

International Rock Gardener

ISSN 2053-7557





Our submission to you this month begins with a piece that is indicative of the fine collaborations that are possible in the plant world – John and Anita Watson have been aided and abetted by various friends to illustrate their article on *Viola uniuissima* and its habitat and the plants found in that area. Wonderful photos have been contributed mainly by Marijn van den Brink and also Leonora Rojas to complement the Watson’s images.

Only two articles this month – the second is from Kenton J. Seth from Fruita, Colorado, giving tips on growing Castilleja. One of the finest modern crevice garden makers, Kenton is a man with a passion for nature - loving the plants

as well as the mountains. He mentions Paul Cumbleton’s article on growing these plants - in the photo below we see Paul and Kenton at RHS Wisley.



Cover picture: *Cumulopuntia ignescens*, photo Marijn van den Brink.

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---International Rock Gardener---

---Species Description---

Meet our most unique *Viola* and its unique high Andean habitat. A renamed new species endemic to the northern semi-desert Altiplano of Chile

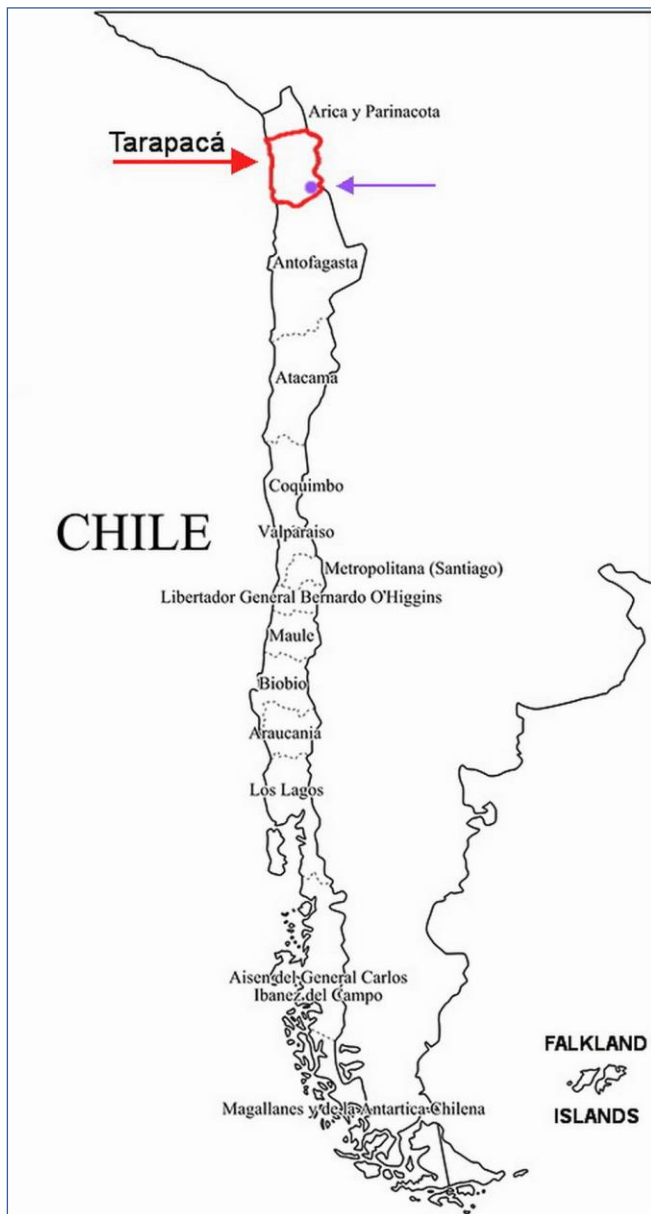
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Published in IRG 128, August 2020 Pages 3 – 52.

What's this 'ere then?



While examining the *Viola* collection at the herbarium (SGO) of the Museo Nacional de Historia Natural (MNHN), Santiago, we encountered a folder with a single unidentified *Viola* specimen consisting of a solitary rosette. It had been found in the high Andes of northern Chile (the Altiplano), at Collahuasi near the border with Bolivia [figs.1, 58], where considerable open-cast mining activity takes place [figs.63, 64]. The plant appeared to differ from all others related to it as known to ourselves, and on investigation it did indeed prove to be an undescribed species.

This situation clearly indicated the urgent need to publish the said new single-site taxon as quickly as possible, so as to make it known to the botanical and conservationist communities in the hope of provoking action to locate and assess it, with official environmental protection to follow, if possible.

fig1: South America. Regions of Chile, with Tarapacá, where *Viola uniuquissima* is endemic, outlined and arrowed red. Its general location is arrowed violet.

The dilemma

However, we were faced by an awkward formal difficulty. The information we had concerning the plant itself, its collector, its habitat, the size of its population, its exact locality, and its precise proximity to any existing or potential threat which might result in its extinction, was vague to say the least, including

non-existent for the majority of those aspects. This meant it was almost certain to be rejected by the peer review process of any standard botanical journal. On the other hand, the potential text was so formal, dry and brief, as well as lacking illustrations of the species in situ, to be of little or no interest to the general non-botanical reader, so as such we considered it quite unsuitable for any 'plantsman' type of publication such as the IRG.

---International Rock Gardener---

The solution?

By great good fortune (it seemed) a recent new type of online electronic publication has appeared. There are various, and a list of them and their modus operandi can be found under the Internet Wikipedia heading of 'Preprint'. The description there states: "In academic publishing, a preprint is a version of a scholarly or scientific paper that precedes formal peer review and publication in a peer-reviewed scholarly or scientific journal." 15 distinct specialist disciplines are covered, plus a further four outlets which cover a range of subjects. Topics include biological and chemical sciences, although nothing for botany alone. About 25 active servers are listed. The only one defined for our requirement is bioRxiv, although the general servers might also be open to such submissions (Wikipedia 2020b).

Impressed by the potential speed of publication and lack of the peer review process, we accordingly contacted the bioRxiv editorial team, who agreed in principle, so we submitted our draft. There appeared to be no obstacle to acceptance by the official international taxonomic plant name register IPNI (2020), as it seemed to us to comply with all the formal requirements for legitimate, valid publication as stated by the governing ICN Shenzhen Code plant name rules (articles) (Turland et al. 2018). The species was duly presented to the world as *Viola unica* on 11th December of last year (Watson & Flores 2019d), shortly after we'd sent it, and following inspection and acceptance of the paper by the bioRxiv editorial team. It was listed within days by IPNI, and remained so to all intents and purposes until April 14th of this year, 2020.

Once more into the breach ...

On that date we received an e-mail from Dr. Gandhi, our IPNI contact, which surprised and shocked us. He wrote that the Shenzhen Code Chief Editor had just drawn his attention to the fact that bioRxiv is a platform providing an archive/preprint service which lacks ISSN registration, not being a serial journal, for which reason it doesn't constitute an effective publication [*vide* ICN Shenzhen Code Article 29.1] (Turland et al. 2018). Annoyingly, we'd overlooked that, but would have been unaware of the fact in any case as there's no explicit indication of it on the server's website. So the epithet *Viola unica* was not valid for IPNI. We wrote an e-mail to bioRxiv asking whether they might be able to do something about the situation to warn others, but have received no reply to date. The upshot was that we had to republish the species with a new name, as follows herein. We've slightly modified some, and eliminated or shortened much of the botanical detail as appeared in the original bioRxiv text, which - for anyone interested - may be seen in that e-publication (Watson & Flores 2019d).



That lengthy and tedious tale, its basic contents unavoidably requisite, is also intended to serve as a warning to anyone who, like us, might unwittingly consider publishing new species or new names as a preprint. At the time of writing it's our intention to send the botanical journal *Taxon* a letter to that effect as well.

fig.2: Typical Chilean high Altiplano landscape and vegetation in Antofagasta to the S of Collahuasi where *Viola uniuissima* was collected. (6 Jan 2006. ARF)



fig.3: A sterile Altiplano landscape near to, but below, where *Viola uniquissima* was found. Collahuasi sector, Tarapacá. (1 Apr 2008. L. Rojas)

Landscapes of the Altiplano

Unfortunately, as explained above, it's impossible to decorate the written text with photos of an interesting selection of this new viola and others of the genus closely related to it growing in the wild, as is our usual practice. They simply don't exist. So we've decided instead to compensate by going to town on a picture gallery of the little-known wildflower communities in the viola's wider surrounds. It also gives us an opportunity to begin by illustrating the remarkable high-level Andean scenery where they grow [figs.2-5, 10, 19, 24, 44], matched only by that of Tibet. The intention is to provide an 'ecotour by proxy' for the great majority who are never likely to visit this part of the Andes, so we hope readers may enjoy our little contextual sidetrack.



fig.4: A persisting indication of the force and extent of floods on the Altiplano during the annual 'Bolivian Winter' period. Collahuasi, Tarapacá. (1 Apr 2008. L. Rojas)

---International Rock Gardener---

fig.5: A dried-up mud pan where water accumulated during the 'Bolivian Winter'. Its benefit for the vegetation can be seen.
Collahuasi, Tarapacá.
(1 Apr 2008. L. Rojas)



Flora and habitats of the Collahuasi sector

Teillier (1998, 1999) published a valuable survey of the vegetation that has been recorded from the general vicinity where the new viola was collected, with the taxa concerned listed in systematic order. Drawing from our own and others' photos of these, we've managed to concoct a representative selection comprising 34 of the most common or interesting, sometimes as growing in their broad, panoramic settings. How to present them posed something of a difficulty, but we've settled on grouping according to life-forms and habitats, with the most visually or numerically predominant as four headings to start with, their individual taxa also arranged from the most to least common. The remainder are arranged as three further headings based on morphological and ecological differences. For consistency, nomenclature follows the recent catalogue of the Chilean flora (Rodríguez & Marticorena 2019).

