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To Grow • To Study • To Share

Recent revisions in *Sulcorebutia* – a New Zealand amateur’s view

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Introduction

Classifying the beautiful plants in *Sulcorebutia* has proven enormously frustrating. There are a myriad of forms, with intermediates between apparently distinct groupings. Pot (2006) summarised:

“Everyone who studies the genus *Sulcorebutia* will, after a period of time, dejectedly shake his head. One finds that many forms appear to have few morphological differences and are nearly impossible to differentiate by eye, but many specialists call them by different names. Others take a more radical view like Dr David Hunt, who said (pers. comm., 2000): ‘*Sulcorebutia* contains only a few species, perhaps only one, with many faces.’”



Figure 1 *S. breviflora* - pectinate

Any botanist working with collected and cultivated plants faces a problem that they see only a fraction of the variety of forms that exist in the wild. Here in New Zealand we see only a fraction of what is available in cultivation and little or none of the plants discovered since biosecurity rules came into effect. So we are necessarily spectators in the debate. But there can be great intellectual interest in the evolution of views of the plants. This article attempts to summarise and contrast the classifications that have been made recently.

Even with the limited material available here, it is possible to see just how variable these plants are. Figures 1-4 show four plants of *S. breviflora* in my own collection (I will use the abbreviations *S*, *R*, and *W*. for *Sulcorebutia*, *Rebutia* and *Weingartia* respectively; and sometimes drop the genus initial completely.). *S. breviflora* is a well-defined species, generally easily



Figure 2 *S. breviflora* - bristly

recognisable and not intergrading with its neighbours. Only two other names have been proposed for plants in this species, *caineana* and *haseltoniana*, which compares with greater than 50 names referred to *steinbachii* by Hunt (2006). This species is well-defined, compared to, say, *mentosa* or *steinbachii*. Figure 1 shows a tidy plant with short, almost pectinate spines. Figure 2 shows a plant with bristly, erect spines. Figure 3 shows a third, '*caineana*', with strong centrals. Finally figure 4 shows a heavily spined plant, rather similar to



Figure 3 S. '*caineana*' KK1263

the cover picture on Augustin et al (2000). When it is full of water it expands a bit and the skin does become visible between the spines. If these plants were, say, *Mammillarias*, they would be four different species without a doubt. But in *Sulcorebutia* this amount of variation within a species is mild. It's easy to see

how new plants get described as a new species and then later it is realised they are really just different forms of the one species.

Donald, as reported by Pilbeam & Hunt (2004):

"...had come to the conclusion [in 1986/7] that nearly all the proposed taxa (species, subspecies, varieties and forms) could be classified within just three broadly defined species (*steinbachii*, *mentosa* and *canigueralii*), each of them with a hierarchy of subspecies, varieties and forms, plus four species he regarded as more individually distinctive (*breviflora*, *cylindrica*, *tarijensis*, and *cardenasiana*) on the fringes of the distribution area."

His subspecies are reported by Hunt (1997). This classification was the basis for the *CITES Cactaceae checklist*. But even at this level of aggregation there is not agreement about which taxa belong in which species or group. For example *S. heinzii* HS151 is referred to *mentosa* by the New Cactus Lexicon (Hunt 2006, now referred to as the "NCL"); but Hentzschel & Augustin (2008) & Gertel & de Vries (2007) both make it a synonym of *tiraquensis* v *totoensis*, ie in the *steinbachii* group.

The splitters and the lumpers

The differences in classification in *Sulcorebutia* are a part of the great debate in cactus taxonomy. Very roughly we have the lumpers, predominantly Anglo-American, and the splitters, predominantly European.



Figure 4 *S. breviflora* - spiny

The lumpers produced their culmination in the NCL, Hunt (2006), but it should be noted that this is the work of a broad committee, not just the views of one person. Pilbeam & Hunt (2004) quoted the specific epithets of Augustin et al. (2000), but without in any way accepting their classification.

And once the different classifications are examined and compared it is apparent that there is much agreement, and it is a gross simplification to see it just as “lumping” or “splitting”.

