period in August, which occasionally precipitate a light rain. In August 1905 approaching Sicuani from Cuzco I travelled through fine rain that persisted from five in the morning to around noon".

It is therefore perhaps not too surprising that R.K.Hughes considered the vicinity of Lake Titicaca rather moister than Arequipa. This difference is reflected in the predominant vegetation; grass tufts with a sprinkling of bushes in the Titicaca basin, a Tola heath of dwarf bushes and sprinkling of grass tufts on the Pacific side of the watershed. It is also reflected in the differences between the hummock forming Tephrocacti of the Titicaca basin and Tephrocactus ignescens.

When Kiesling came to talk to the Chileans' Weekend, well before he published his treatise on Tephrocactus, he showed us a slide taken near Vulcan Chani (not far from Moreno) of a tall hummock of Tephrocactus with red flowers which he identified as ignescens. A rather similar looking hummock from the same locality is illustrated by Fries (1905) and identified as Opuntia grata. There appears to be no specific reference to T.ignescens in Kiesling's treatment of Tephrocactus. However there is a reference to O.grata as a synonym of Maihueniopsis glomerata. In addition, Kiesling's description of M.glomerata gives it "Occasionally red flowers" and a distribution outside Argentina of "southern Bolivia, Chile throughout the Cordillera to the north of Santiago". Presumably "throughout" means as far as the border with Peru. In this way Kiesling appears to put T.ignescens into Maihueniopsis glomerata, but purely by inference.

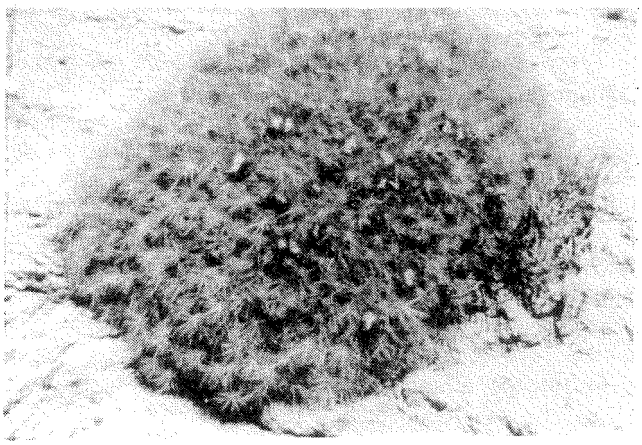
Now if the Tephrocactus found near Pampa Canahuas is to be regarded neither as Maihueniopsis glomerata Kiesling nor as T.ignescens Vaupel, Rauh, Ritter, et al, but as T.dactylifera growing in a harsher climate, then we must ask what is the justification for other specific names of Tephrocactus found on the altiplano. The available illustrations and slides suggest that at least the nature of the surroundings at Pampa Canahuas, at Chucuyo, and near Moreno, are rather similar.

. . . from R.K.Hughes.

Surely you should not be surprised that the sort of habitat conditions which I met with near Pampa Canahuas are to be found much further south. The point was made by putting together in Chileans No.43 the Lepidophyllum formation that Fries observed near Moreno in Argentina, that Herzog noted on the Bolivian puna, and Weberbauer recorded for the south-east Tola zone in Peru.

. . . from H.Middleditch

The southern limit for species ignescens in Chile lies approximately at the latitude of San Pedro de Atacama. Not far to the north of that place Ritter found and describes Cumulopuntia tortispina, growing between 3000 and 3600m altitude. "At heights above 3300m it grows together with Cumulopuntias ignescens and frequently hybridises with it". In the Grand North of Chile, to the west of Ticnamar, Ritter found and describes Cumulopuntia ticnamarensis "around about 3300m



Nevado Chani
Photo - R Kiesling

Chucuyo
Photo - R Ferryman

TEPHROCACTUS IGNESCENS

altitude. Grows here together with the more abundant Cumulopuntia ignescens and frequently forms hybrids with it". Presumably it will be plants which give the impression of a transition between the two species that Ritter classes as hybrids. In addition we have:-

Cumulopuntia echinacea Ritt. Type location, watershed between the R.Lluta and R.Azapa on the road from Arica over the small pass to Chapiquina, around 2900m altitude. Distribution extends north into southern Peru and southwards into the mountains of the upper Caminia valley. Grows from 2600m up to over 4000m altitude. At the upper altitudes it overlaps to some extent with C.ignescens and C.ticnamarensis and forms occasional hybrids with them. Possesses a hard turnip like root, fruit without flesh, only the uppermost 4 to about 10 areoles with spines but without or almost without glochids; the lower spineless areoles with thick bunches of short yellow glochids. Spines very variable in number, length, and robustness. usually very long and stout, straight to curved; spines on uppermost areoles usually 4 to 10, stronger, longer, deeper coloured in the middle, those around thinner and paler, usually 1 to 12cm long, occasionally up to 20cm - I measured up to 26cm long near Puquios; sometimes they are upright, sometimes very divergent; colour usually reddish brown, occasionally pale brown, often with pale and dark coloured bands. Many plants have spines only a few cm long. The same plant varies to a relatively extraordinary degree in spination according to its exposure to the sun. Stems exposed to full sun often have enormous spines, whilst the same hummock makes only a few short fine spines on segments away from the sun."

With the variation that Ritter describes for echinaceus, how is it possible to decide where and when a line can be drawn to justify having a further species rather than simply another degree of variation on the same species? And for the collector who wants to write an appropriate name on a label, how does one decide how to identify a plant or piece of Tephrocactus?

. . . from R.K.Hughes

Some time ago I tried to identify what I saw in habitat by drawing side by side, at full size, the segment sizes and spine lengths of the relevant described species. For simplicity I did not show the somewhat tuberculate upper areoles. Now when I compared the descriptions for T.ignescens and T.dactylifera, both by Vaupel, I find that the only realistic separation is by habitat location. So I also looked at the locations given for the species from southern Peru and the immediately adjacent parts of Chile and Bolivia:-

| | |
|---|---|
| pyrracanthus K.Sch. | Tacora and Cerro Tornarape |
| chichensis Card. | Chichas, Dept. Potosi |
| cylindrariculatus Card. | Chichas, Dept. Potosi |
| fulvicomus Rauh & Bkbg | Chala valley |
| zehnderi Rauh & Bkbg | Incuio |
| noodtiae Bkbg & Jacobs | Lake Titicaca |
| alboareolatus Ritt | Quicacha |
| longiarticulatus Bkbg | |
| echinaceus Ritt | Tacna — Camina |
| galerasensis Ritt | Galera (Nazca-Puqui) |

It was from this comparison that I put the name dactylifera on the plants from Sillustani

. . . from H.Middleditch

From the description I see that the spines on T.dactylifera are red-brown to yellow-brown, segments grey-green. The size of the segments quoted for dactylifera would fit the plants found by R.K.Hughes at Puno and Sillustani, but between the description of this species and the account by R.K.Hughes there appears to be some difference in both the colour of the epidermis as well as the spine colour.

. . . from R.K.Hughes

As to the identity of the Tephrocacti at Sillustani, I have read the original description of T.dactylifera by Vaupel; the type plant was collected by Weberbauer No.1357 in August 1902 at Azangaro, Dept. Puno, on stony patches at 3,600m. This appears to attribute a tuberculate form to the segments which was evident on the habitat plants and may also be seen on the piece that is now growing in my own collection. The spine colour on the plants growing at Sillustani and Puno certainly did vary from yellow through to red-brown, which does match the description for dactylifera. Also I would suggest that grey-green, blue-green, yellow-green and grass-green are all vague terms whose use will vary from one person to another; even one person looking at a plant can select a different colour to describe the epidermis depending on the position of the sun.

. . . from H.Middleditch

When I refer to Ritter's books on the cacti of South America I find that he regards the several illustrations of Tephrocactus pentlandii which appear in Backeberg's Die Cactaceae not as this species at all, but as Tephrocactus rossiana. Ritter also considers the plants described by Backeberg as T.bolivianus to be a match for Salm Dyck's Opuntia pentlandii. On the other hand Ritter goes on to say that the original description of Opuntia boliviana by Salm Dyck would pass well enough for the habitat forms of a variable species whose distribution area is from the central and southern Bolivian highlands into the adjacent region of northern Argentina. So if Ritter's ideas are accepted what name could be given to the RKH Tephrocacti from Sillustani?

. . . from F.Ritter, Kakteen in Sudamerika, Vol. 2 Cumulopuntia pentlandii v. dactylifera

Although it is a very characteristic cactus on the high mountains in southern Peru, Bolivia, and north Argentina, it was only described in 1913 and then as a species. The plant from which the original description was made by Vaupel is from Azangaro in Dept. Puno, Peru, a place which is not recorded on my maps. I give here some notes of specimens from the high areas of western Bolivia.

Hummocks becoming larger than v.pentlandii, hemispherical, with fairly close-packed segments, these somewhat grey-green, eggshaped to more cylindrical with end tapering thinner and very blunt base, but not conical, very variable in size between populations, from 3 up to around 10cm in length and 2 to 4cm thick; with not many elongated tubercles, those above more prominent, more flattened below; in general the prominence of the tubercles varies a great deal. Areoles in lowermost quarter of the segment usually absent, increasing in number upwards, in general not numerous, round to elongated, 2-3mm diameter on the upper end of the tubercle, prominent bunches of glochids growing later. Spines only on the upper half or the uppermost quarter of the segment, usually strong, straight, pointing upwards in close packed bunches of between three and ten, usually 2-5(-6)cm long, very occasionally a little longer; under cultivation in Europe the spines often remain considerably less than 3cm in length; occasionally the spines are curved downwards so that the bunch points more away from the stem or is directed somewhat downwards; particularly is this so when the spines are somewhat slim; on immature plants the spines are thinner and more often bent somewhat downwards than in age. The spine colour is very variable, most commonly yellow or brownish yellow, at other times reddish brown, orange red, brown, white, or black. Frequently specimens with different sorts of spine colour can be found at the same location. On the other hand cultivation at different places determines predominant spine colour; sometimes the spine colour even changes on one mountain with altitude. Also the stoutness of the spines changes considerably from one population to another. Often hybridises with v. pentlandii. FR 65e is from Vamburuta, Dept. La Paz, varying somewhat away from there towards Cumulopuntia ignescens which grows further west from there in Chile."

. . . from H.Middleditch

In Chile the southern limit of Ritter's Cumulopuntia lies just to the north of San Pedro de Atacama. In Argentine (excluding C.famatimensis) the southern limit of Cumulopuntia falls roughly at Moreno. Cumulopuntia occurs on the moister altiplano around Lake Titicaca, as far north as Azangaro. On the Pacific side of the Andes Backeberg reports cushions of Tephrocactus from near Incuio, a little to the south of Puquio. The maps in Chileans No.43 will cover most of this territory.

Within this broad area Ritter places Cum. rossiana on the Puna between Yamparaez and Iturbe; Cum. boliviana on the high Andes of central Bolivia; Cum. pentlandii on the eastern part of the high Andes of Bolivia and northern Argentina; Cum. pentlandii v. dactylifera in the central to eastern area of the high Andes of Bolivia together with the adjacent parts of Peru and northern Argentina. So by Ritter's allocation of names, the RKH plants from Sillustani would indeed be Tephrocactus pentlandii v. dactylifera as no other name of Ritter's extends so far north. There is a choice of Backeberg names which are given as synonyms of dactylifera by Ritter. No identification appears to be possible from Kiesling's treatment of Tephrocactus.

. . . from R.K.Hughes

I can envisage a plant that I recognise for each of these names until Ritter claims that the Backeberg pictures of T.pentlandii are incorrect. It is then that confusion takes hold.

. . . from H.Middleditch

Indeed I too still find it difficult to thread my way through this labyrinth of names. In addition there could well be a great many of these plants which are in collections today that carry names according to Backeberg's descriptions and illustrations. Most of them would require a different specific name if Ritter's work is to be followed. Yet a third different specific name would be needed for many of them if Kiesling's work is to be adopted. The following table attempts to correlate the nomenclature for a few of the more familiar species.

| Backeberg<br>Tephrocactus | Ritter<br>Cumulopuntia | Kiesling<br>Maihueniopsis |
|---|---|---|
| pentlandii v.rossiana | rossiana | rossiana |
| pentlandii | rossiana | |
| pentlandii | | pentlandii S.D. |
| bolivianus | pentlandii S.D. | |
| bolivianus | | boliviana S.D. |
| | boliviana S.D. | boliviana S.D. |
| ferocior | | ferocior |
| dactylifera | pentlandii v.dactylifera | |
| flexuosus | pentlandii v.dactylifera | |
| flexuosus | boliviana S.D. | |

It is difficult to justify the use of Kiesling's names for most of the hummock-forming Tephrocacti from the Altiplano. Firstly many of these plants are described as lacking the thickened, almost tuberous, rootstock which Kiesling specifies as a characteristic of Maihueniopsis. Secondly Kiesling has studied only those from Argentina and would not really appear to be familiar with those from Chile, Bolivia, or Peru.

**MAIHUENIOPSIS — WHAT'S THAT?**

From H.Middleditch

In his work on the cacti of south America Ritter adopted the name of Maihueniopsis for quite a number of species which would have previously been more familiar under the name of Tephrocactus. Under the name of Maihueniopsis Ritter separated from Tephrocactus a group of species on the basis that the fruit was fleshy within when ripe, differing from the remaining Tephrocacti Lemaire which had dry fruit. In making this segregation Ritter does not appear to have made use of any other feature, such as size of segment, or habit of plant. Hence those species which Ritter includes within the genus Maihueniopsis range from the dwarf bush-like form of Tephrocactus molinensis with a branched and somewhat open mode of

growth, to plants such as Tephrocactus pentlandii with a very compact form of growth. On this account, external appearance seems to offer no guide as to whether a plant should be Tephrocactus or Maihueniopsis. By comparison most of the south american cacti that are met with in cultivation can be slotted into a genus with no great problem on the basis of their external appearance. This situation obviously puzzled some of our readers and one or two reactions to this situation were expressed in Chileans 43. A further review of the subject has been made by R.Kiesling, as follows.

