Yavia cryptocarpa – conservation action on a new and interesting cactus

R. Kiesling[1] and O. Ferrari[2] discuss a recently described Argentinian cactus and detail a project, financed by the BCSS Conservation Fund, to help ensure its survival in habitat. Photography by R. Kiesling, L. van der Hoeven, E. & V. Foik, V. Emiliani and J. Miller.

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Introduction

The new genus and species *Yavia cryptocarpa* has recently been described from Argentina (Kiesling & Piltz, 2001). After the publication the authors and other friends started to be concerned about the conservation of the species. The known area of habitat is relatively small and the plants are growing in a very special sort of soil. Although the species surely has a wider dist-

Figure 1 This is thought to be the first photograph ever taken of *Yavia cryptocarpa* flowering in the wild. (Photo: L. van der Hoeven)

ribution, its small size plus the strongly camouflaged aspect make it difficult to know its distribution with any degree of confidence. Consequently, any more localities are as yet unknown.

In general, we consider alteration of the environment as the most frequent reason for destruction of individual species and for vegetation in general. However, in this case, we consider this to be a very remote possibility due to the impossibility of carrying out arable farming on this sort of rocky soil. Even the grazing of animals in the area is very unlikely due to the very scarce vegetation, with only sparse grasses after the rains. It is a desert, or more strictly a poor, semi-desert, where the bushes are separated several yards apart.

Figure 2 Part of the habitat of *Yavia cryptocarpa*, with V. Foik and R. Kiesling examining one of the plants (Photo: E. Foik)

We feel that the real danger to the species is over-collection by commercial or amateur collectors. Other recent new discoveries in Mexico (*Geohintonia mexicana* and *Aztekium hintonii*) resulted in very fast over-collection of habitat plants. We feel there is an immediate necessity to calm the anxious desire of commercial and amateur growers by providing them with the possibility to have the species available in reasonable time, but with as little disturbance to the natural populations as possible.

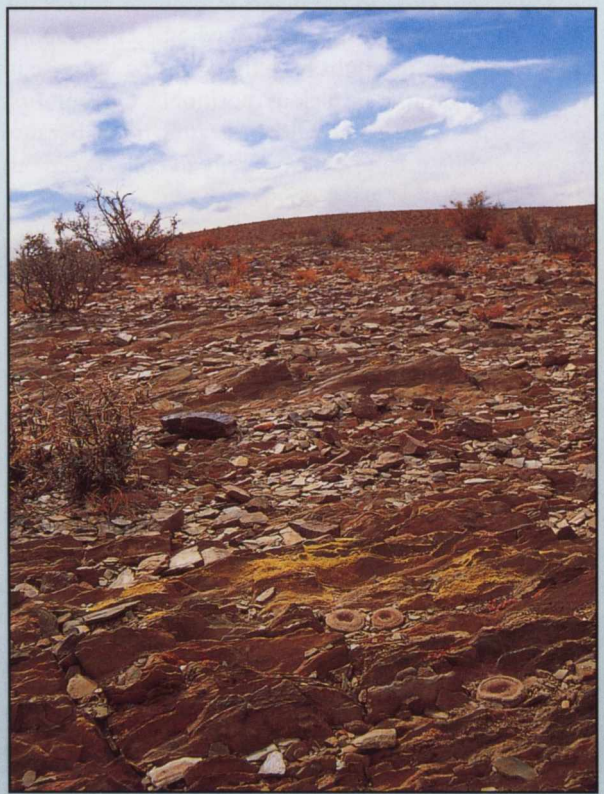

Figure 3 The habitat of *Yavia cryptocarpa* – note the sparse vegetation. Three specimens can be seen in the foreground. (Photo: E. & V. Foik)

Although regulations make the collection and especially the exportation of these cactus novelties illegal, in practice it is impossible to stop. In fact, the more strict and complicated the regulations, the more people avoid fulfilment of them. Desire of amateurs, plus commercial interest, makes the legal papers unhelpful. We therefore decided to try a new way, which was a friendlier one, to satisfy conservation intentions, commercial needs, and the wishes of amateurs.