The European school are represented by Augustin et al. (2000), and subsequent revisions by Hentzschel & Augustin (2008) and Frtiz, Gertel & deVries (2004, 2006, 2007, 2008). An extreme splitter’s view is presented by Horáček (2008). It is Europeans who have done nearly all the collecting of *sulcorebutias*, and most of the botanical description, so their views command considerable deference.

As well as the definition of the species, there is the recurring question as to whether *Sulcorebutia* is a good genus or not? What is the relationship to *Rebutia*, *Cintia*, *Weingartia* and *Gymnocalycium*? Whether or not *Sulcorebutia* is merged with other genera, it remains an identifiable group of attractive plants, be it genus or subgenus.

The publications referenced here are mostly unavailable in New Zealand. However there is an excellent resource on the web: Sulcopassion (www.sulcopassion.be) where much of this material is available for download, and there are links to other relevant sites. A second important site is SSK (www.ssk-kaktus.org), a study group that includes many of the European experts on *Sulcorebutia*.

The Anglo-American school

Hunt (1999, 2006) subsumes *Sulcorebutia*, and also *Cintia* and *Weingartia*, into *Rebutia*. Hunt (1999) follows Donald's unpublished classification, allowing 8 species, with 6 distinct subspecies, for a total of 8 species and 14 taxa:

Table 1. Classification of Hunt (1999)

<i>arenacea</i>	<i>mentosa</i>
<i>caineana</i>	<i>ssp purpurea</i>
<i>canigueralii</i>	<i>oligacantha</i>
<i>ssp crispata</i>	<i>steinbachii</i>
<i>ssp pulchra</i>	<i>ssp kruegeri</i>
<i>cardensiana</i>	<i>ssp tiraquensis</i>
<i>cylindrica</i>	<i>ssp verticillacantha</i>

This classification was followed by Anderson (2000).

Hunt (2006) in the "New Cactus Lexicon" modifies the classification somewhat, with 11 species and 15 taxa:

Table 2. Classification of Hunt (2006)

<i>arenacea</i>	<i>oligacantha</i>
<i>breviflora</i>	<i>pulchra</i>
<i>canigueralii</i>	<i>steinbachii</i>
<i>cardensiana</i>	<i>ssp kruegerae</i>
<i>cylindrica</i>	<i>ssp tiraquensis</i>
<i>glomeriseta</i>	<i>ssp verticillacantha</i>
<i>mentosa</i>	<i>vasqueziana</i>
<i>ssp purpurea</i>	

Note: under each species, if there is a subspecies with a different name, there is also one with the same name, containing the type plant, ie under *mentosa* there is a subspecies *mentosa* as well as *purpurea*. Similarly with varieties. I leave these out of the list unless it is necessary. It may be needed when there are both subspecies and varieties, to make clear which subspecies the variety goes under.

Although there are only 15 taxa in this classification, Hunt expected that varieties and forms would be described under it. Certainly this has happened in an informal way. Those, like myself, that follow Hunt's classification usually append the old species name as a variety. For example, *S. flavissima* is labelled

R. mentosa flavissima. With the great variety of forms under *mentosa*, there need to be some labels to discriminate them. Hunt has tried to encourage the use of the old names as cultivar names (eg *R. mentosa* ‘Flavissima’ or *R. ‘Flavissima’*), but this does not seem to be popular.

Hunt (pers. comm.) advises that he is “likely to be more “hard-line” in the next edition of the CITES Checklist (scheduled for 2010), though with amended synonymy in the light of Ritz’s new data.”

I think it would be fair to say that there is considerable acceptance of the classification in the NCL – the lumping of *Echinopsis*, *Eriosyce* and *Parodia* seems to be generally accepted. But the treatment of *Rebutia* has been resisted. Those who accept the amalgamation still want possibly more species, and definitely more varieties. Part of the problem is that the 11 species as defined have some misfits in the way old species are subsumed under the 11.

Anderson (2000) was produced in a German edition, Anderson (2005), translated by Urs Eggli. In the process of producing it errors in the original edition were corrected and *Sulcorebutia*, maintained as a separate genus, was modified in deference to the refusal of the German cactophile community to accept Hunt’s classification. The species listing and introductory material of this book is available at www.DeutschesFachbuch.de. By using a Google search the translation option can be used. This classification has 17 species, with no subspecies or varieties. The difference with the NCL is that the four subspecies have been elevated to species, and two new species added.

