THE CHILEANS '81

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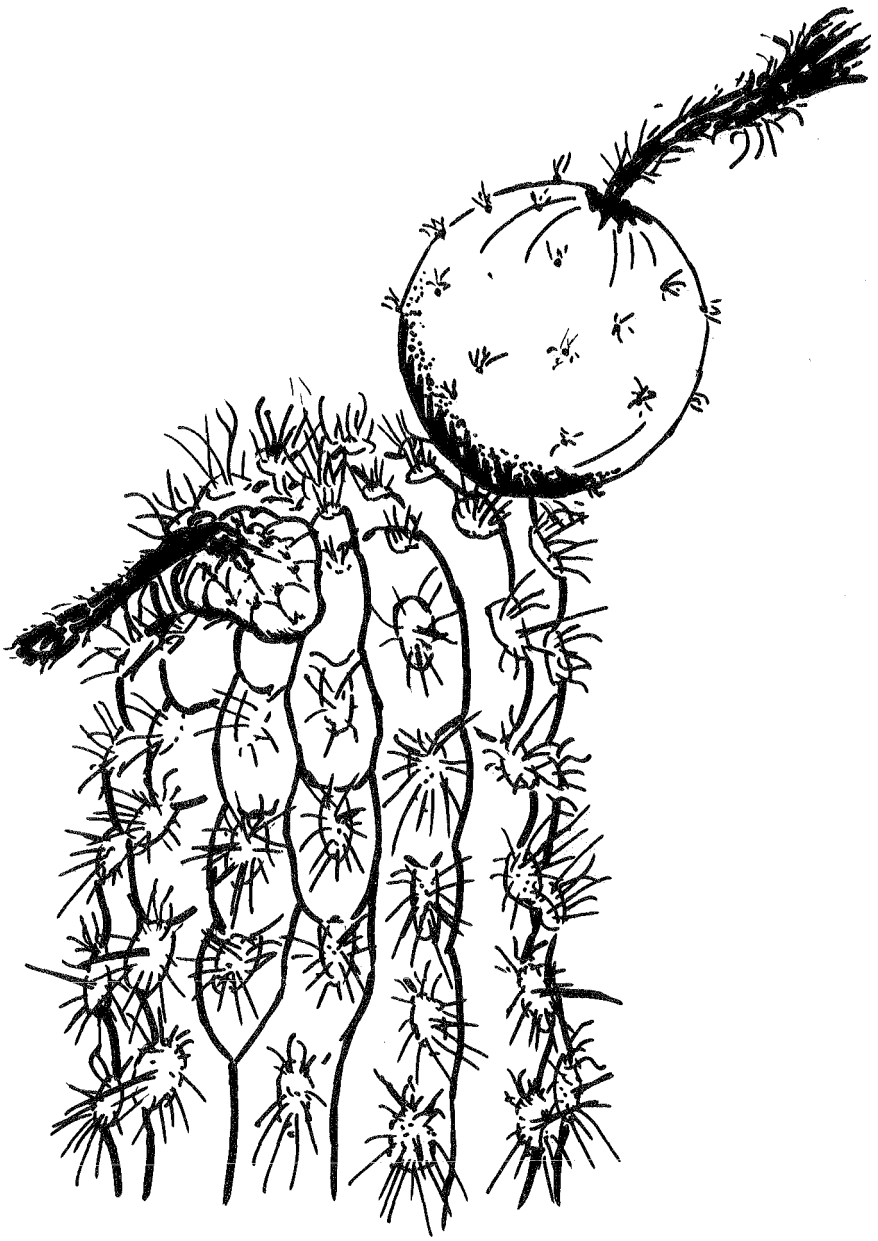


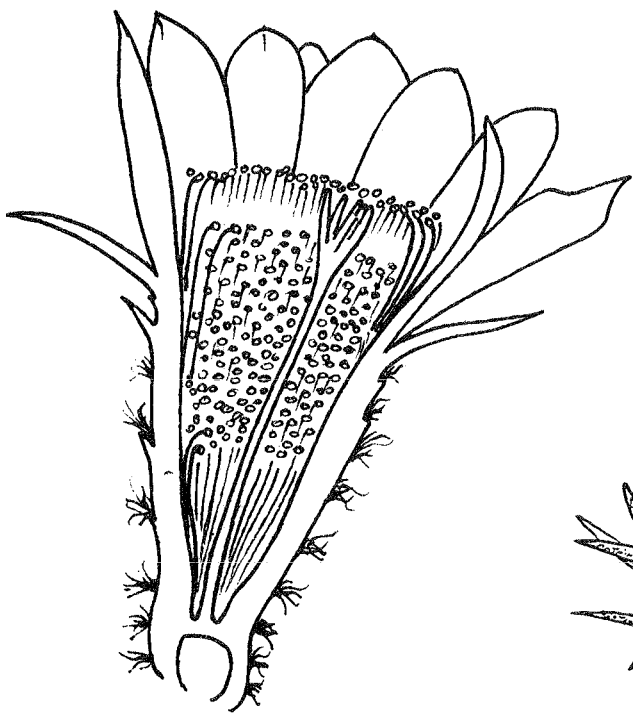
Setiereus roezlii KK 266

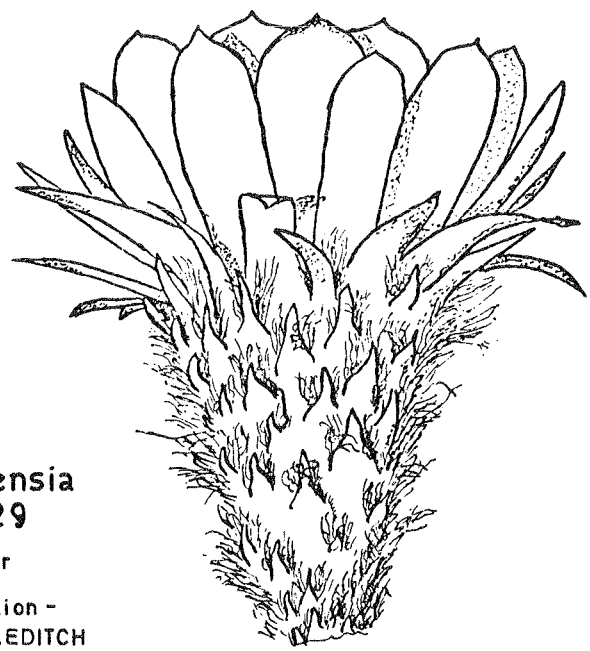
Collection - R. MOTTRAM

Actual size

Soehrensia rosarioana K.u.a.s. 30.12.1979

Soehrensia
formosa
Flower section
Collection - R. MOTTRAM





Soehrensia
R 129
Flower
Collection -
H. MIDDLEDITCH

SOEHRENSIA "FAMATIMENSIS" FLOWERS By H. Middleditch

Two or three years ago, I took an opportunity to call and see E. W. Bentley in Devon, when he still had his fine collection of plants. Among them was a 3ins. globular plant labelled Soehrensia famatimensis. The spination was somewhat reminiscent of plants which I had seen labelled Soehrensia formosa. Great indeed was my surprise to be told that it had flowered pretty regularly for the previous year or two. Whether or not it was my apparent scepticism that any Soehrensia less than football size could possibly flower, I would not know, but I finished up bringing the plant itself back up north with me. Much to my astonishment, it put out buds in the following summer and three flowers all opened at the same time. They were growing fairly close to the centre of the crown and remained open more than one day. There was no problem in taking slides of the flower and its section. The real problem lay in trying to find out whether it was really entitled to some valid name or whether it was merely the result of someone dabbling with a pollinating brush together with a fertile imagination for dreaming up new names.

For some time I had been aware that various red and yellow flowered cacti were to be found around the periphery of the Pipanaco basin. The taxonomists seemed to have had a heyday in arguing about the names of these plants: now it was Lobivia huascha, now Trichocereus huascha, now Helianthocereus huascha; there was Soehrensia formosa, or lately Lobivia formosa — or was it Echinopsis formosa? One could find reams of print about the names, but precious little about the plants, or about the nature of their habitat. It looked as though it would have to be a case of "sort it out for yourself", as usual. And again as usual there was the question — where to start? In this respect, I was extremely fortunate in that two other plants also flowered in that same year, and although all three were quite different in body appearance, there was a remarkable similarity in the flowers. And all three came from the periphery of the Pipanaco basin.

The second of the three plants was the happy possessor of three labels — it had appeared in various other collections as Chamaecereus grandiflora or Lobivia grandiflora, but Roberto Kiesling added yet another as Trichocereus rowleyi. The last of the trio was entitled Lobivia andalgalensis, a small, globular plant with one or two offsets. At our Chileans weekend, a slide of the flower section of each sort — Lobivia grandiflora, Soehrensia famatimensis, and Lobivia andalgalensis — were put on the screen side by side. It became evident straight away that nobody was particularly familiar with the flowers from this group of plants. Indeed, it was even suggested that the flowers were sufficiently alike to justify some of the taxonomist's lumping. But that was not really the full story, for the flowers on all three plants were not completely alike, if one took the trouble to compare them feature by feature.

Taking the similarities first; the tubes were very much alike in length, stoutness and appearance, being some 50-60mm tall and tapering from 12-15mm broad at the base to some 30mm across at the margin, of a grass-green colour with quite a large number of prominent thickish green to browny green scales with a moderate amount of fairly long hair in the axils. There were only a few transition segments between scales and petals so that the transition was pretty sharply defined. There were only a few outer short red petals, and these had a darker, fairly broad mid-band. All the petals were of a similar shade of clear and pretty uniform red colour, without any tinge of green or lilac. All the petals were quite broad, blunt with a very short point. Each flower had a very dark crimson-red throat, with a single ring of stamens at the base of the petals. In the throat, the stamens more or less inserted from base to margin, having stout pinky-red filaments and big heavy-looking cream coloured anthers. No Lobivia flowers that I could remember had quite such a stout tube, but I was not familiar in any way with flowers or Soehrensia or Helianthocereus. Nor could I find any reliable guidance in the literature to the characteristic external features and internal structure of these flowers.

Then there were the differences; the petals on Lobivia grandiflora were rather longer than those on the Soehrensia famatimensis and on Lobivia andalgalensis. Both Lobivia grandiflora and Lobivia andalgalensis had a slender style which leant against one side of the flower. In addition, the stigma lobes on both these flowers were long, slender, tapering, spreading half-open. On Soehrensia famatinensis, the stigma lobes were short, stout, more or less cylindrical, lying parallel and close to each other but not quite touching; the stigma was carried on a style which held itself upright in the middle of the flower. The Soehrensia flowers were bunched close together near to the growing point whereas on the other two plants, the flowers arose singly in the vicinity of the shoulder. The section of the flower of Soehrensia famatimesis was very similar to that of the Soehrensia formosa on the inside front cover; when cutting the flower off the plant, most of the ovary was left behind because of the difficulty in getting right to the base of the flower due to the long stiff spines, so that the external view of the flower on the inside front cover has lost the bottom 10mm or so of its full height.

This still left me unable to make any comparisons which might give me a lead as to the correctness or otherwise of the name Soehrensia famatimensis. Nothing in Rausch's treatment of Soehrensia in his "Lobivia III" would suggest to me that a red-flowering Soehrensia is to be found in or near the Sierra Famatina. Perhaps E. W. Bentley may still have a record of his plant which could give us a lead as to its origin and help to decide what it ought to be called?

. . . . . From E. W. Bentley

I see from my record cards that I first made a note about these two plants of Soehrensia famatimensis in April, 1972. They were 28mm diameter at that time, so I probably bought them as seedling plants. One of them flowered in May of 1975. They were supposed to have been grown from Rausch 129 imported seed. The name on the label is that given to me when I bought the plants.

LOBIVIA ROSARIOANA sp. nov. By W. Rausch
Translated from K.u.a.S. 30.12; 1979 by H. Middleditch

Solitary, globular, up to 10cm diameter, fresh green with shallow roots; ribs 13-18 perpendicular, prominent; areoles 7-8mm apart, oval 7mm long, with white felted wool, radial spines 12 to 14, up to 25mm long, curved back towards the body, central spines 4-6, up to 50mm long, all spines needle-like and somewhat curved, brown with darker tips.

Flower appearing from close to the crown, 65mm long and 50mm diameter, broadly globular ovary and tube yellow with small red-tipped scales and brown hairs, outer flower petals with reddish tips, inner petals yellow, throat and filaments pale yellow, style and stigma lobes (12) whitish. Fruit and seed like Lobivia formosa (Pfeiffer) Dodds, fruit globular, 30mm diam., golden orange-red with very small scales and brown to grey hairs, splitting open vertically and with watery fruit flesh. Seeds oval, crowded together, black, shiny with small, oblique hilum.

Habitat: Argentina, province La Rioja, near Famatina, from 3,000m.

Type: Rausch 129 deposited in the Zurich City Succulent Collection (=Rausch 565 from the Sierra Velasco near Pinchas from 2,600m).

Lobivia rosarioana var. rubriflora
Distinguished from the type on account of the red flowers.

Habitat: Argentina, province Catamarca, in the Sierra Ambato near Poman, from 3,000m.

Type: Rausch 528, deposited in the Zurich City Succulent Collection.

In 1965, I found the first specimens of these plants growing sparsely in the Sierra Famatina, later however in the Sierra Velasco as well, in whose rocky gorges they even grew somewhat short-cylindrical. The basic type is Lobivia formosa (Pfeiffer) Dodds, but these never come into flower in Europe unless they grow 2 to 3 metres high and with a diameter of 40cm, whereas Lobivia rosarioana forms the pocket edition of the whole group for it displays its first large flowers as early as a 6 to 7cm diameter seedling. In the Sierra Ambato near Poman one finds the self-same small forms, only the spination is here more brown and the flowers appear a deep red — the variety rubriflora. I name this small Lobivia "formosa" after my wife and companion Rosario.

. . . . . From H. Middleditch

Paying a visit to John Hopkins during Whit week, I found a most interesting plant standing at the back of the staging, sporting a flower whose shape, size and general appearance was quite reminiscent of the flower on my own plant of R129 — but it was yellow in colour. The yellow colour was almost entirely uniform over the whole of the petals. The petals themselves were pretty broad, curving to a blunt tip with a miniscule point. The funnel was very stout indeed and the transition from scales to petals was somewhat abrupt. The body of the plant was like a small football with good armament of long, stiff, but moderately slender spines. Was this some relation to R129?

. . . . . From J. Hopkins

The seed of my Lobivia "soehrensiana" nom. prov. R129 was probably sown in 1974 and the plant flowered for the first time in 1981 at a body size of some 6ins. diameter and 3½ins. high, plus the spination. It is indeed the yellow flowered form and I thought that the flower was typical of Soehrensia; this impression was based on another flowering plant of a Soehrensia sp. in my collection, whose source is unknown, but is almost certainly seed raised. The epidermis of my R129 is mid-green, the spination light brown radials (ca.12) and reddish brown centrals (ca.5) arising from very white areoles ca.15mm apart. There are several points which differ from Rausch's description, notably size and epidermis colour. The plant also looks very different to the illustration showing the yellow flowered plant in K.u.a.S., but very like the black and white photo of a plant with fruit (reproduced on the inside front cover of this issue).

I see that after first being listed as Lobivia soehrensiana nom. prov., R129 appeared in the Rausch Lobivia book Vol.3 as Lobivia grandis v. flaviflora n.n. (=L. pinchasensis nom. prov.); R565 also appeared there as L. Grandis v. pinchasensis nom. prov. and R528 was listed as Lobivia grandis.

. . . . . From H. Middleditch

In the Rausch Lobivia book Vol.3, there is a map on P.61 which gives the distribution of Lobivia grandis sensu Rausch. Presumably the title of Lobivia grandis as used in the legend to this map is intended to include the L. grandis v. pinchasensis and L. grandis v. flaviflora listed in the appendix to that volume. The distribution area mapped for Lobivia "grandis" extends from about Tafi del Valle in Tucuman through Aconquija to the Sierra Manchao and the Sierra Ambato.

Relatively speaking this is the less dry part of the environs of the Pipanaco basin. The dryer central and western areas of the Pipanaco basin including Belen, Tinogasta, Sierra Velasco and Famatina, are mapped by Rausch as the distribution area for Soehrensia formosa. But in his article in K.u.a.S., Rausch tells us that Lobivia/Soehrensia rosarioana R129 and R565 are found at locations outside the distribution area for Lobivia grandis sensu Rausch. Does this mean that the distribution areas for Soehrensia formosa and for R129/565 overlap? Do these two species grow more or less side by side, or do they grow in different ecological niches within the same general area? What a pity that Rausch did not see fit to make some observations about the ecological nature of the habitat in which each was to be found.

. . . . . From R. Mottram

A plant of Soehrensia formosa has flowered in my collection; the flower habit and flower section appear to be fairly similar to the flower on H. Middleditch's R129. On Soehrensia formosa, there is a ring of secondary stamens around the base of the petals, and the primary stamen insertion occupies more or less the remainder of the tube; the style carries the stigma upright in the flower. The flowers appear in mid-season, about July, producing a single flush of flowers, each flower staggered slightly in the speed of maturing, and at their best for only one day each.

. . . . . From H. Middleditch

At a local Chileans get-together in the N.E., we looked at a slide of a flower section of Lobivia grandis from Roy Mottram. This gave the impression that it differed from R.129, Soehrensia formosa and Lobivia dobeana, but an appreciation of the differences required more study.

MY TRIP TO SOUTH AMERICA By E. Zecher

Translated by K. Wood-Allum from the G.O.K. Bulletin for June, 1973

We left on a Swissair plane from Zurich for Buenos Aires. From there we travelled next to La Plata, which was to be the headquarters for the expedition. We worked as a team with the Botanical Institute of the La Plata University throughout our trip. For some months we were accompanied by two gentlemen from the Institute and a vehicle which they had placed at our disposal. Before our departure we called on Mr. Ferrari, a cactophile who has what is probably the largest private collection in Argentina. Here we were able to establish that the difference between South American and European cactophiles lies in the former's enthusiasm for aurea and rubra forms.

From La Plata we set off across the pampas to Neuquen, some 1200km south of our actual target because a Botanical Congress was taking place in which we and our new colleagues wished to take part. En route we were able to photograph our first plants, for example wildgrowing Passiflorae, an Austrocactus, Tillandsias growing down from the rocks and Pterocactus tuberosus.

Before we left for Mendoza, we made a diversion to the Sierra de la Ventana where we discovered a new Pterocactus and a splendid yellow flowered form of Gymnocalycium platense.

Mendoza itself is a splendidly situated town with magnificent parks. From here we drove to our intended collecting area. The road ran at an altitude of between 3,000m and 4,000m. Here there were Opuntia clavaroides and Denmozas in flower — whose name is of course an anagram of Mendoza. We also found here a Gymnocalycium with a peculiar blue-grey epidermis. There were masses of Soehrensias in bloom, the flowers very similar to those of Lobivia. The only thing which distinguishes plants of this genus from those of Lobivia is their size. They can reach 1.2m high. Whether this difference is in itself sufficient to separate the two genera is in my view doubtful. We were very lucky to catch the flowering season, but of course we lost out on seed.

In the Quebrada del Toro, which we traversed next, there were masses of Soehrensias in flower. Amongst them was Trichocereus candicans, also in flower. In addition, there were examples of Echinopsis leucantha which grow to a height of 50cm and could therefore be identical to Echinopsis melanopotamica.

We moved on to the neighbouring province of San Juan. We were told that they make the best wine in Argentina here, even though there is little enough water. Many bunches of grapes reach 3kg! We found the first Lobivias here, L.famatimensis which occupies a wide area. It is 300km from here to the type habitat which is the Sierra Famatina. In the dry valleys, we saw Pyrrhocacti, amongst them a species with chalkwhite epidermis and pink flowers. On the steep rock faces, there were large numbers of Lobivia famatimensis, on the slopes Trichocereus terscheckii full of flowers and — to the sorrow of many authors — flowering during the day! We also saw Helianthocereus huascha in flower. We were also able to collect Gymnocalycium uebelmannianum R.141.

We then moved further northwards. During a short break, we washed up our crockery in the river — that's part of the everyday chores for cactus hunters. Near Cafayate, we collected Lobivia haematantha. There is a beautiful church in Cafayate, a medium-sized township. All around mountain ranges rise up like a moonscape.

Comments

. . . . . From Kurt Svimbersky (G.O.K. bulletin, June 1973).

We had looked forward impatiently to our great surprise: Herr Zecher, who was already back from his South

American expedition — Herr Rausch being still over there — was coming to our Branch meeting on the 16th of May. So we had the pleasure of the very first showing of 250 slides, the photographic harvest from this collecting trip.

. . . . . From H. Middleditch

The Quebrada de Toro mentioned in this article is not the well-known valley of that name near Salta, but another valley of the same name which is situated in the Andes of Mendoza province.

. . . . . From J. Hopkins

This very interesting narrative by Zecher again highlights the classificatory hotch-potch surrounding Lobivias and their allies. I would agree that the flowers of Soehrensia are very close to those of Lobivia both in size and by the common characteristic of two series of stamens. Several other genera, of course, possess this latter feature, including Helianthocereus, into which (in my view) Soehrensia could well be absorbed. In passing, I am puzzled as to why Backeberg places Soehrensia in Austroechinocacti and not in his Trichocerei.

Very few Lobivias attain body sizes close to even the smallest Soehrensia and those that do e.g. L. ferox and L. longispina, are quite different in spination. Helianthocereus on the other hand covers the whole range of Soehrensia sizes and possesses the more or less vertical continuous ribs of Soehrensia not to mention the fairly close spaced areoles and similar spination. The flowers of Helianthocereus are in general somewhat larger than those of Soehrensia, but are wide tubed and densely hairy in both genera. The few seeds I have examined of these two genera are to all intents and purposes identical and differ from any Lobivia seed I have yet seen — except for "Lobivia" andalgalensis which is surely a small Helianthocereus.

The fruits of Soehrensia are much larger than those of Lobivia — 3-4cm compared with 0.5-1.5cm — and compare in size with those of Helianthocereus. Rausch retains the name Lobivia for Helianthocereus grandiflorus (R.525), the seed of which is identical to other Helianthocerei.

. . . . . From J. D. Donald

The relationship of Soehrensia to Helianthocereus is much the same as that of Echinopsis to Trichocereus. But having said this, one must be careful in blindly accepting Backeberg's Helianthocereus in toto. If one accepts the four genera mentioned above as quite separate and distinct (and I, personally, do not), then quite a few of the species that Backeberg places in Helianthocereus really belong to Trichocereus. With those species out of the way, it then becomes easier to merge Soehrensia with Helianthocereus, and perhaps away from Lobivia.

I would go quite a long way with the Friedrich-Rowley merger of Echinopsis and Trichocereus and am also reasonably happy with Soehrensia and Helianthocereus joining the enormous Echinopsis complex, because there are so many overlapping characters and much common sharing of significant features. This latter makes any facile separation of the 4 genera extremely difficult unless one resorts to trivia.

As John Hopkins says, Soehrensias are not Lobivias, but large globular or short cylindrical Echinopsis, sensu Rowley and Friedrich, sharing the straight low tuberculate rib with its in line actinomorphic podaria, large fruits, and regular linear papillate seed testa and broad basal hilum with large micropyle. The flower of Soehrensia is developed by a progressive reduction in limb length from that of the long classical Echinopsis flower — broadening and shortening into Trichocereus, shortening still further in Helianthocereus, to give its characteristic wide funneliform flower with short tube. No true Lobivia has a flower like this, except possibly the Peruvian group based on Lobivia mistiensis/panyava; similarly, L. Markusii and L. chrysochete may belong to Soehrensia rather than Lobivia.

Similar flowers found on L. ferox, L. aureolilacina, L. andalgalensis, L. caineana and L. wilkae, suggest that they may not be true Lobivias at all, but belong to the Echinopsis group. This is reinforced, of course, by their Echinopsis body structure.

If any rationalisation takes place in relation to the number of species of Soehrensia, then I suggest that the globular species Soehrensia formosa (Pfeiffer) Backbg., is associated with S. bruchii (Br. & R.) Backbg, S. korethroides (Werd) Bckbg., S. ingens Br. & R. ex Bckbg., S. oreopepon (Speg.) Bckbg. and S. uebelmanniana Lembck. and Bckbg. Soehrensia grandis (Br. & R.) Bckbg. has an entirely different habit from the formosa group, with short thick cylindrical stems even when relatively young, unlike the globular juvenile habit of the formosa group. All of these are, of course, Echinopsis in the sense of Rowley and Friedrich.

A TRIP ROUND THE PIPANACO BASIN

At the 1980 Chileans Weekend, we had the pleasure of welcoming two visitors from Germany, Jorg and Brigitte Piltz, who had been out to northwest Argentina on more than one occasion on the hunt for cacti. The slides which they showed to us were almost all taken around the floors of the valleys and basins or at some distance into the foothills of the mountains. We gained the impression that there were no cacti on the flat ground in the middle of the dry broad valleys or basins, but that they were to be found more to the sides of the valleys and on the lower hill slopes. Most of the slides of the landscape seemed to include scattered bushes which appeared to be growing several yards apart and sometimes a tall Cereus also appeared.

When we were visited by Roberto Kiesling, we saw a slide of the clouds banking up against the high eastern wall of the Andes in northern Argentina. Now we were shown a slide taken where the road to Mazan crosses the Sierra Ambato by the Cuesta de Sebila, with the clouds pouring up the valley almost to the photographer's viewpoint. Then came a slide of Gymnocalycium saglionis which is pretty widespread in this area. On the more sloping ground we saw Trichocereus terscheckii and also a Parodia which may well be Parodia riojensis n.n. Ritter. Descending into the basin in which the town of Mazan is situated, we saw sprawling clumps of Trichocereus andalgalensis. Here, too, were plants of Gymnocalycium mazanense which exhibited various forms and body colouring seemingly according to the amount of shade they received. There were joints of Opuntia syringacanthus and on lower, flatter ground we saw Tephrocactus alexanderi v. bruchii. Climbing out of the Mazan basin at a different spot we saw a G. mazanense v. ferox which had attained a length of about 30cm and was growing procumbent.

On the Sierra Mazan, there were more plants of G. mazanense, some fine plants of Pyrrhocactus catamarcensis which reached up to 60cm in height, Echinopsis leucantha and a Gymnocalycium species with pink to deep rose-pink flowers which may be G. rhodantherum. To the west of the Sierra Mazan on ground south of Aimogasta came G. nidulans, Lobivia aurea v. fallax, and a long-flowered G. weissianum. On the plains at the foot of the Sierra de Velasco were Echinopsis leucantha and also various species of Trichocereus and Helianthocereus. Further into the foothills of the Sierra Velasco were found Lobivia aurea v. fallax, G. schickendantzii and various forms of G. ochoterenai, with white flowers having either a yellow, pink, or deep red throat. Beyond the Sierra Velasco, on the edge of the Sierra Copacabana, were more G. schickendantzii and a Parodia which Jorg Piltz wished to name P. mazanensis. The flower on this Parodia had a pericarpel with few bristles and was considered by Piltz to be close to, if not identical with, the original Parodia sanagasta of Fric. Here, too, was G. glaucum with a bluish grey epidermis which changes to green in cultivation in Europe. Not far away were found other plants similar to G. glaucum, but with finer spines and on return to Europe, it was established that Rausch had already collected this plant. It was proposed to name it G. ferrarii.

When travelling north from Mazan, plants of G. schickendantzii had been encountered in the Sierra de Ambato, not a long way from where Rausch came across this species in his trip from Poman during which he found G. tillianum. Nearer Andalgala we saw Trichocereus terscheckii and T. andalgalensis again, also Lobivia shaferi, Parodia pluricentralis, G. pugionacanthum which is normally pink flowered and rarely white, and Parodia sanagasta Ritter with flowers between 7 and 8cm wide. Nearer Belen, there were Gymnocalycium species similar to hybopleurum and a variety of Parodia sanagasta sensu Ritter.