No trees exist at these elevations (3000-4700 m) in this semi-desert Altiplano environment - with the surprising exception of two species in the genus *Polylepsis* (Rosaceae). However, only one is noted for the Collahuasi sector. It's very localised and apparently doesn't grow in the same type of general habitat as this viola anyway, so has been excluded from our survey.

fig.6: *Baccharis tola* in seed, looking as if being protected by communal spiders or attacked by processional caterpillars!
(22 Dec 2013. Marijn van den Brink)





fig.7: *Baccharis boliviana* shows what inflorescences of its genus look like. Los Flamencos National Nature Reserve, Antofagasta. (22 Dec 2013. Marijn van den Brink)



fig. 8: *Parastrephia quadrangularis*. Pampa de Tamuragal National Nature Reserve, Tarapacá. (24 Dec 2013. Marijn van den Brink)



fig.9: *Parastrephia quadrangularis*. Detail of inflorescences simultaneously in flower and seed. Pampa de Tamuragal, Tarapacá. (24 Dec 2013. Marijn van den Brink)

Shrubs

On the other hand, a wide range of lower-growing ligneous taxa from a variety of genera embellish the plains, valleys and lower mountainsides. As a rule they tend towards scattered individuals, as may be seen in figs.4, 5, 10 and 12, but on occasions they form dominant colonies, their species some of the mainstays of the Altiplano flora. Examples of the latter are *Baccharis tola* [fig.6], *B. boliviana* [fig.7] and *Parastrephia quadrangularis* [figs.8, 9] all of the Asteraceae. Another is *Lampayo medicinalis* (Verbenaceae). As its specific epithet indicates, the latter is an important remedial element for the local indigenous South American Indian inhabitants of the Altiplano, particularly the Aymara and Quejua. However, the two *Baccharis* and the *Parastrephia* listed also serve the same purpose.

---International Rock Gardener---



fig.10:
Senecio nutans in
habitat at ca.
4000 m.
Salar de
Huasco,
Tarapacá.
(24 Dec
2013. Marijn
van den
Brink)

Senecio (Asteraceae - in case you didn't know!), the largest of about 2000 Chilean plant genera, is the most numerous among those which populate the Altiplano too, as also in much of the rest of the country. Moreover, its species *S. nutans* [figs.10, 11] is relatively plentiful and widespread in the extreme north. The nodding flower heads, as indicated by the Latin *nutans*, and long slender growth form give it away readily, making it one of the very few of this often taxonomically perplexing genus which are relatively easily named. *S. puchii* [figs.12, 33] is frequently met with as well, although not quite so common. As may be seen from the photos, it can be very variable in size, although with its growth always very dense and compact.

fig.11: *Senecio nutans* in detail showing the pendant flower heads which gave it its name. W of Salar de Huasco, Tarapacá.
(24 Dec 2013. Marijn van den Brink)



---International Rock Gardener---



fig.12:
Senecio puchii caught at the end of flowering and beginning of seed dispersal. Salar de Huasco, Tarapacá. (24 Dec 2013. Marijn van den Brink)

S. dryophyllus [figs.13, 14] shares more or less the same geographical and elevational distribution as the other two here, but is noted as quite rare in the environs of Collahuasi, with a preference for rocky or stony places. By contrast, *Adesmia melanthes* [figs.15, 16] (Fabaceae) and *Junellia seriphioides* [fig.17] (Verbenaceae) mainly dwell in the more sheltered and better watered dry valleys (quebradas), being quite often encountered in those habitats.

fig.13:
Senecio dryophyllus inflorescence detail. By the Arica to La Paz railway line. Tarapacá, near the border with Peru. (31 Dec 2013. Marijn van den Brink)





fig.14: *Senecio dryophyllus*. By the Arica to La Paz railway line in Tarapacá near the border with Peru. (31 Dec 2013. Marijn van den Brink)

fig.15: *Adesmia melanthes* photographed in a sheltered wide Altiplano valley of Antofagasta Region (6 Jan 2006. ARF)



fig.16: *Adesmia melanthes* showing its characteristic spines and the absolutely typical yellow flowers of its large (225 spp.) temperate South American genus. (6 Jan 2006. ARF)

Our last, the most striking and colourful representative of the taller woody flora here, is *Chuquiraga spinosa* [fig.18] (also of the Asteraceae). Its flower heads bear a quite

remarkable resemblance to Argentinian endemic *Mutisia kurtzii*. That latter, which occurs at the same latitudes on the other side of the Andes, was introduced to readers in IRGs 107 and 115 (Watson & Flores 2018c: 33, fig.16, Watson & Flores 2019b: 30, fig. 49). Both species share the same elongated, imbricate, spindle-shaped floral structure when fresh and closed, with a tight bunch of long, more or less straight projecting stamens. This morphology, coupled with their respective red and red-to-yellow floral colorations, leaves no doubt they are products of parallel evolution, driven by high-elevation hummingbirds. Two living species of these delightful little feathered friends are recorded as reaching at least 4500 m in extreme northern Chile (Martínez & González 2004). The genera *Chuquiraga* and *Mutisia* bear typical aerial-distributed seeds with long, feathery pappi, for which reason the heads of both species open like a starburst to expose these to the wind.



fig.17: *Junellia seriphioides*, a prickly customer to be sure. Los Flamencos National Nature Reserve, Antofagasta. (22 Dec 2013. Marijn van den Brink)



fig.18): *Chuquiraga spinosa* in its 'hummingbird flower mode'. Near Chitita, SE of Arica, Tarapacá. (27 Dec 2013. Marijn van den Brink)

---International Rock Gardener---



fig.19: Dominant *Festuca chrysophylla* bunch grass. Between the Salar de Atacama salt pan and the Miscanti Lake, Antofagasta. (22 Dec 2013. Marijn van den Brink)



fig.20: *Antherostipa venusta* and *Pappostipa. frigida* bunch grasses jointly dominate the landscape. Pampa de Tamuragal, Tarapacá. (24 Dec 2013. Marijn van den Brink)

---International Rock Gardener---

Bunch grasses

Where they occur on the plains and gentle, well-drained lower slopes, the Altiplano Poaceae, sometimes called needlegrasses, can make 'wall-to-wall' seas of their dry hay-like, pale to darker coloured individual tufts [figs.2, 19], which provide an important niche for a variety of other far less abundant species. *Festuca chrysophylla* [fig.19], *Antherostipa venusta* [fig.20] and *Pappostipa frigida* [fig.20] (both the latter genera as syn. *Stipa*), three of the sixteen Poaceae species listed for Collahuasi, are undoubtedly among the most dominant and prolific plants of all on this high elevation plateau.



fig.21: Contrasting *Azorella compacta* and *Pycnophyllum bryoides*. Salar de Huasco National Park. Tarapacá, near border with Bolivia. (24 Dec 2013. Marijn van den Brink)

The preponderant cushion flora

Nothing so instantly identifies and defines the Altiplano as differing from all other global ecosystems, and nothing is more characteristic, locally famous and attention-grabbing than the eye-poppingly large, dense cushions and mounds of *Azorella compacta* [figs.21, 22-25] (Apiaceae). It's known to people in this part of the world as llareta (pronounced 'yareta'). Although architecturally less impressive and generally of flatter growth, we mustn't forget the azorella's almost constant companion, the genus *Pycnophyllum* (Caryophyllaceae), of which *P. bryoides* [figs.21, 22, 26-28] is probably the most frequent.

What wouldn't alpine gardening fanatics give for appreciably-sized specimens of either. And that's the problem with *A. compacta*, were it ever to be available. It's so desperately slow growing you might have to live longer than Methuselah or a Galapagos tortoise to raise one to showbench size even! It's very likely the planet's oldest non-arborescent plant, with today's most humongous individuals calculated to have been around for some 1000 years before Jesus Christ walked the Earth. It served

---International Rock Gardener---

as a traditional fuel for native inhabitants in the past. This reached crisis point when it was put to similar use for the production of copper and nitrates in the north. Fortunately, however, it had reached sufficiently abundant proportions before the arrival of *Homo sapiens* on the scene, and now there's a general popular and scientific awareness of the need to conserve it. In fact it's virtually achieved the status of a national monument. Nevertheless, although still reasonably widespread and frequent, it's categorized officially by the Chilean Ministry of the Environment as 'Vulnerable' on account of its inordinately slow growth.