I note that the German resistance may be weakening. On the website of DKG (the German Cactus Society), there is currently (Mar 09) a picture labelled “*Parodia scopa*”, so they have accepted the amalgamation of *Notocactus*.

Table 3. Classification of Anderson (2005)

<i>arenacea</i>	<i>mentosa</i>
<i>breviflora</i>	<i>pulchra</i>
<i>camargoensis</i>	<i>purpurea</i>
<i>canigueralii</i>	<i>steinbachii</i>
<i>cardensiana</i>	<i>tarijensis</i>
<i>crispata</i>	<i>tiraquensis</i>
<i>cylindrica</i>	<i>verticillacantha</i>
<i>dorana</i>	<i>vasqueziana</i>
<i>krugerae</i>	

Note: *S. tarijensis* is synonymous with *R. oligacantha*. As there already is an *R. tarijensis* it is necessary to rename *S. tarijensis* if it is moved to *Rebutia*.

The European school

Augustin et al. (2000) was the first thorough review of *Sulcorebutia* since Pilbeam (1985) and there has been a lot of new plant material discovered since then.

Table 4. Classification of Augustin et al (2000)

<i>alba</i>	<i>krugerae</i>	<i>rauschii</i>
<i>albissima</i>	<i>var hoffmanii</i>	<i>santiaginis</i>
<i>arenacea</i>	<i>langeri</i>	<i>steinbachii</i>
<i>augustinii</i>	<i>losenickyana</i>	<i>var. horrida</i>
<i>breviflora</i>	<i>var. chatajillensis</i>	<i>var. tunariensis</i>
<i>var. haseltonii</i>	<i>var. vasqueziana</i>	<i>tarabucoensis</i>
<i>var. laui</i>	<i>mariana</i>	<i>var. aureiflora</i>
<i>candiae</i>	<i>var. laui</i>	<i>var callecallsis</i>
<i>var. kamiensis</i>	<i>markusii</i>	<i>tarijensis</i>
<i>canigueralii</i>	<i>menesesii</i>	<i>tiraquensis</i>
<i>caracarensis</i>	<i>mentosa</i>	<i>var. aguilarii</i>
<i>cardenasiana</i>	<i>var. swoboda</i>	<i>var. lepida</i>
<i>crispata</i>	<i>mizquensis</i>	<i>var. longiseta</i>
<i>cylindrica</i>	<i>oenantha</i>	<i>var. renatae</i>
<i>fischeriana</i>	<i>var. pampagrandensis</i>	<i>var. totorensis</i>
<i>frankiana</i>	<i>pasopayana</i>	<i>torotorensis</i>
<i>glomeriseta</i>	<i>polymorpha</i>	<i>verticillacantha</i>
<i>inflexiseta</i>	<i>pulchra</i>	<i>var. cuprea</i>
<i>krahnii</i>	<i>purpurea</i>	<i>var taratensis</i>
	<i>var. unguispina</i>	<i>vizcarrae</i>

There are 38 species and 59 taxa.

This group of authors then split, giving us two opinions as expressed in Hentzschel & Augustin (2008) and Fritz, Gertel & de Vries (2004), Gertel & de Vries (2006ff). The following table shows the first classification.

Figure 5. right *S. cylindrica crucensis* HS44a (see page 86)



Table 5. Classification of Hentzschel & Augustin (2008)

