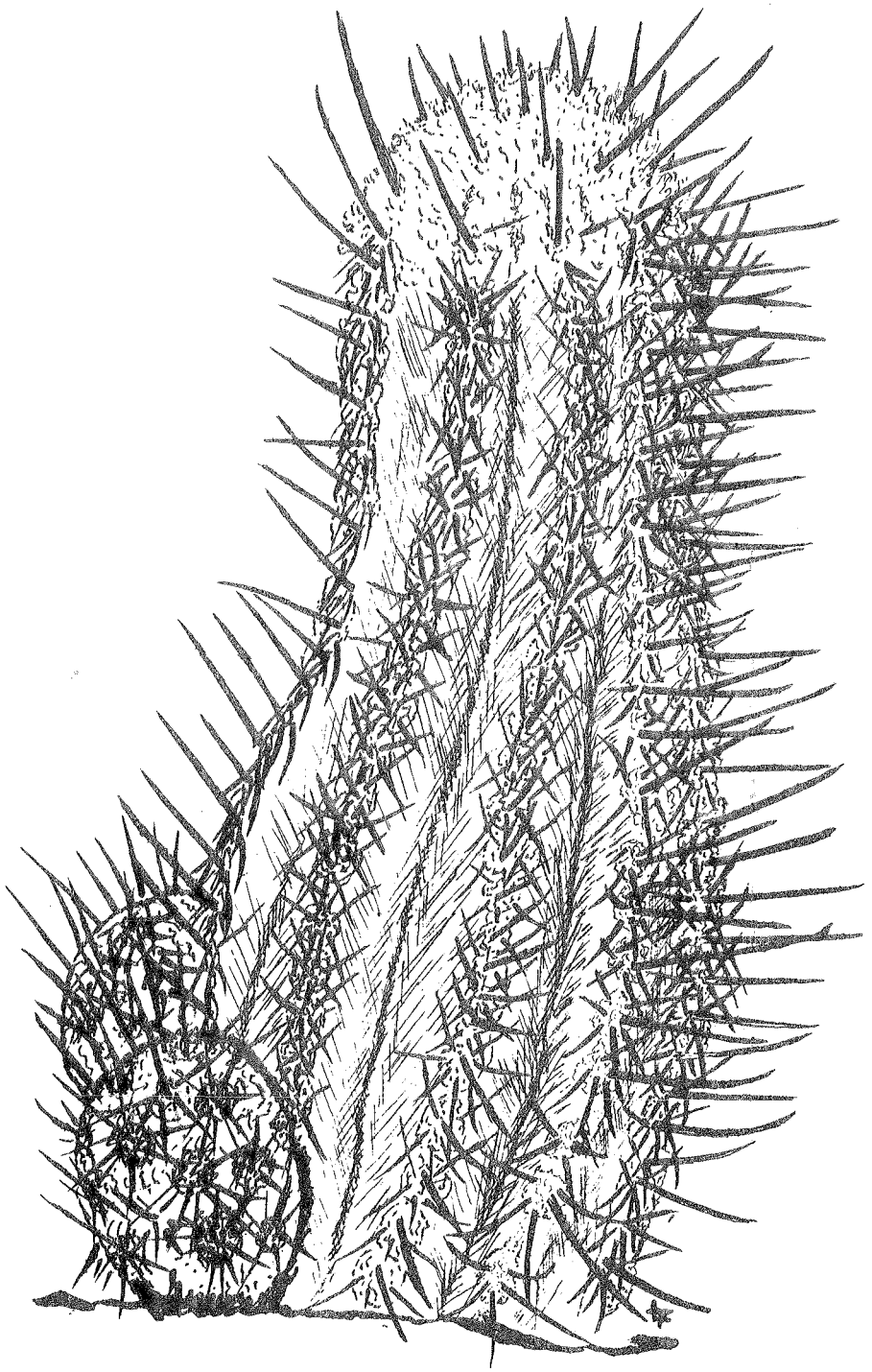
# THE CHILEANS '80

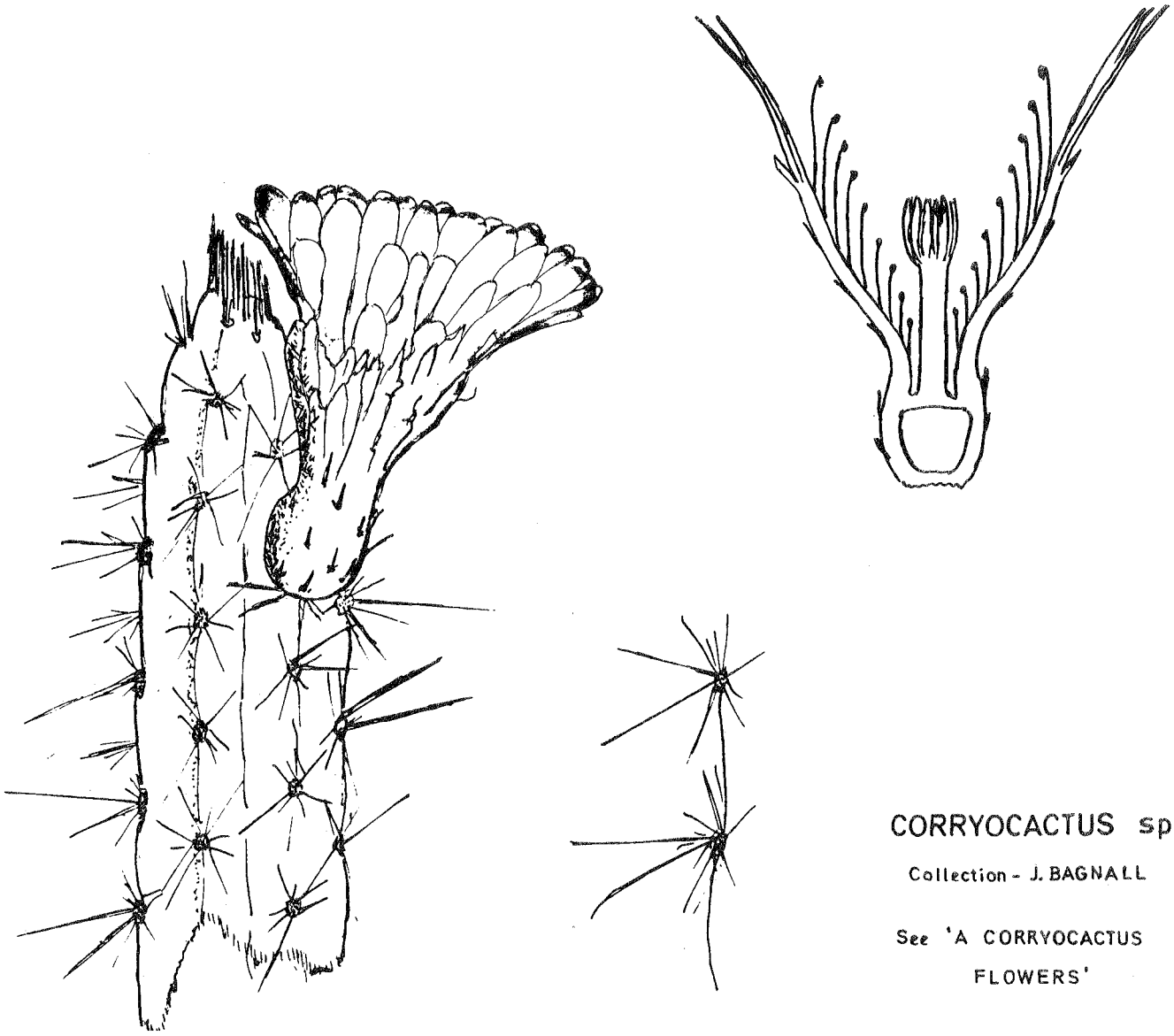
VOLUME 11 NUMBER 38



COPIAPOA SH 829

Collection - E.W. BENTLEY

Three quarter full size



CORRYOCACTUS sp.

Collection - J. BAGNALL

See 'A CORRYOCACTUS FLOWERS'

CORRYOCACTUS BREVISTYLUS

ROAD FROM IQUIQUE TO CHUSMISA

## A CORRYOCACTUS FLOWERS From J. Bagnall

Some five or six years ago I acquired a cereiform plant from another local collector, Fred Wass, under the label "Harrisia bonplandii". He did not really know for certain where and when he bought it, but it is possible that it came from Churchman Bros. at Mansfield Woodhouse since he had purchased a few plants from them at a time when they were almost the only cactus nursery in the country which sold imported plants. This particular plant had not made any offsets before it came into my collection, but it grew quite well for me and reached a height of nearly two metres (about six feet) and so it had to be stood at the end of the greenhouse, otherwise it would have been touching the roof glass.

Towards the end of May I was walking round the outside of the greenhouse when I happened to notice that two buds had formed not far from the top of the stem — they were pointing towards the glass, so that I had not noticed them when I was inside the greenhouse looking at the plants. The buds were conical in shape on top of a narrower tube; the upper parts of the buds were pinkish in colour. They did not really look at all like Harrisia buds to me and the more they grew the less they looked like a Harrisia; I began to wonder if it was perhaps one of the red-flowering Trichocerei. The buds grew larger and after about another week the first flower opened. It was about 7cm tall and also about 7cm in diameter. The ovary was about 13mm broad and above the ovary the tube was pinched in a little to form a waist; above that the flower opened out to a bell shape. The ovary and the tube were green; there were a large number of what looked like tiny areoles on the ovary and the tube, with very short black felt and a few tiny black bristles. These areoles were only 4 or 5mm apart on the ovary but on the tube they became spaced further apart. The upper part of the tube was completely covered with green scales (or sepals?); the petals were a bright orange red, blunt at the tip. When we had a close look at the petals we found that the blunt tips were denticulate.

On the day after the flower opened we were due to travel to the Chileans meeting at Brooksby to hear Dr. Moyna from Montivideo speak about Uruguay and its cacti, so I decided to take the flower off the plant and take it to Brooksby with me. I certainly did not recognise the flower and I was now doubtful whether it really was a red flowering Trichocereus so I hoped that among the Chilean members at Brooksby there would be someone able to identify it. Before leaving for Brooksby I sliced the flower and made a sketch of the interior. The style was very thick indeed and also quite short, so that the stigma was carried below the top of the tube. The stamens were inserted fairly regularly from the very top of the tube all the way down the interior wall almost as far as the base of the tube. The uppermost filaments were the longest and the length of the filaments gradually reduced going down the tube. The stamens stood fairly close to the wall of the tube, curving inwards very slightly, so the stigma stood at the bottom of a cup of yellow anthers.

This flower evoked appreciable interest from other members who were at Brooksby and it was quickly decided that it was either an Erdisia or a Corryocactus. From the strong upright nature of the stem growth it was the general opinion that the plant was most likely to be a Corryocactus. The two halves of the sliced flower were passed on to Mrs. Hobart who took them away from the meeting to preserve them in resin. The preserved flower in its block of resin came back to Brooksby for our September weekend. After I had been convinced that the plant was indeed a Corryocactus, I remembered Harry Middleditch had shown some slides at the 1975 Brooksby weekend of vestigial leaves at the growing point of his Erdisias, so I went back to look at my own plant and really there did not seem to be any sign of this sort of thing. However, after the very first flower, the plant started to put out some offsets from the bottom 25cm (ten inches) of the stem. These four new branches put on a total of 65cm (about 26") of new growth in a bare three months and at this time I could see that there were some vestigial leaves at all five growing points. They were very small and within 20mm of the growing point they had disappeared, perhaps because they were deciduous or because they had fused into the tubercle. These vestigial leaves could be seen much better through a hand lens.

The second flower opened a week or so after the first one. By taking the plant out of the greenhouse and putting it down on the ground, I could stand on a stool and aim the camera at the flower. At the Brooksby week-end, we looked at some slides of this flower, and of the vestigial leaves. We also examined the preserved flower and endeavoured to identify the species from the flower and the following body features: Stem 1.8m high, 30mm diameter, branching from the base, ribs 8, at first tuberculate but later almost straight. Areoles 2.5mm diameter, roughly circular, 20mm apart; areoles offset to those on the adjacent ribs. Flowering areoles oval, 5 x 7mm with much short fawn wool. All spines vertical at growing point but soon take a radial or central attitude; central spines 1 ( -2) 22mm long, slightly deflexed. Radials about 10, variable, up to 12mm long; all spines offwhite to straw-yellow at first, later darkening and becoming grey-brown. Vestigial leaves at growing tip only, bright green, about 1 x 0.3mm.

Now as to the identify of this plant, the yellow-flowering Corryocacti, such as pachycladus, puquiensis, krausii, chacapoyensis, brevistylus, and the orange-yellow flowered ayacuchoensis and brevispinus, seemed to be excluded as possibilities on account of their flower colour, likewise the purple-flowered otuyensis and the pale violet-pink flowering perezianus. This left the red or orange-red flowering species from which ayopayana (4/5 ribs), pulquinensis (4/5) ribs and charazanensis (4/5 ribs) can probably be excluded on the basis of rib count. The description of tarijensis states clearly that this species is "up to 60cm high" which rules out this plant, so we are left with brachypetalus and melanotrichus as a choice of name for this particular plant. Both descriptions have the appropriate rib count and the correct size and colour of flower. But the illustrations of brachypetalus in Backeberg's "Die Cactaceae" show, and the description confirms, that the central spines are up to 16cm long and in any case the body does not look like my plant. So perhaps I can now rewrite the label?

. . . . . from R. Mottram

I remember that after first reading the original note from Harry Middleditch regarding the feature of vestigal leaves on Erdisia, I rushed out to the greenhouse and was sadly disappointed to find no traces of leaves; this was early spring. At first I thought that the original note was an hallucination, but later in the season when the plants were in vigorous growth, it became easy to see the vestigial leaves on the new shoots of Erdisia and thereafter prompted a search in other related genera. I found the same feature on the young areoles of a Eulychnia of the E. longispina group, and they can also be seen on Samaipaticereus, Erdisia, and Corryocactus. I am not so sure how Samaipaticereus fits in, but the other three genera are very closely related.

. . . . . from K. Wood-Allum

Shortly after Mammillaria theresae became rather more readily available, I obtained a grafted specimen of this plant. When it arrived, it could hardly have looked less like a show specimen, but it did not take very long for the new growth to give it a much better appearance. Once there was a reasonable amount of new growth, I beheaded the scion, leaving behind on the stock a very shabby looking residue which I hoped might offset. However, the first thing that occurred was that this rather scruffy piece seemed to take on a new lease of life and it was actually a visitor in the greenhouse who drew my attention to the first few tubercles which had emerged from the stump — they were not rounded, but were long and thin, tapering gradually to a distinct point and looking just like a vestigial leaf stalk. It was the translation of Buxbaum's article about Cephalia which led me to believe that this plant might be exhibiting vestigial leaves.

. . . . . from A. W. Craig

I have a plant in my centre bed which I believe to be Corryocactus melanotrichus, which flowered for me at about the same time that Jeff Bagnall's plant was in bloom. My plant is about three feet high and has several branches; I have taken quite a lot of cuttings from it over the years. The flower appeared just as June was passing into July; the flower was about 3" tall, the tube was green with small pale green scales, each one having a tuft of very short dark brown felt and a few bristly dark brown hairs; these hairs were 3 or 4mm long at the base of the tube and almost 1cm long near the rim. The petals were red. By recollection, the flower was similar to that in Jeff Bagnall's sketch.

. . . . . from R. W. Field, Australia

We have three species of Corryocactus plants out in the garden and these are big bushes seven or eight feet high. Corryocactus brachypetalus has wonderful spines up to 7" long and yellow flowers. The other two are C. charazanensis and C. melanotrichus which have red flowers and very spiny fruit.

. . . . . from H. Middleditch

We also heard from another member, W. Moseley, who had a flower on his plant of Corryocactus; it seems remarkable that such an uncommon event should occur with three different members in one year. Perhaps it was the Year of the Corryocactus?

## VOYAGE INTO THE NORTH OF BOLIVIA AND THE ADJACENT PARTS OF PERU By A. H. Wedell 1853

Translated by H. Middleditch

Some minutes after the arrival of the steamer at Arica, we had loaded our baggage into a small open boat and we reached a sort of jetty, whose end was occupied by a small office where we stopped for passport examination. Here we received the most affable treatment from the Peruvian customs.

Having nothing particular to do in Arica, we decided to leave immediately for Tacna, capital of the Department of Moquequa, about 14 leagues distant. The heat being considerable, we were advised not to set out before the afternoon, and to travel overnight, which we did. We saddled up at three o' clock and on leaving the village we met with a vast sandy desert which separates Tacna from the coast. This desert rises gradually towards the interior, and at Tacna reaches an altitude of about 550 metres above sea level. No rain from the sky, no stream of water comes to moisten the sands of this region which seems to be destined for eternal aridity.

Our animals were wretched and our saddles not less so, so that the road seemed to us to be of an intolerable length. One could but with difficulty convey an impression of the painful sensation produced in us by the prolonged and abnormal spread to which our limbs were subject, on account of the diabolical shape of the saddles. For a change, we went on foot, but the sand was so loose that we tired ere long and the more quickly as we were obliged to cover ourselves with our heavy cloaks to ward off the cold which was rather keen. Otherwise it was fine weather, almost as clear as day, such was the clarity of the air and the reflection of the moonlight on the white earth.

At two o' clock in the morning, we descended from the plateau into a hollow which appeared to be the broad bed of some early stream, the deep ravine having been cut by the waters into the alluvial earth which made up the whole of this region. We were told that we would be in the valley of Tacna, but it needed another two hours' long march before we reached that goal. Now we walked over a more humid terrain, cut by irrigation ditches which we crossed successively. Then we entered the town and the hotel was soon in front of us. In a moment we took to our beds and I closed my eyes. I was already dozing when I felt

attacked over the whole of my body at once by bites which were only too well known to me: I was tormented in my dreams by battalions of hemiptera (bed bugs — G.J.S.). These insects added to my desire to make only as short a stay as possible at Tacna.

The principal usage to which the waters of the little Rio de Tacna are put is the irrigation of the cultivated ground which it has been possible to establish in the neighbourhood of the town. The soil is naturally so arid that wherever the moisture has not been artificially provided, the vegetation is practically non-existent. The precious fluid is distributed in such a manner that not a drop is lost, and the river, diminished by successive withdrawals, ends up by disappearing altogether. Below the last cultivated ground, its bed is still quite visible, but the sand is barely moist. Further on it is just as arid as the fields which border it.

The preparations which we had to make to restart our journey consisted principally in the purchase of various necessary items of equipment for our saddle animals, cooking utensils, provisions etc. Our own provisions consisted of fresh mutton, potatoes, onions, rice, bread, chocolate and sugar and various seasonings. In regard to clothing, our broad felt hats, our enormous boots, and our striped ponchos would have sufficed for us to be taken, in Europe, for brigands; but here, in Peru, we had only the appearance of a local. For my part I had a pair of instruments, an aneroid barometer and my Fortin barometer.

On April 23rd we set out for La Paz. Our mules, well rested and almost frisky, soon got beyond the cultivated area around Tacna. Then we came into the desert once again and we directed ourselves towards the north-east, towards a chain of mountains crowned by many snow-covered peaks, of which one had been pointed out to us under the name of Navados de Tacora. It was at the foot of one of these peaks that we would have to pass. On the plain, our route was marked out on a terrain of alluvia completely covered with pebbles and with huge boulders and scattered with shrubby trees with resinous leaves belonging to the genus Eupatorium, with succulent plants and with a low-growing grass with stiff and sharp leaves which forms, in some spots, a sort of pasturage which the mules never disdained.

At one o' clock in the afternoon we passed by the small village of Calama, which is but two leagues from Tacna, without coming to a halt, and at a quarter of a league beyond there, we made a stop in a dependency of the same village, known as Cercado. Leaving here, we quickly directed our steps towards the spot where we were to pass the night. This lodging which had been pre-arranged for us, was none other than the shade of an enormous tree called Vilca (Acacia sp.?) which was to be found close to the edge of the road. When we arrived there it was after nightfall. The mules were soon unloaded and the preparations for supper were put in hand.

It was indeed a magnificent tree which bestowed upon us the protection of its branches and foliage; it well deserved to be regarded as an extraordinary object in a country where trees are so uncommon. The single major defect which we found in this rustic boudoir was a slight excess of dust. The temperature, at first very agreeable as the thermometer indicated 17 degrees, later dropped a little too much, towards the middle of the night, and went down to 13 degrees; we then experienced a very marked sensation of cold. The next day, at first light, we broke camp, after having taken a cup of chocolate each for breakfast.

The terrain continued to rise again for some time, evenly and open, then it started to rise appreciably. At that time we were about four leagues from Tacna. Shortly after having passed a little hamlet by the name of Pachia, we entered a fairly deep ravine (quebrada), a tributary of the Rio Tacna, which we went along and climbed upwards again. The road became steeper by the minute and the landscape wore a most desolate aspect. Nevertheless the walls of the quebrada, although composed of the same elements as the plain, supported a slightly less dwarfed vegetation, thanks to the proximity of the river bed. The plants which showed themselves there most frequently were a bushy member of the Bignoniaceae — Tecoma fulva Don, – with trumpet flowers, Molle – Schinus molle of the botanists – in stunted form, and numerous Eupatoriaceae. A little higher up we saw a considerable number of large cacti to which were given the name of "candle of Peru". As we left the ravine behind us at an elevation of about 3,870 metres above sea level, we found one of the stone heaps raised by the Indians. The cultivation of maize, seen only at suitable spots in the ravine which we had just come from, ceased completely at that point as we ascended further. At the same time, an attractive bushy tree with long orange flowers — Mutisia viciafolia — came to characterise by its presence the new zone of vegetation into which we had entered.

Continuing our trek, we passed a second apecheta (or pile of stones) situated higher than the first one, prior to once again entering the ravine which we had just left. Numerous ancient tombs of quadrangular shape, widening out above and constructed of clay, attracted our attention here. Constructions of this nature are not uncommon in Peru and they are known by the name of Chulpas. The vegetation became more prolific in this section of the ravine and although trees were not to be found, large shrubs were in evidence there. The village of Palca, which gives its name to the quebrada, is situated on the right bank. We reached there at 2 o'clock and we decided, after consulting our muleteer, to pass the remainder of the day there. The elevation of Palca is about 2,900 metres above sea level; we found the air infinitely more fresh there than under our Acacia, and we felt the effects of its rarefaction in a very keen fashion. The painful sensation which this rarefaction produces on the heart and lungs is described as soroche in this region.