More to the south, between La Rioja and Sanagasta, were more Lobivia aurea v. fallax, Gymnocalycium albiareolatum Rausch, large plants of G. saglionis up to 40cm in diameter, and also large and clumping plants of a G. mazanense variety. Further still to the south, in the Sierra Malanzan, was G. castellanosii.

Comments

. . . . . From A. W. Hill

Our visiting speaker had helpfully prepared a sketch map of the Pipanaco basin which he put up on the overhead projector. From time to time, he referred to this map in order to show us which particular part of the area he was talking about. Even with this aide, I was not always able to follow the whereabouts on the map, for the location of each slide. In one or two parts of his talk, I suspect that I did not follow his reference to location correctly at all. In consequence, my own notes contain many queries in respect of actual locations of the plants which we saw on the slides.

. . . . . From G. J. Charles

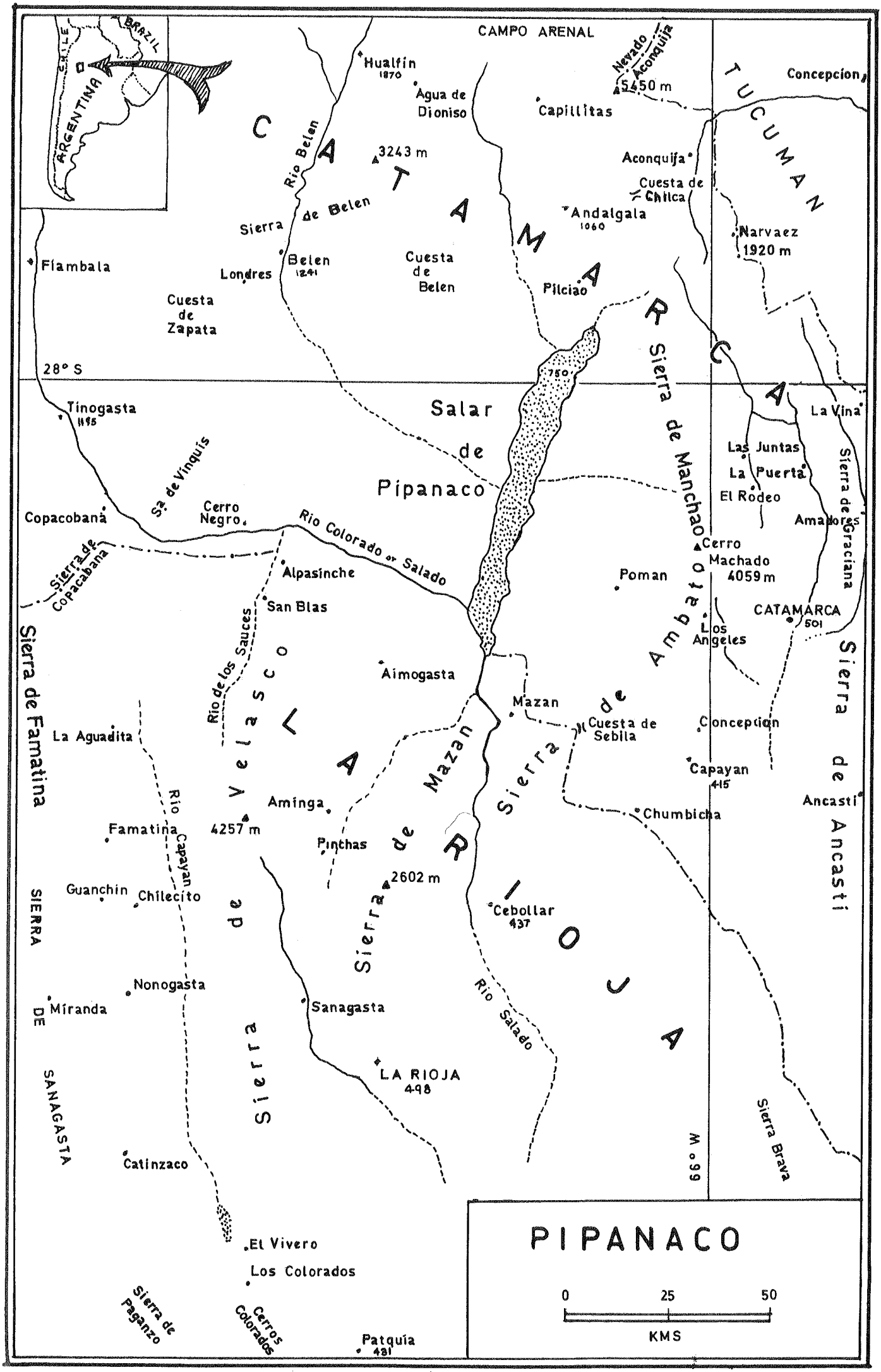
It was difficult to keep notes of the plants we saw on the slides, and of the information about them which the speaker was giving to us. If I watched the slides and listened to the speaker, there was no time to write notes; if I wrote notes, it was difficult to follow the speaker's commentary and barely time to glance at the slides. In consequence, my own notes are quite brief.

. . . . . From G. J. Swales

When I come across an illustration of an Argentinian cactus landscape in the literature, I usually take a slide of the picture, but I have seen very few habitat photographs which have been taken in the area described to us by Jorg Piltz. We had some fine slides shown to us by Roberto Kiesling which covered the whole of Argentina, but there were only a few from the Pipanaco area. I was therefore looking forward to seeing Jorg's slides with considerable interest. They were indeed a remarkably fine set of slides with a commentary to match. A few weeks after our 1980 Chileans' weekend, I sat down with Harry Middleditch to refresh our memories of this talk and to make some notes on the plants (particularly Gymnocalyciums) we had seen and the places where they grew. After quite a long chat, we were still left with a virtually blank sheet of paper before us, because we found it almost impossible to recollect any specific details. Is there anything we can do to overcome this difficulty in future years? So much invaluable information cannot be allowed to go unremembered and unrecorded.

. . . . . From H. Middleditch

The slides and talk presented by Jorg Piltz appealed to me because it included shots of both individual plants and general views of the landscape. In this way the cacti were related to their general surroundings, an aspect which receives scant attention in most cactus literature. It struck me that there were not a great many questions raised during or immediately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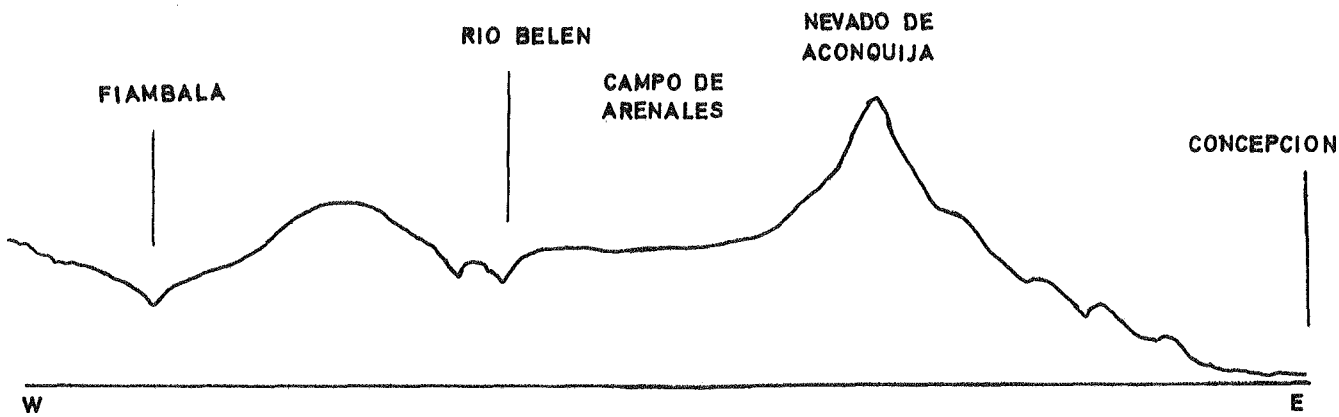
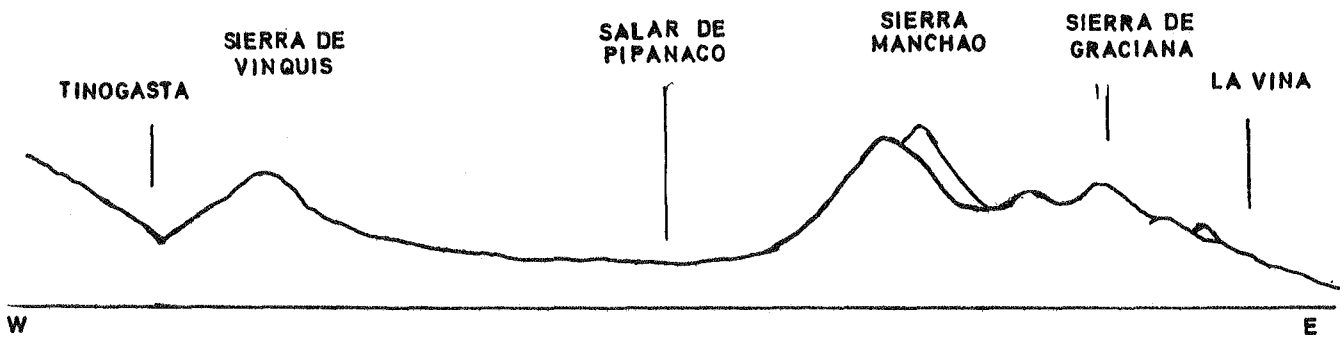
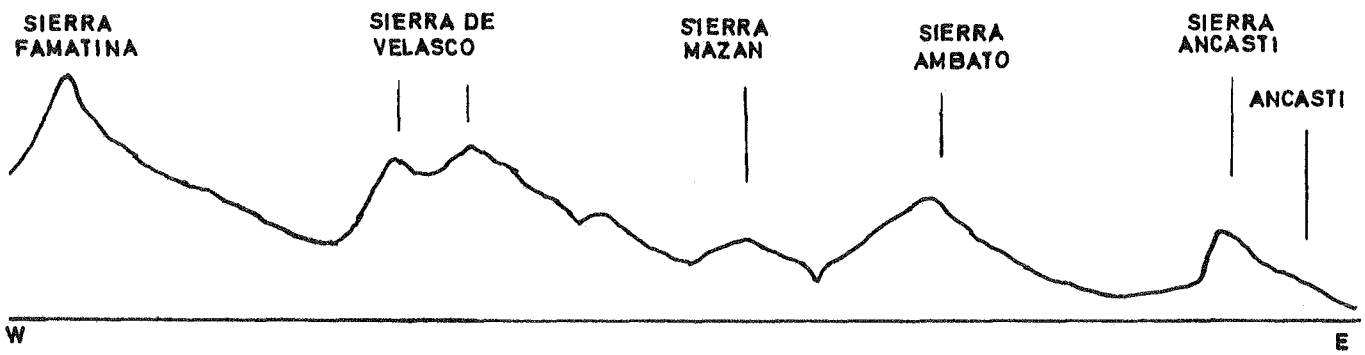
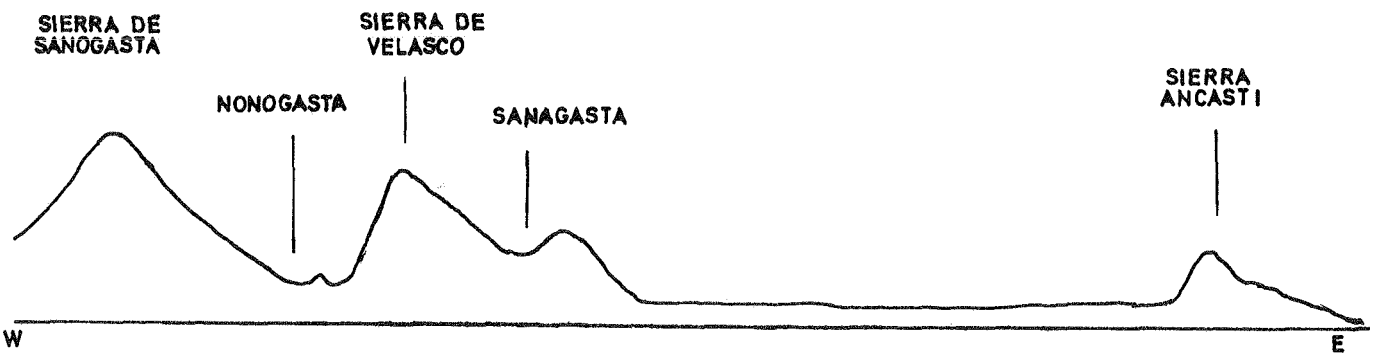








PIPANACO BASIN - PROXIMATE PROFILES

VERTICAL SCALE GREATLY EXAGGERATED

following this talk; was this due to it all being "new" to everyone but the speaker? In the course of relating what we remembered of the slides to other relevant information which it was possible to collate in the months following our weekend, plenty of questions certainly came to light then. Does this mean that we really need background information from a variety of sources in order to provide a basis for an adequate appreciation of a visiting speaker's talk and also to assist in the generation of queries and comments? We would normally endeavour to do just this in order to discuss a subject in the pages of The Chileans; should we be trying to take the same approach when we invite a visiting speaker to our Weekend?

THE PIPANACO BASIN

This elevated basin lies in the southern part of Catamarca Province, on the border with La Rioja. The bottom of the basin lies at some 750m altitude, from which it slopes gradually upwards to meet the feet of the encircling mountains at about 950-1,000m altitude. The mountains which surround the basin are formed by main ranges which follow roughly a north-south alignment, together with various interconnecting spurs and hilly plateaux. These form a rim of varying height all round the basin, fairly even in parts, jagged in others. On average, the rim lies some 2,000m or more above the floor of the Pipanaco basin. In a few places, there are peaks which exceed 5,000m and elsewhere, they are passes which lie as low as 1,500m. The only permanent river of any magnitude within the basin is the Rio Salado or Colorado, which leaves the southern end of the basin by a gap between two parallel ranges, to lose itself at the edge of the even vaster, lower-lying basin of the Salinas Grandes. Apart from this single river exit the basin is completely surrounded by mountain ranges which effectively deter any rain-bearing winds from precipitating moisture in the basin itself. As there are few, if any, clouds over the basin itself, the evaporative effect of the sun is pretty fierce. A certain amount of rain falls on the heights of the surrounding mountains, and from these heights streams descend to the drier, lower-lying basin or valley floors. Once the run-off water reaches the alluvial floor of the basin it becomes mostly subterranean. When the water collects at the very bottom of the basin, the level of the water table is near enough to the surface for it to be drawn to the surface, where it evaporates, leaving behind any dissolved minerals. In this way, a huge salt pan or salar has been formed, some three to four miles in breadth and about forty miles in length, called the Salar de Pipanaco. Apart from a very open woodland of deep-rooted algarrobo trees which almost encircles the salar, the hot dry climate and the stiff winds effectively inhibit any other vegetation from growing on the floor of the basin.

In general terms, the winds which do bring rain to this area blow more or less from east to west. To the eastern (windward) side of the basin there lies a series of parallel mountain ranges, each one rising higher than the range before it. There is the Sierra Graciana, the Sierra Ancasti, the Cumbre de Narvaez and the Sierra Manchao/Ambato. At Aconquija, these ranges together span but a narrow breadth, so that the winds approaching from the east rise rapidly and drop an appreciable amount of moisture over a short advance. In consequence, the rainfall there can exceed 1,500mm annually over a band of narrow width on the east-facing slopes. From this region southwards there is in any case a gradual reduction in the amount of moisture borne on the winds, but in addition the rainfall is now spread between the parallel ranges in Catamarca. The leeward slopes of these parallel ranges and also the longitudinal valleys between them receive a certain amount of carry-over rainfall. In the lower-lying Catamarca valley and on the Pipanaco side of the Sierra Manchao/Ambato range, there is a much greater reduction in altitude on the leeward slopes. As a result of this, there is a marked reduction in rainfall which corresponds to the decrease in altitude as one descends to the foot of the range.

To the south of the Pipanaco basin, the Sierra de Ambato is paralled on its western side firstly by the lower-lying Sierra Mazan, then by the somewhat more elevated Sierra de Velasco, and finally by the even higher Sierra Famatina (prolonged southwards as the Sierra Sanagasta). Each range in turn causes some further precipitation which falls largely on the most elevated parts. Over almost all the Pipanaco basin, the rainfall amounts to less than 200mm per annum. To the north of the Pipanaco basin lies an area of high mountainous ground which is rather less elevated than the Nevado de Aconquija. In consequence there is probably even less rainfall on this elevated ground than on the higher parts of the ranges surrounding the Pipanaco basin to the east, south, and even the west.

The heavy rainfall which occurs on the slopes overlooking the Pampas and the Chaco supports a vegetation of dense selva woodland on the windward slopes in Tucuman. This forest is found up to about 1,500m altitude. Above 1,500m and up to about 2,000m altitude, there is a more open, dryer woodland. Further southwards on the parallel ranges of the Sierra Ancasti, Graciana, Narvaez and Ambato/Manchao, the selva gradually gives way steadily to more open woodland. Above, some 2,000m altitude the vegetation is formed of grasses, herbs, and low shrubs. On other ranges bording the Pipanaco basin, the higher parts also receive sufficient rainfall to maintain a vegetation of grasses, herbs and shrubs in suitable locations. On the floor of the Pipanaco basin and on the floor of the deep valleys between the mountains ranges, the combination of low rainfall, drying winds, fierce daytime insolation, and a wide diurnal temperature range is hostile to the development of vegetation. Due to the absence or sparsity of vegetation, there is little or no humus to contribute to soil formation. These areas will only support vegetation in the immediate vicinity of surface streams or above subterranean water which is within reach of plant roots. Larger or smaller areas are devoid of vegetation or covered with sand dunes.

The sloping sides of the mountains, almost down to the margins of the valleys or basins, are similarly lacking in vegetation and exhibit a surface almost entirely composed of bare rock. At the higher altitudes the absence of water vapour

and dust means that the rays of the sun fall in full force directly on the rock surface, leading to an extremely rapid rate of temperature rise on rock faces and a remarkably high surface temperature at noon. At night, the clear skies permit a rapid rate of heat loss by radiation from the ground surface so that the temperature frequently falls below freezing during the hours of darkness, even in full summer on the upper heights. These effects are confined to the surface of the rocks. Only a negligible diurnal oscillation of temperature occurs a few inches below the surface. The daily expansion and contraction of the surface layer of rock sets up stresses between the surface layers and the bedrock, which eventually result in the rock surface shelling off in flakes. This loose surface is still subject to the diurnal heat-freeze cycle, but it is now free to creep relative to the bedrock; at the gradients typical of these mountains, the loose covering will creep remorselessly downhill with extreme slowness. Some will eventually reach the base of the mountains and form an accumulation of detritus along the sides of the valley. Some will creep into gullies where short-lived streams from the occasional thunderstorm will gouge a track in the rubble carrying some of it down towards the valley below.

In its slow passage down the bare hillsides or when impelled by a passing torrent, some material will be ground down into gravel, sand, or even finer fragments. Some of this fine material will lodge amid the rubble alongide the courses of the streams. Here and there a patch of bushes will grow alongside the stream. The mixture of coarse and fine material lying in a belt where the mountains meet the valley floor, will also support a growth of bushes and columnar cacti. Where the streams slacken their headlong pace as they reach the valley floor, they will drop their load of waterborne rubble, blocking their own tracks. When the next spate brings a fresh load of rubble, this will drop in turn on top of the first deposit. The stream may seek a path to one side or the other of the pile, so broadening the pile, which becomes steadily broader as each deposition fills more of the width of the mouth of the stream; and steadily higher as each deposition builds back up the track of the stream. In this way an alluvial cone is built up in the mouth of the stream at the base of the mountain. The coarse material — large boulders — will be dropped at the first slackening of the pace of the stream, so that the head of the alluvial cone is usually formed of large stones. The finer material will remain longer in suspension, even in fairly slow-flowing water, so it tends to be carried further out into the valley floor and be deposited on a fairly shallow gradient, so forming an alluvial fan.

Some storms will generate roaring torrents, others just a powerful stream. On occasions, the upper part of the alluvial cone will be swept away and dropped further towards the valley; in this way, a heterogeneous mixture of sandy rubble can be formed, cut about by newer water courses in the form of deeper or shallower gullies. Some moisture will be retained in the interstices between the rocks or in the sand below. This ground will often support bushes, shrubs, columnar and globular cacti. The finest material becomes deposited on nearly level ground, where the uniformity both of the surface and the fine, sandy soil can support only a limited variety of vegetation, usually the deeper rooted bushes and (in some places) Tephrocacti, but still with a pretty high proportion of the ground totally free of vegetation. On this account the ground has no inherent cohesion, and the strong winds that are pretty commonplace in the Pipanaco basin can scour away the ground, transporting the fine sand and heaping it up into sandhills.

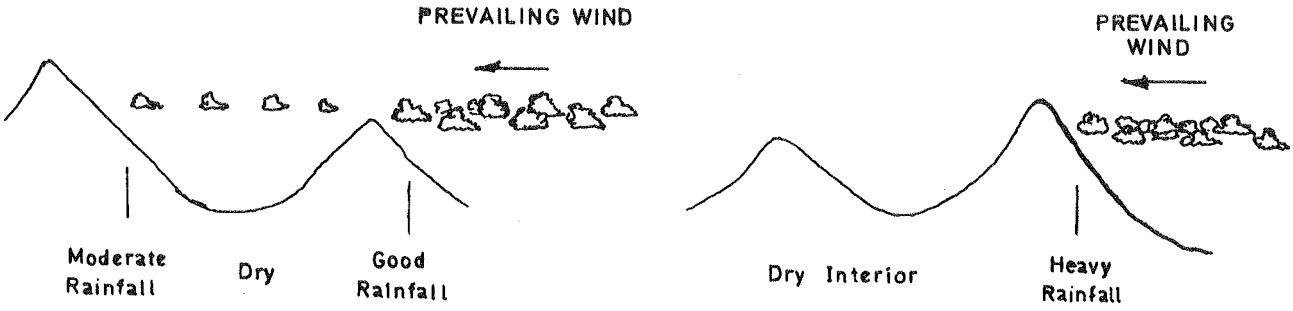
Those mountain slopes which lie to the east side of the Pipanaco basin are the first in the path of the rain bearing winds, and so have a decidedly better rainfall, and also far more cloud cover. Not only does more rain arrive here than elsewhere in the Pipanaco basin, but less of it is lost by evaporation because of the better cloud cover. The extra cloud cover also makes for less harsh growing conditions, due to less exposure to the merciless rays of the sun. Because of this marked difference in environment, there are evidently differences between the cacti which grow in these eastern ranges and the cacti which grow in the rest of the Pipanaco basin. On this eastern rim are found Helianthocereus crassicaulis, "Lobivia andalgalensis", and Chamaecereus/Lobivia grandiflora (Trichocereus rowleyi) as well as slender, clumping Trichocereus andalgalensis. Elsewhere around the Pipanaco basin parts less favoured by humidity and cloud cover are found the stouter growing Trichocereus/Lobivia huascha, Pyrrhocactus catamarcensis, together with various species of Gymnocalycium, Soehrensia, Opuntia and Parodia. The tall columnar Trichocereus pasacana and terscheckii seem to favour patches of rubble or rocky slopes, whilst many of the Gymnocalycium and Parodia species seem to favour the shade of the bushes.

The proximate profiles across the Pipanaco basin (see page 9) run approximately east to west. The actual location of each profile may be related to the map on page 8 by the place names identified above each profile. the effect of this saw-tooth profile on the prevailing moisture-bearing westerly winds may be gauged from the idealised profile/climate relationship depicted on page 12.

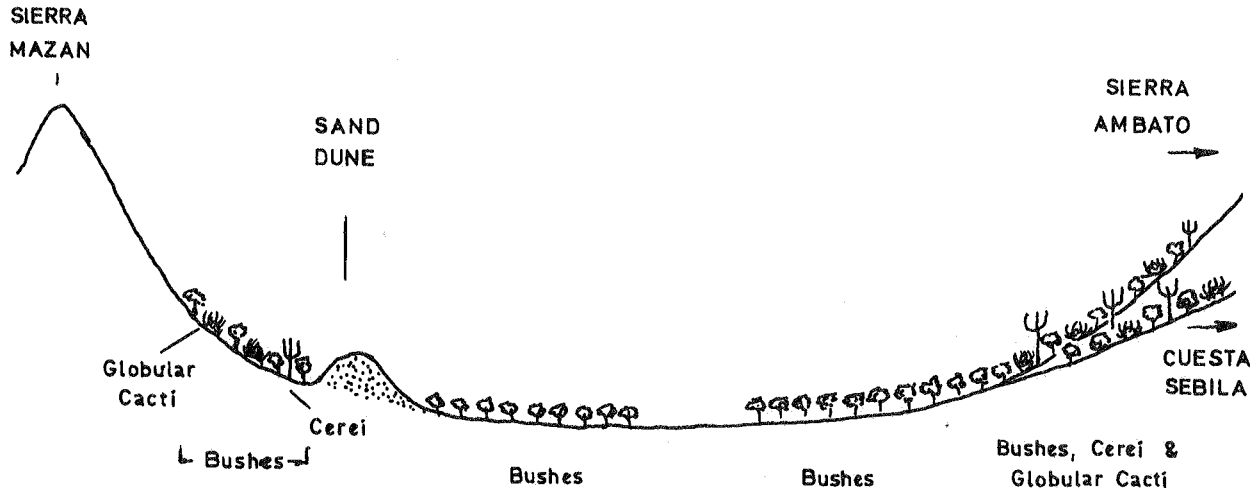
THE BASIN OF ANDALGALA By Kurt Hueck

Translated by H. Middleditch from Boletin de la Sociedad Argentina de Botanica III.4; 1951

To the south of a line drawn from Andalgala to Belen, in the province of Catamarca, there lies an extensive plain which is characterised by an extraordinary aridity. Its altitude above sea level ranges from less than 800m in its eastern part up to somewhat more than 1100m in the west. This plain, known in its northeast section as the Campo de Andalgala, extends for more or less 95km from north to south and in the north reaches its greatest breadth of approx. 100km. Its area amounts to about 5,000 square km, but owing to the extreme scarcity of water, it is inhabited only in a narrow marginal band. The central parts of the basin have very seldom been studied, and almost nothing in the way of botanical observations has

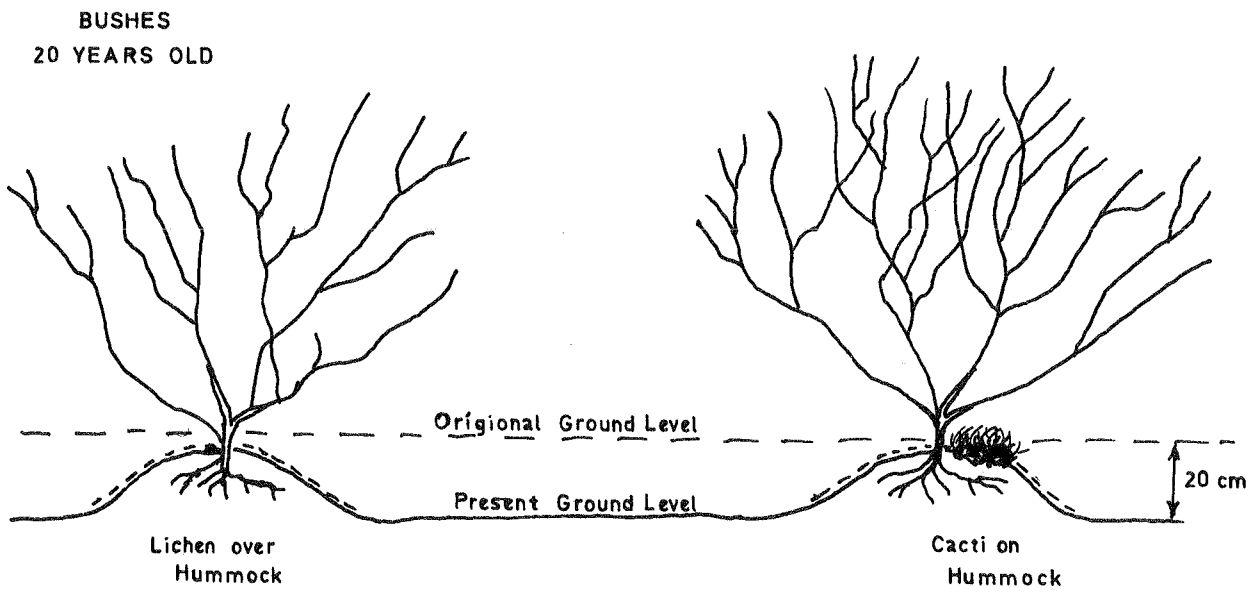


Idealised Profile - Climate Relationships



Section NW - SE across Mazan Basin

FROM A SLIDE BY J. & B. PILTZ



AERIAL EROSION

SEE HUECK - ANDALGALA BASIN

been added to knowledge apart from the information of a more economic character which Schickendantz published in 1875.