<i>arenacea</i>	<i>juckeri</i>	<i>tarabucoensis</i>
<i>var. candiae</i>	<i>langeri</i>	<i>var. aureiflora</i>
<i>var. kamiensis</i>	<i>mariana</i>	<i>var. callecalleensis</i>
<i>var. menesesii</i>	<i>var. prantneri</i>	<i>tarijensis</i>
<i>augustinii</i>	<i>var. laui</i>	<i>subsp. carichimayensis</i>
<i>azurduyensis</i>	<i>markusii</i>	<i>subsp. samaensis</i>
<i>breviflora</i>	<i>var. mizquensis</i>	<i>tiraquensis</i>
<i>var. haseltonii</i>	<i>var. tintiniensis</i>	<i>var. aguilarii</i>
<i>var. laui</i>	<i>mentosa</i>	<i>var. longiseta</i>
<i>canigueralii</i>	<i>var. albissima</i>	<i>var. lepida</i>
<i>cantargalloensis</i>	<i>var. swobodae</i>	<i>var. totoensis</i>
<i>caracarensis</i>	<i>naunacensis</i>	<i>var. pampagrandensis</i>
<i>cardenasiana</i>	<i>pasopayana</i>	<i>var. renatae</i>
<i>crispata</i>	<i>pulchra</i>	<i>var. krahni</i>
<i>var. hertusii</i>	<i>purpurea</i>	<i>torotorensis</i>
<i>cuprea</i>	<i>var. santiaginis</i>	<i>vargasii</i>
<i>cylindrica</i>	<i>var. unguispina</i>	<i>var. viridissima</i>
<i>var. crucensis</i>	<i>rauschii</i>	<i>vasqueziana</i>
<i>dorana</i>	<i>roberto-vasquezii</i>	<i>var. losenickyana</i>
<i>elizabethae</i>	<i>steinbachii</i>	
<i>fischeriana</i>	<i>subsp. krugerae</i>	
<i>frankiana</i>	<i>var. hoffmaniana</i>	
<i>gemmae</i>	<i>subsp. verticillacantha</i>	
<i>glomeriseta</i>	<i>var. taratensis</i>	
<i>heliosoides</i>	<i>var. tunariensis</i>	
<i>inflexiseta</i>	<i>var. horrida</i>	

This has 37 species and 71 taxa. Hentzschel & Augustin also consider *Cintia* and *Weingartia* to be in the same genus as *Sulcorebutia*, and since *Weingartia* has priority, they transfer all their species into *Weingartia*.

Gertel & de Vries have not completed their revision, with the southern species still to be done. Fritz et al (2008), Gertel (pers.comm.) provide a complete list of their recognised species. However it is possible that they will make some further changes when they complete the revision, as the recent revision of the central species modifies some species. With that reservation, their classification is as follows on Table 6, next page:

Table 6. Classification of Fritz, Gertel & de Vries (2004), Gertel & de Vries (2006ff)

<i>arenacea</i>	<i>naunacensis</i> *	<i>tarijensis</i> *
<i>var. candiae</i>	<i>pasopayana</i> *	<i>subsp. carichimayuensis</i> *
<i>var. kamiensis</i>	<i>pulchra</i> *	<i>subsp. samaensis</i> *
<i>var. menesesii</i>	<i>var. longispina</i>	<i>tiraquensis</i>
<i>azurduyensis</i> *	<i>purpurea</i>	<i>subsp. tiraquensis</i>
<i>breviflora</i> *	<i>var. santiaginensis</i>	<i>var. aguilarii</i>
<i>var. haseltonii</i> *	<i>var. unguispina</i>	<i>var. longiseta</i>
<i>var. laui</i> *	<i>rauschii</i> *	<i>var. lepida</i>
<i>camargoensis</i> *	<i>roberto-vasquezii</i> *	<i>subsp. totorensis</i>
<i>canigueralii</i> *	<i>steinbachii</i>	<i>var. oenantha</i>
<i>cantargalloensis</i>	<i>subsp. steinbachii</i>	<i>var. renatae</i>
<i>caracarensis</i> *	<i>var. tunariensis</i>	<i>var. augustinii</i>
<i>cardenasiana</i> *	<i>var. horrida</i>	<i>subsp. krahni</i>
<i>crispata</i> *	<i>subsp. krugerae</i>	<i>subsp. mariana</i>
<i>dorana</i> *	<i>var. hoffmanii</i>	<i>var. australis</i>
<i>elizabethae</i> *	<i>subsp. verticillacantha</i>	<i>var. laui</i>
<i>fischeriana</i> *	<i>var. taratensis</i>	<i>torotorensis</i> *
<i>frankiana</i> *	<i>subsp. markusii</i>	<i>vargasii</i> *
<i>gemmae</i> *	<i>var. mizquensis</i>	<i>var. viridissima</i> *
<i>glomeriseta</i>	<i>var. tintiniensis</i>	<i>vasqueziana</i> *
<i>inflexiseta</i> *	<i>tarabucoensis</i> *	<i>subsp. alba</i> *
<i>juckeri</i> *	<i>subsp. tarabucoensis</i>	<i>subsp. chatajillensis</i> *
<i>langeri</i>	<i>var. aureiflora</i> *	<i>subsp. losenickyana</i> *
<i>mentosa</i>	<i>var. callecalleensis</i> *	
<i>subsp. mentosa</i>	<i>subsp. hertusii</i> *	
<i>var. albissima</i>	<i>subsp. patriciae</i> *	
<i>var. swobodae</i>		<i>verticillacantha var. cuprea</i> *
<i>subsp. cylindrica</i>		
<i>var. crucensis</i>		