Before sunrise we set off again on our route, and we continued to climb up the ravine once more by a road which became more and more steep. The mules, although accustomed to making this journey, showed signs that they were feeling the effects of the altitude, by stopping every few minutes to regain their breath. Of the more typically Andean plants — Chuquiraga principally, Bolax and some Baccharis — only those which we had already come across up to that point characterised the

vegetation. At eight o'clock, we reached a sort of plateau where we found a pile of stones just like those we had come across earlier; two or three bushy Solanaceae, the last shrubs that we would see, gave us a little shade in this spot, of which we took advantage and escaped for a while from the rather too intense rays of the sun. The thermometer then stood at 17 degrees, which did not prevent all the streams at some distance from there being covered with a sheet of ice. At this altitude the vegetation was again composed of a fairly large number of species, but in climbing further these were found to decrease and but half a dozen, among which Bolax glebaria, a Baccharis with short and imbricate leaves, and glutinose Senecio, were almost the only ones attracting attention.

At last we found ourselves on the highest spot of this section of our route, a spot known as Paso de Gualilos. I took advantage of the brief halt there to make the barometric height. The figure which I determined corresponded fairly closely to that which had already been given by Mr. Pentland (about 4,500 metres). After the pass, the trail started to descend; shortly afterwards, we passed the foot of one of the peaks which we had seen from Tacna; the snow which covered it came down in some places a little way below the level at which we found ourselves. Already the trail did not have quite so steep a gradient. We travelled over one of the extensive glacial plains which make up the Cordilleran plateaux, and which are called Punas in Peru. Some vicunas, the first that we had seen, were evident in the middle distance in front of us.

Numerous species of grasses, among which were to be particularly noted the greyish tufts of a Deyeuxia, grew in this high altitude zone in company with a resinous Baccharis called Tola. We continued to trek across the puna for the rest of the day, and at about half past five we reached the village of Tacora, which lies several gunshots off our route. When I say that we reached the village, I use a figure of speech, as I should say the remains of a village, as Tacora has been uninhabited for many years.

The next day, we were all asleep in the morning when the muleteer came to tell us that four vicunas were passing close to the village. Despite being delayed by hunting these vicunas, we restarted on our way a little after 8 o' clock. The region which unfolded before us was rather similar to that which we had crossed over the previous day, being covered with closely spaced tufts of Deyeuxia and of Baccharis. At 2 o'clock, we stopped for lunch, on the banks of a river called Uchusuma, in a little marsh, all embillished with Gentians in flower. But the mist accumulating for some time above our heads suddenly took on such a menacing character that we quickly took to our saddles again and covered ourselves with our ponchos to protect ourselves from the wind which, minute by minute, became stronger and more icy. Ere long flakes of snow obscured our surroundings and the puna became covered with an immense white sheet, over which our guide had the greatest of difficulty in ascertaining the direction of the trail. We hoped impatiently to arrive at some shelter where we could warm ourselves up again and pass a good night, but the heavens had come to an altogether different conclusion. Our despair can be imagined when arriving at the longed-for resting place, we saw only an unsightly black ruin, far more dilapidated than that of Tacora.

It was about half past five when we came to a halt before this dreadful hovel; in a comparatively short time, the place was cleared up, and beds installed. Tired out as I was, I went quickly to sleep, giving a last glance at some stars which shone above my head. When I woke up, it was broad daylight and the snowfall had completely ceased. Nevertheless the cold was again so sharp, 3 degrees below zero, that I parted company with my mattress with some regret, even though it was pretty well soaking wet. It seemed that the mules had been even less satisfied than ourselves with the place where they had had to pass the night and one of them had left to seek his fortune elsewhere. Whilst we waited for the arriero to seek it, we passed the time in hunting the mice which infested our sleeping quarters. I was quite surprised to find these little animals in this place as I did not think that food so plain as the herbiage of the puna was sufficient for them; I was not aware, however, where they would find anything else at this altitude.

Our baggage being loaded, we resumed our trek. Towards eleven o'clock, we left the plain to undertake a descent, as rugged as it was picturesque, taking us to the bank of the Rio Maure which at this point forms the border between Peru and Bolivia.

**A JOURNEY TO THE PROVINCE OF TARAPACA By Friedrich Philippi.**

Translated from Verhandlung des Deutschen Wissenschaft Vereins Santiago 1887 by E. W. Bentley.

The expedition consisted of the author as leader, the sub-director of the National Museum Karl Rahmer and Otto Philippi as assistants and also the technician from the Museum, Pablo Ortega. The expedition had as its objective the study of the zoology, botany, archaeology and palaeontology of the recently acquired Province of Tarapaca and was to proceed from Copiapo onwards through Antogfagasta de la Sierra and San Pedro de Atacama to Tarapaca, in order to open up research in those areas, still completely unknown as far as our scientific knowledge was concerned.

Early on 19th December we went by express train to Valparaiso where we spent the rest of the day purchasing a few items we were short of, getting our baggage on board and procuring tickets, so that we could go on board the steamer Laja at about 3 o'clock in the afternoon and at about 9 o'clock in the evening we left the harbour. We travelled to Caldera in company with Mr. San Ramon and his companions. The steamer put in at Coquimbo on the 21st, at Huasco and Carrizal on the 22nd and early on the 23rd we found ourselves in Caldera, where we landed immediately with all our baggage. On the 27th we put up in Copiapo. (Here follows a descripton of the first half of the journey.)

On February 27th we found, at the top of the pass, a great heap of stones marking the old border between Peru and Bolivia. From here we rode down a Quebrada from whose upper reaches we saw towards the west the vast Salar de Empexa. We followed the course of the valley downwards and pitched our camp on the edge of an extensive meadow, which was also called Empexa. On the 28th we were all ready to set out by 7 o'clock, as we had a very lengthy day's journey before us. We rode over the aforementioned plain on which we had stopped overnight, further towards the west, until we crossed over a small hill, from the other side of which extended a small Salar, whose northern edge we followed. Upon a steep rocky slope on the southern side we caught sight of a number of Cereus atacamensis, and in their vicinity we saw a body of mist rising up from the Salar, coming from a hot spring. At 9 o'clock we left the Salar behind and until 10 o'clock went over an almost level terrain towards the great Salar of Napa and Empexa. At half past twelve we came to the west side of the Salar at a spot called Napa. From there the way went over some small hills towards another pair of Salars along whose margin we travelled southwards, in the course of which we passed the Isma spring. Soon afterwards we left the Salar, losing it entirely from our view at a quarter to two as we ascended a height lying to the north. This one and the adjoining hill were swathed in thick cloud for the whole of the afternoon; the higher we ascended, so the thicker became the mist, until it turned into a harsh rain. This continued until we came to the other side of a level piece of ground, from which we still had two and a quarter hours to ride until we reached our stopping place at Huasco. Here we warmed ourselves over a good fire and we were able to get more or less dry. Fortunately the night passed without rain.

Early on the 1st March the weather was misty and the mist first began to disperse about 10 o'clock. The lagoon (of Huasco — H.M.) should perhaps rather be called a large marsh which extends over a large flat area enclosed between chains of hills and only shows patches of water here and there. On the latter there are many birds but they do not come within shooting distance. Since the stretch to Pica is very long and is quite bereft of water and food, we let the animals eat until 11 o'clock and set off at about a quarter to one. The road soon leaves the Salar, crosses a plain of Trachyte and continually — though gently — ascends. Within an hour the lagoon was lost to our sight since we entered the cap of mist that covered the whole of the high ground and permitted us to see less than a mile around us. About three o'clock we reached the top, which consists of a small stony plain with several large Apachetas (as the stone heaps are called that serve as route-markers for travellers and to which the mountain dwellers are accustomed to add a stone every time they pass by). From here the trail goes steadily downwards. The hillside is not so steep, the path is good and mainly follows a ridge or a valley bottom, and only if one has to cross one of these valleys must one climb for short stretches. These slopes are composed of large lumps of trachyte and resemble steps much more than a path. What we were able to see of the vegetation in spite of the mist did not differ from the general plant growth of the high plateau. At about half past five we came upon a corral called El Asomadero by the muleteer. Here we unsaddled and rested until midnight, in order to continue our journey by moonlight.

On March 2nd we left the enclosure dead on midnight and rode by pale moonlight down towards Pica. The mist of the previous afternoon had cleared and so we could see our way well. At first we had a stony terrain to cross, but soon the ground improved and since the descent was more gentle, we had a fairly comfortable passage. The only difficulty was that the muleteer got lost a short way down from the corral and caused us to lose about two hours. At about a quarter to six we reached the Quebrada del Portillo. It is deeply entrenched into the trachyte flow, has vertical walls, but no water. The descent and the ascent on the other side form part of the worst track I have ever passed over. It was a kind of stone staircase with fairly high steps. When we reached the other side the sun came up and soon warmed us up excessively. From now on the path is sandy and the section from there to Pica is called El Medano. At first it was level, then descended steeply; already one could distinguish the Plain of Tamarugal below and before it, at the foot of the Medano, two dark specks, Pica and Matilla. At about half past eight we were in Pica, the houses of which we saw first between the trees when we were quite near. Pica is almost completely hidden between the trees; only the church stands out and can be seen at a greater distance. We found good lodgings in a hotel belonging to a Mr. Tyska. We also found a chacra where we could leave the mules, which is not so easy when it is a large troop as ours was. On this day we did nothing except put our damaged kit to rights and recover from the fatigue of the journey.

On March 3rd we arranged our plants, reviewed our collections and enquired of various persons the facts about the province that were needed in order to decide on the routes necessary for the further continuation of the investigation. I decided on this day to travel to Iquique, where I had to talk to the manager. Mr. Rahmer remained behind, charged with guarding the collections, to carry out excavations on an old cemetery near Pica, and to investigate a stretch of the Quebrada of Chancrillas up from there, in order to collect the plants which could extend in it up to the middle of the Cordillera slopes, as well as investigate the vegetation of Pica.

Pica lies at the foot of the western slopes of the Cordillera in a sandy and barren depression — barren except for the places where can be directed the water that flows from springs and adits. The latter penetrate in some cases a considerable distance into the mountain and from them flows fairly good water. The water in Pica and in the neighbouring village of Matilla irrigates a line of chacras and gardens which produce a luxurious, almost tropical, vegetation, but where the water finishes a sandy desert begins that shows scarcely any vegetation. Mostly vines are planted, also there are fruit trees, of guava, pears, pomegranates, a few chirimoyos (Anonaceae sp. — E.W.B.), figs, here and there also a mango, lucumo (chicle — E.W.B.), and orpacai (Inga feuillei) (Leguminosae — G.J.S.). Besides that there are produced a few vegetables, cotton and little lucerne. The chief products of the town are vines, wine and fruit, which are taken to the various saltpetre works and to Iquique. Trade with

Bolivia was formerly considerable but seems today to have declined. The town has some 800 inhabitants. The houses are of reed and are whitewashed with one of the white earths found nearby. There are only a few streets, but also a plaza on which the very tumbledown church stands.

Matilla lies to the west and very near Pica and is similar to it, but with a smaller population. However, the products are the same. About half way between both places are a few houses called Los Puquios.

Between the great Cordilleras and the coastal Cordilleras, from the river Camarones in the north to the river Loa in the south, there stretches the Pampa de Tamarugal, a plateau of about 45 Km across. For the most part this plateau consists of loose sand and in other parts of salar, where it is completely covered with the usual salt encrusted layer of soil. North of the Quebrada of Aroma, which partly crosses this plateau, it is complete desert; further north it is crossed by the quebradas of Tiliviche, Camina, Suca and Chisa, which are cut deeply into the ground of the Pampa. Southwards from the Quebrada of Aroma the plateau is continuous; no quebrada interrupts it any more and this part shows some vegetation, some bushes in depressions, and Tamarugos trees all over the Pampa, which attain one metre in breadth and a comparable height, and are a species of Prosopsis. These trees are very dispersed and only form woods in a few places — and then only very sparse ones — as near La Tirana and La Soledad. In the salars there grows a grass called Chepica which is so hard that animals do not eat it ....

Meanwhile Mr. Rahmer had visited the quebrada of Chacarillas which lies some 20 Km south of Pica and brought a few plants back from there. The examination of the Chacras of Pica also yielded some interesting plants. The 9th March passed in preparations for the journey to Camarones, engaging a guide and procuring provisions. On March 10th we resolved to travel to Calera, a small oasis about 15 Km north-northwest of Pica. We departed at 5 o'clock in the afternoon with a load of victuals as well as the necessary equipment for the collection of objects. Accompanied by the guide hired in Pica and our muleteer, we reached Calera after two and half hour's ride, where a small chacra is available, as well as water and dry fodder for the beasts. From Pica to this spot there was nothing but sand without a trace of vegetation.

On the 11th we set out for Tarapaca at about 3.15 in the morning. The road keeps along the base of cordilleras on ground rising a little above the level of the Pampa del Tamarugal and is the worst, most desolate desert that I have ever seen, for it is sandy or composed of loose stones, here large, here small, which are strewn over the ground in colossal numbers, and lacks any trace of vegetation or water, but is completely level. At about 6.20 we crossed a wide valley called Tambillo Grande, and about 11.30 another, Tambillo chico. In both valleys we saw a few young Molles (Schinus molle — E.W.B.) and other shrubs, but no drop of water. The track climbs up a little from the Tambillo chico up to the quebrada of Tarapaca, the almost vertical walls of which we reached at about 2.10; we rode up the quebrada, the town of Tarapaca in view, but only reached it finally about 3 o'clock. Here we found a good reception at the house of Mr. Miguel Cegarra, which had been recommended to us, although the owner was away.

The valley of Tarapaca is well-provided with wheat and alfalfa, maize and vegetables as much as the small amount of water that the river carries and the narrowness of the valley allows. The town lies about 7 Km from the pampa, is built of adobe (unbaked bricks), but seems to be dilapidated, for the buildings are almost like ruins. Nowhere are repairs to be seen — not of any kind, and this is explained by the fact that the town experienced flooding during the recent war and also in the year 1884, due to which many houses were torn down and large part of the cultivated land was destroyed.

Mr. Rahmer .... (continued on the intended route and subsequently) had the following to say about his journey: Early on the 12th I left Tarapaca to travel through Camina towards Camerones. We went through Pachica, Loansana, Sibaya, Usmagama, Cumina, Sipiza and Chiapa. Here I found it necessary to give up the route to Camina, since the condition of the mules did not permit further progress on the extraordinarily bad tracks, which I was told would be even worse further on. The route from Loansana was especially troublesome for the mules so that it was frequently necessary to do long stretches on foot. For this reason I decided to continue down from the pampa along the route to the north. On this stage I went through Jaina, Chismisa, Aroma, and Arequilda, from where I entered the pampa for the second time. From Arequilda the track went through Corsa, Suca, and Chisa, to Camarones. Here I spent a day in the hospitable house of Mr. D. Puch, to give the mules time to recover and to look for the shrimps from which the place takes its name and of which I caught a fair number. From Caramones it was back via Suca, Tana, Jazpampa, Progreso and Pozo Amonte to Pica.

The bird collection was enriched at Sibaya by several species not yet represented in the Santiago museum. The vegetation at the middle levels of the slopes began to increase and the side-walls of gullies passed through were richly covered with cacti and Synanthereae. We could not find any fossils for in the gorges there was only trachyte in the upper parts and granite and clay in the lower.

On the 31st we arrived in Iquique and on April 2nd we shipped on the steamer Mopacha and so reached Valparaiso on the morning of the 7th, still early enough to catch the afternoon express train which carried us on the same day to Santiago.

**The Flora:** The Province of Tarapaca is almost more of a desert than the normally regarded deserts. The coastal cordilleras show a sparse plant growth at only a very few points and then only if rain has fallen — which seldom happens. The Pampa del Tamarugal is a partly salty and partly sandy plain; northwards from the Quebrada Aroma it is quite barren, but south of it in places it shows a vegetation composed of few species. The most noteworthy is the Tamarugo, Prosopsis tamarugo Phil., a tree of 1 metre thickness and 20 metres high in the largest specimens, which frequently forms light woodland, but

sometimes occurs in separate groups; the Retamo - Caesalpinia aphylla Ph., the Cachiyuyo - Atriplex sp. called Pillaya in Tarapaca, the Brea - Tessaria absinthioides called Zorrona in Tarapaca, the Tosoba (in Chile, the monk's crown) Encelia tomentosa; in the salars there is much saltmarsh grass, Distichlis sp.

The flank of the Cordilleras has at its upper zone in Tarapaca a vegetation differing little from that of the high plateau, but the lower part exhibits various plants that nevertheless are not tropical, if one disregards the extensive patches of Quiscos and Tunillas (Cereus and Opuntia). A characteristic tree is the pepper-tree, Schinus molle, which is there called molle — also the chanar occurs fairly frequently.

**Comments from** H. Middleditch.

Most of the place names to which the author refers in this account may be located on the map in Chileans No.37, page 15, which accompanied previous articles in this series, dealing with northernmost Chile. (Further articles and comments in this series will appear in forthcoming issues of The Chileans).

**ECHINOCACTUS LEUCOTRICHUS Philippi.** **By R. A. Philippi**

Translated from Catalogus preavius plantarum in itinere ad Tarapaca Anales del Museo Nacional de Chile, 1891, by H. Middleditch.

Echinocactus (?) leuctrichus: E. (?) globosus, agglomeratus, quindecim-costatus, costis sinubus profundis angustis divisis; areis praeter tomentum brevissimum pilis longis, albis, tenuibis vestitis, spinas c. 6, sat longas, pallide fulvas gerentibus, quarum superior reliquis major; floribus coccineis, siccis fere atropurpureis; ovario et tubo calcino pilis longis, plerique fulvis vestitis.

In province Tarapaca ad Naquina et Usmagama.

*Specimen vivum allatum diametri 6 cm., cui lignum diametri 7 mm. Spinae pleraeque in trajecto fractae, ita ut* longitudinem earum indicare non possim, pili albi usque ad 50 cm. longi.

(From the Latin). Echinocactus (?) globular, multi-headed, 15 ribs, divided by deep, narrow grooves; areoles clothed with very short felted wool as well as long, white, slender hair, and carrying about six fairly long pale yellow-brown spines, of which the upper is larger than the others. Flowers deep red, becoming dark purple when dry; ovary and tube clothed for the most part with long, tawny-coloured hairs.

In province Tarapaca near to Naquina and Usmagama.

The living plant brought back has a diameter of 6 cm., of which the wood (stele — G.J.S.) has a diameter of 7 mm. Most of the spines have been broken off in transport, so that I cannot give an account of its length. The white hairs are up to 50 cm. long.

Comments

. . . . . from Hans Oehme, Cactaceae, Jahrb. D.K.G. May 1940

(From the German) The translation of the original diagnosis from R. A. Philippi "Catalogue of plants collected from the high plateaue of the Prov. Antofagasta and Tarapaca." 1891 runs as follows:

Echinocactus (?) globular, multiheaded, 15 ribs, separated by sinuate grooves; areoles furnished with short felted wool and long, white, slender bristles. Spines about six, fairly long, pale brown, the upper-most larger than the remainder. Flower scarlet, the withering flower almost dark purple; on the immature ovary and on the flower tube long, very numerous brown (reddish-yellow) bristles. In the Province of Tarapaca near to Naquina and Usmaga. The living plant brought back by the author has a diameter of 6 cm. As most of the spines have been broken off in transport, I cannot give an account of their length. The white bristles are up to 50 cm. long.

"White bristles up to 50 cm. long" is no doubt a printing error and should say 5 cm. long. Britton and Rose write that "After leaving Arequipa, Dr. Rose went to Santiago, Chile, where he found in the herbarium of Dr. Philippi the type specimen of Echinocactus leucotrichus which has flowers almost identical with those of the Arequipa plant." In addition we find a marginal note from Britton and Rose which says "In the case of seedling and even with small plants five to six years' old, the spines are hairy." This observation coincides with that made by Quehl in the description of Echinocactus (Arequipa, H.M.) rettigii.

At the Conference of Trustees of the Central Research Establishment in Stuttgart in 1939, the preceeding discussion was outlined, the conclusion being: it must remain undecided whether the Echinocactus leucotrichus Phil. belongs to Arequipa. Britton and Rose in their time knew of the different zygomorphic flowering sorts which we now collect together in the Loxanthocerei group. It appears to be certain that Echinocactus leucotrichus belongs in this group, but to which genus the description by Philippi must be allocated to, still remains indefinite. It could equally be a smaller Oreocereus. The brown bristles on the ovary as quoted by Philippi cause this species to seem especially doubtful. In their description of Arequipa leucotrichus, Britton and Rose have evidently combined the features of the species which they found — Arequipa rettigii — with that of Philippi's description.

. . . . . from H. Middleditch

Fortunately I have been able to obtain sight of a copy of the publication in which this description first appeared. On the title page was hand written "Societati Linneanae. Socius auctor. R. A. Philippi" so I presume that it was the copy donated by the author to the Linnean Society. In the introduction there is a reference to the Museum Director and also to the "sub-disector". Since this is clearly a spelling error, it would seem to be reasonable to accept that there could be another one, so probably the "50 cm." should have read "50 mm" as Oehme observes. However the location in the original is given as near "Usmagama" whereas Oehme renders this incorrectly as "Usmaga". In addition, the original latin text clearly states "pilis" in two places, which Oehme renders as "bristles", whereas Stearn's Botanical Latin unequivocable gives "hairs" as a meaning for "pilis". Small wonder that Oehme got himself confused over the question of "brown bristles on the ovary"!

Perhaps if we recollect that story of Notocactus grossei, which was sent to Europe as a fairly small globular plant, in that respect differing from the more or less columnar form of Eriocactus schumannianus. Eventually it became clear that Dr. Grosse had merely collected the nice-looking young offsets which had not yet developed the corkiness at the base which is characteristic of older, columnar plants and which impedes their ready sale. Not only that, but it is a great deal easier to collect, pack, and transport fairly compact plants, rather than heavier, bulkier, mature columns. What more likely that Rahmer, carrying water and provisions, able to collect a wide range of non-succulent plants within plant presses and so occupy very little bulk per specimen, would limit himself to a cutting or offset from a cactus that would, even then, occupy a disproportionately large volume in comparison with his other collected material. So, although the original author would have a "globular" plant before him, he would not know that it could have come from a columnar plant — just like Haage and his Echinocactus grossei.

