Succulent Plant Conservation 2007

A CactusWorld Supplement, commemorating 25 years since the formation of the British Cactus and Succulent Society by the amalgamation of the National Cactus and Succulent Society with the Cactus and Succulent Society of Great Britain in 1983. Also issued to commemorate 20 years since the formation of the BCSS Conservation Committee.

Introduction

"It is permissible to lament the altered aspect of the earth's surface, together with the disappearance of numberless noble and beautiful forms, both of the animal and vegetable kingdoms. For he cannot find it in his heart to love the forms by which they are replaced; these are cultivated and domesticated, and have only become useful to man at the cost of that grace and spirit which freedom and wilderness give. This evidence of material progress must be a matter for rejoicing only to those satisfied with our system of civilization, or method of outwitting Nature by the removal of all checks on the undue increase of our own species."

William H Hudson, *The naturalist in La Plata* (1892)

This is an early comment on the loss of biodiversity in the Argentinian pampas, thanks to overgrazing by millions of sheep and the planting of crops. Even earlier, in 1840, Alexander von Humboldt warned the Quito authorities that they should control the felling of *Cinchona* trees in the valleys of what is now Ecuador, to make way for crops, else the tree that was then the only source of the invaluable medicament quinine would be lost forever. His warning went unheeded, and *Cinchona* was only rescued later by Spruce, who, under instructions from Kew, collected seeds that were used to start a new plantation in India.

"Pediocactus nigrispinus is exceedingly slow to reproduce and in the case of human interference, very slow to recover from large losses (such as developments or indiscriminate collection).

"Where I stand they are safe. This land is owned by state and almost inaccessible. Large clumps are still to be found and even rare crests grow in peace and safety. All Pediocactus nigrispinus are not so lucky. Some grow on private land or more accessible terrain, which have then been dug and planted in old boots and cans and then sold at flea markets as novelty items. What a degrading end for a cactus that may well be older than the individual selling it!

"Some Pediocactus nigrispinus are close to land developments. Houses and green lawns are swiftly encroaching on more and more habitat of this sagebrush desert cactus.

"In Moxee, Yakima County, Washington, a large habitat is being destroyed as houses creep further into the hills. Bulldozing P. nigrispinus clumps, some up to three feet in diameter, is a standard procedure. The one and only monstrous form of P. nigrispinus that I have ever seen is in direct line with progressing development and only quarter of a mile from the most recently constructed home.

"Until recently, mainly Europeans such as Fritz Hochstätter of Germany, who has spent the last 25 years in the field studying P. nigrispinus (as well as other species), seem to be the only ones really interested in this cactus and its future. My hope is that this is an oversight by Americans and not a case of indifference."

Dixie A Dringman, *Winter Hardy Cactus and Succulent Association* **5**(4): 15. 2005

Meanwhile, in another part of Washington State, in Grant County at a place called Babcock Bench, another population of *Pediocactus nigrispinus* has been threatened, but this time by grazing. It occurs in an area of 160 acres that is currently being leased to a cattle farmer. This is bad, because cattle trample on small cacti. However, an even greater threat to this population was caused by an application by the lessee to the authorities to allow the grazing of 25 buffalo instead. He currently owns about 40 buffalo, which graze a separate area of 160 acres. Unfortunately, buffalo are like goats and eat everything, including small cacti, and completely decimate the natural vegetation of any area to which they are confined.

For the moment this is no longer an immediate threat, thanks to the intervention of Dixie Dringman and others, who have been able to persuade the Washington state licensing authority that *Pediocactus nigrispinus* is a species distinct from *Pediocactus simpsonii*, not merely a synonym. *P. simpsonii* is not a CITES App I species, and therefore not considered as being endangered. As Dixie herself put it: "This revision is very important as it distinguished the Washington cactus as a localized and rare plant compared to *P. simpsonii* that is well known from the Rocky Mountains westwards."

This is the present state of play on this issue, but the threat is still not entirely removed because *P. nigrispinus* is still not yet listed as an App I species.

The example of *Pediocactus nigrispinus* is useful here because it epitomises the plight of endangered succulents everywhere. Other examples are highlighted in this Special Issue of the way that human expansion has become a serious threat to everything in nature, especially those organisms, which, like succulents, have a slow metabolism and do not regenerate quickly.

So what lessons do we learn from all this, and what practical measures are possible? The tide of human population increase will never be easily held back, thanks to the very lack of intelligence and social conscience that we are theoretically supposed to possess. Therefore the minority of us who foresee a

***Pediocactus nigrispinus*. Seen here at home in Idaho, near the confluence of the Salmon and Snake Rivers (Photo: Adolf Mühl)**

period of mass species extinctions in the wild, which has barely begun, must do our level best to preserve some at least of what we have left, away from those native habitats.

It has become clear that all wild populations that are not managed within a special protected area in nature need to be maintained in ex-situ protected reserves, whether under the jurisdiction of the state or the private sector, and whether in institutions, in private collections or in commercial units.

The issue of whether they can, or indeed ought to be, preserved as genetically pure representations of the original wild populations also has to be addressed, and suitable precautions against possible contamination taken, but this is not insurmountable and is of secondary importance. Many such ex-situ reserves of documented plants do already exist, but they are not controlled in any internationally co-ordinated way. Indeed, the existence of CITES legislation has been a significant barrier to such organisations flourishing, both by stifling almost all international movements and also by creating a false impression that traders and hobbyists are unscrupulous consumers of wild origin plants. In fact, the reverse is mostly true in that they are in fact doing their utmost to preserve all plants in their charge.

It should also be recognised that *species* are no longer the basic unit of taxonomy. That is now occupied by the rank of subspecies, so any control lists *must* also reflect that fact. Ideally, each and every subpopulation, whether receiving a name or not, ought to be so recognised, but that does pose practical problems. However, each recognisable population that is disjunct and therefore does not exchange genes with other related populations of the same species or subspecies ought to be represented somewhere in an ex-situ reserve, where they can hopefully be considered as safe.

The articles in this special supplement all have a conservation theme, directly or indirectly. It is a story of failures and successes, but the inevitable conclusion is that, as long as human population growth continues unfettered, all habitats where slow-growing plants occur that are unable to regenerate quickly are doomed to be cleared of everything that is not useful to man. Our response should be to focus on reserve collections in a much more co-ordinated way, so that the non-useful members of the plant world can be preserved for future generations. We are not the only species to have a right to the resources of planet Earth.

The British Cactus and Succulent Society supports conservation as a principle, and believes that the means of accomplishing it best are by means of systematically protecting what we have now in backup reserves while simultaneously trying to preserve as much of the wilderness as possible. Local legislation to protect rare and highly specialised species in wild reserves is useful, but international legislation is too inflexible and does potentially more harm than good.

Roy Mottram

The Society promotes effective practical conservation

Bill Maddams

A brief history of the BCSS Conservation Committee, and a summary of projects already undertaken. With a checklist of projects already funded, compiled by Alan Hill.

The BCSS Conservation Committee was formed in April 1987. There had been a problem caused by the seizure by HM Customs, at Felixstowe, of some plants that had been purchased by a party of members during their visit to mainland Europe. HM Customs had declined to discuss the case, so the Committee's early activities involved a dialogue with the Department of the Environment. Happily this early problem was overcome, thanks to frank discussions, and the Department, now known as DEFRA, has since become more open and friendly towards the various organisations whose members wish to import and export fauna and flora, and to the free movement of all goods and services which now exists within the European Community.

It is therefore wholly appropriate and gratifying that the Conservation Committee now devotes its energies to practical conservation projects, supported by the generous contributions from our members since 1992, and so far the sole source of funding.

The momentum was started by the ebullient enthusiasm of Gordon Rowley, the then President, who took up a call by Ernst van Jaarsveld for assistance to save *Saphesia flaccida*, a modest succulent from the Riverlands Nature Reserve, near the coast in the West Cape of South Africa, which was being threatened by more vigorous alien vegetation.

The threat to succulent plants in habitat by alien vegetation is one of those rare, least frequently encountered problems, and one for which action is easy and effective. Threats from animals, both wild and domestic, pose much greater problems, especially in South Africa, where fencing has proved effective. The stance of the Committee on fencing is that, on the whole, it does not protect from human poaching, and may well draw attention to the site of a rare plant. Fencing is, however, quite common on large South African farms and any additional enclosure of a small area, to protect from grazing animals, often goes unnoticed. Fortuitously, several species in need of protection often occur together in the same small area, such as is the case at Willowmore in South Africa.

Protection of species threatened by the many and diverse activities of humans poses far greater problems, mostly from urbanisation in its various manifestations, and occasionally from the activity of collectors.

An example of what is achievable in this latter context is provided by *Gymnocactus* (*Turbinicarpus*) *ysabelae* in its habitat near Tula, Mexico. The Conservation Fund initially provided the money required for a warden to monitor this site, a task subsequently taken over by the Tula municipal authorities. Promoting a sense of awareness among local people at such sites is not easy, but can prove very effective. Another notable example is the protection of *Melocactus conoideus* in Bahia, Brazil. Its restricted habitat was threatened by local residents removing grit from the area for building purposes. A combination of fencing and an education programme about the value of the plants as their heritage has proved eminently satisfactory.

However, there are many situations where preservation *in situ* is impossible because of the growth of towns and the spread of agriculture. Removal of plants for *ex situ* cultivation is then the only available option. The coastal belt of Peru, centred on Lima, is a good example. Hence, Dr Carlos Ostolaza has brought specimens of a range of threatened species into botanical gardens within the city, for safe keeping and propagation. It may eventually be possible to return plants to the wild, in areas that are not threatened and may be more suitable climatically, a topic yet to be fully explored.

On the other hand, only limited results have been obtained so far on the repopulation of *Turbinicarpus schmeidickianus* ssp. *andersonii* and *T. jauernigii* from seeds sown in habitat by Dr Sotomayor and colleagues, showing that this approach is far from trouble free.

