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The Sulcorebutia of Ayopaya province

John Carr describes important research into an interesting group of *Sucorebutia* species and presents the rediscovery of *S. glomeriseta* in habitat.

Photos by the author (except where stated)

Fig.1 *Sulcorebutia glomeriseta* JC 03-12

The province of Ayopaya is the most northern area in which *Sulcorebutia* have been found and all the forms in this area have yellow or near yellow flowers. The region is part of the Cotacajes river system and the plants grow on the slopes feeding the rivers Santa Rosa and Ayopaya and on into the Rio Cotacajes itself. The region is also the only large area in Bolivia with alkaline soils (Schultz et al 2004).

There are six names attributed to the area, and these are *S. arenacea*, *S. candiae* & its ssp. *kamiensis*, *S. glomeriseta*, *S. menesesii* and *S. muschii*. The plants can be found at different altitudes from 1300m to around 4000m. The habitats are usually small with numbers varying from a few dozen to a few hundred individuals at any one locality. An interesting factor is that often different forms can be found in the same area but at different altitudes, separated only by the climatic conditions that occur between the localities.

There is not a common separation factor at the different locations as climatic conditions change as the rivers pass through the valleys. Starting in the north-east at the lowest point of known locations, *S. menesesii* grows close to the river on rocky outcrops surrounded by dry forest but in very small numbers at each location. At this altitude the climate is subtropical with minimum temperatures around 15°C. The higher reaches of the forest are subject to regular cloud cover before and probably after the rainy season starts, so experience more moisture over a longer period than the lower area

Fig.2 *Sulcorebutia arenacea* JC 07-07

Fig.3 Sulcorebutia arenacea JC 07-07

Fig.4 *Sulcorebutia arenacea* JC 07-07

where it is cooler.

On the top edge of the forest, *S. glomeriseta* can be found. This grows above some of the cloud where its adaptation of finer and more numerous spines probably allow it to pick up moisture from any cloud cover. Its location on the side of slopes rather than the tops and its fibrous root system in combination with fine spination and different seed

Photo: Johan de Vries

Fig.5 *Sulcorebutia candiae* VZ 608

Photo: Johan de Vries

Fig.6 *Sulcorebutia candiae* VZ 608

Photo: Johan de Vries

Fig.7 Sulcorebutia candiae VZ608

Photo: Johan de Vries

Fig.8 *Sulcorebutia candiae* VZ 608 in culture

Fig.9 *Sulcorebutia glomeriseta* JC 03-12 Showing spine colour range

form make it the most distinctive plant in the group. Its habitat and physical appearance are very like those of *Aylostera fiebrigii* which grows further south, but the flowers are typical of *Sulcorebutia*. The location makes it the most northern *Sulcorebutia* species of all (so far!). The photographs show the plants in habitat for the first time ever, since no photographs were taken when it was first discovered in 1949 (named in 1951).

Further south and west near Tirquirpaya, two more populations are to be found. At lower altitudes, around 1600m alongside the Rio Santa Rosa, *S. arenacea* is found. In separate locations some variation in spination can be seen, but all sites are recognisable as the same species. Higher on the same river slopes *S. candiae* can be found. This is a smaller growing plant, with spines usually yellow in colour. Isolation at this site is effected by a very dry cactus and Acacia forest some 1000m in depth.

S. candiae seems to be suffering in habitat perhaps due to a lack of rain in the area in recent times, but also in part due to road building and

Fig.10 Sulcorebutia glomeriseta JC 03 12 Showing spine differences

Fig.11 Sulcorebutia glomeriseta JC 03 12 Showing spine differences

Fig.12 *Sulcorebutia glomeriseta* JC 03-12 Showing vertical habitat

plant collecting.

Further south and west grow plants of *S. candiae* ssp. *kamiensis* at the highest altitudes, up to 4000m. *S. muschii* is also named from this area, but it has been reduced to a synonym by most authors. Several populations of *S. candiae* ssp. *kamiensis* are known and vary in numbers and appearance. Plants from two populations are shown in the pictures. One population contained several hundred plants, while the other had only a few. The higher reaches of this area (above 4000m) experience frost for around 200 nights each year, so this should be the hardiest of the plants discussed. At present no low altitude species are known in this area but included in the photographs is a plant found by Chris Sherrah at 2700m which is at river level this far west. This finding means more work is needed to establish the full distribution of this group of plants.