Our plan of action basically consisted of the collection of seeds from habitat, with as wide as possible distribution to propagators who are proven experts in mass propagation of rare cacti. In our mind commercial growers from all over the world are ideal for this, for they will profit only when they distribute the plants. Some of them have amazing skills in growing cacti as fast as possible, providing the plants with fertilizer and water just at the dangerous maximum limit or, better still, by grafting. But, of course, recognized private growers and botanical gardens could also be considered to receive the seeds under the promise to grow and actively distribute them.

The Conservation Committee of the British Cactus and Succulent Society enthusiastically approved the proposal, provided the necessary funds and undertook the distribution of the harvest. We consulted and informed the national authorities of CITES about our action and

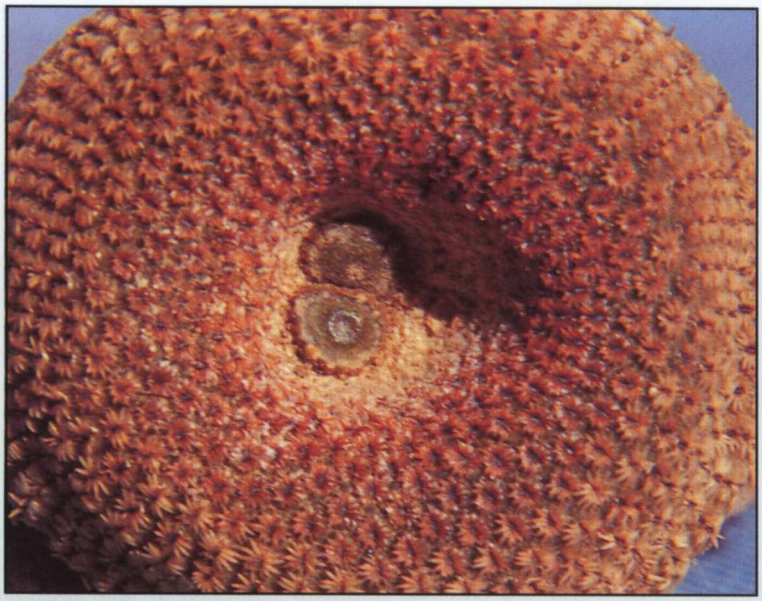

Figure 4 The top of a plant of *Yavia cryptocarpa*, with two fruits deep in the centre (Photo: R. Kiesling)

also informed the provincial authorities of Jujuy Province. We also asked the former to keep the central authorities of CITES in Switzerland informed.

If this action for conservation of the species is successful, a great step in creating harmony between conservation and collection wishes will be well served. We have more trust in this than in other control policies.

Using the advantage that the plants grow near an international border, we asked the border police (Gendarmería Nacional), to observe and care for the area in which they occur. They accepted and registered our request. Due to the varied composition of this force we imagine only a few of the people in the force will really have any interest or understanding of our concerns for the survival of these plants. However, it is possible that illegal collectors could be stopped and interrogated if they try to remove any of the specimens illegally. As this is a "hot area", used by drug and vehicle smugglers to cross the border, the authorities there have the right to inspect people, cars and luggage.

Field work

The fieldwork was undertaken in November 2001. We included a search of other possible areas where the species might also grow in that area of Argentina. It is also very possible that this species might occur in Bolivia, but there is not any certain information on this at present.

The main work was to explore the known localities of these small plants, looking at each plant for fruit or simply for any seeds that remained on the plant or on the surrounding soil. The experience was both interesting and amusing. Initially during the first day we found several plants with hardly any seeds and no fruits, but later we found colonies where some, or most, of the plants had seeds. Our party consisted of four people and we divided into two teams: one person was looking for plants whilst the other collected the fruits with laboratory forceps, putting them immediately in a small container, a film canister.

The very first fruit found was blown away by a gust of wind when one of us showed it to the others! Thereafter we worked lying down in order to diminish the effect of the wind on the working area. When the wind increased two people had to lie down very close to the plants in order to collect the seeds. Any inhabitants of the area who had the opportunity to observe us might have thought that we were in a very strange and suspicious position! On our first harvest day we stopped work just after noon because the wind made it impossible not only to collect seed but also to see what we were doing.