As can be seen from the accompanying photos, the very pale mats and low mounds of *Pycnophyllum* make a most dramatic and satisfying contrast to the llareta, with the two often growing together as one. [figs.21,22]. The main problem with *Pycnophyllum* is the considerable similarity of many of the 22 accepted species (The Plant List 2013), and the almost non-existence of published information about them. We can only cross fingers we've worked out the correct identity here.



fig.22: *Azorella compacta* covered in flowering *Pycnophyllum bryoides*. Lauca National Park, Tarapacá. (1 Jan 2014. Marijn van den Brink)



fig.23: An 'ancient' *Azorella compacta* dominating its territory. S of Colchane, Tarapacá. (25 Dec 2013. Marijn van den Brink)



fig.24: *Azorella compacta* floral detail. 40 km W of Salar de Huasco salt pan, Tarapacá.
(24 Dec 2013. Marijn van den Brink)

---International Rock Gardener---



fig.25: Another venerable and bulging specimen of *Azorella compacta* in habitat. Salar de Huasco, Tarapacá. (24 Dec 2013. Marijn van den Brink)



fig.26: *Pycnophyllum bryoides* in habitat with bunch grasses and azorellas. Above Salar de Huasco salt pan, Tarapacá. (24 Dec 2013. Marijn van den Brink)

---International Rock Gardener---



fig.27: An impressive plant of *Pycnophyllum bryoides* at the Salar de Huasco salt pan sector, Tarapacá. (24 Dec 2013. Marijn van den Brink)



fig.28: *Pycnophyllum bryoides* flowering detail. S of Colchane, Tarapacá. (25 Dec 2013. Marijn van den Brink)

---International Rock Gardener---

fig.29: A *Cumulopuntia ignescens* 'hedgehog' in defensive mode! Salar de Huasco near the border with Bolivia, Tarapacá. (24 Dec 2013. Marijn van den Brink)



fig.30: The enticing but 'touch-me-not' flower of *Cumulopuntia ignescens*. Salar de Huasco near border with Bolivia, Tarapacá. (24 Dec 2013. Marijn van den Brink)

Cacti

The last, but by no means the least, very evident and palpable group is the Cactaceae, especially if you happen to lose your balance and sit on one by accident, as once happened to Anita long ago! Only a single species, the obligatory red-flowered *Cumulopuntia ignescens* [figs.29, 30] occurs in our area, but is regularly encountered there, above all in *Festuca chrysophylla* grasslands.

Seventeen cactus species from several genera, which reach at least 3500 m, are known from the 700 km or so length of the Chilean Altiplano. Of those seventeen, five are columnar species, one of them, *Echinopsis atacamensis*, a surprising giant up to 7 m high, taking its place among the list of such whoppers found in various high mountain ecosystems across the world, such

as the well-known lobelias and senecios of Africa, the echiums of the Canaries, the silverswords of

---International Rock Gardener---

Hawaii, and giant *Puya weberbaueri* as well as espeletias or 'frailejones' in the tropical Andes. The other twelve, which include the species featured here, are low, small or quite small, flattish to dome-shaped mounds covered in an array of spines that can be various colours and are often so long and needle-like they'd almost put a porcupine to shame.

These species yet again give the lie to the ignorant or biased assertion that cacti are not 'proper' mountain flowers, or alpine if you will, as exposed for example in a recently published news item (Anon. 2020). Whether one considers those which do reach up to the heights would be fit company to blend in seamlessly and aesthetically with the likes of saxifrages, campanulas, dionysias, gentians, primulas, daphnes and oxalis, etc., is a matter of personal preference. For some, if not many, they would obviously stick out like a sore thumb. We will advise you from painful experience though that the sore thumb can more likely be yours when you get to weed closely around them!

Taller herbs

Apart from columnar cacti, anything non-woody of any appreciable height is a rarity on the Altiplano. The main exceptions are found in the genera *Bomarea* (Alstroemeriaceae, 2 species), *Tarasa* (Malvaceae, 6 species), and that of the species illustrated here, *Lupinus oreophilus* [fig.31] (Fabaceae, with 3 other Andean native species in Chile). The lupins, always unmistakable, have one of their centres of distribution in upland Peru, with 140 taxa recorded, including relatively Gulliver-like *L. weberbaueri* (up to 1.5 m tall) ascending to 4800 m, although most others occur between 3000 and 4000 m (Baldeón et al, 2006). The majority of the remainder of the 200-plus species are found in North America. In the Southern hemisphere they're concentrated in the upper tropical central Andes, although a surprising number reach across east as far as Brazil, and a fair representation is present in Argentina as native species.

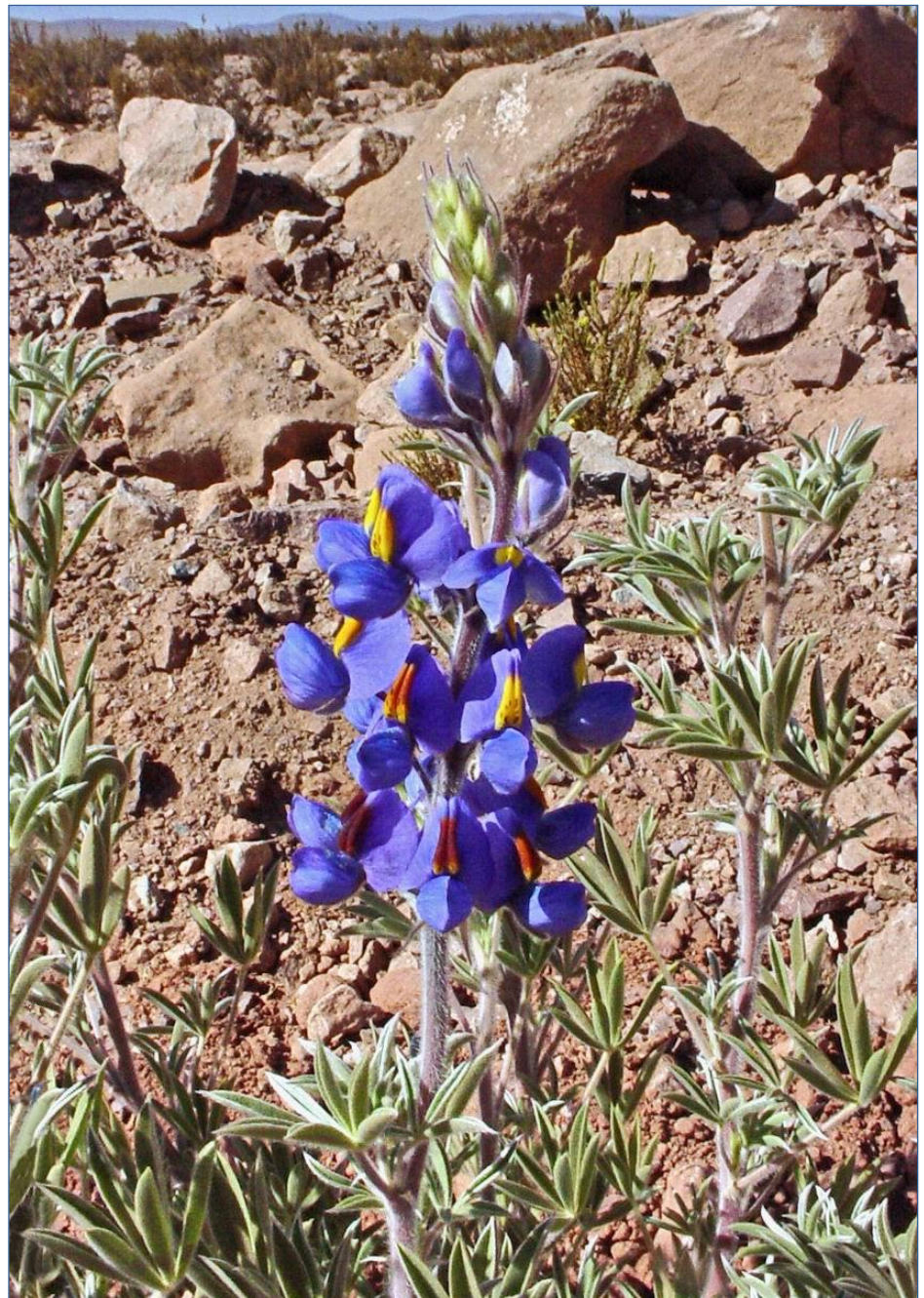


fig.31: *Lupinus oreophilus*, one of the occasional taller herbaceous inhabitants of the Altiplano, here in Antofagasta Region. (4 Jan 2006. ARF)



fig.32: A dwarfed *Senecio puchii* on a rock face. Near Villa Blanca, Tarapacá, at the border with Bolivia. (25 Dec 2013. Marijn van den Brink)



fig.33: *Adesmia occulta*. Notice the pale, often branched spines overtopping the foliage. At the surrounds of the Miscanti Lake at 4120 m, Antofagasta. (6 Dec 2006. ARF)



fig.34, left: Dwarf Verbena relative *Junellia pappigera* among the floral community at the surrounds of Miscanti Lake on the Altiplano, Antofagasta. (6 Dec 2006. ARF)

fig.34a: *Junellia pappigera*, close-up of the flowers. (6 Dec 2006. ARF)