These plants are treated differently by different authors. The new Cactus Lexicon (Hunt 2006) recognises only two species: *S. arenacea* and *S. glomeriseta*, and places all the others in synonymy with *S. glomeriseta*. It also subsumes the yellow flowered *S. krahnii* in with this, but it is clearly a *S. steinbachii* ssp. *tiraquensis* form in that taxonomy.

Fig.13 *Sulcorebutia glomeriseta* JC 03-12

Fig.14 *Sulcorebutia glomeriseta* Card. 4399 In culture

Fig.15 *Sulcorebutia candiae* ssp. *kamiensis* JC 05-12 orange flowered plant

Fig.16 *Sulcorebutia candiae* ssp. *kamiensis* JC 05-12 pectinate spines at this site

Fig.17 Sulcorebutia candiae ssp. kamiensis JC 06-12 longer spines at this site

Fig.18 *Sulcorebutia kamiensis* JC 06-12

Fig.19 *Sulcorebutia candiae* ssp. *kamiensis* JC 06-12

Pilbeam & Hunt (2004) also speculate on the significance of the yellow flowering of some Sulcorebutias and suggests that they are on average lower altitude plants and may have different pollinators. However, the published altitudes are in some cases in error by as much as 1000m. My own observations suggest that all *Sulcorebutia* are pollinated by large solitary or bumble bees at all altitudes. As *Sulcorebutia* are amongst the first plants to flower each spring, they must form an important food source for these insects of the region at the start of their breeding season. One can only speculate on the damage that would be done to the ecosystem should their first food source of the year be eradicated.

My thoughts on flower colour are based on soil acidity but more work is needed for a conclusive answer.

Gertel & Latin (2010) also use the same two basic species but include *S. candiae*, *S. candiae* ssp. *kamiensis* and *S. menesesii* as varieties of *S. arenacea*, a better solution I believe as the distinct differences listed above between the two makes this a better approach. They also place *S. muschii* in the synonymy of *S. candiae* ssp. *kamiensis.* With the inclusion of *S. muschii* under this name *S. candiae* ssp. *kamiensis* is without doubt the most variable of this group with a wide range of spination and body differences and a larger number of known sites than all the other names.

Horáček (2008) listed all the populations as species with the exception of *S. kaminiensis*, which he retains as a ssp. of *S. candiae* (more accurate due to locality and altitude). He is the only author to retain *S. muschii* as a species as he finds it quite distinct although it grows in the same area as *S. candiae* ssp. *kamiensis*. He also suggests that the

Photo: Martin Lowry

Fig.20 *Sulcorebutia menesesii* JC 05-11

species with yellow flowers to the south of Cordillera Real, (*S. cardenasiana* / *langeri*) are closely related. However, there are now other new, recently named yellow flowered plants in the southeast that mean a separate grouping (or two) might be needed.

Brederoo, A.J. and Donald, J.D. (1986) described *S. kamiensis* as a ssp. of *S. menesesii* but later authors have moved it as a ssp. under both *S. candiae* and *S. arenacea* with Hunt reducing it to synonymy under *S. glomerista*! In 1989, Donald proposed that all these plants were in a separate group under *S. steinbachii* but did not make any new combinations. He also placed *S. cardenasiana* and *S. langeri* in a separate subgroup under *S. steinbachii*.

This group of Sulcorebutias has a clearly defined separation from the rest of the genus with a large mountain range running from west to east, with altitudes well in excess of 4000m even at the passes. So it has had a separate evolution for millennia and has become an island grouping. Each site has also become an island isolated within the larger island, separated by climatic conditions for many generations. Whether this makes them

Photo: Martin Lowry

Fig.21 *Sulcorebutia menesesii* JC 05-11

Photo: Martin Lowry

Fig.22 *Sulcorebutia menesesii* JC 05-11

Photo: Chris Sherrah

Fig.23 species Chris Sherrah at 700m lower than any recorded finding near Kami

separate species is for others to judge. However, it does make for an interesting discussion! Yet how do you discuss them if you don't have a name? The use of subspecies for island populations is common in other branches of botany so why not in the Cactaceae?

The conservation status of the group as a whole is not critical as over 30 sites are known (although some may not still exist). One I visited was heavily forested with no plants and another now bare rock. This situation changes when you treat each name as a separate species as then all become vulnerable or critically endangered. All populations are small, probably none more than 300 plants and some less than 20, so extinction is very possible.

If more research on the role these plants play in the life cycle of the pollinators and the possible effects of their extermination would have on the rest of the ecosystem was properly understood, then maybe the local people could be enlisted to ensure that these populations were protected.

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