There is always a demand for interesting new species, which can result in illegal collection from habitat. One approach to overcoming this problem, given that seed can be obtained from habitat, is to embark on intensive propagation in cultivation. This method produced extremely good results with the seed of *Yavia cryptocarpa* collected by Dr Roberto Kiesling. Several hundred grafted plants were made available to enthusiasts in the UK and the rest of Europe, and there is now no perceived threat to plants in habitat.

Some succulent plants are of value for pharmaceutical purposes, *Aloe vera* being the best known example. In most cases the supply of plants farmed for the purpose is adequate. However, there is an example in Kenya, in *Aloe secundiflora*, which does not offset, and wild populations are insufficient to meet the demand. Hence, Professor Len Newton is currently exploring the use of tissue culture as a way to supply farmers with young plants for growing on and harvesting.

These are a few examples selected from the complete list of projects funded by the Society, illustrating the great diversity in the ways that certain plants have become endangered and our approach and response to those new threats. Full reports of all the Society-funded projects may be found in the various issues of the Society's journals.

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Checklist of projects so far financed by the BCSS Conservation Committee

Date	Led by	Description
1993 Oct	Cape Nature	Protect *Saphesia flaccida* in Riverlands Nature Reserve by clearing alien vegetation
1994 Apr	Kirsten-bosch	Replant *Gasteria baylissiana* into habitat at Oudekraal
1994 Oct	Glass	Warden to protect *Gymnocactus ysabelae*, near Tula, Mexico
1995 Aug	Ostolaza	Rescue plants from Lima shanty town development
1996 Aug	Pretoria Bot. Inst.	Re-establishment of *Aloe suzannae* into habitat in Madagascar
1996 Sep	Ostolaza	Collection of threatened plants (part funded with other organisations)
1997 Sep	Ostolaza	Survey the needs of cacti in the Pisco, Ica & Nazca valleys
1998 May	Pritchard	Assessment of *Euphorbia polycephala* in Cradock, E Cape, South Africa
1998 Dec	Areces Malleas	Survey of the succulent flora of NW Haiti and the Dominican Republic
1998 Dec	National Bot. Inst.*	Five aloes project: reintroduction into the wild *Cape Town
1999 Feb	Van Jaarsveld	Progress report on *Gasteria baylissiana* replanting project of 1994
1999 May	Ostolaza	Rescue *Haageocereus tenuis* & *H. repens* from irrigation & farming projects
1999 Nov	Kiesling	Study the conservation needs of *Trichocereus smrzianus* & *Lobivia walteri*
1999 Nov	Van Jaarsveld	Further clearance of alien vegetation threatening *Saphesia flaccida*
2000 Jun	Stegman	Fencing the habitat of *Euphorbia obesa* & other sp. on a farm at Willowmore, South Africa
2000 Dec	Kiesling	Survey of the population of *Lobivia pugionacantha* in Argentina
2001 Feb	Arias Montes	Fencing at Pozos, Guanajuato, Mexico, to designate land ownership & protect the population of *M. albiflora*
2001 Jun	Ostolaza	Survey of cactus distribution in the San Juan river basin, S of Lima, Peru
2001 Sep	Sotomayor	Reseeding of *Turbinicarpus schmiedickeanus* ssp. *andersonii* & *T. jauernigii* habitats
2001 Oct	Kiesling	Survey & gather seeds of *Yavia cryptocarpa*, for *ex situ* propagation in Europe
2001 Nov	Oakman	Survey *Aloe perryi* & *Duvaliandra dioscoridis* in Socotra
2002 May	Ostolaza	Survey of the cactus populations of the Huaura river valley, N of Lima, Peru
2003 Jun	Machado	Fencing *Melocactus conoideus* habitat, Bahia, Brazil, with local municipality involvement
2003 Aug	Ostolaza	Second survey of the cacti of the Huaura river valley
2003 Oct	González -Torres	*Melocactus actinacanthus* population survey and replanting
2004 Mar	Vlok	Fencing of the habitat of *Bijlia dilatata* on a farm in South Africa
2005 Mar	González -Torres	Establishing a Cuban Workshop for the conservation of native cacti
2005 Sep	Newton	Tissue culture programme of *Aloe secundiflora*, for medical applications
2005 Oct	González -Torres	Survey & protection plan for 3 CE (Critically Endangered) species of *Leptocereus* nr. Havana, Cuba
2006 Mar	Stephen-son	Rescue of *Sempervivum* species from a dam site in Turkey
2006 Mar	Ostolaza	Survey of the cactus populations of the Cañete river valley, S of Lima

A new locality for *Mammillaria luethyi* G S Hinton

Jonas Lüthy

Good news of the discovery of a new population of this sensational plant, and confirmation that the type locality remains untouched. Satisfying all demand in cultivation from a sample of just eight plants is a heart-warming example of how the introduction to cultivation of all novelties ought to take place.

When *Mammillaria luethyi* was first described in 1996 by George S Hinton, this species remained largely unnoticed by cactus enthusiasts, because a botanical journal in Texas that is little known in these circles was chosen for publication. This was not quite unintentional, as George, shortly before that, had had a rather bad experience with what came to be known as the "*Geohintonia* circus" (Glass 1997). Only a later publication in the US Cactus and Succulent Journal (Fitz Maurice 1998) drew the attention of the cactus community to *M. luethyi*, creating quite a sensation and a possible demand with the potential to impact heavily on the restricted population. However, the two discoverers agreed to withhold locality data in order to protect the habitat. According to unconfirmed information, up to 60 people at a time were looking for the species in the field. The population of the type locality in northern Coahuila was estimated at only around 200 individuals. George Hinton later revisited the locality and spent two days in the surrounding area without discovering any new plant locations, but he was able to take some quite impressive photos of flowering individuals in situ.

Fig. 1 ***Mammillaria luethyi*** **in habitat at the type locality (Photo: George Hinton)**

Fig. 2 ***Mammillaria luethyi*** **in habitat at the type locality (Photo: George Hinton)**

All plants of *M. luethyi* that later entered the trade and collections originate from eight individual clones of the type collection. These were cultivated by George Hinton in order to complete the documentation of the holotype. Two of them were later

Fig. 3 ***Mammillaria luethyi*** **at the new locality, where it is locally quite abundant (Photo: Jonas Lüthy)**

acquired by the Fitz Maurices, and finally all eight plants found their way to Mario Mendoza, then working with Charles Glass. Mario produced a fair number of grafted plants in his greenhouse, and the species was distributed to various Mexican growers and finally showed up in Europe, USA and Japan. It soon became quite well represented in cactus collections, and whereas demand was much higher than supply at the beginning, the species is now readily available from many nurseries. *M. luethyi* is now even mass-produced in South Korea for Dutch nurseries, grafted on *Hylocereus*, and likely soon to be found in supermarkets, along with "strawberry cacti" and other very commonly traded taxa. Vegetative propagation is very easy and grafted plants soon start to cluster prolifically, from which cuttings can either be rooted or grafted. Unfortunately, propagation from seed poses the same problems as for *M. theresae*. Germination may be inhibited if the seeds, which remain enclosed in cavities of the stem, do not have the right stage of maturity.

Ten years later, in April 2006, we wanted to visit the type locality again in order to check the state of the habitat and hoping to find *M. luethyi* with flowers. Of course we intended to check the surroundings again for possible further populations. We were quite surprised when we came across the species on our way, about 20km from the type locality. In fact we found that this population was many times bigger and consisted of many thousands of individuals. Unfortunately there were no flowers, not even buds, and the plants looked quite dehydrated. We therefore do not know whether flowers are the same as in the type, although this is most likely to be the case, as the plants look otherwise identical. The habitat and local flora showed no differences to those of the type locality. The tiny mammillarias grow on almost horizontal limestone rocks in shallow deposits of a powdery substrate, around 2cm deep, that is covered with fine limestone gravel. Maximum density was around 30 individuals on a surface of 30 × 30cm. Only by carefully removing the gravel were we able to detect the seedlings, because

Fig. 4 (facing page, top) High densities of ***M. luethyi*** **may be reached in places on soil that is too shallow to support other vegetation (Photo: Jonas Lüthy)**

Fig. 5 (facing page, bottom) ***M. luethyi*** **is a dwarf and quite cryptic species, reaching a diameter of just 1 to 1.5cm diameter, and often growing unbranched in nature (Photo: Jonas Lüthy)**

they did not emerge at the surface. This habitat is obviously not threatened by human impacts, and the conservation status of the species has improved significantly with two disjunct localities and a much higher number of individuals. It is in fact quite safe, as long as locality data remain unavailable for the general public. Only unsustainable harvesting poses a potential threat to its survival.

Of course we also later visited the type locality too. We found it completely undisturbed. The agreement to withhold locality data had protected the habitat effectively. We wondered again that back in 1996 we quite easily found this place of about 2 × 10m with no exact idea what we were looking for and with only a few vague hints where to start, taking into account the vast size of northern Coahuila. The number of plants at the type locality could be confirmed and the maximum density is comparable with our new locality. There were no flowers and this is therefore a good reason to try again some time – the plants will be waiting there for us. After all, it is quite a success that a new cactus species was introduced to cultivation without doing any damage to the wild population and without wild-collected plants ever entering the trade.