This has 32 species and 75 taxa. Taxa with an asterisk have yet to be fully revised. They also agree that *Cintia* and *Weingartia* belong in the same genus, and so describe the species as *Weingartias*.

The two classifications are very similar, with a similar number of taxa. There is some disagreement about some new species (*camargoensis*, *heliosoides*). Otherwise the main difference is whether some plants are species or varieties. Hentzschel & Augustin elevate more taxa to the rank of species, which Fritz et al leave at the level of subspecies or variety.

With the passage of time I think that changes are likely to be in the direction of demoting species to subspecies and deleting some varieties, so it is probably better to prefer Fritz, Gertel & de Vries. The changes made by Fritz, Gertel & de Vries in the four publications so far involved substantial merging and relegation to subspecies and varieties, so it is likely that they will similarly judge some of the taxa yet to be considered.

Of the 32 species, 8 (*azurduyensis*, *camargoensis*, *cantargalloensis*, *elizabethae*, *juckeri*, *naunacensis*, *roberto-vasquezii*, *vargasii*) are new species not considered by the NCL, so a proper comparison is 24 species compared to the 11 of the NCL.

In my own view 11 species is too few for the variety of forms in *Sulcorebutia*, so I am attracted to this classification – even if they must all be called *Weingartia* or *Rebutia*. There are also a number of details that seem to fit better. For example, *losenickyana* is referred to *canigueralii* by the NCL, but here it is placed under *vasqueziana* which seems more similar. And the great range of forms of *steinbachii* calls for a number of varieties or subspecies. I also agree with the demotion of *cylindrica* under *mentosa*, because, as is so often the case, there are intermediate forms which are here called *crucensis* (see Figure 5). *Cylindrica* grows into a column up to 30cm high, although never so high in the wild. *Mentosa* is short cylindrical, globular or flattened globular. And *crucensis* looks like *cylindrica* except it is a short cylinder. Figure 5 shows *S. HS44a*, which is the white-flowered form of *S. HS44*. This plant is a problem on seedlists. Some call it *cylindrica*, some call it *vizcarrae*. The second name is almost certainly wrong as it is unclear what plant this name refers to (Augustin et al. 2000), but probably a form of *steinbachii*.

A further recent publication is Horáček (2008). Much of the recent new material has come from Czech collectors, including Horáček, so this should have a good coverage of what they have found. It contains a number of new species, and revives some old ones (*clizensis*, *glomerispina*, *tuberculato-chrysantha*.) There seems to be general agreement that these latter revivals are not good species, and the new species are also generally rejected, so this book will probably not be influential. Horáček makes interesting field observations. *S. confusa* is revived – everyone else considers this synonymous with *cylindrica* or *cylindrica crucensis*. But Horáček observed *cylindrica* and *confusa* growing close together with no hybrids. This would need to be confirmed in cultivation but if they are not interfertile they are different species. He also demotes *dorana* to a subspecies of *purpurea*.

Molecular taxonomy

There have been two studies using molecular biology to try and clarify how closely different plants are related, and hence imply their classification. Both studies have been sponsored by SSK.

Ritz et al. (2007) used DNA, and found that *Cintia*, *Sulcorebutia* and *Weingartia* belonged in the same genus, but so also did two species of *Rebutia* (this would be genus *Rebutia*), and the whole group was separated from the rest of *Rebutia* (which would become *Aylostera*), and separated also from *Gymnocalycium*.