In conformity with its pronounced lack of rainfall, the region is characterised by a very xerophytic vegetation. Its greater extent is occupied by bush steppe interspered with isolated little sand dunes. The whole of the west is an enormous desert with migrating sand dunes of up to 20m in height. Some dry woodlands of algarrobo occur only in the east, around the edge of the Salar de Pipanaco, which is itself entirely free of vegetation.

In the course of the two excursions which we undertook in this region, two phenomena attracted our attention:

1. The exposure of the root systems of the steppeland plants by the erosion effects of the wind and waters, and a method for measuring the phenomenon.

2. The inversion of the limit of woodland on the edge of the salar de Pipanaco. (i.e. the re-appearance of woodland with further decrease in rainfall — H.M.).

Exposed Root Systems

In the country surrounding the locality of Andalgala, the "Jarilla" (Larrea cuneifolia) steppe stretches up to the last land cultivated by means of artificial watering. From there it extends with overwhelming monotony towards the south. Its principal components are Larrea cuneifolia, Bulnesia retamo, Cassia aphylla and Tricomaria usillo. The fact that the bush steppe to the south of Andalgala is extremely exposed to the erosional force of the winds and of the rain waters which drain across its surface, is a circumstance which distinguishes it from many other steppes of the same type. The vigorous erosion here causes forms of growth which, although not wholly unknown in other bush steppes, give to the steppes of Andalgala its particular character.

The effects of erosion are characterised primarily by complete exposure of the root crown of the plants. In this way there appear forms of growth in which the bushes look as if they have grown up on top of a system of root-props. The height of the exposed root-stocks is variable and attains only a few centimetres in young bushes, some 15-20cm in older plants and in especially notable instances as much as 25 to 30cm (10-12 inches — H.M.) above the ground level. It is evident that at the time of establishment of those plants, the level of the ground must have been higher by the amount the root crown now rises above the ground. It is not conceivable that the neck of the root would, for some reason, have raised itself, while the ground level remained constant. As typical for the region, we noted a surface erosion of 10 to 20 centimetres.

The establishment of the age of the bushes presented difficulties, since it was not possible to count the annual growth rings, which were very narrow in parts and in many instances scarcely recognisable. Apparently rings do not form regularly every year in accordance with the rhythm of the temperature, as in the wood of many other trees. In this very arid region, where water is at a minimum, the presence or absence of the necessary soil moisture affects the growth of the vegetation to a much greater degree than does the temperature. It is for this reason that in a year with two or three sufficiently separated falls of rain, there are formed two or three clearly distinguishable growth rings; in dryer years, they may be absent altogether.

Under such conditions, the age of the bushy plants may be calculated more reliably on the basis of the structure of the aerial shoots. In this respect, the Jarilla (Larrea cuneifolia) exhibits the following features; it is a bush which can reach heights of up to 2½m in this region, but normally does not attain more than 1½m. Its very sinuous branches arise from a stout root-stock whose diameter may reach 15cm, with the stronger branches attaining 6cm in diameter. This shrub is almost evergreen, since just before the new shoots begin to grow, the canopy drops some of the old foliage. Fresh growth begins with the first summer rain and the annual increase in length of the stems amounts to 10 to 15cm. In the axils of the leaves, the branches exhibit some thickening rather like nodes. This structure is lost in branches of 10 years of age. It may be supposed that the older bushes attain an age of 25 years. It is also remarkable that the system of branching of the jarilla is orientated exactly in a north-south direction under the influence of the insolation.

From our observations, we were able to calculate the age of the specimens of a meter and a half in height as 10 to 15 years. In a similar manner, we were able to investigate the age of Cassia aphylla, Bulnesia retamo, and Tricomaria usillo. In this way we obtained not only the relationship between the depth of soil eroded with an approximate idea of the "bush generation", but in a very definite proportion for a specific number of years.

However, it would be mistaken simply to calculate the annual erosion according to a formula dividing the height of exposed root-stock by the age of the shrub in years. From precise observations, it was found that the erosion of the ground level is generally much more than that which corresponds to the difference between the root neck and the level of the ground. We were able to observe that the soil on the small patches between the bushes exhibited a lower level than that immediately below the bushes of jarilla and around the neck of other species. Because of the reinforcement of the soil by the root system of the bushes there had formed almost regular mounds which were able to resist erosion. In other words, the bushes were situated on dwarf elevations which stood above the surface of the normally flat steppe.

In addition, the surface of the dwarf hillocks was frequently covered with crowded crustaceous lichens, whose apothecia extended above the top of the soil. It is hardly possible to suppose that these lichens had, from the first, assisted in the fixation of the soil and in the formation of the mounds, which was probably achieved by the root system alone. On the contrary, it appeared that these crustaceous lichens had been able to develop more recently, after the ground had already

become stable; this does not, however, exclude them, in the latter situation, from sharing in the stabilisation of the soil.

Herbaceous species play no part in the flora anywhere on these steppes.

Bulnesia retamo is a tall strong shrub or at times a small tree, which can reach heights of up to 6m and a stem diameter of up to 40cm. The annual growth of the twigs is very variable. Large branches reach up to 40cm, short ones generally no more than 5 to 8cm. (Measurements from root-stock to eroded ground level are tabulated for both species of shrub and indicate) . . . an annual erosion rate of 2.5cm. This implies that a cubic metre of earth is removed annually from each 40 square metres. From each square km there disappears annually 25,000 cubic metres of earth (app. 15,000 tons per square kilometre equal to some 50,000 tons per square mile per annum — H.M.).

The question arises as to whether running water or the wind plays the principal role in transporting this mass. Signs left in the ground by running water are very frequent, partly in the shape of deposits on the surface like those left by the water when flowing over a broad front, but with very little depth down gentle slopes, and partly in the shape of gullies of 1 to 2m in depth. The material thus carried away eventually arrives at the Salar de Pipanaco or at least reaches its border where it is surrounded by algarrobo forest. In view of the great scarcity of rains in this region, however, fluvial erosion is not regarded as of major importance.

Much greater is the effect of the wind, the "zonda" in regard to the erosion of the ground noted above. From October to February, this wind blows with outstanding regularity every day from 1300 hours to nightfall, coming down from the snow-capped peaks of the Aconquija range. This phenomenon may be observed with particular clarity from the road running from the heights of the Campo de Pucara down to the basin of Andalgala by anyone watching the enormous clouds of dust which rise from the plain. Even on relatively calm days some swirls of wind cross the basin. The inhabitants of Andalgala, Belen, Londres and Tinogasta are able to recount convincing stories about the potential of the winds.

The fact that it is not the water but the wind which plays the principal role in the surface erosion, is also evident from the numerous marks of aerial laceration left on the vegetation by winds, mainly blowing from the northwest. The sand driven by the wind is set in motion in the form of airborne clouds, and markedly increases this effect. We observed its greatest impact immediately above the surface of the ground where the girdling abrasion frequently has a fatal effect upon the growth of the plants. The branches and twigs in this zone display the most serious injuries and scars unilaterally on the windward side, having the bark flayed and sometimes stripped off there.

We came across the area of deposition of the flying sand and other transported material in the isolated dunes to the northwest of the Salar, and some 30km more to the west in the enormous dunes of the Campos de Belen, which reach heights of up to 20m.

The inversion of the limit of woodland in the Salar de Pipanaco

The extensive forested area of N.E. Argentina, whose optimum development is represented by the Selva between Tucuman and Bolivia, has a southern limit on the eastern slope of the chain of sierras which extends from Tucuman province to the west of La Concha towards the south, going past the towns of La Vina and Amadores in the province of Catamarca. There the countryside takes on an increasingly arid character and eventually does not provide the ecological conditions suitable for the development of hygrophytic or mesophytic woodlands. Finally, it becomes difficult even for the growth of xeromorphic woodlands, and then there begins the Monte vegetation. In this Monte formation are included the Zygophyllaceae, Cactaceae and other xerophytic families and only in more favourable locations does there flourish a type of xerophytic woodland which is usually composed of species of the genus Prosopsis.

The limit of dryness for the algarrobo woodland in the vicinity of Andalgala in particular is above the isohet of 300mm of annual rainfall. Where the precipitation decreases still more, this type of woodland is also absent, except where special conditions occur. It is all the more surprising that the vegetation profiles which emerge from a section in the vicinity of Andalgala show the existence of woodlands of algarrobo within areas of much lower rainfall.

In order to understand clearly the existence of the enormous algarrobo woodland of Andalgala, extending to many hundreds of square km, within a region climatically unsuited to woodland, it is necessary to consider in detail the rainfall records. The moisture brought by the east winds falls largely on the ranges to the east of Andalgala. Frequently it may be observed that rain falls on the extensive plains to the east of the mountains or in the vicinity of the eastern foothills, and that the peaks are enveloped in clouds, but that the mountain slopes running towards the Andalgala basin are absolutely dry. Observations carried out over 25 years give the following rainfall averages in mm: January, 82.6; February, 60.8; March, 41.9; April, 12.2; May, 5.5; June, 4.6; July, 4.1; August, 4.6; September, 5.2; October, 11.4; November, 15.9; December, 44.5; annual, 293.3.

Attention must be drawn here to the importance of cloud cover as a factor influencing the vegetation in the arid zones, an aspect which has received little consideration up to the present time. For the whole of the year it is usual to see no clouds whatsoever over the basin of Andalgala, whilst the peaks of the surrounding ranges are enveloped in clouds. These clouds also shade the slopes of the dry side for a distance of 2 to 5km. It will be realised that in this manner there exist in the marginal zone, as far as it reaches down the slopes of the mountain, conditions much more favourable for the development of vegetation. The insolation, extraordinarily fierce in the interior of the basin, is reduced and plant transpiration is reduced on account of the shade.

Further into the basin, the precipitation decreases progressively. According to the inhabitants of the region, it rains on the dry plains to the south of Andalgala only a few times each year. Reliable measurements have been taken in Pilciao for some years which give for this locality only 150mm of annual rainfall. Nevertheless there exists in that same place, right in the middle of the dry area, algarrobo woodland covering many hundreds of square km, flourishing in spite of a rainfall much less than that normally considered to be indispensable. This may be due to surface waters flowing to the Salar from the outer margin of the basin, since in many places dried mud and superficial gullies are to be seen. Alternatively, it may be due to subterranean water; but on the outskirts of the woodland there are wells 20m deep, and nearer the Salar, one encounters water at a depth of 10m, whereas the deepest Prosopsis roots reach only 6 to 8m in depth. It is important that this question is investigated further.

(A typical section across one particular basin just to the north of the town of Mazan, will be found on page 12; the prevailing winds have scoured the sand off the more level area of the basin over a great many years and deposited this material in a great long sand dune on the leeward side of the basin. This particular basin is perhaps only five or six miles across; the Pipanaco basin is more or less similar but on a much larger scale).

. . . . . From Jorg & Brigett Piltz

During our visits to Argentina we have travelled through much of the surroundings of the Pipanaco basin as well as areas to the north and to the south of it. Most of the inhabited towns and villages in and around the Pipanaco basin are to be found on the sloping ground or foothills where the mountains join the basins or valleys. The tracks which run between these places cross the valleys or basins or run around the mountain. Apart from an occasional track rising to a pass or to a mine, there are not many tracks up and down the mountains which can be used by a vehicle. We were using a vehicle to travel the considerable distances which are involved as we intended to cover as much of this area as possible. We often made stops in order to walk round the sides of a valley or over a hillside, but we did not attempt to climb the real mountains. We were not equipped for spending several days climbing on foot, but we found that it was not really necessary since we were able to find much of interest on the lower slopes.

On these lower slopes, the most typical vegetation consisted of scattered bushes up to about two metres in height. These grew on the almost level ground sloping gently towards the centre of a valley or basin, on the long slopes which stretched in some places for many kilometres where the mountains gradually merged into the valleys, or on the steeper slopes at the base of the mountains. These bushes can be seen for kilometre after kilometre, growing more or less the same height and more or less the same distance apart. There was no problem when walking through these bushes, in working in a given direction because the bushes were sufficiently open and there was often a hillock or low spur from which a good view could be obtained of the surroundings. However, to the south of the Pipanaco basin, it became a different situation. In the area to the southwest of Patquia we found bushes which were less open and also grew a little higher, so that on ground with a fairly steady slope it became rather more difficult to keep a sense of direction. To the south of Patquia and more towards the Sierra Malanzan, we found that the more densely bush-covered ground became increasingly difficult to traverse. Further still to the south, in the surroundings of the Sierra de Chepez, the bushes grew higher still and even more closely together; here there was an added complication, for much of the ground was quite flat and without undulations from which a view could be obtained above the bushes. In addition, the bushes were now more often between two and three metres high so that it was quite impossible to see over the top of them. If we ventured among these bushes, it was extremely difficult to maintain any sense of direction.

Although we did find many cacti growing in association with the scattered bushes, it did not always follow that where bushes grew, cacti grew too. Between the mountains, the slowly sloping ground levels out to the bottom of the valleys or basins; sometimes it is but a few kilometres across the almost level floor whilst in the Pipanaco basin, the distance is so great that one cannot see from one side to the other. At the bottom of the Pipanaco basin is the enormous Salar de Pipanaco, but there was a whitish-grey salty looking deposit at the bottom of some of the smaller basins too. Growing closest to these salty flats were succulent-leaved plants which we could not identify but which we took to be halophytes. Bushes often started to grow perhaps a kilometre or more away from the salty area and this bush vegetation then occurred either as a continuous band or in extensive patches right to the foot of the mountains. In between the bushes, the ground was virtually bare of vegetation. We also came across quite a number of sand dunes. One of these, at the foot of the northern end of the Sierra Mazan, must have been several kilometres in length along the very foot of the mountain, and twenty or thirty metres high at its maximum height.

In a great many places, we certainly did see the feature of bushes growing on a dwarf hummocks, and there were often Gymnocalyciums or Parodias or sprawling Trichocerei growing on the hummock next to the base of the bush. We also noticed that there was often lichen growing next to the cacti and under the shade of the bush. We showed some slides at the Chileans 1981 Weekend of cacti growing up against the base of bushes in the wild, where lichens were also growing. In the slides, it was not too easy to see the lichen growing on the ground because the colour blended into the background, but on some of the slides, the lichen could also be seen growing on the bark of the bush itself. We were able to show slides of this

feature not only from near Andalgala, but also at a spot between Villa Union and Cuesta Miranda, at Suriyaco in the vicinity of San Blas, and at Chepes Viejo in the foothills of the Sierra Chepez. Of course, these slides showed only a few examples whereas we saw many thousands. I would not have thought that this was a feature that was peculiar to the locality of Andalgala.

When we were travelling round this part of Argentina, we did not connect together the bare open ground between the bushes, the hummocks on which many of the bushes grew, the strong winds, and the many sand dunes, but there is no doubt that all these features do exist.

. . . . . From H. Middleditch

We are told by the author that he observed the mountain peaks around the Pipanaco basin were very frequently enveloped in cloud, whereas at lower levels in the basin proper there was seldom, if ever, any cloud. He also observes that these clouds had a positive shading effect on the upper slopes of the mountains. Would we be correct in assuming that Lobivia grandiflora, Lobivia dobeana, and possibly Helianthocereus crassicaulis, grow in an area which receives much more shade than the area in which Trichocereus huashca, T. vatteri — and perhaps T. andalgalensis — grow, thereby accounting to some extent for the differences in the body habit?

THE PIPANACO BASIN By G. H. Orians & O. T. Solbrig

Abstracts from "Convergent Evolution in warm deserts", 1977

Patterns of Plant Communities

Two characteristics of warm deserts, obvious even to the casual observer, are the sparsity of plant cover and diversity of life forms. Less obvious but equally characteristic are (1) a high species richness in certain areas, but a low richness in others, and (2) the great importance of soil texture characteristics and slope exposure as determinants of vegetational distribution. The more uneven the available soil water because of exposure, soil texture, or topography, the larger the number of species of life forms able to co-exist. The more even the precipitation and the finer the soil texture, the converse holds good.

Flora

Plants rely on evaporative cooling to keep close to air temperature. In warm deserts, plants experience great heat loads, but are usually unable to evaporate great amounts of water. Therefore only the remaining parameter — physical structure — can minimise the heat load. Adaptions include thick layers of trichomes and light-coloured surfaces that increase light reflectance. Although these adaptions reduce heat load, they also reduce photosynthetic rate by increasing stomatal resistance and/or reducing light interception and absorption.

The photochemical steps involving the absorption of light energy and the splitting of water are, as far as is known, identical in all green plants with chlorophyll. However, there are three different pathways by which plants fix CO_2 (carbon dioxide) by photosynthesis. They are (1) the Calvin cycle or C3 method, (2) the dicarboxylic cycle or C4 method, and (3) Crassulacic acid metabolism or CAM method. The C3 plants have the lowest water use efficiency per gram of carbon fixed; out of the three types, the CAM plants use least water per gram of carbon fixed. However, CAM plants have very low photosynthetic rates and a strict requirement of high day temperatures and low night temperatures.

CAM plants include the Cactaceae and most Agavaceae.

Roots and Extraction of Water from the Soil

Generally, energy needed to remove water from the soil increases exponentially with decreasing soil moisture. As soil moisture decreases the plant cells must be at a sufficiently low potential (below zero) to draw water up against the force of gravity. The ability of the plant cells to withstand great negative potentials determines the limiting energy levels at which a plant ceases to remove soil water. Succulents have very low negative water potentials in their tissues — in the order of -1 to -5 bars, and apparently cannot withstand the internal water stresses to which other desert plants are normally subjected. Plants such as Larrea are able to maintain small but positive growth under extreme water stress levels leading to plant water potentials below -50 bars.

During dry periods, succulents shed permeable root hairs so reducing water loss to the soil. If they maintained permanent root systems, they would lose water to the soil during the dry season. Succulents are found outside of the desert areas in the Bolson de Pipanaco, in islands of local dry environments, such as rocky outcrops. If the soil is rocky enough, special microhabitats are formed below buried rocks where pockets of moisture persist for a long time. Rocks on the surface create additional microhabitats. It is in such areas that the greatest richness of plant forms is found.

Blooming and Fruiting

Seedlings are the most vulnerable stage in the life cycle of a xerophyte. A seedling has a limited energy reserve and a low water absorption capacity. Since no seedling can survive long without a supply of water, germination can only take place during the rainy season. This involves surviving the dry season, either in an active or a dormant state. Microtopography will play an important role: rocks, depressions, and different exposures produce pockets of humidity and

shade which can increase the chance of survival for a seedling.

Flowering, fruiting and seed maturation are energy and water consuming events. From a strict energy replenishment point of view, it would be advantageous to bloom and fruit during the rainy season, when soil water is most plentiful and photosynthetic rates are at their maximum. However, this will result in seed dispersal at the end of the rainy season, which is an unfavourable time for seed germination. The alternatives are:

1. To bloom and fruit during the rainy season, producing seeds that will not germinate until the following year,

Or,

2. To bloom and fruit during the dry season, producing seeds capable of immediate germination at the beginning of the rainy season.

The first alternative may well result in more flowers and seeds but because seeds are exposed to predation in the soil for an entire year, there is greater pregermination mortality. There is an inverse correlation between seed size and ability to survive in soil. For the second alternative, the reverse is true — the seeds need not have adaptions to survive the dry season, but the plants bloom and fruit when water is most scarce. This may limit the number of flowers and fruit produced. Since succulent plants have water available to them during the dry season, they would be expected to adopt the second alternative. Other plants may be forced to adopt the first alternative.

Two poorly defined groups of species can be recognised in relation to pattern of leaf and shoot initiation in the Bolson de Pipanaco. One group, the majority of the species studied, is formed by species where vegetative growth starts as soon as temperature increases in the spring (September). The other group is formed by species that delay the onset of vegetative growth until November, December, or even January, depending upon the start of the rainy season. Of the species studied, Acacia furcatispina, Bulnesia, Cercidium and Mimosa are in this category.

One group of species (Cercidium praecox, Jatropha macrocarpa and Prosopsis chilensis) bloom during the dry spring and drop their seeds in January at the beginning of the rainy season. Acacia aroma also blooms during the dry season, but its fruits do not ripen until the onset of winter.

Five species (Bulnesia retamo, Ximenia americana, Cassia aphylla, Larrea divaricata, L. cuneifolia and Tricomaria usillo) bloom occasionally during the dry season, if there are off-season rains. Many of these flowers do not produce fruits and seeds, but some do. The big flowering takes place during the rainy season.

Desert Animals

Desert climates are characterised by long periods without rain, lack of available surface water most of the year, great diurnal variations in temperature, and extremely high midday temperature in the summer. Maintenance of a favourable internal water balance under hot, dry conditions is difficult for amphibians and most mammals, but relatively trivial for insects, reptiles and birds. Heat that is excessive for all living organisms does occur regularly during summer days and can be avoided by living in shaded areas, or by being active when temperatures are lower such as at night, dawn or dusk.

Mammals must lose a certain amount of water to excrete nitrogenous waste products, since urea is more soluble than uric acid. Large animals are not readily able to avoid desert heat and require large amounts of water to maintain their water balance. Desert rodents generally minimise heat gain by being nocturnal or crepuscular and by living in cool burrows during daylight hours.

Granivory is probably one of their major adaptations. Seeds are one of the most abundant and predictable resources in deserts. Seeds form small, easily stored, high energy food packets. However, none of the rodents is able to exist indefinitely using only metabolic water and/or water contained in air-dried seeds. But rodents from the Bolson de Pipanaco do not seem to be as highly adapted physiologically for a desert existence as numerous species from other deserts. They have not evolved the ability to exist without free water and depend upon succulent vegetation for their water requirements. The overall impression after studying mammals at this site is one of faunal scarcity.

Invertebrates: Grasshoppers; Ants, 77 species; Bees, 116 species; Spiders, 13 species; Scorpions.

Vertebrates: Frogs and toads, 14 species; Lizards, 15 species; Snakes, 14 species; Turtles, 1 species; Mammals, 32 species.

The mammals consisted of: opposum, armadillo, gerbil, leaf-eared mouse, cavy, Patagonian "hare", tuco-tuco, fox, weasel, skunk, puma.

Flower — flower visitor systems

Ephemeral species comprise a substantial part of the summer flora at Andalgala. Selfing is highly correlated with the annual habit throughout the world, and the annuals in this desert and scrub area we investigated showed a high level of selfing.

Nonsocial insects such as bees, wasps (presumably the author means solitary bees and wasps — H.M.) and flies are favoured by warm temperatures for maximum activity and dry, open areas for nest sites. Both of these conditions abound in hot deserts.

One group of plants utilising insect pollinating agencies, predominantly species of the lower bajadas and flats, consist of medium-sized, open, dish-shaped regular or slightly zygomorphic, yellow flowers. Species with this type of

flower include: Larrea divaricata, Larrea cuneifolia, Bulnesia retamo, Cercidium preacox, Tricomaria usillo, Cassia aphylla, Zuccagnia punctata. These flowers can loosely be considered as unspecified bee-flowers.

The second class of flowers common over this area is small, pale coloured and clustered into spherical or spicate inflorescences. Species with this floral morphology are most common along washes or on upper bajadas and include Prosopsis chilensis, P. flexuosa, Acacia furcatispina and Mimosa ephedroides. All these studies excluded members of the Cactaceae.

The most abundant group of flower-visiting vertebrates in the deserts are nectar feeding hummingbirds. The most regular hummingbird visitor, Chlorostillon aureoventris, breeds in adjacent mountain canyons and descends to the desert to forage on such shrubs as Bulnesia, Cercidium, Hyaloseris and Tecoma. Other migrants are frequently present in very early spring or late summer foraging about the long tubular-flowered mistletoe Psittacanthus cuneifolius which infests many riparian trees.

Far more abundant than flower visiting vertebrates are pollen and nectar feeding insects. Typical is the prevalence of Hymenoptera, Lepidoptera and Diptera, with solitary bees, wasps and beeflies being particularly abundant and diverse.

The numbers of species and individuals of Lepidoptera were observed to fluctuate widely from year to year during the study period. Irregular outbreaks and periods of low density appeared to show no direct correlation with resource availability for either adults or larvae. This may possibly be due to variation in pressure from predators or parasites. The most extensively used taxa include mimosoid shrubs, Compositae and a variety of other shrubs with flowers having relatively deep-seated nectaries, that are commonly aggregated into heads or similar inflorescences.

Using a different set of hosts are the larger, most active lepidopterans such as the Sphingidae — long tongued hawk-moths. Primarily nocturnal or crepuscular, these large moths tend to frequent large, pale, nectar-rich flowers of such nocturnal blooming species as Habranthus, Nicotiana and various Bromeliaceae.

Another abundant group of nectar feeders prevalent here are bee flies (Bombyliidae). Differences in foraging patterns are evident among species due to differences in mouthpart lengths.

The dominant group of flower-feeding insects is bees with more than half the species of dominant perennials at each site being exclusively or predominantly bee pollinated. This desert has a rich fauna of solitary bees, while social bees are virtually absent. Species of bees with long flight seasons include such abundant species as Centris brethesii (Hemisia), Svastrides zebra and various species of Xylocopia and Megachile.

A possible basis for the extended period of activity at Andalgala is the presence of several subterranean river systems which permit a low level of (but virtually continuous) flowering by several species of riparian shrubs and trees throughout the dry spring and early summer.

Large variations in composition and abundance of bee species, within a given site between different years, made comparisons difficult. Bee species encountered at Andalgala site were: Colletidae, 28 species (Colletinae, 18 species; Diphaglossinae, 4 species; Xeromillisinae, 6 species), Halictodae-Halictinae, 8 species; Oxaeidae, 1 species; Andrenidae-Panorginae, 12 species; Megachilidae, 29 species (Lithurginae, 1 species; Megachilinae, 28 species) Anthophoridae, 36 species (Anthrophorinae, 31 species; Nomadinae, 2 species; Xylocopinae, 3 species) Apidae, 2 species; Bombinae, 2 species. The bees are listed in approximate order of tongue length, starting with the shortest-tongued species.

The bees are listed in approximate order of tongue length, starting with the shortest-tongued species.