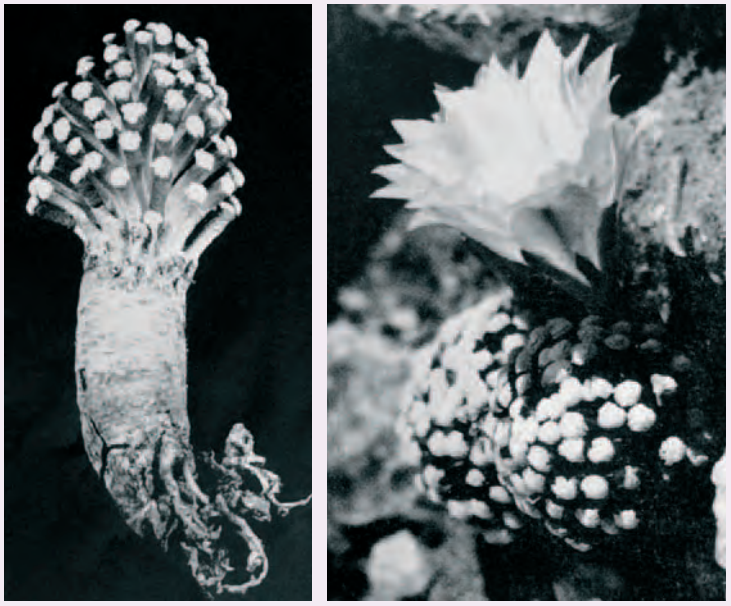

Fig. 6 *Mammillaria luethyi* was known to Ladislaus Cutak from 1952, when he received two plants. He sent these two photos to Backeberg, who first published them in the *National Cactus and Succulent Journal* of December 1959. Backeberg had no other information and surmised that it might be a *Neogomesia*. It was eventually rediscovered and published as a new *Mammillaria* species by George Hinton in 1996

Fig. 7 A 2-3 year old seedling of *Mammillaria luethyi* (Photo: Roy Mottram). They will flower quite easily on their own roots soon after reaching this age, although they are more frequently seen in cultivation grafted

We walked many kilometres in a wonderful, pristine desert without finding further *M. luethyi*, although many places looked virtually identical. Nevertheless we are convinced that they are there, just waiting to be discovered.

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A giant in the genus: *Discocactus diersianus* from Goiás, Central Brazil

Pierre J Braun & Eddie Esteves Pereira

The largest discocactus in Brazil is introduced. Alarmingly it is now believed to be in serious danger of losing its habitat, along with other discocacti that may well have already been completely destroyed by the same process of inexorable economic expansion. Photography by the authors.

Discocactus diersianus is one of the most outstanding species in the genus. It is characterized by large, flattened, globular plants with strong ferocious spination. With its well defined morphology, the plant differs significantly from *Discocactus heptacanthus* (Rodrigues Barbosa) Britton & Rose.

As we have stressed many times in the past 25 years, it was an error to synonymize this species with the latter as in several papers by Taylor, the current second edition of the *CITES Cactaceae checklist* (1999) and Anderson's *Cactus family* (2001), including the revised German version edited by Eggli, *Das Große Kakteen-Lexikon* (2005). Apart from the bigger stems and the characteristic spination, *Discocactus diersianus* can also be distinguished by its very slender, acute, light yellowish flower buds, very slim linear perianth leaves and its white, long and slender fruits. Fortunately, in the

Fig. 1 Eddie Esteves Pereira with a huge specimen of *Discocactus diersianus*, in spring 2006

Fig. 2 Adult plants of *Discocactus diersianus* with impressive strong and blackish spination

most recent handbook, *The new Cactus Lexicon* (2006: 75), *Discocactus diersianus* was restored to the rank of a distinct species. It has a distinct relationship with the small-sized *Discocactus lindanus* Diers & Esteves (1981) and *Discocactus cephaliaciculosus* Braun & Esteves (1995), with its unique cephalium spination, but the authors disagree completely with the proposal to synonymize these two characteristic species from northern Goiás with *Discocactus diersianus* as has been proposed in *The new Cactus Lexicon.*

It seems probable that *Discocactus diersianus* was discovered about half a century ago. A few plants of uncertain origin arrived in Rio de Janeiro in the 1950s and were sent by Voll from the Rio Botanical Garden to Curt Backeberg in Hamburg, Germany. He described them as a new species, *Discocactus paranaensis* Backeberg (1960: 2628-2629), illustrated with a photo of a group of three plants in cultivation in his handbook *Die Cactaceae* (1960: fig. 2506).

The Latin description together with the single illustration are sufficient for valid publication under the present *ICBN*, although for many years the pundits have been dismissing most of Backeberg's names as invalid. So if you believe them to represent the same species, then *Discocactus paranaensis* Backeberg would have to be adopted as its correct name.

The plants illustrated by Backeberg definitely did not come from the state of Paraná (where the genus does not occur), but the place name could have been confused with the Serra Geral do Paraná, north of the distribution area of *Discocactus diersianus*. This is south of the Rio Paranaiba valley and we do know that the collector of Backeberg's plants had crossed this river. But all this is speculation...

In the early 1970s, Eddie Esteves found several new discos in the southern part of his homeland, Goiás, including Esteves collection numbers 10, 10a, 29 (the most similar to Backeberg's *D. paranaensis*), 72, 74, 87 and others. Two of them were formally described: first *Discocactus diersianus* (Esteves 87) in 1979, and one year later *Discocactus goianus* (Esteves 10) which turned out to be no more than a subspecies.

Since the discovery of *D. diersianus*, the species remains a rare plant, not only in cultivation but also in the wild. Fortunately the holotype locality is situated in a National Park, but the population is small and very restricted to some places near an old volcano. Farmers do not appreciate these spiny balls, because cattle

Fig. 3 ***Discocactus diersianus*** **Braun 306**

Fig. 4 ***Discocactus heptacanthus***

injure their feet on them. Ever since those early days, Eddie has observed that the farmers clear out the cacti from time to time. Other populations that are not protected by the park fences (eg ssp. *goianus*) were dramatically over-collected in the early 1980s for commercial reasons (Braun & Esteves 2002).

Now in spring 2006, we have found a new, virgin habitat of *Discocactus diersianus*. Not far from an old farm in the same National Park are some outcrops of granite bearing this discocactus in great abundance, together with vellozias and *Dyckia* species Esteves 355. This habitat is completely undisturbed by man, and there are hundreds of plants from seedlings to old, mature plants. Diameters of 30-40cm are quite common. The biggest plant we know is a real giant of approximately 50cm. As we have seen all known *Discocactus* species in hundreds of populations across Brazil, Bolivia and Paraguay, we are convinced that *D. diersianus* produces the biggest plants of the genus.

Fig. 5 Comparison of the flowers of *Discocactus diersianus* (left) with *Discocactus heptacanthus* (right)

Although we are glad to have discovered this wonderful new habitat, unfortunately we also have to report that there are still some very dark clouds on the horizon. The small, unmade, dirt road near the habitat has assumed some infrastructural importance, and may be upgraded very soon. Due to a lack of rock material, we are very afraid that the few available granite outcrops, which are home to this discocactus, will be cleared and used for the resurfacing in the not too distant future.

More and more of the campo cerrado (lightly wooded grassland) is being destroyed systematically, in the past mainly by fires, today by tractors to prepare pastures and the production of soya bean, eucalyptus, sugar cane and renewable biodiesel. In many municipalities of Goiás, less than 10% (and even down to zero) of the native cerrado remains. With the disappearance of the cerrado, *Discocactus* will also vanish forever. Since about 1984, we have been unable to find *D. subterraneoproliferans* Diers & Esteves again. In 1998 we probably saw the last few plants of *D. prominentigibbus* Diers & Esteves, and also since the same year we have not found a single specimen of *D. squamibaccatus* Buining & Brederoo at the type locality or from the surrounding areas. Our prediction is that in Goiás, *Discocactus estevesii* L. Diers and *D. diersianus* will be the next species of this unique genus to become extinct.

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Conservation of *Leptocereus scopulophilus* and *L. wrightii*, two endemic cacti from Cuba

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Two extremely rare leptocerei from Cuba, in imminent danger of extinction in the wild, are the subject of a survey supported with finance from the BCSS Conservation Fund. Photographs supplied by the authors.

Leptocereus (Berger) Britton & Rose is a West Indian genus of cacti that comprises about a dozen species, whose distribution extends from Cuba through Hispaniola to Puerto Rico (Areces, 1993). Most of the species in Cuba are endemic, growing in small, isolated populations throughout the island. Three of these *Leptocereus* are endemic to Havana province. Two of them occur in the low-altitude, limestone mountains of this province (*L. leoni* Britton & Rose and *L. scopulophilus* Areces), and the third one, *L. wrightii* León, occurs in the northern, karstic limestone coast of the same region. (Karstic limestone is a weathered and deeply fissured form of limestone).

Fig. 1 A young branch of *Leptocereus wrightii* in flower

The conservation status of these species is quite grave. Borhidi and Muñiz (1983) considered *L. wrightii* extinct as a consequence of the urbanization of the north coast of Havana. *L. scopulophilus* was considered almost extinct by Areces (1993) when it was described. *L. wrightii* and *L. scopulophilus* have not been re-collected in the past thirty years.

In this paper we update the conservation status of

Leptocereus wrightii and *L. scopulophilus*. Unfortunately, *L. leoni* has not been found again so far.

Leptocereus wrightii León

Leptocereus wrightii is probably the most threatened cactus of Cuba. It is considered to be Critically Endangered by Berazaín *et al.* (2005) in the *Red list of Cuban Vascular Flora*, but some authors considered that this species might be extinct in the wild (eg Gutiérrez 2005) or completely extinct (Borhidi & Muñiz 1983).

This cactus is an erect, greatly ramified shrub up to 3m high, with a simple cylindrical trunk to 20cm diameter. The younger branches are vivid green. It has four flattened, crenate ribs with bunches of 1-4cm long spines located within notches along the rib margins. The flowers are terminal, mainly 2-4 per branch, 5-6.5cm long, 3.3cm wide with a spiny receptacle. The outer segments of the flowers are red, but the inner segments are pink at the apex and yellowish-white at their base (Fig. 1).

Fig. 2 *Leptocereus wrightii* on the karstic cliff of Puerto Escondido, Havana

Fig. 3 A burnt plant of *Leptocereus wrightii*

This endemic species was discovered by Charles Wright in 1862 (*WRIGHT* 2622 *pro parte*, HAC) in the "low flats near the seaside [at] Havana" and described by León (1940) based on a specimen collected by himself (*LEÓN* 16556) in 1936 in the vegetation of the karstic coast of Cojimar. This cactus also occurred in the Carmelo Hills at the Vedado neighbourhood in the central coast of Havana city (*LEÓN* 3129, 3689, HAC, collected in 1912-1913). The last herbarium specimens of this species were collected in 1973 by Alberto Areces (*HFC* 24543, 24544, 24545, HAJB) on the way from Cojimar to the Camilo Cienfuegos (Habana del Este) neighbourhood. This area was almost completely destroyed by the enlargement of Cojimar town and the city of Havana. In 1992, the last of the relict

L. wrightii population was depleted for the construction of the new neighbourhood of Villa Panamericana.

A recently discovered population of *L. wrightii* occurs on the boundary of the karstic hills (Fig. 2) at Puerto Escondido in Santa Cruz del Norte, Havana. The plants grow on karstic rocks in the transition zone between the coastal thicket and the remains of a dry tropical forest. The areas originally covered by the dry forest now support a secondary thicket of the yellow coast sunflower (*Vigueria dentata* (Cav.) Spreng.) and grasses.