Pot (2006) conducted a similar study using isoenzyme analysis, likewise finding no reason to separate *Sulcorebutia* and *Weingartia*, but also finding a relationship to *Gymnocalycium* and none to *Rebutia*. Pot (2009b) provides a key to the genus based upon vegetative characteristics (spines, flowers, body morphology etc.) and Pot (2009c) provides a PC program to display the relationships between different taxa. There are a large number of taxa, but any attempt to reduce the number leads to unrecognisable taxa. (Pot, pers. comm.).

The varying results suggest that molecular biology is a very promising assistance to taxonomy but that sufficiently consistent results have not yet been obtained. SSK are carrying out a more thorough study (ssk-kaktus.org/en/projekt2007.php). Ritz (2009) reports that there are changes in the relationships between taxa, particularly within *canigueralii* and *mentosa*.

Cross-breeding attempts between *Sulcorebutia* and *Gymnocalycium* all failed (Diers 2008, quoted in SSK). Cross-breeding between *Sulcorebutia* and *Weingartia* produced successful offspring (Hentzschel & Augustin 2008). SSK comment (ssk-kaktus.org/en/mitteilung.php):

“However, we have a different opinion concerning the hurried recombination of all *Sulcorebutia* and *Cintia* to a now unbelievable number of 73 (seventy-three) species and subspecies of *Weingartia*. If we follow the argument of the authors that the capability of different parents to interbreed and produce fertile offspring indicates close relationship and militates for the merging of three genera on one side then the nearly unexceptional success of hybridisation suggest at best only a few biological species on the other side.”

The argument about hybridisation is significant but not conclusive. For example, among orchids there are many inter-specific and even inter-generic hybrids, the parents of the plants now in cultivation.

The new species

The lists above contain a number of new species, and new descriptions continue to be made. Most of these do not survive long as a species, or even a variety. *S. christiei*, first described in 2003, has been rapidly relegated to a synonym of *vasqueziana* by de Vries & Gertel (2006). *S. horacekii*, described very recently, has even more rapidly been relegated to synonymy with *purpurea* v. *unguispina* (Gertel & de Vries 2008). *S. heliosoides* (I believe *S.*

solisioides is a synonym), a very distinctive plant, shown in Figure 6, I have seen referred to as *R. heliosa* v. *solisioides*.



Figure 6 above *S. heliosoides/solisioides*

My own conjecture is that the argument above about cross-breeding is a good one, and there are some further reductions to be made in the number of species, even if not to the extent of the NCL.

Is *Sulcorebutia* a good genus?

Unfortunately there is a unanimous opinion that the answer is no. Everyone considers that *Weingartia* and *Cintia* belong in the same genus as *Sulcorebutia*, so if it is a separate genus its name is *Weingartia*. Those that follow the NCL and further merge into *Rebutia* must use that name. So it seems as though *Sulcorebutia* is at best a subgenus. Rowley (2009) has created subgenus *Weingartia* under *Rebutia*.

Getting plants – dealing with MAF

There are two aspects – the index of permitted species, and the difficulty of importing plants. The conditions for importing plants effectively exclude amateurs, so only seed imports are possible. New species tend to come

available first as plants, and only later is seed available. For example, only now is seed of *S. rauschii* generally available. For nearly all the new species seed is not available at all, so the problem of the index doesn't arise. By the time seed is available I'm sure some at least of them will have been reclassified into existing species.

The older species are reasonably well established in New Zealand, and seed can always be imported. For the newer species it's a problem. If only the world followed the NCL – it has only 11 species of sulcos (as *Rebutia*), and they are all on MAF's index – 11 as *Sulcorebutia* and 10 as *Rebutia*. Since the NCL is the official guide, in theory there should be no restriction to importing sulco seed! But people persist with the other names.

One consolation is that with so many synonyms, different suppliers often use differing appellations, although most nurseries do tend to use splitter's names as a different name sells. Hunting around among the different suppliers often turns up an acceptable name. For example, Succseed sells *S. mentosa* v *swobodae* rather than *S. swobodae* as most list it. It helps to have references to check on the field numbers. They never change even if the species does.