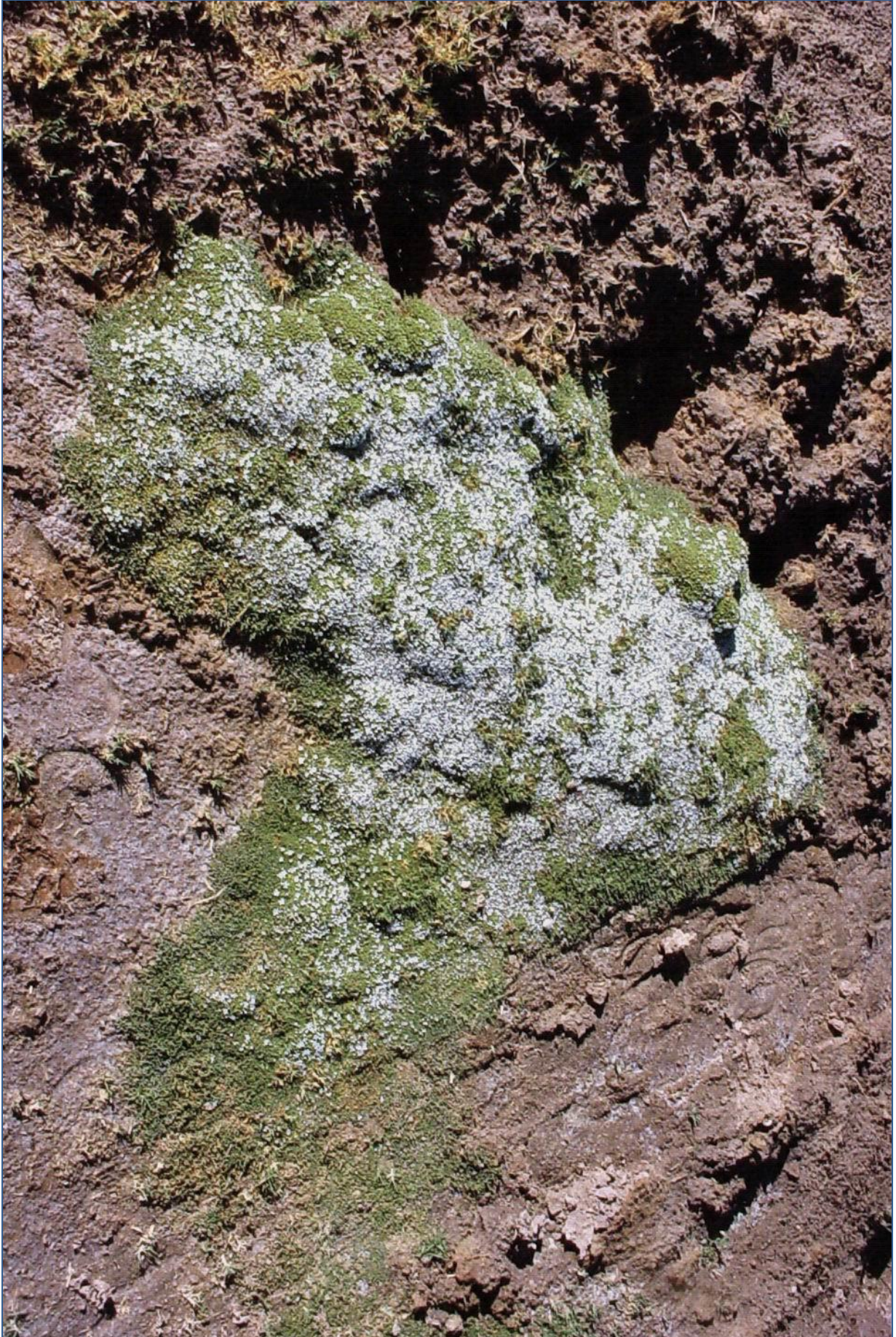


fig.35: Come off it! South American *Arenaria rivularis* trying to fool us as a map of Africa. Pass to Argentina near Laguna Miscanti, Antofagasta. (6 Jan 2006. ARF)

Dwarf subshrubs

If the woody life form of larger trees, shrubs and subshrubs is as easy as ABC to define, the same can't always be said for equivalent prostrate taxa, particularly at alpine elevations. Some are no problem, of course, because their ligneous structure is readily evident at sight, or from casual closer inspection. This holds even for dense reductions of the same *Senecio puchii* [fig.32] when acting the facultative chasmophyte, as in the photograph, or else becoming a lithophyte in terrain where quantities of soil are too low and poor in nutrients to sustain its otherwise extended aerial growth.

Another which might also confuse, but offers clear clues for those with eyes to see, is *Adesmia occulta* [fig.33] of the Fabaceae. Like its close relative *A. subterranea*, which 'replaces' it in the next three regions to the south, the wooden framework is hidden below fine, loose ground. But the visible signal lies in the thick, rigid, paler spines, which protrude above the tight mat of foliage, particularly so in the case of *A. occulta*. When there's a dead branch exposed, as with ours, it's even more of a giveaway.

Mat-forming and rosulate high Andeans

In fact, some plants classified technically as prostrate subshrubs do look just like a typical spreading dwarf carpeter of the *Androsace vitaliana* type, for example, which is exactly how any gardener or wildflower enthusiast would see them. In common with the nomenclature here, we've used life form definitions from the new Chilean flora catalogue (Rodríguez & Marticorena 2019). And they're absolutely correct for *Junellia pappigera* [fig.34] (Verbenaceae). But you'd have to dig it up to reveal the huge thick, ligneous tap-root and stout woody network, which are completely hidden by fresh growth and flower cover when the plant is seen in situ, so we're treating it as if herbaceous here.



fig.36: *Arenaria rivularis* flowering detail. Pass to Argentina near Laguna Miscanti, Antofagasta. (6 Jan 2006. ARF)

---International Rock Gardener---

Arenaria rivularis [figs.35, 36] (Caryophyllaceae) forms impressively sizeable mounded cushions or flat, dense carpets, spangled with diminutive white corollas like freshly fallen snowflakes. Neat, stemless *Senecio algens* [fig.37] is the only species of its genus featured here which is actually not woody based.



fig.37: Mat-forming *Senecio algens* at the border with Bolivia, Tarapacá. (25 Dec 2013. Marijn van den Brink)

---International Rock Gardener---

The following five are that alpine enthusiast's other particular delight, along with cushions, dwarf geophytes and dense, flowering shrublets - the rosette formers. We start with a pair of Asteraceae, the family with by far the most representatives in our coverage here, in fact not far short of half. As being likely to feature on the show bench wish-list of anyone who knows about it, *Trichocline deserticola* [fig.38] leaves most of its generic fellows standing, although there are undoubtedly one or two others you wouldn't kick out of (the alpine) bed. Although somewhat coarser in growth, *Urmenetea atacamensis* [fig.39, 40] with its impressively large, short-stemmed inflorescence would certainly be a welcome newcomer as well. What a misfortune that - due to questionable legislation and short-sighted conservation vision - plant introduction by responsible 'private' seed collectors has been almost stifled, with the exception at times of those who live in the countries concerned. Sadly, these two little composites aren't on the website of resident Michail Belov, the only remaining supplier of Chilean seeds we know.



fig.38: *Trichocline deserticola* growing in splendid isolation. Collahuasi sector, Tarapacá.
(8 May 2008. L. Rojas)

So far we've covered families, if not genera and species, widely known to any with an interest in plants. Now we come to two which are certainly not. This first, Calyceraceae, is exclusively endemic to South America as well. John has nicknamed some of them from central Chile as Andean 'cauliflowers' or 'broccoli', due to their dense, compound inflorescences, which place them well up the dicotyledonous evolutionary scale and close to its present summit, the Asteraceae. Admittedly they're more interesting than showy, as the dense green inflorescence disc of *Moschopsis monocephala* [fig.41] betrays. We know this from The Altiplano sector of the next region down, Antofagasta (or 'auntie-go-faster', as someone at the British Consulate called it in 1971 during our first visit: we suppose - hope - he was joking!).

---International Rock Gardener---



fig.39: *Urmenetea atacamensis*.
A scattering of these in full
flower on the bare, open
Altiplano is quite a sight.
Collahuasi sector, Tarapacá.
(1 Apr 2008. L. Rojas)

fig.40, below: The striking
Urmenetea atacamensis flower
head. Collahuasi sector,
Tarapacá.
(1 Apr 2008. L. Rojas)



---International Rock Gardener---



fig.41: Unusual *Moschopsis monocephala* with its dense mass of tiny flowers. Surrounds of the Altiplano Miscanti Lake, Antofagasta. (6 Dec 2006. ARF)



fig.42: *Caiohpora rosulata*, a 'stinging lampshade'. We wouldn't mind it hanging from our ceiling! Lauca Park, Tarapacá. (30 Dec 2013. Marijn van den Brink)

---International Rock Gardener---

No such slightly belittling judgement could be levelled at our other species from an unfamiliar family, *Caiophora rosulata* [fig.42] of the Loasaceae. The latter has a wider distribution than Calyceraceae, but is nevertheless limited to the Americas and Africa. It contains some truly spectacular and surprising genera and species, such as the one here. John has come up with another nickname, this time for flowers of *Caiophora* - 'stinging lampshades'. And boy, do they sting if you're allergic to them (and more than enough if you aren't). You've been warned! Their best known species, the usually white *C. coronata*, has been aired on several occasions in alpine gardening literature, but this equally compact species, an Altiplano endemic, is not by any means well-known, if at all - and it deserves to be.



fig.43: Sadly 'not for sale' in cultivation! Ultra-choice *Nototriche turritella*. Volcán Isluga National Park, Tarapacá. (25 Dec 2013. Marijn van den Brink)

Surely everyone reading this will agree with us that in *Nototriche turritella* [fig.43] (Malvaceae) we've come to the crown jewel of this Altiplano flora, both in terms of its species and its genus. Nototriches are one of the plant world's three big magnetic attractions in the Andes, the others being *Gentianella* and the rosulate violas. This posed a dilemma when John and Martyn Cheese were planning that first exploration to take place in South America during 1971 and 1972, as *Nototriche* and *Gentianella* are centred on the tropical Andes, above all Peru, while the rosulates peak further south in temperate Chile and Argentina. We won't say they exactly came to blows, but Martyn's preference for Peru was unshakeable, while John wished to consummate his established distant love affair with the Andean violas. To break the stalemate, Martyn told John that he, John, was the boss, so the choice was his. The final decision in favour of Chile hinged on the practical consideration that plants in