The population of *L. wrightii* is composed of ten adult plants that reach no more than 1.5m in height, but no seedlings or young plants were found. There was only one plant in flower, but none with fruits. All the individuals have been totally or partially damaged by recent fires (Fig. 3), but its recovery had been excellent (Fig. 4). Young branches were also damaged by herbivores, probably snails.

The conservation status of the *L. wrightii* population, as well as the critical condition of its habitat, support the category 'Critically Endangered' referred to this cactus by Berazaín *et al.* (2005). The discovery of this new population leads to new opportunities for the conservation of this species that in recent times was known only in collections (Gutiérrez 2005). The establishment of an *ex situ* collection, and its propagation to reinforce the wild population are essential for the conservation of *L. wrightii*, but it is also necessary to continue surveying similar habitats of the north coast from Havana to Matanzas provinces searching for other possible populations.

Fig. 4 Regeneration of a *Leptocereus wrightii* plant damaged by fire

Fig. 5 Growth habit of *Leptocereus scopulophilus* in the wild

Leptocereus scopulophilus Areces

This species was described by Areces in 1993 based on a specimen collected in 1975 on the limestone summit of Somorostro Hill in Havana province. This author remarked on the degradation of the habitat of *L. scopulophilus* by limestone quarrying in this locality (Areces, 1993). Therefore, it was considered as Critically Endangered by Berazaín *et al.* (2005).

L. scopulophilus is an erect shrub to 10m tall (Fig. 5), with a simple, cylindrical trunk to 30cm diameter. The main branches are erect and greatly ramified in the upper part. The upper vivid green branches have plagiotropic (obliquely directed) growth. This species has 4-5 flattened, crenate ribs with fascicles of 8-10cm long spines located within rib depressions. The flowers are terminal, 4.5-5.5cm long, 3-3.5cm wide, with a spiny receptacle. The outer segments of the flowers are pale wine-red coloured, but the inner segments are whitish-pink to nearly white (Figs. 6, 7).

We organized a survey on Somorostro Hill in June 2006. The locality was completely destroyed (Fig. 8) and it is now covered only by grasses and the alien legume *Dichrostachys cinerea* (L.) Wight & Arn. After our exhaustive survey, not one plant of *L. scopulophilus* was found on Somorostro Hill.

Fortunately, this species does occur in another locality recently discovered by our team. The newly discovered population is on the deep south-eastern slope of the karstic hill called Pan de Matanzas, in the province of Matanzas (Fig. 9). The population grows in the undergrowth of the semi-deciduous, tropical forest. Adult plants reach 10m high, with 30cm diameter main trunks. During the survey that we made in this population we found 545 plants, 301 being adults and 244 juveniles, of which 35 were recently germinated seedlings.

Although the population structure of *L. scopulophilus* seems to be quite adequate, its narrow distribution, restricted to a single slope on a unique small and unprotected hill, constitutes a great threat for this species. The human exploitation of this area could lead to the complete extinction of this cactus species, and therefore it is necessary for the establishment of a protected area on the Pan de Matanzas hill.

Fig. 6 Flower of *Leptocereus scopulophilus*

Fig. 7 Flower and fruit of *Leptocereus scopulophilus*

Fig. 8 Current view of Somorostro Hill, the former type locality of *Leptocereus scopulophilus*

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Fig. 9 Pan de Matanzas, the newly discovered locality for *Leptocereus scopulophilus*

Ex situ conservation of *Melocactus* at Kew

Nigel Taylor

The importance of large public collections of well documented plants such as that at Kew is outlined, with an example of how the acquisition of a unique scientific and genetic resource of melocacti is now helping to back-up research and conservation efforts in their Cuban and Brazilian homelands. Photography by the author, except where stated.

The living plant collections at the Royal Botanic Gardens, Kew, which date from c. 1759, are often claimed to be the largest and most diverse of any garden in the world, a claim which few would dispute. Indeed, Kew's Living Collections Database has recorded some 30,000 different kinds of plants in cultivation over several recent decades. The actual composition of these collections over this time has varied, as plants die or are de-accessioned and new research interests result in different acquisitions, rather than like-for-like replacements. Some themes, however, are of longer duration and these include, amongst other things, rich assortments of orchids and cacti, reflecting a strong interest in these groups amongst Kew's botanists, gardeners and the visiting public.

Cacti, certainly, have been a fascination for Kew and its stakeholders since early Victorian times. Then, the likes of Frederic Staines were sending unbelievably huge barrel cacti from Mexico in 1844-45 to be put on public display, including an *Echinocactus platyacanthus* weighing 325kg, known affectionately as "The

Fig. 1 (a-c) Three views in the Hättich *Melocactus* collection since it has been rehoused at Kew

Fig. 2 (below) ***Melocactus actinacanthus*****. One of the Hättich plants from which seed has been gathered in order to begin a recovery programme in its native Cuban habitat**
Photo: ©RBG Kew (Andrew McRobb)

Monster Cactus", while Walter Hood Fitch (1817-1892) was busy painting beautiful and extraordinary discoveries, such as *Leuchtenbergia principis*, for *Curtis's Botanical Magazine*, whether at Kew or from the glasshouses of the many correspondents of the Gardens' first Director, Sir William Hooker.

Later, towards the close of the Victorian period, one famous Kew Gardens Curator, William Watson (1858-1925), wrote a pioneering and very popular book on cacti, *Cactus culture* (1889), which went through five editions, was in print for fifty years and no doubt made the cactus hobby accessible to the man in the street, perhaps for the first time. Watson's knowledge was largely based on Kew's living collections, some of which he illustrated, but today he would have recognised few of the plants that we now grow, because most of them have been discovered and introduced over the last hundred years.

While collection size and diversity may seem good to boast about, the modern reality is that living plants represent a significant cost in resource terms for their maintenance. Therefore, the collection must earn its keep. This means that it needs to be used, whether for research or public display, education or enjoyment, or more importantly have a value for *ex situ* conservation.

For the latter purpose it should ideally be genetically diverse, but such is the degraded state of some natural environments, where certain species are becoming extinct, that sometimes even a single specimen in an *ex situ* collection has great conservation value. There are many examples of these in Kew's living collections, and better still rather more are conserved as genetically diverse seed samples in Kew's Millennium Seed Bank (MSB), sited adjacent to our sister garden at Wakehurst Place (West Sussex) and well worth visiting. The living collections and the MSB are working together in building the world's largest gene bank of, and in effect an insurance policy for, naturally occurring higher plant species. That is a boast of which we are very proud.

Fig. 3 (below) *Melocactus deinacanthus*. One of the larger Brazilian species, notable for the colourful spines

Fig. 4 (above) *Melocactus glaucescens*. Named and known for its intense light blue body colour, which turns to a light greyish green with age

The Klaus Hättich Melocactus collection

(Fig. 1 and rear cover)

In late 2002 I received an interesting email from our New Cactus Lexicon collaborator, Graham Charles. He had been 'tipped off' by a German cactophile that a very large but little-known living collection of *Melocactus* might be coming up for sale. Sadly, a dedicated melocactus enthusiast, Klaus Hättich, had recently died leaving his widow and family with more than 1200 specimens crammed into a single greenhouse. They knew the plants were unusual but were worried about how to care for them and, how to ensure that the collection found a good new

Fig. 5 (above) ***Melocactus levitestatus*****. A distinctive but variable Brazilian species**

home. Given that melocacti need a lot of warmth and the collection was in northern Germany, I guess there was also an ongoing and not inconsiderable cost to be met. Friends of the deceased would offer assistance in the short term, but a new owner or owners would need to be found. The collection was a mixture of very fine mature specimens, sporting well-developed cephalia, some being original wild imports obtained in the days when CITES was not yet operating, and besides these a multitude of younger plants and seedlings expertly raised by Hättich (apparently he had never seen the plants in habitat, but over many years had received seeds from diverse contacts abroad). It was easy to see that there would be keen specialist buyers of the best of the plants in the former category and undoubtedly some of these could have fetched good prices, but what about the majority of juvenile plants. So it was suggested to me that if Kew could find the funds to purchase and transport the entire collection, a very favourable price might be negotiated. Having received digital images of the collection and some of its finest specimens I set about persuading my boss, Kew Director, Sir Peter Crane, to grant funds from one of the institute's 'donations' accounts. It was not hard to make convincing arguments for this purchase – as a specialist in the genus I could vouch for the value of the specimens for research and potentially, at least, for conservation purposes too.

Funds secured, price agreed and plans made, two garden staff from the

Fig. 6 (a-b) (below and facing page) ***Melocactus pachyacanthus*****, young and old examples. The body is quite bluish when young, but loses that colour with age to become plain green**

Tropical Nursery hired a large van and set off for Germany in the following summer of 2003. Upon arrival, they could hardly believe the dense arrangement of specimens packed into the former owner's glasshouse. It took some days of unpotting and wrapping in newspaper before the return journey to Kew could commence and then, upon arrival, the long job of potting up began. Given that a proportion of the specimens were quite old and showing signs of slowing down (as all of us know happens sooner or later), it was not expected that all would survive this change in management. In fact, the majority established very well, helped no doubt by the fine, hot summers we have experienced in recent years. The younger plants soon came into vigorous growth, while the old warriors put out many flowers followed by abundant fruit. The biggest and most pleasant surprise, for me at least, was the comprehensiveness of the collection and more especially the high proportion of plants with clear wild provenance data. The timing of the acquisition was also very fortuitous, because David Hunt had just asked me to draft the account of *Melocactus* for the *The new Cactus Lexicon*. And meanwhile, various so-called 'new' species had been described, but had not been available as specimens for critical study. To my delight I found all of these represented in Klaus Hättich's collection. Within months I had worked through the collection in spare moments (botanizing no longer being what my career is supposed to be about) and had some notes to publish prior to finalizing the Lexicon account. Understanding what was in the collection was an important precursor to realizing its potential for conservation purposes.