Comments

. . . . . From H. Middleditch

Of the wide diversity found among the Gymnocalycium seeds, the plants with medium-large seeds are found in the grasslands and meadows of central Argentina; those with the largest seeds of all are to be found in the grasslands of Uruguay and southern Brazil which enjoy an even more favourable rainfall and denser grass and herb vegetation. The smallest Gymnocalycium seeds are to be found in the hot, dry lands of the Chaco, in the deep inter-Andean valleys and in the Bolson de Pipanaco. In the Parodia there is also a fairly broad range of seed sizes to be found; those plants with the larger seeds grow in central and southern Bolivia. The smallest Parodia seeds are borne by plants of the Microsperma group which are found generally on dry, exposed slopes of the Andean foothills, or in the deep inter-Andean valleys, and on hill ranges to the east and south of the Bolson de Pipanaco. It is understandable that the rodents which rely on seeds for an important part of their food intake, will find it very difficult to search for large seeds amongst grass and herbs, but far more practicable to seek out seeds on a desert-like floor. The larger, more or less rounded seeds would be rolled over the desert floor by the wind until they collected together in a hollow, just waiting for a searching rodent to find them and make a meal of them. Smaller seeds will be less easily blown about by the wind and trivial hollows or the shadow of a large granule of sand will shelter them from a wind which could have continued to roll larger seeds. Smaller seeds will thus be expected to have a widespread dispersal over the desert floor, only marginally affected by the wind collecting them into pockets. Where granivorous rodents exist, this wide dispersal will increase the chance of survival of a small seed in comparison with larger seeds. Does this now afford us an explanation for why the Gymnocalycium and Parodia growing in this part of Argentina possess small seeds?

The conception of "heat load" on a plant perhaps strikes one as somewhat unusual at first acquaintance — possibly due to being familiar with the ability of human beings to offload excess heat via sweat glands over most of the body, or dogs offloading excess heat via sweat glands on their tongue. But in conditions of arid heat and scarcity of replacement water, cacti will probably have their limited number of stomata in a closed condition, when they will be able to transfer neither moisture nor heat from the plant body to the surrounding atmosphere. Hence their internal temperature must rise appreciably if they are exposed to the full sun. The effect of this was observed by Rauh (Chileans No.36 p.114) when he cut open a Melocactus fortalezensis and remarks upon the extraordinarily elevated temperature attained by the interior of the plant.

There is no clear observation in this article that would tell us positively that the cacti in this area flower prior to the rainy season, thus setting fruit and shedding their seed so that it is in time to germinate at the onset of the rainy season. However, although the fruit on Gymnocalycium tend to remain for many months in a turgid condition, a significant difference appeared when we had a really good summer, long, long ago (1977 was it?). The intensity and duration of sunlight could have been rather closer to that which the plants encounter in the wild and it was rather surprising to see how quickly the fruit on Gymnocalycium dried up and dehisced. Is this process even quicker in habitat? The process of flowering involves fairly heavy water consumption by the plant and if this occurs prior to the rainy season when replacement water is virtually unobtainable, the plant has only one recourse — to put out flowers in small numbers or even singly in order to conserve water. My own plants from the surroundings of the Bolson de Pipanaco appear to do this. On both counts, therefore, it seems probable that the Gymnocalycium will flower and fruit, prior to the onset of the rains. Hence, in cultivation, could these Gymnocalycium appreciate a supply of water for a month or two after the flowering season?

It is particularly interesting to read the statement that "CAM plants have . . . a strict requirement of high day temperature and low night temperature", as I am under the impression that many cacti are CAM plants. Several comments have appeared previously in our pages from members who felt that various plants in their collections seemed to grow fairly well in Spring and Autumn, but little — if at all — during the height of the summer. My own experience suggests that growth can be quite remarkable in autumn when the days are often bright and warm, but the nights are quite sharp; this fits the warm day/cold night regime defined by Orians and Solbrig. Does this mean that all my cacti that grow well in autumn are CAM plants?

SPECIALISED FLOWER POLLINATION **From J. C. Hughes**

In several recent issues of The Chileans there have been articles discussing the suitability of certain cactus flowers for humming bird pollination. In the last of these articles in Chileans No.38 p.178, the relationships of pollinators and pollinated plants was discussed in general and this raised several ideas in my mind. Some plants are apparently designed for pollination by a particular species or genus of insect. Among xerophytic plants an example would, I believe, be Yucca breiflora (The Joshua Tree) where one particular moth is responsible for the pollination. It seems strange that a plant should ever develop to such an extent as to exclude pollination by any other insects. I suppose that the most probable reason for this specilisation is that its pollen will not be wasted on chance visitors who may visit other sorts of flower before returning to a sister plant. One might expect the specialised insect to concentrate on this plant almost exclusively, perhaps developing a taste for that particular strain of nectar, in much the same way as we do with wine.
way as we do with wine.

Such specialisation would, however, seem to have serious drawbacks. The attack of a virus disease, a forest fire, or the encroachment of man could decimate a wild population of plants. What, then, happens to the insect? At least it is mobile and driven by sheer hunger it may find an alternative source of food; but what happens if the insect population falls victim to some external influence? It certainly seems improbable that the plant, especially a cactus, could evolve sufficiently rapidly to ensure survival by the use of a different pollinator.

One last thought on the pollinator: certain flowers, such as Notocacti, have short flowering seasons. If plants of this nature have evolved to use a specialied pollinating agent, what would the insect feed on during the rest of the year? With the Yucca moth, must we assume that the adult phase corresponds to the flowering period of the Yucca? Perhaps some more information concerning the insect life of South America would yield some clues about our plants and their pollinators?

. . . . . From G. J. Swales

It is suggested that an insect dependant upon a specialied flower for its source of food, could always make a change and visit an alternative food source if its normal source of food supply failed for any reason. However, a great many insects which are specialied to a particular food source are quite incapable of moving to an alternative source of food and will die among an abundance of alternative food. It is also asked what an insect will feed on during the large part of the year when its own specialised flower is not in bloom. There are many adult insects which have a very limited life span; I would not be at all surprised to find that there is some degree of matching between the life span of an insect which is specialised to visit one flower and the blooming period of the plants which it visits.

. . . . . From H. Middleditch

It is not just abnormal external factors which can cause the non-appearance of a population of wild flowers. In "Ecology" Vol.54 No.4, 1973, J. H. Brown observes that "annuals have adapted to the unpredictability of desert climates by

evolving mechanisms which ensure that only a portion of their seeds germinate each season. This is essential because many desert areas receive rainfall sufficient only for annuals to produce a new crop of seeds every second or third year." So we might well ask the question as to what happens in non-flowering years to those insects which rely on such annuals, or any other flowers, for their food.

It may be imagined that when one particular flower does not bloom that insects may turn to an alternative flower for food. But it is not just one sort of flower which is affected by a poor season and this means that in a poor season, it is most probable that no alternative food source is available. In addition, many insects from arid areas obtain their food not from a variety of plants, but from only one species or from one or two quite closely related species. Those insects which are programmed from birth to seek food in this manner are called oligolectic. In arid areas, almost all of the bees are solitary bees; a large proportion of the solitary bees are oligolectic. Thus a fairly large number of bees in arid environments rely on one species or a small group of closely related species of flowers for their food, even though these flowers cannot be relied upon to appear unfailingly every year. Hence the question posed by J. Hughes is not a hypothetical one, but a fact of life that has to be faced from time to time by insects domiciled in an arid zone.

It may be as well to bear in mind that many solitary bees fly for a relatively small number of days in the year. Hive bees and other social bees will fly for one hundred days (or perhaps more) in one year; some solitary bees fly for as many as eighty days in a year or as few as 25 days per year. Generally, the oligolectic bees have the shorter flying period. For the remainder of the year, the bees retreat to their nests where a few will survive until the next flying season; in addition to the survivors from the previous season, the next generation will also emerge either at that time or shortly afterwards, for their flying life which may be as little as three weeks. If it should occasion surprise to find that the flying life of one generation of bees is so short, it may be recalled that the flying life of a mayfly is one single day.

The flying life of an oligolectic bee appears to be controlled by various environmental factors which also equally affect the vegetation. Thus, the actual days on which oligolectic bees are found in flight are also those on which the flowers are open which the bees use for food. Not only that, but where the flower is open for a specific portion of the day, the part of the day during which the oligolectic bees are found in flight will correspond closely to the opening times of the flower. Take for example the white-flowering species of the evening primrose or Oenothera. These species open at or near sunset and will close/wilt at or near sunrise (A. G. Linsley, J. W. McSwain and P. H. Raven — Comparative behaviour of bees and Onograceae; University of California publications in Entomology Vol.33 No.1, 1963). Taking O.hookeri in particular, flowers would start to open from about 20 minutes before sunset up to 20-30 minutes after sunset, this varying from colony to colony. In any one colony about 20-30 minutes elapsed before all the flowers in a colony were open (D. P. Gregory — Hawkmoth pollination of the genus Oenothera; Aliso Vol.V No.3). The Halictine bee Evyglaeus galpinsiae is known to be oligolectic on Oenothera pallida (G. E. Bohart and N. N. Youseff — the Biology of Evyglaeus galpinsiae; Wasmann Journal of Biology 34.2, 1976). This bee was only observed in flight during the time of day that the flowers of O.pallida were open, and only for those days on which these flowers were open.

Observations were carried out at one site for a period of five years, and in 1972, there was a poor season and for practical purposes none of the Oenothera pallida came into bloom at that site. Likewise for the whole of the observation period in 1972, no bees of Eveglaeus galpinsiae were seen in flight. In 1973, there was a better season and once again the flowers bloomed. The oligolectic bees were also seen in flight once again during the 1973 flowering season. These first flying bees of the 1973 season had retreated to their nests at the close of the 1971 flowering season so that at the opening of the next (the 1973) flowering season, they were two years old. Thus the answer to the question put by J. Hughes is that, in this particular case, when the food source failed to appear, so did the insects dependent upon it.

Just in case it may be considered that the foregoing relationship is a good example of a close association between pollinating insect and pollinated flower, it should be noted that in Oenothera pallida the anthers and stigma project above the petals which act as a landing platform for a bee — far enough above to be untouched by a bee which flies in and lands on the petals. Apart from a blundering bee making a bad landing, in which case the flower may become pollinated by chance, the bee contributes little or nothing to the pollination of the flower. Pollination is affected by the hawkmoths which visit the flower during the hours of darkness.

Many cacti grow in arid areas which provide suitable ground in which solitary bees can make their nests. Those cacti which have open, rotate flowers such as Notocacti, Neochilenia, Opuntia, give the impression that they are suitable for bee pollination. But bees do not like strong winds, nor damp air; on the coasts of Chile where the onshore mist prevails, there are far fewer bees than in the inland districts. So at the coast, where there are few bees we find the Neoporteria, with flowers suited to humming bird pollination; inland from the misty coast, where bees are far more numerous we find Neochilenia, with flowers suited to bee pollination. In the arid zone of the Chaco, the basin of the Salinas Grandes and the basin of Pipanaco, we find Gymnocalycium of the Muscosemineae and Microsemineae groups which have flowers where the stamens curve over the top of the stigma, covering it from view. This is not the sort of flower construction which is found in flowers known to be pollinated by bees. Are these Gymnocalycium flowers orientated towards some other sort of pollinating insect? In the Pipanaco basin, there are records of solitary bees (Orians and Solbring, this issue), so why should these Gymnocalycium produce flowers which are not like orthodox bee flowers? Can it be that the flying days for the solitary bees

simply does not coincide with the Gymnocalycium flowering season? Or is there some other selective mechanism at work which has led to these Gymnocalycium producing forms of flowers that are less suitable for bee pollination and more suitable for some other sort of desert insect? Why should these plants develop in the direction of a different specialist pollinator? Is it "strange that a plant should ever develop to such an extent as to exclude pollination by other insects"?

In his "Ecology of solitary bees", E. G. Linsley suggests that "it appears quite obvious that bees which as individuals or as a species collect pollen from only a few species of plants are likely to be more efficient pollinators than those which utilise many." Presumably he has in mind that if a bee is in the habit of visiting only one plant, then every visit to a flower provides a chance of cross-pollination; if a bee normally visits two sorts of plants, there is only a 50% chance that two consecutive visits will be to the same sort of flower; and if a bee is in the habit of visiting various sorts of plants then there is even less chance of cross-pollination being affected. Hence it is to the advantage of a plant to be visited by oligolectic bees. But what does the insect stand to gain from such a system? In the case of Oenothera hookeri, the flower tube is narrow in proportion to its length; the lower third of the tube forms an open chamber round the style, in which nectar accumulates; the middle section of the tube carries a dense mat of short hairs standing straight out from the tube wall and abutting against the style; immediately above this section, the walls of the tube are covered with longer hairs which point downward. Where the longer hairs begin on the tube, there is a corresponding section of the style which carries lanate hair, which in general points towards the orifice of the tube and so opposes that on the tube wall. This evidently obstructs any access to the nectar by ants which are so common in arid environments and probably greatly restricts access to the nectar for any other chance visitors. But access to the nectar is freely available to the pollinating hawkmoth which is able to insert its long tongue without difficulty past the barricade of opposing hairs.

Hence the advantage of this specialised pollination system to the flower is that of improved likelihood of cross-fertilisation to the hawkmoths which are the prime pollinators the advantage is that of an assured supply of nectar and to the bees the surplus pollen provides a source of food. But the insects have an additional advantage from this specialised system. In years when flowering is poor and there is a shortage of pollen, the hawkmoths are only in competition with their own species for the limited supply of nectar and the bees are also only in competition with their own species for the pollen. By this means, each species would be assured of a minimum of food for the survival of the species, whereas if a number of species were competing for pollen or nectar in times of scarcity, the less able ones would be exterminated. In fact, the less able species have already been exterminated by this sytem, leaving only those with an inter-related pollination/food source system which is efficient enough to survive. In less arid climates where the annual rainfall is far more regular and consistent, food sources are far more reliable from one year to another; insects are not obliged to develop a food source/pollination system which ensures that a proportion of that species will survive when the food source is sorely depleted by drought or other similar natural disaster. Hence there is far less need for oligolectic specialisation of pollination systems to ensure survival of the species. In arid climates, where rainfall is far more erratic, there is an increased need for oligolectic pollination systems if the survival of insect species is to be assured. Hence flowers on cacti are quite likely to reflect an oligolectic pollination system, by the form or absence of the landing platform, the relative disposition of stigma and stamens, and the degree of protection afforded to the nectar.

What is the nature of the pollination ecology of the Gymnocalycium from the Pipanaco basin which has led to the flowers adopting their particular form? Does that form extend to those Gymnocalycium which come from a less arid area, such as the Sierra Cordoba? Is the flower form substantially similar among all the "species" of Gymnocalycium from the Pipanaco basin and the surrounding mountains? What is the particular pollination ecology which appears to cause Soehrensia from the dryer western half of the Pipanaco basin to carry the stigma in the centre of the flower on a stiff, more or less straight style, while the Hilianthocereus from the less dry eastern margin of the basin have a flexible style which leans against the inside of the wall of the flower tube? Do Lobivia/Helianthocereus/Trichocereus vatteri, andalgalensis and crassicualis have a stiff or a floppy style?

COPIAPOA LEMBCKEI Bckbg. sp. nov. By C. Backeberg

Translated by E. W. Bentley from Die Cactaceae Vol.III, 1960

At first globose, later more or less cylindrical, up to 15cm (or more) long, whitish grey-green, up to about 10cm diameter, with strong root; ribs 11, rounded, later about 2.3cm wide, not set obliquely; areoles set fairly closely, about 6mm apart, 7mm diameter, felted grey-black, black when wet, round; radial spines seemingly always 7, radiating up to 13mm long, straight or somewhat recurved: central spine 1, up to 2.2cm long somewhat pointing somewhat upward; all spines at first blackish to black, later going grey or of a dirty yellow colour and somewhat hoary-grey, the spines rather stiff, bristling out from the body in a fairly dense bundle, even to the extent of touching each other. Chile, north of Caldera.

I hope to give further details in Vol. VI. The species stands perhaps near C. cinerea, but has however a relatively small grey-white crown and by reason of its growth form and the smooth ribs, which are covered with a floury grey-white coating, and also the close bristling characteristically coloured spines, is a good and handsome species. I name it after its discoverer, Herr Lembcke, Santiago, Chile.

(In Backeberg's "Die Cactaceae" Vol. VI, the further details concerning this species appeared under the

heading of Copiapoa pendulina; a translation of these observations will appear in this series. In Backeberg's Kakteenlexikon, the entry reads "Flower — ?". — H.M.).

Comments

. . . . . From E. W. Bentley

My plant of Copiapoa lembckei was obtained from Sargant in the January of 1970 under Lau's number SH825 — said to be from North of Caldera. It was about 75mm in diameter and had a pale elongated offset — obviously formed or at least grown on in the dark during transit. The flower, disappointingly small, opened on July 8th 1970. It hardly emerged from the wool in the crown — compared with most Copiapoas which stand well out above the wool.

Now that I have the official description of this species, I would say that my SH825 fits it fairly well. The old areoles are about the right distance apart but by then are rather less than 7mm diameter. The radials are not very spreading, but they are indeed about 13mm long and the central spines are erect and about 22mm long. The young spines are not black at first; they are definitely brown and go black and then grey lower down the plant and they certainly do not touch laterally — only along the ribs. Perhaps that is what Backeberg meant because he says the ribs finish about 2.3cm apart — which is the case in my plant. I would have said that the epidermis was matt and bluish but perhaps not really "chalky", for the epidermis is not too different from my "streptocaulon". I have probably been paying too much attention to the wool dust that is formed fairly freely and tends to coat the upper part of the plant. This also happens, but less obviously, in the "streptocaulon". The new wool in the crown is cream (as on SH829), not white, and so is the wool of the seed-grown plants of this species. I am reasonably sure that the miserable size of the C. lembckei flower is a permanent feature. The blooms that appeared these last two summers were no bigger than the flower that appeared soon after I bought the plant and they were also fairly embedded in the wool.

What puzzles me are the numerous seedlings that I have grown as C. lembckei. In these the spines do indeed begin black and are very like the offsets of the "streptocaulon" and near enough to the offsets on the imported C. lembckei. None of them look as though they will ever grow into the latter type of plant and some are 8 to 9 years old.

. . . . . From A. W. Craig

My plant of SH825 also came from Sargant; it has grown a little in cultivation and is now about 9 inches high and about 7 inches in diameter near the base; it is not quite cylindrical as it tapers slightly towards the top. There were 13 ribs on the habitat growth and two further ribs have appeared on the cultivated growth. The lower half of the plant has a very greyish coating and is not really corky; above that the body is matt green — that is, green with a chalky appearance. The uppermost part of the plant is a less chalky matt green colour. On the most recent growth the areoles are more or less 10mm apart, but on the early cultivated growth and on the last habitat growth the areoles are confluent and measure about 5mm across the wool. On the older habitat growth the areoles seem to have grown closer together vertically and are more or less 5 to 6mm apart; with regular spraying, much wool has been removed from the old areoles so they can be seen to be separated.

The crown is covered with a creamy-white wool from which the new chestnut brown spines appear. Later the spines go greyish but some of the old spines are a golden yellow colour something like the colour of the wool in the crown of my C. haseltoniana. The central spines are barely 20mm long and the radials are more or less 15mm long, pretty well straight. In the new areoles the radials are spreading, but with the compression of the old areoles the spines are either in line with the rib or else spreading sideways and projecting, so that on the bottom half of the ribs, there are three distinct vertical rows of spines.

This plant has now put out some flowers which looked as if they had no tube at all, they were so deeply immersed in the wool which grows over the crown of the plant.

. . . . . From Mrs. L. Teare

I have three plants of C. lembckei, one of which is an imported plant that I obtained from Sargant and brought out with me from England. It is 15cm high, 6cm diam. at the top and 9cm diam. at the base, 17 ribs, bluish green skin, one central spine 5mm long and six radials, white towards the base and reddish towards the top, except the lower radials which are a dirty grey black at the tip. This plant must have had its apex damaged in quarantine, as it has grown a "hat" and a much more spiny one than the original plant; the areoles there are barely 2½mm apart and the wool in this crown is creamy orange. Further offsets are growing all round the base and these are extremely spiny, just like the new growth at the crown. It is now starting to put out more offsets about two-thirds the way up the body. But it has never flowered.

I also have two seedling plants and these are one of the slower growing of the Copiapoas. One of these three year old seedlings flowered this summer. The body is the same colour as the imported plant, but it has a velvety skin; it has twelve ribs that are more wavy than the import. The areoles are about 5mm apart, with one central spine about 10mm long pointing downwards and eleven radials, the lowermost the longest and 12mm long, the three lower spines slightly recurved, the next three on each side shorter and the two uppermost spines shorter still, the longer spines brown to black, the others reddish-brown, dark at the tip and straw coloured at the base. The spines are the same colour as those in the new growth on the imported plant, but weaker. The areoles are not very woolly, but the apex is completely covered with creamy wool.

The second seedling has much stronger spines which are entirely black, from areole to tip, central 8mm long, radials 5mm long, with buff coloured wool on the areoles. The spines are nearer those on the import although this seedling is only 30mm diameter and the previous one is 50mm in diameter. So I am beginning to wonder if my first seedling really is a C. lembckei as the spines on the areole are set out quite differently, and the body is quite definitely smooth and velvety. Can there be such variation in one species?

Some time ago I started a study group on Copiapoa out here and although I have Backeberg's books, Britton & Rose, Taxon, and Cactus (the old one), we still cannot trace anything about a number of Copiapoa. We have been lucky to get seeds of the rarer ones from Knize, but there is also the difficulty that the younger plants are so different from the mature ones. Can anyone help with our problem?

. . . . . From E. W. Bentley

I have come to the conclusion that many Copiapoas have not only one juvenile form which can differ from the adult form, but two. One of these is in seedling plants and the other is seen when adult plants are offsetting. The offsets now breaking out of the C. longistaminea look as though they belong at the coquimbana/vallenarensis end of the shelf! An elongated Copiapoa with a yellowish-green body and slim, curved, ginger-brown spines has produced a number of offsets that I have removed and rooted up; these offsets have remained flattened globular in shape and have themselves put out further similar-looking offsets, so I now have a clump of flattened globular heads that has grown into a much larger pot than the original columnar parent.

Some Copiapoas also seem to vary very much according to whether they are on their own roots or not. One plant I have, when grafted, had the tubercles so flat that they were almost non-existent. After less than a year on its own roots (during which time it has flowered), its tubercles are now conical (like some Mammillarias) and each one has developed the distant miniature "spine" or vestigal leaf below the areole. This particular feature can be seen in small seedlings of species such as C. hypogaea and in very young areoles in the crown of C. hypogaea and C. barquitensis. Another thing that has happened to this plant after I established it on its own roots, it is now hemispherical instead of spherical, and olive-green instead of purplish black. It is all very difficult! This is the trouble with Copiapoas. There is no decent base line for many species; even seed comes up often differently from what the label leads one to expect.

However, I have no difficulty in vizualising two species that are closely related and several hundred miles apart, while other pairs are close together. You can overdo this business of geographical propinquity. Birds, for example, can carry seeds about and I doubt if there are big enough climatic and edaphic differences between one part of the coast of northern Chile and another that would determine whether a given species of Copiapoa would survive or not if accidently carried there — though I am not saying that there have not been such differences in the geological past.

. . . . . From R. Ferryman

I have insufficient Copiapoa seedlings and juvenile offsets to compare although I would expect offsets to look "more mature". When young Copiapoa seedlings (up to three months old) are grafted on to Peireskiopsis, rather than bloating they form almost adult-looking plants very quickly. Why a 4-week old seedling should grow away to form the equivalent of a 2 to 3 year old plant within a few months intrigues me. Having grafted over 100 seedlings this year, I can confirm that only in certain circumstances do they grow bloated. This seems to indicate to me insufficient knowledge when raising seeds — we obviously don't know all we should.

. . . . . From H. Middleditch

I have three seedling plants labelled C. lembckei which are quite consistent in having seven radial spines at each areole; they also exhibit the pale brown areole wool at all but the oldest areoles. An imported plant from Hallet, which came as Lau 809, but might have been 829 i.e. from north of Caldera, has up to eleven spines per areole; these are bunched together so that up to four spines could be regarded as centrals. Two other imported plants exhibit as few as five spines at some areoles (possibly where the two topmost and weakest spines are missing), often nine spines per areole and not infrequently up to eleven. One plant has nine ribs and the other has thirteen. Should these plants be described as C. marginata because they do not "always" have seven radial spines? Or should they have a new name altogether, because the rib count matches neither that for C. lembckei nor that for C. marginata? Or do we accept that Backeberg is describing just one plant of C. lembckei, not the range of rib and spine count in the population? And if this is so, can C. lembckei be synonymous with Echinocactus marginatus S.D.? Backeberg clearly regarded the non-columnar plant from near Antofagasta as C. marginata and presumably did not regard Pfeiffer's original description of C. marginata as relating to a plant from Caldera or its vicinity.

In my own collection I have a plant of Copiapoa streptocaulon Kz.72, which came in a joint order direct from Knize in Lima. But Kz.72 was first listed as Copiapoa echinoides; it is so named and illustrated in Dodonaeus 6:6, 1968. On a visit to Jumanery nursery in 1976, I found on the staging a selection of C. lembckei which had recently been received from Knize, and among them were two or three specimens that were pretty well an exact match for my Kz.72 Copiapoa streptocaulon, ex-Knize. This probably goes to show that the well-established practice of giving plants the wrong name and the wrong place of origin is not being allowed to fall into disuse.

SETICEREUS ROEZLII FLOWERS From R. Mottram

The plant which appears on the front cover is a top cutting about 7cm in diameter and some 20cm high, which was received from Knize in 1978. It gave no problem in rooting down, but for a plant which grows up to two metres high in the wild, it has put on new growth at a very slow rate. The first flowers appeared in the autumn of 1978, but in spite of carefully ensuring that pollen reached the stigma lobes, they failed to set any fruit. The flowering performance improved further in 1979, but once again most of the flowers failed to produce fruit. However, one flower did finally set fruit, without any help from me (and I suspect without any help from the insects) followed in due course by a second. The fruit is undescribed, either in the original description or in Backeberg's works.

The fruit on this plant develops in a similar way to most other Borzicactinae, very slow to form initially, with prominent podaria, and dark green in colour. After some weeks, it starts to ripen rapidly, swelling to about 4.4cm in diameter, losing the podaria and changing colour to a pale yellowish green. The surface carries a few tiny, slightly hairy areoles. The fruit is indehiscent, and the seeds are embedded in a white fleshy pulp, just like the fruits of Seticereus icosagonus and Cleistocactus baumanii, but of course much larger. Unlike other fleshy-fruited plants, it was surprising to find that the fleshy pulp had a bitter, acidic taste, rather like unripe apples, although I wonder if this was simply a case of it not being quite ripe.

The flowering areoles of this plant are very weakly armed. Many carry spines in the lower part of the rather large areole, while the upper portion carries only a few weak bristles, mostly shorter than the spines. It differs from the original description in having 13 ribs, against the 9 quoted for this species (Backeberg states "up to 9") and there is also an implication that flowering branches should carry many more bristles. However, Backeberg does mention a variety or form which flowers quite profusely even when small, in which the flowering zone does not develop any bristles for a long time, and even then they are relatively sparse. Perhaps we have this particular form, which is being collected by Knize from the higher part of its range, at 2000m near Huancabamba.

From illustrations I have seen, Seticereus roezlii appears to be a rather variable species. Our example has regular flowers, although some forms are slightly zygomorphic. The more strongly zygomorphic Cleistocactus chotaensis from the banks of the Rio Chota is perhaps related, and the same general reluctance to produce fruit has been experienced with the flowers on that species.

. . . . . From H. Middleditch

An examination of the available literature suggests that the four species of Seticereus may be conveniently considered as two distinct pairs: the sprawling S. icosagonus and S. humboldtii on the one hand and the upright, branching mini-trees S. chlorocarpus and S. roezlii on the other hand. So what distinguishes S. roezlii from S. chlorocarpus? They would both appear to grow in the Huancabamba valley and also over the crest of the cordillera on the neighbouring Pacific flank. In his Die Cactaceae, Backeberg says that S. chlorocarpus may be distinguished easily from S. roezlii by the absence of a sharp V-shaped groove above the areole. Does he mean a V-shape in the section of the groove or a V-shape when you look at the rib? If the former, does this groove separate the areoles on elongated hexagonal tubercles, like Loxanthocereus granditessalatus?