Thus we can see that only by scrupulous appreciation of the original description is it possible to establish which of the clues to the true identity of this plant are leading in the right direction, and which are misleading. What other clues come out of the literature which might help us to find out if Philippi's Echinocactus leucotrichus really is today's Arequipa leucotricha . . . or whether it is something else altogether?

. . . . . from J. Soehrens Z.f.S. 1923 "Echinocactus leucotrichus"

A plant was collected by me in the province of Tacna (Peru) which certainly agrees with that observed by Dr. Rose in the northerly adjoining province of Arequipa. The plant seen by Dr. Rose in Philippi's herbarium originated from the northern end of Tarapaca province, again placing it near to the habitat of my plant. I do not doubt that the three plants are like one another; whether Echinocactus hempeliana Gurke also belongs here I do not know since I have not seen this one.

The flower which is produced by this plant in its mountain homeland has five hindmost inner petals standing straight upright, and four of the front petals are bent downwards so forming a lip. Below the centre of the upright-standing petals are the filaments with the anthers bunched together. The form of the flowers grown here in cultivation appears different having only a slight suggestion of petals bent towards the front. This change in flower form was brought about by the transplantation into the coastal area of central Chile. The climatic conditions in their habitat at about 3,000 m. above sea level are distinguished by torrid days and cold nights. In that region, the body of the cerei lean somewhat towards the north, which is also towards the sun, and so do the flowers of the cacti.

I have been able to observe very thoroughly the biology of the flower of E. leucotrichus. The only pollen-carrying insects in habitat are flies for whom warmth is essential; during the night they crowd closely together between the branches of the cacti on large cliffs. The zygomorphy of the flower favours the approach flight of these insects. However, not much importance can be attributed to the zygomorphy of the flower since it is by no means equally prominently featured in all flowers.

The Echinocactus leucorichus is not the only cactus with zygomorphic flowers in that region; plants with such flowers even occur among two Cerei, one of which has long white hairs.

. . . . from H. Middleditch

And if the Cereus with the zygomorphic flowers and long white hairs was Oreocereus celsianus, what was the other Cereus with zygomorphic flowers? I can find nothing in either the FR or Lau Field number lists from the vicinity of the Chile-Peru border which might fit this item. Was it another species of Arequipa? Or a Loxanthocereus?

from Hans Oehme (Ibid)

The plant depicted by Soehrens is a collected specimen which had been in cultivation for ten years, according to his article. In my opinion the plant of Echinopsis hempeliana described by Gurke in M.f.K. 1906 stands very close to that of Soehrens. However it does not have a close affinity with either Echinocactus leucotrichus or with Echinopsis rettigii Quehl.

Once when we were contemplating the plants to be found in my collection, Backeberg related to me that even the plant which he called Arequipa leucotricha developed very strong central spines in old age; those which he was acquainted with were large habitat plants. Even if one discounts that aspect, the appearance of the plant in Soehren's picture is altogether different. From the specimen of Echinopsis hempeliana Gurke in the collection of Heerklotz — which is on complete agreement with my own plant — and the illustration in Soehren's article, it is clear that this sort also develops the strong central spine at an early age in cultivation. Considering the overall impression of the plants, they are about as distinct as Notocactus scopa and Denmoza erythrocephala.

. . . . from H. Middleditch

In his description of Echinopsis (Arequipa) hempeliana, Gurke tells us that the plant concerned came from Haage in 1902, without any information regarding its habitat location. However, this plant did bloom in cultivation and the flower is described as being 7.5 cm. long, 6-7 mm. diameter, with narrow triangular scales 3 mm. long by 1 mm. broad which lie on a ridge running the length of the tube so that exterior of the tube has 10-12 flutes. It now seems that I have not been looking at flowers on Arequipa with sufficient care as I cannot recollect whether I have ever seen these flutes on the outside of the flower tube. Do they appear on all Arequipa flowers, or just on this species?

A multiheaded Arequipa to match up to Philippi's Echs. leucotrichus, is something else that I do not seem to have seen in cultivation. However, in his Die Cactaceae Backeberg has several photographs of Arequipa in the wild with as many as eight or nine heads all growing up from soil level. Are there any Arequipa in cultivation which have started as a solitary head and grown into a multiple headed plant? And as for the long white hairs on Philippi's Arequipa leucotricha, I cannot bring to mind seeing in cultivation any plants of Arequipa with long white hairs, nor with short white hairs, or even with hairs just on the crown! But some imported Parodia arrive almost bare of areole wool and then after a period of cultivation produce a dense cushion of white wool covering the crown down to part-way below the shoulder. Has anyone seen an Arequipa which is growing hairs which might approach Philippi's description? Or is Wagenknecht right when he calls it Oreocereus leucotrichus? Did he acquire this idea from Ritter?

When Soehrens wrote his article about the Arequipa which he had collected in Tacna Province, he said that it had been in his collection for ten years. In this series of articles on the "Grand North" of Chile there is the account of a field trip made by Soehrens to Tacna in the year 1911, which is effectively ten years before he wrote about this Arequipa. Most of that trip was occupied in travelling along, or in the surroundings of, the new railway line being laid from Arica towards La Paz. It would seem probable that he found his Arequipa between 2500 and 3500 m. altitude at a point not far from that line. This plant was later designated as Arequipa soehrensii.

The original collection of Arequipa leucotricha was evidently made by Rahmer in 1887 when he undertook a journey from Tarapaca towards Camarones. Philippi himself was not well enough to take part in that particular trip, when Rahmer passed through Tarapaca, Pachica, Sibaya, and Chiapa. Echinocactus (Arequipa) leucotricha was stated to have been found between Usmagama and Naquina (not Naquira, as Britton and Rose state in error).

A perusal of Lau's field number lists shows A. leucotricha "East of Tarapaca" i.e. virtually at Philippi's original location; Arequipa soehrensii from near Tacna i.e. near the route of Soehren's 1911 trip; and Arequipa hempeliana v subtilispina from Pachia (north-east of Tacna). This varietal name must surely have been identified as such by Ritter himself. Likewise the Peruvian species are in accord with original finding places. On the other hand, Knize's field number list puts A. hempeliana at Mocha, whereas a plant from this locality is far more likely to be A. hempeliana or A. soehrensii. From Poroma is listed KK1203 as A. weingartiana, whereas that species comes from further north near Ticnamar, so that KK1203 may also be A. leucotricha. One feels suspicious that Lau was better informed than Knize about Arequipa.

The altitude at which various species of Arequipa have been found may be obtained from Field Number lists and from Backeberg's Die Cactaceae. This data would seem to place Arequipa in a similar altitudinal zone to Corryocactus. This might tend to suggest that in northern Chile, we have a Browningia-Erdisia formation at the lowest level of the summer rainfall zone, followed at the next higher level by a Corryocactus-Arequipa zone, then by an Oreocereus zone. The lowest level at which Arequipa are to be found might be comparable to the 2400 m. line which has been suggested as the lowest level at which Matucana are to be found in central Peru.

. . . . . from D. W. Whiteley

If there is a place name of Guasquina not far from Usmagama, I expect that this could quite easily be the same as Naquina, since it is all a question of how you spell the name — they probably sound the same.

. . . . . from Mr. and Mrs. P. Collins

Now in regard to the name of the original finding place for Arequipa leucotricha, Guasquina and Naquina are not phonetically close at all, apart from the final two syllables. In addition, it is difficult to see how they could be confused typographically.

. . . . . from H. Middleditch

An appreciation of how differences arise in the spelling of place names may be readily gained by asking the way to Bicester from some of the natives thereabouts. In just the same way, Europeans visiting N. Chile would not necessarily all express with the same spelling, place names heard in the native Aymara tongue. The following examples are taken from the original travellogues of the Arica-Tacna-Titicaca ascent:

| Pentland 1827 (English) | D'Orbigny 1830 (French) | Meyen 1831 (German) | Wedell 1851 (Anglo-French) |
|---|---|---|---|
| Tacna | Tacna | Tacna | Tacna |
| — | Calana | Caleo | Calama |
| — | Pachia | Patchi | Pachia |
| — | Palca | Palca | Palca |
| Gualillas | Gualillas | Gualillas | Gualillos |
| Tacora | Tacora | Tacora | Tacora |
| — | R. Ochusuma | R. Utchusoma | R. Uchusuma |
| — | R. Maure | R. Maure | R. Maure |
| Chipicana | Chipicani | Chipicani | Chipicani |
| Chullunquani | Tuyuncane | Chulunano | Chulunquaiani |
| — | San Andres | — | San Andres |
| — | Crassacara | — | Nasakara |

These have all been checked as really being the same location not only against a good map but by detailed day-by-day comparisons of the itineraries against the map; even the occasional Tambo or stone-walled corral that passed muster as an overnight resting place for travellers in an otherwise uninhabited and inhospitable environment is on the map. Personally I would be inclined to accept that Philippi's 1891 Naquina is the Guasquina on my more modern map.

. . . . . from A. Johnston

Some years ago I bought six imported Arequipa from Sargant. With me they like to grown at the back end of the year when the spines are really colourful, but they don't put on a lot of growth. Last year A. rettigii var. from Tacna SH 139 budded up in October, but the bud aborted — this was the first time any of them had showed signs of flowers. This year it did produce a flower. I am hoping now that one has flowered that it might be a good sign and the others will do the same, or perhaps it was just the funny autumn we had. I also have another A. rettigii var. Tacna which came as SH 126 which is completely different from the first mentioned one. This plant had flower remains on it when it arrived but has done nothing since; however, after planting it up, a seedling appeared very close to the body which was potted up only this year, when I repotted the plant. I also have plants of A. spinosissima SH 113, A. erectocylindrica SH 165, A rettigii SH 123 and A. leucotricha from Pachia SH 140. Whether the names and varieties are valid or not, all the plants have different looks. I have certainly not had any offsets and I have never seen a plant other than solitary. There is certainly no hair on A. leucotricha, in fact none of them have any. They have a large number of white radial spines. Some of the spines on the plants are very strong and even an inch in length but even the old spines low down have not gone feathery or frayed. I rather like these old plants even though they are hardly show plants, they do have something about them.

. . . . . from I. le Page

My Arequipa seedlings have made steady progress since being sown from seed in 1973 — I have just three, A. erectocylindrica, spinosissima, and leucotricha. At present all are about 5" high and look remarkably similar with the exception of the spine colour which varies from grey to brown. A close examination of A. leucotricha reveals one or two fine bristles from some of the upper areoles, but they are very sparse and might simply be very fine spines. I am left asking myself when does a spine become a bristle and a bristle a hair? A much larger plant from the same sowing that I passed on to a friend is now 10" high and shows no sign of hairs, bristles, — or flowers! On this evidence, Arequipa leucotricha is hardly deserving of its specific epithet.

. . . . . from Mrs. R. Howard

Many of my mature plants have been in my collection for quite a number of years — some of them as many as twenty years. I have a very old Arequipa leucotrichus. The main stem is over three feet long and semi-decumbent; from the base is growing a new stem about two feet long and another about a foot long, then further up there are five small branches. It flowers well but the flowers are very much slimmer than some of the "newer" plants in the family, as I call them — these have wider flowers with a "hooded" look.

. . . . . from H. Middleditch

It would appear that there are no Arequipa which exhibit long hair at the areoles, even in maturity, so that it is no longer tenable to use the name Arequipa leucotricha. The account by Knize (in this series) of the plants which he found not far from Usmagama, indicates clearly that Oreocereus "hendriksenianus" is found growing thereabouts. The illustrations in Backeberg's Die Cactaceae of clumps of Oreocereus growing in the wild show nice, clean, globular offsets at the base, handy for a collector. So it would seem that Echinocactus leucotrichus Philippi (synonym Arequipa leucotricha Br. & R.) should now be described as Oreocereus leucotrichus, with the Type as the herbarium specimen in the National Museum of Chile?

**CONTRIBUTION TO THE KNOWLEDGE OF THE FLORA OF THE RIVER VALLEYS CAMARONES AND VITOR AND THE LAND BETWEEN (19° S latitude).**

By Dr. R. Pohlmann and Dr. K. Reiche

Translated from Verhandlung der Deutscher Wissenschaft Vert IV 1900 by H. Middleditch.

On the 23rd November, 1897, the Commission — consisting of 4 men and attendants — together with instruments, provisions etc., departed from Pisagua in a steamlaunch towards the Bay of Camarones. From there we and our luggage set out with riding- and pack- animals provided by the kindness of the Hacienda Camarones, after an overnight stop first in a tent. Observations and measurements commenced on the following day and we eventually returned to the Bay of Camarones for departure to Pisagua by our steamlaunch on 18th January, 1898. (The complete itinerary is detailed on a day-by-day basis — H.M.).

On the occasion of the topographical survey of the above named area by a Commission appointed by the Chilean Government, the author of this paper was enabled to see the tract of land, the scientific possibilities of which were still entirely unexplored. The author pursued the objective of collecting natural history and ethnographic data for the Chilean National Museum. The collection brought back turns out to be satisfactory in regard to its scientific value in mineral and geological respects, equally as good in botanical respects and very good in spite of the extensive stretches of vegetationless desert through which the route frequently passed.

**Geological structure of the Region visited**

In relation to the general ground formation our region in essence consists of a high plain (Pampa) which, in the neighbourhood of the coast has a height of 700 to 900 metres and gradually ascends towards the east, to reach over 4,000m height in the vicinity of the Bolivian border — the numerous high mountain peaks excluded — and bordered to the north and south by two deeply entrenched river valleys, the Quebradas of Camarones and Vitor. The mostly waterless side quebradas joining on to the principal valleys figure less prominently in the account.

The Camarones and Vitor valleys with their extensive vegetationless steep sides make possible an excellent insight into the geological structure of this region. We start with the coast and proceed eastwards. The precipitous cliffs of the coast in the Bay of Camarones and Vitor were formed of Mezozoic volcanic rock. The strata fall quite gradually with an inclination to the east, here and there somewhat variable. Overlying this usually dark coloured volcanic material were numerous pale coloured, more or less horizontal, sheets and layers of later eruptive or sedimentary material. The latter commence on an average at 600 metre altitude above sea level and sometimes reach several hundred metres in thickness except near the coast. Going inland, the older volcanic rock reduces in thickness in its eastwards extension from the coast; in the Camarones valley it disappears at about 35km. from the coast, cropping up once more however in island — or barrier — forms at the so-called Angostura between the Hacienda Camarones and the Indian village of Huancarane, and on acount of its greater hardness than the upstream or downstream strata, it brings about a narrowing of the valley. in addition, near to Esquina enormous boulders of resistant ancient volcanic rock were observed in the river bed.

In the Vitor valley the layer of old Pre-Tertiary volcanic rock disappears under the floor of the valley at about 15km. from the coast, so that from Chacarilla onwards only the rock deposited at a later age was to be seen, without the former again re-appearing on the surface. The older volcanic rocks became overlain by an almost always horizontal layer of pale coloured Andesite (Hornblende—Mica—Andesite) and the sedimentary layers formed from this material, generally alternating with more recent volcanic rock. In the structure of the deposits, Tufa also appears to have played a significant part. From its geological age, this Andesite with the accompanying deposits can only by Tertiary; they disintegrate very easily and cover the sides of the valley in the rainless or very sparse rainfall area with a generally brownish grey weathered talus (often however other colour tints also appearing), which is fairly fine and easily movable, so that in the vicinity of the coast it was piled up like dunes by the wind and could be tiring and dangerous for men and pack animals in the ascent and descent of the valley side.

**Climatic conditions, rainfall, etc.**

The climate of the lower half of the Vitor and Camarones river valleys must approach close to that of Tacna. During the sojourn at the Hacienda Camarones the temperature was measured by means of some Max/Min thermometers. In the month of November, the average minimum temperature for the night was found to be 9°C and by day in the shade the maximum about 25°; in the month of January 10° up to 13° was recorded by night, by day up to 30°. In the Vitor valley near the coast higher temperatures were measured, and while during the night the thermometer did not go below 12°, by day it climbed to 35° in the shade. The warmest part of the day was usually represented by the period from 9 to 11 o'clock. Generally a west wind set in about this time which moderated the temperature in an acceptable manner. If this flow of air failed to appear, there prevailed over the midday an oppressive heat. In winter the temperature is naturally lower; it would go down as far as 0°C at the Hacienda Camarones.

Upon the Pampa from the coast to far inland, by day a very high temperature generally prevails. The nights by comparison are very cool, particularly just before the dawn, painfully cool. The difference between the day and night temperatures is here very considerable (as in many other desert areas also) and much greater than in the adjacent Quebradas. With the increase in altitude going inland the temperature generally falls; around 4000m altitude the minimum thermometer went

down each night (between Xmas and the New Year)almost to 0° — once even to minus 2° below; on some mornings the ground was coated with rime. The numerous summer thunderstorms bring about a really quite appreciable lowering of the temperature. During the winter a very cold wind will also generally blow in the sheltered valleys of the highlands and snowstorms are not uncommon.

On this account the Indians' dwellings are very firmly constructed, the walls composed of strong masonry (usually rock and mud), the roof of a thick layer of so-called Pampa grass. (A reliable statement about the winter there was not to be obtained from the Indians).

The last observation relates to the rainfall conditions. We start with those of the high mountains, that is, the region of the tropical summer thunderstorms. The latter set in about the month of November or December and continue up to the month of March; in the region of the highest mountains they are a daily event. Almost every day opens with sunshine and reveals the mighty peaks with their immense snowcaps. Occasionally in the morning, but more frequently approaching the noon hour, one or other of the peaks becomes covered with a thick cloud layer and then lightning and thunder will not be long awaited. These thunderstorms are normally very frequent and usually there is a violent down pour of rain and hail in the valleys accompanied on the higher hills by copious falls of snow. On account of the water coming down in quite a short space of time, the small, almost dried-up mountain-girt quebradas change into raging torrents, whose waters vanish again at the close of the thunderstorms just as rapidly as the streams were formed.

The summer thunderstorm with its cloudburst extends — as far as our area is concerned — only from the mountain region proper, and from the Bolivian boundary (i.e. the watershed) to about half way down to the coast; in the Villa Codpa on the Vitor, summer rain appears but rarely; at the Hacienda Camarones it has not been observed for many years. In the territory close to the coast a dense winter mist (camanchacas) frequently appears, which sometimes develops into precipitation in the shape of a light fall of rain. (According to newspaper reports, proper rainfall has taken place in both previous years, thus first in October 1899 in Pisagua and Arica, then in May 1900 on the coast of Tarapaca). (The river hydrography is then discussed H.M.).

Especially significant for the nature of the flora in both river valleys is the dissolved salts content of the water. Whilst the Vitor river in its whole extent carries sweet water, the Camarones in its upper reaches is salt-rich. This salt content is clearly perceptible with the tongue, although it is not so high that the water has to be avoided for use as drinking water for men and beasts; surprisingly since only a few tributary quebradas of the Camarones valley carry more or less sweet water (Esquina, Pahica). (Salt deposits at warm springs and a high altitude lake are discussed — H.M.). From the salt content of the water originates the differences in the flora of both valleys.

According to the time of year the water content of the rivers varies quite considerably; it is at least at the start of summer, i.e. at the start of the rainy season (October, November), increases during the latter month, and reaches its maximum towards the end of the rainy season (February, March). During the winter months, the water flow will be pretty steady. The water of both rivers does not reach the sea (above ground) during the greater part of the year. (Details are given of the year-to-year changes in the downstream extent of the water flow H.M.).

**The Flora of the Camarones valley**

The area considered here comprises only the valley bottom proper from the coast as far as the vicinity of Esquina. The sides of the Quebrada do not come into the review here, as they are quite devoid of vegetation above Huancarane; further to the east this is no longer the case, as the Flora matches that of the mountainous pampa.

The Flora of the regions away from the immediate coast, that consists chiefly of the broad river bed and further inland extends to the whole of the valley bottom, looks like the characteristic bush vegetation. It extends many kilometres further upwards along the valley and it changes its character especially where, on account of the cultivation of the ground, the original vegetation has been obliged to retreat, completely or partially. It is mostly thick clumps of bushes often ten or more metres across and up to four metres high. Between these, the ground is, so far as it is not just loose sand or gravel, colonised by a grass — Distichlis sp. The bushes are: Chilca (Plunchea chingayo), by itself or in association with the Sorona (Tessaria absinthioides), and an Atriplex species, that forms clumps of bushes by itself. This latter plant is more abundant than the Chilca from the junction of the Quebrada Chiza with the Camarones valley as far as the sea. In December and January the bushes and hence of course the grasses as well are destroyed by burning, so that when irrigation is introduced, a new vegetation-growth can be produced which is servicable as a sheep pasture.

Further up the valley are found isolated bodies of Cortadera (Gynereum argenteum), as well as a small sedge called Junquillo. Above Cuya appears the pepper tree, Pimentero or Molle, Schinus molle, at first very scattered, later more frequently; likewise thorn-bearing acacias, perhaps two different species, of which the one creeps almost on the ground and rises barely a metre in height; the other, however, is more bush or tree-like in stature. Also the Chanar (Gourliea chilensis) appears in some small clumps of bushes.

Of wild growing herbs there were collected in the Hacienda Camarones: Baccharis juncea, which occurred as numerous specimens on the edges of some ditches; Solanum nigrum; Lycopersicum atacamense, growing in clumps among the piles of stones in the dried-up riverbed; L. atacamense (tomatilla) likewise occurring near Esquina; Lippa nodiflora, in and between the hedges of Sorona; Flaveria contrayerba called Yerba de Santa Maria which is an extremely troublesome weed

among the lucerne; Herpestris monniera described as Verdolga and Heliotropium curassavicum called Jabonallo. In the half-dry riverbed and in the near vicinity are to be found the grasses Sporobolus deserticola, Diplachne tarapacana, Polypogon crinitus, all with at least a few flowers, and the sedge Scirpus chilensis called the Junquillo, that is much more frequent in Esquina than at Camarones and, as already stated above, also occurs near Cuya.

**The Flora of the Vitor Valley**

At the mouth of the Quebrada Vitor, there is very little vegetation. Some kilometres away from the coast however, the vegetation becomes more plentiful and spreads out here and there over the whole valley. In contrast to the groups of close-packed bushes in the Camarones Valley, we have here a sort of open thicket that consists, besides the Sorona and Chilca, of the Molle, one or two Acacia species, Chanar (Gourliea chilensis), and a member of the Anacardiaceae called Carza, with small black fruits and willow-like habit. The trees and bushes reach no more than 4 to 5 metres in height. Eastwards from Chaca almost as far as Cadpa, the valley exhibits the selfsame character in all places which are not cultivated; on the margins of the river beds there appears a scanty shrub vegetation, which, wherever the Quebrada becomes narrower and canyon-like, more or less completely disappears.