6b

The collection as an ex situ conservation resource

During 2004 I had exchanged some emails with Sara Oldfield (now Secretary General of Botanic Gardens Conservation International) about a cactus conservation project in Cuba. Her Cuban contacts desired copies of relevant literature and subsequently I heard that they were intending to hold a workshop in March 2005. I was placed in contact with Professor Luis Roberto Torres, a bright young lecturer at Havana's university and partly based at the national botanic garden, situated on the outskirts of the capital. From further exchanges of emails with LuisRo, as he prefers to be known, I learnt how a key part of the programme he was conducting was to attempt to save an almost extinct race of the rare *Melocactus matanzanus*, namely the large-stemmed regional form known as *M. actinacanthus* (Fig. 2). However, his efforts had almost reached an *impasse*, because the last known adult plants in its habitat had disappeared and only two juvenile specimens remained. Could they wait until these developed cephalia and produced seeds or would the plant become extinct in the meantime? LuisRo then asked me if by any chance I knew if *M. actinacanthus*

was cultivated in a botanic garden anywhere. Yes, I did, because there were four plants among the Hättich collection now at Kew, and two of these were mature with cephalia full of ripe fruit. More importantly these plants had wild provenance data and when I checked the locality with LuisRo he informed me that it was the very same as the one where the last two wild individuals were hanging on. Hättich's plants had been grown from wild-collected seed obtained many years before, when the wild population was in better condition.

Very soon I was invited to attend the March 2005 workshop, but on the condition that I bring as many seeds of *M. actinacanthus* with me as could be harvested from the two mature plants at Kew. Thus, in late March I boarded a plane to Havana carrying more than 400 precious seeds, besides a similar number of the rare *M. matanzanus* itself, likewise harvested from plants of known wild provenance formerly belonging to Hättich but now in the Tropical Nursery at Kew. It was a satisfying moment, while making a presentation on Kew at the workshop, to be able to announce that I had come to Havana bearing gifts – the seeds that would become the nucleus of a future reintroduction programme in its native habitat. Incidentally, BCSS members may not be aware that the workshop was part-funded by the Society's Conservation Committee, which has also given a grant to LuisRo in support of his work (see his report on *Leptocereus*, also published in the present special issue).

Most recently I received three more items of good news. First, another population of *M. actinacanthus* with some healthy mature plants had been discovered in Cuba, increasing the survival chances of this race in the wild. Second, LuisRo announced that his project team were getting ready to begin reintroduction of plants raised from Kew's seed, but first they would need to conduct tests to ensure that the plants were genetically diverse and healthy – this was excellent news indeed! Thirdly, and most pleasing of all, LuisRo had obtained funds and a place to attend this year's Conservation Techniques International Diploma Course at Kew and would be visiting us and be able to check out for himself the *ex situ* specimens of his

Fig. 7 ***Melocactus paucispinus*, a Bahian species with a flattened stem**

Cuban plants in the Tropical Nursery. He was already asking if he could collect more seed and take it back to Cuba. Certainly he can and for my part I will be watching the plants closely over the coming months, hoping that my regular pollinations will encourage as much seed production as possible.

Besides this encouraging story of cactus conservation in Cuba, the Hättich collection has a wider botanical significance. For example, this week I was able to supply Marlon Machado (University of Zürich), one of our keenest collaborators and a familiar BCSS National Convention speaker, with tissue of nearly all the *Melocactus* species from beyond his native Brazil, with the purpose of undertaking a molecular study of the evolutionary relationships of the entire genus. But it is certainly its use as a conservation resource that the Hättich collection has greatest value. Last year I was able to harvest seed of twenty species from the collection to send to Kew's Millennium Seed Bank. This includes plants of endangered species from Brazil, some of whose wild populations have been severely damaged but still persist *ex situ* as old habitat plants and specimens raised from seed of precise wild provenance, indeed sometimes even from plants of the original type collections.

The strength of Hättich's legacy at Kew is the abundance of healthy young specimens, because these should ensure future seed production and propagation opportunities beyond the life of the currently ageing mature specimens. Thus, plants such as *M. deinacanthus* (Fig. 3), *M. glaucescens* (Fig. 4), *M. azureus* and *M. levitestatus* (Fig. 5), all of which are threatened to greater or lesser degrees in Eastern Brazil by agricultural expansion and mining operations, are each represented by healthy groups of vigorous young plants that can even be expected to be carefully cross-pollinated one day, increasing the genetic diversity within these captive populations.

The harvesting of seed under artificial conditions of a glasshouse cannot be said to be entirely risk free in terms of avoiding hybridization, but in the case of Kew's melocacti this is minimized, because their natural pollinators (hummingbirds) are absent, few insects

Fig. 8 *Melocactus schatzlii* ssp. *chicamochae*: a few-spined Colombian subspecies described only as recently as 2002

Fig. 9 ***Melocactus stamineus*****. A species from Aruba, with an unusually broad cephalium relative to its body**

enter the huge nursery complex and the staff know what they should and should not do. Most importantly, the vast majority of melocacti are self-fertile and produce seed without any kind of intervention. However, as stated above, there would be advantage in careful cross-pollination of different individuals from the same race in the interests of enhancing genetic diversity. Perhaps the most significant aspect of the Hättich collection at Kew is that, unlike a private collection, ultimately at risk from the demise of its owner, this publicly funded operation can ensure continuity, not to mention conditions of cultivation that few amateurs can afford. But we cannot be complacent. Public collections do not all have a good reputation, because they depend heavily on the quality of their staff resources and that depends in turn on the continuity of funding and provision of good training. Horticulture at Kew is fortunate in having both of these necessities adequately catered for, but we do need to work in partnership with others, be they public or private, to spread the responsibility for caring for the world's rapidly shrinking habitats and flora. After all, *Melocactus* is but a single genus in a family of more than 100 genera, while cacti are an even smaller part of the plant kingdom as a whole.

However, the most positive message here is not just about what grand public institutions like Kew can do, but the contribution of the amateur and individual. This story could not have been told without the private dedication of Klaus Hättich, whose legacy of melocacti has been a triumph and should encourage us all. We do not know whether his interest was purely selfish as, in reality, most collecting hobbies are, but for sure his skill and determination as a grower and collector have been and will continue to be of great benefit to the conservation of the plants that fascinated and drove him to assemble this unique collection.

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Conservation by propagation: a case study – *Turbinicarpus alonsoi*

David Quail

An example of how a choice, newly discovered cactus can be propagated quickly on its own roots, from just a few seeds to a plentiful supply of plants for collectors, and some observations on how current legislation seems to hinder the process of conservation by this method. Photography by the author.

The 1990s were an exciting time for those interested in slow-growing Mexican plants, as this decade produced a number of wonderful new discoveries. Among them was *Turbinicarpus alonsoi*, discovered in February 1996 and first reported in our journal for September 1996 (Holland, 1996: 107). There was only a brief reference to it, as it was just one of a number of new turbinicarpus species, and there was no picture to illustrate the beauty of this plant, with its unusual body characteristics and perhaps more significantly its spectacular flowers, which are quite unlike those of any other turbinicarpus. Remarkably though, despite numerous subsequent references in our journal to *Turbinicarpus alonsoi*, photos of the plant and its flowers have been conspicuously absent, an omission which I now take great pleasure in rectifying.

My curiosity was aroused by that article, and, with the assistance of the invaluable internet search engine, Google, I trawled the web for further information about this new plant. What started as curiosity turned rapidly into amazement when I saw internet pictures of a most unusual and very spectacular plant. Its appearance, from pictures of habitat plants, was of something quite like an obregonia in body shape and tubercle formation, but with longer, brush-like, curling spines (the only feature which looked much like a turbinicarpus), mainly in the upper tubercles, as they would have broken off further down. The very large flowers are the most remarkable attraction, however, in a striking magenta colour, again unlike those of most other turbinicarpus species.

I determined that this was a plant that I absolutely had to propagate, and set out to find a source of seeds. I was fortunate in tracking some down and managed to acquire a precious eight seeds in early 1997. The second good omen was when all eight germinated, a not unusual occurrence with this genus, the seedlings of which, though quite slow-growing, are sturdy little things. As my aim was to propagate this plant in volume as fast as possible, and as the future seed supply was at that time uncertain, the strategy was to bring my seedlings to flower, and to produce my own seed, in the shortest possible time. This necessitated grafting, as the speed of growth on their own roots was anticipated to be, like other turbinicarpus species, rather slow. While some of our BCSS members have wonderful grafting skills, and can consistently achieve close to 100% success rates, unfortunately I am not one of them, and consider it an achievement to get any at all to graft successfully. However, in this case, three of my seedlings were successfully grafted onto pereskiopsis stock (Fig. 1), and grew on well, flowering in around

Fig. 1 Three eight-month-old seedlings of *Turbinicarpus alonsoi* in 1997, grafted onto pereskiopsis stock

Fig. 2 The same three plants as in Fig. 1 earlier this year, re-grafted onto trichocereus stock

two years. I even managed to re-graft them onto trichocereus stocks, where they remain to this day (Fig. 2), reliably producing copious quantities of seed, and all of it viable.

In 1998, I managed to buy a hundred more seeds from a regular commercial seed list, and 79 of these germinated, which I retained on their own roots. These grew to maturity and flowered in the normal time-span

Fig. 3 Two-year old seedlings, with a high germination rate and in desperate need of pricking out!