---International Rock Gardener---

general from the temperate Andes should adapt to Northern Hemisphere cultivation better. In the end no tears were shed, and a good harmonious and productive time - which even included three nototriches - was enjoyed by all! With hindsight it's slightly ironical that one or two of that ilk, e.g. *N. macleanii*, have actually adapted better than the violas in the hands of such experts as Martin Sheader, although it's doubtful whether there was enough know-how and knowledge of the high South American flora around in the 1970s (as opposed to enthusiasm!) to have achieved that. But what a spell-binding genus, with glorious new species being revealed regularly, in parallel with those of the rosulate violas. A surprising 22 perennial species of the present 139 total for the genus sneak into the high top end of Chile, but you don't exactly trip over them. The southernmost one we encountered in 1971, *N. compacta*, does actually reach down as far as the pass to Argentina where we live now - and beyond.



fig.44: The Cotacotani lakes and Pomerape and Parinacota volcanoes, Lauca National Park, Tarapacá. (2 Jan 2014. Marijn van den Brink)

Moisture seeking herbs

We round off our little floral survey with a selection of those Andeans for which constantly saturated ground is essential to their survival. As explained more fully below under the **General habitat** heading in the formal part, for a while during Chile's summer months the otherwise long period of the year almost lacking precipitation, which results in the semi-desert nature of the Altiplano, is broken. Intense, strong rain and significant snowfalls occur, which remain permanently on the mountains [fig.44]. In the aftermath of this climatic event the surface of well-drained ground soon dries out, while leaving persistent visual evidence of the extensive flows of surface water [figs.4, 5]. By contrast, the occasional upper mountain rivers [figs.45, 46], streams, lakes and low, sunken ground are fed non-stop by the gradually melting snow above and support a varied but very different flora from that of the surrounding terrain. These mesophytes and hydrophytes must also benefit from increased local air humidity.

---International Rock Gardener---



fig.45: One of the occasional rivers on the Altiplano. Las Vicuñas National Nature Reserve, Tarapacá. (29 Dec 2013. Marijn van den Brink)



fig.46: View of another Altiplano river, here green and bordered by *Distichia muscoides*. Salar de Huasco, Tarapacá. (24 Dec 2013. Marijn van den Brink)

---International Rock Gardener---



fig.47: Moist to saturated mesophytic 'lawn' habitat. Salar de Huasco National Park, Arica y Parinacota, near the border with Bolivia. (24 Dec 2013. Marijn van den Brink)



fig.48: A typical Altiplano marsh, called a bofedale locally. Lauca National Park, near Lake Chungará, Arica y Parinacota. (2 Jan 2014. Marijn van den Brink)

---International Rock Gardener---

One of the most significant aspects is the large, flat lawns of verdant grasses [fig.47], mostly cropped short. They provide vital nourishment for domestic and wild grazing animals such as the vicuña, a llama relative, as well as harbouring a variety of invertebrates which attract a good amount of diverse terrestrial birdlife. The other type of very typical habitat consists of areas with increased surface water, often forming shallows [fig.48], which sustains obligatory and facultative aquatic species such as the predominant background component of the community, dense cushion-forming *Disitichia muscoides* [fig.49] of the rush family, Juncaceae. These habitats are called humedales or bofedales in Spanish, which can be translated as alpine marshes.



fig.49: 'Amphibious' *Disitichia muscoides*. Near the border with Peru, Lauca National Park, Arica y Parinacota. (2 Jan 2014. Marijn van den Brink)



fig.50:
Xenophyllum pseudodigitatum.
Lauca National
Park, Arica y
Parinacota. (2 Jan
2014. Marijn van
den Brink)

Another prostrate subshrub which fails to reveal its short, woody lower base inhabits these communities, and by pretending to be a neat herbaceous dwarf compounds the deception. This is

---International Rock Gardener---

the attractive composite *Xenophyllum pseudodigitatum* [fig.50]. Until as recently as 1997 it was known as *Werneria digitata*, which from thenceforth became its synonym, as happened to the other 20-odd taxa transferred to the new genus at the time. The reduced genus *Werneria* is still fairly well represented however, with 15 accepted species distributed along the Andean zone from Venezuela to central Chile and Argentina. Two stemless examples of these upland wetland daisies, *Werneria glaberrima* [fig.51] and *W. pygmaea* [fig.52] are found in our present geographical area. By a most curious coincidence a genus of equally hydrophilic African toads (the smalltongues) also shares the name of *Werneria* (Wikipedia 2020a)!!



fig.51: *Werneria glaberrima*, a natural rock plant. Volcán Isluga National Park, Tarapacá. (25 Dec 2013. Marijn van den Brink)

fig.52: Big daisies on pygmy plant. *Werneria pygmaea*. Aguas Negras, Andes of San Juan Province, Argentina. (8 Feb 2011. JMW)



---International Rock Gardener---

Now at last we get to a plant that almost everybody, if not everybody, who grows alpines will recognise, albeit once its new alias is uncovered. Ever since the beginning of John's obsession as a 15-year-old schoolboy with mountain wildflowers in cultivation he's known it - and as *Hypsela reniformis* right up to the time he migrated with Anita to become a resident of Chile, where it is native. The first encounter was when cycling down to Robinsons Nursery in the north of Kent to weed pots in exchange for alpines he coveted. The last in his native land was as a component of his short-lived Four Seasons Nursery. But prior to that, in 1972 he and Martyn Cheese, accompanied by our great friend Prof. Carlos Muñoz of the Santiago herbarium, saw it growing wild in southern Chile. Then and later, when he co-authored the field guide to Andean plants (Hoffmann et al. 1998), it was still *Hypsela*. But during the last year of the 20th Century an American botanist published a paper (Lammers 1999) in which he pointed out that the previous recent synonymisation of *Hypsela* and *Pratia* had rendered the base name *reniformis* of Kunth in 1818 unusable, and that the earliest valid now available epithet derived from the later described *P. oligophylla* Wedd. of 1858. Furthermore, the equally recent synonymisation of *Pratia* under *Lobelia* on morphological grounds meant that our conventional species sported the completely revised name of *Lobelia oligophylla* [fig.53] (Campanulaceae, Lobelioideae). Of course that was completely unrelated to its familiar one for those multitudes 'not in the know', and who still may be. So there you have it.



fig.53: *Lobelia oligophylla* (syn. *Hypsela reniformis*) as it grows in the wild. Salar de Huasco, Tarapacá. (24 Dec 2013. Marijn van den Brink)

There's no need to rattle on about the tiny but jewel-like and starry little annual gentian, *Gentiana sedifolia* (or maybe *G. gayi*) [fig.54]. We've dealt in depth with the headache of its taxonomical identity in our most recent IRG offering (Flores & Watson 2020). On the other hand a species of the choice lewisia-related genus *Calandrinia* (Montiaceae [syn. Portulacaceae]), the very dwarf *Calandrinia compacta* [fig.55], is scarcely known outside its own natural range and botanical circles. It spreads itself below ground, and can be seen dotting the flattest stretches of wet green turf in groups here and there with its short-lived little solitary white corollas.



fig.54: *Gentiana sedifolia* (or *G. gayi*). The upper Maule Lake in the region of that name, southern Chile. (11 Jan 2014. JMW)



fig.55, above right: *Calandrinia compacta* by Lake Chungara in the Lauca National Park, Arica y Parinacota. (2 Jan 2014. Marijn van den Brink)



fig.56: *Hypochaeris taraxacoides*. Volcán Isluga National Park, Tarapacá. (25 Dec 2013. Marijn van den Brink)

---International Rock Gardener---

To return to composites found in this type of environment, when it comes to recognised similar-looking genera, *Hypochaeris taraxacoides* [fig.56] relates more to the hawkweed type of inflorescence than to the daisy. It's undeniably appealing at its best, with large, bicoloured, almost stemless flowers that can overshadow the narrow foliage.



fig.57: The waterborne celandine *Halerpestes uniflora*. Lake Chungará at 4500 m in the Lauca National Park, Arica y Parinacota. (2 Jan 2014. Marijn van den Brink)

Our last is a facultative hydrophyte, *Halerpestes uniflora* (syn. *Ranunculus uniflorus*) [fig.57], as our illustration of it in the water shows. It's a celandine in the broad sense, and a tiny one at that. Ten years ago an inclusive molecular study of the genus *Ranunculus*, as then was, and others of its immediate group in the family (Emadzade et al. 2010), discovered that many were not sufficiently closely related to be included in the same genus. Most of the original distinct genera were confirmed, while *Ranunculus* itself retained its core, but lost several species to smaller genera. These included *Halerpestes* here, and also the common lesser celandine, which became *Ficaria verna*, with the common or garden *Ranunculus ficaria* reduced to a synonym. If this happens to be news for any readers, then our living has not been entirely in vain.

Taxonomy

Viola uniuissima J.M. Watson & A.R. Flores, sp. nov. [figs.59-62, 72]

Synonym: *Viola unica* J.M. Watson & A.R. Flores, bioRxiv.