A good example is *S. hertusii*. This is probably the best of all the newer species/varieties. It has long shaggy white hair, and has also been informally called *senilis* or *gerosenilis*. A “*senilis*” plant with flowers – wonderful. There is also a golden-haired form, *patriciae*. *S. hertusii* was first described as *S. crispata* v *hertusii*, a year later elevated as *S. hertusii*, shortly after re-relegated as *S. tarabucoensis* v *hertusii*. In the NCL it and *crispata* are referred to *R. pulchra*, while *tarabucoensis* is referred to *R. canigueralii*, implicitly preferring the original placing of *hertusii* with *crispata*. Everyone it seems now agrees it is not a species, and under any of the other names it is on the index. Unfortunately, I think because it is so attractive, suppliers tend to list it as *S. hertusii*.

However all is not lost. Mesa Garden offer *S. crispata* HS125. HS125 is the type of *hertusii*! I have raised some of these, and the hairs are only 15mm long. Once again the plants are variable, and HS125 includes plants with relatively short hairs as well as the long-haired beauty; and this is from the short-haired end of the range. Perhaps that's why Mesa Garden lists it as *crispata*. Still different from the normal *crispata*, but not as different as I was hoping. Never mind. Arizona Cactus Garden follows the NCL, roughly, and lists all sulcos as *Rebutia*. He lists *R. senilis* KK2005. KK2005 is *S. senilis*, ie *hertusii* again. *R. senilis* is on the index. Maybe this will be truly hairy.



Figure 7. *S. hertusii* HS125



Figure 8. *S. hertusii* KK2005.

Synonyms

The following table gives the synonyms corresponding to the classification of Fritz, Gertel & de Vries as shown in Table 6. I have omitted from the list the species for which there are no other synonyms.

Table 7. Synonyms from Fritz, Gertel & de Vries (2004), Gertel & de Vries (2006ff)

<i>arenacea</i>	
<i>var. candiae</i>	<i>xanthoantha</i> ,
<i>var. kamiensis</i>	<i>muschii</i>
<i>mentosa</i>	<i>flavissima</i> , <i>flavida</i>
<i>subsp. cylindrica</i>	
<i>var. crucensis</i>	<i>confusa</i>
<i>purpurea</i>	
<i>var. santiaginisensis</i>	
<i>var. unguispina</i>	<i>horacekii</i>
<i>steinbachii</i>	
<i>subsp. steinbachii</i>	<i>tuberculato-chrysantha</i> , <i>glomerispina</i> , <i>steinbachii</i> v <i>gracilior</i> , v. <i>rosiflora</i> , v. <i>violaceflora</i> <i>W. backbergiana</i>
<i>subsp. krugerae</i>	
<i>var. hoffmanii</i>	<i>hoffmaniana</i> , <i>cochabambina</i> , <i>veronikae</i>
<i>subsp. verticillacantha</i>	
<i>var. taratensis</i>	<i>verticillacantha</i> v <i>minima</i> , <i>W. minima</i> , <i>W. ansaldoensis</i>
<i>subsp. markusii</i>	<i>W. formosa</i> ; <i>S. markusii</i> v <i>longispina</i>
<i>tiraquensis</i>	
<i>subsp. tiraquensis</i>	
<i>var. longiseta</i>	<i>polymorpha</i>
<i>subsp. totorensis</i>	
<i>var. totorensis</i>	<i>heinzii</i>
<i>var. oenantha</i>	<i>pampagrandensis</i>
<i>subsp. mariana</i>	
<i>var. laui</i>	<i>vizcarrae</i> v. <i>laui</i> , <i>mariana</i> v. <i>prantneri</i>

Concluding remarks

Adopting a grossly simplified view, there are essentially two elements in the taxonomic classification: how taxa are interrelated, and how coarse or fine a degree of difference demarcates a species.

In the first aspect, I believe the European school clearly has a better view of the relationships between different taxa, putting similar plants together in a more logical way. It then remains to decide how much difference makes different species as opposed to different subspecies or varieties. Here I am inclined to prefer the lumpers' approach. So my appeal is for a more aggregated version of the European classification.

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