(Introduced and cultivated vegetation is discussed at length — H.M.).

**The Flora of the so-called Pampas**

In this area Pampa means not just the more or less level desert area in the proximity of the coast, lying between the deeply entrenched river valleys, but also the vegetation-covered regions of the high mountain area, where plateaux and hills, valleys and massive high mountains alternate one with the other. Also the side slopes of the upper Camarones valley — more or less from Esquina onwards — and the upper Vitor valley, above Guanacahue, are included on account of the analogy of their Flora with that of the true Pampa of about the same altitude.

In what follows we will differentiate four formations in accordance with the character of their Flora, which are also identifiable on the basis of their separate altitudes: A, the region of the cacti (1900 to 3600m) which is formed of two subsections, the candelabra cactus (1900 to 2500m) and the usual columnar cacti, here called cardones or quiscos (2300 up to 3600m); B, the region of the Tola, without columnar cacti (3600 up to 4000m); C, the grassy plateaux of the high mountain valleys (3500 to 4400m); D, the region of the Llareta and Quenoa (4000m and over).

**The Region of the Cacti**

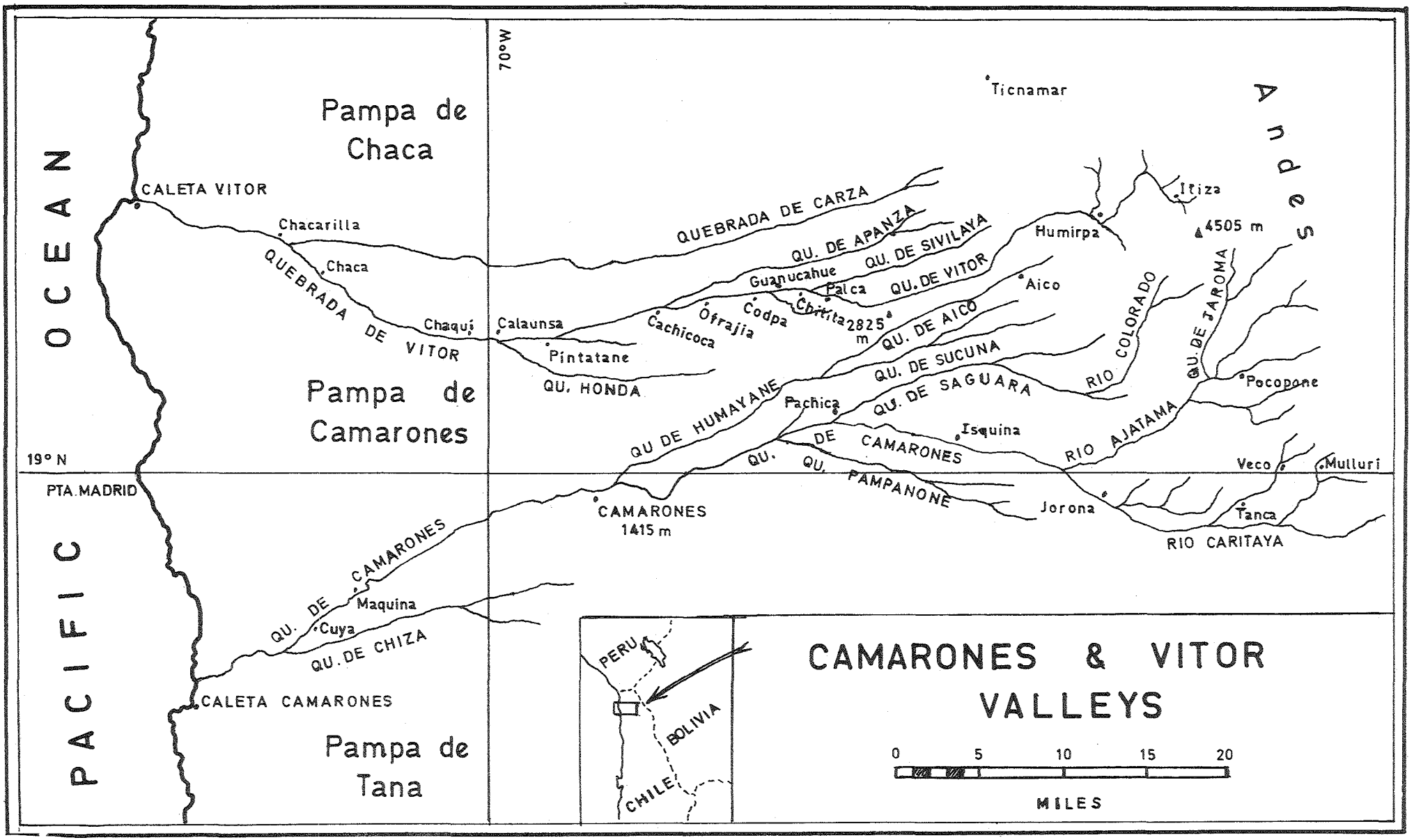
As already indicated, this zone, of which the characteristic plants are mostly tall-stemmed cacti and which occurs in our area at an altitude from about 1900 up to 3600 metres, can be divided into two subsections. The representative of the formation in the lower section is Meyen's candelabra cactus, Cereus candelaris (equals Browningia candelaris — H.M.). In really splendid isolated specimens of 4 and more metres high, it was first observed in the Vitor valley between Guanacahue and Chitita on the valley sides and almost due south of there in the Camarones valley between Huancarane and Pachica, in both cases at an altitude of about 1900 metre. With the ascent to the Pampa near Chitita plant growth was then entirely lacking on a several kilometre long stretch towards the east, on account of the small amount of precipitation. then the candelabra cactus appeared pretty frequently (altitude 2,400m) though on further ascent it was soon to disappear (altitude 2500m). Numerous fine specimens, grow above Esquina just above the valley bottom (altitude 2,200m), where the road from the pampa on the southern slope reaches the floor of the 1400 metre deep Quebrada.

From a greater distance, the candelabra-cactus tree almost gives the impression of a leafless, severely pollarded apple tree. Flowers and fruit were nowhere found. A few hundred metres higher, this cactus gradually disappears, to relinquish its place to the other commonplace cacti, called Cardon. The candelabra cactus reaches the maximum development in terms of numbers of specimens at about 2200 to 2300 metres altitude.

Of other plants in addition to the usual cacti, there were collected in this area in Esquina, Mentzelia ignea, Stevia pinifolia, Flourensia gayana, Polyachyrus tarapacanus, Trixis cacaloides, Senecio sp. nov.; from the Pampa near Chitita a yellow-flowering member of the Solanaceae and a low-growing bush called tola in the form of generally desiccated specimens.

The zone of the true columnar cacti has its lower boundary about where the candelabra cactus reaches its maximum development (2200 to 2300m), as can be readily confirmed on the valley sides near Esquina. On the pampa near Chitita the lower boundary lies somewhat higher. The representatives of the vegetation formation are several columnar cacti, of which there are probably more species than are mentioned in the discussion below. (Although flowers of different cacti were preserved, the precise identification of the species was not possible. For this is required a special study of the habitat. Several districts of our area offered a classical field for the latter). The lowest observed was a barely 1 metre high species called Airambo, of dark grey-green colouring with blood-red flowers and very numerous spines. From the same root rose up several unbranched stems of this cactus. At a somewhat higher altitude there was associated with the foregoing, a species similar to that Quisco which is widespread in the costal hills in central Chile; it has yellow flowers and is called Cardon. The colour is paler and the number of spines fewer than the foregoing species. The columns are often branched. Furthermore there occurs sporadically a species similar in growth to the Airambo but still somewhat higher and thicker stems, whose spines and rib crowns exhibit deep reddish coloration. Flower blood-red.

In addition there are to be found clumps of a small columnar finger-like cactus, with white flowers; as well as a smaller globular cactus called Jala-Jala, of hens-egg up to fist-sized, with yellow flowers. These smaller species appear in


PACIFIC OCEAN
Pampa de Chaca
Pampa de Camarones
Pampa de Tana
70°W
19° N
CALETA VITOR
Chacarilla
Chaca
Chaqui
QUEBRADA DE VITOR
Calaunsa
Pintatane
QU. HONDA
QUEBRADA DE CARZA
QU. DE APANZA
QU. DE SIVILAYA
Guanucahue
Palca
QU. DE VITOR
Cachicoca
Ofrajia
Codpa
Chirita
2825 m
Ticnamar
Humirpa
Itiza
4505 m
Aico
QU. DE AICO
QU. DE SUCUNA
QU. DE SAGUARA
RIO COLORADO
QU. DE JARAMA
Pocopone
QU DE HUMAYANE
Pachica
Isquina
QU. DE CAMARONES
RIO AJATAMA
Veco
Mulluri
QU. PAMPANONE
Jorona
Tanca
RIO CARITAYA
PTA. MADRID
CAMARONES
1415 m
QU. DE CAMARONES
Maquina
Cuya
QU. DE CHIZA
CALETA CAMARONES
PERU
BOLIVIA
CHILE
CAMARONES & VITOR VALLEYS
0 5 10 15 20
MILES

various places between the larger ones. In the same area between Chitita and Aico (3,600m) to which the foregoing statements refer, some kilometres before Aico (and likewise between Tanca 3,900m and Jorone 3,600m), near the upper boundary of the cactus flora, one meets a dark-green, very spiniferous species, which bears close to the growing point of the stem, lengthy, almost white, hairlike structures. It agrees with Pilocereus celsianus (equals Oreocereus celsianus — H.M.) in Schumann's G.d.K. and Cereus eriocarpus in Phillipi. The latter hang downwards on all sides from the top of the plant and give the plant the appearance of having a crest or wig. These hairlike structures serve for the absorption of moisture from the air; when it was observed (18th December 1897, in the afternoon), large water droplets hung down the body, and the air was saturated with moisture, yet there were no signs whatever that it had rained shortly beforehand.

Also in the area referred to between Chitita and Aico the columnar cactus forms the principal vegetation upon the heights near Aico, where the yellow flowering Cardon is very common. Then on the southern valley wall near Esquina, where the selfsame cactus forms the principal plant, its distribution area extends out into the neighbouring pampa.

The lofty stemmed columnar cacti reach their maximum development in terms of numbers of plants near an altitude of about 3000 metres. I might designate their densest stands with the expression "thicket"; individual specimens then stand far enough apart for a carefully moving person to be able to pass between them without injury; with baggage-animals on the other hand, the travelled road must be taken. The upper vegetation boundary of these cacti can lie as high as 3600 metres altitude, in connection with which it naturally goes without saying, that at this contour line, all cacti have disappeared. Low growing species occur, however at even higher altitudes.

**The Region of the Tola Formation**

Various plants with approximately similar habit are designated as Tola; there are ligneous plants with strongly developed rootstocks, with less than finger-thick stems of usually half to 1 – rarely 1 ½ – metres in height and with small resin-rich leaves. The following species were collected: Baccharis tola, called the "true Tola" (Paquisa); Baccharis santelicis (Pocopocone); Heterothalamus bolivianus (Jorone); Senecio graveolens, the "female Tola" (Humirpa); Fabiana ericioides (Aico). These Tola plants give rise to a characteristic plant formation at altitudes of about 3500 up to 4000m, either one single species or several together, of which these are the chief representatives. In particular the valley floors of this region (Humirpa — between Humirpa and Itisa; between Itisa and Paquisa; Taruguire; Mulluri, etc.) exhibit extensive stands of "true bush-steppe", that comprises only a few other plants besides the Tola. Of the other plants, there particuarly attracts attention low growing cacti and the so-called Pampa grass (Stipa frigida) in yellow-green crowns, that is used in the construction of the roofs of the Indians' shelters and in default of any other provender, is consumed by the mules. The places where the Pampa grass of the Tola occurs more or less in abundance bear the name Pajonales. Stone and screen slopes are not scarce in this region. They often lack plants entirely and if such do exist, then the Tola plants take first place.

(A detailed list follows of the other plants collected in this zone — H.M.).

**The Grassy Levels of the High Mountain Valleys**

A thoroughly characteristic feature occurs in the high mountains of this region, at altitudes of about 3500 up to 4500m. Generally small plains occur, which are covered with a more or less thick, low growing layer of grass. They are best described as mountain meadows. They owe their existence either to small river courses that are fed from springs or from the meltwater off the high mountain snows or to lakes and pools often lacking outlets in the flat valley basins. These meadows serve as pasturage for the sheep and llama herds of the Indians, upon which, or in their immediate vicinity, lie the human dwellings. The traveller who passes through the inhospitable mountain district, chooses such spots as camping sites, because water is to hand and it offers the riding and pack animals something to assuage their hunger. The sheep and llamas graze the grasses down to the roots, so the height of individual plants is very low; the flat green areas produce the impression of freshly mown meadows. Even in places where the plant cover is protected from destruction by the herds, the plant growth reaches barely more than a few centimetres. Because of the many coloured flowers scattered amongst the grasses, such as Werneria (white), Gentiana (blue), Astragalus (Violet), and others, these mountain meadows offer a pretty picture in comparison with the desolate scree slopes of their surroundings, especially when they are permeated by small water channels.

The locations at which these plants were collected are: Aico, Humirpa, Itisa, Paquisa, Achechamayo, Popopocone, Taruguire, Mullun, Tanca and Jorone. As to flowering, i.e. identifiable, Gramineae and Cyperaceae (grasses and sedges — H.M.), there were collected in this region: Distichlis misera (Aico), Poa trivialis (Pocopocone), Polypogon crinitus (Aico), Scirpus sp. (Itisa). The grasses possess deeply descending, widely spreading roots, which give rise to a peat formation after they die. (Other species belonging to this zone are detailed — H.M.).

The valley of Aico is decidedly interesting from a botanical point of view on account of which a few words should be devoted to it. It calls to mind to some degree, the lower lying valleys, since limited cultivation of lucerne (Alfalfa) occurs on the terraced valley sides — as long as stream water can be led there. Fruit does not thrive much because of the night frosts, no more than do potatoes, peas, and similar vegetables. On the valley meadows, whose vegetation has already been described, stand singly or in groups tall bushes (from 1 up to 3m high) a feature which is comparable to certain places in the deeper lying valleys but found again nowhere else in the high mountains.

Of shrubs and the plants that were growing between them, the following were collected: Baccharis rupicola, called "Chica blanca", quite numerous and with sometimes white, sometimes faintly reddish tinted flowers; Grindelia

tarapacana, "Chine"; Dunalia senticosa, called "Chanar silvestre"; Cassia tarapacana; Cajophora sp.; Mutisia viciaefolia — "Tarilla"; Mutisia microphylla. Butterflies are as numerous in the valley above Aico as for example in Middle Chile. Particularly there is found a species similar to the German small tortoise-shell butterfly; in addition, yellow and white butterflies were observed . In all other regions they appeared to be a rarity.

**The Region of Llareta and Quinoa**

*On the trail from Humirpa towards Itisa (around 4000m altitude) the appearance of the vegetation gradually* changes completely; on the surrounding heights appeared beyond the yellow-green Tola and the still paler looking pampa-grass, dark green cushion plants that increase in number and extent towards Itisa; it is the Llareta (Azorella compacta) which appears close to Itisa in a particualarly striking and abundant formation. Specimens reached up to 1 metre in height and up to 2 metres in diameter; many carried flowers and fruit at the same time (24th December 1897). The cushions are so firm that the weight of a man makes no impression upon them, and blows from a hammer are barely discernible. They secrete lumps of an almost white resin, that is greatly prized by the Indians as a medicament. Older clumps are destroyed by a fungus, crumbling away to some extent into a black peaty heap and looking as if they had been charred by fire. The Llareta was observed neither further inland nor in the Camarones basin in the same striking appearance and number as in those surroundings of Itisa in the Vitor river basin.

Comments.

. . . . . from R. Mottram

I think that the saturated Oreocereus is an interesting illustration of one of the functions of hair on cacti. Spines themselves are of course widespread in many xerophytic plants as a means of providing condensation points for atmospheric moisture. I suspect that their thermal conductance is very high, and under conditions where there is no direct solar radiation falling on the spines, there will be a net flux of heat along the spines to the pointed end, where it is rapidly dissipated. Thus the spine will assume a lower temperature than the surrounding air and provide a surface for condensation whenever the air is near or at saturation level. Hairs, however, could not function in the same way and I venture to suggest that they are only capable of gathering moisture when the air is super-saturated i.e. when the air is laden with moisture droplets in suspension (fog). Then once droplets start to form on the hairs, they grow at an ever-increasing rate by coalescence with other atmospheric droplets until they are large enough to run along the hairs and eventually reach the ground around the base of the plant. If this theory is correct then we would only expect to find hairy cacti in regions which derive most of their moisture from fog rather than from precipitation, unless of course there are other reasons for the presence of hairs as well.

Identification of the cacti mentioned in the article is rather tricky. There appear to be five plants mentioned, as follows:- The first is barely one metre high, called Airambo, of dark grey-green colouring with blood red flowers and very numerous spines, having several unbranched stems growing from the base, and growing at 2200 — 2300 m. This sounds very much like Corryocactus melanotrichus, but it is normally reported much further west, on the other side of the Andes, and at a higher altitude, about 3,300 m. Secondly, the plant which is similar to the Quisco which grows in central Chile, and flowers yellow. I guess that this is Corryocactus brevistylus or a near relative; this species is normally recorded from the Arequipa area. Thirdly, the species similar to the Airambo but with somewhat higher and thicker stems. Once again, this must be a Corryocactus species. Then there is the globular cactus, called jala-jala, of hens-egg up to fist sized, with yellow flowers, and growing at altitudes of 3,500 to 4,000 m. Although the size and altitude would be right for Neowerdermannia, I've never seen any flowers which could be described as yellow! The flower colour sounds more like a Weingartia or Copiapoa but the altitude is too high for those. In addition there are clumps of a small columnar finger-like cactus with white flowers. This sounds like Pygmaeocereus, but I always imagined that this was restricted to the coast and Knize does not record them over about 600 m. This one has me stumped completely!

. . . from H. Middleditch

On completing the translation of this article, I felt that I had become fairly familiar with the detailed observations made by these authors concerning the cacti in the Camarones and Vitor valleys. After making comparisons with one or two of the other articles being prepared for this series, I felt fairly happy to put certain names to these cacti. Most of my conclusions were, indeed, not greatly dissimilar from the thoughts expressed by R. Mottram (above). There is no problem in identifying the Browningia candelaria, growing at the lowermost margin of the summer rainfall zone; nor with the Oreocereus celsianus (or perhaps it is O. hendriksenianus), representing the highest-altitude columnar cacti.

However, the "spiny one meter high red flowering cactus" is surely too tall to be an Arequipa. I, too, interpreted the description originally as 'branching from the base.' But that is not quite what Reiche and Pohlmann say: their words are "from the same root rose up several unbranched stems." Now a root is normally underground, so Reiche and Pohlmann appear to be telling us that a number of unbranched stems came up out of the ground separately off the one plant. This particular feature is the outstanding characteristic of Erdisia Meyenii. When this plant was originally discovered, Meyen described the flower as yellow. The plants of Erdisia meyenii which Rauh collected near Arequipa possessed orange-red flowers. Is Reiche and Pohlmann's plant a further variety of Erdisia meyenii? It may be advisable to note that this "Airambo" can hardly be an "Airamo" or Tephrocactus — it has stems, not joints. Nowhere in the literature have I been able to locate any reference to an "Airambo". Now this "Airambo' is similar to an even taller and thicker stemmed plant, both sorts with blood-red flowers. In this region, the most probable thicker-stemmed plant appreciabley taller than 1 m high, with blood-red flowers, could be a Corryocactus. For

the "Airambo" to be similar to Corryocactus in general appearance and flower, it would have to be an Erdisia.

But no red flowering Corryocactus has been reported from northern Chile, only the yellow-flowering C. brevistylus and C. kraussii. If the "Airambo" with its numerous spines and unbranched stems is an Arequipa — up to 1 m. high! — then the plant of similar growth and flower, but taller, would not be an unknown red-flowering Corryocactus, but an Arequipa growing over 1 m. high . . .!

There is yet a further alternative identification for the tall, branched, Airambo-like plants as they could be Trichocereus. The T. pasacana/Helianthocereus poco group are common in central Bolivia but they have also been reported from places which may be located on the map on p. 15 of Chileans No. 37, of Northern Chile. In the north-east corner of the map, Helianthocereus are reported from Corocoro and from Perez, a place which is located about the "O" of Bolivia. Trichocereus pasacana is reported by Phillipi from San Pedro de Atacama northwards to Cana and the Salar de Empexa; Cardenas reports the same plant from Colcha K and around to the north-west side of the Salar de Uyuni. Knize reported "yellow-flowering" Trichocerus, clumping, up to a metre high, with long spines, from near Poroma. Could the Airambo and its taller relative be red-flowering Helianthocereus?

The yellow-flowering "very common" Cardon will almost certainly be Corryocactus brevistylus, as R. Mottram indicates. This species is reported near Arequipa at approx. 17°S and 72°W by both Weberbauer and Rose. Johnson describes a Corrycactus with a clear yellow flower from above Tarata at about 3,600 m. and this would appear to fit C. brevistylus. Buining also describes a Corryocactus which he found at about 3,100 m. altitude, inland from Arica, as this same species. Werdermann writes about seeing this species in the vicinity of Parca, at about 3,000 to 3,500 m. altitude. His photograph of that habitat locality includes a Corryocactus looking remarkably similar to the yellow flowering Corrocactus kraussii from Mamina, six or seven miles away to the south.

Then there is the cactus between hen-egg and fist-sized; at first I read this as a multi-headed plant and was imagining a Tephrocactus having enormous joints for the genus, or possibly a Lobivia far to the south of any previous reported locality, but then I realised that the authors seemed to be speaking of a plant with a solitary body. Not many miles north of this location, Backeberg came across Neowerdermannia on his trip around Ticnamar and it is probably this same sort which Reiche and Pohimann observed. To date, no one cultivating these plants has recorded a yellow flower, although yellowish might be an acceptable description. It may well have looked yellow in comparison with its dull surroundings in habitat, whereas it may not look yellow if was stood amongst dandelion flowers.