Fig. 4 A tray of four-year-old seedlings, most already at flowering size

of three to five years, which can be expected of any turbinicarpus grown on its own roots at the normal rate. My seed-raising methods have been covered in previous journal articles (Quail, 1997: 16-20; 2002: 69-75 and 2006: 75-78). By 2000, a steady, though initially small, supply of seeds from my own grafted plants was produced, so that I had no need to purchase further seed, and I planted large quantities, all of which germinated very well (Fig. 3), and which continue to give great satisfaction as they grow on, again reliably, into very attractive, compact little plants (Fig. 4). I was, of course, not the only person trying to propagate this plant, and as early as December 2000, the amazingly skilled seed-raiser, grafter and for many years now, our very diligent seed-buyer, David Rushforth, was able to offer seeds from his own grafted plants in that year's BCSS seed offering. He too had grafted his seedlings on

Fig. 5 A dehiscent seed pod on a six-year-old plant

Fig. 6 A six-year old plant which is now starting to develop its typical mature body shape

pereskiopsis and then, subsequently, re-grafted onto trichocereus.

In the past three years, my seedlings on their own roots have also started to produce seed. The small, round fruits are packed full of seeds and in the early months of the year after flowering as they mature, they split open to disperse them (Fig. 5). As with all my slow-growing Mexican cacti, once I prick them out from my standard seed-raising compost, they are transferred to trays of a gritty, soil-based, John Innes compost with the addition of about 25% small, hard limestone chippings, which come from a nearby North Yorkshire carboniferous limestone deposit. On their transfer later to individual pots, the proportion of limestone is increased to 40% or more, which produces lovely tight little plants that look as though, a few years hence, they will acquire the obregonia-like body shape of their mature habitat cousins (Fig. 6). This is something that the plants grafted on trichocereus will perhaps never achieve, with their much more open and more globular growth as shown in the Fig. 2 mentioned earlier. In both cases, however, the plants have the same lovely, curling, brush-like spines which so appealed to me when I first saw pictures of them.

The crowning glory of these plants is their spectacular flowers, produced in great profusion during the summer months. Grafted plants in fact produce so many at one time that they can often hardly open fully (Fig. 7), whilst those on their own roots produce them at a slightly more leisurely pace, allowing the full glory of each flower to be appreciated (Fig. 8).

So, in comfortably under ten years, I have gone from eight seeds to a situation where I could easily literally supply world demand for these plants.

Fig. 7 A mature grafted plant in full flower

Fig. 8 Two five-year old plants on their own roots in flower

I shall not of course be called upon to do so, since many other enthusiasts have also been busy propagating it as well. However, it is very satisfying that the joint efforts of all of us can so very quickly produce mature plants, which are a match for habitat plants, and obviate any pressure on habitats resulting from any illegal collecting.

The principal remaining problem that needs to be overcome is to make distribution easier. The internet gives to the world the most complete worldwide free market in goods that has ever been achieved, and powerful search engines allow buyers easily and quickly to find sellers. Then, however, sledgehammer bureaucracy intervenes in the form of the cumbersome CITES Appendix I legislation (under which *Turbinicarpus alonsoi* is listed), which forbids the transfer of these artificially propagated plants between countries without acquiring import and export licences. This is a prohibitively expensive and time-consuming process, which effectively means that there is a completely unworkable barrier preventing low-volume transfers from propagators to their market of enthusiastic devotees. Thus at best it severely limits, or at worst completely stops this beneficial trade and, counterproductively, maintains the incentive to indulge in illegal trading with the concomitant consequential pressure on habitats. The one saving grace within Europe is that the European Union (EU) is a free trade area, so that plants can move within it without the need for CITES certificates. The increasing size of the Union at least widens the potential for our plants to move freely here. However, I have yet to hear a valid reason why making it illegal for a plant raised from seed in England to be moved to, say, Switzerland (outside the EU), without this bureaucracy, in any way assists in the prevention of illegal trade in habitat plants out of Mexico. Rather, I believe it makes illegal trade more likely. Local border and export controls within the countries of origin of our plants, coupled with the removal of CITES licence requirements for the movement of plants and seeds between other countries, would allow administrative resources to be targeted in a more effective way. However, keen propagators like myself will continue to persevere to make these wonderful plants available to as wide a market as the authorities will allow us to do.

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A Mexican adventure and some experiences with an extra-ordinary reference collection

Martin Smith

The curator of Mexico's premier cactus botanical garden shares some of his experiences during his last seven years in Mexico, caring for a huge reserve collection of cacti and succulents. Maintenance of this important collection is central to Mexico's battle in trying to preserve its unique flora. Photography by the author.

El Charco del Ingenio A C, (formerly known as CANTE), is a nature reserve and botanical garden, covering 100 hectares on the edge of the town of San Miguel de Allende in the Mexican state of Guanajuato. The varied topography and conditions in the reserve, including permanent fresh water, a steep rocky canyon and rolling semi-desert lands, are home to around 560 native plant species, of which about thirty are succulent plants. In addition to these, the garden is also the custodian of a collection of around 7500 Mexican cacti and succulents, mainly collected by Charles Glass and his team during their time at the garden during the 1990s. Most of these plants are displayed in the outdoor landscaped areas, the main show house or conservatory and in an area of introduced plants.

For reasons of space and security, many of the smaller species are cared for in the nursery/propagation unit. As I wrote previously (2004), the collection was in quite a poor condition when the present management organization took it over in the year 2000, and readers should refer to the above article for details of the many improvements made during those first four years at the gardens.

In the present account, the intention is to concentrate more on the day to day, practical aspects of the work:

Fig. 1 Part of the new garden of *Agavaceae* and *Nolinaceae*, with the Conservatory visible in the background

the problems, difficulties and some of the joys of cultivating these plants in their Mexican homeland.

Of the many differences between the UK and Mexico that have an effect on the cultivation of cacti and succulents, the most obvious is the climate. San Miguel is situated in the southern central highlands of the country at an altitude of around 2000m and enjoys a sunny, semi-desert climate. Summers can be surprisingly wet, but rain is infrequent and usually light between November and May. You may think that this sounds like perfect conditions for growing succulents outdoors, and indeed I cannot complain when comparing conditions to those in England, but there are some limitations.

In an average year, winter night temperatures will fall below freezing on fifty or more occasions, with a minimum of -4° to –6° Celsius being quite common. In December of 1997, shortly before my first ever visit to the gardens, the temperature had fallen alarmingly to -13° C, resulting in extensive damage even to the opuntias, and killed many of the mature *Myrtillocactus geometrizans* found on the reserve.

Clearly, such temperatures restrict what plants we are able to grow outside without protection and as a rule of thumb, plants from lower altitudes, or more southerly latitudes, are regarded as a risky prospect. Of course, we employ the protection of trees, shrubs and walls for some of the more tender species, but on this north-facing site, cold night winds are impossible to avoid. The affected plants are not necessarily killed outright, but they may be scarred badly or simply grow poorly, as is the case with most columnar cacti outdoors here in El Charco. In fact, one of the two native columnar cacti on the reserve, *Isolatocereus dumortieri*, is represented by only a couple of struggling plants on the canyon walls, where they are frequently badly frosted.

Some of the more tender plants do make satisfactory subjects for outdoors, such as *Bombax ellipticum* and some of the manfredas. The top growth on these plants is killed by frost each winter, but they quickly regenerate from the caudex or underground rhizomes when the temperature rises in February or March. In the case of the bombax, the stems never become mature enough to flower, but the lush, bronzy-red, new growth in the spring is most attractive.

The cacti that do best and look good all year round outdoors here include the larger globular and clustering species, some columnar cacti such as *Pachycereus marginatus* and *Myrtillocactus geometrizans*, and most opuntias,

Fig. 2 Grafted stock plants of *Mammillaria luethyi* in the propagation area

of course! Agaves and yuccas grow well too, as do members of the family *Nolinaceae*, the garden boasting some particularly fine specimens of *Dasylirion* and *Calibanus* from the Zimapan dam rescue operation. When planting the lower-growing plants, such as *Echinocereus*, *Coryphantha*, *Mammillaria* and most *Crassulaceae*, it should be borne in mind that most are growing in the wild under shrubs, amongst grasses or in clefts in the rocks. All of these locations provide some shade, and it is important to emulate this in the garden, a practice that took me a while to grasp fully, having been used to trying to provide as much sunlight as possible for these plants in the UK. If not given protection from the intense sunlight we receive here in Mexico, particularly in April and May, the plants turn reddish, growth is poor, and flowering, which puts extra water stress on the plants, can be adversely affected.

The best season for planting these plants outside is February or March, when the worst of the cold nights are over and heavy rain is unlikely, thus enabling us to control the moisture content of the soil. Both

bare-root plants and those from pots are not watered for a week or two after planting out, after which they are given a soaking every two or three weeks, to help them establish during the hot, dry spring. With the arrival of the rains at the end of May, the plants become properly established, and most receive no further watering.

With a free root run and nearly ideal conditions for many species, growth rates can be phenomenal in the early years, although most seem to slow down again as they reach maturity. This is just as well, because at first I tended not to give some of the plants enough space, and if they had not slowed down a little, we would have been obliged to move at least some of them after a very few years. This rapid growth can of course be a great advantage when one knows what to expect and means that new displays and landscaped areas achieve a mature look very quickly. A good example would be the new garden of *Agavaceae* and *Nolinaceae*, planted during 2006. Although we had some large specimens of *Yucca* and *Dasylirion* available to use, most of the plants were quite small, having spent many years growing in pots, or were younger plants that we had propagated. Bearing in mind the large number of offsets produced by the majority of species, I gave the plants plenty of space, which left the garden looking rather bare at the start, and I worried that it might take several years before the intended design was realised. I need not have worried, however, as a little over a year later the plants had grown beyond expectation, and the garden already has a mature feel and is producing ample material for propagation of this important group of Mexican plants.

Alongside the outdoor beds, the conservatory is our main display house. Here, a representative range of plants are growing in beds under cover, with many smaller species included. Although some of the plants in the conservatory would grow well outside here, others need the protection of a greenhouse, not only from the cold in winter, but also from excess rain in summer.