<http://dx.doi.org/10.1101/787564>: 1 (2019), nom. inval.

Type: CHILE. Tarapacá Region, Tamarugal Province, Pica Community near Collahuasi (or Collaguasi), approximate coordinates 21°00'S 68°00'W, ca. 4000-4500 m, Feb 2008, collector unknown, specimen number P15! (holotype SGO).

---International Rock Gardener---

Diagnosis: The new species herein is distinct from all known others of section *Andinium* W. Becker by various combinations of its features. Among confirmed perennials, its discretely trilobed style crest is a morphological feature shared with the four described taxa of the informal *Triflabellatae* W. Becker alliance as well as *Viola flos-idae* Hieron., which differs from *V. uniuissima* by the glandular, not eglandular undersurface of its laminae inter alia. *Viola mesadensis* W. Becker, possibly a perennial, similarly possesses apical and lateral crest appendages, but also differs from *V. uniuissima* by its glandular lamina undersurface and its glabrous, not bearded, lateral petals. Except for *V. mesadensis* and at times *V. flos-idae*, all those taxa have a narrowly elliptical to ovate lamina with an acute apex, as opposed to the rounded, obtuse blades of *V. uniuissima*. The latter foliar morphology, in addition to the regularly crenate leaves of the novelty, ally it more with several species related to *Viola volcanica* Gilles ex Hook. & Arn.; also with *Viola beati* J.M. Watson & A.R. Flores and *Viola singularis* J.M. Watson & A.R. Flores. But the style crests are apical for the first named group, and lateral only for the following two taxa. In addition, the strongly curved crest lobes of this new species are unique, only being otherwise known in one very distantly related annual of the section.

Description (from only extant specimen): *Life form* perennial (or annual, see notes 1 and 3 below), acaulous, rosulate, evergreen (if perennial) hemicryptophyte. *Rootstock* axial, narrowly flagelliform, fibrous, ca. 7 cm long × 1 mm dia. at junction with caudex. *Caudex* 3 mm, naked (on specimen, but see notes 1 and 3 below). *Plant* solitary with single *rosette*, this 19 mm dia., open-structured, plane. *Leaves* spatulate, 7-12 mm when mature; *pseudopetioles* 4-7.5 × 0.5-0.7 mm, plane, fleshy; *stipules* 1.3 × 0.5 mm, triangular, hyaline, apex blunt; *lamina* 3-3.5 × 3-4.5 mm, rotund-ovate, approximately as wide as long or somewhat wider, narrowly cuneate to pseudopetiole, 4-5 rounded-crenate on each lateral margin, somewhat carnose; face dark, dull greyish green, alveolate reticulate; undersurface dark greyish, minutely farinose-papillose; margins usually glabrous, occasionally few-ciliate at base; apex rounded to shallowly subtruncate-undulate. *Flowers* axial, solitary, situated within circumference of rosette. *Peduncles* to ca. 9 mm, shorter than mature leaves, sparsely pilose apically; *bracteoles* adnate with base of peduncle for 0.2 mm, free and spreading above, when 1.5 × 0.6 mm, narrowly ovate, hyaline, apex acute. *Sepals* free, entire, triangular-lanceolate, subacute, herbaceous with broad hyaline margin; *superior sepal* 1.5-2 × 1.2 mm; *lateral sepals* 1.7-2.2 × 1-1.2 mm; *inferior sepals* 2-2.2 × 1-1.2 mm. *Corolla* white or pale, reverse of petals stained diffuse violet at base (see also note 2 below); *superior petals* 5 × 2.1 mm, oblanceolate, apex rounded; *lateral petals* 5.5 × 2.5 mm, upcurved-oblanceolate, apex rounded, upper half of face except apex bearded with short, stout, hyaline, clavate indumentum, as also present and suberect on adjacent upper margin; *inferior petal* 6 × 6.5 mm, broadly obcordate, sides incurved towards base; apical sinus broad, evenly curved, lobes rounded; *spur* 2 mm long × 1.5 mm dia., cylindrical, apex bluntly rounded. *Anthers* ca. 1.2 × 0.8-1 mm, lower pair with 1.2 mm filiform nectar spurs; *connectives* slightly shorter than anthers, ca. 1 mm, dull yellow. *Style* 0.7 mm, straight, clavate; *stigma* small frontal aperture on style head; *style crest* as long, linear, down- and incurved lobe with acute apex, situated on either side of style head, and third lobe apical, obtusely obovate, porrectly directed, with downcurved tip. *Fruit* ca. 5 mm, orbicular, tri-valved capsule; *seeds* not seen.

Note 1: The life duration of the new species is difficult to assess from a solitary plant with a single rosette and without remnants of any previous seasons' growth on the caudex. In conjunction with the equivalent longevity of most allied species, the main evidence favouring a perennial life-form is the length of the rootstock and its relative thickness at the crown-junction with the rosette. Also, evident live cotyledons are present at the base of the rosette, which suggests the plant germinated fairly recently, is not yet mature, and was therefore likely to develop significantly. It should also be noted that in order for annual taxa to survive in these harsh environmental conditions, sizeable colonies are obligatory. In that case why was just one specimen taken? However, in unfavourable seasons such annuals may survive as seed banks, when this individual may have been one of a few, or even the only one, to have germinated.

---International Rock Gardener---

Note 2: Floral pigmentation is eliminated or changed by pressing and drying, and the only way of knowing the exact living colour of the corolla is from accurate notes made by the collector, photographs, or knowledge of the plant in vivo (none in this case). However, it is reasonable to speculate from the saturated specimen that the internal ground colour is white, very pale violet or lilac, probably with darker basal veining or dense streaking on the inferior and perhaps lateral petals, and certainly with a yellow inferior petal throat, as would be consistent with all other close relatives of the species.

Note 3: The flower is notably and atypically large relative to the foliage and rosette. This may be a standard feature of the species. Such morphology is certainly known in four perennial species of the section with a southern distribution, the informal *Viola truncata* Meyen alliance (Watson & Flores ined.). Alternatively, the rosette may be an undeveloped immature perennial in its first season, as noted above, bearing regular sized flowers. Lastly, it may support the lesser possibility that it is in fact an annual.

Distribution: The new species is only recorded as one collection of a single individual found in the southern sector of Tarapacá Region in Chile. It is therefore a regional and national endemic respectively. [Figs.1, 58]



fig.58: Tarapacá Region, northern Chile, with violet-ringed area within which *Viola uniqueness* occurs. (Courtesy of Turistel)

fig.59: *Viola uniuissima*. The pressed herbarium type specimen. (25 Aug 2008. ARF)

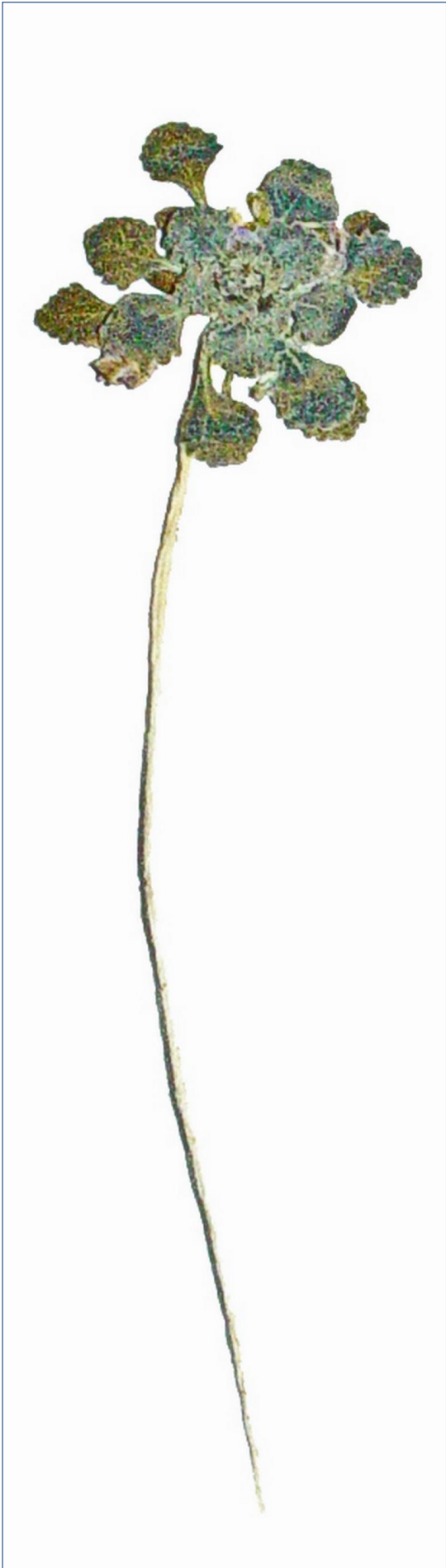
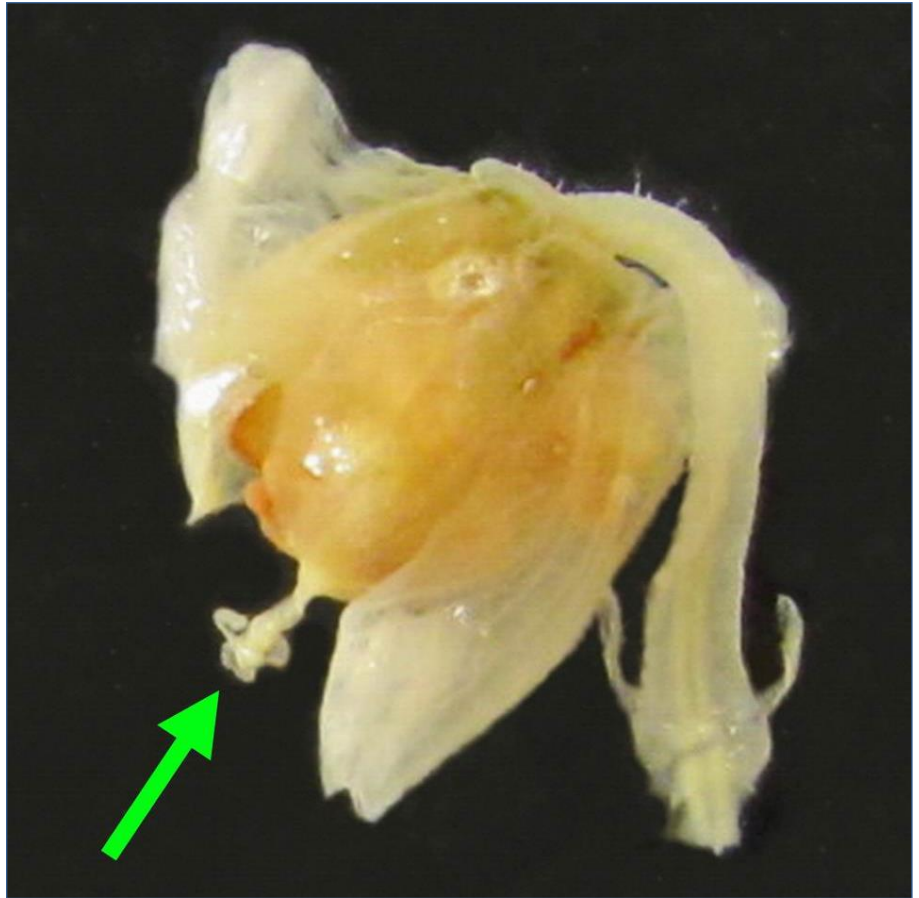