**MAIHUENIOPSIS and TEPHROCACTUS** **By R.Kiesling.**
Translated by H.Middleditch from Darwiniana 25(1-4) 1984

The subfamily Opuntioideae, unlike the Cereoideae, have received relatively little attention on the part of the specialists, which may be due to their lack of appeal as ornamental plants, to their tiresome glochids, and because of their sparsity in collections. This work has as its prime objective to consider restoration of the genus Maihueniopsis — proposed by Ritter in 1980 - and to give a key and description of the species known to occur in Argentina. It is considered useful to complement the latter with keys and descriptions for the species of Tephrocactus, a genus within which the species of Maihueniopsis have been included up to the present time.

The classical concept maintained even today by some authors accepts Opuntia in extended form. In fairly modern times there has been segregated Tephrocactus 1868, Pterocactus 1897, Quiabentia 1923, Maihueniopsis 1925, Cylindropuntia 1930, Austrocylindropuntia 1938 and Puna 1982. All these genera differ from Opuntia sensu stricta by their segments of circular section. In addition each of the genera mentioned differ from Opuntia by various characters, amongst others: Tephrocactus by its areoles in the form of a crypt, its dry fruit, dehiscing, and its aerated seed aril with well developed earpiece; Pterocactus by its enlarged rootstock, its apical flowers and its seed aril. Quiabentia by its broad leaves and by its vertical branching; Maihueniopsis by forming compact cushions, by its enlarged roots, by its less obvious joints and by the areoles generally crowded into the upper part of the segments; Cylindropuntia by by the podaria (tubercles) notably projecting and elongated and by its spines covered in a papery sheath; Austrocylindropuntia by its large persistent leaves; and finally Puna by its thick rootstock, its diminuitive stems, the absence or reduction of glochids, the simplified areoles on the pericarp, its dry fruit and its aril.

**Materials and Methods**

In the first place, the classical methods of vegetal taxonomy have been used: 1. Study of herbarium material, in particular the type specimens. 2. Review of the bibliography, in particular the original descriptions. In the second place this has been complemented by other methods, such as the study of pollen, of the epidermis, and observations upon the majority of species in their habitat. Nearly all of them were observed in cultivation.

[Technicalities of pollen and epidermis examination reviewed]

In those cases, unfortunately quite frequent in the Cactaceae, in which the type material does not exist, it was necessary to designate a neotype. For each one of these designations the most perfect possible example was chosen and in general from the same locality or region mentioned in the original description.

**Roots**

In Tephrocacti the primary root enlarges, becoming napiform. From its lower extremity extend more or less short secondary roots, which quickly branch. The thickest roots become corky, forming several layers which flake off. In general the individuals originate vegetatively by fragmentation of the branches. The separated segments put out roots from the broken joint and in addition from the areoles which come into contact with the ground. These secondary roots are fibrous, much branched, relatively short (up to 20cm). Several enter the ground vertically, but the majority remain parallel and close to the surface.

In Maihueniopsis the main root completely swells up but in most of those measured it forms a tuberous root (which can be globose or more or less napiform, or divide into two or more branches, etc.) at certain depths (5 to 15cm), which is jointed at the waist with its upper part, not so enlarged, more or less cylindrical. The majority of the secondary roots - of some few mm in diameter — originate from the lower half of the tuberous roots. As in Tephrocactus, the stouter roots form several layers of cork which flake off readily. The old roots lignify. Young specimens have been found in which their roots have not yet completely enlarged nor do they possess the slimmer upper part. This difference between young and old specimens does allow it to be supposed that the roots in the genus are contractile and that it would be the cause of the upper part narrowing. The adaptive advantage of this circumstance is evident, considering the plants live under very cold climates. Vegetative reproduction is rare in this genus. If experimentally new segments are rooted down (the old ones are difficult to strike), the roots arise from the areoles and from the scar and its vascular bundle, but the plants do not attain outwardly complete development.

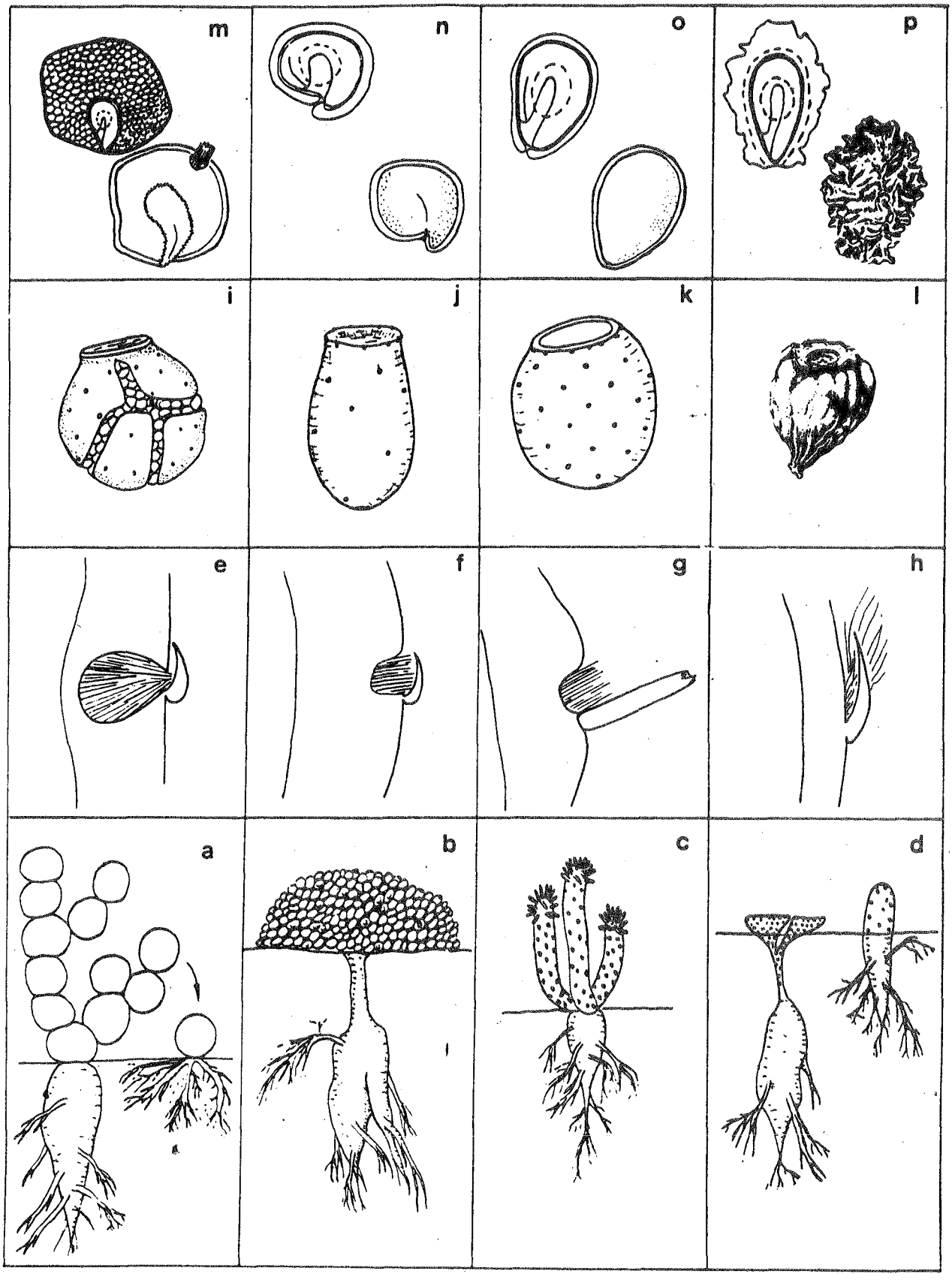
In Puna the roots enlarge, napiform, joined to the stems with no waisting, as in P. subterranea, or tuberous joined to the aerial stems by underground stems; in this latter case the plants behave like geophytes, losing their stems in the winter and producing new stems from the nodes which remain in the upper part of the tuberous root, as in P.clavarioides.

In Austrocylindropuntia the roots are enlarged. napiform, similar to the young roots of Maihueniopsis.

**Stems**

In Tephrocactus the stems are often joined together in rows of segments like a string of beads, forming open bushes, of more or less low stature. The joints are usually fragile, which facilitates vegetative reproduction. The most conspicuous example of this is T.articulatus, whose uniformity in each population is due to their identical genetics. In T.molinensis, each segment produces 2-3 segments in its turn, on account of which its habit is more compact, almost globose, but quite different from the hemispherical cushions of Maihueniopsis.

The segments are usually globose, subspherical, with two exceptions, T.articulatus v. articulatus, frequently with cylindrical segments, slightly conical, and T.weberi normally with cylindrical segments. The tubercles are rhomboidal,




TEPHROCACTUS MAIHUENIOPSIS AUSTROCYLINDROPUNTIA PUNA

## MAIHUENIOPSIS

R. KIESLING, *Estudios en Cactaceae de Argentina*

more or less isodiametrical or somewhat broader than tall. The epidermis is rough, typically greyish-green and covered with a grey coat of wax, which readily detaches on herbarium specimens.

In Maihueniopsis the stems clump together in a most compact manner, forming cushions more or less hemispherical. The joints are not fragile, nor so noticeable; vegetative reproduction is not common. The segments are ovoid or elliptical. In addition sub-globose or cylindrical in spp outside Argentina. The tubercles are barely distinguishable and are prolonged longitudinally. The epidermis is smooth, yellowish-green to dark green in colour, covered by a thin layer of wax, which is found to be strongly adherent.

In Puna the stems consist of one or more cylindrical or obconical segments. The joints are not fragile and vegetative reproduction is not apparently normal. In P.clavarioides the aerial stems detach themselves in autumn or at the onset of winter and according to observations, die off without re-rooting. Unquestionably the possibility exists that in favourable conditions new individuals would be generated. The tubercles are more or less rhomboid, isodiametrical, at times inconspiculous. The epidermis is more or less rough and the coat of wax is extremely thin.

In Austrocylindropuntia the stems are cylindrical and their few branches 3-5(-10) are arranged to form an open, dwarf shrub, up to 50cm tall, except for one peruvian species A.exaltata (Berg)Bkbg. The tubercles are more or less isodiametric, rhomboidal to hexagonal. The epidermis is from light to dark green.

**Areoles**

In Tephrocactus the vegetative areoles as well as those on the pericarpel have greater internal development than external. The recesses are more or less obconical, from whose narrow openings some of the many glochids and hairs which clothe its walls only just protrude. The upper areoles of the stems also develop some spines and have a wider opening and more projecting glochids. Generally the glochids may be observed in bundles in the upper part of the areole and in a continuous annulus at the periphery surrounding the central part where hairs and glochids are mingled. An exception occurs with T.molinensis: in this species the areoles possess a stout bundle of projecting glochids encircled by a continuous ring of relatively long hairs. The apertures of the areoles are generally found at approximately the crown of the tubercles and are circular. In T.weberi on the other hand they are located on the upper margin of the tubercles and are drawn out longitudinally. The glochids vary from 1.5 to 5mm [long?-H.M] of red-orange or chestnut brown colour in distinctive tones. On rare occasions yellow ones are noted, but always with a chestnut tinge.

The spines are straight or arched, stiff or flexible, sharp pointed or not, sometimes quite flattened, in the form of ribbons, others awl-like, or of circular section, etc. The epidermal cells separate from the body of the spine from their distal end which is very rare in Opuntioideae. Only in the vicinity of the apex are displayed backward-pointing whiskers characteristic of this subfamily. Tephrocactus weberi has a similar spine surface but the extremities of the cells do not reach the point of separation.

The areoles of Maihueniopsis are simply formed by a cylindrical or conical recess of moderate depth. All carry glochids and hairs and are located at the apex of the tubercles. The glochids are disposed over the whole of the areole cavity, generally intermingled with hairs; they are yellow, from almost hyaline to dark, very occasionally with chestnut tinge. The exception consists of M.nigrispina, whose glochids are red. The spines of Maihueniopsis are straight or curved, stiff or flexible, generally sharp pointed. Their epidermal cells are arranged in longitudinal rows and are not detached from the body of the spine, nor separated one from the other, so that the spine surface is more or less smooth. The exception again is M.nigrispina, whose spines are of the same type of surface as those on Puna. In general they are of circular or elliptical section: some (M.glomerata, M.andicola) are flattened and in one instance (M.darwinii) they possess a central core and two lateral wings. Generally they do not display a well defined arrangement, but in some cases the secondary spines are disposed in lateral pairs.

In Puna the areoles are elliptical or linear and are located on the apex of the tubercles. Glochids are completely absent from P.clavarioides and in the floral areoles and in addition in the juvenile areoles of the stems of P.subterranea; when they do occur they are in a bundle in the extreme upper part of the areole and are of chestnut colour. The spines are minute, feeble, adpressed to the stem and grow in lateral pairs, their epidermal cells form continuous rows and at maturity separate only at the both ends of the contiguous cells.

In Austrocylindropuntia the areoles are circular or elliptical, located on the apex of the tubercle. They have hairs, glochids, spines and their leaves are relatively large, subulate, persistent, showy. The surface of the spines is smooth.

**Flowers**

In Tephrocactus the pericarpel has areoles similar to the vegetative parts, the upper ones often with diminuitive spines or bristles; they are shielded by a tiny bract which quickly falls off. The perianth petals terminate in a short, sharp point. Curiously in some examples this point is large and hard, with barbed epidermal cells similar to those of the glochids (most noticeable in T.aoracanthus).

In Maihueniopsis the pericarpel is green and the areoles are similar to the vegetative ones; the upper ones may bear spines or bristles. These are shielded by a stout bract, more or less persistent. The perianth petals usually terminate in a short, sharp point, but this is tiny and white.