. . . . . From R. Mottram

On this plant of Seticereus roezlii the V-shaped groove is quite well-marked, but it terminates before it reaches the furrow where the base of two adjacent ribs come together. Hence this groove is nothing like that on Clistanthocereus tesselatus etc., where the inter-areole grooves run directly into the intergonal furrow. Incidentally, the term "intergonal" was invented by yours truly to refer to the line which runs down the channel between the ribs. I had intended introducing the term and the concepts behind it in my "Genera Cactacearum", but since this has so far foundered on the rocks of the establishment, you can have the doubtful privilege of introducing it in the Chileans, if you wish.

There are three basic stem forms in the Cactaceae, representing evolutionary development of the stem morphology through the family.

Stage 1. A non-ribbed flat or more or less cylindrical stem; this occurs in Peireskia, Opuntia (except Grusonia) and some Rhipsalis. The areoles are scattered over the surface of the stem, more or less in a regular, equidistant pattern.

Stage 2. An angled stem. This occurs in all other epiphytic cacti, other than the non-ribbed Rhipsalis, and it occurs in some cereiform genera, such as Armatocereus, Acanthocereus, some Echinocereus, some Harrisia, and a few other minor genera. Here the areoles are organised into prominent vertical angles, without any vertical discontinuity between them.

Stage 3. Ribbed stem. This covers the remainder of the Family, and here there is a line running down the centre of the region between the ribs, representing a discontinuity in the angle. Presumably this feature assists the folding process which allows for the shrinkage of the stem.

All three stages may have the podaria formation at each areole, and of course as the stem reduces towards the globular stage, further transverse gooving may occur, as in the V-formations of the Echinopsidinae and Borzicactinae. It is the line of discontinuity between the ribs which is only found in Stage 3, that I refer to as the intergonal groove.

. . . . . From H. Middleditch

To my mind, the suggested term "intergonal" does not seem too happy. According to Stearn's Dictionary of Botanical Latin, — "gonal" relates to angles and hence intergonal literally means between angles. I would have thought that since ribs=costis then intercostal or intercostate would have been a more appropriate term for something which lay between adjacent ribs. In addition, the method proposed for describing stem form would not appear to take into account long-established terminology which may well be quite suitable for this particular purpose. The schedule of such terminology published by Lindley in 1839 which is repeated with one or two additions by Stearn, includes a selection of "Stems and leaves", of various form. A plain cylindrical stem is described as terete and I would suggest that this is a quite satisfactory term which may be used rather than "non-ribbed". A stem with ribs but lacking a distinct groove between the base of adjacent ribs is defined as angled (Lindley 40), which matches Roy Mottram's terminology. However, there does not appear to be any stem form in Lindley's schedule which is angled together with a groove between the base of the ribs. How about Obcarinate i.e. the reverse of Lindley 44 — keeled?

. . . . . From R. Mottram

On reflection, I think I would use the term intercostate in preference to intergonal; now that my memory has been jogged, I do believe that this suggestion has already been made to me previously and I would now believe it to be more appropriate. However, when we come to stem forms, the range of terminology applied here by Stearn is quite bewildering, but trying to pick something which is suitable for cacti does prove to be difficult. Certainly I would agree that the most appropriate term for a long cylindrical stem is terete (Lindley 28). The flattened pads of Opuntia are really a modification from the terete stem and the most appropriate term for these appears to be discoid (Lindley 34); but this appears to apply to an actinomorphic shape, so for an elongated Opuntia pad do we have to use the term ovate-discoid? For my Stage 2, angular (Lindley 40) does appear to be quite appropriate.

In regard to Seticereus chlorocarpus, this was the type species for Backeberg when he raised the genus Gymnanthocereus. Later he realised that S. chlorocarpus was really a Seticereus after all, so he was left with no type species for the genus Gymnocanthocereus. He then described Gymnocereus to accommodate the two remaining species, which are allied to Browningia, with white nocturnal flowers. In regard to the other tall-growing species, Seticereus roezlii appears to have been re-described by Ritter as Borzicactus neo-roezlii on the basis that Cereus roezlii (Haage jnr.) Schumann is a different species and is really Borzicactus sepium! Ritter's original illustration of B. neoroezlii is similar to our plant of Seticereus roezlii, but his flowers are distinctly zygomorphic, and the flowering areoles are more spiny. Nevertheless there does seem to be some affinity.

. . . . . From H. Middleditch

In K.u.a.S. for April, 1961, F. Ritter writes about Seticereus roezlii and renames it Borzicactus neoroezlii, on the grounds that Cereus roezlii (Haage jnr.) K. Schumann is not the same species as Seticereus roezlii. In Schumann's Gesamtbeschreibung der Kakteen there is an illustration of the top of a Cereus roezlii; this certainly does look similar to those Borzicacti labelled as plagiostema/sepium/samnensis/morleyanus which have ribs and tubercles so blunt that they form almost a smooth body with faint lines between tubercles. From this situation, it is easy to understand why Ritter should consider Cereus roezlii sensu Schumann to be a different plant to that which grows between Abra Porculla and Huancabamba. Ritter goes on to observe that according to his observations, Borzicactus neoroezlii Ritter has orange-yellow to orange-red fruit, so that the more or less similar plants which have green fruits would be Seticereus chlorocarpus Backeberg synonym Cereus chlorocarpus H.B.K. of 1823. The relevant parts of Ritter's description translate as follows:

"Forming a bush or small tree from 1 to 3m high, freely branching, branches 4.5 to 6cm thick. Ribs 7 to 14. Kimnach observes that Johnson had found a form near Abra Porculla with numerous ribs. I am not able to verify this, since the rib count near Abra Porculla amounted to 7 to 12 according to my counts and 9 to 14 near Huancabamba. Just as little can I verify that the form from Abra Porculla according to Johnson should have more spines, since my Herbarium specimens from both these locations have the same spination, likewise even more or less the same appearance. Ribs shiny, very blunt above, not much wider at their base, 0.5 to 1cm high, 1.5 to 2cm broad, the longitudinal grooves between them are sharp, narrow, and sinuous. Ribs pretty deeply grooved with wing-grooves above the areole down to half the depth of the rib.

Spines brown, rarely black, going grey later, outer ones 10 to 14, later often up to 22, fine needle like, radiating around all sides of the areole, 3 to 10mm long, the lower or even the upper sideways directed ones the longer, all nearly equally slender, straight. Central spines occasionally 4 to 6 short and pretty slender of 0.5 to 1.0cm long, more usually one long, strong, sharp one, ordinarily 2 to 4cm long, occasionally up to 6cm long, straight or curved slightly downwards. On taller stems the spination becomes pretty well bristle-like, all very similar, projecting and more or less 1 to 2cm long. This bristle formation on older heads of B. neoroezlii, which bears no relation to the flowering zone, has nothing to do with the formation of bristles in the flowering zone such as may be found in Borzicactus icosagonus (Seticereus Backeberg).

Flowers 6 to 7cm long, unscented. The flowers are generally zygomorphic but all transitions are produced from strongly zygomorphic to actinomorphic. By chance it happened that I found on the one stem both one strongly zygomorphic and one actinomorphic flower standing side by side.

Fruit 2 to 4cm long, 2.5 to 4cm broad, in cross section more or less oval, orange-yellow to reddish-orange, with tubercles; pale scales 0.5 to 1.5mm long and 1 to 3mm wide with a few little white hairs at the upper end of the flat tubercles. Internal hollow elongated, more or less 1cm long, 0.5cm wide and 0.5cm deep with more or less pleated margin and with 1.5 to 3mm thick base with a stump in the centre (base of style). Fruit splits above when ripe, pulp white, juicy, not slimy, flower remains attached".

So much for Ritter's description. The "wing-grooves" over each areole are presumably the grooves which are perhaps akin in vee-shape to a sea-bird in flight when viewed head-on. The chunky ribs are certainly quite different from the smooth almost-flat tubercles seen on the group around Borzicactus sepium. Do they grow like this in cultivation?

A RIDE OVER THE WOODED CORDILLERA By C. Backeberg

Translated from "Stachlige Wildnis" by H. Middleditch

"Up there, where the three dark peaks tower up, it goes up to the black wall then left to the small basin. Then the road goes through the heights, an undulating plateau, and from there down the other side along to the Laguna Negra towards Huancabamba. We must ride about 18 hours!" So has Ignacio, the leader of my drivers, described to me the crossing of the west cordillera and added: "For the present, one can only get to that place with mules. However the survey for a road from Canchaque to Jaen will shortly be started. Nevertheless a considerable time will elapse before the first vehicle drives over the range."

I proceeded early to bed, in order to be well rested for the long ride, since we would depart in particularly good time on the following day. Before going to sleep I reflected on the stretch due the next day. We were to follow the old caravan route, which everyone had travelled for centuries, that runs through here from the coast to the upper Amazones. Decade after decade the patient mules and donkeys had walked over this trail to bring salt and a great many other goods to Jaen and to fetch back tobacco, the state monopoly, which the Indians cultivate to braid into long, solid, plaited sticks. I wondered whether I would be successful in finding all the species which Alexander von Humboldt once discovered there? Twleve days is not much time: it means pressing ahead with the work.

It is still dark when Ignacio awakens me. Outside I hear the mules pawing on the pavement with their hooves, the faint jingle of bridles and the conversation of the Arieros who are to accompany us on foot. From somewhere or other there comes the first neighing cry of one of our donkeys, that heralds the coming day. With a bound I am out of bed. Quickly I get myself washed, then I go out to my men, who were busy around the silent Plaza with a stable lantern. Here is a sack of Algarrobo nuts to be taken as fodder for the animals, there are the belly bands not tight enough, the stirrup of my mule must be lengthened a little, since the Gringo is not as short in the leg as the natives, and the balancing of the weight of the packs at either side calls for meticulous checking, since if not done correctly, everything would need to be put in order again at the first steep ascent.

On the opposite corner a Chinese has already opened his shop. The industrious yellow man lets slip no opportunity for business: he sleeps behind the counter and so can be on call at any time. For a couple of Reals he stays awake for the whole night, if it is necessary; otherwise no-one achieves modest affluence here. Yet only a Chinese musters so much tirelessness. I purchase from him two bottles of beer and stow them away in my knapsack. Then comes "Mount up". Having left Canchaque lying in deep slumber behind us, we ride out to the high forest. Cheerfully our beasts welcome their fellows grazing freely, which the Indians set loose in the evening, so that plump and satiated in the morning they can carry load and rider. From time to time a belated glow-beetle still floats ghost-like above the trail. At the last settlement we cross through an orange plantation. The large yellow fruit, the best of its kind in the whole of Peru, almost dangled in our faces. In view of such abundance we pull up under the trees and cram the saddlebags full, since no-one in Chanchaque would be concerned.

Hairpin after hairpin takes us uphill into the even thicker growing vegetation, until we reach the caravan trail via a short cut. The damp breath of the morning mist blows through the enveloping jungle, on which the countless Bromeliads, ferns, lichens, mosses and orchids live. Moist branches brush us in the face; water drips from all the trees and gurgles to the right and left of the trail. The slippery ground sighs under each step of the mules. We ride on through the rain forest.

In three days our route displays all the climates and landscapes of the New World. The day before yesterday we travelled through the yellow desert, yesterday I tarried in the green tropical quebrada, today we are in the cool mountain forest and towards noon we must cross over the lonely, cold, high plateau. Bluish early light glints through the branches, the birds shyly begin their first morning twittering; even our horses and mules are apparently really woken up now for the first time since they originally got to their feet.

The forest gets lighter: we notice that it extends up to the great barrier. My hired hands jog patiently ahead of me, untiring as if it were only the foothills; the mountain Indians are able to keep up with the mule train. Monotonously echoed their prompting Burroa!! Mulaa!! The fine fellows wear themselves out honestly. Now a four legged one has lagged behind, now an animal baulks at a slippery rock, here a harness needs to be pulled tight, and there a load must be straightened up

once again. So the men have 18 hours of uninterrupted work to carry out. Yet the muleteer knows no other life, which only exisits for him in walking and stowing cargo; and, if necessary, coming back from his remote destination straight away on the following day, by the same difficult road.

Gradually the forest becomes steadily more open and more low growing; eventually it turns into bushy growth. Now our view can wander far into the distance, if it were not for the white veil arising from the deep with the rapidly rising sun. It surges below us, as far as the eye can see. Like the crests of a gently swell the numerous tops of the mountain forest rise out of the sea of haze. Towards the horizon a rosy light shines over the thick mist, which suddenly turns into billows, breaking up into long tatters and gliding upwards towards us. Already the first streamers cling to the steep slopes of the dark mountain wall which we now have to tackle. Captivated by the beauty of the early morning, I draw up my mule. The Indians on the other hand think only of filling their stomachs in due course.

We ride straight forward in a narrow ribbon, that leads upwards to the immense barrier, as our caravan is overtaken by the mist and disappears in milky opacity. An uncomfortable feeling creeps over me. Only now and then I hear a snort in front of me, a disconnected cry behind me, and sometimes if a slight movement appears in the white void, I see fleetingly a shadowy outline of my man ahead or of a mule tail; in spite of that it is a doubtful pleasure to be handed over to the good fortune of the capable climbing ability of these long-eared four footers. Certainly one harbours a constant concern that they always move along the outer edge of the trail of their own volition, probably to be able to step off casually. Quite unpleasant is this habit in the sea of cloud, high above a frightful abyss.

The I collide. From somewhere or other a human being cries out. Alarmed, I cried into the mist — "has someone fallen down the slope?" "No," answered the invisible driver behind me — "we have come to a passing place. If a troop should find itself over there, it should wait. On this part of the road there is only room for us." In the meantime it had started to rain; the weather deteriorated. We are on the great wind-shed below the Tambo, where the air masses from the upper Amazonas and from the coast conflict. Suddenly complete chaos overtakes us beyond a bend; rapidly a storm breaks loose, tearing at the body of mist, roaring round the rocks and shredding thousands of water trickles into spray. I come to a stop in this witches' sabbath somewhere at the barrier, my extinguished pipe gripped between my teeth, and — captivated — observe the continual change in the struggling clouds. Deep down below there, storm the dismembered vapours like the wave crests of some gale whipped ocean, whilst on the peaks the expelled shreds burst into pieces like little clouds of shrapnel. One more tantrum, then the storm and the ascending sun gain the victory; the white, misty spray has no more resistance to oppose the strength of the young day and slowly disssolves.

Now we are at the most dangerous corner. We must cross between a bluff and a rocky pinnacle. My animal pants, the flanks shiver. I let the reins hang, encourage the mule in a friendly manner, lay a hand on its sweaty and rain-soaked neck . . . a shout, a clattering slide and already with a plunging leap the brave four-legged beast has accomplished it. Silently the men riding in front look at me. At last they nod and we go on. Now, after the Gringo has surmounted the barrier safe and sound they surely have no thought other than to assuage their hunger as soon as possible. Shortly before the Tambo there again grew trees in shelter from the wind. From all branches, aerial roots and creepers dripped beads of rainwater, and the Bromeliads living on the branches have their cup-like leaf whorls so completely filled that little mountain torrents pour down from the plants if one moves them.

Finally we reach the shelter. Here we first dry our Ponchos, then begin to get ready for our meal-time. In the smoky living space of the Tambo my eyes water. So I go into the next room and look at the objects that the owner of the shelter would offer for sale to the muleteers; cord of leather and thread, saddles, Indian pouches and a variety of horse bridles. From the roof hang down thick, tough strips. I cannot envisage from which sort of animal it originates, since there are no hippopotami in South America — but it is dried mule flesh, for the muleteers. These chaps must have a good stomach.

After an hour's rest, we set away again, up to the cold heights, through the hilly landscape of the high pampa, over which sweeps an icy wind. In this oppressive solitude, our troop passes four hours, until the road goes slowly downhill again to black lakes and gnarled shrubs. Only on a single occasion do we meet up with any people at this height, two thickly muffled riders who apparently shiver with cold. They are probably inhabitants from the warmer eastward lands, who for some reason or other have to come over to the coast.

Then we plunged into a sea of mist once again, and as we leave it behind us, a delightful landscape in rich colours stretches before our feet; on the left arise the many-coloured mountains of the Ecuadorian border, and behind the valley of Huancabamba the eastern cordillera tower up in the distance. Dexterously our mules and donkey pick their way down the steps of the new ever-widening mule-track. Warily they tread too, in the same holds that innumerable fellow-travellers before them have trodden in the red earth, and without any incident we surmount the fairly steep, slippery slope.

I have hung the reins over the pommel and put my hands into my pockets. I gaze with satisfaction over the land lying below me. Finally I have reached my goal; and for the second time I have come once again to the upper Amazonas. The slender, shimmering ribbon down there below is the Rio Huancamamba, which flows away to the Maranon. Whilst the bottom of the valley gradually sinks into the darkness of night, for a while there shines in the tiny streams the reflections of the light from the evening sun which gilds the mountain peaks.

At the first settlement a rich smell drifts towards us. There stand immense Floribunda, treelike Datura. I marvel to myself the length of time that the Indians are able to tolerate the stupifying perfume of large reddish-yellow trumpet flowers. Although we now make even quicker headway, nevertheless a long time passes before we see the lights of Huancabamba. We must travel the last part of the road especially carefully. At one spot the trail becomes very narrow and the animals often shrink unexpectedly from pale coloured stones.

My guide calls out that we have just reached the first Piscoles. I stare with straining eyes into the dark. What species might it be? There appear on the slope a ghost-like giant pallid candles. I pull up the mule and clamber up to them with my flashlamp. Between the rocks stand large groups of the fairly short, whitehaired Cerei with a long ribbon of wool at the side. Humboldt's handsome discovery, Espostoa lanata, has been found once again.

(After an overnight rest men have to be found to help with the collecting work . . .) "Have all the people of Huancabamba gone crazy?" I asked my arrieri: "No", he answered, "they are celebrating a religious feast". When the whole place is in this state, must we scramble up the hillsides on our own? "I have already found a dependable helper," my Indian reassured me, "one of the really devout, who does not touch any alcohol." The "Real Devout" is a herbalist, who lives at the foot of this place. When I visit him, he shows me an old, thick book, in which he has carefully preserved one sample of each of the different medicinal herbs which he collects in order to sell them down towards the coast. A genuine herbarium! I was amazed. I made him an offer for this curiosity, but smiling shyly he declined the deal. I increased my offer, but he would not part with his remarkable herbarium. "You fool to let slip that amount of money" my arriero taunted him. "Do you think that the Gringo will go all the way down to the Maranon like you to seek these plants there? He has more important things to do — he must look for Piscoles!" The Indian shrugged his shoulders, laid down the book and led me to the doorway.

We waited below at the river, until the Indian botanist really did arrive with three sober inhabitants. Then we scrambled up the steep slopes, at whose feet this place lies. Up there the rocks are occupied everywhere with the white columns of Espostoas, and between them I also see the golden-yellow clumps of Seticereus icosagonus and the sprawling redspined stems of Seticereus humboldtii, two further discoveries of Humboldt. The Espostoa belong to those cacti which form a wooly flowering zone or cephalium on the stem. With this genus, it bursts sideways out of the trunk and the wool is produced directly from the axis, as Humboldt previously stated. I see it for myself for certain as I chop into a stem.

"We work out the hair with a machete in order to fill our mattresses" the herbalist told me. "Previously it was collected and sold in bales. Today there is no longer any money to be earned that way." At one place I see an Espostoa whose branches are changing into enormous ribbons of cephalium. I ask Ignacio whether we could transport one of these huge white columns over to Canchaque. "It could not be done" enjoined one of the Indians "since it is impossible to make a packing case. There is no suitable timber. A two metre long package is also too long for the mules and for porters the distance is too far". Ignacio nodded; he is of the same opinion. I will not accept it however, without further effort. Before our return I will tramp all round to seek out timber and to seek men who are prepared to go with me. But I had no luck. It was a feast and everyone declined to help with polite regrets. There was nothing else for it but to fill my patent cardboard boxes with smaller plants. Hopefully I will travel safely over the mountain with these fragile cargoes. It is remarkably that no carrier frames are to be made for them, as timber for this is really impossible to acquire, so they have to be covered with old sacks as a protection against moisture.

Whilst we collect on the slopes, some men start with the packing. It turns out to be a curious load: cardboard boxes full of cacti with a cover of sugar and flour sacks. I am nevertheless happy that at least I can protect them; without them I would hardly transport my harvest safely back to Canchaque, if it should rain en route.

My stay in Huancabamba draws to its close. It is still dark as we set away on the return journey. Whilst my caravan wormed upwards towards the heights, I constantly gaze suspiciously around the sky. Would it stay dry? I did not trust the waterproof packing of my cartons too much. Over the mountain side scarcely any rainfall occurred, then towards noon the weather looked as if it was improving. So we reached Canchaque late in the evening with our cargo safe and sound.

. . . . . With Piura behind us, the road stretched away in front to Payta and the sea . . . . A few hours later our lorry and cargo arrived at the coast. The plant harvest was left to be shipped by the forwarding agent . . . . From the ship's deck I looked out over the yellow sands, behind them the broad desert stretching as far as the mountain forest. Now the blue mountains have disappeared long ago from view. But I will not forget them. The journey to the old Humboldt discovery places will always remain among my finest memories.

OBSERVATIONS ON THE GEOGRAPHY OF SOUTHERN PERU **By W. Bollaert**
From the Journal of the Royal Geographical Society 1851

A residence of some years in lower Peru in the provine of Tarapaca, department of Arequipa, commencing in 1826, during which I was engaged in mining operations at the celebrated silver mines of Guantajaya, afforded me the opportunity of studying the physical geography etc., of this but little frequented portion of Southern Peru.

The first account we have of southern Peru is in 1450 when the Inca Tupanki established for a time his court at Atacama, intrusting the command of an expedition to Sinchi Roca against the Copiapinos. Almagro, when he undertook the

conquest of Chile, took the mountain route from Cuzco over the Andes, in which the sufferings of the expedition from cold, hunger, and fatigue were very great. Having experienced so many privations by the mountain track, he decided to return to Peru by the eastern margin of the Desert of Atacama. On this march some of his followers determined to remain behind in the less arid localities of Pica, Tarapaca, Camina, etc.

Tarapaca was the most distant and extensive province of the empire of Peru, and so uninhabited and without the means of cultivation that it was almost disregarded by the discoverers who said that "its tracks were over rocky mountains, sandy, uninhabited, and rainless deserts, covered with salt and without water, excessive heat during the day and cold at night." Thy physical features of the province may be described as follows.

1. The arid mountains of the coast, running north to south, rising oft-times abruptly from the sea, from 3,000 to 6,000 feet above it, and some 30 miles in width, having large hollows and undulations in them; destitute of vegetation.

2. The Pampa or great plain of Tamarugal, is from 3,000 to 3,500 feet above the sea, running north into the province of Arica and south into the desert of Atacama, about 30 miles wide; much of it covered with sand, salt, nitrate of soda and other saline bodies. Water, derived from the mountains in the east, is found at various depths. A few tamarugos or acacia-trees are met with in the pampa.

3. Thence rises a desert range of mountains, chiefly of sand-stone, some 7,000 feet above the sea, and 20 miles in width.

4. An elevated district follows, much broken, and here for the first time are seen coarse pastures, brushwood, and large cacti. The pastures improve as they get higher up, until by the severity of the climate they diminish, and finally disappear at an elevation of from 10,300 to 16,000 feet.

5. Now there is the Andes, or Cordillera Real, in which are very high mountain ridges. Crossing the high passes and descending a little, is an elevated undulating region, known as the Puna.

The province of Tarapaca lies between 19 degrees and 21 degrees 30′ S. It is bounded on the north by Arica, on the east by Bolivia, on the south by the desert of Atacama, and on the west by the Pacific Ocean. It is divided into four curacies viz: Tarapaca, Pica, Sibaya and Camina. The town of Tarapaca is the seat of the government of the province. The ravine, at the mouth of which it is situated, rises in the Cordillera of Lirima. In general there is barely sufficient water to irrigate the land capable of cultivation in this quebrada; but when thunderstorms with their heavy rains occur in the Andes, great torrents gush down the ravines, bringing with them masses of rock, trees, huts, cattle, indeed all that may be in the way — leaving, after one of these sudden and destructive floods, nothing but a bed of stones. Up the ravine are the Indian settlements of Pachica, Loansana and Puchurca.

Mamina is a large Indian town east of Tarapaca. The potato is here met with in great perfection, and this locality is supplied with water from clear boiling sulphur springs. To the east of Mamina is the high range of Yabricoya, abounding in metals at the points known as Picuntisa and Paihuanta; the climate of these elevated mining districts is very severe, there being much rain, snow and cold. In the vicinity of Quipisca, west of Mamina, are many sandy desert ravines, and those unaccustomed to travel in such countries would be alarmed at the overhanging precipices, large masses from which have been thrown down by earthquakes. The road from Mamina to Pica passes through several deep dells without water. In this province, as well as many other parts of Peru, no one starts on a journey without a pair of bullock's horns full of water slung in front of his saddle, provisions in the saddle bags, and a thick poncho or two to serve as blankets, as at times he may be for days without falling in with water or a hut.

The town of Pica is on the eastern margin of the Pampa, on a very sandy soil at the base of an arid range of mountains, above which is an elevated tract, where the humidity of the air and occasional rain produce coarse pastures upon which feed the domestic llamas, alpacas, and sheep. Some large cacti and a little brushwood are seen and, ascending in an easterly direction, the frozen regions of the Andes are entered. The land at Pica capable of cultivation is very limited, the chief supply of water being from inconsiderable thermal and other springs.

Sibaya is an Indian town to the east of Tarapaca. Much maize is grown and sheep and llamas are bred. There is a route from this place to Potosi, across the Andes, which takes the Indians 12 to 15 days. From Sibaya to Mocha there are two tracks, one by the mountains, used when the valley is impassable by reason of the sudden rushes of water through the angostura or narrow, which is two miles long, 800 feet deep, two or three yards in width, and in some places almost excluding the light of day, This pass, though originally a fissure, has been worn down by torrents some 20 to 30 feet more, the latter distance being remarkably smooth; the rock is dark blue slate. Mocha produces wheat and maize. Usmagama, Chusmisa and Guasquina are Indian hamlets where llamas are reared, wheat maize and potatoes grown. Gigantic cacti are hereabouts seen, 20 feet or more high, a foot thick and when split serve for doors and even rafters. Usmagama is at the bottom of a very deep ravine prettily surrounded with trees. The mountain road to Zipisa from Usmagama is steep and dangerous, along a precipice in a zig-zag course, some of the steps being cut out of solid rock and at a great distance from each other, so that a mule in descending is obliged to drop both the fore feet at once. On leaving Guasquina for Zipisa, the track leads up the north side of the ravine. It is cut out of the mountain and looks nearly perpendicular; the road is firm but so narrow that there is much danger when travellers or troops of animals meet.

Zipisa is in very rugged country, supplied with water from springs and conveyed by a long aqueduct which is made to wind round the mountains. A few parakeets, wood pigeons and small birds are seen. Socota is reached by a mountainous track and half way between it and Zipisa both villages are seen beneath the traveller.

The ravine of Camina cuts straight through the Pampa, is wide in parts and narrow in others. The hamlets of Quimpasa, Yalamanta, Moquella, Quistagama, Cuisama and Chapiquilta are found before reaching the large Indian town of Camina. Much of the cultivated land here is far above the level of the stream, formed into terraces and watered by means of an aqueduct brought from some distance up the ravine. A track from Camina to Isluga leads up the ravine through trees and shrubs . . .

On the route from Cobija to Coquimbo, I made the passage in an open boat from Cobija to Paposa, a tedious one of 12 days. Cobija is the only port of Bolivia or Upper Peru, supplied with water from springs. Having crossed the great bay of Mejillones, I had the opportunity of witnessing the vast numbers of seals that inhabit the coast. The appearance of the coast was steep, naked, jagged rocks, 2,000 to 3,000 feet above the sea, with a heavy surf beating on them. There is no water there, but with the constant traffic of steamers on the coast, water and the provisions might without much difficulty be transported thither. At Paposos a little rough pasture grows on the heights. Passing the fishing coves of Punta Grande, Cachinal, and Agua Dulce, I came to Hueso Parado which is the old acknowledged boundary between Peru and Chile. The frontier line is in 23 degrees 23′ S. which at about 1½ miles from the shore is marked by a whale's jaw placed upright in the sand. It is the general opinion that it had been placed there by the old Spanish boundary commissioners.