As to the finger-like plant with white flowers; this does not convey an impression of a Tephrocactus, plants which commonly have joints of globular, ovoid, or elongated ovoid shape.

Could this plant have been a Haageocereus? Wagenknecht quotes Haageocereus from much further south, at Mocha. On the other hand, the entry for KK 1128 in Knize's Field Number list is "Arequipa/Loxanthocereus sp.?" If the plant was not seen in flower, this might equally have been a Haageocereus. In describing his trip through Chile in company with Ritter, Buining also notes that he saw a plant in Haageocereus chilensis Ritter n.n. in flower and fruit, in northern Chile.

It seems to be impossible to improve upon Reiche and Pohimann's own comment that "The precise identification of . . . . the cacti was not possible. For this is required a special study of the place and spot." To judge by the available literature, this is still awaited.

. . . from P. A. Smart

But possibly not still awaited for one item. One interesting group which has rather puzzled me recently is Neowerdermannia. I did have a "normal" Neowerdermannia chilensis with shortish spines and white flowers, which left me in the dreadful winter of 1979. I was therefore pleased to see buds on a recently acquired N. chilensis variety ex K.K., which has very long and more numerous spines and a much wider, fatter, body. This one flowered on the same day as N. vorwerkiana and N. peruviana. It had yellow flowers, a good bit bigger than the other two. The N. vorwerkiana has a violet-pink flower, but the N. peruviana, ex K.K. and flowering for the first time, had normal sized yellow flowers.

Now I had previously believed that all three Neowerdermannia "species" had either white or violet-pink flowers, and that either colour was normally found in all stands of all three species. But yellow? A quick glance through the literature failed to unearth any real data — although one Chileans reference did mention a "posssibly yellow" flower. Do we have anything else on this?

. . . . . from D. W. Whitely

Once I had FR 199 N. chilensis with a white flower I wrote a letter to Ritter to ask him about the flower colour and received the answer "Neowerdermannia chilensis has white flowers. Those on the very similar N. peruviana in nearby Peru are pale yellow, but I am not aware of how variable these colours are in both species."

**NEWER NOTOCACTI** by G. J. Charles

When I first started collecting cacti I just acquired plants that took my fancy — I suppose most beginners will build up a mixed collection from cuttings they are given and plants they buy. But a few years ago, I developed an interest in the Notocacti and started to keep a look out for plants and seeds, especially of the newer sorts which had only recently come into cultivation.

In the last year or two, I have added some imported plants of Notocacti to my collection and I have been fortunate enough to be able to select one or two of them off the staging at the nursery. More recently I have been aiming to have both a seedling and an imported plant of each species.

Now I have about 75 species of Notocacti (including varieties and forms), including a dozen imported plants and in addition I grow quite a lot from seed. Last year I repotted all my plants and changed to a quite different compost — now everything is in Arthur Bowers compost in place of a mix of 1 part John Innes, 1 part grit plus sedge peat. The Notocacti are quite suited with this new soil.

Unfortunately I don't have much opportunity to observe flower opening times and nor have I done any seed examination under the microscope. The terms used for describing seeds I find very confusing. What is even more confusing are some of the names — I get hold of plants with names on the labels but I can't find the name anywhere in any books. Like N. glaucescens, Noto. K 1256, noto. Schl. 151, N. elegans, and N. laetivirens. And then there is N. arechavaletai v. alacriportanus which is not the same as N. alacriportanus; also N. linkii buenekeri which is not the same as N. buenekeri. It's all very well combining Notocactus and Wigginsia, but what happens with Noto. horstii and Wigg. horstii? Also, aren't N. arechavaletai and Wigg. arechavaletai two different plants?

. . . . . from R. Zahra

Well now, to start with there is the first basic problem — do we accept Notocactus and Wigginsia as two separate genera or do we lump them together in one genus under the older name of Notocactus? If we consider Notocactus and Wigginsia as one genus, we cannot have two different plants with the same name; however this is what has happened with Notocactus horstii and Wigginsia horstii. On the other hand, the problem with Notocactus arechavaletai and Wigginsia arachevaletai has been solved, for N. arechavaletai has been reduced to a variety of Notocactus ottonis, as N. ottonis v. arechavaletai. In old lists one could find N. arechavaletai var. alacriportanus HU 27, but this should not be confused with N. alacriportanus FR 1284, HU 44; N. arechavaletai var. alacriportanus is now considered only as a form of N. ottonis var. arechavaleti. Again, Notocactus linkii var. bueneckeri (FR 1026b, HU 22) is not to be confused with Notocactus bueneckeri (FR 1278, HU 41) as these are two different plants.

I should think that G. Charles must have a few wrongly named plants. His Notocactus glaucescens should read N. glaucinus. On the other hand, Notocactus laetivirens (FR 1266, HU 58) and N. longispinus (FR 1403a, HU 6) are quite correct. Notocactus elegans HU 338 is not to be confused with N. mueller-melchersii var elegans DV 39.

I think the best advice I could give to our correspondent would be to stick to the list of Notocacti given in the Ashingtonia Journal — although I do not agree with all of it, it has many good points, and contains many of the latest name changes.

. . . . . from H. Middledich

I do not think that I would altogether concur with this last piece of advice. The trial of fancy names left by authors. whose prime concern is taxonomy, seems to afford us precious little information about the plants themselves. I would have preferred to suggest to anyone like Graham Charles, who is seeking order among the confusion of Notocactus names, that small bites at the problem would be easier to digest. Such as the detailed comparison of N. linkii and N. megapotamicus undertaken at a Chileans weekend, or of N. werdermannianus and N. vanvlietii; or fixing in one's mind an appreciation of the different basic flower forms that appear in this genus. In this way a better understanding can be obtained of the genus as a whole and the real problems can be isolated.

. . . . . from J. R. Gooch

The comment appended to the notes on these Notocactus names to the effect that "it is a little confusing at times" is an understatement par excellence. There has indeed been a wild proliferation of names in the Notocacti.

I am sure that most people can produce a mental picture of a Wigginsia (or Malacocarpus). They are normally dwarf, flattened, globular, dark green plants with sharp ribs and bear copious areole wool in the crown and shoulders of which most is later lost. Flowers generally rather small i.e. less than 4cm. in diameter, yellow with a red stigma. Typical examples are W. arechavaletai, erinacea, sessiliflora. The previously accepted genera of Brasilicactus and Eriocactus are well enough known not to require amplificiation. More recently plants have been found that bear a similarity to Parodia and were introduced with the provisional descriptive name of Brasiliparodia. They are small globular to short cylindric, clustering plants, close ribbed with

many fine spines — sometimes a strongly hooked central spine is produced. Typical examples are N. alacriportanus, brevihamatus, and buenekeri.

This leaves us with the Notocactus that most of us have recognised as this genus for many years. This in turn contains several distinctive looking groups of plants and two of these in particular show a wide range of variation — Notocactus ottonis and N. mammulosus. Unfortunately it seems to me that the usual error has been perpetrated in that every minor variation has been given varietal status. No doubt the distinct forms could usefully have been given the status of a described form. Added to these many forms to be found in the field, I suspect that much hybridisation has taken place in cultivation so I fancy that we have a multitude of man-made cultivars as well.

. . . . . from D. Angus

I also changed the compost I use, some time ago, and find that Notocacti are now growing quite well. Previously they were grown in a compost of loam and peat made up with coarse grit — for some time one eighth inch size fish tank gravel was used. Now I use Levingtons to which about on third of fine sand is added. This compost is kept wet in summer — almost to say soggy. If the compost once dries out then the Notocacti lose their roots and have great difficulty in becoming re-established.

. . . . . further from G. Charles

I have now had an opportunity to do some more tests on the Arthur Bowers compost which I use and have some interesting findings. Loss of roots after a year or so seems to be accompanied by a move towards alkalinity — even watering with Birmingham's super-soft water. A friend of mine, a professional horticulturist, grows Notocacti fantastically well (and other cacti!). I tested the soil around the toots of a huge N. herteri which had been in the same tray for 2 years. The result was pH 5.5 and the plant was growing extremely well. Next year I shall adjust my soil to give this kind of acid reaction.

. . . . . from J. R. Gooch

It was always suggested at the local branch of the National that Notocactus were ideal beginners' plants as they were very easy to cultivate and generous with their flowers. I accepted this quite happily during my early years to the hobby and the plants thrived. More recently I have heard it said often that this one or that one had stopped growing and I am certain mine have become far more temperamental of late.

But seriously, I used to repot every year and all the cacti appeared to appreciate this. This procedure is not now practicable and I am of the opinion that the Notocacti are quick to show their resentment to exhausted soil. If one is quick to detect when a plant is not growing strongly and it is repotted immediately, things will soon improve. If left until considerable shrinkage is observed, then the benefit from repotting will be much slower to show, as very often most of the existing root will have rotten. Observations from habitat and also in cultivation suggest a low pH is to be favoured for this genus and I am contemplating trying a test batch of plants in one-eleven aggregate and controlling the feed and pH carefully to see how they fare.

. . . . . from J. Hopkins

I have tried planting a number of Notocacti into trays instead of individual pots. Some plants seem to do very well in these conditions but others are not too happy.

**ECHINOCACTUS STREPTOCAULON. Hooker sp. nov.**

Curtis's Botanical Magazine No. 77 1851

Erectus (sesquipedalis) columnari-cyclindraceus 12-14 sulcatus spiraliter tortus (nunc proliferus), angulis sulcisque acutis, areolis approximatis nudis (lana nulla) 8-aculeatis, aculeis fuscis rectis 7 patenti-radiatis mediocribus, unico centrali triplo majore verticali, floribus 3-4 terminalibus vix spinas superantibus flavis, petalis spathulato-lanceolatis, stigmatibus 9-12 *linearibus staminibus longioribus.*

(From the Latin). Erect (one and a half feet high) columnar-cylindric 12-14 furrowed spirally twisted (now offsetting), with angled and acute grooves, areoles close together, naked (lacking wool) 8-spined, spines dark brown straight with 7 wide spreading radiating of moderate length, single central three times as long, perpendicular, with 3-4 terminal yellow flowers, rising above the spines with difficulty, petals spathulate-lanceolate, stigma with 9-12 parallel-sided, short, narrow, stigma lobes longer than the stamens.

A very distinct species of the genus Echinocactus, if we judge it from the flowers; but almost a Cereus in the elongated habit of the plant, which we purchased from Mr. Bridges, who had brought it from Bolivia. We find nothing like it anywhere described, and have named it from the remarkably spirally twisted character of the stem, without, however, holding ourselves responsible that this is a constant or permanent mark of distinction. It flowered in the Cactus-house of the Royal Gardens (Kew H.M.), in August 1845.

Our plant is a foot and a half high, erect, columnar, cylindrical or a little contracted towards the base, occasionally proliferous, obtuse and woolly at the top, the sides fluted with twelve to fourteen spirally twisted, rather acute ribs, the furrows also acute. Areoles densely crowded, often almost touching one another, and forming a nearly orbicular dark-coloured disc, free from wool, and bearing generally eight straight, palish brown spines: of these, seven outer are nearly equal, half an inch long, forming a spreading ray, while from the centre, one spine, twice or thrice the size of the rest, stands out vertically. From the woolly crown on the summit appear three or four yellow flowers, scarcely rising above the wool and not so

long as the spines, an inch or an inch and a quarter in diameter, entirely of a sulphur-yellow. Petals lanceolato-spathulate. Stamens numerous. Anthers sub-globose. Style as long as the stamens. Stigma of many linear spreading rays. W.J.H.

Cultivation. From some peculiarity in the nature of the Cactus region of Chile and Bolivia, we find that Cactae imported from these countries do not so readily conform themselves to the artificial modes of cultivation to which they are necessarily subjected in this country, as allied species from Mexico. This is more especially the case with the Echinocactae. We learn that they inhabit very arid and hot places, enduring extreme drought, which is very obvious from the harsh, dry, and often dead-like appearance they present when they arrive in this country. The species now figured was introduced with many others about six years ago, by Mr. Bridges, and on inquiring of him the nature of their places of growth, and what mode he would recommend as best for cultivating them in this country, the point on which he laid the greatest stress was to give them no water. But we find that even harsh, dry-looking Cactae are, like many other dry-climate plants, capable of assuming a freer habit of growth by good treatment; the difference of the growth they make in this country, as compared with that of their native country, is so great, that the top and lower part of the same plant, if separated, might be taken as two distinct species. It is probable that many cacti from dry regions when placed under the influence of a climate more favourable to vegetable development, will assume a different aspect, varying according to the degree of heat and moisture they receive. In habit this species approaches Cereus reductus,figured in Tab. 4443, and what is there stated as regards cultivation is suitable for this species. J.S.

Comments.

. . . . . from E. W. Bentley

Early in 1970 I paid a visit to Sargant in the Isle of Wight. At that time he had a fairly good selection of imported plants for sale and amongst those which I selected for purchase was a Copiapoa bridgesii SH 829 from "North of Caldera." This plant was about 3½" in diameter and some 4" high, with a distinctive elongated-globular appearance, with a fairly smooth, bright green body divided into ten vertical ribs. There is a faint narrow groove running vertically between the base of the ribs. The areoles were so close together that they were quite touching, all the way from base to apex of the rib. The areoles were black, but this would be just dirt and mould of course. The crown was covered with a cushion of wool, the central spines were about 3 cm. long, stout, round, tapering,standing out almost perpendicular to the body, the radials being shorter and spreading. With the confluent areoles, the outstanding central spines, and the radial spines not overlapping from one rib to the next, it looked rather like the plant figured by Britton & Rose, Vol. III Figure 99.

The plant established itself with no apparent difficulty and has about doubled in height whilst remaining more or less the same diameter so that it became distincly columnar. The new growth continued to be very similar to the habitat growth, with a bright green body and vertical ribs; the areoles still touch each other, the central spines are just as long and stout and still stand straight out from the body, so that now the plant is taller it looks even more like Britton and Rose's Fig. 99 in Vol. III. The areoles that have appeared in cultivation are now much the colour of those on, say, Copiapoa haseltoniana.

. . . . . from H. Middleditch

This particular plant was brought along to the 1975 Brooksby Gathering by E. W. Bentley and we were able to compare it with a colour slide of the plate which accompanied Hooker's original description of Echinocactus streptocaulon. The similarity between E. W. Bentley's plant of SH 829 and the original streptocaulon Hooker were almost too good to be true. The green colour of the epidermis was the same, the creamy-brown wool cushion covering the crown was similar in colour and compactness, whilst the outward-pointing spines that give the impression of a pallisade could hardly have been a better match, in length, straightness, stoutness and spacing.

The photograph of E. W. Bentley's SH 829 was taken shortly after the plant was first purchased. To judge by the slight bend at the base of the plant, it might well have been collected in habitat as an offset from a clump like the one in Ritter's photograph. On the front cover may be seen the appearance of the plant in 1980, when it has grown almost cylindrical and is starting to offset just like the plant in Ritter's photograph. But these offsets have a quite different appearance to the parent plant. The offsets are ribbed, but by no means as acutely and distinctively as the parent. The areoles on the offsets are quite large, but set apart one from another. They bear some resemblance to seedling plants grown under the name of C. lembckei.

Now if this particular plant is indeed a replica of Bridge's collected plant which received the name streptocaulon, then according to Ritter it should occur south of Caldera (at Morro Copiapo), not "North of Caldera". Unless it comes from both locations. Normally it would evince little surprise to suggest that a particular cactus species was to be found over an area extending perhaps one hundred or two hundred miles in length, never mind a bare twenty miles or less, as in this instance. But it would appear that there are a small number of Copiapoa species, like C. cinerea, which have been found to occur over a patch of ground perhaps fifty or a hundred miles in extent, whereas a fairly large number of Copiapoa species are described by Ritter, for example, as "only from this locality." But does not C. lembckei come from north of Caldera? Do imported specimens of C. lembckei look at all like Echinocactus streptocaulon? Even young seedling plants of C. lembckei which I have seen in various collections have the cushion of creamy-brown wool covering the growing point, just the colour of the woolly cushion on Hooker's original illustration!

. . . . . response from E. W. Bentley

As far as your suggestion is concerned that my plant of SH 829 from North of Caldera could be C. lembckei, I would not argue strongly against it. After receiving your letter I put the SH 829 next to my SH 825 C. lembckei, and was struck by

the even greater resemblance of the offsets of the two plants. And I began to see other similarities. The lembckei has a suggestion of pallisaded central spines and the areoles are more or less confluent. The main difference is in the colour and texture of the epidermis — in lembckei it is matt and bluish. In the SH 829 it is and was green and smooth. So perhaps it could still be C. bridgesii. Or streptocaulon? But what do you think of the suggestion that C. lembckei is only a synonym for C. streptocaulon (Hooker emend Ritt.) Ritt.? And so that both Backberg and Ritter are partly right?

. . . . . from J. Forrest

I also obtained an imported plant of Copiapoa SH 829 from Sargant in 1970. The body of this plant has a grey-green coloured habitat growth; the ribs are vertical and number 10. It has grown well during the intervening years and it is now about 12 cm. high and 10 cm. in diameter — it has about doubled in size since 1970. It shows no waist between the new and the habitat growth but the cultivated growth is a lighter green colour. The spines are just as strong and long as their habitat counterparts. The central spines are about 3 cm. long, thick, strong, and straight; they stand out quite parallel to each other and they do give the impression of a palisade. The radial spines are shorter than the centrals — approx. two thirds the length. The areoles grow close together and almost touch, especially near the bottom. The wool in the crown is yellow to pale brown at first, but soon going grey; the grey felt gets darker nearer the bottom but much of the black has come off the habitat areoles whilst in cultivation.

I reduce my watering of Copiapoas in October and give them a spray four or five times from November to the end of February. I start watering again early in March. Fairly early in 1975 my SH 829 produced offsets which definitely differ in habit from the parent and are really quite like that described on E. W. Bentley's SH 829 (see comments under Copiapoa pendulina, this series — H.M.). The parent flowered for the first time in the August of 1975 — it was a typical Copiapoa flower, yellow in colour.

**COPIAPOA STREPTOCAULON (Hooker emend Ritt.) Ritter comb. nov.**

By Friedrich Ritter

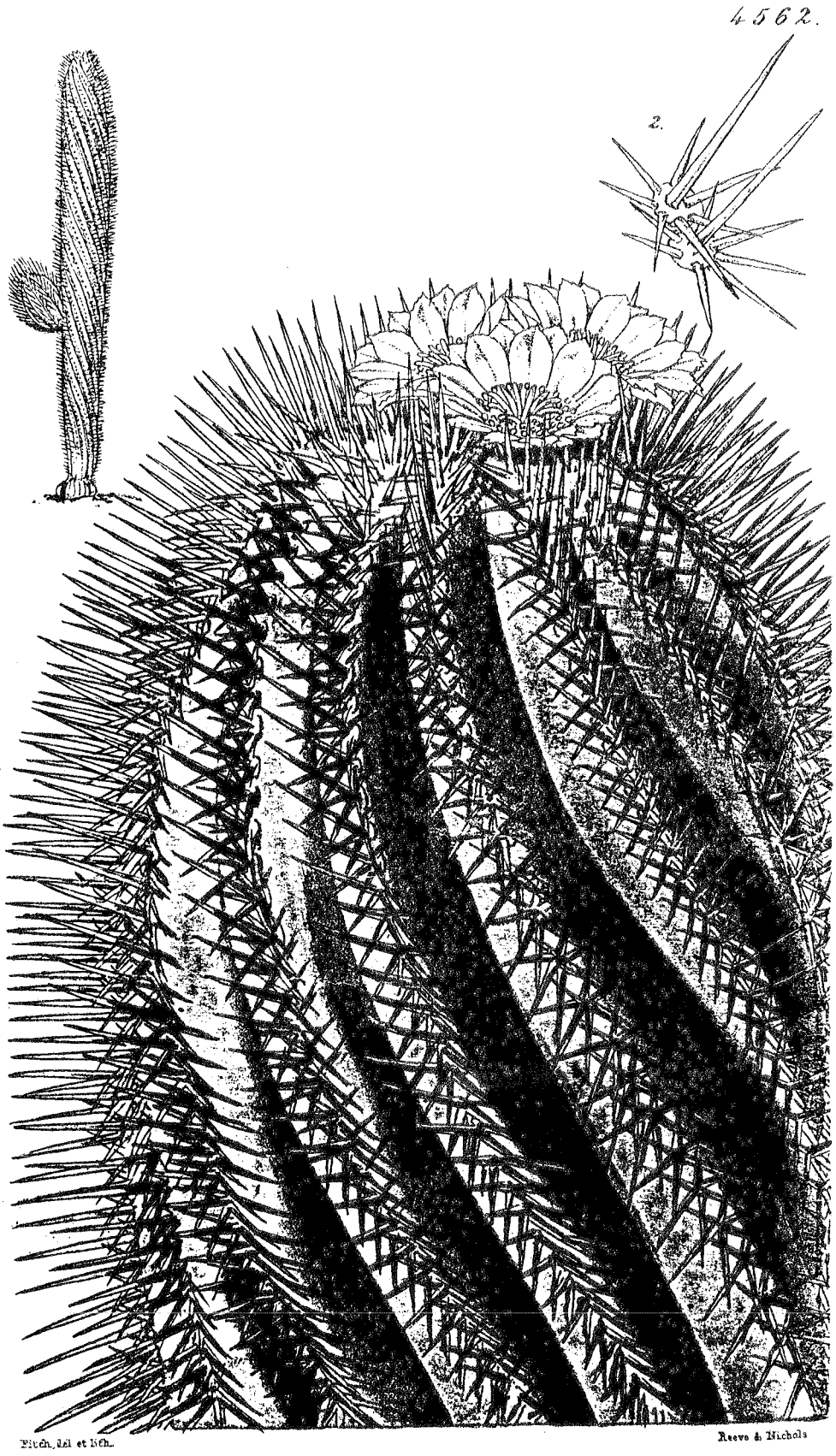
Translated by E. W. Bentley from K.u.a.S. 12:1:1961

This species was described and figured by Hooker in the year 1851 in Curtis's Botanical Magazine 77 as Echinocactus streptocaulon. A copy of this illustration is to be found in Britton & Rose's Cactaceae Vol.3. p.86. Later K. Schumann in his Gesamtbeschreibung took this species to be a synonum of Echs. marginatus S.D. with the observation: "In my opinion it cannot in the least be doubted that Echinocactus marginatus S.D. corresponds to Echinocactus streptocaulon Hook., even if the latter is more sharply spirally twisted." The spiral twisting will be unimportant though; it can come about in individual stems as a result of some check (as in the picture here attached the head on the left below is twisted) without it being a specific species character. According to my experience there is no Copiapoa in which twisted ribs are specific. Thus the name "streptocaulon" chosen by Hooker would be misleading, for it means twisted-stemmed. The original illustration however undoubtedly depicts a Copiapoa. Britton and Rose follow Schumann and also take Echs. streptocaulon as synonymous with Echs. marginatus S.D., which they recombine as Copiapoa marginata (S.D.) Br. and R.