Average rainfall for San Miguel is around 65-70cm a year, with nearly all of it falling during the months of June to September. This rain usually occurs in heavy downpours, often on consecutive days, and saturates even well-drained soils, making conditions too wet for many of the plants from the drier habitats further north. Even with this protection, some genera, such as *Ariocarpus*, *Aztekium*, *Turbinicarpus* and the smaller mammillarias have not prospered by being grown in beds. I think that here too, the problem is that the soil does not dry quickly enough after watering and to get around this problem, most of these plants currently on display at the gardens are grafted specimens.

The part of the collection not on display to the public is housed in pots in a polytunnel greenhouse on our nursery site. Here the conditions can be controlled more easily, but again, some changes to the cultivation methods of northern Europe are necessary for the plants to thrive. As is the case with the conservatory,

Fig. 3 Landscape at the entrance to the gardens, using rescued plants of *Ferocactus histrix* and *Agave striata*

Fig. 4 View of the nursery area, showing the polytunnels and shaded patio

the polytunnels are exposed to full sun throughout the day, so shading of 30-50% is required to avoid overheating and burning of the plants. This shade is provided by commercial shade-cloth stretched over the greenhouse and ventilation is achieved by opening the double doors at the two ends of the structure.

Watering continues more or less all year round: about once a month during the winter, increasing up to twice a week during the hot months of March to the end of May, which is when many of the plants are in full growth and bloom. With the arrival of the rains in June, the temperatures fall a little, the sky is often overcast and the higher air humidity means that the plants dry out more slowly. At around this time, many species seem to enjoy a summer rest, with little growth evident until later in the season. Naturally, we reduce watering during this time, to around once every 10 days, increasing it again for a few weeks in the autumn until the plants enter their winter rest period.

Outside the larger cities, commercial potting mixes are difficult to obtain in Mexico, and, when available, are of variable quality and generally quite expensive. In addition, the garden has a policy of using local materials whenever possible, so we make up our own mixes from commonly available ingredients. Our standard mix consists of 35% each of sharp sand and black alluvial soil, with 15% of pumice gravel and 15% of a fine, pale, sandy soil known locally as tierra lama, all of which we can get from the local builders' merchants. Although the ingredients do vary a little, these provide a neutral, well drained substrate for most plants and this is also the mix we use outdoors where some addition or improvement to the soil is needed. In the last two years we have been adding around 20% of well rotted garden compost to this mix for the *Crassulaceae*, epiphytic cacti and cycads, with good results, reflecting the generally more humus-rich soils of their habitats.

In container cultivation, this compost provides sufficient nutrients for a year in the case of younger plants, and two years for more mature plants. Feeding with a low nitrate soluble fertilizer is carried out in the propagation houses perhaps three or four times a year, but plants in the collection rely on repotting to provide fresh nutrients. This keeps the plants in satisfactory health without them outgrowing the limited space available. Fertilizers are also relatively expensive and the simple equipment used at the nursery makes feeding a slow and laborious task.

Regular repotting is also needed to counteract the build-up of harmful salts, caused by a combination of the very hard mains water we have available and the high evaporation rates. Failure to do this results in poor growth and sickly, yellowish plants, although fortunately they recover quickly when given fresh soil.

Watering in the conservatory is done using water from the dam on the reserve, which is filtered through a series of artificial reed beds to remove dissolved salts and other contaminants, and with this system we have not noticed many problems with salt build-up in the substrate.

I have to say that, in relation to pests and diseases, growers in Europe have got it pretty good, with only a handful of problems being commonly encountered. In contrast, the situation for the plants in their homelands is very different. Here, succulent plants form an important part of the ecosystem, and as such attract a wide range of insect and other predators. Plants in cultivation are no exception. Some of the pests, like mealy bugs and scale insects, will be familiar enough to all of us, but here they exist in a range of forms both larger and also more voracious than their cousins in the UK. Some were not so familiar to me at the start and various cacti were lost from attack by larvae of several insect species. Although not positively identified, we believe from observation of adults and from the size of the usually single larvae, that most of these belong to various species of moth. The adult female appears to lay her eggs on the plant at ground level, from where the grub makes its entry into the plant, to begin eating it from the inside. Unfortunately on the outside, nothing is visible until it is too late and the hollow plant topples over to reveal the culprit. In the summer, the echeverias are prone to attack by a small greenish caterpillar, which eats tunnels in the young leaves to such an extent that the whole centre of the rosette can be eaten, and the agaves too have their own suite of insect enemies hidden within, such as the well known agave worm (*Hipota agavis*) and the larvae of a large scarab beetle.

Some of these pests are fairly easy to control with pyrethrum-based products or even solutions of washing powder mixed with alcohol and chilli. However, the pests that hide within the plants and some of the scale insects need a tougher approach, as the above measures cannot reach, or fail to make contact with the pests. Despite our reluctance to use systemic insecticides, both for environmental concerns and visitor safety, we do apply these chemicals twice a year to those plants grown under cover, in spring and late summer. This is enough to control these more insidious pests, while outbreaks of those more easily seen are meanwhile dealt with on an individual basis using the safer options at our disposal. Outdoors, pests are less of a problem, as many are prey themselves for birds, animals and other insects, giving us a degree of natural biological control, in addition to spot treatments with home made controls in the case of bad attacks. The worst problems come with the agaves and their unseen enemies within, which often strike as the plants are nearing maturity. Once again, we have little recourse but to use systemic insecticides on vulnerable plants, but in these cases, the chemicals are applied to the soil around the plants in the form of granules.

Fig. 5 One of our propagation houses, showing cacti growing on in trays

Fig. 6 Rescued plants of *Astrophytum ornatum* at the gardens entrance

All this work of displaying and maintaining the collection has an obvious conservation value, with the plants being available for study and educational purposes within the context of a reserve, which itself provides protection for many native succulents. However it is our work within the nursery, away from the gaze of the public, that I feel makes the largest contribution in the fight to preserve endangered species in cultivation and reduce collecting pressure on the wild populations.

This collecting pressure can take many forms, ranging from amateur collectors (both Mexicans and foreigners) illegally removing plants and the harvesting of certain species for religious or practical uses, to the wholesale stripping of smaller plants that occurs each December to satisfy the demand for decorations used in the nativity scenes found in every Mexican home at Christmas. This last practice is a problem within the El Charco reserve itself, and extra vigilance is needed during this time to protect some of the wild plants. It is hoped that by having a range of attractive propagated plants of the more common species for sale at the gardens, we at least provide an alternative to the illegally harvested plants on sale cheaply in the local markets; a hope encouraged by the healthy sales of echeverias, (a nativity scene favourite), and bowl gardens at this time of year.

The propagation that will be of most interest to readers is that concerning the smaller-growing, rarer genera beloved of collectors here and abroad. Of course our intention is not only to provide Mexican enthusiasts with legally obtained plants, but also to produce reserve material for the collection in addition to plants for exchange with other institutions. Much of the propagation is from seed produced from our own plants, in isolation where appropriate, to avoid hybridization, both between different species and also plants of a single species that have originated from different populations in the wild. Our seed-raising techniques do not differ significantly from those used in the UK, so I will not go into detail, other than to stress the need to soak the newly sown pots in a fungicide (I use Chinosol, which I bring from Europe) to counteract at least some of the pathogens present in the unsterilized soil. We also water a little less and admit more air to the newly

Fig. 7 Dudleyas, propagated from seed, almost ready for sale

germinated seedlings than was my usual practice in Britain, in order to prevent damping off.

Growth rates are good: roughly double the average in the UK, but genera like *Ariocarpus*, *Pelecyphora* and *Strombocactus* are still among the slowest, as even here, they resent being hurried too much. Most of these genera take three to five years to reach flowering size with us, unless grafted as stock plants for further seed production, in which case flowering is achieved more quickly.

Grafting has been a vital tool in the propagation of some plants, particularly for the species of which we have only a single specimen, or where seed production is limited. Grafted plants such as these provide back-up plants for the collection as well as providing many more cuttings than could the original plant. Other species, such as *Mammillaria luethyi,* were obtained by us as grafted plants, and we maintain these four clones on grafts as stock plants. From these we have propagated hundreds of new individuals; many on their own roots, as we have found it fairly easy to grow from cuttings.

Cuttings and offsets are our preferred propagating material with some groups, especially agaves and *Crassulaceae*, as we find it difficult to produce pure seed from these plants, even when isolated; a practice that is not always practical in the case of agaves, because of their size. *Crassulaceae* grow very rapidly, producing saleable plants in a matter of months, even from leaf cuttings.

Once of a suitable size, those plants not needed for our own work, or for exchange with others, go for sale at the entrance to the gardens. Since making available an increasing number of the rarer species, it is pleasing to see a growing group of Mexican collectors returning to us again and again to purchase these legal plants. Even better, many use these plants as the basis of their own propagation, helping to reduce further the pressure on the plants in habitat. In addition, the money raised by these sales, the prices of which reflect the desirability of the plants, is a useful source of income for the gardens, which receives no outside funding for its day to day activities.

These past seven years have taught me much, not only about cultivating plants and learning about their habitats, but also the threats they face. Today, the conservation of the natural world is more important than ever, with habitats throughout the world being destroyed or put under increasing pressure from a range of human impacts. Mexico is no exception, and while deeply saddened at some of the thoughtless destruction I have witnessed, I am also encouraged by the increasing environmental awareness I have seen amongst visitors to the gardens, educational projects and government agencies, amongst many others. It is to be hoped that this trend continues, before it is too late to save the wealth of flora and fauna we still have.

In the meantime, it has been a pleasure and a privilege to be able to help in the battle to preserve one small part of Mexican plant life in its homeland.

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Two out of three is not good enough!

Ray Stephenson

Ray and Joyce Stephenson attempted to rescue three critically endangered, lowland Turkish *Sempervivum* species in May 2006, and succeeded in saving two. A remarkable example of the tenacity of two enthusiastic amateurs overcoming the extinction of two species from the march of 'progress', with the help of BCSS Conservation Committee financial assistance. Photography by the author.