Comments

. . . . from H. Middleditch

When Bollaert refers to the boundary at Hueso Parado between Chile and Peru, he means the boundary between Chile and the Viceroyalty of Peru, the latter included upper Peru or Bolivia. Any cacti found between Hueso Parado and Cobija at this time would (if correctly recorded) come from what was then Bolivia; any found to the north of the mouth of the River Loa would come from what was then Peru.

The original description of Oreocereus leucotrichus was quoted in Chileans No. 38 together with the finding place "at Naquina and Usmagama". On the basis of the place names available at that time, it was suggested that the map location of Guasquina might have been rendered as Naquina, but it was pointed out by Mr. and Mrs. Collins that this seemed to be unlikely as the two place names were phonetically different. Now that we have a more detailed map, prepared by Bollaert in connection with this article, it is possible to locate the place name of Guavina which lies much closer to Usmagama and also at the sort of altitude that one might expect to find Oreocereus growing. Would this place name be a more likely equivalent for Philippi's "Naquina"?

The constant traffic of coastal shipping noted by Bollaert collected the products of the mining enterprises situated inland from the coast and supplied them with provisions and equipment. This traffic would be used by Thomas Bridges when he visited the coast near Caldera and collected Copiaopa marginata, streptocaulon, columnaris, bridgesii, and echinoides, as suggested in Chileans No. 38 on p. 171. Thomas Bridges could not have collected Copiapoa atacamensis (C. marginata sensu Briton & Rose) at Antofagasta since there was no means of disembarking there in 1851, as Bollaert states here, never mind in 1844, when Bridges would sail past on his way to Cobija.

SOME CACTI FROM CHILE By Rudolfo Wagenknecht

Translated by H. Middleditch from Rev. Acad. Chil. de Ciencias Naturales 1956.

During my sojourn of more than 30 years in the Province of Coquimbo, one of the regions most rich and varied in respect of the cacti, I have been able to become acquainted with and to collect numerous species. In the years 1938 and 1939 I had the opportunity to participate in the famous Goodspeed Exhibition travelling over the whole of the north of Chile and subsequently the southern part and Juan Fernandez Islands as well. In April of 1950, I went on a trip by motor car between La Serena and Tocopilla, with stops at various places, in which journey I concentrated upon collecting cacti. Again, in April of 1955, I was lucky enough to undertake a tour of almost one month through the three northern provinces of Atacama, Antofagasta and Tarapaca, on which occasion I collected interesting material from the same group. These tours enabled me to increase my knowledge of botany and to form an impression of the dispersion and distribution of the species of cacti in the Grand North.

In order to make special reference to particular species, I took a look at the work of Gualterio Looser, entitled Catalogus Cactacearum Chilensium, published in the Revista Chilena de Historia Natural, Vol.33: 583-614 1929. Subsequently there have been published various works with descriptions of some new species or revisions of others (Paul C. Hutchison, Marcial R. Espinosa, Curt Backeberg etc.), to whose names I shall refer in each case. I do not know the works of the German botanist Curt Backeberg, which deal with Chilean genera and species, for which reason I shall not consider them, expecting in those instances when the name has been given to me by another author. In this instance it is the notable North American botanist Paul C. Hutchison, of the University of California, Berkley, who travelled through Chile in 1952, studying and collecting exclusively Chilean cacti.

I have received from my friend Luis E. Pena G a certain number of cacti collected by him in the high Cordilleras of the north, accompanied by some excellent photographs and I am grateful to this well-known entomological collector for his impartial contribution. In this province, I have taken the advice of the botanist Carlos Jiles Pizarro of Ovalle, who is a keen observer of cacti and thanks to him I was able to obtain valuable data concerning some localities. In La Serena, I am grateful for the co-operation of Juam Mandakovi, agronomist, director of the Farm School, and an enthusiastic cactophile. I particularly place on record my deepest gratitude to Gualterio Looser, who through many long years has given me every encouragement to undertake botanical collections. His identifications and his thorough knowledge of this subject, have enabled me to enlarge my knowledge about the intricate problem of the Chilean cacti. My gratitude also extends to my friend Dr. Roman Wygnanki, a thorough student of the cacti, whose suggestions were of the greatest use to me.

The recent visit of an amateur collector, Herr Friedrich Ritter, who undertakes extensive tours through the north of Chile and also of Peru in search of cacti, was of great benefit to me on account of his practical knowledge and his great authority upon the subject. Thanks to his information, I was able notably to enlarge my list from the North and effect some revisions. A small collection of indigenous Chilean cacti which grow in the garden of my house in La Serena, have been of great value for the study and comparison of various species collected subsequently, especially since most of them were identified by P. C. Hutchison, on his way through here in 1952.

Lastly, a useful collection of photographs, of my own and from other sources, have been of great value in the study and comparison of species and this illustrative material is of the greatest help for the enthusiast and the collector. Now it rests with specialists in Cacti to judge and correct my observations, which I modestly offer as a contribution to the study of the natural flora.

Browningia candelaris (Meyen) Br. & R.

This species, which is abundant on the southern coast of Peru is relatively scarce in the North of Chile. I was able to locate one very mature plant on the slopes of the hill which goes down to the hamlet of Mocha, Alto Chumiza 150km to the east of Iquique, Tarapaca province. The peculiar form of its sinuous branches on top of a stout, cylindrical, vertical trunk, strongly attracts attention. From a distance these twisted branches resemble the antlers of a giant moose. In April of 1955 I could find neither flowers nor fruits on this plant, which was the only one situated at this spot. The altitude at this place was recorded as 2,500m.

Arequipa hempeliana Gurke.

Quoted for the north of Chile and the south of Peru, under the name of Arequipa leucotricha (Phil.). However it has been possible to ascertain that the original description by Phillipi was based upon an Oreocereus, having a tall stem with hard, erect spines, and not upon the Arequipa which has a low, rounded form similar to the genus Neoporteria. Both have white silky down, that is well able to take on the name of leucotricha. In my trip to the Banos de Chusmiza in the high cordillera of Tarapaca, from the small truck which carried me at a fast rate, I was able to observe a group of cacti which were unknown to me. Of the size of Neoporteria, covered with white hairs, they displayed open flowers of a dark red. Their height was no greater than 25cm. The shortage of time and the desire of my host to arrive promptly at the Spa, did not allow the vehicle to be stopped and I remained hopeful of collecting them on our return run. Ill-fortune dogged me, since it fell to us to return by night. The speed of the vehicle and its poor lights, virtually left me unable to recognise the place observed during the ascending journey. Ritter assured me that Arequipa is to be found in that area, for which reason I leave it noted down under the name that he has indicated to me.

Oreocereus leucotricha.

There has been quoted for the north of Chile, Oreocereus celsianus (Lem) Ricob. which would also be represented in Bolivia and southern Peru. There exists on the other hand the citation Oreocereus hendriksenianus Backbg. I have preferred to record the new combination which heads this paragraph, based upon the fact that Phillipi described his Echinocactus leucotricha from specimens of the present day genus Oreocereus.

Within a landscape completely verdant in full autumn (April), owing to the rains of summer which envelop the high cordillera of Tarapaca, in the region of Chusmiza, I was able to observe handsome groups of cacti covered with a white nap, similar to "Angora wool". Their short stems, markedly swollen towards the crown, reach a height no greater than 1.40m. These were crowned with white nap and through it project long and hard spines of a blood red colour. On some stems of every group are to be found two to four flowers, which were usually located on top of the head. These flowers are of a dark red colour, of a half-closed form with projecting pistils of a purple colour. It is very reminiscent of the flower of the ananuca, when it is about to unfold. In the cactus catalogue "Cactees, La Maison Rustique, Paris" there appears in colour a cultivated specimen of Seticereus icosagonus, whose flower is almost identical to that of the Oreocereus dealt with here.

The clusters are of from 20 to 50 stems and do not associate with the other more abundant cactus, Corryocactus brachypetalus, which here dominates the landscape by its bulk, height and sheer numbers. Higher up, in the Quebrada which shelters the Banos de Chusmiza, very nice groups of Oreocereus leucotricha are to be observed in alcoves in the vertical face of the cliffs, alternating with other groups of Corryocactus brachypetalus, so as to make a real natural exhibition of unusual novelty and beauty. (Banos de Chusmiza, Alt. 3170m Lat. 19° 41'. Long 69°/ 13').

Corryocactus brachypetalus (Vaupel) Br. & R.

This cactus is the most prominent plant on the plateaux in the region of Mocha, Chusmiza and their neighbouring Quebradas. This area belongs to the province of Tarapaca, 160km inland from Iquique. Its habitat should be considered between 2,800 and 3,600m. Its long upright, strongly grooved stems with sparse spines, ornaments the Pampas. Its height exceeds 2.50m and nearly always grows in sizeable groups. In April I found neither flowers nor fruits.

There has been quoted for this northern region Trichocereus fascicularis Meyen, in addition to figuring in the mountains of the south of Peru and frequently at Arequipa. At first I considered it as belonging to this latter species, but Ritter, who is very well acquainted with the Flora of Peru and Chile, noted down the following for me: "Corryocactus brachypetalus (not Cereus fascicularis) is plentiful from here to central Peru. The frequent literary reference to the presence of Cereus fascicularis in Chile is erroneus. According to my personal investigations, this latter species hardly goes beyond the boundary of the province of Arequipa".

Haageocereus australis.

Genus and species not quoted for Chile up to the present time. Its geographic distribution is from the north of Chile in Tarapaca as far as central Peru in the high desert-like region of the Andean foothills. It is more abundant in Peru. With a height of no greater than 80cm it can be compared with a stunted specimen of Eulychnia acida. However, its creeping form of growth and tendency to form numerous dense, low-growing groups distinguish it. Its stems are covered with dense and flexible spines, rather slender and of moderate length, which is surpassed in this respect by Eulychnia iquiquensis, which we observe at the coast.

The fruit is spherical, ovoid, bare, of a yellow colour when ripe. I was not able to find any flowers. These plants were located on the slope of a deep chasm opposite the hamlet of Mocha, on a turning off the road to Banos de Chusmiza and at an altitude of 2000m. The genus Haageocereus is one of Backeberg's.

Comments

. . . . . from H. Middleditch

It may be as well to bear in mind that "northern Chile" extends only as far north as about Copiapo — or possibly Taltal — to many a native of Chile. The Atacama desert was for many years the boundary between Chile and that part of Bolivia which extended down to the sea coast. Hence when Wagankecht states that he accompanied the Goodspeed Expedition over the whole of the north of Chile in 1938-39, we should not imagine that he familarised himself with the territory between Copiapoa and Arica, as his words might lead one to believe. In his book "Plant hunting in the Andes", Goodspeed himself tells us that "At Taltal, Rudolfo Wagenknecht, a Chilean collecting assistant, was scheduled to catch up with them. Because of a misunderstanding he had been waiting in Iquique as they sailed past that port. Telegrams went back and forth and two days later Rudolfo appeared. After some discussion with him they decided to go by train to Copiapo". The two days were most probably occupied in travelling from Iquique to Taltal, rather than collecting; subsequent collecting with the Goodspeed expedition was all undertaken south of Copiapo.

Wagenknecht carefully refers in his opening words to the cacti in the Grand North; this is that part of present-day Chile which was formerly Bolivian or Peruvian territory. Wagenknecht states that he made a tour of almost one month through the three northern provinces i.e. the provinces of Tarapaca, Antofagasta and Atacama. He comments about his journey inland from Iquique to Mocha and Chusmisa, when he evidently travelled with his host. There is no record of any other journey undertaken in the Grand North, so it does seem probable that Wagenknecht had very little personal acquaintance with any of the Grand North other than the run from Iquique to Chusmisa. We might therefore be advised to take his account of the cacti from the Grand North as being largely a consensus of views and observations collected from others, rather than an appreciation based on personal observation.

Wagenknecht observes that Corryocactus brachypetalus is the most prominent plant around Mocha and Chusmiza. At this altitude other authors identify this Corryocactus as C. brevistylus. In the photograph on the inside front cover of Chileans No.38, there may be seen plants of Corryocactus growing near to the road crossing the plateau or Pampa to Chusmisa. Reiche and Pohlmann also note that this same "Cardon" spreads out over the neighbouring pampa from the valley sides at Esquina. At this latter spot it might be growing at as low an altitude as 2,400m. At the upper end of its range it is observed by Reiche and Pohlmann near Aico at some 3,600m altitude. This altitude distribution range for Corryocactus brevistylus is in conformity with that reported by Wagenknecht. Reiche and Pohlmann also quote the optimum development of Corryocactus brevistylus as 3,000m. It is logical that where this species finds the growing conditions most to its liking and so attains its optimum development, it competes so successfully with Browningia candelaris as to exclude the latter. Likewise, where Browningia reaches its optimum growth at about 2,200/2,400m, it in its turn appears to compete so successfully as to exclude Corrycactus.

The original finding place for Echinocactus (Arequipa) leucotricha must have been only a few miles from Mocha, where Wagenknecht reports "Oreocereus" leucotricha. However, these plants which were seen by Wagenknecht were "up to 1.40m high" i.e. 4ft. 6ins. tall; this does seem to be pretty tall, even for columnar Arequipa, which are recorded in Backeberg Die Cactaceae Vol.II as up to 40 or 50cm high. Wagenknecht also notes that their stems were "swollen towards

the crown" a characteristic which has not been reported in Arequipa but which may be observed in some Oreocereus. The "white nap-like Angora wool" covering these plants is most unusual for Arequipa, but conforms well to Oreocereus hendriksenianus, as illustrated in Abb. 974 and 975 in Backeberg's Die Cactaceae Vol. II. Backeberg does illustrate plants of Arequipa in habitat with as many as ten heads, but nowhere in the literature is there any suggestion that they grow into a "colony", as Backeberg describes for Oreocereus hendriksenianus. Illustratios of this Oreocereus in habitat — Ibid Abb. 977, Tafel 70 and 71, depict colonies of close-standing upright stems; up to as many as fifty heads can be counted in the colonies in these illustrations. This matches perfectly with Wagenknecht's description of "from 20 to 50 stems". It should be born in mind that Wagenknecht states quite openly that "he does not know the works of the German botanist Curt Backeberg", so he would neither have seen these illustrations or read about Backeberg's Oreocereus hendriksenianus or know its characteristics. In consequence it is hardly surprising that he would not recognise the plant as such when he saw it near Chusmiza.

Knize evidently did recognise this plant when he saw it some fifteen miles to the south, near Poroma. He describes how the fruit is used by the Indians for food: no doubt the seeds will pass through the body and so could establish the do-it-yourself vegetable patches of this plant which Knize noted "grew near to all the Indian villages". From the accompanying map it may be seen that the location of Guavina and Usmagama given by Rahmer and quoted by Philippi, the location of Paroma given by Knize, and the location of Chusmiza given by Wagenknecht, are not widely separated. There would now seem to be no doubt that we must acknowledge Oreocereus leucotrichus syn. Arequipa leucotricha.

I am under the impression that the fruit on Haageocereus is pink — but is this in the unripe condition? Is there a possibility that the sprawling plant seen near Mocha and described by Wagenknecht as a Haageocereus was an Arequipa? Or a Loxanthocereus? But 2000m is a low altitude for Arequipa. In his field number list, Knize has a "KK 1128 Arequipa sp. (Loxanthocereus?)" from 1200-1500m in the Vitor valley. Johnson notes, at the lower level of the cactus zone above Tacna, a "sort of Cereus that I first took to be Arequipa . . . procumbent stem up to 1m long" — a length not far from Wagenknecht's 80cm long creeping stem. So we have three different collectors who have noted a sprawling cactus within the 1000 to 2000m band, in three separate quebradas, and in each case there would seem to be some doubt as to its identity. Another new species just waiting for an ambitious collector?

COLEMAN'S DRIVE By John Coleman (1962)

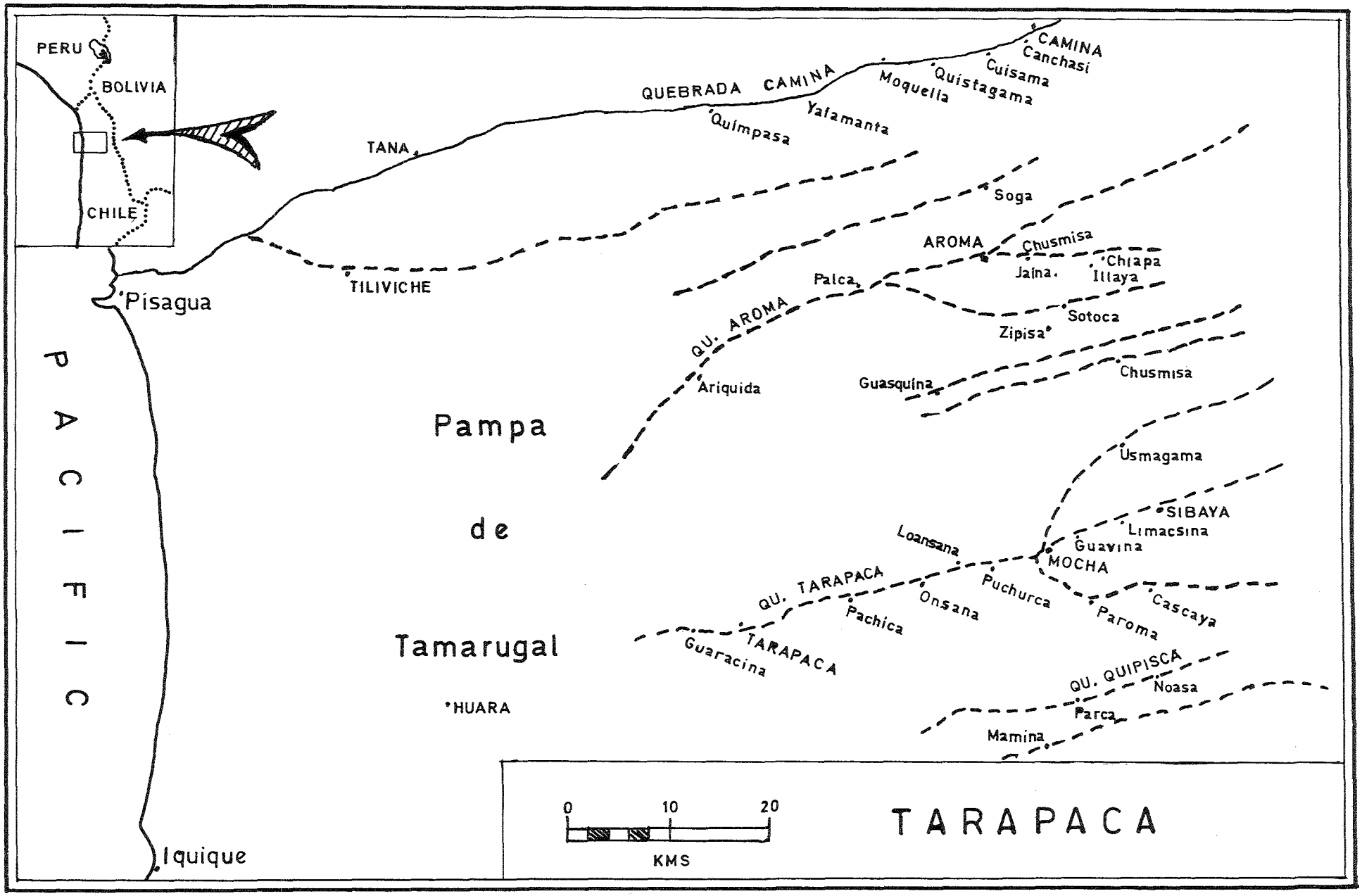
From Antofagasta to the end of the desert I had to rely completely on my own resources. In Quillagua the local Carabineros told me that on the way to Arica "you will come to a flooded valley where no vehicle will be able to pass for at least a month." All the land around was owned by an Italian farmer who quickly agreed that I could camp in one of the fields on the farther side of the stream, whose presence alone brought life into this valley. Next morning I climbed slowly up the stony track on the north side of the valley; once I had climbed the hill the road seemed relatively good. Mile after mile of it continued so. After that pleasant surprise of 20 miles of passable track, a notice by the side of the road read "Provincia de Tarapaca"; the last province of Chile but the most bleakly desolate.

I covered a few more kilometers that day, slept the night in the wild, lonely desert and continued on the following morning. The day went by and I made my gradual way towards Humberstone. Occasional patches of scrub appeared, which indicated that water lay somewhere beneath the parched surface. I was approaching another mining district. A track ran off to the east leading to Pica. Another police control point was set up at the road junction and a piece of amazing news awaited me. The floods were almost over. Only a few inches of water remained to impeded traffic. Night was impending and I finally reached the entrance to Humberstone itself.

Next morning I decided to check the car before refuelling and attending to supplies. The rear spring that had been repaired in Copiapo was broken again. It was well on towards midday when I finally left Humberstone. Several miles of paved road runs north of the mining settlement and at the end of the road was another police check point. A further report that the trouble from floods was over was the good news I received there. Nevertheless it was not exactly with a light heart that I set out on the last wild section of the Atacama desert. My world consisted simply of desert and a road with increasingly deep corrugations. I had hoped to reach the Rio Camarones before dark.

The valley I was coming to was called Tana. I descended to the bottom of the valley till I came to a point where a fast moving stream, about 15 or 20 yards wide, had burst its way across the road. I had clear information that the water was only a few inches deep and I decided that it would be better to move slowly and cautiously into the water rather than getting out and testing the depth. So I moved into the water, hoping to get through and carry on quickly up the far side of the valley. It looked as though the reports about the depth of the muddy water were correct until, near the centre, the front wheels suddenly plunged downwards and within moments water was rippling round my waist inside the car.

I gave a vigorous wave to the Chilean on horseback above; together we contrived to get the Austin into shallow water once more and then right out of the stream. Evening as now drawing on, so I turned my attention to dry clothes and to the car. Finally I tackled the worst problem of all, the magneto. Darkness descended and all was still and quiet except for the movement of the water. I suddenly heard shouts and noises and at last the gang of men came splashing through the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water, but they had no better fortune than I had had earlier despite the height of their van. I settled down and began to doze off from sheer fatique. Suddenly I was woken by blinding lights glaring straight through the windscreen; the lights came from an old bus. The bus pulled the truck out and then plunged through the water successfully. I learned later that for a couple of weeks the water had been several feet high and only on that day had it been possible for any vehicle to pass.

At the crack of dawn I set to work on the magneto. Shortly two heavy lorries came plunging through the water and pulled up beside me. There was a family in each and they were travelling in convoy. One of the men insisted on taking over the magneto from me, while the women prepared a fine hefty breakfast; thick slices of ham, hunks of bread and large enamel mugs full of steaming hot coffee. I was as hungry as a horse, but by the time I had finished I felt fortified to face anything.

. . . . . from H. Middleditch

In his account of his travels in Tarapaca, Bollaert mentions the occasional floods which rush, short-lived, from the Andes towards the Pacific. In his "Desert Trails of Atacama", Isaiah Bowman also observes that the ravines running down towards the Pacific from the high Andes will occasionally carry an abnormal torrent of water, whilst for years on end they may carry only a bare trickle. This account by John Coleman illustrates most graphically the effect of these flash floods and refers (on the accompanying map) to the valley running down from Camina to Pisagua. All accounts in this series of articles relating to the Grand North of Chile which describe the weather conditions met with in this part of the world, appear to suggest that showers of sleet or snow could be encountered at altitudes where Oreocereus, Neowerdermannia and Corryocactus grow, and possibly to where Arequipa grow. But it would seem to be questionable whether they — or the Browningia — receive any extra water from the flash floods.

A TRIP TO THE CORDILLERA By Karel Knize

Translated from Kaktusy '67 by Mrs. Y. Coughlan and C. Burston

Entirely isolated — thus all on its own — is a good description of the inner Cordillera. I left Nicolasa and travelled to the north of Chile, to explore a not very well known region, the "Interione" as the local people from the south of the Province of Tarapaca (east of the Iquique locality) call these parts.

Huara was my last stop before the journey. I bought some stocks of food and goods and started my journey using a newly purchased Lambretta scooter. I had passed the first part of my planned journey with no troubles, if I may use the expression in this countryside. After the first few kilometres my optimism had dropped to zero and later even below freezing point. I had to walk and push the scooter more than drive it. The situation was getting worse and even lightening the load was not good enough. The engine was complaining even though I was helping it a great deal . . . but it was no good.

During the evening I proceeded literally step by step and arrived at a little village called Pachica. I was glad to have a roof over my head. My Lambretta had had enough and it was plain that I could not continue like that, as a longer and more difficult part of my journey was before me. I had reached 2,000 metres above sea level in this area but saw no sign of cacti, only occasionally some stunted trees near a small streamlet.

The saying — things will be better in the morning — was really true this time. The sound of a lorry woke me from my sleep. The lorry was delivering goods to Cancasa, which was about 5,000 metres above sea level. The driver saw my unenviable situation and offered me a lift. How wonderful it was to ride in the lorry and look at the road winding in front of us. I kept my eyes open but could not see even the smallest place where any cacti grew. But before coming to a stop — at 3,000 metres above sea level — we were welcomed by a large Browningia candelaris.

At home in Kladno, I always dreamed of seeing this typical plant — and now I could see it, it was a wonderful feeling. The top part of the trunk shone in the sun's glare and its red spines contrasted with the blue sky. It was disappointing that even here I did not see any young plants or seedlings. Perhaps it was too soon — perhaps some time in July.

Browningia is not the only representative of the Cereus cacti in those heights. The greatest perhaps is Corryocactus krausii, with its light green body, growing up to a height of three metres. They formed colonies or bushes. Shaggy and isolated grew Trichocereus KZ 83 with its long white spines and gold brown tops, which has not been given a botanical name. Another Trichocereus KZ 83 was to be found there with yellow flowers and shiny white spines. This form was growing in clumps, but the individual stems were not longer than one metre.

A magnificent sight was a specimen of the genus Arequipa. First of all there was Arequipa weingartiana (KZ 83b) with red flowers; these grew into cushions of many headed bodies. The spines — usually slightly bent towards the tip — have a pale colouring (mainly brown) which later on changes to grey. At approximately 3,500 metres above sea level I found another rarity — Arequipa hempeliana (KZ 83c), and was followed by a very isolated — and to me entirely unknown — Arequipa which I designated as KZ 84a. The body was only 30 cm. high and approximately 20 in diameter. This plant has about 18 to 25 ribs with deep grooves and soft straight spines up to 8 cm. long, honey brown in colour. The flower is dark red and up to 9 cm. long.

In the region of Cascaya and Paroma the plants were quite untouched, thanks to a very rocky and difficult ground. I was not surprised to see large stands of Oreocereus hendricksenianus and also its yellow forms, which grow very

near to all villages. These are cacti which give food to the people and also to the cattle, to a certain extent. The Cereus fruits are served as we serve apples. Sometimes they can be bought in the markets and they are called "Romby" and taste like lemons. The local people told me that this fruit was very important for the good condition of the body functions. The men there are under greater strain than those in the lower regions; the climate here is very tough. During the summer the temperature rises up to 25 degrees C., or 40 degrees C., but very soon after sunset, drops to a freezing point; also the sun's rays are more efficient than in the lower lands. They said that during the winter, there is some snow (only about 5cm.) but it quickly disappears because during the day the temperature is fairly high.

The rain comes during July and August; at this time there is more than enough water but later in the year there is a noticeable shortage. The lack of rain during the rest of the year is compensated for by the morning dew, which is the only source of water for the dry earth. From these facts I conclude that it would be very difficult to grow these Arequipas anywhere else.