In Puna the areoles of the pericarpel are rudimentary, reduced to some small hairs which nestle in the axils of the bracts, which are persistent; the abcision of these bracts is brought about just as the fruit drys up.

In Austrocylindropuntia the pericarpel has areoles distributed uniformly and they are similar to the vegetative areoles.

**Fruit and Seeds**

The species of Tephrocactus have dry fruits and dehiscence is brought about by several irregular slits; at maturity the more or less thick wall which separates the pericarpel from the fruit drys up and is reduced to a thin membrane, which remains firmly adhering to the adjacent seed arils. These latter appear to possess glochids, for which reason it is opportune to mention the feature of "fruit with internal glochids" or "seeds with glochids".

The seeds exhibit two testa layers, the external one chestnut brown in colour, the internal whitish. Completely

covering the seeds, as in all the Opuntioideae, there exist a funicular aril which in this genus exhibits a noteworthy development and is made up of aerated tissue (T.articulatus, T.aoracanthus, etc) or may even be partially hollow (T.weberi). This characteristic doubtless facilitates the dispersion of the seeds by the wind or by flushes of water. The general form of the arils is lenticular, but they are commonly found mis-shapen by mutual contact within the fruit. They are large, 3-6mm broad, and of light chestnut colour or yellowish or whitish, smooth, with aural tracks at each side, which can attain appreciable development (T.weberi).

The fruits on Maihueniopsis are indehiscent, fleshy, with thick walls. Complete mature fruits have been found rolling over the ground, from which it may be surmised that the dissemination of the seeds is brought about by mechanical fracture or by the intervention of ants or other animals. The seeds are similar to those of Tephrocactus but their arils display an appreciable difference: they are compact, more or less soft to quite hard, from lenticular to globose or piriform, smooth, glabrous or with a smooth tomentum. They do not display auricles and have a distinctive margin which corresponds to part of the vascular bundle of the funiculus.

In Puna the fruits are indehiscent, dry. Their fracture is brought about by mechanical action from rolling over the ground. The seeds of this genus do not display any notable differences from Tephrocactus either, but the arils are soft and the surface looks like bundles of hairs; the internal portion of the aril is more or less compact and the external part is made up of a fibrous tissue, with cells arranged in lines.

The fruits of Austrocylindropuntia are turgid, indehiscent, with thick walls. The seed arils are more or less piriform, quite hard, glabrous, without auricles.

**Epidermis**

In species of Tephrocactus this may be seen by naked eye or by binocular magnifier to be dull and rough, greyish green. In dry specimens the detachment of a layer of wax may be observed.

In Maihueniopsis the epidermis is shiny and smooth, dark green to yellowish green, but never greyish. In herbarium specimens no detachment of a surface layer of wax may be observed, from which it is possible to assume that this is thinner and more adherent to the epidermal cells.

In Puna the epidermis has been studied in its two species, it is rough with a thin layer of wax. Its colour is green or violet.

In the species of Austrocylindropuntia the epidermis is smooth or slightly rough, shiny or somewhat matt, apparently without a coating of wax or with only a quite thin one.

[A pollen comparison is also provided]

. . . from H.Middleditch

This fairly comprehensive review of Tephrocactus Lemaire has been undertaken from a quite different standpoint to that adopted by Ritter. So much so, that I find it difficult to see whereabouts Cumulopuntia Ritter fits into Kiesling's system, if indeed it fits in at all. As an example, Kiesling places Tephrocactus pentlandii and Tephrocactus bolivianus under Maihueniopsis, whilst Ritter places both these species under Cumulopuntia. Both these sorts evidently occur not only in Bolivia but also in northern Argentina so Kiesling may have had an opportunity to see them. So why did Kiesling decide to place them where he did? Ritter separates Cumulopuntia with the dry fruit from Maihueniopsis with the flesh filled fruit. How does Kiesling regard this? Under the heading of Maihueniopsis Kiesling states "fruit fleshy" which could well refer just to the fruit wall. Is he carefully avoiding the question of the fruit being dry or filled with pulp?

There is no doubt on this point in Ritter's description of Maihueniopsis - Fructus...pulpa succosa, pituitosa, subacida (fruit with pulp full of juice, full of mucilage, somewhat bitter) - Samenkammer ..ausgefullt mit ein sauerlichen schleimigen fructfleisch, nie trocken, in gegensatz zu Cumulopuntia und Tephrocactus (seed chamber...filled with a tart mucilaginous fruit pulp, never dry, in contradistinction to Cumulopuntia and Tephrocactus). The original basis adopted by Spegazzini for establishing Maihueniopsis was the enlargement of the joints between the segments, as discussed in Chileans No.44. Ritter pointed out that this was not a suitable characteristic for the separation of Maihueniopsis. Kiesling observes "...acepto la enmienda efectuada por Ritter (1980) ese caracter, aunque a otros de su diagnosis los considero trivales" (I accept the emendation effected by Ritter (1980) for this character, although as to the others in his diagnosis I consider them trivial). So does Kiesling simply ignore the distinction of dry or pulp-filled fruit?

Under the main heading of "Maihueniopsis Speg. emend Ritter" (immediately prior to his species by species review) Kiesling lists "Cumulopuntia Ritter Kakt. Sudam. 2. 1980". The purpose of this entry is not entirely clear; does he intend to say that Cumulopuntia is a synonym of Maihueniopsis? He does give the distribution of Maihueniopsis as "from the high mountains of Peru, Bolivia, Chile and western Argentina" and in this way effectively includes within the scope of Maihueniopsis all those cushion forming Tephrocacti from the high Andes, exclusive of the mat-forming Austrocylindropuntia. By effectively placing Cumulopuntia as a synonym of Maihueniopsis, Kiesling also includes within Maihueniopsis those Tephrocactus such as spp. berteri, sphaericus, and kuehnrichianus. The habit of this group of Tephrocacti does not match the features laid down by Kiesling as characteristic of Maihueniopsis.

. . . from R Ferryman

During our travels through Chile we came across not only the compact hummock forming Tephrocacti, but also another sort of quite different growth form, which we identified as T,berteri. This particular sort will jump up and attach itself to you if you are foolish enough to get too close to it and it is an abomination to try and free ones-self from their segments. It seems to be quite widespread, at moderate altitudes, and where it did exist you were walking round it, over it, and on it. I suppose that it would probably only make four or five segments' growth before the top two fall off. I certainly got the impression that it was spread round by human activity, mainly pedestrians. It is probably fair to say that it often looks like an untidy heap, just like a pile of potatoes tipped out of a sack.

. . . from H.Middleditch

Kiesling could have listed under his heading of Maihueniopsis "Synonym Cumulopuntia Ritter pro parte" in

order to encompass those Tephrocacti which do form compact hummocks and exclude the sphaericus/berteri group of plants. Those hummock forming plants so defined may well match the aerial features tabled by Kiesling in his paper for Maihueniopsis, but according to Ritter, many of them do not have swollen rootstock. Thus as Kiesling's paper stands, his table of characteristic features would not match all the plants he includes within Maihueniopsis. So it hardly comes into the category of "Well documented nomenclatural changes, if properly researched, are likely to be generally accepted" (Gordon Rowley, Name that Succulent).

. . . from P.H.Davis & V.H.Heywood Principles of Angiosperm Taxonomy, 1963

When generic limits are being revised (and this applies both to the delimitation of genera and the decision whether to accord them separate generic or infrageneric rank) it is absolutely essential that the whole group should be reviewed throughout its geographical range. Many of the "splits" recognised in Europe are unsatisfactory in a world context.

. . . from H.Middleditch

Likewise one might say that splits produced in Argentina without proper reference to the full geographical range of the Tephrocacti Lemaire are equally unsatisfactory.

. . . from A.C.J.Hall

I must take issue with you on this question of swollen roots on Maihueniopsis. Fortunately I have quite a number of Tephrocacti, both of the sort which form pretty compact hummocks and also others which I describe as belonging to the sphaerica group. Of the latter I have plants under the names of sphaericus, kuehnrichianus, dimorphus, mirus, etc. None of these plants have large i.e. thickened roots, but if the roots are exposed they are very soft. The external skin can be rubbed off these roots at a touch and if the roots are left exposed they will dehydrate very rapidly. Similarly I have never found any swollen roots on any of the T.articulatus complex, nor on molinensis, alexanderi, or weberi.

On the other hand the thickened roots that are found on the hummock forming sorts have a skin which is about as tough as the epidermis of the body. For example I have a plant which came from Abbey Brook as T.subterraneanus; from the shape of the segments and the nature of the areoles it may possibly be T.mandragorus. It stood quite still for well over a year until it had produced a thick root, and only then started to put out new segments; as you can see by pushing to one side the top layer of grit, it now has two main roots each about 10mm thick. A single joint of T.subterraneanus which came from C.Pugh sat for about two years without any indication of growth; after it had established a thickened rootstock it started to put on new growth. Another single joint, this time from Kew, came as T.ovata, and increased by one further joint every other year; when it had put down a thickened rootstock, it produced several joints every year. The 7 or 8 recent segments are still spineless but there is an occasional very weak central which is up to 1½in. long. The epidermis is very soft so that I suspect it will fit into the pentlandii group. Yet another plant came as an established cutting of sp. Abra Pampa, with joints about 25mm long by some 6 to 8mm in diameter which were growing parallel to the ground and carried only glochids at the areoles, no spines. For four or five years it put out a few more similar horizontal joints and then suddenly started to grow segments pointing upwards, with spines. I found out that it had produced a vertical root of about 1½in. in diameter which had a definite neck where it joined the aerial parts; the top of the root did not look a great deal different from the first segment.

You may also recollect that a couple of years ago I brought along to the Chileans Weekend some photographs which I had taken of about a score of my Tephrocacti when they were out of their pots, with most of the soil removed from the roots. Every one of them had a thickened rootstock, varying from pencil thickness to a stout carrot shape, one or two being quite like Kiesling's sketch of a thick root on his Maihueniopsis. So I am inclined to think that Kiesling is right when he says that Maihueniopsis possess a thickened root. Several of my plants in the glomeratus group do display a distinct necking in the taproot. However in the examples that I have, areoles can be found down the length of the neck, suggesting that the neck is a remnant of the juvenile plant (seedlings of this group start off fairly tall and thin )that has been covered over before it has had time to branch from the base. Of course this is pure conjecture!

It has to be accepted that there are very few of these plants in cultivation which have the benefit of a field collection reference or data on their habitat location; they also have a mode of growth which can be largely controlled by their cultivation rather than by their habitat appearance. So when it comes to satisfying ones-self about their names or whether they come from Argentina or Bolivia, we have to identify them from photographs. I am pretty sure that not all my Tephrocacti with thick roots come from Argentina; some of them must surely come from Bolivia.

. . . from H.Middleditch

As a result of the foregoing comments I decided to try my hand at exposing the upper part of the roots on some of my smaller Tephrocacti. I am not too keen on this operation because I do not have a definite layer of loose grit on top of the compost and in consequence I am somewhat wary of damaging the roots in the process. I must admit that I was surprised at what I found. One of my few Tephrocacti of known origin is a rooted cutting from a piece which R.Ferryman collected at Cuesta de Diablo, northeast of San Pedro de Atacama, Chile. This had two thickened roots, not quite pencil thickness. A rooted cutting of T.variflorus ex Cardenas via Roanoke, together with several rooted cuttings of a similar looking plant which I acquired on the Riviera in 1962, in addition to rooted cuttings of T.glomeratus, all displayed either one or two roots approaching pencil thickness. The larger plants, including one from Arrequentin, province San Juan, ex Kiesling, will also be examined for this feature at a suitable opportunity. Of appreciable importance was a three-segment plant ex Sillustani from R.K.Hughes, which had a couple of roots about pencil lead thickness which might even pass for "fibrous" roots. On this (admittedly flimsy) basis, I can understand that Kiesling considers the hummock forming Argentinian plants possess a thickened rootstock and I can also believe the observation by Ritter that many Bolivian hummock forming Tephrocacti do not have a swollen rootstock.

The comment above about new segments putting out weak spines is in line with my own experience. About September time I look at the current year's segments on my T.glomeratus v.andicolus, which have short, weakly looking spines and look so miserably poor in comparison with the spination on the previous year's segments. I never cease to be amazed at how this weakly spination improves perceptibly in October and then by November the current year's spines are not far off the length and build of those on the rest of the plant.

. . . from A.C.J.Hall

But on my T.sp.Abra Pampa the spines will continue to grow in length and robustness for three or four years. Another small segmented plant is T.glomeratus v.longispinus and here it may be two years before the long spines appear and grow on new segments. On T.russellii the thin bristle like spines of the first year of a new segment become much longer, flattened, and twisted along their length in the subsequent year.

. . . from H.Middleditch

The reference to Tephrocactus sensu Kiesling having glochids on the seed does strike me as most peculiar. I am still not altogether clear if the seed near the outside of the fruit is supposed to acquire glochids by attachment from the fruit wall, or whether glochids are supposed to be feature of all the seeds in the fruit.

. . . from A.C.J.Hall

A few years back I bought but failed to germinate a packet of seed of Tephrocactus articulatus, which were covered in small dark orange glochids rather like a rose hip. I will not be handling any more of this seed without tweezers next time!

. . . from R.K.Hughes

I received from Berlin Botanic Gardens, via J.Arrowsmith at Ness Gardens, a packet of seeds of Tephrocactus aoracanthus. There were only five seeds in the packet, only one of which had developed to its full extent, to match perfectly those shown in Kiesling's article.

. . . from R.Crook

A batch of Tephrocactus seeds were sent to me by J.Lllif which he had received from R.Kiesling and I have been busy taking slides of these. Because these seeds are fairly large they are not too difficult to photograph. Certainly the seed of Tephrocactus articulatus did give the impression that it carried a small tuft of glochids.