fig.60: *Viola uniuissima*. Underside of rosette of soaked type specimen. (7 June 2019. ARF)



fig.61: *Viola uniuissima*. Plan view of rosette of soaked type specimen. (7 Jun 2019. ARF)

fig.62: *Viola uniuissima* flower showing peduncle with basal bracteoles, ripe capsule, and attached trilobed style crest arrowed green. (7 Jun 2019. ARF)



General environment: Gajardo (1994) classified the major ecosystem where *V. uniuissima* was found as 'Estepa Alto-Andina Sub-Desértica', which translates as 'semi-desert high Andean steppe'. It is frequently dominated by extensive stretches of individual wiry bunch grasses (Poaceae) of the species *Anatherostipa venusta* and *Festuca chrysophylla* [figs. 19, 20]. Dispersed, compact, dense cushion and mat-forming species, cacti and dwarf xerophytic shrubs resistant to the effects of the extreme climate at high elevations characterize the overall accompanying flora. Representatives of these are named and described under the opening subtitle **Flora and habitats of the Collahuasi sector** above [figs.6-18, 21-30]. The Chilean Altiplano lies below the Andean watershed heights at or near the border with Argentina to the east, and continues northwards into Bolivia and Peru. It consists predominantly of an extensive plateau punctuated by shallow salt lakes and dry pans (salars), and volcanoes, relieved at times by mountain chains running north to south. The climate is basically dry and arid, but with low to very low night temperatures. This weather system is broken to a greater or lesser degree during the local summer, when systems drive in from the Atlantic to the east, resulting in heavy snowfalls, which accumulate on the highest mountains [fig.44], and rainstorms causing floods and saturating the terrain, effects of which remain visible [figs.4, 5]. This period of precipitation, called the Bolivian Winter (Invierno boliviano), provides a subsequent water supply to feed rivers, also creating perpetually damp local wetlands [figs.46-48]. These and persistent groundwater maintain the Altiplano flora, although some stony flats, including near the considered *Viola uniuissima* habitat, do remain sterile [fig.3].

Phenology: So far as can be judged, *V. uniuissima* is presumed to flower in February, and seed dispersal may be assumed to follow upwards of a month after anthesis.

Etymology: This species only exists outside its natural habitat as the type herbarium specimen, a solitary plant. For that, in December 2019 we accordingly named it *Viola unica* (Watson & Flores 2019d). It was later found to have been published invalidly, however, so needed to be presented again with the same diagnosis and description, but a different specific epithet. Consequently, we

---International Rock Gardener---

have decided on *Viola uniuquissima*, meaning 'the most unique viola', as the replacement, so as to relate it to its original name, which has now become an illegitimate synonym. We appreciate that the accurate Latin rendition would be '*unicissima*' of course. But to avoid the risk of the epithet being thought of or pronounced as 'unississima', we have deliberately changed the 'c' to 'qu', equivalent to 'unique' in English, and as also in the Latin *quisque*, for example.

Conservation assessment: Even although no information exists as to the size or extent of the only known population of the new species, with only one individual collected so far, the fact that it was found in an extensive and ever-expanding area of open-cast mining operations [figs.63, 64] leaves no doubt at all that it must qualify as EX (IUCN 2012): i.e. potentially in danger of extinction.



fig.63: Aerial view of an open-cast mine at Collahuasi, Tarapacá. (Photo from the Internet)

fig.64: An open-cast mine at Collahuasi, Tarapacá. The machinery gives an idea of the scale of the excavation. (Photo from the Internet)



---International Rock Gardener---

Where does *Viola uniuquissima* fit into the systematic picture?

(The following is a précis of the coverage of this topic given originally when the species was described under the invalid name of *V. unica*. The full version may be found in the publication listed in the References below as Watson & Flores 2019d.)

The new species belongs in the exclusively South American section *Andinium*, known colloquially as the rosulate violas. When all its taxa are taken into account they make up the largest of 16 sections comprising the cosmopolitan genus *Viola*. As accepted by ourselves, these mostly very distinctive little plants total at least 147, both published and unpublished. Their range extends down the west side of the subcontinent from the equator to southern Patagonia and from the Pacific coast to the high Andes, where the majority grow. (Wahlert et al. 2014, Watson & Flores 2018b).

Historical study of the section was at its most intense from the time of the monograph on the violas of Chile by Carl Reiche (1893) to the untimely death in 1928 of its leading authority, Wilhelm Becker of Berlin-Dahlem. Over a period of 22 years the last named added an impressive 35 of the present published and accepted 111 total by 31 authors, which included his absence during WW1 due to obligatory military service. He also named the section and wrote an outline survey of it (Becker 1925), but did not live long enough to produce a comprehensive monograph, which he may well have had in view.

Only two more new species were added during the 75 years from the time of Becker's demise until the first one during the resumed specialist study of the genus this century (Rossow et al. 2003). Meanwhile, Becker's large and important collection at Berlin-Dahlem was destroyed by bombs during WW2 (Hiepko 1987, Haagemann & Zepernick 1993). Many of its taxa inhabit inaccessible locations, the majority as solitary or few recorded populations, with as many as 40 species currently unknown in the wild. Distinguishing between some taxa can also be difficult. Taking all these factors into account, it is hardly surprising that *Andinium* is still poorly understood compared with the other sections, despite considerable recent advances.

Species of section *Andinium* allied to *Viola uniuquissima*

The novelty we are reintroducing here, as lodged in the SGO collection, is exemplary of the difficulties involved in providing accurate information on many section *Andinium* taxa. It is one of those currently unknown in the wild, with no details other than its general locality available. Furthermore, the *Viola* flora of these remote high semi-desert regions is few and far between, the relationships between them and others of the section far from obvious. Nevertheless, we have been able to provide some preliminary observations in this respect.

A currently informal division of section *Andinium* based on morphology results in a number of affiliations, most of them very distinctive (Watson & Flores, ined.). Two are considerably more numerous than the rest, the largest being what we refer to as the broad *V. volcanica* alliance, which itself splits naturally into a number of smaller subdivisions. Two of the latter are relevant to this discussion, having in common flexible, broad, more or less ciliate leaves, usually crenate along the margins, and lamina faces with raised reticulate venation. Underleaf glands may be present or not. Most taxa have no more than one apical style crest, although two species possess lateral lobes only, one on either side of the style head.