I did not find so large a variety among the Arequipa as there was when the genus Copiapoa was discovered. The definition by Backeberg of A. weingartiana and v. carminanthema is very debatable. On a large clump, the flowers have a darker colour on the older parts and a brick colour on the younger parts growing near the top. I can conclude by saying that it is great pity that the Arequipas are not grown on a larger scale. The flowers are beautiful — the most beautiful I have ever seen.

Comments

. . . . . From H. Middleditch

In this article Knize mentions Corryocactus krausii which he encountered between Pachica and Paroma; this would appear to fall within the typical altitude zone in which Corryocactus is to be found, as indicated above. Corryocactus krausii was discovered by Kraus (a resident of Santiago) at Mamina, at an altitude of 2,735 m. From the accompanying map it will be seen that the Knize location is not very far from Mamina; other place names mentioned by Knize will also be found on this map. In Die Cactaceae Vol. II, Backeberg states that Corryocactus krausii is "the only Corryocactus to be found in Chile up to now", thus overlooking previous observations by Werdermann (Chileans No. 39 p. 56) and other writers. In addition, when Backeberg travelled from Arica to Ticnamar and back (Chileans No. 37 pp. 11-12) he makes no mention of Corryocactus even though he passed through the altitude zone which is attributed by other writers as supporting the growth of Corryocactus. However, at the altitude at which Corryocactus might have been encountered, Backeberg describes how the camp fire was made from "dried up stems of Neoraimondia". But this took place at an altitude decidedly more elevated than most reported Neoraimondia. Now both Corryocactus and Neoraimondia branch from shortly above ground level, makes perhaps half a dozn branches and grow possibly two or three metres high, each stem commonly having four ribs and being perhaps a foot thick. Does it look as though Backeberg might have been mistaken in describing these plants as Neoraimondia? Would these plants most likely have been Corryocactus brevistylus?

It is not entirely clear whether Knize means to say that rain comes to those parts in which he found Corryocactus, Browningia and Arequipa, during the months of July and August. This is rather odd, since all other writers quote December to March as the rainy season for these slopes.

THE ARGENTINE LAKE DISTRICT By E. Young

From "South American Excursion" 1940.

On December 1st, I set off from Bahia Blanca for an excursion to the Lake District of Argentina, a journey by train of about 900 miles. When the train left Bahia Blanca, rain was falling, a very welcome happening for rain lays dust and I had been warned that the first six hours of the journey to Patagonia would carry me over the dustiest part of this dusty continent.

Beyond Luro we crossed the River Colorado whose banks were fringed with willows, entered a region of much small scrub and, after lunch, saw the salty areas called the salinas shining like silver plates. At hot Patagones, set on the bank of the Rio Negro in the midst of sand, we crossed the Rio Negro to Viedma on the opposite bank. In its westward crossing of the continent the railway would rise to levels of 3000 feet above the sea before dropping to levels of 2000 feet and winding amongst the hills of the pre-cordillera to emerge and end on the shores of Lake Nahuel Huapi.

From Viedma, almost all the way to the lakes except for about forty miles, there is a vast sterile region where every breeze raises dense clouds of dust. We had hardly left the station before the coaches were covered inside with a thick grey mantle and the air was filled with a fine powder that could be both smelt and tasted. For nearly five hours we saw no trees, nothing but bits of low scrub and tufts of salt bush or coarse grass on which small flocks of sheep were feeding.

Night intervened. The morning found us still in the plain, but with some hills in sight. We were in a region of flat shallow basins with low hilly rims. The vegetation was scanty and soil sandy, but yellow rather than red and there were numbers of sheep feeding amongst giant thorny pin-cushions. The slopes of the hills were smooth, their curves graceful. Wherever there was any kind of cutting the section always showed pebbles and grey dust. By early breakfast we were at Ingeniero Jacobacci (previously Huanaluan ranch — Chileans No.39 p.42 — H.M.), a typical village backed by bare, dry,

dusty hills. Its streets are inches thick in dust. There are a few puny trees that wage an everlasting fight with the wind that tries to uproot them and the dust that tries to choke them.

After the next settlement, the scenery gradually grew more wild, rocky and interesting, the railway line more winding and the country more worth while fencing and a little more thickly populated. It was distinctly cold — everyone in the train was rubbing their hands. Cultivated and irrigated patches of alfalfa accompanied an increased but still sparse density of human settlement. Soon we were high enough up to get our first glimpses of snow on distant hills. Then we came to a river that really was a river; it had water in it. At Los Juros there were a few stunted conifers on the hills and wide views of the snowcapped Andes, standing out against a foreground that was now green. Finally, dead on time after a run of nearly 1,100 miles from Buenos Aires, the train drew up in San Carlos de Bariloche, or Bariloche for short.

The picturesque glacial lake of Nahuel Huapi, on whose shores Bariloche lies, has an area of 308 square miles. It stretches from the treeless plateau and the soft undulating plain to a region of high mountains with steep slopes — from pampa grass and bush to virgin forest that comes down to the water's edge or ends in cliffs above it — from a generally clear sky to one of heavy rainfall. It thus extends across a transitional zone from the desert to the forest. The fierce wind which continually streaks the water with lines of foam, or even raises it into large waves, makes navigation dangerous.

One day I climbed Mount Otto, 4,500 feet. Climbed is perhaps not the right word as there is a road to the summit. The walk up and back again occupies about four hours; during the ascent one can turn to look back on the red roofs, wooden houses and green trees of Bariloche. The road winds through shady glades where the air is saturated with the smell of pines, up to the open slopes decorated with flowering shrubs and bushes. The most familiar of these is our own wild rose, but the most conspicuous is the scarlet of the "Chilean Flame". As a rule you can have the summit of Mount Otto to yourself, with the green velvet of slopes and a few cultivated fields around or below you.

Some seven and a half miles farther to the east I spent a day rambling amongst some low hills that, from below, resembled the Downs in shape and colour, but not in vegetation. On the top an icy wind was blowing tufts of tussock grass and brown cushions of a plant I do not know. Under one of these huge prickly pin-cushions I picked the little white, yellow and mauve flowers set close to the ground, too small and too few to colour the hillside, each holding its own in the shelter of the thorns. While I was lying in the shelter of a thornbush, a huge condor inspected me. But either he did not like the look or the smell of me and left me unharmed.

I have spoken of the smallness of many of the wild flowers in the windswept hills, but despite the wind and the bitter winters, some of the flowers we know so well at home here grow to a very great size. Cow parsley and broom become trees, the former reaching up to fifteen or twenty feet and having clusters of blossom eight to ten inches in diameter. In the gardens of the hotel were lupins, fox-gloves, marguerites, poppies, pansies and lilies of surprising size and brilliance.

The next day we set out on a journey to the lakes to the north and north-east of Nahuel Huapi. The day was a little warmer but rain was coming across the Andes and most of the snowy peaks to the west were invisible. Where they could still be seen to the north, their sides showed that more snow had fallen during the night. The wind, which had for ten days blown ceaselessly with terrific force and intense cold, did not abate. The road began by leading us back to the north-east, across the sandy desert to the village (that is, the post office) of Nahuel Huapi. Here it turned again westwards and carried us through a mountain landscape and forest. There was constant change — from pampa to forest, from sand to snow, from gentle hill to rugged precipice. I went on from Lake Correntoso to Lake Espejo, then down the valley into the valley of the river Limay and so back to Bariloche. Part of the way lay through rock scenery of the most extraordinary character. Rocks rise into castles and cathedrals or are twisted and contorted into shapes of phantasy. Of course they are the result of erosion by snow and ice, by wind and water.

(The route of this rail journey may be traced on the map of Patagonia in Chileans No.39 p.42).

PHYTOGEOGRAPHIC STUDY OF PATAGONIA By Prof. L Hauman

Translated by H. Middleditch from Bulletin de la Societe Royale de Botanique Belgique Vol. 58 Part 2 1926

South of the 40 degree parallel, South America is occupied by three major phytogeographic regions. To the north-east there is the southward continuation of the subtropical formation occupying the whole of the core of Argentina and for which it is convenient to retain the local botanical name, the Monte. In the centre and as far as Tierra del Fuego, there is the Patagonian Steppe. Finally, all along the Pacific and upon both flanks of the Cordillera, there is the subantarctic forest. I find it convenient to distinguish a fourth formation of scant extent, the alpine vegetation of the subantarctic Andes, which occupies the space above the forest up to the perpetual snowline.

The subantarctic forest extends in a very narrow but very lengthy band from 37 degrees (even 36 degrees in Chile) as far as Cape Horn, 20 degrees further south. The principal characteristics are extremely constant, as well as many of the most important constituents. From the biological point of view this uniformity is no doubt a result of an extremely rainy climate, persistent over the whole length. However, it is evident that the inevitable differences of thermal regime over such a wide range of latitude must bring about considerable floral differences between the southern and northern parts of the formation. But whilst it is the gradual reduction in temperature from latitude to latitude which produces this effect, on the other

hand the very rapid reduction in rainfall which may be seen from west to east, necessitates a longitudinal subdivision. One, the western part, far larger, with a very damp climate, characterised by evergreen Nothofagus, exhibits from place to place an appreciable variety of species and of vegetation forms. The other, the eastern part, much narrower, with drier climate, with deciduous Nothofagus, and which can be considered as only a border of transition to the Patagonian semi-desert steppe. It is quite clear that in places one passes insensibly from one association to the other.

Within the particular domain, there are species with a remarkably extended area of distribution, from Tierra del Fuego to the mountains of Neuquen, growing where the rainfall, thermal regime and the nature of the ground permit. Unfortunately we have very little information from the interior of Chubut. But where I was travelling westwards in 1920 from the confluence of the rivers Limay and Neuquen, we observed the same Flora of the Monte; but when one reaches the railhead at Zapala at 900 m. altitude, the vegetation was clearly Patagonian. At Las Lajas, however, in the shelter of the winds one could find associations characteristic of this section of the Patagonian precordillera. It is of course a mixture of Patagonian elements with species from the Cordillera of Chile and Mendoza and naturally some species of the Monte as well. At 38 degrees latitude and 120 kms. from the border, we once again encountered the Patagonian vegetation which, in proportion to the increase in altitude as one went westwards, became intermingled with the fine flora of the more northerly and drier section of the eastern margin of the subantarctic forest, a section characterised by the forests of Araucaria imbricata.

More to the north, in the province of Mendoza, where there is an increase in temperature, the elements thriving particularly on the mountainous terrain extend to a much greater altitude in the precordillera — as far as 2,300 m. altitude in the bottom of the valleys at 33 degrees S. latitude, where Larrea nitida is characteristic of this zone. At this latitude the flora of the high Andes also includes an appreciable number of Patagonian elements, but here we find ourselves in a quite different domain, that of the alpine vegetation of the dry temperate Andes. I would establish 37 degrees S. latitude as the frontier with the alpine vegetation of the antarctic Andes with its humid climate. Moreover there occurs a zone of transition where one may see all mixed together the flora of the dry Andes, some components of the humid Andes such as Pernettya, Ribes and Caltha, together with other elements which are Patagonian in the strict sense of the word such as Cruckshanksia glacialis and Trevoa patagonica.

Comments

. . . . . from H. Middleditch

There are records of Austrocactus being found in many places in Patagonia, both from the extensive zone of the Patagonian steppe and from the narrow band of less arid vegetation along the foothills of the Cordillera. It is this latter belt which Hauman describes here as the Patagonian precordillera which has a narrow east-west extent but a very lengthy north-south extent. Hauman also tells us that this type of vegetation extends from the tip of South America northwards to about 37 degrees S. latitude, and that it bears a remarkably similar appearance and has a similar composition over the whole of this extent. It would appear that Austrocactus is probably one of these regular components. It is certainly found as far south as Lago Argentino, whence a plant was found by Lembcke. From the account given by van Vliet of the plants which he found at Alumine, at Junin de los Andes, and at Bariloche, Austrocactus would seem to be fairly prolific where the band of precordillera vegetation passes through Neuquen province. It seems to be so prolific here that one could anticipate the distribution area extending further to the north — perhaps as far as the transition zone around 37 degrees S? Up to the present, it has not been possible to obtain sight of the original descriptions of those Austrocacti which may originate from this pre-cordillera, nor to establish with any degree of certainty just whereabouts they were found.

. . . . . from Hans Lembcke

I have left you waiting a long time for an answer to your letter, because I undertook my journey to Patagonia in the southern summer of 1969; since that time I have changed my home so often that most of my notes from that date have been lost. Now that I have had an opportunity to discuss the matter with my son, who had accompanied me to Patagonia, I can tell you that we found Austrocactus near to the small town of Perito Moreno, on the hills just outside that place. The surroundings look very similar to the high north of Chile, that means dry and scarce vegetation. Perito Moreno is located not far from Lake Buenos Aires.

. . . . . From H. H. Pritchard "Through the heart of Patagonia"

By the time we reached Lake Buenos Aires we were, both men and horses, pretty well done up. Owing to the wildness of our horses, the journey from Trelew had been an especially trying one. On November 8th we went out hunting over hill rising behind hill, with wind-lifted wisps of sand turning and twisting upon them. Up on the shore of a lagoon close to the lake, a smart shower of sleet, rain and hail overtook us and we had to lie down in the lee of a thorn bush. During the night of the 10th, half a gale of wind blew up with an extraordinary coldness. While we were at Lake Buenos Aires the wind never died down, it blew all the time, often lifting sand and gravel. As for our base camp, three large thorn bushes were Nature's contribution to it; the tents huddled as much under the lee of the bushes as possible. Below the camp, which stood on a ridge, the ground fell away in a three mile slope to the usual angry water. Our troop of horses were turned out on the marsh grass that extended in a broad strip down this slope. Before reaching the lake we crossed an arid spread of yellow mud and stones, yet close to our base camp a neck of land displayed green scrub and flowers — beautiful purple sweet pea like flowers in

profusion! On the northern shore of the lake was a high water mark outlined by piles and piles of driftwood. Some of the trunks were as large in girth as my body. Between these and the water lay a wide strewing of trunks of antarctic beech. The upper rim of timber was about 200 yards distant from the edge of the water.

On November 12th I caught a horse and went down to the long point that stretches out into the lake. Although this was a ride of upwards of 20 miles. I saw no living thing upon the land and on the water only a couple of grebes and three upland geese. On November 15th, we started to make an expedition west-wards towards mount Pyramide, on the northern shore of the lake. We made our way across a grey desert, varied by marshes and califate bush, stone and boulder, thorn and sand. Presently we struck the deserted camp of the Argentine Boundary Commission near which the steam launch, which had been brought across the Pampas for the exploration of Lake Buenos Aires, was secreted. The lake measures 75 miles in length.

On November 21st we made a little expedition to where the river Fenix enters the lake; we pitched camp in the midst of yellow grass besides the narrow river, on whose banks low green scrub ran riot and enormous califate bushes made impenetrable patches of thicket. Our camp was quite drowsy with the humming of insects, being sheltered from the winds by trees and by cliffs. There were marshes of wet or drying mud and sand on the eastern shore of the lake where tracks made when the snow has melted and the ground is soft remain visible for five or six months. On November 28th we went hunting in the slight depression through which the river Fenix winds. The sun, newly risen, had just begun to suck up balls of mist that rolled up and down the cuplike hollows.

On December 2nd we camped in the canadon or valley of the river Deseado, a swampy, reedy spot tenanted by great numbers of upland geese, flocks of Chiloe widgeon and brown pintails. I also observed here the rosy-billed duck, the blue-winged teal, and what I took to be the red shoveller. Besides these I saw flamingoes and the black-necked swan. A flock of parrots was flying about the heights. The reedy pools and backwaters in this canadon were, without exception, the most glorious paradise of wildfowl that I have ever seen.

On December 7th we continued along the south shore of the lake until we arrived at the river Antigua, a small but rapid torrent flowing through a huge gorge between very steep barrancas (valley sides - H.M.). At the bottom of the canadon we forded across, the water barely reaching to the horses' knees, but flowing so rapidly as to bring good-sized tree trunks with it. After our meal of half an emergency ration each, we climbed the western barranca and discovered an open space in the forest, where we made our camp. Here we were greeted by the wet smell of earth, to which we had long been strangers on the dry stretches of the Pampas. Quite close to the camp I found tracks of wolves, guanaco, deer and smaller rodents. The gorge was not an inviting spot with its hot marshy valleys and fat stinging flies. As I would sit writing my diary, diabolical looking insects with upturned tails used to crawl across the page.

. . . . . From M. M. Job, "Berberis from Nahuel Huapi".

Berberis buxifolia, native name Calafate. Berberis linearifolia Phil., native name Calafate. Berberis cuneata D.C., native name Calafate.

. . . . . From C. Skottsberg "The Wilds of Patagonia" (1911)

One of the first attempts at a pioneering settlement in Patagonia was the colonising enterprise of Sarmiento in 1584, with rather unhappy results. In 1621 Captain Flores de Leon started with an expedition from near Port Montt on the Pacific coast. He discovered the Peres-Rosales pass over the cordillera and reached Nahuel-huapi where he encountered numerous Indians. There was a Jesuit mission on the shore of Nahuel-huapi from 1670 to 1717. The first botanical work in the area was by R. A. Philippi who started to explore the regions of Llanquihue and Nahuelhuapi in the 1850's. In the years 1875-1880 Dr. F. P. Moreno crossed Patagonia in all directions. He and his companions were the first to reach Nahuel-huapi from the east. A German-Chilean company now owns land at both sides of the mountains and has established regular traffic between Port Montt and Bariloche at Nahuel-huapi. German colonists have changed the province of Llanquihue into a land producing butter and honey for export.

Nahuel-huapi has so many different aspects : far to the west it washes the foot of the Andes in narrow inlets reflecting the dark forests of alerce and cedro, with thickly wooded isles. In the east it opens into the pampas, the mountains are left behind, the forests have dissolved into groves and patches. It had started to blow hard and winter made its expiring efforts; a storm, first with rain and then with snow and cold. All the forest lay powdered with snow. Three days passes during which the gale raged with unabated strength. Finally the sun showed its face again and the lake steamer arrived after a rough voyage. The village of Bariloche was now its destination. Bariloche is situated on the edge of the forest region. West of it are the big cedar forests (Libocedrus chilensis) in the east a yellowish steppe.

(After acquiring horses and provisions the party made its way south from Bariloche . . .) It was December 8th when we started to cross the pass and descend to the large depression where Lake Buenos Aires extends — the largest of the Patagonian lakes. It was an agreeable ride in bends and turns between forest patches. The rise was not so hard but that it permitted us to remain on horseback at all times and at 3,400 feet we reached our highest point. From there we beheld the vast expanse of the lake with the blue mountains behind. In the east the lake reaches the Pampas : the western arms penetrate far into the mountains, as far as the edge of the inland ice.

Lake Buenos Aires has a surface area of about 800 square miles. We were sorry not to have a boat and had to keep along the shore. The Lake empties in the Rio Baker, which flows to the Pacific. We camped early that day and I got time to look at the vegetation. On the sandy banks of the river Fenix where we had our camp. I found quite a number of species I did not know, of which several had just been described as from other parts of Patagonia. Further down the river, we came upon a sort of peculiar bush vegetation, well worth being studied, and we stayed there the next day. The bushes, fine species of Lycium, Verbena, and others were in full flower everywhere in the hot sand. Beautiful yellow flowers of Alstroemeria pygmaea peeped out, as well as small spiny cactus with large yellow, red, and white blossoms. I had to find out a method of conveying the prickly things with me, but they landed home in good condition. Between the tussocks, many-coloured lizards scurried to and fro, black and yellow, brown with red and white markings, or with a copper lustre. We had not come across armadillos until we came to the Fenix valley; later on we saw them at all times. They live on locusts and other insects, and to judge from the contents of their stomachs there is no lack of such.

At midday the sun became too hot for us, and especially for our horses; nowhere was there an inch of shade. At sunset it grew rapidly chilly, and the thermometer fell to freezing point — which did not prevent it running up next day to 86 degrees F. in the shade again. We followed the river Fenix for some distance and then took a short cut across the hilly country down to Lake Buenos Aires. Here we chanced among a veritable labyrinth of sand-dunes. The river runs east for some miles before turning south and finally west to empty into the lake. Just east of its bend, another river, the Deseado, starts from a swamp and runs across Patagonia into the Atlantic. The water parting between the Deseado and Fenix i.e. between the Atlantic and the Pacific, is very insignificant. The Rio Fenix has only just abandoned its old course to the Atlantic and it was possible for Dr. Moreno to remove some of the morainic material and coax it back for a while.

At the east end of the lake there is almost a desert — dry stony plains where the few plants look like monsters, to such a degree have they adapted themselves to an abnormal life. One is agreeably surprised when suddenly the canyon of Fenix river opens at one's feet; there is luxurious green grass. The River Fenix winds in innumerable serpentines, bordered by a green fringe. In spite of the good grass along Fenix and south of the lake, the whole region is uninhabited.

. . . . . from H. Middleditch

In Backeberg's Die Cactaceae Vol. I p. 162 we find Pterocactus skottsbergii, type habitat Rio Fenix, Patagonia. According to Backeberg, there seems to be a dearth of information regarding the flower colour of many species of Pterocactus, but I am under the impression that it is usually pale yellow. So what were the cacti seen by Skottsberg with red and with white flowers? The small town of Perito Moreno now stands near where the rivers Fenix and Deseado come close together and here Lembcke found an Austrocactus. Did Skottsberg see an Austrocactus in flower here in December of 1908?

THE BERBERIS FROM THE REGION OF NAHUEL HUAPI By Maria M. Job

Translated by H. Middleditch from Revista del Museo de la Plata (New series) Vol.V Botanica No.18, 1942-1944.

This contribution deals exclusively with the species of Berberis which grow around the Lake Nahuel Huapi, a very important area for the number of species and the abundance of individuals. The material gathered during the excursions undertaken in the year 1935, emanated (amongst other places) from Cerro Otto, of 1400m height, located 15km to the west of San Carlos, and from Cerro Runge, only 3km to the west of Bariloche.

The surface of Neuquen exhibits a natural inclination from west to east, interrupted at the edge of the cordilleras by the numerous ranges of hills which branch off from the cordillera. In accordance with its morphological features it can be divided into level ground and mountainous ground, in turn subdividing the latter into the zones of high plateau, the eastern sierras, the cordillera with its north, central and southern sections. We are particularly interested in the southern section where the large lakes are to be found and which extends southwards from Lake Alumine. Here beings the Patagonian Cordillera which has the following characteristics, according to available studies: average altitude 2000m, absence of a central watershed of connected peaks, existence of numerous transverse valleys and lakes of characteristic form, vegetation coherent woodland, decreasing in altitude in proportion to the distance travelled southwards, and a large amount of snowfall and rainfall.

The lakes or chains of lakes have been brought into being by the numerous lines of hills which, running from west to east, form closed basins. The most important of these lakes is Nahuel Huapi: it takes up a south-west to north-east alignment (in fact it lies approx. NW-SE — H.M.), is situated in the south of Neuquen and extends to the valley of the river Limay. This lake has a maximum depth of 440m and lies to 765m above sea level. It has a surface area of 523 square kms. The lakes of the Limay basin, which are numerous and fairly large, comprise a total surface area of 1,148 square kms. The region of Nahuel Huapi has an absolute maximum temperature of 40 degrees (C? — H.M.) and an absolute minimum of minus 15 degrees.

The margins of the lakes, accessible in some places and high cliffs at other points, are in the main covered by exuberant vegetation which is to be found at altitudes between 700 and 1100m. The valleys contain in their bottoms an arm or chain of lakes fed by the streams of water or the thaw from the neighbouring heights. In places where the valley floor lies at 600 to 800m altitude there are passes which lie at 1000 or 1200m by which one may cross from one valley to another. The

mallins are covered with tender pasture, and when they receive an appreciable amount of water, they become marsh or quagmire. Elsewhere this is a permanent feature, due to the existence of subterranean waters which are in contact with a bed of clay. When this occurs, the mallin should contain springs of water.

San Carlos de Bariloche, lying on the edge of Lake Nahuel Huapi enjoys an average annual temperature of 8 degrees C, an absolute maximum of 35 degrees C and an absolute minimum of minus 14 degrees C. The usual rainfall is some 1144mm per year, with snowstorms in June and July. The winds blow from the west and south-west with great force in the winter season (June) and register a much reduced speed at the start of the summer (October). They blow with increased intensity from 12 to 14 hours and calm down at dusk. This is the reverse of what takes place over almost the whole of Patagonia, particularly in Santa Cruz, where the wind blows with greatest violence in summer, from November to January, the minimum velocity coinciding with the month of July.

. . . . . From H. Middleditch

Not only does the author mis-state the orientation of Lake Nahuel Huapi, she also quotes Lake Gutierrez "South-east of Bariloche" whereas it lies south-west of Bariloche. With this in mind, how much credence are we entitled to give to the figures and conditions of climatic regime quoted by the author for this Austrocactus habitat? A rainfall of 1144mm at Bariloche is corroborated from other sources (e.g. Latin America by Pohl & Zepp 1966) and amounts to some 45 inches per annum. This is a fairly large amount for a location near which van Vliet found specimens of Austrocactus growing. This rainfall and the average annual temperature is comparable with the regime on Dartmoor or Exmoor. It is less rainfall than occurs in Eriocactus habitat, where both latitude and altitude are less, and where evaporation will be greater. Do the Austrocactus also grow on more stony ground near Bariloche?

IN SEARCH OF AUSTROCACTUS **By D. J. van Vliet**

Translated by W. W. Atkinson

The literature on cacti displays many gaps. One of them is the genus Austrocactus, and the situation does not improve since there are very few plants of the genus to be found in collections. In planning our journey through South America I wanted to look for Austrocacti in order to bring more clarity to this group of plants. Because of the enormous distances involved in fulfilling this plan and the associated loss of time, my travelling companion and I had to drop this idea. Furthermore, these areas in the south of South America are considerably poorer than those in the middle of the continent. This is why one seldom sees imports from these parts. However, Austrocactus had for me an irresistable attraction and thus we decided eventually for each of us to do a part of the journey separately, with the object of fulfilling two ambitions.

From the literature I knew that Austrocactus were to be found, among other places, around and near the 41st degree of latitude and it was no sad parting from Mr. Rausch when the train left Sucre in Bolivia on the journey of 5000km to where the plants grew. The journey to the Austrocacti took nine days, with breaks in Salta to pick up plants collected in North Argentine and in Buenos Aires to send these and also plants from Bolivia back to Europe. I had chosen as my destination Junin de los Andes, which is about 2000km from Buenos Aires. The nearer I got to the objective, the more effect did the weather have on nature and I began to wonder if cacti could possibly grow in these conditions.

On arrival at Junin de los Andes, we had travelled for a day, a night and a morning. A harsh wind blew cold rain in my face. Was I now in Holland or in South America? First and foremost I sought accommodation. This was fairly easy, with the help of a fellow-traveller who lived here and took me to an address where I soon had my feet under a comfortably warm stove on which my cherry-fresh landlady was busy cooking a meal. All the ingredients were now present for me to imagine that I was back in Holland where such comfortable conditions are normal in the winter.

After lunch I decided to go at once and look if cacti really did grow here. The weather meanwhile had become even worse. The cold rain had become wet snow and I had to force myself to point my steps in the direction of the very bare looking hills several kilometres away. A pessimistic feeling came over me when I found I had to trudge through thick layers of mud. Under these conditions you have to be able to smell cacti or you would turn round and go right back. The first hillocks offered no prospects. "That would not be possible" I thought, because they were covered in soaking wet clay which was splendid for sliding about on. The humour of the situation escaped me and when I thought of that warm stove I wondered whyever I was sloshing about in this mud. After the first hills they got higher. Perhaps on top I would find cacti and so I plodded on further in snow and mire, up hill and down dale. After about four hours of slipping and scrambling up and totally drenched in all that wetness, one thing seemed absolutely certain. If cacti grew here, they must be in the greenhouse of some Argentinian amatuer or other. The shadows were already united with the rain into night when I got back to the little house, tired, dirty and disappointed. The woman surrounded me with all Argentinian hospitality with the object of making me more presentable and bringing my numbed limbs back to normal temperature. For this process I was thrust into some of her husband's underwear with home-knitted socks of real lambswool on my feet. The hot meal that evening with the splendid Argentinan wine made me very quickly forget the misery of the day and so I crept real Dutch between the clammy sheets and ere long dreamed of Austrocactus with blue flowers in a beautiful warm pampa.