Copiapoa marginata grows near Antofagasta and is the most northerly species of this genus. It is not however possible to get the description and still less the illustration of Echinocactus streptocaulon Hook. to correspond with that of Copiapoa marginata and if Forster-Rumpler's hand-book gives both as distinct species there are good grounds for it. As however was rather frequently the case, Schumann was too hasty in his species determination and identification. Forster-Rumpler gives a translation of the original description of E. streptocaulon. It reads "Homeland Bolivia, introduced from there by the English Botanist Dr. Thomas Bridges. Body upright, columnar-cylindrical, almost like a Cereus, at the base somewhat narrowed, 45 cm. high, the crown blunt and woolly. Ribs 12-14, very sharp, running up in a screw-like spiral, with sharply indented furrows between. Spine clumps very closely placed, bare. Radial spines spread out in a ray, not quite 1½ cm. long. Central spine 1 standing up vertically, 2 to 3 times longer than the radials. Flowers 3 to 4 developing out of the wool of the crown, yellow, scarcely standing out from the spines, when completely open only 2¾ to 3½ cm. in diameter, with lanceolate-spathulate perianth leaves. Style longer than the stamens with 9-12 rayed stigma."

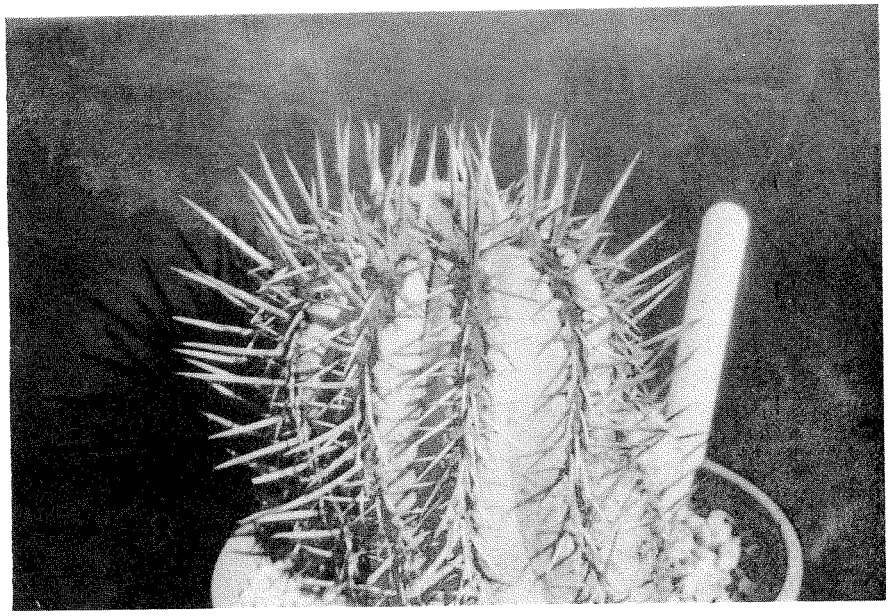
Habitat data at that time only rarely agreed with the facts. The Chilean province of Antofagasta belonged to Bolivia when Bridges collected there. There are now no cacti there that agree with this description by Forster-Rumpler, but perhaps other plants found further to the south in the latitude of Caldera would agree with it. The same goes for other species. Thus Echinocactus bridgesii was also despatched as from Bolivia, whereas it is now found growing in Chile in the neighbourhood of that Copiapoa which I associate with the description of the so-called Bolivian Echs. streptocaulon Hook. On the other hand, Echts. marginatus S.D. was at that time attributed to Valparaiso in Chile, while it grows far away near Antofagasta, at that time in Bolivia.

The ribs of my Echts. streptocaulon, as the figure shows clearly, are sharper and higher than those of Echts. marginatus; the continuous ribbon of areoles is very characteristic of the species from Caldera while in Echts. marginatus in contrast the areoles are distinct and only sometimes ribbon-like. Above all, however, the spination does not correspond; in Echts. marginatus the central spines are not two to three times longer than the radial spines, the centrals are only slightly



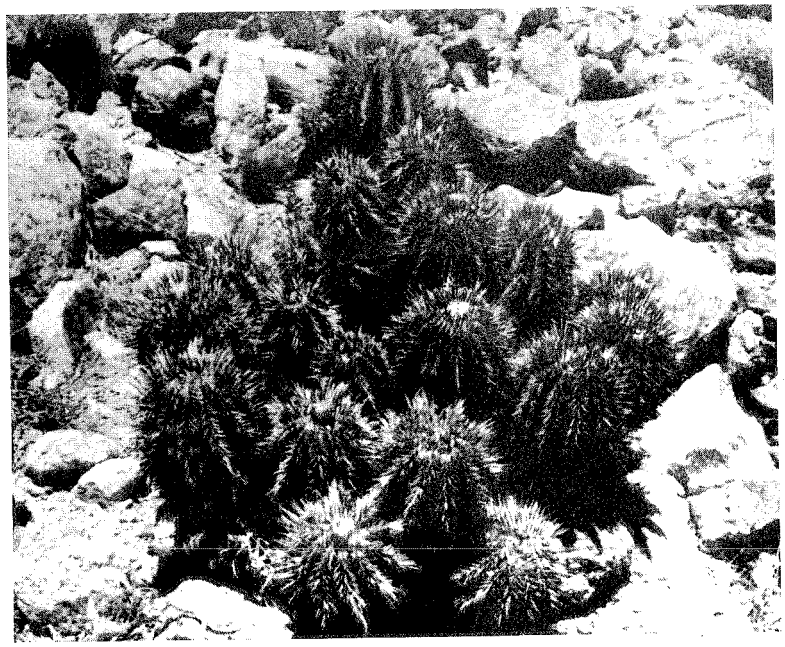

COPIAPOA STREPTOCAULON

Curtis's Botanical Magazine No.77 1851



COPIAPOA SH 829

Collection - E.W. BENTLEY



COPIAPOA STREPTOCAULON

Habitat Photo - F. RITTER

K.u.a,S 12.1.1961

stronger and longer than the radials and they do not stand out of the areole ribbons as shown in the picture of my Echts. streptocaulon from Caldera. The other data from Forster-Rumpler's description also hold true for this species. Since I know of no other species which otherwise could come into consideration, I therefore identify the species from Caldera with Echinocactus streptocaulon Hooker, choose a neotype for it, since Hooker's original material is no longer available, and give for it the following emended description.

Echinocactus streptocaulon Hooker emend Ritter.

Viridis, radice brevissimo conoideo-napiforme, valde proliferans, pulvinos laxos, ad 50 cm. altos formans. Caules 7-10 cm. diam., vertice plano, griseo-lanuginosos. Costae 10-14, obtusae, vix gibbosae, supra 1 cm. altae, interdum tortae. Areolae approximate vel inter se contingentes, rotundatae, 0.5 — 1 cm. diam., brunneo-tomentosae, canescentes. Aculei atro-brunnei, canescentes; marginales 5-7, paene recti, robusti, 1-1.5 cm. longi, lateraliter radiantes; centrales 1-3, rigidissimi, porrecti, 2.5 — 4 cm. longi. Flos 2.5 — 3.5 cm. longus; tubus 1—1.5 cm. longus, flavus, paucis squamis magnis instructus; camera nectarifera 3-5 mm. longa, 3-4 mm. lata, semipatens; filamenta flavida, ca. 1 cm. longa, antheris citrinis; stylus 1.75 — 2 cm. longus, flavidus, stigmatibus 10-15, pallide-citrinis. Phylla perigonii ca. 15 mm. longa, 7 mm. lata, apice rotundata, flavida. Fructus plerumque nudus, interdum apice 1-2 squamis rubidis, ca. 5 mm. longis instructus, pallide-viridis. Semen 1 mm. longum, ⅔ mm. latum, nigrum, nitidulum, minutissime verrucosum, hilo albo, ovali, basali praeditum.

Locus typi: Morro Copiapo, prope Caldera, Chile borealis. Coll Fr. Ritter (FR 511).

Body grass-green, with shorter, tougher, rapidly tapering swollen root-stock with thick neck. Individual heads 7 to 10 cm thick, readily offsetting, large, forming a somewhat open clump, up to 50 cm. high. Flat crown with grey wool.

Ribs 10 to 14, broad obtuse, neither tubercled nor notched, more than 1 cm. high.

Areoles closely approaching each other or touching one another, rounded 0.5 to 1.0 cm. in diameter, brownish felted when new, later going grey and becoming black.

Spines: Radial spines more or less 5 to 7 practically straight, stout, pointing sidewards, the sideways or downwards pointing ones commonly the longest, dark brown, quickly going grey, about 1 to 1.5 cm. long; additionally 1 to 3 straight, very stout, porrect, 2.5 to 4 cm. long central spines similarly coloured.

Flowers from the crown, with characteristic Coiapoa flower-scent, 2.5 to 3.5 cm. long, opening more or less wide, but frequently prevented from doing so by the spination, without any narrowing above the ovary.

Tube funneliform, pale yellow, 1 to 1.5 cm. long, opening 1 to 1.2 cm. broad, exterior with a few larger, greenish scales becoming red-brown above.

Nectar chamber 3 to 5 mm. long, 3 to 4 mm. broad, half-open.

Filaments pale yellow, the lower ones 1.2 cm. long, the upper 0.7 to 0.9 cm. long. Anthers citron yellow. Insertion chiefly above the nectar chamber, fewer inserted in the upper part of the tube as far as the margin.

Style 1.75 to 2 cm. long, 2 mm. thick, pale yellow, the 10 to 15 spreading stigma lobes, pale citron yellow, barely projecting above the highest anthers.

Perianth leaves 1.2 to 1.7 cm. long, 6 to 8 mm. broad, narrower below, rounded off above, pale yellow, the outermost reddish at the tips; expanded.

Fruit usually quite scaleless, occasionally with 1 or 2 reddish scales on the ovary of 3 to 7 mm. in length and 2 to 3 mm. breadth. Fruit pale green, or with a faint red tint, at the upper end greener or more reddish-brown, 1 up to 1.2 cm. long, 0.8 up to 1.2 cm. broad, barrel shaped, the lid-like top cracking open wide when ripe. Fruit hairless.

Seed about 1 mm. long, ⅔ mm. broad, ⅓ mm. thick, black, somewhat shiny, very finely tuberculated; Hilum at the basal end inclined half ventral-wards, oval, white.

Type locality (according to Ritter, not Hooker) Morro Copiapo, south-westerly from Caldera, on the north Chilean coast. Area of distribution: only known from the Type Locality.

The flower data comes from two different plants. I reference this rediscovered species under my field number FR511. The Neotype and seed samples from the Type locality (sensu Ritter) were sent under this number to the Stadtische Sukklenten Sammlung in Zurich.

The species from Caldera identifiedby me as Echinocactus streptocaulon Hooker is consistent with the description of the genus Copiapoa Britton and Rose. Accordingly I combine it anew; Copiapoa streptocaulon (Hooker emend Ritter) Ritter. Systematically this species stands between Copiapoa dura sp.n. (still unpublished) which grows further to the south-east and Copiapoa bridgesii (Pfeiffer emend Ritter) Ritter comb. nov. (still unpublished) which grows to the north. The differences from C. bridgesii are as follows: offsetting more readily, thicker but relatively shorter offsets, flatter crown with less felt, more ribs, longer nectar chamber, shorter style, scales fewer on the fruit and more elongated, flatter seeds, with C. streptocaulon.

Figure 1 is a shot of Copiapoa streptocaulon from the type locality near Caldera. For comparison in Fig.2, I show a habitat shot of C. marginata (S.D.) Br. and R. from Antofagasta. It is easy to see that, contrary to K. Schumann and also the assumption of Britton and Rose, there are two different species.

Comment

. . . . . from E. W. Bentley

The translation of the original description of Echts. streptocaulon by Forster-Rumpler does not seem to be very exact.

. . . . . from H. Middleditch

It does indeed appear at first sight that there are differences between the original description of Echs. streptocaulon by Hooker and that quoted by Ritter as Forster-Rumpler's description. However, it seems that the latter description utilises part of Hooker's original Latin text and parts of Hooker's English text. After comparing both descriptions, I do not find anything in Forster-Rumpler's description which modifies the original description by Hooker, although it does include additions. Ritter then goes on to say that there are no plants "there" i.e. in the Chilean province of Antofagasta, "which agree with Forster-Rumpler's description." This might suggest that Ritter is having to rely on the second-hand description by Forster-Rumpler and has never seen the original description and illustration from Hooker's Botanical Journal; naturally he would find a German publication easier of refererence than an English one. But this would further suggest that he may not appreciate that the illustration in Britton and Rose's publication is a fairly good copy of Hooker's original. To what extent, therefore, are we to accept that Ritter has been unable to find a plant conforming to Hooker's description and illustration of Echts. streptocaulon around Antofagasta, if we only know that Ritter has been unable to find there a plant conforming to Forster-Rumpler's description?

But if Ritter was not familiar with Hooker's original illustration of Echts. streptocaulon, on what does he base his comment that "it is not possible to get . . . the illustration of Echts. Streptocaulom Hoook. to correspond with . . ." This would suggest that Ritter has indeed had sight of Hooker's original illustration and hence would know if such a plant was to be found near Antofagasta. Do we accept, therefore, that the original streptocaulon which was collected by Bridges now no longer exists in the region of Antofagasta? Or do we accept that it never did exist there? Do we further accept that it actually came from near Caldera, where Ritter found it on Morro Copiapo? Could Bridges have collected it there when (and if) the ship on which he sailed from Valparaiso in early 1844 called in at Port Copiapo or Caldera, en route to Cobija? Was this a likely calling point for a coastal boat in 1844?

Of all the cactus collectors who have operatedin Chile, there is little doubt that Friedrich Ritter has travelled over more of that country, more frequently, and over a longer period, than almost anyone else. Although come collectors may well be more familiar with certain plants from specific localities, it seems probable that Ritter will be unequalled in his appreciation of the cactus flora of Chile as a whole. If Ritter does indeed mean that he cannot find any plants near Antofagasta that resemble Hooker's illustration of Echts. streptocaulon, then either there are none left there, or alternatively there were never any there and Bridge's collected plants did not come from there. Hence it is difficult to avoid the thought that Bridge's boat may have put in at the mouth of the Rio Copiapo in 1841 or 1844 — perhaps to unload coal for transit to the smelters at the copper or silver mines inland up the Copiapoa valley; Bridges would perhaps have had time to travel eleven or twelve miles along the coast and so visit the site of Ritter's collecting locality for C. streptocaulon, there to collect Echts. streptocaulon Hook, Echts. marginatus S.D., Echs. columnaris Pfeiff and Echts. bridgesii Pfeiff. The grass-green body of Ritter's streptocaulon would be a fair match for the colour of the plant body in Hooker's original illustration, a slide of which was screened at our 1975 Brooksby Gathering. Hooker's original streptocaulon was described as being "a foot and a half high" which is round about half a metre or 50 cms. And Ritter's stretocaulon is described as "up to 50 cm. high." It seems nearly too good to be true. On one point, however, there appears to be a difference. Hooker's description of Echs. streptocaulon made no mention of the colour of the wool in the crown, whereas the colour plate which accompanied his description quite clearly displayed creamy-brown wool in the crown. Ritter's own description for Copiapoa streptocaulon quotes grey wool in the crown. In comparing this species with C. bridesii, Ritter states that C. stretocaulon has less felt in the crown. The original illustration of Echs. bridgesii which accompanied Pfeiffer's description has the crown obscured by the flower but there is no sign of a woolly crown although Pfeiffer's description states that there is dense wool in the crown. The flower on the original plate of E. bridgesii is 55 mm. across. The pale crown on the plate of Echs. stretocaulon Hook. (reproduced in this issue) appears on the original colour plate as creamy-brown wool, which is in no way obscured by three flowers, each of which is some 30 mm. across. It seems to be almost impossible to relate the colour and relative amount of wool in the crown of these two species as quoted by Ritter, with that which is evident on the original plates. Is this to be regarded as a matter of any importance, or is it to be disregarded? If it is disregarded, how does one differentiate (if at all) between Copiapoa streptocaulon Hook., C. streptocaulon Ritter, C. marginata, C. lembckei and C. bridgesii?

The plant which Ritter refers to in this article as "Copiapoa marginata from near Antofagasta" is a clumping or solitary plant with globular to shortly-elongated-globular bodies; it is not the cylindrical or elongated-ellipsoid bodied plant originally collected by Bridges near Caldera, a very great distance to the south of Antofagasta. Ritter's "Copiapoa marginata" is Copiapoa atacamensis sp. nov; see Chileans No. 37.

The flower of C. streptocaulon is described by Ritter as having a characteristic Copiapoa odour. It had not previously been borne upon me that any scent was associated with flowers on Copiapoa.

. . . . . from K. Wood-Allum

On the question of scented flowers on Copiapoa, I can report that Copiapoa pendicolour has a strong germicidal smell and C. marginata a slight sweet scent. My wife confirms both observations. The scent was only discernable shortly after the flower had opened fully and faded rapidly even though the flowers themselves lasted for up to three days.

. . . . . from Mr. and Mrs. Collins

We have flowered C. hypogea, C. barquitensis and C. coquimbana and all three definitely had a distinct sweetish scent.

. . . . . from Mr. and Mrs. Swales

The basis of smell is provided by the essential oil in a plant or flower, which is a substance which evaporates readily and strongly affects the sense of smell. Perhaps the most obvious examples are the citrus fruits such as the orange, which contains essential oils in the skin of the fruit and also in the leaves. In flowers, the essential oil is in the petals from which it is extracted for the manufacture of perfume. The essential oil is probably produced by special glands in the petals. Some smells are not detectable by some or all Homo sapiens but still exist and can be detected by insects. Some male moths for example can detect the scent emitted by a female moth in concentrations as low as a few parts per million. When the smell is so faint as to provide no discernable concentration gradient, the male moth will turn and fly into the wind, until it is able to detect a change in the concentration of the smell, when it will change its direction to follow the steepest gradient of increase in the concentration of the smell.

(Further articles concerning the plants collected by Thomas Bridges in the Caldera-Chanaral area will appear in future issues of The Chileans.)

## SOME THOUGHTS ON WEINGARTIA AND SULCOREBUTIA From P. A. Smart

I have become somewhat interested in the genus Weingartia in the last few years but have not yet started to collate the many observations noted and photographed since then. Perhaps I should explain that my two deepest interests are in Rebutia and Sulcorebutia. In the latter genus, the newer names which have recently become available as plants — and very occasionally as seeds — have been intriguing me in their obvious relationship to Weingartia. The very last straw was a plant (imported) of "Sulcorebutia hoffmanniana" bought from L. Nyman in 1970. The body could just be reconciled with Sulcorebutia but the flower absolutely beat me. A mid-crimson flower had a tube akin to the genus Rebutia, section Rebutia (B and D) — some white hairs in the scales! — other flower parts akin to Sulcorebutia — and spination more like a Weingartia. At this point I decided that I had to build up a representative collection of Weingartia spp. and start to investigate the potential intergrading with Sulcorebutia.

Since that time I have managed to acquire some 24 plants — at this stage between 3 year unflowered seedlings and mature habitat plants. I had decided to start some serious research this year, but as I am a rank novice in the Weingartia scene it would naturally be better to wait a little while before expressing any opinions. However, perhaps a few observations at this stage may help to elicit ideas from other members with similar interests.

The many Chilean articles and those in other Journals and text books are, to me anyway, conflicting and confused so I can start with a "clear sheet". Perhaps the only real concept I have from these is an agreement with the Donald grouping on characteristics which do seem to bear a valid theory of a Sulco-to-Gymno grading of Weingartia species when going from north to south. I find it extremely difficult, however, to get hold of genuine habitat material, plant or seed; I suspect that I am not alone in this. Apart from the distinctive southern species, there does seem to be much confusion over names of plants in cultivation — or could this be partly due to greenhouse hybrids?

Habitat plants seem to establish quite easily for me, but they are very reluctant to flower; on the other hand, seed grown plants flower readily for me, mainly in May-June, but the northerly species — particularly cumingii and multispina — often have a second heavy flush in August/September.

As a keen seed grower (I sow 300-400 species every year) I find Weingartia very easy to grow from seed, but I should qualify that with certain reservations. Germination for me is either 50-60% or nil and I have assumed so far that this is due to seed being too old — or could it be that it was too young? I often sow freshly harvested seed as a control, but I have not tried this yet with Weingartia. From memory it is the southern species which are the least likely to germinate (I ought to go through my records to check this). I sow my seeds in Levington compost and I find that seedlings are less prone to damping off or early rot if the compost is made more porous. There does seem to be a tendency for larger than average losses over the first two winter dry periods with Weingartia seedlings.

I have checked on my records of seed raising to see if there was any connection between germination times, percentage of seedlings germinated, etc., and the geography of the Weingartia species. This check covered four years' seed sowing, 37 batches of seed and 27 spp. and vars. of Weingartia. Even allowing for major variations from the pattern being due to the age and viability of the seed, I can find nothing to show any significant difference between the North and South species. But this comment excludes the Southern Weingartia species for reasons of assumed seed age, but it was just these species that took longest to germinate — between 60 or 70 days from sowing, whereas all other Weingartias average 7 to 10 days. There was

an interesting paradox to be seen in my records in that the only genus to exhibit this characteristic out of some 1400 batches of seed was Sulcorebutia. Perhaps just an odd coincidence — or is it?

As far as successful pollination is concerned, I use pollen from Weingartias to produce seed on Sulcorebutia, with a fair degree of success, but I seem to have slipped up as I don't think I have ever bothered to record which particular Weingartia I took the pollen from! Probably the ones which happened to be in flower at the time, I suppose. Neither have I tried the reverse process — I must try this out this year. Have you any information on the use of Sulcorebutia pollen to effect fertilisation of Weingartias?