. . . from H.Middleditch

New offsets on Tephrocactus always seem to have a tiny leaf at each areole, even though I never see any on fully grown segments. On some plants these leaves are green, on others yellowish green, and on yet others brownish green, but all the same colour on any one plant. Looking round my Tephrocacti at the start of their offsetting season, I was struck by the fact that all the new offsets were appearing from existing areoles. As far as I could see no new offsets were appearing at the growing point of the segment. On reflection, I realised that this was because there was no growing point on the segment which would have been able to push out new growth. Did each new offset lose its growing point as it got to full size? But then a careful look at the new offsets led to the idea that possibly all the areoles for the fully grown offset were already there, even on the tiniest of new offsets, in exactly the same way that all the areoles on a flower tube together with all the other flower parts are present in a flower bud, however small the bud may be; both of them grow larger, but do not grow any more nodes. Are all Tephrocactus like this? How peculiar that Kiesling does not seem to have made any reference to this characteristic.

. . . from R.Ferryman

When you mention it I suppose it is correct to say that there is no growing point on a segment of Tephrocactus. But I suspect that small plants of Tephrocactus, possibly seedling plants, may have a growing point before they start to show only mature growth form. I have checked the cuttings which I have in my collection of Tephrocactus RMF 14 from Cuesta de Diablo, Chile. The cuttings which have been rooted down most recently do indeed continue to grow like other cacti, with a growing point, but display an almost segmented stem. The older cuttings have in fact started to offset more from the base and from other areoles, leaving one longish segmented growth. I can only assume that this very unusual mode of growth is because the plant is in a juvenile stage. I have some seedlings from this collection; to date they are small and have only one "typical" head, so I will watch their progress with interest.

. . . from D.Neville

My own plant of T.weberi will by now have about a dozen branches, the tallest being about five inches high. This was being transported to a show when it befell an accident and lost a branch about two inches long, which I stuck back into the same pot. This has now rooted and it can be seen to be putting on new growth at the tip in the normal fashion, so it must have a growing point. But it is not really possibly to see with certainty if the other new growths on the plant are from an areole or from the growing point at the end of the previous season's stem.

. . . from A.C.J.Hall

The idea came to me some time ago that Tephrocactus segments did not have a growing point and I would think that in general terms this is probably correct. However I am quite sure that plants in the first few years from seed do have a growing point and so produce a rather long straggly sort of growth, until they start to form segments that we are familiar with. There is an illustration in Leighton-Boyce & Lliffe of a seeding plant displaying this immature form of growth. I grew a plant of glomeratus from seed and after four or five years it looked just like that illustration.

Of course the floccose sorts of Tephrocactus form a cylindrical stem by putting on annual growth from the growing point. I would also regard T.subterraneanus as having a growing point, as it puts annual growth on to the same stem. It is also quite probable that the sphaerica group of plants also grow from last year's stem and not from an areole. One segment on a sphaerica type plant growing in my bed is clearly growing with a growing point in orthodox manner, but it is almost impossible to tell how mature segments have originated. However if a segment is broken off at a joint it is very often possible to see a ring, or annulus, of flattened woolly hairs or glochids, right round the break, which shows that that particular segment did originate from an areole and not from a growing point.

The production of offsets seems to be rather unusual on T.rossiana; this plant has segments which are about as tall as they are broad. The offsets do not grow from the areole cushion but burst through the epidermis.

. . . from H.Middleditch

A quick look at my own plant of T.rossianus sensu Ritter confirms that this is indeed the case. I am always intrigued by the areoles on this plant, which seem to lack any wool cushion and are in the form of a narrow slit out of which projects one spine about 12mm long; this spine is directed away from the segment when new but before the end of the growing season it has turned to grow downwards relative to the axis of the segment.

It must be more than five ago since I acquired a plant of T.articulatus, usually called var. papyracanthus because of the wide, thin, papery-like spines. It only consisted of three or four joints and was never very happy. Ere long it performed the usual self-destruct operation leaving me with a couple of segments which looked as though they might reroot. One of these dried up and the other has lain on a pot for over four years without making any attempt to put out roots. Has it taken a dislike to me, I wonder?

. . . from P.Bint

Tephrocactus articulatus as a pot plant is something of a swine. On many occasions I have had segments galore which have parted company from the parent plant, which refuse steadfastly to root. Even when they have fallen over, no roots have appeared from the side or anywhere else. Just occasionally one has rooted without anything special happening to help it. I think possibly a medium like perlite kept moist where a warming effect is produced naturally by this 'compost' is a partially successful method. I have been told, although I have not tried it, that hortag produces good rooting results. Again I would assume that the container would need to be stood in a saucer of water. Many other Opuntia and allied genera that I have wished to propagate — mainly in the Tephrocactus section — have rooted quite well both when stood upright or when accidentally left on their sides.

. . . from H.Middleditch

I find myself quite confused over a couple of detail points of nomenclature in Kiesling's paper. Firstly, under the heading of Maihueniopsis minuta, Kiesling notes as synonyms the names of:- Tephrocactus mandragora Bckbg (sine typus) i.e. lacking a Type; Opuntia mandragora (Bkbg) Rowley (comb.illegitima); Maihueniopsis mandragora (Bkbg) Ritter (comb.illegitima) - presumably these latter two are stated to be illegitimate names because the basic name of T. mandragora lacked a Type specimen. Is this correct? Secondly, under the heading of Maihueniopsis boliviana there appears as synonym:- Cumulopuntia boliviana Ritter name invalid on account of absence of Type specimen. But in the Ritter book this name appears as Cumulopuntia boliviana (S.D.) Ritter, not as C. boliviana Ritter. I do not understand why this name should require a Type species to make it a valid name, since Opuntia boliviana (S.D.) is surely valid. In the same way Opuntia pentlandii (S.D.) is a valid name but in this case Kiesling seems to accept Cumulopuntia pentlandii (S.D.) Ritter as a valid name. Yet both Opuntia boliviana and Opuntia pentlandii are equally ancient and long accepted.names. Why does Kiesling treat them differently?

. . . from R. Mottram

I am not surprised that you can become confused by the nomenclatural rules - join the club! Frequently I do find myself referring to a summary of the main points of the ICBN prepared by Urs Eggli, in Bradleya 3. On that basis, as long as a latin diagnosis is given, then Tephrocactus mandragora Bkbg in Cactus 38:250.1953 is validly published. And on checking, this does appear to be the case. The requirement for a nomenclatural type to be cited in the original publication is only required after 1 Jan. 1958 (ICBN Article 37.1).

Lack of a type is of course a handicap to subsequent authors, and this is exacerbated by the lack of a precise type locality. Later authors would therefore be justified in rejecting the name as insufficiently known, but they could not do so on the grounds of invalidity. A later author may wish to designate a type, and he would look first for a herbarium specimen of the type collection, which we can be reasonably sure does not exist in this instance. He would then check if Backeberg published a good illustration, and indeed he publishes three photographs in his Die Cactaceae, of which the clearest is probably Abb.363 (p.349) and he would then designate this as the lectotype for the species. The plant in the illustration agrees well with plants in cultivation under this name, so that is no problem.

If there was no illustration suitable for designation as lectotype, the writer would then search for, or prepare himself, a herbarium specimen which agreed in the essential features of the first description, and this he would call the neotype of the species, i.e. the specimen on which the new author based the name, even though not of the type collection. Taking all the foregoing into account, Opuntia mandragora (Bkbg)Rowley and Maihueniopsis mandragora (Bkbg)Ritter, are both validly published.

Cumulopuntia boliviana (S.D.)Ritter is also validly published. The absence of a type does not enter into the validity of this name because of its age. Roberto Kiesling must surely be confused on this point. He can only reject the name if he considers that Salm-Dyck's description does not fit any known plant.

. . . further from H.Middleditch

In Cactus 38.1953 there is indeed an entry under Tephrocactus mandragora Bkbg sp. nov. which reads as follows:- "Radice longo et crasso, usque ad 12cm x 3cm, forma variante; articulis oblongis vel ovoides, ad 2cm longis, apice attenuatis; aculeis tenuissimus, brevibus, 1-3 albidis, ad 5mm longis vel deficientibus; flore fructuque ignoto. Argentinia borealis". Whatever views may be held as to the suitability of this description, it would seem to be valid, as R. Mottram observes.

It is specifically stated by Kiesling (p.172) that neotypes have been designated for Maihueniopsis minuta and for M. boliviana, where he regards the Ritter names as invalid. Neotypes have also been designated for M. ovata (Pfeiff) Ritter and for M. pentlandii syn. Cumulopuntia pentlandii (S.D.)Ritter where both Ritter names are accepted as valid. Hence it is still quite unclear why Kiesling considered two of these Ritter names invalid, whilst accepting the other two (and others) as valid, unless it was an oversight on his part.

. . . from G. Rowley

The comment from R. Mottram says it all on the names Tephrocactus mandragora Back (1953) and Opuntia boliviana S.D. (1845) and the validity of other combinations based upon them. I would only reaffirm my allegiance to a united Opuntia as "lumped" in 1958 and hence I do not accept Maihueniopsis, Cumulopuntia, and other Ritter segregates at the generic level, nor do I consider that there is much of a case to retain them as Subgenera, Sections, or Series.

. . . from H.Middleditch

Quite a few of the north american Opuntia are composed of shortish joints which are substantially cylindrical in section, as opposed to the flattened section exhibited by Platyopuntia. Is there a realistic basis upon which these can be separated from the south american group represented by Tephrocactus (or Cumulopuntia)? Or have we no alternative but to

accept Opuntia Rowley?

**REISE um die ERDE By F.J.F.Meyen 1834**

Abstracted and translated by H.Middleditch

[En route from Arica to Lake Titicaca ...] April 2nd. The temperature in the morning was very sharp. Some leagues further beyond Palca the road runs along the floor of the quebrada and is exceptionally pleasant. At the end of it however there was no longer any water and from here the vegetation greatly diminished. Soon all was bare rocks.....the tall cacti were replaced by low growing sorts....the mountain sides here were extraordinarily steep and their ascent was extremely fatiguing for our beasts. Tall plants are absent at this altitude and even the bushes, which still occurred here, were stunted and dwarflike.

Most noticeable here is the growth of some small alpine plants which are found not far from the boundary of the permanent snow; there are large hummocks of Laretia acaulis Hook and Verbena minima, etc. These plants are situated by preference on large boulders. In the course of a year they generally make such appreciable growth that it is not uncommon to see a group of these plants which cover 12 or even 20 square feet. Whole boulders are overlain with their mats, whose surface is so firm that one can scarcely penetrate it except with the sharpest knife. The stem of such a plant, which is probably several centuries old, rarely reaches a length of one foot but on the other hand acquires a thickness of 5 to 6 inches, with almost an infinite number of branches.

It is a prominent feature of the alpine vegetation that the plants which live at high altitudes grow more in colonies; at least these are nowhere so outstandingly prominent as right in this area. On the ascent of the Vulcan Maipu in Chile we commented upon the peculiar plant form of small round hummocks. Here in the Cordillera above Tacna they likewise occur but even more prominently. One may see, often from a considerable distance, small humps of 1 to 1½ feet high, which have a reddish yellow colour and at first the traveller deludes himself into thinking perhaps he has caught sight of some wild animals. On closer inspection this hump becomes a Pereskia, whose leaves are pressed very closely together and are furnished with 2in. to 3in. long reddish yellow spines. The flowers of this plant are pressed very closely together and do not jut out beyond the spines. At the altitude where the Pereskia appears is the upper limit of the cactus vegetation.

Around noon, after a lengthy and tiring ascent, we reached the crown of the ridge. An immense, splendid, but less impressive panorama lay before our eyes. All the heights and ridges which we had surmounted lay at our feet and the immense ocean in the far distance looked like a mist cloud. Not a tree, not a blade of grass, nothing but bare rocks and snow was to be seen.

Beyond the crown of the mountains extended an immense plateau. As we rode over it a sharp wind arose, so sharp and cold that we were obliged to cover our faces with woollen scarves. After two hours ride across the plateau we approached Nevado Tacora.... ..several hours further to the east lies the hamlet of Tacora. Some three leagues beyond Tacora lay a lake on whose banks were countless flocks of birds. The further we progressed to the northeast, the more the plateau rose. Here and there occurred marshy patches on whose surface effloresced a salt crust. Where these were crossed by our route the animals sank in quite deeply.

The high plain is covered with masses of porphory. Veins of quartz outcropped in some places, as later did red sandstone, covered with a conglomerate. Nothing but small Crucifera, Astragalus, Werneria and quite dwarf bushlike Baccharis spp.; they were often only a few inches high and only appeared in places where there was sufficient moisture. The sun was on the point of sinking and we already had 12 leagues behind us that day. We pressed on in the dark as far as the R.Uchusoma.

The beds of trachyte on this plateau were at such regular intervals that at a distance they looked like old mine workings running round basin like depressions. We rode all the morning through such fields of trachyte which were often so weathered that the stone lay several feet deep like fine sand so that progress through it was made very difficult. This trachyte is a blinding white colour and is extraordinarily rich in small quartz crystals. It covers almost the whole plateau from Tacora and on account of its white colour gives it an extraordinarily monotonous appearance. At some places we found individual lumps of black gritty stones enveloped in the trachyte. On our return trip, between Puno and Arequipa we found this trachyte once again forming the highest part of the passes. Only here and there in this weathered stone are occasional plants to be found; here a small bushlike Baccharis quadrangularis, there an extremely low-growing Malvacea.

At noon we came to the R.Cano, a tributary of the R.Maure. During lunch we sorted and packed the collected stones and plants. Nowhere was there any shade to be found. neither a bush nor a rock would have been able to provide it. The sun stood at its zenith and the ground was heated to 23°R. The water in the stream was at 14.6°R whilst at 8- hours that morning the water near us at that time was covered with thick ice. From this stream we climbed on to a more elevated plateau. In about an hour we reached the R.Maure. It ran rapidly at a sharp gradient. From there the route climbed steadily and somewhat later fine green valleys opened up here and there, which, because of the prescence of water, grew exceedingly good pasture for the domestic animals in this area. Everywhere were to be seen large herds of llamas, as well as guanacos grazing in their vicinity. Once again the splendid Pereskia appeared there, forming small hummocks, which with its reddish yellow spines was immune from grazing animals.