Figure 5 Some wild-collected specimens, in cultivation after 6 months. The smaller ones in the centre maintain their original appearance, but the others are growing faster and have become bloated as a result of extra nutrients and reduced sun radiation. (Photo: R. Kiesling)

Habitat and characteristics of the genus and species

As mentioned above, this species is growing just on the Argentinian side of the border with Bolivia, in the province of Jujuy, near La Quiaca, at 3,700m. Vegetation is scarce, with only well spaced bushes. Temporary grasses can be found for some weeks after the rains, which fall between December and March, but it is possible also to have some rainfall from October to April. My Professor, Dr. Angel L. Cabrera, considered the area where this new cactus had been found as a place of endemism, and he encouraged us to search the vegetation there carefully. Dr. Cabrera (1908-1999) was the Director of a large project to study the flora of Jujuy province, where he explored many times over many years.

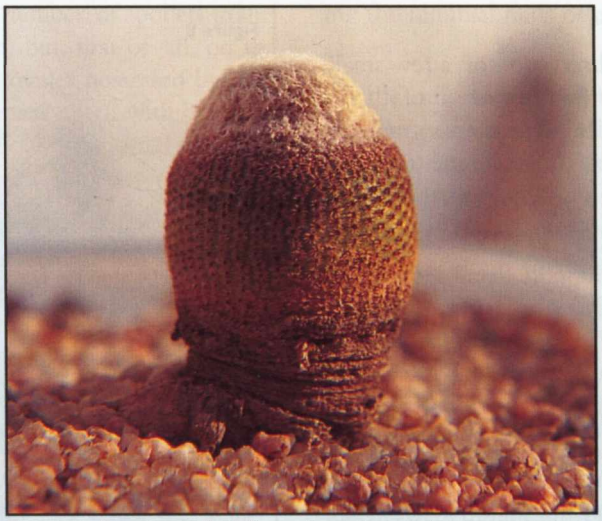

Figure 6 An extremely deformed specimen after 6 months in cultivation. (Photo: V. Emiliani)

The *Yavia* specimens are growing in the crevices of the rocky soil, on the horizontal or on gentle slopes.

To give a quick idea of *Yavia cryptocarpa*'s appearance, the cactus most similar to it is perhaps *Epithelantha micromeris*. The small stems of *Yavia* are single, more rarely with two or more heads, and are normally just at the level of the soil surface or even lower, immersed in the crevices. Some are even covered by small pebbles.

The stems are small; a specimen of 25mm diameter is an extraordinarily fat and old plant. They have a flat top, with a woolly depression in the centre. This superior disk is the only visible part of the plant and the only part receiving the sun's rays. Areoles are ordered in several lines that are not really ribs, just small undulations for which the term tubercles is perhaps too much. The spines are small, 0.3 to 0.7mm long, and barely visible without the aid of a magnifying glass.

The lateral part of the stem is almost cylindrical and is rugose. This rugosity corresponds to previous epidermal tissue of the superior disk, which over the years comes to the side, with the spines attached although decrepit, more or less destroyed. We believe that each of these "wrinkles" corresponds to one year's growth and we counted more than twenty on some plants. Cultivated plants change dramatically in their aspect (see under cultivation).

Roots are conical, succulent, and are a continuation of the underground stem. Often the underground stems and the roots are compressed by the stones (making them ideal specimens for herbaria!)

Figure 7 A seed-raised specimen, approximately one year old and 10mm diameter, grafted on *Pereskiopsis*. (Photo: J. Miller)

The most interesting part of the morphology is the centre of the plant where one or more flowers are produced at one time. This deep centre, which is full of hairs that protect the fruit during its development over several months, is where the fruit dries and dehisces and where the new buds expel the fruits and seeds for dispersal.

Corrections and additions to the original description

Thanks to the number of fruits that we saw, it has been possible to observe some details and to correct slightly the original description that was made

when we had only four fruits.

The main correction is the observation of a few small, vestigial scales on some fruits (but not on all of them), which carry small axillary hairs. This is a very important character and will perhaps aid those attempting to understand the relationship of this genus to other Cactaceae.