Seed types of Weingartia — I have not yet attempted to study these, although I do rely on photography to achieve all my visual records. I have yet to perfect a satisfactory method of getting the 9 to 12 times magnification that I want for flower studies, so I have not gone too deeply into recording of any seed characteristics as yet.

Now as to the matter of flower position on the body: a quick look round the greenhouse as I write and I find that two W. pulquinensis, one W. cumingii, one W. hediniana, and one W. multispina all with some buds/flowers/this years flower remains, low down on the shoulder (round the bend would be an apt description). None of these plants are seedlings and two of them are quite old. Next, a look at the Sulcorebutias by the side of them shows the following species with buds or flowers up as high as these Weingartias! Some are very mature plants, too! Sulcorebutia candiae (grafted) ditto (own roots), kruegeri, tunariensis (old habitat clump in 6" pot), haseltonii (graft), tiraquensis (very old plant in a 12" pot — only because of the long curved buried stem — otherwise a 9" would do), glomerispina, and brachyantha (small rooted offset from a Cardenas plant).

This sort of evidence can only lead one to question the validity of the absolute statements made about some botanical features. I accept fully that the collectors describing plants in habitat have only recorded Weingartias as flowering from the crown or shoulder and Sulcorebutias as flowering laterally. I also accept that my own plants are growing in a completely unnatural environment half the world way from their natural homes. However, I also believe what I see, and surely a hard and fast botanical characteristic cannot change overnight without obvious reason! I would have thought that a plant being mature or a young grafted offset (perhaps having its first shot at procreation!) could make a difference. I remember quite clearly the first time a seedling W. hediniana flowered for me at about 2" across and high. Before I realised that it was going to oblige with a flower it had its flowers open just 1" from the pot — I had been looking for buds on the top!

As another example, take Rebutias where there can hardly be any doubt that they flower basally to low lateral. If I had £1 for every Rebutia flower or bud at shoulder or extreme edge of the crown in my greenhouse at the moment, my pipedream of retiring shortly to spend the rest of my life studying plants in South America would come true!

I would hope that further studies and observations on all these aspects will come later on.

Comments

. . . . . From P. H. Sherville

I have had mixed success in raising Sulcorebutias from seed. Sometimes nothing, at other times 10 out of 10 seeds germinate. It is not even related to species as sometimes for example S. rauschii germinates freely and on other occasions nothing comes up. I have even kept seed trays from one season to the next in case it was something to do with the time of year that affected germination. But in any case Sulcobutias are mostly easy to propogate vegetatively, the offsets rooting readily in either sand and peat or plain vermiculite, or a mixture of all three.

One interesting point that I have noticed — which applies generally, not just specifically to Sulcorebutias — is that "spent" compost or seed raising media almost always gives superior results for rooting cuttings. I found this out quite by accident recently, having bought some unrooted imports and having nothing fresh made up in which to set them to root. I used some old stale compost as an interim measure. Like all of my interim measures, the plants were ultimately left in this ancient mixture for about 6 to 8 weeks and they rooted superbly.

So, having considered the matter, I realised that I had an analogous situation regarding seed sowing. Some plants, especially Parodias, Copiapoas, and some Matucanas set seed freely and inevitably some seed falls around the plant and germinates like mustard and cress, whilst seed from the same fruits carefully sown in the propagator germinates indifferently. If one considers also that many of our plants resent disturbance (ensuing from repotting) and often lose ground for some months afterwards, I have come to the conclusion that there is something present in old "spent" compost which is lacking in freshly made-up batches. Some weeks later I had the opportunity to consult a rather ancident gardening manual (of the 1890's) and looked under the section entitled "Soils and their preparation." At the end of the general introduction was the phrase "all freshly prepared mixtures should be left to weather for at least 3 months and preferably for a full annual cycle." I wonder if we have any soil technicians amongst our members who could elaborate on this phrase and provide an explanation? I wonder if it has anything to do with micro-organisms, enzymes, or whatever, which would almost certainly be present in used compost and could well be lacking in freshly prepared mixes.

Anyway my original batch of "spent" compost has been used almost continuously for about five months now and has rooted at least 150 cuttings including some Sulcorebutias and is still good for further use. It has only been topped up with further old compost to replace that carried off on the roots of the cuttings. So G.E.H. Bailey who observes that "those who say

that Sulcorebutias are easy to root should be made to give a public demonstration" could well be advised as an initial move to try to root some in an old batch of compost which has had plants growing in it.

Returning to seed raising of Sulcorebutias, a fellow Chilean, Roger Ferryman did say to me recently that he arbitrarily divided a packet of 100 Sulcorebutia seeds into two lots of 50; sowed them in identical compost in 3" square pots and placed them adjacent to one another in the propagator; after a period he had 38 germinated out of 50 in one pot and nothing at all in the other. Obviously one cannot read anything into this — it is just one of those querks which serve to ensure that we carry on studying our plants to find out why these things happen. An exactly analogous situation arose earlier this year with some seeds of Rodentophila and Eriosyce species purchased from K. Knize. As a small group of people we compiled a joint order and out of the same packet of 100 seeds of Rodentophila, Roger Ferryman had no germination from his twenty seeds yet another local grower succeeded in growing 8 seedlings from 10 seeds.

Although I have not sown my own share of these seeds yet, had ten people each bought a packet of ten seeds, some would have complained about the terrible quality and others would have probably been delighted. But it does seem that the bigger the quantities purchased the better the overall picture tends to be of the results obtained. It might be a worthwhile project for the Chileans to purchase a large batch of seeds (500 or even 1,000) of a species for distribution to members who could then report back on successes or failures. Those who were successful could sell or exchange their seedlings, giving many members a chance to keep records of subsequent growth, flowers, etc. It would have a further benefit that those participating would see all the resultant plants and everyone would obtain a better idea of the natural variation obtainable from habitat; this might provide some members with a broader concept of what constitutes a "species"!

. . . . . From J. Hopkins

I am surprised to see both Pip Smart and Paul Sherville quoting lateral flowers on quite a few species of Weingartia. In my view this may be found on seedlings where the boundary between shoulders and sides are not really defined. The only plants on which I would say flowers arose in a truly lateral position are W. riograndensis. All of the others are better defined as shoulder flowering plants, with the fidaiana group (including cintiensis, neumanniana and westii) having flowers mainly from the current year's areoles, or perhaps from the previous year's ones.

. . . . . From R. Rolfe

My experience with raising Sulcorebutias from seed is limited, for seed is not easily obtained. That which I have sown usually has a poor germination rate. However, they germinate, if they are going to, fairly quickly for me — say 3-4 weeks. My seed compost which I am trying this year is a commercial product called Vermipeat. It comprises of a sterile, blended mixture of vermiculite and peat, plus normal slow release fertilisers and chelated trace elements. For my own purposes I add extra fertiliser. So far I have found that germination is very much quicker in Vermipeat than in my previous seed compost mixture — basically John Innes, peat, sand and fertiliser. For example, Gymnocalycium gibbosum germinated within 3 days in Vermipeat yet took ten days in my own mixture. I intend to continue to experiment with Vermipeat for some time to ascertain its full range of usefulness.

I must admit to have never used old soil for rooting cuttings. However, the question of plants setting seed which germinate in old soil is quite a common one. We should however bear in mind that when a pod on a plant bursts, the seed is both fresh and plentiful. The chances are that most will germinate and the strongest will survive. I doubt, however, whether much difference would, or in my experience has, been seen between old and new soils. There is one point, however; my soil is not usually used immediately but stored for some time after mixing. The fertilisers blend into the soil in this time and I end up with a fairly uniform and stable soil mixture. Is it not possible that before the advent of any artificial fertilisers that it was necessary for soil mixes to settle down before use? By that I mean that non-composed manures needed to be diluted and neutralised otherwise they would — and still do — burn the roots of many plants. Micro-organisms are known to be beneficial — indeed vital — to healthy plant life, and P. H. Sherville may be correct in his views that their presence in older, used, soil induces better root formation.

. . . . . From A. Gray

I find the comments on growing Sulcorebutia from seed very interesting, as this year I have sown quite a number of Sulcorebutia seeds with very little success. Certainly the odd one or two that did germinate took their time about it and even sweating it out in a plastic bag on top of the central heating boiler made very little difference. The only real success I did have with Sulcorebutia seed was with S. steinbachii some three years ago when I managed to set seed on two plants of this species by hand pollination; the seed was sown as soon as the fruits burst and germination was very much as one normally expects of home produced seed. However, since then I have not been able to repeat the success at hand pollination with other species of Sulcorebutia and after talking with other Sulcorebutia enthusiasts this seems to be something of a problem experienced by them all.

For the past two or three years I have re-cycled (for want of a better expression) spent compost from seed growing for further seed sowing and I find very few problems with it and have had no failures that one would attribute to unsterile compost.

One idea that I was experimenting with, up to moving house was reducing algal growth on the top surface of the seed pan and also reducing the caking and binding together into a crust of the top dressing of fine grit that I used. I had at my

disposal supplies of de-mineralised water which I used every time for watering all my first year seedlings, and using as a fertiliser the formulation published a year or two ago in the NCSS Journal by Bill Putnam. So far the results are quite encouraging, with no sign of any algae and the top dressing on pots that has not been disturbed for two years is still as loose as the day it was applied.

. . . . . From R. Mottram

Viability of Sulcorebutia seed produced by cross pollination with some other species, has been quite good — for example, S. weingartiana x S. lepida and S. totorensis x S. lepida; the only instance in which hybrid seed failed to germinate was a S. totrensis x Rebutia heliosa. I have grown most species of Sulcorebutia from seed and have not noticed any particular tardiness in germinating. The Sulcorebutia arenacea seed which I gathered this year, was sown during July and there is now (three or four weeks later) virtually 100% germination. I think that if you have been told different then someone must be pulling your leg!

. . . . . From R. Purves

Since I last wrote I've had quite a few more portions of Sucorebutia seed germinate. The compost I use is the same as I use for potting — a mixture of leafmould, some peat and sand, and some composted manure (all sterilised). The same mixture I sieve for a ¼" top dressing and once I've sown the seed I cover lightly with coarse sand so that the young seedlings have some support once they are through and also to keep the top of the soil from drying out hard. I usually keep all seedlings away from the sun all the time — the propagator is under the staging and alongside it I have the pans of pricked out seedlings which have the staging to shade them.

. . . . . Response from P. Smart

Yes, indeed, I am sure that the type of compost used has a vast effect on the germination of all cactus seeds. Not, I feel, through any mystic properties, but purely by degree of water retention, all other factors being equal, of course. In short, the more water a compost holds, the better the germination. It also seems vital that seed composts have an acid pH. The compost used for germination is basically only a carrier for the necessary moisture and heat. Sterility is not an absolute essential, although advisable as fungus spores like our seed-growing conditions and some of them are detrimental to seedlings. Moss, algae and lichen does not harm the seedlings but may reduce the "freshness" and "openess" of the compost surface and these weeds may crowd out the delicate seedlings we are trying to grow. Again, sterile compost helps.

I find that the best compost is a peat based one such as Levingtons. It holds water well, it is acid, and does not dry out too quickly. Moss etc. is easily kept down by gritting up seedlings after a few months sowing. It can be made more porous by the addition of non-alkaline grit but this increases germination time considerably. It does, however, seem to lessen the damping off of twelve month old seedlings from the first watering after their first dry winter rest. The John Innes and other soil based composts dry out too quickly and do not hold sufficient water for early germination. I could accept that the micro-organisms existing in spent compost will probably improve the growth rate of seedlings, but surely will not effect the speed or percentage of germination?

Now heat is not essential but if supplied in the right place produces far better germination. It also ensures that the seeds do not have time to rot! The optimum temperature seems to be 80 — 100°F at (say) 4" to ½" below the surface of the compost. For this purpose, bottom heat is essential. I always sow a small thermometer in one put with the bulb ½" down, so that my home-made propagator can be regulated to give accurate temperatures. The depth of seed pan must be small or otherwise a fantastically high bottom heat must be applied to keep the right temperature at seedling root level. This sort of temperature is only used for 10 to 21 days and then the seed pans are put on a heating cable and kept at 50° to 70°F for a few weeks. Experience shows that temperatures higher than 90 to 100°F may well retard germination in some genera.

I do find it essential to keep the compost absolutely sodden for the first few weeks. By this I mean that the tray holding the seed pans (I actually use 2" square pots) is kept covered with water and the seed pans themselves flooded every day for a few minutes. It also seems essential to allow light to reach the seeds. To this end, I never cover the seeds — just press them half into the compost surface, and grow in full light under a cover of 4 to 6 layers of old net curtains. Germination in darkness, or with the seeds covered fully by compost, is slow and low, and anyway, light must be given as soon as the first seeds germinate or the seedlings will etiolate and collapse.

It also seems obvious that freshly harvested seed will germinate more effectively than old seed. It seems reasonable to assume that natural selection will have ensued that plants which time their seed dispersal to coincide with suitable climatic conditions for seedling growth will have flourished. Those which do not manage this must of necessity have perished unless there was a suitable delay mechanism within their seeds. It would seem, therefore, essential to qualify this theory with the rider that seed must be harvested when the plant says so by starting its dispersal process — and not when we are ready to switch on our propagators! As my Weingartias never seem to dehisce, when should I sow them?

My experience of sowing both Weingartia and Sulcorebutia seeds shows very variable results. A lot of packets seem to show a seed germination period of 5 to 15 days on the whole. However, in the case of Sulcorebutias it is not uncommon to find them starting to germinate between 60 and 90 days from sowing. I, too, find that a large proportion of commercial Sulcorebutia seeds show nil germination. Experiment shows that Sulcorebutias germinate better at very high temperatures. Apart from this being a contributory factor, I can only assume that old age is the reason that we often get poor germination from Sulcorebutia seed.

In mid-June this year, a blitz on the lack of tidiness in the greenhouse brought to light several lots of Sulcorebutia seed and Weingartia seed — it had been harvested in late March. I counted the seeds and sowed them; the soil-temperature at ½" depth was kept at a minimum of 100°F and the pots stood in ½" of "chinosol juice" in the propagator. Germination was an average 33% when I transferred them to the greenhouse hot bed (at roughly 60° to 70°F) after two weeks. The four Weingartia species had germination times of three to five days, Sulcorebutia flavissima had started germinating after 36 hours, three more Sulcorebutias had germinated between four to seven days, and the last Sulcorebutia (tunariensis) germinated at 10 days. This experience again makes one wonder about the age of commercial seed and its condition of storage.

This year I have been taking some notes on my experiments on the effects of pollinating Weingartia with Sulcorebutia pollen and vice versa. As a result of this I find that Weingartia flowers seem to have very little pollen whilst most Sulcorebutias seem to have almost no problem at all — or is it microscopically small?

. . . . . From J. R. Gooch

Sulcorebutias and Weingartias from seed have not proved too difficult in my experience. I probably only saw a modest 4 or 5 kinds of Sulcorebutias each year, and would feel disappointed at less than 50% germination. If conditions are right i.e. adequate warmth, viable seed will be visible in three weeks. During the first season I keep them well shaded (even to the point of becoming slightly etiolated) as in this way one appears to obtain the optimum growth from plants that, in their early life at least, are rather slow. I do not attempt to encourage the seedlings to continue slow growth overwinter or losses from damping off or sciara fly cruelly decimate my few plants. During the second year, the seedlings are given normal greenhouse conditions, pricked out into trays, and begin to assume recognisable characteristics of their respective sorts. I might add that variation in appearance is often more than one would expect within a single species and I suppose the whole batch ought to be grown on together to compare flower and fruit, but pressure of room dictates that only a couple of what I consider most typical ones are kept, the remainder quickly finding new homes. Most plants flower in the late spring, shortly after their second birthday, and those that do not will oblige the following year.

The story with Weingartia, on the other hand, has been one of only limited success. Up till 1975 I had tried W. totorensis from De Herdt. I have yet to germinate one of these, after three attempts with ten or so seeds each year. Later in 1975 I sowed about 20 seeds of W. ambigua (so-called) from Knize in Peru. I believe 18 seedlings came up. Perhaps rather rashly I attempted to graft a dozen on to Peireskiopsis to hurry them along but, alas! only one of them took. I am now left with four plants about 2½ cms. diameter and the one that was grafted which is now 5cm across and tall and on its own roots. With any luck these plants will flower next year and I should see if they do flower purple. At present the body looks very much like W. cummingii. This last summer 7 varieties of Weingartia were carefully sown in the propagator: W. lanata, pilcomayensis, fidaiana, neumanniana, Lau 958a, riograndensis and totorensis. From all these only two seeds germinated — both W. fidaiana. All this seed originated from De Herdt, though I am not implying that his seed is no good. It may well be the seedlings got dry for a critical hour or two in our exceptional summer, but it must be said that other varieties of cacti germinated in normal percentages for me.

I have not made any record as to the setting of fruit on Sulcorebutias using Weingartia pollen, or vice versa. My greenhouse is not insect proof, and, as a result, is humming with bees and numerous other beasties throughout the flowering season. Because of this, any plant or plants I wish to isolate have to be placed under a bell jar or polythene tent whilst in flower otherwise the bumble bees — who will visit every open flower — make all my efforts pointless. Fruits have set on almost all Sulcorebutias and Weingartias but with many out at any given time, the pollen that fertilised them could have been that of its neighbour or a relation at the other end of the greenhouse.

. . . . . From J. D. Donald

I think that the reluctance of Sulcorebutia to set seed, is a climatic one: 1977 was bad, but 1876 fantastically good. The other point is that most Sulcorebutia plants in cultivation are derived from a single clone of each species — hence no seed in crossing.

. . . . . From H. Middleditch

This last comment rather surprises me as I have seen two or more plants of a given species in various members collections, where the plants concerned have either been imported from more than one supplier (i.e. collector, not just from one collector via different nurseries), or else imported from Knize directly at different times, between which times one of our members has visited his nursery in Lima and seen that he was out of stock of Sulcorebutia at that time. In many cases, imports in members' collections have not just been single heads — which would have been a very profitable line for a nursery breaking up a multi-headed clump — but quite often these plants were cushions of numerous heads. I can bring to mind seeing such plants in collections which are spready fairly widely round the country. It does seem to be that John Donald is unlikely to have seen many of these collections and could well be unaware of many of them. Hence it would appear to be rather unwise of him to say that most Sulcorebutias in cultivation "are" derived from a single clone, without first checking out the present situation. It would seem that some other cause must be sought in order to explain the reluctance of Sulcorebutia to set seed; in my experience it seems that Sulcorebutia are not alone in this respect. However, the comment from P. Smart that Sulcorebutia flowers seem to have very little pollen, could be an answer. Have any readers actually checked their Sulcorebutia flowers for the presence of pollen? Do the anthers actually burst and release the pollen, or does the micro-climate in our greenhouses offer no inducement for the

anthers to open and shed pollen? Have any of our readers actually observed opened anthers shedding pollen on Sulcorebutia flowers?

. . . . . From P. Bint

I have been able to make observations on S. pulchera, lepida, steinbachii, candiae, alba, vasqueziana, misquensis, tiraquensis and tunariensis. In general, a flower section appears to show three ranks of stamens — a series of short stamens near the base of the style, another longer series of stamens inserted near the base of the petals, and a third series intermediate between the other two. All the flowers conformed to this general pattern. Without exception, every rank of anthers seen under a x10 magnifying glass were bursting with fluffy pollen grains, on every flower. The flowers have all been viewed within three hours of opening and again later in their flowering life. I have taken some slides of the flowers which I have halved.

## GYMNOCALYCIUM — FLOWERS AND FRUITS

In a previous number of the Chileans, Mrs. J. Hobart recorded some observations on the way Notocactus flowers chose to open at differing times during the course of the day. It would seem that Gymnocalycium also respond to the right sort of conditions when it comes to opening their flowers. In midsummer John Hopkins observes that "I have just been coaxing Gymnocalycium vatteri to open its flowers. It has full sunshine all day but the air temperature is quite low — about 65°F. It wasn't until I closed the frame that it started to open in the heat and it did so quite rapidly. I have noticed this with most Gymnos, particularly G. artigas which was most stubborn. Gymno. gibbosum var. nigrum and v. nobilis opened reasonably quickly and generally in the morning, which is not surprising considering their cooler habitat."

Having the advantage of several degrees of latitude, with a warmer and sunnier clime, Mrs. L. E. Macintosh in New Zealand says "My Gymnos now have a special house, built to cut out direct sun rays between noon and 3.00 p.m. during our hot summer — the temperature is already (October) over 70°F with summer still to come. I notice that the flowers close as soon as the sun is off them even though the temperature remains the same. They do last several days longer, however; it will be interesting to see what happens when the temperature really soars." The observations regarding full sun match my own experience — I have been in the greenhouse about noon when the shadow of the greenhouse framing has moved on to an open Gymno. flower; the flower moved to a half-closed position as it was eclipsed from the direct rays of the sun.

In regard to the fruit on Gymnocalycium, Mrs. Macintosh observes that "they all have a sticky pulp — more or less — starting with the yellow flowered ones which have the largest seeds, the pulp — while being sticky — is easily separated from the seed by hand; the pulp gets more 'gooey' as the seed gets smaller and if the fruit is left to dry they set like a piece of concrete with the seed impossible to remove without damaging. I think that this is why a lot of seed never germinates. I remove the fruit immediately it splits — scoop the pulp into a piece of fine linen — wash well with cold water — spread carefully over the linen and leave flat in a draught to dry — the seeds wipe off easily leaving the pulp sticking to the linen — a handkerchief in my case. The pulp is usually white, sometimes pink and in G. pungens bright cerise.

From Chris Webb comes a slightly different impression: "The fruit on my G. saglione is fat and healthy but still green though now with a pinkish tinge. I believe it has to be quite red before it is ripe — indeed I seem to remember reading that it eventually becomes tomato red! I crossed the flowers with practically everything else I could get my brush into (in the absence of another plant of this group in flower) but only obtained the one fruit. The fruit is almost spherical, pinched in at the top where the floral remains soon fell off. The fruit on G. pflanzii is rather different from that on G. saglione, being almost spherical on G. saglione and elliptical cylindric on G. pflanzii. I have been checking the Gymno. fruit and find that only G. saglione can really be described as juicy right up to and after dehiscence. The Trichomosemineae I would describe as dry, since one the fruit splits the seed thrust out on their stalks and are readily disengaged. The Macrosemineae tend to be more mushy and the seeds are quite wet and sticky until laid out in the sun."