Towards evening we reached the indian village of Morocollo. The temperature of the air at Morocollo was extraordinarily low and was very surprising to us since we had been constantly exposed to burning sunshine during the daytime. At 6 in the evening when the ground was still quite warm, it was 7°R, but a few hours later the temperature fell rapidly. It was 2°R at 8 o'clock and at 6½ hours the following morning it was -1.5°R. The water in the vicinity was covered with ice and the fields were heavily coated with hoar frost. In the evening and overnight, as in daytime, the sky was clear and bright, and no clouds put in an appearance.

On 4 April we set off in the direction of Pisacoma. In some places beds of lava may be recognised which attain a depth of 7 to 8 feet at various places, covering the white trachyte. It probably came from the extinct volcano at the edge of the plateau. The vegetation up to the highest point of the plateau at 16,200 feet was as previously described. The pass over the Altos de Toledo lies at over one degree of latitude to the north of this area, at a height of 15,500 feet, yet in comparison

with this area it is covered with a very rich vegetation. The selfsame bush which attains 1 to 1½ feet in height there are barely 5 to 8 inches tall on the weathered patches of lava here.

The vegetation here is extremely meagre and it must be said that this desert was inhabited more by animals than by plants. Everywhere here was that small rodent which burrows into the weathered stones; it came to the surface in small packs of 10 to 12 individuals but as soon as we headed towards them they quickly retreated underground. Two beetles were also to be seen. Up till now we had not come across a single insect on the whole plateau. Around noon we halted at a small stream which probably ran into the R.Maure..... Already in the morning as we left Morocollc a small cloud had appeared in the east. It steadily increased, covering almost the whole of the sky by noon. A number of Vicunas showed up on the neighbouring hilltops but rapidly made off.

From now we descended the eastern slope of the highlands and at each opportune step we wondered at the disparity presented by such distinct changes east and west of the watershed. Even here we caught sight of no rock other than porphory and trachyte. Several mountain tops within our view, not covered with snow, displayed a complete peak of reddish-yellow colour, something like weathered trachyte. An imposing panorama unfolded itself as we ascended the valley of the R.Pisacoma. Boundless mountain chains, here and there with snowcrowned peaks, were all around, and at last presented an undulating landscape. In the far distant east, some 45 leagues away, the peaks of Illimani and Zorata were visible.

Particularly impressive was the difference in the character of the vegetation; the whole valley along which we made our way was covered with vegetation that is characteristic of the pampas east of the cordillera; it consisted of hard and fairly tall grasses with pointed leaves. These pointed leaves, which possessed a central rib, suddenly closed up on themselves in their upper half and appeared to be completely round and so were like stout spines, especially on the tall and strong grasses. These species of grass have the characteristic that they always grow in small tussocks which are scattered more or less widely apart.

With the change in the ground, the sky had also altered, from bright and clear on the plateau of Tacora; here it was regularly covered with clouds and the incessant crashes of thunder were heard again in the distant mountains. Regretably it was not long after we started over the pampa of the R.Pisacoma that we were overtaken by a violent storm with accompanying hail. The temperature fell to such a degree that the cold was excessively painful.... Finally we reached Pisacoma towards evening.

On our rest day we explored the surroundings. As far as the eye could see the porphory looked the same as we had encountered before meeting the R.Pisacoma, where it was somewhat weathered. It appeared here in regular upright columns which surrounded the mountain peaks and chains in the form of raised terraces. On these terraces, which are bordered by porphory columns, the indians cultivate their root crops; on all the mountain slopes around Pisacoma they have divided the ground into small plots by means of stone walls. We made a rich collection of fine and rare plants, partly on the slopes of the neighbouring mountains. An appreciable number of viscachas lived amongst the porphory boulders. On the pampas close to the banks of the R.Pisacoma we made an interesting collection of amphibians; we found some lizards, a toad, and a poisonous snake.

Early on 6 April we left Pisacoma; for about an hour we crossed the pampa. Right at the eastern end of this pampa were outcrops of red sandstone. It appeared everywhere on the slopes and peaks of the mountains. Under the rubble in this area we noted various unfamiliar and particularly striking rocks of volcanic origin; it was mainly a black, vesicular, basalt-like stone with with fine, crystalline, uneven flaws. As around the indian villages of Morocollo, Pisacoma, etc., so also here, all the mountain slopes are enclosed with stone walls. The round houses of uniform appearance were there too, but of the indians who lived in them there was never a sign.

The whole journey from Pisacoma to the indian village of Piche-pichun was very monotonous and yielded but few plant collections. Of animals there only remained the white throated ibis and the beetle which lived in the llama dung. Before noon we reached Piche-pichun, where an extraordinary number of birds were obvious near the houses and around the tiny stream running in front of them. The birds were so numerous that we never shot without expecting 2 or 3 birds with one shot. .....even here is a complete absence of wood and limited cultivation, on account of the appreciable altitude. Only with great difficulty were we able to obtain feed for the animals. Groups of houses were to be found in the surroundings and large herds of llama lived in the fields.

Next day we set off very early as we had a tiring day's journey ahead of us. The trail went steadily over the broad pampa, gradually descending. Everywhere we caught sight of innumerable herds of llamas, also sheep were frequent and even grazing horses here and there. At the foot of the mountains which enclosed the plain lay the stone houses of the indians. Water became steadily more plentiful in the area, the lower we descended. Never in our journey had we seen so many and such a variety of birds as on this day. Huge flocks of black ibis flew over us, in such numbers that they darkened the sun. Towards midday we crossed a small stream, surmounted a ridge, beyond which we came across a small lake. The surface of the lake was completely covered with white and black birds, about the size of a hen.

An hour after we left this small lake we reached the last rise and there was the long awaited view over the Chiquito basin. The whole valley of Chiquito with its immense lake lay before us, surrounded by green fields. Rapidly we descended to the floor of the plain and we met with a mixture of splendid plants here on the route, as far as the mission station of San Francisco de Anquac. The road from there to Ilave went straight across the plain and everywhere herds of llamas, sheep, pigs, donkeys, horses, mules, and even horned cattle were to be seen. For the first time we saw agriculture here which was like that in our homeland, here in an oasis enclosed on all sides by deserts and snow capped mountain ridges. All the flanks of the mountain chains are covered with fresh green and innumerable houses stand on their slopes.

As we rode over the plain at an easy gallop we were struck by the scent of a pretty plant which occurred in such great numbers that the meadows were covered with a carpet of it. On the morning of that day we had already seen several very stunted specimens of it near Piche-pichun. The sky had been marvellously clear for the whole day but with the setting of the sun the thunder rolled round the nearby hills whilst lightning continually crossed the sky. Late at night we reached the R.Ilave and had to wait until the morning to cross it. In the rainy season it is impassable from time to time.

[The party proceeded onwards to Puno and thence returned to Arequipa.]

. . . from H.Middleditch

In the foregoing article, read Tephrocactus for Pereskia, and for leaves read segments. On the basis of both location and spine colour it seems to be very probable that these were T.ignescens. This journey took place in April which is near the close of the rainy season in that area. In view of the comments on flowering times made under the heading of "To water - or not to water" in Chileans No.43, it is somewhat unexpected to find Tephrocactus flowering shortly before the dry season sets in..

**VOYAGE dans l'AMERIQUE MERIDIONALE** **By Alcide Dessalines D'Orbigny1844**
Abstracted and translated by H.Middleditch

[En route from Arica to La Paz....] May 20th — I arrived at the junction of the Palca ravine with another waterless ravine. There I left behind the moisture with the vegetation; the trail, difficult to follow, took a very steep gradient. It was ascended only with difficulty in the midst of broken terrain. The slope became even steeper; we zigzagged between sharp rocks, above fearful precipices, having in front of us a wall which had to be surmounted. After a great deal of effort we reached the crest. No words can express my feelings as I viewed Tacora, with its perpetual snowcap, set in the midst of a vast plain, with a bright and cloudless sky above.

The vegetation of this region is quite special. There are no trees, no bushes. With a few scarce grasses, only plants growing in a most unusual fashion are to be seen. They do not grow upwards, but lay across the rocks, forming a compact rounded mass, often several metres in diameter, of a fine green, whose branches are so pressed together like turf, that an axe will scarcely cut into them. Each mass represents just one plant, provided with just one root, which barely attains half a metre in height over the course of many centuries.

We stopped by a stream for the night, south of Tacora. The night was cold and sharp, all the water in the vicinity being turned to ice. The plain all around us was covered with hoar frost. It was possible to walk on the ice over the stream without cracking it; and that, believe it or not, in the tropics.

The mules walked with difficulty over a terrain covered with large smooth pebbles of porphory, or from time to time across peaty patches covered with a thick bed of salty effloresence. On a steady gradient I stopped to collect some plants, a species of Baccharis, etc.; at the top of the rise there was in view to the right a depression filled with white saline effloresence in the middle of which was lake Aracayo, about half a league across. On its banks were numerous water birds as well as a troup of geese. After another rise we dropped down to the R.Ochusuma or Ancomarca. This river is about 15m across, very swift, but shallow and fordable in all weathers.

I stopped for a while in the next valley, very fortuitously as in the afternoon a fearful and violent SW wind arose in which one could hold on to one's horse only with difficulty. Further on, I saw viscachas for the first time, living in holes in the cliffs of trachyte. In this section I shot a woodpecker, which lives only on the rocks, and two fine spp. of rodents which make their burrows in the moist plains. The surrounding rocks are packed with quartz crystals; when these rocks decompose such large quantities of these crystals remain on the ground that they shine in the sun.

May 23rd — I crossed an immense plain, the ground everywhere covered with smooth porphoritic pebbles and an aromatic, resinous shrub belonging to the Compositae. There were occasional patches of dull grey vegetation. Only the noise of the mule's hooves broke the desolate silence. Nature seemed to be entirely inanimate. Only the condor wheeled overhead, the birds had fled. A blue sky without a trace of a blemish ran from horizon to horizon.

Eventually we reached the R.Maure, suddenly arriving at the edge of a canyon several hundred feet deep cut into this almost horizontal plain. At first I wondered how we were going to get down to the river bed but there was a tiny path the width of a mule in the white trachyte. You must enter it by following a multitude of turns, suspended over the abyss, above and below masses of alternating porphory and trachyte, half balanced, which threaten to break off underfoot; the river is thirty or forty metres wide but of only slight depth, running swiftly over a bed of pebbles. Some grasses form small green ribbons floating at the whim of the waters, in the midst of which some small fish disport themselves. The crossing is easy despite the force of the current. On the far side I found a less difficult route as the slope is easier, but longer, eventually regaining the plateau.

We halted on the edge of the R.Tuyucane, where I espied a mountain shepherd descending from the higher parts. Moreover some vicunas appeared on the facing slopes, then disappeared rapidly from our view. The cold turned out to be most excessive during the night; the thermometer which showed 25° during the day, dropped as far as -5°C towards 6 hours in the morning. A very strong wind of a distressing dryness ceaselessly affected the skin of the face, especially cracks, above all the lips. It brought out some blood at each movement, which added considerably to my problems.

I set off again next day and, after passing many streams and skirting the foot of a mountain, came to a rise from the top of which a view of vast extent opened before my eyes. At my feet, the bolivian plateau stretched to left and to right for more than thirty leagues in breadth, running on until it was lost to view. In the middle of this vast plain arose only three lines of low, gently undulating, hills; those of La Paz, Corocoro, and San Andres. I could catch sight of a few patches of water between the hills, the famous lake Titicaca. Behind this panorama rose the huge chain of the Andes, crowned by the peaks of Illimani and Sorata. It was the finest spectacle offered to my eyes during the whole course of my voyages.

My small caravan crossed another deep gorge. Alongside the stream a fresh green carpet where a number of llamas and alpacas grazed. After crossing more stony slopes I reached a small peaty plain, crossed by several streams and covered with a short turf, carrying herds of animals and their shepherds. On all sides were round huts with conical roofs. Everywhere on the mountainside a patchwork of small fields enclosed with stones where potatoes were cultivated. I was close to the village of Calacote. I passed several more streams and crossed many rocky slopes, then rode down into a broad valley. As night fell we came to a halt besides a small river at a spot covered with the same resinous aromatic bushes already seen on this journey. These bushes not only cover a large part of the western plateau of bolivia but also all the part south of the great bolivian plateau. They seem to be especially suited to weathered trachyte or sandy ground.

At eight in the morning the sun was gilding the slopes around us. On the opposite slope everything was still in

the shade and under the influence of the night's severe frost. I followed the bottom of the Aygaderia valley, making innumerable detours to follow the windings of the river, seeing traces of cultivation everywhere on the hills.... I turned away from the river on my left and set off in the direction of Santiago de Machaca whose bell tower was visible about a league and a half away. To reach it I only had to cross this level plain covered everywhere with resinous bushes amongst which I came across plenty of herds of sheep, llamas, and alpacas.

On quitting Santiago I once again traversed the plain, which had now changed its appearance. No longer did I find any bushes, but hard and spiny grasses everywhere, on a sandy surface, covered at numerous spots with saline effloresence and equally numerous small lakes of salty water, where I shot some wildfowl. For abcut four leagues there was not the least undulation; I frequently stopped for a moment, now to pursue a bird, now to search for insects ...on leaving the plain, I once more came across my small aromatic shrub at the foot of a hill of silurian sandstone. I then crossed two parallel ridges a short distance from each other, both of the same geological composition. At the east side of the latter I arrived at the town of San Andres de Machaca, which is located on the brim of a deep canyon.

Beyond San Andres we crossed a gently sloping sandy plain similar to that of Santiago, with saline patches and small salty lakes here and there ... and arrived at two hours at the Desaguadero.