We were also able to observe in more detail the method of dehiscence employed by this plant. The fruit splits from the base, in two or three longitudinal furrows; and in some cases there are some longitudinal incomplete apertures. The very thin wall of the fruit looks like thin, brown paper and the vascular system is visible through this translucent wall.

It seemed strange to us to find fruits empty of seeds but full of hairs. We already knew that hairs do not grow inside the fruits. To be sure of this we opened some completely closed fruits and examined them carefully and thus confirmed our initial observations. Our conclusion is that some of the fruits, which persist in the centre of the plant for months after losing the seeds, were in some cases penetrated by new, developing buds. These new buds have very many hairs at the growing point and thus push many hairs into the empty fruits. We also saw, in two cases, a fruit with a bud inside.

Another new observation is the number of seeds produced in each fruit. Previously we had mentioned 4 to 6 in a fruit on the basis of the few fruits available for the description. We counted the seeds of the complete and closed fruits only, not of those that were partially open. Some fruits contain only 1 or 2 seeds, but most contain between 4 and 7, with 5 or 6 the most common number. Some (about four fruits) contained the exceptional number of 14 or 15 seeds. Finally, only once, we counted 25 seeds.

To know the maximum possible number of seeds that could develop in a fruit we looked for aborted ovules on the inner walls of the fruit. However, only a few were noted in each fruit. Apparently the number of seeds is

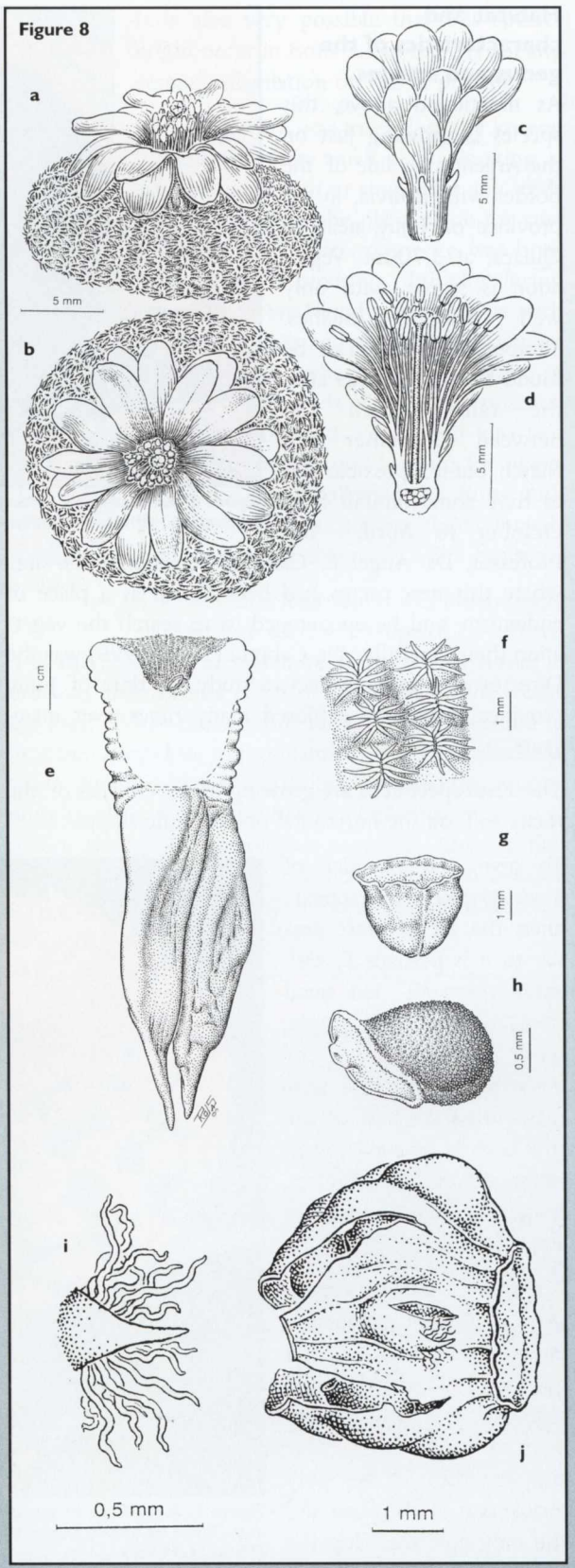

Figure 8
Line drawings of *Yavia cryptocarpa*

a & b	**Flowering plant (paratype)**
c & d	**Flower sections**
e	**Lengthwise section through the plant (holotype). The position of the sunken fruit can be clearly seen**
f	**Areoles**
g	**Fruit**
h	**Seed**
i	**Vestigial scale from a fruit**
j	**Fruit**