And from Roger Moreton we hear that "It is interesting to note that there were two batches of flowers pollinated on Gymnocalycium saglione but the first fruits developed up to a large fat size, pinkish red in colour, while the second lot stayed small and looked as if they would abort. But after I gathered the first fruits the second lot developed rapidly until they were of the same size as the first lot."

On opening times of the flowers, Colin Walker comments that "The flowers on nearly all of my Gymnos open for a few hours around midday — and only in bright sun — none of my Gymno flowers open on dull days."

And Mrs. M. Stacey comments "Gymno. lagunillasense flowers well — the urnshaped, apricot coloured flowers produce fat green seed capsules, which later turn tomato red. My plant of this species is Lau 946 with pale, matt epidermis and only a few spines. Also Lau 473 which is from Salinas Grandes flowered; according to John Donald this belongs to the Schickendantziana series. I waited in vain for the tall-tubed, pink flowers to open up but they did not oblige, even in the strongest sunlight and the temperature in the 90's.

I have two plants of G. ragonesii, both flower extremely well. The larger of the two plants, approx. 6cm. diameter, has five flowers at present, although closed up as it is cloudy."

. . . . . from C. Webb

What a funny year 1976 was, with the extended drought I had to cut down on watering, just giving the plants enough to keep them going and then increase the water in mid-August when we got our first rain. It had some interesting results

too as I've never had such an impressive display of flowers so late in the year, on Lobivias, Rebutias, Gymnos, Parodias, Wigginsias, and even an Acanthocalycium. I have also noticed the way that fruits have quickly dried and fallen off though the usual colour changes occurred. I was fascinated to watch wasps in the greenhouse cleaning out the seeds from freshly split Gymno fruit — I'm sure they wanted the pulp rather than the actual seeds but they cleaned out several fruits completely — I couldn't find the seeds afterwards so presumably they've ended up in the nests.

. . . . . from R. Moreton

I now find that Gymno. horstii does open its flowers fully, but the question is, what causes them to open? It is not just sunlight or temperature, as some flowers open in shady or cooler conditions, but close in hot conditions. Is it something to do with humidity? Also some other Gymno. flowers open first thing in the morning and close in the evening regardless of weather, but some of them are very temperamental. Some even seem to stay open all night.

. . . . . from G. J. Swales

Many of my Gymnocalycium set fruit each year and the fruits remain turgid for many weeks, perhaps even months, even after they have split and exposed the seeds. If these fruits are left on the plant for a sufficient length of time, they will eventually dry up and turn brown. My own experience in the long, hot summer of 1976 was similar to that reported by Chris Webb, with fruit splitting far more quickly after it set and then turning brown and drying up very rapidly indeed.

I find G. horridispinum rather unusual in its opening times, for the flower seems to open at about 4.30 p.m. and then stays open until the sun sets; this is very late in the day for a Gymno. to open.

. . . . . from F. Merrett

Concerning the open times of Gymnocalycium flowers, most of my observations are confined to one day per week and the chances of that particular day being sunny are small. However, whenever I take a photograph of any of my plants in flower, I do make a note of time of day and from this record I find that I have had G. mihanovichii var. piraretense and also G. saglione both with fully open flowers before noon. However, this started off a train of thought regarding the factors which might be related to flower opening, such as soil temperature, light intensity, sun's elevation, air temperature in the immediate vicinity of the plant — not just the general temperature in the greenhouse.

Then I realised that I knew nothing at all about the mechanism of flower opening and closing. What physical mechanism could nature employ to obtain the reflexing of petals? Is it achieved by pumping fluid into the veins on the calyx side of the petal? Is the procedure reversed to close up the flower? If this — or something like it — is indeed the mechanism, this leads to the next question: what triggers it? Without doubt, sunshine and warmth are involved. Is the trigger a chemical reaction? Does the plant produce a hormone when the sunlight reaches a certain intensity, to act on the differentiated cells at the base of the petal? But what about the night flowering plants like Selenicereus, Trichocereus, Hylocereus, Mediocactus, Discocactus, and so on? Is it a delayed-action hormone here? The more I thought about it, the less I realised I knew, so I took a trip to the local library and browsed through some biology books to see if I could find an answer, but none so far; yet I feel that the answer to these questions could be of vital importance in any serious study of cacti.

In connection with this, I would like to relate the story about the time when I wanted to photograph the flower which had appeared very late in the season on a Gymno. "Hibotan". I waited patiently for a sunny day, and gradually the flower began to open. It opened half-way, then stopped, yet I desperately wanted to film the inside of the flower, to find out what colour the style and stigma were, etc., but concluded that the sun was not intense enough. What to do to obtain more light and heat? Well, I focused my shaving mirror on one side, and my large magnifier on the other, until the plant was bathed in extra warmth and light — which I could feel by my hand — but the flower refused to open any further and I had to be content with filming it as it was.

When photographing my flowering cacti I always take the pots out of the house because I believe that the ultra-violet end of the spectrum is enhanced outside the glass, resulting in better slides. But this has led to some problems, for although the sun's rays were stronger outside the house, invariably the flower tended to close before I could set up, focus, stop down, etc. This must have been due to the drop in temperature and not in light intensity. I solved the problem by choosing a plant in flower of the approximate same size, setting up on this, and substituting the required plant at the last moment.

**HUMMING BIRD FLOWERS? A query from F. Wakefield**

The discussion on the pollination of Matucana flowers in Chileans No.35 seems to have come full circle. Is there not a danger that in this kind of discussion we tend to lose sight of the fact that, in nature, everything is grist to the mill? So one is likely to find that flowers with long tubes will be pollinated by any animal that can be tempted into the flower and which will disturb the pollen. The most that one can say, without observation, is that if a flower has a long tube, and if at certain times it secretes a fair amount of nectar, then it is likely to be visited by humming birds. Conversely I can see no reason why a short tubed flower secreting a fair quantity of nectar should not also be similarly visited. The only answer in the end is to observe the plants in the wild.

. . . . . from H. Middleditch

There is no doubt whatsoever that certain pollinating agents have been observed to visit a wide variety of flower forms. And, conversely, certain flowers are known to be visited, and cross pollinated by a fairly wide variety of insects. For example, the flat top of the head of flowers on an Umbelliferae provides a platform on which even a clumsy insect can walk about and feed from the shallow flowers. In flying from one umbel to another, or even in the course of walking round on the numerous flowers in one umbel, many sorts of insects can effect transference of pollen and thereby cross-pollinate flowers. In their "Pollination of Flowers", Proctor and Yeo observe that those less-specialised flowers which are most visited by short tongued Deptera (two-winged flies) are also those most visited by insects in general.

On the other hand, those Diptera with relatively long tongues can reach nectar not available to short-tongued insects; long-tongued flies do show some diminution of attention to flowers with well exposed nectar. Lepidoptera (butterflies and moths) possess a proboscis clearly adapted for reaching nectar at the base of long-tubed flowers. There is little doubt that Lepidotera will also visit umbelliferous flower heads and will play a part in transferring pollen from flower to flower. On the other hand there are flowers specially adapted to pollination by Lepidoptera and these flowers may be visited by short-tongued flies and other insects who may occasionally effect a chance pollination. Such flowers can be described as adapted to pollination by butterflies or moths. Among the Hymenoptera (four winged insects), bees are of significant importance as pollinating agents; many flowers are adapted to pollination by bees and are rarely pollinated by visits from other insects. Observations on the foraging habits of marked bees has shown that they are remarkably constant in their flower visiting habits; one bee will consistently visit only one type of flower at a time in a garden or meadow even though many different flowers are in bloom. As the flowering season progresses, most bees will change from visiting a certain flower, or a specific selection of flowers, to foraging from later-blooming sorts. However, some bees are very restricted in the number of different flowers which they visit, and certain bees consistently and regularly collect pollen from a single plant species; in turn that single plant species is often pollinated only by that particular species of bee. Documented evidence establishing specific flower-pollinator relationships is available in:-

The Ecology of Solitary Bees. Linsley E.G. Hilgardia 27:19:1958.

Chile-California Mediterranean Scrub Atlas. Thrower N.J.W. and Bradbury D.E. Institute of Ecology 1977.

Differences in flowers visited by four species of Bumble Bee. Brian A.D. Journal of Animal Ecology 26:1957

Also promising, although not yet on my bookshelf, are:-

Grant V. Pollination systems as isolating mechanisms in Angiosperms. Evolution 3. 1949.

Grant V. The flower constancy of Bees. Botanical Review 16:1950.

Free J.B. The Flower constancy of Bumble Bees. Journal of Animal Ecology 39:1970.

In Proctor and Yeo's "Pollination of Flowers" there are innumerable sketches and photographs of insects in the act of pollinating flowers. Together with the explanatory notes, these display in comprehensive detail how the successful pollination of certain flowers is restricted to a few insect visitors. This does not prevent other insect visitors who blunder into the flower from effective pollination by chance on occasions. However, it is necessary to distinguish between prime pollinating agents, without whose co-existence the continuance of future generations of the flora could be in doubt, and chance pollinators, whose elimination would not materially effect the ecology of a particular flower. To give just one example, quoted by N. Lewis, "Rape of Amazonia" Observer Magazine April 22, 1979 — "In the province of Acre the worst deforestation took place. A law was passed prohibiting the cutting down of the castanheiras — the Brazilian nut trees. Where it was possible to leave one standing in isolation, it was soon found that such solitary survivors failed to produce nuts. It was discovered that without the presence of certain insects the pollination of their flowers could not take place, and the pollinators had gone with the rest of the forest."

Flowers which afford an easy landing platform for almost any insect, which also have wide opening petals and freely exposed nectar or pollen are usually pollinated rather indiscriminately by a wide variety of insects. From this stage, the next stop in floral evolution is represented by increased concealment and inaccessibility of nectar, associated with the beginnings of specialisation in pollination. Flowers which are much more specifically adapted in form and structure to particular pollinators are mostly associated with long tongued insects which themselves have become specialised flower visitors.

The illustrations in Proctor and Yeo's "Pollination of Flowers" can be brought to life simply by watching insects foraging from flowers in field or garden and it does not take very long to see that the whole process is not entirely haphazard. It takes a little longer to digest the implications of Proctor and Yeo's observation that "An increasing concealment of nectar and its increasing inaccessibility are among the main features of floral evolution, going hand-in-hand with a corresponding evolution in the length of insect mouth parts and in insect behaviour. As accessibility of nectar gradually decreases, so the balance in insect visitors changes, with the less well-adapted forms becoming less frequent visitors but not disappearing altogether." It is less easy to follow their advice that "An extensive knowledge of the structure and behaviour of flower visiting insects will make it possible to appreciate the functioning of the advanced types of flowers." This is largely because of the great difficulty in obtaining any relevent information regarding insects which live in areas where Matucana and Arequipa grow. Nevertheless, there is ample documented evidence available to establish that, when it comes to inter-relationship of flowers and pollinators, not everything is "grist to nature's mill."

Pollination may possibly be carried out by any pollinating agent which can be tempted into the flower. But what sort of pollinating agent is likely to be tempted into a long-tubed flower? There is probably one thing we might be fairly certain about — it is not the long tube itself which tempts the pollinating agent. The "face" of the flower, the view seen by an insect which is approaching the flower, is likely to be most effective in tempting a visit. For humming birds, colour will be important, but not scent. For Bees, certain colours, shape, and also scent will be important. If it was not necessary for flowers to adopt different "faces" in order to tempt a specific type of pollinating agent, then the range of flowers which we may now see in nature would simply not exist. But even the vast panorama of flower forms which nature provides is not the fully story. In their "Flower Pollination in the Phlox Family", Grant and Grant note that Ipomopsis thurberi has a long, slender flower tube, the flowers being visited at night by Hawk Moths. In this flower "Nectar may be present in small amounts at the base of the tube by day but its flow increases at dusk." So here it is a sufficiency of nectar which tempts the prime pollinating agent. Grant and Grant also note with this plant and also with other closely related species of Ipomopsis which carry similar flowers, that "the slender flowers and flowering branches bend down under the weight of large bees and are usually avoided by them." Thus we see that apart from positively tempting certain pollinating agents, the flower can positively discourage others. It is not many months ago that I was watching solitary bees feeding from flowers of what I took to be Hypericum — with a flat, rotate flower about one inch across having a hemispherical pin-cushion-like mass of stamens nearly as broad as the flower. As I was watching, a bumble bee flew in and attempted to visit these flowers. The petals did not protrude far enough beyond the stamens to provide a landing platform, so he tried to stand on the stamens; at every attempt the stamens bent down under his weight, apparently conveying a sense of insecurity so his wings never quite stopped beating, and he quickly backed off the flower; after several such attempts he gave up the unrewarding exercise and departed. Next year ( it is always "next year" isn't it?) I shall have to play at being a tourist and carry my camera slung round my neck, in order to catch them in the act.

If a chance visitor to the flower "disturbs the pollen" this is far from assuring effective pollination. We need look no further than Charles Darwin's "The Effects of cross — and self — fertilisation in the Vegetable Kingdom," 1876, to find evidence, amplified by later authors, that the most important function of the prime pollinating agent is to effect cross-pollination, not just to blunder into a flower, and disturb the pollen. In the centennial commentary on "Darwin's Biological Works", H.L.K. Whitehouse notes the implications which followed from Darwin's publication of 1876: "The bright colours, scent, nectar and innumerable mechanical contrivances of flowers, were seen for the first time in their proper setting, as admirable adaptions to achieve cross-pollination by insects. Dichogamy (the maturing of the anthers and stigmas of individual flowers at different times) was seen not merely as a device to reduce self-fertilisation of individual flowers, but also as a means of favouring the crossing of different individuals. Thus, the most frequent dichogamous condition is one of protandry (the maturing of the male region before the female), and Darwin related this to the habit of bees alighting at the bottom of an inflorescence and working upwards. The insects would then meet functionally female flowers first, subsequently removing pollen from the younger flowers above and taking it to the older and hence female flowers of another individual."

In Matucana, the flowers appear together in a flush from round the crown; the flowers usually open together, the stamens extend at the same time on each open flower, and the flowers usually wilt together. This would suggest that the stigma ripens first, the anthers releasing the pollen later, so that cross-pollination with another plant is to be promoted, whilst pollination between flowers on the same plant is hindered. My own experiments on brushing stigmas of Matucana paucicostata with pollen from the same plant has so far failed to set fruit. Many more experiments and better control would be needed to attain Darwin's own careful approach, but at least it is a start. It would suggest that an insect blundering into this flower would hardly achi- pollination, never mind cross-pollination.

The German Cactus Society Yearbook for 1937 provides an extremely detailed and professional review of cactus flower pollination; this review designated Matucana and Arequipa as Humming bird flowers. As quite a number of Chileans members have noted that the flowers on these plants remain open during the hours of darkness, the possibility of an alternative effective pollinator to the humming bird has been discussed in the pages of The Chileans. This is the first new contribution to this subject since the D.K.G. review of 1937.

. . . . . Response from F. Wakefield

The question of how pollination is brought about is indeed interesting and could probably form a study of its own. There are pitfalls, though, even in interpreting observations. I have a honeysuckle and have noticed that it is frequently visited by moths in the evenings; there is little doubt that they go for the nectar. However, the same flowers are visited during the day by bumble bees. These could be going for either nectar or pollen — or both. Certainly I think that the tongue of a bumble bee would be long enough to reach the nectar of these flowers.

Incidentally, I have always thought that the so-called "humming-bird" moths got their name from the hum of their rapid wing beats — they do not seem to be able to hover well enough to feed on the wing very successfully. All this is a long way from the cacti of South America but it serves, I think, to widen ones appreciation of the breadth of the problems involved in trying to make some contribution to the subject at this distance.

## CHILEANS 1980 AUTUMN WEEKEND

Our 1980 Autumn weekend event will be held at Brooksby Agricultural College, between Melton Mowbray and Leicester, over the weekend of September 12/13/14th. As we go to press we hear from a German couple who will be freshly back from yet another cactus hunting trip in the Andes to show us some slides. And from J. Medway who will be showing us slides of this trip to Bolivia. The Mediolobivia group will be discussed by P. A. Smart and G. J. Charles will talk about Notocacti, including slides of the rutilans group and some plants which have flowered for the first time. There will be a discussion on the Microseminae group of Gymocalycium with some slides from F. Fuschillo and supporting comment from G. J. Swales. We will have a talk on Discocacti from J. Arnold. After the subject of bi-coloured cacti was opened at our 1979 weekend, we look forward to an introduction to virus disease of cacti from G. J. Swales and supporting comment from P. Goodson. Following comments in The Chileans on flower scents, P. A. Smart will be testing the scent-sitivity of participants. There will also be short discussions on a variety of matters, including Ritters Cactus Book; queries, comments, slides and plants will all be very welcome — especially FR numbered plants requiring to be named from Ritter's Cactus book. Bookings please to Mrs. M. Collins, 11, Tudor Gardens, Upminster RM14 3DE.

## RITTER'S CACTUS BOOK From D. W. Whiteley

The first book of Ritter's Monograph has arrived — Kakteen in Sudamerika Vol. I, Brasil, Uruguay and Paraguay. It is by no means the height of the book publishers' art, as it is virtually the typed manuscript lifted direct onto litho plates and printed as it is, without much relief by the use of variations of typeface for chapterheadings or for generic and specific names. Nevertheless I still think it is good value at £10. After all, the Lexikon costs £25, as a reprint after the german edition has paid for the cost of the plates for the illustrations.

It is a pity that the illustrations are so poor, but again this will be to keep down initial expense. Although Ritter is publishing it himself I doubt if he will make it pay in the end. Ritter himself told me that no commercial firm would take on its publication so that he had to publish it himself if it was ever to see the light of day.

In this first volume, Ritter lists the genera, old and new, which he recognises for all four books (the other three as yet unpublished) so from this we have a list of any new genera now published or yet to come. There are quite a few surprises there for me, not so much in the Ritter names which have appeared in the past in Winter lists and elsewhere, but the resurrection of some catalogue names and some old names lost in the past. Tephrocactus, Platyopuntia, and also Cylindropuntia are re-established at generic level. And the genus Espostoopsis — I have seen this somewhere before. Brasiliparodia is published as a genus for the Buenekeri/alacriportana group of Notocactus, in spite of virtually universal acceptance to the contrary. Certain groups of Lobivia are segregated as Neolobivia, Hymenorebutia, Cinnarbarinea, etc.; some of these names have been discarded for years. Then there is Borzicactella, which I believe was a catalogue name and has never been validly published.

In the first volume of Ritter's work which has now been published we find Mirabella as a new genus for Britton and Roses's Acanthocereus albicaulis (The Cact. II, p.125, 1920). He also adds Mirabella minensis F1238 to this genus. Another new genus is Floribunda with Floribunda pusilliflora FR 1232 as type.

All in all not books of general appeal to the average cactophile. However for the specialist they contain much unpublished material, especially as they do not set out to be all embracing works and what they do cover is covered in detail. The complete four volume work will only deal with parts of the South American cactus flora — those which Ritter has comment to make upon or has seen for himself. Other names are just listed for completeness.

. . . . . from H. Middleditch

I would not regard Ritter's book as a monograph, more as a commentary. Those cactophiles who expected "all to be revealed" with precise habitat data and correlation with the names of Backeberg and other field collectors, may be only partially satisfied. Collectors who wish to be aware of what Ritter saw in habitat should be quite pleased with this publication, and tthose who seek full descriptions for what have previously only been field collection numbers, should be delighted. All this should not cause us to lose our sense of objective criticism. For example, Ritter suggests that the name Discocactus tricornis must fall into disuse in preference to D. alteolens, citing Dietrich 1846 as authority. In fact, D. tricornis was published earlier by Monville and it is D. alteolens which must sink into oblivion. All in all, there is every indication that this work will be as much of a "must" for the serious cactophile as Schumann's Gesamtbeschreibung der Kakteen, Britton and Rose's Cactaceae, and Backeberg's Die Cactaceae.

## STUDY GROUPS/REFERENCE COLLECTIONS

| | |
|---|---|
| Cleistocacti | T. Lavender, 62, Finchale Avenue, Billingham, Cleveland, TS23 2 EB. |
| Frailea | J. Forrest, Spring Garden, 2, Darngaber Road, Quarter, Hamilton, Scotland. |
| Gymnocalycium | G. J. Swales, 5, Hillcrest, Middle Herrington, Sunderland, Tyne and Wear. |
| Lobivia | J. Hopkins, Primrose Cottage, Monks Lane, Audlem, Cheshire, CW3 0HP. |
| Matucana/Borzicactinae | P. H. Sherville, 51, Park Road, Enfield, Middlesex, EN3 6SR. |
| Melocactus/Discocactus | J. Arnold, 4, Lonsdale Court, Churchill Park, Washingborough, Lincs. LN4 1HJ. |
| Neoporterianea | R. Ferryman, Nichelia, The Street, Stonham, Aspal, Suffolk, IP14 6 AH. |
| Notocactinae | G. J. Charles, 138, Whitehouse Common Road, Sutton Coldfield, Birmingham, B75 6DT. |
| Opuntia/Tephrocacti | J. W. Bagnall, 22, Perlethorpe Avenue, Mansfield, Notts. |
| Photographing Cacti | A. W. Craig, Davela, Forest Lane, Kirklevington, Nr. Yarm., Yorks. |
| Rebutia | P. Smart, 5, Tomlinson Avenue, Gotham, Nottingham NG11 0JU |
| Sulcorebutia & Weingartia | J. R. Gooch, 51, Bourn Avenue, Hillingdon, UB8 3 AR. |
| Trichocereus | N. T. Hann, The Retreat, 28, Beckenham Road, West Wickham, Kent. |

## THE CHILEANS

| | |
|---|---|
| *Organiser* | H. Middleditch, 5, Lyons Avenue, Hetton-le-Hole, Co. Durham, England, DH5 0HS. |
| Treasurer | R. L. Purves, 19, Brocks Drive, Fairlands, Guildford, Surrey, GU3 3ND. |
| Membership Secretary and Back Numbers | Mrs. A. Lavender, 62, Finchale Avenue, Billingham, Cleveland, TS23 2EB. |
| *Seed Exchange* | J. Hopkins, Primrose Cottage, Monks Lane, Audlem, Cheshire, CW3 0HP. |
| Slide Librarian | A. W. Craig, Davela, Forest Lane, Kirklevington, Nr. Yarm., Yorks. |

## CONTENTS