**VOYAGE DANS LE NORD DE LA BOLIVIE** **By H.A.Wedell 1853**
Translated by H.Middleditch

[En route from Arica to La paz. After leaving Tacna on April 23rd] At last we found ourselves at the highest point on our route, a spot known as the Pass of Gualillos. We halted for a moment whilst I took the altitude by barometer. The measurement corresponded exactly to that already given by Mr. Pentland. On the other side of the pass the trail started to descend. Shortly thereafter we passed close by the foot of the peak which we had seen from Tacna. The snow which covered it came down quite close to our route in several places. The trail now levelled out. Several spp. of grass grew in these elevated parts, amongst which the greyish tufts of Deyeuxia were quite notable, in association with a resinous Baccharis called Tola. This is a true community plant. At the end of the day's march we reached the village of Tacora.

We set off shortly after eight in the morning, passing through a landscape pretty much like that we had traversed on the previous day, with a cover of closely spaced Deyeuxia and Baccharis ...we stopped two hours after noon on the banks of the R.Uchusuma at a small marsh all bedecked with gentians in flower. But the clouds thickened after a while, rapidly taking on a menacing aspect, which sent us promptly to don our ponchos against the wind which became stronger and icier by the minute. All at once the sky became obscured by large snowflakes and the surface of the puna became covered by a blanket of white, over which our guide had considerable difficulty in deciding which way to go.

We halted for the night in a ruined building. When I awoke in daylight it had ceased to snow. It was a fine day but sharp (3 degrees below zero). After reloading our baggage we set off once again. Towards 11.00 a.m. we left the plain to start a picturesque but rough descent down to the banks of the R.Maure, which here forms the boundary between Peru and Bolivia. On April 24th, at seven in the morning, we set out and shortly came to the edge of a vast puna, perfectly uniform, scattered with clumps of tola and displaying here and there large plaques of Yareta and two other plants of similar appearance (Verbena minima and a Pycnophyllum) which were almost as common over the plateau. About eleven o'clock we arrived in sight of the village of Santiago de Machaca.

On leaving this village we continued across the puna, where the Tola and the Paja Brava competed for ground....to San Andres. On April 30th we continued our journey, gradually losing altitude. Little by little the region of the cordillera gave way to that of the cultivated puna. The barley, the quinoa, and the potato successively climbed up the better exposed slopes of the mountains. [The journey continued to La Paz and returned towards Lake Titicaca.]

Four leagues separate Tiaguanaco from the banks of the Titicaca lake, where there is a village called Guaqui. Between these two points the ground is covered over a great extent with a bed of gravel, and carries all the signs of being under water in the not too distant past. As well as the porphoritic rocks and sandstone around Puno, limestone is equally abundant. From Vilque I followed the grand quebrada Maravillas, in which ran only a small river. Following a side valley led to a steep climb. After a short travel I found myself on the edge of a lake whose surface was covered with wildfowl. By now I was in the midst of the mountains. The trail is visible across the mass of alluvial ground which is everywhere covered with resinous Tola bushes. One dry basin followed another, now joined by equally dry valleys, now cut off by bare limestone hills. Some of these basins are streaked with small rivers and streams; others, more or less marshy, support a covering of short grasses.

On April 22nd, after crossing the watershed of the cordillera, I arrived at an extensive plain on whose perfectly bare ground is scattered small fragments of quartz, which shine like diamonds in the sun. They look like small lumps of sugar, hence the name Pampas de Confital. It is swept incessantly by storms. When the wind blows there the sand is lifted by whirlwinds. This pampa lies at 4,870m altitude. Not a blade of vegetation appears to enliven this desolate region. When there are no clouds on the horizon, the majestic cone of Misti may be seen to the west.

. . . from H.Middleditch

All three above accounts confirm the impression conveyed by R.K.Hughes that the western part of the high Andes, from where T.ignescens is reported, is more arid than parts lying more to the east.

. . . from R.Ferryman

I can certainly confirm the overall impression of aridity at the western side of the Andes in northern Chile. On the occasion of my very first visit to Chile we paid a visit to the very northernmost part of that country. We made use of a track which starts at Arica and runs inland to Putre; travelling further inland from there in a more or less northwesterly direction we passed between some high peaks which form part of the main western chain of the Andes. On the inland side of this chain of peaks we only went as far as the vicinity of Chucuyo.

Here we came across about a dozen well-separated mounds of Tephrocacti, roughly about a metre wide and perhaps a good half metre high. One of them was in the process of submerging a grass tussock; some of the grasses were growing in the form of a ring, presumably the original plant having died off in its centre, leaving only the outside growth. The

grass grew in individual tussocks which were anything from a metre to a stone's throw apart. There were some very sparse, dwarf, stunted, almost leafless bushes. Most of the ground was quite bare, covered by gravel and stones up to fist-sized, with an occasional head-size piece of stone. For every square metre covered with this vegetation, there would be at least ten, if not twenty, square metres of just bare ground. Even this was abundant vegetation in comparison with most of the terrain in this area, which was virtually lacking in vegetation altogether.

Perhaps the most surprising thing was to find here were some extremely shallow hollows on the surface of the ground in which were laid some bird's eggs; presumably these passed for nests, although they were without a vestige of a twig.

**AN ACCOUNT OF A JOURNEY IN PERU AND BOLIVIA** **By Dr. A.Hettner**

Abstracted and translated by H.Middleditch from Verhandlung der Gesellschaft fur Erdkunde Vol XV 1888

On August 25th we left Arequipa via Chiguata, then skirted the Ubinas volcano which has a larger crater than that of Misti. A village of the same name lies in a deeply entrenched valley. On the main route from Arequipa to Lake Titicaca the puna is indeed a cohesive high steppe, but this representation does not apply everywhere, since in other places, as here at Ubinas, deep valleys cut into it. From Ubinas we travelled north, crossed a tributary of the R.Tambo and then over the desolate Pampa de Confital to Alto de Toledo, the highest spot on the main route from Arequipa to Puno.

For a few hours beyond the Alto de Toledo, plain sedimentary rocks outcropped at the roadside for the first time, for up till then it had run over volcanic stone and tuffa. From here to the banks of L.Titicaca there outcropped chiefly conglomerate, sandstone, and clay, of a red colour with interbeds of hard blue limestone. We joined the railway line at L.lagunillas, then left it again to go to Vilque. From there I took a side road to L.Umayo; on three sides of it were hills whose lower parts were of red sandstone, above which occurred basalt in sheet-like layers. At various places on the verge of hills, particularly on the Sillustani peninsula, were erected picturesque tombs of the old indians.

My journey in the following month took me through Chucuito, Acora, Ilave, and Juli, across the Desaguadero to Guaqui and on to La Paz. The mountains on the southwestern side of the lake are only a few hundred metres above the surface of the lake and consist largely of the red sandstone and conglomerate noted above, which were often capped by a layer of basalt. The southwestern part of the Copacabana peninsula is formed of trachyte; the northeastern half is mainly carbonaceous strata. From Zepita to the Desaguadero the ridges next to the lake were of red sandstone, which also appeared south of Tiahuanaco going in the direction of Corocoro, etc., whilst the low chain of hills which arose between Tiahuanaco and La Paz appeared to consist of carboniferous and devonian strata.

[The route continued right round Lake Titicaca and returned to Puno.] From there I did not take the direct route via Ayaviri to Santa Rosa, but cut across the highland to Mascusani. On the other side of Macusani arose a huge mountain. From Macusani I headed for Santa Rosa via Nunoa. The whole character of this section was similar to that on our outward journey to Macusani.

. . . from H.Middleditch

The name of Ubinas, Peru, appears in the KK field number list as the location for Neowerdermannia peruviana. As far as I am aware this is the most northerly reported location for this genus. Thus it would appear that the northern limit for the hummock forming Tephrocactus (excluding the floccose Austrocylindropuntia) and for Neowerdermannia both lie at a similar latitude.

If the foregoing account by Hettner is accepted then there is more than one change in the bedrock going from west to east across the Andes, apparently in more or less parallel bands. In consequence there will also be differences in what passes for soil on the surface. It is well known that such changes can have a material influence on the type of vegetation that is supported. Is it just coincidence that the Ritter names for the hummock forming Tephrocacti of the bolivian altiplano are also effectively arranged in similar parallel bands? Could these recorded differences in the bedrock, more especially if taken in conjunction with the reduction in humidity from east to west, account in any way for the differences noted from one species to another in the Ritter descriptions?

. . . from M.Cardenas. Recollections of a Naturalist 1972

During my stay at La Paz in April 1956 I undertook a trip for the collection of cultivated potatoes in the area bordering Titicaca, in the vicinity of the frontier with Peru. Leaving La Paz in the direction of Huaqui, I went through Jesus de Machaca, and from there to Santiago de Machaca. In the section from San Andres to Santiago de Machaca and scarcely interrupting the montonous desolation of the Altiplano without more natural vegetation than the tufts of Stipu ichu, are a great number of those cacti which form a sort of large hummock, from which project their yellow flowers. They corresponded mostly to the species Tephrocactus bolivianus, although there must exist some taxonomic surprises which are of no interest to the majority of foreign collectors who come for commercial purposes, because these cacti have no marketable value.

. . . from H.Middleditch

Yet another record of Tephrocactus flowering at the end of the rainy season! The Department of La Paz not only extends over this patch described here by Cardenas but stretches as far as the junction of the borders between Chile and Peru. It has not so far been possible to locate Vamburuta in Dept. La Paz, which Ritter quotes as the location for his FR 65e, T.pentlandii v. dactylifera, which "varies somewhat towards T.ignescens, the latter growing further to the west in Chile".

**THE I.O.S PROPOSALS FOR GENERA OF THE CACTACEAE.**

In Chileans 44 we were advised by G.Rowley that the present was the right time for views to be aired on the I.o.S. proposals for revising the genera of Cactaceae. There are evidently divergent views among the members of the I.o.S. working party on the questions of what genera to conserve and what to discard. It appears that there are divergent views outside that working party, too.

. . . from R.Bregman Succlents 67.5.1988

What is the I.o.S. up to?

The I.o.S. is an organisation which has the aim of promoting study of succulent plants. A number of prominent botanists and other specialists in cacti and other succulents are members. They meet once every two years In 1984 they initiated a plan to revise the taxonomy of the whole cactus family, because the nomenclatural chaos was becoming excessive. Their thoughts were published in 1986 in Bradleya, the journal of the British Cactus and Succulent Society. In short, the I.o.S. proposal was to divide the Cactaceae into 85 genera in place of the more than 200 genera according to Backeberg. This has, among other aspects, the consequence that genera such as Notocactus, Lobivia, Matucana, Trichocereus, Sulcorebutia, and very many other established generic names would be lost. This article speaks of a provisional classification, a concept of genera perceived to be desirable from the viewpoint of I.o.S. members. Further study is thus required to arrive at a definitive classification.

Apart from the fact that the approach of the I.o.S. can, at best, be described as scarcely scientific, the article in Bradleya has stirred up considerable dust, especially amongst Lobivia and Sulcorebutia enthusiasts. In itself, the aim of the I.o.S. is very sensible; it is indeed necessary to bring order into the chaos, and to eliminate some of the Backeberg and Ritter genera from the range of synonyms, but this must be done in a taxonomically responsible manner. One might well be prepared to accept merging of, for example, Notocactus into Parodia or Lobivia into Echinopsis.

But what do I read in Bradleya 1987? Hunt and Taylor have transferred many Notocactus species to Parodia, Sulcorebutia spp into Rebutia and Lobivia spp into Echinopsis. I thought that the 1986 article was a type of guideline for future taxonomic studies and monographs, but Hunt and Taysdlor have disregarded this and now produce tens of new combinations without substantial research. I conclude the latter when I read that the type species of Loxanthocereus (L.acanthurus) is to be placed under Cleistocactus, whereas L. acanthurus is placed in the genus Haageocereus in the 1986 article. I cannot view the new combinations of Hunt and Taylor in any manner but as a thoroughly cheap way to link their names to a plant species. This is the way to increase, rather than to decrease, nomenclatural chaos.

. . . from D.Schweich

The I.o.S. proposal to include Lobivia in Echinopsis and to leave Rebutia sensu Buining and Donald separate is absolutely ridiculous. Note that the working party included Roberto Kiesling only as a field specialist and he did not approve that point of view. To my mind it is the "English paper botany" that results in stupid things such as Rebutia famatimensis or Echinopsis thionantha. These sort of names simply strike me as proof of fantastic incompetence.

. . . from H.Middleditch

I tend to get the impression that the I.o.S. proposals have stirred up quite a bit of dust of this nature in Europe. It may be that this is in no way related to the suitability or otherwise of the proposed generic revisions, but simply to the fact that they have been handed down "from above" with what the recipients regard as inadequate explanation.

. . . from J.D.Donald

There has indeed arisen a marked sloppiness in the world's amateur succulent plant literature in the publication of new genera and species, which does need correction to bring the Cactaceae into line with modern generic and specific concepts. Enthusiastic authors and uncritical editors are clearly to blame, the latter especially in not submitting proferred text to knowledgeable professional referees, as would be the normal procedure in the scientific press and by learned societies. The work of the I.o.S. panel has been directed towards a wholesale review and revision of the genera of the Cactaceae and their proposals have already been published.

The traditional taxonomist worked on the basis of the features which could be seen, such as plant habit, the appearance of the flower, as well as the type of fruit and seed, without the benefit of modern techniques. The proposals put forward by the I.o.S. working party are based upon this traditional approach. Where we have a currently accepted genus, such as Sulcorebutia, we can not only observe the features which originally brought about the separation of this genera, but we can also see how closely some of these plants get to those in related genera. Where the I.o.S. proposals place such closely related groups in a composite genera, it will not be difficult to produce a key to separate out natural groupings.