The next day I would try my luck in the hills on the other side of the valley in which the village lay. First I had to march 7km to get to a bridge over the greatly swollen Rio Chimehuin. The weather was better than on the day before. True, the wind was still just as harsh, but the precipitation was now mainly mist with now and again a burst of drizzle to cool the heated wanderer. After about 1½ hours I was at the foot of the first hills. These were being grazed by an enormous herd of cattle which blocked my way. This sort of thing is found pretty often in Argentina because of the corned beef. It is possible to walk through such a herd, but not entirely without danger. If the animals get frightened by something and start to bolt you can be certain to go under the hooves. There is also the danger that the animals, driven by curiosity, come to inspect what to them is a strange being. For they are used only to men on horseback and not passing walkers. A farmer who was once in such a situation told me that he was able to escape by offering them his jacket. The beasts gored it completely into the ground during which time the man had a chance to reach a fence.

After a quarter of an hour's wait, the herd was clear and the cactus hunt could proceed. But no matter how I searched, once again there was no trace. Somewhat further away the hills were of rocky formation and I decided to try my luck there. Irritatingly, again no success. I did find fossiled wood of which there were lovely brown, yellow and blue coloured pieces. In any case, a consolation prize, I thought. Fossils of complete tree trunks are found in these parts, as well as of lizard-like animals. So far as is known, no cactus fossils. Still wandering, I had come into an area of higher hills. Why, you can't tell, perhaps its an intuition, but you suddenly feel that you are near cacti. The previous day I thought I had smelled them, but this time the itching in the nose was getting stronger. Getting nearer, I saw that these hills were of rocky formations, ideal for cacti which are mostly found in stony parts.

My joy was indeed indescribable when on the northern flanks — here the sunniest — I indeed found cacti. The first Austrocacti were a fact. There were plants with brown, yellow, white and black spines. Splendid to be able to experience this. For nearly two days I had doubted their existence, but in spite of snow, ice and mud, there they were. I filled the rucksack and then set off back to Junin in high spirits, and where the Argentinian pot tasted once again delicious, but this time yet better than before. I rinsed the muddy plants clean and was allowed to lay them to dry under the stove. As soon as they were dry I examined them more closely and was able to extricate a few fruits with seeds which were still caught behind the interlaced spines.

On the third day of my stay here I went searching again in the hills whence I had had to return empty handed on the first day. I set out early, and intended, now that I had a full day before me, to push further into the hills. After several kilometers I found here also, Austrocacti. They were different from those I had collected the day before. But let me not be tempted in this place to quote the specific names. The plants have first to be studied. Besides, these plants grew not in the stony ground like those of the previous day, but on the tops of hills in the black clay with which I had been so beautifully smeared. What conclusions are to be drawn from this on methods of cultivation?

These Austrocacti were growing here always either under or near to a frightful looking companion — Xanthium spinosum — armed with long yellow-white spikes. The Austrocacti were well camouflaged by them, the spines and spikes going well together. Because I kicked the low bush, which is ball-shaped and reminded me of a football, I saw that a cactus was growing under it. The Argentinians call these plants cepo caballo and also abroito — horse snare and little thistle.

The conditions under which these Austrocacti manage to hold their own are quite different from those which apply to the general run of cacti. Winters in these parts are very harsh and cold with much precipitation, very much like home (Holland — H.M.). There is no question that the plants are then protected by a layer of snow. That can occur, but just as often they are frozen solid. Ritter, who found Austrocactus hibernus (Sukk'kunde VII/VIII) on the 38th degree of latitude in south Chile describes a climate there similar to that of my area, although this, at 41 degrees is further south. Ritter states in addition that the plants should be winter-hardy in Germany. To prove that I shall have to do some winter trials with the plants in Holland.

The work in Junin de los Andes was completed and so I left for La Rinconada some 50km further on. According to the literature Austrocactus gracilis occurs in the hills on the banks of the Rio Alumine at a height of 800m. By a bridge over this said river was a motel which offered me a good shelter in this lonely district. The manager of the motel answered my question as to whether or not there were cacti about, that he had never seen one. These statements are of little value. People do not bother themselves much with such things and there is also the possibility that they do not really know what is meant by a cactus.

Although the day was already well advanced, I took a walk in the immediate neighbourhood, and immediately found the sought-after plants. Whether this was really Austrocactus gracilis I will not say certainly. The plants were better spined than those which I had found earlier. I also found a Tephrocactus here which, in so far as it is possible to identify with the existing literature, must be Tephrocactus neuquensis (Borg) Bkbg. It is the only described Tephrocactus from this countryside. Tephrocactus darwinii (Hensl) Bkbg. grows much further south. Tephrocactus neuquensis forms splendid yellow spined clumps which from far off shine in the sunlight. I suggest that these Tephrocacti should be winter hardy in our country, also T. darwinii. In order to test out this theory, several pieces disappeared into the rucksack. The bad weather that had accompanied me up till this afternoon began to get better. The air was clearer and here and there patches of ice began to

form on the pools. A trip along the Rio Alumine was an attractive thought and with that in mind I had much to think about for the following day.

It froze hard in the night and everything was covered in hoar frost. However the sun showed itself and within an hour nature was again its normal colours. The trip along the clear blue river was exceptionally beautiful. I was completely alone and this is an experience that we hardly ever enjoy in our over-full little land. I have experienced the enchantment of deserted landscapes and thereby of the great wide world many times during my journey through south and central Argentina. Everywhere on the way I found Austrocacti and Tephrocacti. In this district gold is found, but alas I never found the odd kilo nugget amongst the cacti. That would have covered the cost of the journey nicely. Completely happy I returned to the motel around nightfall, where a number of new guests provided the necessary company. It also provided me with the opportunity of arranging a lift for the following day to Bariloche — which saved a few pesos . . .

. . . . . From W. Rausch (G.O.K. Rausch Field Number List).

The more one works in these high valleys and ranges of the Andes, the more one realises how little one knows about them. So in December 1967, I set off on my third expedition. This time I went together with the Dutch cactophile D. J. van Vliet. We were in Argentina with the collector H. Fechser for one month. After that we collected for two months in Argentina, in Salta and Jujuy, and for one month in Bolivia, in Cochabamba and Sucre. There my companion had problems with the altitude so that he had to go down to a lower level. He went back to Buenos Aires and collected alone in the south around Rio Negro, whilst I remained in Bolivia for two months. We joined up again in Buenos Aires, going on to Montevideo, hiring two bicycles — the hills are not so high in Uruguay — and in three months travelled more than 2000km.

. . . . . From H. Middleditch

We have been very fortunate in obtaining the loan of half a dozen slides from van Vliet which show something of the nature of the countryside where Austrocactus grow together with an indication of the immediate surrounds of the plants. The vegetation of the Austrocactus habitat near Junin de Los Andes and Rio Alumine appears to be bunch grass, with tufts set positively apart from each other, sometimes up to a metre apart, with some herbs growing close to the grass tufts. There appear to be some dwarf shrubs but certainly no bushes, so that one gains an impression only of grass tussocks, spreading over gentle slopes. When looking at these slides I felt that I might have easily been looking over the moors between Beattock and Douglas, or near the head of Arkengarthdale or Swaledale — above the last farm. Even the stream in a foreground, cutting into its bank and exposing the same mixture of various sizes of stone and gravel, left by the glaciers, heightened the illusion. But where the Austocactus grew the close-up views showed that the ground was bare and stony between the clumps of vegetation.

PROBLEMS WITH GLASS MOUNTED SLIDES

At a local Chileans meeting in the north-east of England, the opportunity was taken to screen half a dozen slies taken by van Vliet of Austrocactus in the wild. These slides had only been received a week or two previously and were about 6.5cm x 6.5cm square format. The slides had travelled from Brazil unframed and so they were put into glass mounted frames for projection. Very fortunately there were two suitable projectors on hand which were capable of taking this size of slide, an Aldis of traditional design from Geoff Swales and a Gotschmann G67 taken "on approval" by Roy Mottram, both being manually loaded and operated.

Naturally there was a fair amount of discussion over the habitat slides so that they remained in the projector for several minutes at a time. More or less by chance, when looking at the slides after projection, one of them was found to show some evidence of buckling between the glass mounts, but we were not to know whether this had just taken place or was like that on receipt. However, on looking carefully at the test slide which came with the G67 projector, this was found to be quite clearly buckled into concentric rings. The G67 projector looked and weighed as though it had been built in a naval dockyard and defeated all attempts at dismantling to scrutinise the heat shield and ventilation arrangements. Alan Craig observed that he had never had any problems of this nature with his Hanimex Lerond cordless projector so this was loaded with a 2ins. x 2ins. glass mounted slide and left on for a couple of minutes or so; where this slide was removed it, too, was permanently distorted inside the glass.

Various theories were put forward as to the cause of this problem; the greenhouse effect of the glass enclosure leading to overheating of the slide seemed to be possible. However, the real cause of the problem became even more obscure (if that was possible) when we heard . . .

. . . . . from F. Fuchsillo

Your letter telling me about problems with glass mounted slides was opened and read after tea when I was in the middle of mounting a new batch of my own slides into glass mounts. We were just about to watch an hour-long television programme, so I put one of my glass mounted slides into my Kinderman 66 type 1050 projector and left it on for a total of sixty three minutes. You will see from the slide that it shows no signs of distortion at all. (This slide was passed round at our 1981 Brooksby weekend).

. . . . . From D. W. Whiteley

Surely this problem will be due to the method by which the slide is held in the mounting frame? A slide which is mounted in a cardboard or plastic frame heats up when you put in in a projector; you can hear the slide "pop" when the expansion of the hot slide causes it to change shape. If a glass mounted slide is clamped tightly around the edges then these cannot move to accomodate the expansion due to the slide heating up, and the middle of the slide cannot belly out because of the glass. So it makes ripples in the slide which remain there when it has cooled down.

. . . . . From H. Middleditch

But does not a slide heat up more at the centre than at the edges? is this not the reason why a slide "pops" — because the heat gradient from the centre to the edge of the slide causes differential expansion, the centre expanding more than the edges so the slide buckles or bellies to accommodate the change in dimensions? If a hot slide is assumed to have a surface representing a simple curve, whilst the sides of the slide continue to remain straight and rectangular, then if the slide expands by one mm across its width, there will be a rise of very nearly one mm between the chord and the arc. It is unlikely that the gap between the glass plates will exceed 0.2mm so that the only way the width of the slide can expand is to form a series of ripples. Was Francis Fuchsillo's slide holder all metal, held in a metal slide transporter, so that it conducted the heat away as fast as it was captured by the slide and so circumvented the problem?

. . . . . From F. Fuchsillo

No, my slides are in plastic mounts.

. . . . . From R. Mottram

From conversations which I have now had, it seems that transparencies of any size will be damaged by any projector, if and only if they are mounted in glass. The maximum recommended exposure of glass mounted slides which are required for subsequent publication is one minute, with buckling due to the heat generated by the glass of the mounts occurring normally at 3 to 4 minutes. This does not alter the image on the screen because the buckling takes place within a very narrow field, but printers require a completely flat film in the printing process and they are useless for this if exposed to the projection problem. I now intend to use my 35mm transparencies in the original card mounts for projection and will keep the 6cm x 7cm photos in special card mounts. I belive that Alan Craig has many of the slide library transparencies in glass mounts and he may be interested in these findings. Incidentally, I have decided not to keep the G67 projector after all.

. . . . . From P. Smart

My own projector has a fan which ventilates both sides of the slide and I have no recollection of any slide ever having been damaged, however long it may have been in the projector. Is it the projector that is the real cause of the problem? Is this why Francis Fuchsillo says that he has never suffered with any permanent distortion of his slides, because he has a projector with a better heat shield and/or a better ventilation system?

. . . . . From H. Middleditch

Does anyone know if there has been a "Which"? survey carried out by one of the many photographic magazines, dealing with the effectiveness of heat shielding and heat dissipation on projectors?

. . . . . From J. Bagnall

No-one seems to be aware of any such survey so I am prepared to offer to help if anyone is interested in testing their own slide projector. Fortunately I have acquired some surplus temperature sensitive strips which I can mount into a slide frame. These can be put into a projector and if the range of the sensitive strip is suitable for the temperatures generated, it will show how hot the slide really does get. (Arrangements were made at the 1981 weekend to supply mounted strips to those members interested in partaking in the experiment).

SCENT IN SULCOREBUTIAS From J. R. Gooch

My own observations on Sulcorebutia flower scent largely support those of Rudolf Oeser (Chileans No.37), except that where I have several clones of a species usually exhibiting a pronounced fragrance — such as S. candiae — in one or two plants it is so faint and elusive as to be hardly discernable. I had at first thought that these same plants were completely without scent, but realised a little later that this was the fallibility of my nose after first sniffing at those plants more strongly fragrant.

Rudolf Oeser's group "5" covers a rather mixed selection of plants in which S. Markusii, S. losenickyana and especially S. vizcarrae look a little uncomfortable to me, standing alongside S. crispata, S. alba, S. zavaletae etc. My own thoughts tend to link the first named with S. flavissima, S. Oenantha and S. pampagrandensis from habitats a little further north. Certainly I must pick up the observation that S. vizcarrae is without scent. I only possess one example (unfortunately) but this is my most strongly fragrant Sulcorebutia, having that distinctive scent of cloves which Rudolf Oeser ascribes to some S. cylindrica forms alone. In fact, I could detect very little scent with S. cylindrica, and even had I done so, it is not a characteristic that would have aligned this species closer to Weingartia with its short funnel form flowers, the northern form of this genus as I see it.

There are a few plants in the area around Torotoro, Mizque to Aiquile that appear to link up Sulcorebutia and

Weingartia e.g. W. purpurea, W. torotorensis, and S. vizcarrae — all purple flowered; perhaps the recently described S. santiaginiensis also. Then there is possibly another separate convergence around Comarapa with S. krahni and some forms of W. neocummingii such as Lau 958a which has dense bristly spines and short tubed yellow flowers. Fred Brandt's Weingartia aglaia, found in many of our collections as S. tiraquensis bicolorispina, may tie in here also, as a purple flowered form of S. krahnii, but I am not sure at present what are the western and eastern limits of the habitat of S. Krahnii and W. aglaia respectively.

Comment on Oeser's article

. . . . . From P. A. Smart

The botanical characteristics which are significant in the taxonomic sense have always been somewhat mysterious to me and, I suspect, to most cactophiles. Those characteristics used by individual taxonomists often seem to be chosen rather subjectively, hence the differing views on relationships we so often read. Oeser suggests that flower-scent may be a stable and taxonomically significant characteristic. He may well be correct and his findings agree largely with my own conclusions about Sulcorebutia relationships. There are many loopholes in the data he records though, and I have strong reservations about his conclusions.

1. Scent seems to be one of the most fickle of human senses. Is there any evidence that a given scent produces an identical reaction in different individuals? Do they experience the same intensity? Do they identify the same source? (i.e. Flower, compost, pot, surroundings). Do they match the scent they perceive to the same reference scent? My experience indicates that the answer to each of these pertinent questions could well be no. If this is the case, then Oeser's theories must be treated with great caution. Who is to say that the scent I identify as "clove" may not be identified by others as "musty"? Or what I perceive strongly may be faint to another?

2. There is no indication in the article of the ambient conditions at the time of each observation. What conditions might affect the strength, quality and even the very emission of flower-scent? I would have thought that such factors as the age of the flower, the time of day, the temperature, the age of the plant and the turgidity of the plant tissues could affect the situation. Unless Oeser's observations were all made under similar ambient conditions, we can surely not accept the strength of scent as indicative of relationships.

3. Evolution is hardly a finite process and we can only guess at the factors which brought about the morphology of each Sulcorebutia species. Never-the-less, on the strength of the data available there seem to be three (or four?) quite distinct lines of development in the genus. Oeser's evidence seems to define each of these lines fairly accurately. Now I would assume that the presence of flower scent in a species indicates that it is essential to the continuance of that species that it should attract a particular pollinator. Perhaps it might be the only pollinator in the habitat. Do we assume then, that each developmental line has a different and unique pollinator? If not, then why do we not find some plants in each evolutionary line which have strong musty, faint musty, fruity and clove scents, or even no scent at all. Until we have real evidence of the purpose of flower-scent in the genus and until we can isolate the part played by scent in the evolutionary process. Oeser's theories must be suspect.

4. What evidence have we that all the plants used in Oeser's survey are acceptable as the species named on his labels? He quotes a plant labelled S. sucrensis nom.nud. which has S. krugerii type spination and flowers as being S. krugerii mainly, it would seem, because of its strong musty scent! (S. sucrensis I find to be represented in collections by three fairly constant but quite different plants. But they all have similar red/magenta flowers, and spination which is far from being like S. krugerii). Now I accept that there is no reason why S. krugerii should not have a magenta flowered form, even if none had been reported but, really, Herr Oeser!

In conclusion I must state that I think Oeser's ideas are worthy of a lot more research. What is scent? Surely it can be assessed by modern scientific equipment? Do the plants exhibit the same scent in habitat? These and many other questions must be answered before we can make any real assumptions. Herr Oeser is to be congratulated on his astute observations, but their publication might cause problems. Scent is a rather fickle sense and I fear that we may soon see a large number of conformations of Oeser's findings. Many of these may, however real to the observer, be psychosomatic in origin. There seems to be a very close relationship between the senses of smell and taste, of which the latter would seem more stable. I wonder quite seriously, that perhaps if we could isolate the part of the flower which emits the scent we might be able to detect this factor in its taste.

PROBLEMS WITH PLACES From P. Goodson

In the process of looking through the latest copy of The Chileans I find I have a few problems once again as I do not know the whereabouts of a number of towns and various other places mentioned in the text. To quote the sort of thing that leaves me completely lost, take Chileans No.38 on p.157, the article about the Vitor and Camarones valleys where it says that "The climate of the lower half of the valleys approaches close to that of Tacna". When I refer to the map on p.160 of that issue, thanks to the inset I know what part of Chile it represents; but I can find no place named Tacna, only one named Tanca. Are we talking about two different places? And then again there is a place called Esquina in the text — is this the same as Isquina on the map? And how about Mullun in the text and Mulluri on the map?

. . . . . From H. Middleditch

The German Cactus Journal K.u.a.S. once ran a brief article entitled "The Printer's Devil" after a particularly confusing misprint had converted a small (klein) feature into a non-existent (kein) one. Despite the proof copy of The Chileans being read twice, on two separate days, we seldom seem to catch all the necessary corrections and a dozen or so seem to escape in each issue. Among them, Mullun which should have read Mulluri. But a very different matter is Esquina/Isquina. When I first started to prepare translations of articles which had previously been published in a language other than English I had an inclination to delete or adjust any passages which gave an impression of being out of line with other currently available data. It was quickly pointed out to me that if this was done, then the article ceased to be a translation of the author's work, expressing the author's views, and became transformed into the re-writer's views. On what basis did the rewriter take upon himself the decision that the original author was "wrong"; and furthermore how could an article purport to be a translation when it no longer represented what the original author stated? Not only the general context, but also the degree of emphasis placed upon phrases, have to be considered when undertaking a translation if the author's intent is to remain unimpaired in the process. I might have tended to discount this idea in the first place, had it not been for a particular phrase that I was half inclined to cut out on the grounds that it "had no relevance to cacti". Quite by coincidence I happened to see that it could have a possible bearing upon some question of flowering season which was being discussed at that time. The real value of a passage which had at first been looked upon as irrelevent was thus established by pure coincidence. Was fortuitous coincidence, then, thereafter to be the deciding factor in determining what was cut out of an article on the grounds that it appeared to be irrelevent? Or was the point of view to be taken that such passages would not necessarily be irrelevent to all readers at that time? Or at some time? If we failed to repeat an author verbatim, our readers would have no opportunity to latch onto a phrase or observation which they considered to be of value. Was it better to repeat an author's words and argue the case for the validity or otherwise of the article in the following comments? In this way, the author's intent would not be miscontrued; at the same time, any suggestions that the author was in error would be plainly stated and also seen to be so stated. This procedure has been followed, even to the extent of writing Esquina in our text when the author quotes Esquina in his text and putting Isquina on our map when the writer puts Isquina on the map with his own article.

It may also be as well to bear in mind that the spelling of place names is very often a European interpretation of a place named heard in an Indian tongue. The comparison table on p.156 of Chileans No.38 demonstrates how different writers can produce remarkably different spellings for one and the same place or feature. In addition, maps which provide reasonably comprehensive information regarding locations and names of places and physical features in South America are neither cheap nor readily come by. For this reason, various maps have been published in The Chileans which are intended to fill this gap. Most of these cover a fairly extensive area and include major places and features. Others, like the map of the Camarones and Vitor valleys, carries some places names which can consist of one hut. In the earlier section of the articles dealing with northernmost Chile, which appeared in Chileans No.37, several authors make reference to Tacna and this place also appears on the map on p.15 of that issue. Reiche and Pohlmann are noting that there is no real change in the landscape between that of the Tacna valley and their subject valley.

. . . . . From A. G. S. Hispanic America map.

As far as possible, Indian names are transcribed according to Spanish usage; but since Indian tongues are rich in gutturals, the conventional kh has been used to express them. Gua is identical with Hua, being pronounced like wa in English.

CHILEANS AUTUMN WEEKEND 1982

It is proposed to hold our autumn weekend at Brooksby Agricultural College from the evening of Friday, 3rd September, to the afternoon of Sunday, September 5th. At the time of going to press there was the possibility of a visiting speakers' travel expenses in reaching the U.K. would appear to require consideration. We hope to hear from R. Crook and also from F. Fuschillo about close-up photography. The lack of fruits after hand pollination will be raised by G. Charles and T. Jenkins will provide habitat slides from Brazil. Opuntia aurantiaca and Dr. Gillies will also be discussed. It is anticipated that the cost per head may be £31. Bookings to Mrs. M. Collins, 11, Tudor Gardens, Upminster RM 14 3DE. Fees payable by end of July.

. . . . . From G. J. Swales

Could not the cost of the Brooksby weekend by quoted in two parts, one for board and accommodation, the other being the contribution to the visiting speakers' expenses? Bearing in mind the inestimable value of the slides which we have seen already, I could not imagne that anyone would object to a figure of about £5 (say) per head to enable us to see and hear more from cactus collectors who have been out in South America.

. . . . . From J. Hopkins

Brooksby has become an expensive weekend . . .

ANOTHER TRIP TO PERU From R. Hughes

During my trip to Peru at the end of last year, I did keep a look out for possible pollinating insects; whilst concentrating on photography I did see insects at all sites except near Ilo. Bearing in mind that here as one kneeled to take close-up shots, invariably the wind seemed to draw a stream of sand into one's eyes, it is not surprising that insects were absent. It was difficult to understand how plants could exist there anyway. Many of the Islayas seen at one site had dead flower remains but I only found a few seed pods. At Ayacucho there were ants about, in and out of the flowers as I photographed though I do not know if there are any on film. On the Cleistocactus there were ladybirds around the flowers. On the Huanta road site large spiders waited in their webs strung between the cacti. They were so fat that there must be plenty of insects about. The ants come as tiny brown ones or large black ones. I did get a shot of a locust type grasshopper 4 to 5 inches long.

At Pisac I shot an Erdisia flower and from the stamens the rear end of a large fly protrudes. It is red and the red petals reflect from it making it almost invisible unless one knows it is there. I am sure there were ants as well as other insects about at Pisac, Cuzco, Puno and Ilave. I have written up my notes about the small amount of plant and seed material which I brought back with me whilst trying to keep the offsets and cuttings alive in the middle of winter. I have sorted out and listed the slides.

Whilst in Peru I acquired maps of all the southern departments except Lima (which was sold out). I had hoped that they would all be the same scale, but all of them — ten or so — are of different scales as they have been made to fit one size of sheet. I hope to prepare slides from these maps to show the various sites that were visited.

REPORT AND ACCOUNTS FOR NUMBERS 37 TO 39 INCLUSIVE

Income	£		*Expenditure*	£	
Subscriptions	1754.76		Printing of Journals, etc.	1630.61	
Sale of Back Numbers	464.65		Postage, Stationery, etc.	262.28	
Other Publications	37.35				
		2,256.76			1,892,89
Sales of Plants, Seeds, etc.	644.85		Purchase of Plants		414.96
Miscellaneous Income	44.17				
Bank Interest	440.44				
		1,129.46			
Balance brought forward from previous account		995.73	Balance carried forward		2,074.10
		4,381.95			4,381.95

The Treasurer advises that an appreciable proportion of the subscription and other income has only come to hand during the 1981 calendar year; on this account, an appraisal made prior to setting the subscription for Numbers 40 to 42 inclusive suggested that the financial position would be nothing like as favourable as that shown above. Certain stationery stock, purchased pre-VAT at SET-free prices, are nearing exhaustion and in consequence a heavy increase in this item cannot be far off.

It is unfortunate that recent issues of the Journal have been beset with unacceptable delays and printing faults — in particular, a dreadful mess was made by the printers of certain half-tones. The financial adjustment received from the printers in acknowledgement of this has made a material contribution to the favourable aspect of the above figures. Delays in publication, John Hopkins advises, have had a most adverse influence on the volume of plant sales.

Our long-serving Membership Secretary, Mrs. Agnes Lavender, has been obliged to relinquish this good work due to moving house. Inumerable problems and queries in connection with back numbers and payments for subscriptions have all been attended too with quiet efficiency, virtually since the start of The Chileans. Our good wishes go with Tom and Agnes Lavender to their new abode. At the same time, it has been our good fortune to have this task taken over by Mrs. Gwen Craig who has already had to face the influx of a veritable mountain of stock of back numbers.

The discussions of habitat ecology enjoyed by our plants together with relevant queries and comments seems to have led to an ever-broadening view of our plants being taken within the pages of The Chileans. Acquiring a reasonably collated body of information for an issue now involves a steadily increasing amount of time, a commodity seemingly becoming scarcer for many of our members. Not all contributions necessarily appear in print but the manifold forms of support received are essential for the future of The Chileans. Offers of assistance in translation would always be welcome, as would encouragement to potential new subscriptions.

STUDY GROUPS/REFERENCE COLLECTIONS

Cleistocacti	T. Lavender, Kalanchoe, Market Place, Tetney.
Frailea	J. Forrest, Spring Garden, 2 Darngaber Road, Quarter, Hamilton, Scotland.
Gymnocalycium	G. J. Swales, 5 Hillcrest, Middle Herrington, Sunderland, Tyne & Wear.
Lobivia	J. Hopkins, Primrose Cottage, Monks Lane, Audlem, Cheshire CW3 0HP.
Melocactus/Discocactus	J. Arnold, 4, Lonsdale Court, Churchill Park, Washingborough, Lincs. LN4 1HJ.
Neoporterianea	R. Ferryman, Nichelia, The Street, Stonham Aspal, Suffolk IP14 6AH.
Notocactinaea	G. J. Charles, 38, Whitehouse Common Road, Sutton Coldfield, Birmingham B75 6DT.
Opuntia/Tephrocacti	J. W. Bagnall, 22, Perlethorpe Avenue, Mansfield, Notts.
Photographing Cacti	A. W. Craig, Davelea, 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 3AR.
Trichocereus	N. T. Hann, The Retreat, 28, Beckenham Road, West Wickham, Kent.

THE CHILEANS

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Slide Librarian	A. W. Craig, Davela, Forest Lane, Kirklevington, Nr. Yarm, Yorks.

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