Background

In June 2004 Joyce and I journeyed to the north-eastern corner of Turkey and found three extremely localised, lowland *Sempervivum* species, which I realised would be in danger of extinction with the future damming of the Çoruh Valley. I presented a paper in the BCSS Journal (2004: 147-150) really just to pose the question: "Does anyone care?" The response from members was most encouraging and several suggested: "Why don't you go back and do something?" That option was not really open to me, but I did make contact with Professor Faris Karahan of the Faculty of Agriculture at Erzurum University, who has a real interest in Turkish *Crassulaceae*.

At that stage I had really hoped that he or members of his team would survey the site and save the three taxa. However, this was not to be, but he was extremely helpful. My wife was critically ill last year, so there was no way that we could travel, but I was encouraged, especially by Alan Hill, to apply to the BCSS Conservation Committee for a grant to enable me to retrace our steps in 2006 (3 months before the planned flooding). The response of the Conservation Fund Committee was rapid and fully supportive.

Fig. 1 The Çoruh Valley at the end of May 2006

Fig. 2 Damage to the Çoruh Valley walls

Joyce and I were keen to go back to Turkey to travel across the central plateau from the Black Sea to the Mediterranean in order to photograph *Sedum* species in the wild – the main reason for our last trip! Cachet Travel organised an itinerary so that we could follow the Çoruh Valley and then travel south from Erzurum, achieving both objectives of the trip. Unfortunately this would take the total distance to be driven to over 4,000km in just 14 days.

Despite many letters sent to the Turkish authorities over an 18 month period, I received no responses to my applications to seek permission to remove plants from the valley, nor to acquire the necessary phytosanitary certificate and export licence to send cuttings to England. However, Dr Karahan was eventually able to obtain permission for us to remove 13 plants of each taxon in order to take them to Erzurum University for safe keeping, where I had made special arrangements for their well-being. The official '13' figure had been suggested as "the minimum necessary to ensure the protection of a collected species in cultivation".

The journey

We drove along the Black Sea coast from Trabzon, then cut inland to follow the Çoruh river. Dropping down from Borçka my biggest fear revealed itself before us. The scene was unrecognisable to the one that had greeted us only two years earlier (Stephenson, 2004: 147). The new high level road being carved into the landscape had mostly buried the old lower road in rock and rubble. Traffic from Borçka to Artvin either followed the new high level road, or, where viaducts had

Fig. 3 Remnants of *Sempervivum glabrifolium* in the lower Çoruh Valley

Fig. 4 Flower of *Sempervivum glabrifolium* in the lower Çoruh Valley

not yet been completed, dropped down to a makeshift, temporary, hardcore route, in places still unfinished, regularly wetted with bowsers down at the water's edge.

As a result, no landmarks were recognisable and only a few valley sides retained their natural rocks (Figs. 1-2). Moreover, the distances that we had so carefully recorded were now meaningless. Two years previously, we had found a large colony of *Sempervivum davisii* together with a single plant of *S. glabrifolium* at a distance of some 6km from the dam. I now understand that the former species is much more widely distributed than we first thought and also grows in the Erzurum district, but *S. glabrifolium*, on the other hand, is extremely localised and restricted to the lower Çoruh Valley. Along one section of old road, about 12km north of Artvin, we spotted *Sempervivum* plants on roadside cliffs. They were out of reach, but a few hundred metres further on it was possible to climb the 10m or so in order to examine them. We had stumbled over *S. glabrifolium*, and a single exposed cushion of plants was in full flower (Figs. 3-4).

We concluded that the site where *Sempervivum davisii* used to occur had now been destroyed or buried. I do know of a small plant of *S. davisii* from the Çoruh Valley in cultivation, so hopefully this regional form can be perpetuated ex-situ. We spent the next two days moving first up, then down the valley, trying to spot rocky river cliffs not devastated by earth movement, and, of course, accessible from the present route. We completely failed to find any other sempervivums of any sort.

Fig. 5 Probably one of the last sites of *Sempervivum staintonii* being visited by Ray

Fig. 6 The rare *Sempervivum staintonii*, known only from this last, soon to be lost, locality in the Çoruh Valley

Fig. 7 Ray Stephenson presenting Professor Faris Karahan with a grant from the BCSS Conservation Fund

On the third day of our search we moved higher up the valley, knowing full well that we needed to reach Erzurum before nightfall, which is a 240km drive through narrow gorges on tortuous roads. After assiduously searching a 10km stretch of vertical, basaltic cliffs for most of the morning, we spotted sempervivums about 4m above the roadside, which fortunately was not an insurmountable obstacle. Closer examination showed that we had found the extremely rare *S. staintonii*, easily recognised by its highly succulent, few-leaved rosettes with retrorse cilia (Figs. 5-6). No plants were in flower, nor were there any signs of the previous season's inflorescences.

The next day we were greeted by Prof. Faris Karahan and taken to the University of Erzurum. His doctorate concerned the alpine flora of the area, so his knowledge of the ecological needs of such a species is second to none. I was pleased to be able to present him with a grant from the BCSS Conservation Fund to enable him to keep plants at two different sites for added safety, in order to cultivate, to propagate from them, and, under the auspices of the university, to authorise plants to be shipped to the UK next year with the necessary documentation (Fig. 7). In this way, expert growers, in particular the national collection holder Howard Wills, can receive material to develop stocks, perpetuate and eventually distribute these two little-known species more widely.

I was extremely disappointed to be too late to retrieve *Sempervivum davisii* from the lower Çoruh Valley, and so frustrated that laws had forbidden me from recovering a small quantity of rosettes when we had found them plentiful only two years ago. Hence, the six-day rescue operation proved to be only two-thirds successful. It highlights the very urgent need to fast-track bureaucracy for the movement of plants between political borders, in order to enable skilled horticulturalists to propagate material and spread it throughout cultivation, thereby mitigating the demise of plant populations in nature.

The series of Çoruh Valley dams is essential to Turkey's future prosperity. For a country with half of its population of only school age, having a surplus of energy to export is a situation somewhat like gaining a goose that lays golden eggs. No doubt pioneer species such as *Sedum hispanicum* and *S. pallidum* will thrive among the devastation of the Çoruh Valley, but the less resilient relict species will be lost forever in their natural habitat with this imminent inundation.

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Goodbye to the type locality of *Aloe ballyi*

Leonard E Newton

A sad tale of habitat destruction in Kenya.

In 1952 Dr Gilbert Reynolds visited East Africa in search of aloes. On 31 March of that year Dr Peter Bally, who was then living in Nairobi, took Reynolds to Coast Province and showed him some tall aloes growing in thick bush alongside the road near the town of Mwatate, in Taita District. In the following year Reynolds described these plants as a new species, to which he gave the name *Aloe ballyi* (Reynolds, 1953). Although it became the type locality, Mwatate was not the only known locality for this species. Bally had collected the same species as early as 1934 near the Pare Mountains in northern Tanzania. Several other localities are known, in both Kenya and Tanzania (Carter, 1994).

Reynolds (1966) also mentions plants found by Bally much further inland, on the western side of the Rift Valley in both northern Tanzania and Southern Kenya. However, Bally considered these to be different from *A. ballyi*, and on one of his specimens in the East African Herbarium, Nairobi, he added the name *Aloe elata* (meaning tall), though he did not publish the name. In June 1989 I climbed the Nguruman escarpment, which forms the western wall of the Rift Valley in southern Kenya, and on top I found flowering specimens of the plants that Bally had called *A. elata*. I noticed a number of differences from *Aloe ballyi*, which I reported to Susan Carter, who was then writing an account of the genus for the *Flora of Tropical East Africa*. When examining herbarium specimens, Carter had also noticed these differences, and so Bally's name *Aloe elata* was eventually published in that work (Carter, 1994).

In May 2003 I took some overseas visitors to the type locality of *Aloe ballyi*. We were delighted to find a number of flowering aloes, up to about six metres tall, in the dense vegetation alongside the road (hence the telephone wire in fig. 1). I told my visitors that they were treading in the footsteps of Peter Bally and

Fig. 1 ***Aloe ballyi*** **at the type locality, roadside bush near Mwatate, in May 2003. (Photo: Charlotte Bjorå)**

Fig. 2 Inflorescence of *Aloe ballyi*. (Photo: author)

Gilbert Reynolds! We also found various other succulents there, including *Ceropegia ballyana*, though the type locality of this species is elsewhere in Kenya. Seven months later, in December 2003, I took another group of overseas visitors to the same place. Imagine my horror on finding that the bush had been cleared and almost all of the aloes had been cut down, and the few remaining ones were also threatened as the clearing was continuing. In place of the thick bush, there were recently planted crops. Previously the farmers had left a wide fringe of natural vegetation between the road and their farms, and this was the home of the aloe. Now they were farming right to the roadside. That was the end of the *Aloe ballyi* population at the type locality!

Conservationists become very agitated over the collection from the wild of plants that are transported around the world for subsequent cultivation by hobbyists, and CITES was set up to control this international trade. Certainly there are numerous horticulturally desirable species for which this is a threat. However, the present operation of CITES has complicated and expensive bureaucracy. This makes it uneconomical to distribute the thousands of plants that could result from the propagation of rare species in cultivation (Mottram, 2003) so does little to remove the threat. However, for many species a far greater threat is habitat destruction. It is estimated that the population of Kenya at the beginning of the twentieth century was between one and two million people. A census a few years ago revealed that there are now well over 30 million Kenyans. Both fauna and flora have suffered great losses as more and more land is converted to residential areas, farmland and other artificial habitats. As the botanical exploration of Kenya is relatively recent (Newton, 2004), we have no idea how many species might have become extinct without having been scientifically described.

Aloe ballyi does survive in several other places in Kenya. It is also still to be seen in northern Tanzania, not very far from the Kenyan border, or it was when I was last there. However, the species has been listed as endangered for many years (Beentje, 1988), and it is the only Kenyan aloe in the 2006 *IUCN Red List of Threatened Species* (IUCN, 2006). Several species of *Aloe* in Kenya are protected by local people because they have medicinal value and are still used in traditional herbal medicine, but *Aloe ballyi* lacks this protection because it is poisonous (Newton, 2002). Consequently it could be only a matter of time before it becomes extinct in the wild as more and more natural vegetation is destroyed.

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