Some of the I.o.S. proposals are in my opinion correct but some are mistaken. Clearly there is a paucity of understanding amongst the I.o.S. panel of certain of the south american genera. Their knowledge of these genera, admitted by themselves, is purely literary based, not upon a physical study nor from experience of cultivation, and decidedly not from field work. It is thus a pure paper exercise in taxonomy of dubious value. However it cannot be dismissed and must be taken seriously because it does indeed have considerable justification in its original concept.

It is difficult for me to be dispassionate as I am deeply involved in the study of plants belonging to some of the genera in question. Personally I am convinced of the general principles inveighed by the IoS committee in reaching their consensus, and I am prepared to present my future studies in sympathy with their findings. So I would accept their proposal regarding Sulcorebutia, but reject it for Weingartia. The loss of Lobivia is very questionable and does not solve the inherent problem of "where to draw the line" between these genera. You see paper taxonomy relies upon accurate descriptions and understanding as to what really constitutes the type species. An awful lot depends upon the real nature of the actual type plant involved and thus it could be that the type species for Lobivia is really an Echinopsis. But this does not mean that all the species allocated to Lobivia are indeed Lobivias in the sense of the original type species. What exactly is Lobivia? Rausch's Vol.4 puts Mediolobivia and Digitorebutia into Lobivia as well, while the IoS committee maintain the two latter belong to Rebutia. Do the committee believe they understand Lobivia better than Rausch? Clearly the I.o.S. panel worked too much in isolation, and published their findings too hastily without external criticism or consideration.

. . . from G.J.Swales

If you are looking for a ready made definition of what constitutes a genus, then you will be disappointed. Perhaps it would be best if I was to refer you to two publications by different authors who are recognised authorities on the subject of taxonomy. Bear in mind that there are quite a number of fairly recent publications of comparable standing that could equally well be consulted but the following are broadly in line with current thinking on the subject.

. . . from Principles of Angiosperm Taxonomy, by P.H.Davis & V.H.Heywood, 1963

We should always bear in mind that the most important "function" of the genus is to bring together species, preferably in the most natural manner. Rollins (1953) writes: It is my contention that a genus is made up of a group of closely related species. In determining the nature and even the limits of a given genus, interest should centre upon the relationship of the species. When attempting to place a species in a given genus, the primary question should be, is it related to the undoubted species of that genus? Rollins's contention does not help us to distinguish a genus from a section, but it does focus attention on Naturalness (in terms of overall resemblance) as the corner stone of the modern genus concept. The idea that a genus should always be readily definable on a few technical floral characters no longer holds the field as the prime generic criterion; the overriding consideration is whether it is naturally delimited.

There are three questions to be asked when we are deciding on generic concepts: (1) Is the group a natural one, and if not is it possible to make it so? Monophyly, in modern taxonomy often deduced by means of cytogenetic and geographical information in relation to morphology, is very helpful in deciding where the line should be drawn between two genera. Whether an unnatural group can be conveniently reclassified in a more natural manner will depend on the degree of discontinuity of variation and on how well the characters are correlated. If reclassification is a practical proposition, it should be carried out.

(2) Where should the line be drawn between closely allied genera? This presents no difficulty when the genera are very distinct from one another, but it is a considerable problem if the separation is not clear cut, as is so very often the case in large and natural families.

If our classification is to be natural, the modern taxonomist should be guided "not by a single arbitrary or artificial character but by the sum total of characters manifested in each group studied" (Sherff,1940). An excellent example is found in Bidens which was traditionally separated from Coreopsis by Linnaeus and de Candolle by the retrorse barbs on its achenial bristles. Several species of so-called Coreopsis contain forms with retrorsely barbed bristles and therefore technically referable to Bidens. It was left to Britton to abandon tradition and and refer all "Coreopsis" species showing ambiversalism in their bristle barbs to the genus Bidens - a decision taken on overall resemblances, not on a single character.

We have already expressed the opinion that there is no reason why vegetative characters should not be as good as floral ones for the delimitation of taxa. Which is used should depend on character correlation and discontinuity of variation. The influence of Linnaeus has resulted in the recognition of genera primarily on floral characters, or at least in these characters being stressed in their diagnosis. The tribe Scilleae of Liliaceae provides an example in which vegetative characters have proved most useful for the delimitation of natural genera (Chouard, 1931). The same applies to the segregates of Cotyledon (Umbilicus, Rosularia, etc). Such genera have the added advantage of being very readily distinguished.

It will be apparent to many taxonomists that generic characters are often adaptive ones — the inevitable result of natural selection. So far as floral characters are concerned, they are usually adaptive in relation to a particular mode of pollination or dispersal. Indeed, a family which shows marked diversity or elaboration in flower structure seldom shows it in its fruits or seeds — and vice versa (cf. Scrophulariaceae, Labiatae and Orchidaceae on one hand, Cruciferae, Umbelliferae, and Gramineae on the other). In so far as these characters reflect the adaptive evolution of the group, we may claim that classification is evolutionary.

Our taxonomic groups must be primarily based on the discontinuity and correlation of characters, irrespective of their "biological significance", not on inferred adaptive or phylogenetic interpretations. Such considerations may, however, be taken into account when it comes to delimiting groups and particularly in the attribution of rank.

. . . from "The evolution and classification of flowering plants" by A.Cronquist, 1968

It is obviously desirable that each taxon be sharply delineated and well characterised. The existence of intermediate forms, which could as well be assigned to one group as another, is disturbing to our sense of order. It is, unfortunately, impractical to insist that there never be any intermediates between recognised taxa, however much the existence of these intermediates may disturb our sense of propriety.

If a small group is so different from others that it cannot be included elsewhere without undue difficulty, it is kept as a separate unit. Thus we have some genera with only one species, some families with only one genus, some orders with only one family.

On the other hand, if a large and mentally unwieldy group can be divided by using characters of less evident importance, or by ignoring the existence of a few transitional units, it may be useful to undertake this division. Thus the genera in such large and closely knit families as the Compositae, Cruciferae, and Umbelliferae are notoriously difficult to define. In order to have any genera at all, we must use relatively trivial differentiating characters, and even then be prepared to face the existence of transitional species. In the Compositae we would otherwise confront the prospect of including the whole subfamily Asteroideae (Tubiflorae) with some 15,000 or more species, in a single genus. In such a large group, an imperfect organisation is better than no organisation at all.

The larger the group, the greater the mental pressure to divide it, even if minor characters must be used and some intermediates must be arbitrarily placed. Conversely, the smaller the group, the greater the differences must be between it and its relatives, if the group is to be maintained.

We are thus led to the principle of seeking the best compromise among the often conflicting objectives of the taxonomic system. The taxonomic system is a general purpose system, and it cannot properly serve any one purpose so faithfully as to exclude some other purpose altogether. There can be as many special systems as there are special purposes, but only the taxonomic system attempts to balance all these needs against one another in a single scheme. It should not be surprising that taxonomists often differ about how best to meet the multitude of conflicting objectives.

The fact that recognisable groups are not always sharply limited should not be surprising. The evolutionary concept provides the basic rationale for the taxonomic system. If the fossil record were complete, all gaps between groups would disappear. At any particular time level there are gaps, but these gaps developed only through the extinction of intermediate forms after evolutionary divergence. It is only to be expected that extinction of the connecting forms will progress

irregularly, and that at any given time there are perceptible groups which are still connected by an evolutionary remnant of transitional forms. Asa Gray once observed that the several segregates of the genus Gilia just failed as genera "by want of a little extinction". Most students of the Polemoniaceae now regard these segregates as distinct genera, in spite of the connecting species.

It is perfectly clear that natural, recognisable groups of species, and groups of groups, exist. The ranks at which these groups should be received are not inherent in the nature of the group, but depend upon subjective individual judgement. The criteria on which that judgement should be based are recondite. They come down to a personal evaluation of the importance of the differences and the size and coherence of the group, in the context of the system as a whole. Since individual characters cannot reasonably have a fixed, inherent taxonomic value, any evaluation of the importance of the characters marking a group is likely to be difficult and subject to unresolvable differences of opinion.

In spite of these inherent difficulties, a very considerable agreement has grown up regarding the groups to be recognised as genera and families of angiosperms. In part, at least, this agreement involves typological thinking. If the circumstances permit, we try to define genera in such a way that one can recognise a genus from its aspect, without recourse to technical characters not readily visible to the naked eye. Thus a person who is familiar with one species of Aster or Solidago can readily recognise other species of these genera when he first sees them, etc.

In the case of maples, the typological concept that "a genus ought to look like a genus" has clearly influenced the traditional definition of the group. There are enough well correlated differences in the flowers and inflorescence of various species of Acer to permit the recognition of several genera with characters just as strong as those of genera in other families; but the trees all "look so much like maples", because of the opposite, usually palmated lobed leaves and characteristic double samaras, that it is customary to define the genus broadly.

The trouble with such typological concepts is that they often do not provide a clear answer. Although it is possible to learn to recognise an Aster, or a Quercus, or Solidago by its general appearance, it is equally possible to learn the sections or subgenera of these and many other genera in the same way. There is nothing but custom and individual opinion to determine whether the segregates from these genera should be held as distinct genera or considered as sections or subgenera of more broadly defined genera. Custom, in such matters, is merely the sum of a series of individual opinions, plus inertia.

. . . from H.Middleditch

When the I.o.S. proposals for south american cactus genera are examined it will be found that the changes proposed for Brazilian cereoids, for example, are somewhat similar in conception. Thus Arrojadoa would include Micranthocereus; Stephanocereus could be submerged in Pilosocereus; Zehntnerella would be included in Facheiroa. Whether a cephalium is terminal or side, and even the presence or absence of a cephalium, is evidently not regarded as generically important by the I.o.S. It can hardly be the "naturalness" of "looking like each other" that has influenced these particular proposals. The differences between the existing genera is somewhat more than "retrorse barbs on the achenial bristles". Or is it that with few species involved per genera "their separation may not be justifiable on grounds of convenience"? Is there continuity or reasonable similarity in flower, and fruit? And also in the seed - or is the seed a technical character "not visible to the naked eye"? If the evaluation of characters used to define a genera can be "subject to unresolvable differences of opinion", do the IoS proposals circumvent such problems by avoiding evaluation of the defining characters?

It has been mentioned before in these pages that the uplift of the Andes is geologically the most recent mountain building movement on earth. Not far from Tarija, well above the forest zone, there have been found the remains of animals which lived in and fed on the forest that once grew there. Neither the forest nor the animals have survived there. The animals no longer survive anywhere. The cacti which once grew there may have been able to adapt to their new elevation and climate. Or like the forest animals they too may have been eliminated and in their place new sorts may have been able to migrate from adjacent territory. Some of the newcomers may have adapted to the new conditions,and thrived at the higher altitude. If the intermediate adaptions no longer exist, we may now be looking at examples of both forms of survival growing in association, and be able to distinguish between two groups without difficulty. When the intermediate adaptions and variations which resulted from the changed conditions still remain in existence today, any such division can only be artificial and subject to personal opinion. Nevertheless, we may be very fortunate in having before us a still picture from the slow but inexorably moving scene of the development of a section of the Flora. Traditional taxonomy can put into little boxes each sort of developed and distinct flora without too much trouble. But traditional taxonomy is not designed to deal with a still from a moving scenario.

Many authors have become involved in the course of establishing generic names for the Andean cacti. For many years knowledge was patchy and scanty; separation of genera on the basis of material then to hand did not pose too many problems. For practical purposes the days of discovery are over; nowadays it is destruction or conservation that exercises the mind. Added details provide invaluable information but hardly affect the overall picture of relationships. For the taxonomists the time is suitable to review the genera involved.

Where there still exists not just the new types of cacti that have adapted to the uplift of the Andes, but also the intermediate stages of the adjustment process, it becomes taxonomically difficult to decide "where to draw the line". In these circumstances there is only one route the academic taxonomist can take, and that is to lump together the main bodies and the intermediates. This results in genera which contain very divergent plants and for convenience of study and reference such genera are commonly divided either into sections or subgenera. Thus one may have Borzicactus (subgenus Cleistocactus) candellila, for example. This is a perfectly acceptable taxonomically. But it is clumsy and inconvenient for everyday or frequent usage and has nothing to commend it from the point of view of communication between cactophiles. No doubt it was acceptance of such mundane practicalities that led the I.o.S. working party to note that "Collectors and other specialists remain at liberty to use subgeneric and sectional names informally as if they were generic, and to argue about relationships without being entangled in the formal apparatus of nomenclature".

Just as the Andean cacti have adapted themselves to a change of circumstances, cactophiles have adapted themselves from the simplicity of Schumann's genera to the intricacies of Backeberg. Almost every splitting, whatever its other merits or demerits, was accompanied by comparison of features or catalogue of details which not infrequently told us something new about the plants. But the current proposals are for the pure taxonomist, merely a culmination of the Opuntia of Rowley, the Borzicactus of Kimnach, the Echinopsis of Friedrich, and so on. By their very nature they are paper proposals, not concerned with the plants. They are not intended to enlighten the collector or anyone else about details. They are not intended to be a service to cactophiles, nor can they be. As the I.o.S. working party evidently recognise, the time has now arrived for cactophiles to cease adapting to the taxonomist, and go their own way.

## THE NEW RAUSCH LOBIVIA BOOK

. . . from R.Purslow

I was interested in Lobivia before the publication of the first Rausch books on this genera in 1975, but their appearance certainly led me to devote a large part of my collection to this genera. In consequence I viewed the prospect of an additional volume with more than passing interest. As with the previous volumes, what appears at first to be straightforward treatise stands up to rereading on many subsequent occasions. Cross referencing certain points not only within this book but also with the earlier volumes sheds new light on many areas.

Lobivia 85 is important as a text as it contains not only many new combinations at species level but also the first publication of many new species and varieties, approximately 40 in all. His treatment of those species which were already dealt with in his earlier works, is essentially a refinement of original ideas, based upon further field work, study, and observations. In general I believe that it is an improvement on the original combinations, especially at the lower levels of synonymy.