not only dependent on the number of pollen grains which succeed in fertilization, but, first of all, on the evidently variable number of ovules possessed by each flower. One exceptional fruit was noted with only one mature seed surrounded by about 19 aborted ovules.

Relationships

In the original description there was some speculation over those genera to which *Yavia* might be closely related: *Cintia, Blossfeldia, Weingartia* and *Neowerdermannia.* The last one was considered the most similar because it also keeps the fruit for years inside the areoles and the seeds only come out when, after good hydration, the stems grow.

Very recently, thanks to Leo Van der Hoeven and Brian Bates, we observed one specimen of *Cintia knizei* with the rest of the fruit and a couple of seeds in the centre of the plant, just as happens in *Yavia.* The fruit walls have a similar structure (thin, papyraceous, with the vascular bundles observable). This suggests that *Cintia* and *Yavia* could be more closely related than we realised at the time of the original description. The *Cintia* seeds, observed at the end of December, can be assumed to be products of the flowers from some months before, but in *Yavia* the fruits are protected for many more months (throughout the summer, winter, and part of the spring). This is a noticeable adaptation. On the other hand, the two genera have very different seeds. Therefore, before making any nomenclatural change, we will wait for some molecular studies that are in progress at the molecular laboratory of botany of the University of Saskatchewan, under the direction of the Dr. J. Hugo Cota S.

Although separated by well over one hundred miles, cintias and yavias grow in almost identical habitats. The similar geological formations are vertically striated rocks on gentle slopes.

We also took a sample of soil for analysis. From the analysis results provided by a private company we can record here that the pH is 6.5, the N 30 ppm, K 140 ppm, P 16 ppm, S 22 ppm, Fe 31 ppm, Mn 17 ppm, and Zn 4 ppm.

Cultivation

The wild plants we took to San Isidro and La Plata grew very well only if they were kept in a dry soil, but watered frequently (almost every day) by spraying, at least for some months, to avoid dehydration. This sort of absorption, we suppose by the spines, appears to be very important in the wild, and is a method of absorbing the minimal rains or dew occurring during the dry season.

A little more water can be supplied through the soil after the plants are rooted. Once established, the plants grow well in diameter and height, producing white areoles on the entire top, and then changing completely from their original appearance. In fact it is tempting to change the words "grow well" in the previous sentence to "grow abnormally", because the change from the natural aspect produces an abnormal, fat plant with whitish hairy areoles.

Pots of plants that were watered more freely, and also some which suffered from flooding by an unusual tropical rain, soon contained a high proportion of dead specimens. It is our opinion that the plants were attacked by a fungus that came with them from the wild. The deceased specimens did not suffer from wet rot, but appeared to be desiccated. Perhaps this putative fungus attacks the thinner feeding roots and prevents the uptake of water?

Growing Yavia from seeds

This conservation action is based on the propagation ex situ of wild collected seeds. The following information is important to aid this aim successfully.

Very recently Rene Zahra from Malta informed us that about a year ago he obtained seeds of *Yavia* which he shared with a friend, Dr. Francis X. Sammut. Both had success with the germination (90%). However, one of them grafted the seedlings on to *Hylocereus* and had low success, only 30%, but the other grafted onto *Pereskiopsis velutina* and obtained 100% success. The latter grower now has amazingly large and healthy specimens, with an average of 3 offsets, which can be grafted again. Re-grafted on *Trichocereus pasacana*, some are now giving the impression that they will even soon flower. We hope this information will help those who attempt to propagate this species in the future.

Separately, O. Ferrari grafted a wild specimen of *Yavia* on to *Trichocereus pasacana.* This resulted in a plant growing slower than the plants cultivated on their own roots and intermediate in appearance between wild and cultivated specimens.

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