The inclusions of some Mediolobivia species may not meet with wholehearted approval, although the disquiet aroused is likely to be no more than that which greeted the inclusion of Soehrensia, aracnacantha, and aurea as sections in the original work. Rausch gives the impression of being somewhat uncertain as to the relationship of the various Mediolobivia sections to each other. Undoubtedly the inclusion of Acanthocalycium will cause some consternation.

There is little in the text to suggest relationships between the various Lobivia complexes, other than rather tenuous ideas, which given the limitations on his research is probably a wise decision. In addition Rausch's enlarged concept of the genus unfortunately means that in some 160 pages he can only hint at many points. Inevitably this leads to a frustrating brevity of material dealing with many species and certainly some of the brief descriptions would by no means be adequate to permit the species described to be identified with certainty. The book appears to be aimed primarily at those collectors who are already reasonably familiar with the plants under discussion. It looks as though there would have been enough material for a publication twice the size. The book as presented probably represents a good compromise between content and price.

Plants raised from Rausch seed are probably the backbone of many a Lobivia collection so I anticipate that no little confusion will arise out of changes of name brought about by this publication. Especially so where the original field collection number is not included on the label. Just as an example:- R 168, formerly L.nealeana, now L.pseudocachensis, whilst R 773 is now L.nealeana.

Is it worth the cost? When they were first published his Lobivia 1,2, & 3 together cost over £20 and that was a good ten years ago. The new volume is hardback and so should be much more durable than the first three volumes which have a habit of losing pages after years of use. It does represent a welcome addition to the literature available dealing with this group.

. . . from H.Middleditch

The photographs in this volume are comparable in colour tone and definition with those in Rausch's earlier work. Where the same plant is illustrated in both publications then if previously it was a close up view there is now a photograph where something may be seen of the nature of the habitat surroundings, and vice versa. Many of these habitat shots provide a useful impression of the surroundings which is not equalled by information from other references, or on some cases not available at all.

## A HARE-RAISING TAIL?

. . . from H. Middleditch

During the course of our 1986 Weekend there was a brief reference made to the Trichomosemineae group of Gymnocalycium being so named on account of the slender projections rising from most (if not all) of the testa cells on the external surface of the seed. This brought forth a remark from N. Taylor to the effect that it was rather unfortunate that this term had been used because the projection on the cells of the testa of this group of seeds was not really a trichome.

. . . from N. Taylor

In amplification of my brief comment about trichomes, or hairs. Three classes of hairs may be recognisable in the Cactaceae. (1) Simple, single-celled extrusions forming part of the testa cell in seeds of Gymnocalycium, Frailea, and Blossfeldia (2) Uniseriate hairs e.g. areolar felt, formed of single rows of cells joined end to end. (3) Multiseriate hair-spines such as are found in Oreocereus etc. and on the tube of flowers in the Echinopsis/Cleistocactus alliance, which are derived from spines or have a similar origin - these, as the name suggests, are formed of more than one row of cells fused together. At Kew, we use the term areolar trichomes or wool or felt for type (2) but do not employ the term trichome for any other type of cactus hair. A proper terminology for all cactus structures is now greatly needed, but this implies a full understanding of basic similarities. For example, the presence or absence of spines in Acantholobivia seems less significant when it is realized that the tube hairs and spines have the same origin - one is just thicker and stronger than the other.

. . . from G.J.Swales

I can sympathise with the contention that the projection on the testa cells of the seed from the Trichomosemineae group of Gymnocalycium is not really a trichome. An example of a trichome may be found in a scented

geranium; the scent is held in a minute container consisting of one cell, which is raised above the surface of the petal on a equally minute stalk consisting of one or more cells. The slightest touch on the surface of the petal ruptures the cell containing the aromatic fluid and so releases the scent. As this is a projection consisting of more than one cell I would class it as a trichome.

On the other hand N. Taylor does suggest that a trichome can consist of a "single-celled extension forming part of the testa cell". However if it is an integral part of the testa cell, then it is not a single celled extension. If it is a single celled extension, then it is not an integral part of the testa cell. Where a single-celled trichome arises from a leaf, for example, there is a cross wall between it and the epidermal cell that produced it and both cells possess their own nucleus. This is a *unicellular trichome. Such a trichome is illustrated in Fig.18 Plate II Lindley J. 'An Introduction to Botany' Vol.2 1848. There is* also a single celled trichome shown in Gibson & Noble 'The Cactus Primer' 1986 fig 10.32 page 225.

On the other hand, root hairs are epidermal cells with relatively very long extensions but they have only one nucleus and are therefore still a single cell unit. Root hairs are therefore not a trichome. It is my belief that the projection on Trichomosemineae seeds is more akin to root hairs i.e. papillose cells, being an integral part of the testa cell.

. . . from H. Middleditch

So is what we call a cell (or tubercle, or wart) on the testa surface of a seed, really just one single structural box i.e. one plant cell?.

. . . from G.J.Swales

It is possible to answer this question by cutting a seed in section and then looking at the cross section of the testa wall under a scanning electron microscope. I have done this with a number of Gymnocalycium seeds and in most of them the protrusion which we call a cell is indeed the top of a single hollow box-like plant cell.

. . . from Esau,K. Anatomy of seed plants

Trichomes are highly variable appendages of the epidermis, including glandular (or secretory) and non-glandular hairs, scales, papillae, and the absorbing hairs of roots (Uphof J.C.T. Plant hairs, Handbuch der Pflanzenanatomie, Vol.4 Part 5 1962). They occur in all parts of the plant and may persist through the life of the plant or may fall off early. Some of the persisting hairs remain alive, others die and become dry. Although trichomes vary widely in structure within larger and smaller groups of plants, they are sometimes remarkably uniform in a given taxon and may be used for taxonomic purposes.

One of the most prevalent characters of xeromorphic leaves is the high ratio of volume to surface i.e. the leaves are small and compact. A xerophytic flora may also have a high proportion of representatives with leaves having a a hypodermis, a tissue with few or no chloroplasts. Trichomes are abundant in many xerophytes and if the same pubescent species has mesophytic and xerophytic forms, the latter usually have a denser covering of hairs.

Xeromorphic features (and other ecotypic features) show variable degrees of constancy, but they may be well fixed genetically in a given species. Environmental factors, however, may induce a degree of xeromorphy in normally mesophytic leaves or intensify the xeromorphic characters in xerophytes. The deficiency of moisture is only one such factor. Succulence, for example, is increased when nitrogen is defecient. Another important factor is light; leaves developing in light of higher intensity show a higher degree of xeromorphy than those protected from light.

External secretory structures vary in complexity. Sometimes the secretory cells are components of appendages — glandular trichomes and glands — derived from the epidermis or from both the epidermis and subepidermal layers. Trichomes often have a unicellular or multicellular head composed of cells producing the secretion and borne on a stalk of non-glandular cells. In the oil secreting trichomes of Mentha, the oil is released to the surface when the extension at the upper end of the trichome is broken. A somewhat similar mechanism of release of contents is found in the stinging hairs of nettle. The trichomes on the leaves of insectiverous plants secrete fluids that trap insects and digest them. In species of saltbush (Atriplex) salt is deposited on the surface of the leaf after the trichomes collapse.

. . . from H. Middleditch

Alongside the foregoing are sketches of various examples of trichomes, one of which is of cotton seed. Each strand of cotton is a trichome consisting of one epidermal surface cell which has elongated. Here the outward bulge on the cell has almost the same cross section as the epidermal cell, but it is still only one cell. If this is the textbook compass of a trichome, then a cell which bulges outward on seed of a Trichomosemineae type of Gymnocalcium is also a trichome, and the terminology is then correct.

. . . from Strasburger, Textbook of Botany 1970

Of frequent occurrence are epidermal appendages, consisting of from one to many cells, and known as hairs or trichomes. Single celled hairs may be shaped like papillae, as on the petals of Viola tricolor or on the petals of Lupinus luteus. They may have thin and delicate walls like the hairs of the seed of cotton which exceed 4cm in length and out of which cotton wool and cloth are made.

. . . from H. Middleditch

It is beginning to look as though Schultz had indeed read his textbooks before deciding on his "Trichomosemineae".

. . . from Weir, Stocking and Barbour — Botany, an introduction to plant biology 1970.

The bodies of blue-green algae consist of single cells, colonies, or short filaments (trichomes).

. . . from Seed Biology, Ed. T.T.Kozlowski, Vol.1

Plant organs involved in seed dispersal may vary considerably. The diaspore may consist of the seed only, of part or the whole fruit, and may include different floral parts or vegetative organs. The diaspores are moved from the mother plant to the place of seed germination either by external agents or by methods originating from the plant itself. Dispersal by animals —- zoochory,....includes pizoochory...where the diaspores adhere to the fleece, coat, or feathers of animals....but gradually loosen and fall to the ground.

The hooklike spines by which the diaspore clings to animals may be unicellular or multicellular. They can be either trichomes or emergences or may even constitute a whole organ. The simplest type is that of an epidermal cell that developes into a hard, thick-walled hooklike trichome e.g. on fruits of Galium spp, on fruits of Asperula odorata, on bracts which surround the fruit of Parietaria officinalis and on glumes, paleas, or spikelet axes of many Gramineae. Epidermal cells surrounding the widened base of such a trichome may often be specially arranged. When inner cells also take part in the construction of such a base, an emergence is formed. The emergence can terminate with one hooklike cell, as for example the spines on the fruits of Ranunculus arvenis.

Wind is the most active of all agents in the dispersal of seeds. Dispersal by wind can be achieved by active transport of diasphores by wind. Plumed diaspores are equipped with trichomes. The trichomes are often one-celled, although many celled trichomes also occur. Hairs may cover a diaspore over its entire surface — for example in seeds of Gossypium [cotton -H.M.]. In Compositae the hair may develop into intricate feathers, as in Taraxacum officinale [British Standard dandelion — H.M.].

. . . from H. Middleditch

Is the epidermal cell with its trichome on the fruit of Galium spp, just one plant cell i.e. without a cell wall between the epidermal cell and the trichome and without a separate nucleus in the trichome? Just like root hairs? Like cotton hairs? Like the projections on the cells of Trichomosemineae — trichomes?

## CHILEANS 1988 WEEKEND

This will be held from 7.00p.m. Friday September 9th to 4.00p.m. Sunday September 11th. As requested by those members who had sampled the halls of residence used for our previous two years' Events, we have been able to book into Cavendish Hall, at Nottingham University.

We are expecting to hear from J.Lambert about his third trip to Argentina, to the north-west of that country and to Paraguay; as he is also planning another trip to Argentina shortly there will be an opportunity to suggest possible items of interest en route. From D.Hunt we hear that he expects to talk about the trip made recently to Venezuela.

At the suggestion of R.Ferryman we expect to discuss Thelocephala, with a floor map, and also Pyrrhocactus sensu Berger i.e. those from Argentina. Comments on Parodia have been offered from G.Hole and from R.Moreton, with emphasis on those from NW Argentina. Any plants which would support these discussions will be most welcome, as would plants of Echinopsis silvestrii. A further set of slides from Peru will be presented by R.K.Hughes, including some Tephrocacti; examples of plants with and without thickened rootstock will be very welcome. Some propagations from the plants used to illustrate the Leighton-Boyce & Illife publication on Tephrocacti are expected to be on hand. There will be a discussion on illustrate the Leighton-Boyce & Lllif publication on Tephrocacti are expected to be on hand. There will be a discussion on Tephrocactus/Cumulopuntia/Maihueniopsis. More thoughts on the Lobivia aurea complex are anticipated from P.Allcock. Any other slides, comments, and queries would be welcome.

The cost for the Weekend will be £49.60 per head, covering accomodation in single rooms together with all meals as well as morning coffee and afternoon tea. To make a booking cheques made payable to "The Chileans" should be sent to H.Middleditch as early as possible, when a draft programme will be provided together with information on how to find the meeting place.

## CONTENTS



## SPECIAL INTERESTS

| | |
|---|---|
| Austrocacti | A. Johnston, 11, Malvern Road, Scunthorpe, DN17 1EL. |
| Cleistocacti | T. Lavender, Kalanchoe, Market Place, Tetney, DN36 5NN. |
| Copiapoa | A. W. Craig, 32, Forest Lane, Kirklevington, Yarm, TS15 9LY. |
| Echinopsis | M. Murse, 32, Fielding Road, Birstall, Leicester, LE4 3AJ. |
| Frailea | J. Forrest, Spring Garden, 2, Darngaber Road, Quarter, Hamilton. |
| Gymnocalycium | F. Fuschillo, 55, Emberton Court, Torpion Street, London, EC1V 0EP. |
| Lobivia | R. Purslow, 130, Brighton Road, South Croydon, CR2 6AE. |
| Matucana | P. Allcock, 49, High Street, Burford, OX8 4AQ. |
| Melocactus | J. Arnold, Suffolk House, 2, Oak Hill, Washingborough, LN4 1BA. |
| Neoporterianae | R. Ferryman, Nichelia, The Treet, Stonham Aspal, IP14 6AH. |
| Noctocactinae | G. J. Charles, Briarsbank, Fosterbridge, Ketton, Stamford, PE9 3UU. |
| Tephrocactus | R. K. Hughes, 16, Ashbourne Avenue, Bootle, L30 3SF. |
| Uebelmannia | S. Stringer, 27, Oaklands Way, Winklebury, Basingstoke, RG23 8LU. |

## THE CHILEANS

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| Organiser | H. Middleditch, 5, Lyons Avenue, Hetton-le-Hole, Co. Durham, DH5 0HS. |
| Treasurer | R. L. Purves, 19, Brocks Drive, Guildford, GU3, 3ND. |
| Membership Sec. & Back Numbers | Mrs. G. Craig, 32, Forest Lane, Kirklevington, Yarm, TS15 9LY. |
| Slide Library | A. W. Craig, 32, Forest Lane, Kirklevington, Yarm, TS15 9LY. |