Becker (1926) described a third, much smaller division, which he named the Triflabellatae. It is the only infrasectional grouping of *Andinium* to be defined, outlined and described in the literature to date and consists of four proximate species endemic to NW Argentina between the adjacent provinces of La Rioja (30°S) to the south and Jujuy (22°S) in the north, *VV. joergensenii*, *hieronymi*, *triflabellata* [fig.67] and *tucumanensis*. The group consists of four perennials described by Becker himself from

---International Rock Gardener---

1922 to 1926, but was published without a formal taxonomic rank. Its relevance here is that all its members possess three long style crest lobes, two of them lateral, the other apical, a unique, rare and unusual morphological feature for these violas.

fig.65:
Viola flos-ideae.
San Juan Province,
Argentina. (Roberto
Kiesling)

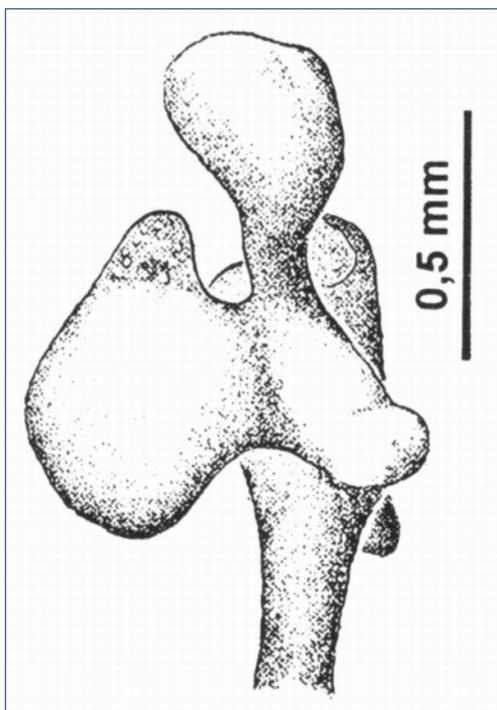


fig.66: The three discrete style crest lobes of
Viola flos-idae. (Drawing from Flora de San Juan,
courtesy of R. Kiesling)



fig.67: *Viola triflabellata* W. Becker (Triflabellatae). Cerro de la Mesada, Sierra de Famatina, La Rioja Province, Argentina. (14 Mar 2007. ARF)



fig.68: *Viola marcelorosatii*
J.M. Watson & A.R. Flores.
Llanos de los Morteros, Vallenar
Province, Atacama Region,
Chile. (20 Aug 2017. JMW)

---International Rock Gardener---



fig.69: *Viola x josephii* J.M. Watson & A.R. Flores (Triflabellatae). Vega Altos de Muñoz, Tafí del Valle Department, Tucumán Province, Argentina. (22 Feb 2007. ARF)



fig.70: *Viola lullailacoensis*. Antofagasta. (Photo anon., ex Internet)

---International Rock Gardener---

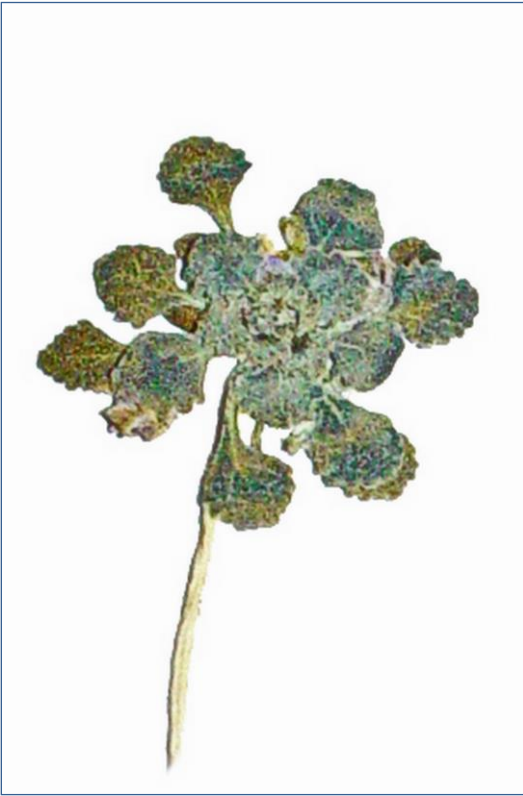


fig.71: *Viola uniuissima*. (25 Aug 2008. ARF)

However, Becker's four are by no means unique in this respect. One, *V. flos-idae* [figs.65-66], another perennial, which extends down as far as Mendoza Province (33°S), was described four decades earlier, while Becker added another, the annual *V. mesadensis*, in 1928, the year of his demise. He did not link these latter two to his Triflabellatae at all, however, so their interrelationship, if any, has remained a mystery since. Subsequently, we ourselves have presented another two, annual *V. marcelorosasi* [fig.68] (Watson & Flores 2018a) from northern Chile, and the perennial hybrid *Viola* × *josephii* [fig.69] (Watson & Flores 2019c). Two further species, both perennial, await publication.

In our unfortunately illegitimate work (Watson & Flores 2019d) on which the present account is based, we attempted a provisional conclusion as to the status of those not included in Becker's original four. One fact became immediately obvious.

All differ significantly from the appearance of the latter and as such are much closer to others without the three lobes. We

conjectured that they are either hybrids, evolutionary intermediates, or have evolved in parallel. We nevertheless very tentatively placed *V. unica*, as it then was, in the Triflabellatae.

During the intervening eight months since that 2019 account was written and its present replacement here begun, a remarkable coincidence has changed the panorama markedly. The next species we are preparing for publication, which comes from the same geographical sector, but in Chile, is also triflabellate. Furthermore, it also resembles other species very closely, including *V. flos-idae*, far more than Becker's quartet. This situation has led us to investigate all the triflabellates in depth as they relate to Becker's original diagnosis. Our incontestable conclusion is that along with Becker's four, only two others are genuine Triflabellatae, while the remaining five are quite unrelated to them.

We plan to publish a detailed analysis of this situation in due course, but can and must correct herein our original speculation that *V. uniuissima* (syn. *V. unica*) apparently belongs in the Triflabellatae. Its actual systematic placing in section *Andinium* is only likely to be revealed by future molecular analysis. It can be noted though that the only two species closely resembling it in the outward appearance of its broad, crenate leaves are similarly triflabellate *V. mesadensis* and the Chilean endemic *V. lullaillacoensis* [fig.70], which has an apical crest and inhabits this same sector of the Chilean Altiplano.

Acknowledgements

We are most grateful to the staff of the Santiago National Natural History Museum herbarium (SGO) for permission to visit and for valuable assistance. Thanks are also due to Dr. Gandhi of the IPNI organization, who informed us immediately of the invalid publication, resulting in our being able to rectify it promptly here. He has continued to remain in helpful contact. Our indebtedness for clarification of the invalidity situation also extends to Dr. Nicholas Turland of the ICN Committee, who took the time and trouble to respond personally, confirming and defining the precise formalities involved.

It's impossible to put in adequate words what we and this publication owe to our Dutch friend Marijn van den Brink. As can be seen from the photograph author credits, he has generously made available over half the illustrations here, amounting effectively to almost all those of the Altiplano

---International Rock Gardener---

flora. (Most of our fewer equivalents are on colour slides and virtually inaccessible.) In other words, this article could not exist in the IRG without his contribution, which dates from a privately organized visit with several others to the sector in 2013/14. It may be seen in full on his website:

<https://photos.v-d-brink.eu/Flora-and-Fauna/South-America/Chile-Northern-part/i-TmMTFGd>

Leonora Rojas has also provided valuable supporting photos.

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---International Rock Gardener---

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--- Good News! ---

Martin Shearer is a good friend to John and Anita Watson and to the IRG – he has been very ill with Covid-19 and associated problems and was in hospital and in rehabilitation for three months – we are delighted to tell you that Martin is now back home, walking miles to regain his strength and looking forward to being able to tend his plants again. Wonderful to have some good news in dark times – we wish Martin all the very best for a return to full health!

Growing Paintbrush – Kenton J. Seth



Castilleja miniata among the Aspen. (*Populus tremuloides*)

I named my late landscape company after *Castilleja*: Paintbrush Gardens LLC. Now that name refers to my micronursery that supplies my garden designs and also expresses my demented whims in personal plant tastes.

Here is the way I grow paintbrush myself. There are other ways. I'll list a few at the end.

1. Chose a species that is native to a similar climate as your own. For example, *C. applegatei* and *latifolia* have been good for growers in Washington, Oregon, and the UK. I've grown many from the lower elevations of Colorado but struggle with our alpine species.
2. Collect your own seed. For whatever reason, I find my own seed from the last year or two or three germinates better than anything I buy. Usually! Commercial seed is perhaps old or stored poorly. An exception has been the superb seed from Western Native Seed here in CO.
3. Screen that seed. A decent set of screens makes this really fast, or you can do creative things with folded paper (winnowing) or scraping with a credit card (reenacting Pulp Fiction).
4. Store seeds in Fridge until you are ready to sow.
5. Sow out in fall, say October. Just two months of cold strat may not be enough. Three is more reliable. Do it like traditional rock garden plants- low fertility and high porosity soil mix, a fine (not too deep) gravel grit topressing. Use a small 2"-4" pot. (5-10cm)
6. Pull into greenhouse in Jan/Feb. This gets the seedlings going to be big enough to plant this spring, rather than next fall. Bright light and good air movement. Look out for slugs. Fertilize but gently. I grew half a dozen paintbrush species before I had my little greenhouse, so don't let this step exclude you.



Castilleja sessiliflora is so boring it blends right in while in full bloom. Pollinators still find it. It's one of the easiest to grow and some forms are pink and/or white.

---International Rock Gardener---

7. Prick out from one another, pair up with host. Letting the roots touch one another so the *Castilleja* finds the host easily, putting this unhappy couple in their own pot in March/April. I like to use one year old seedlings of subshrubs or other tough, long-lived and deep-rooted plants so they make a sturdy host. *Eriogonum* have been shown to be one of, if not the best. Use something easy that likes you. If I have enough seedlings, I'll often put two tiny 1/2" (1cm) plants of paintbrush per host for better odds at having one take. Also obviously pair up with a host that likes similar conditions to the species of *Castilleja* you are growing. I personally only bother to differentiate between mountain species and desert species.

There was a great study done by Love and McCammon in Idaho, published in *Native Plants Magazine*, which had at least two big takeaways: Use *eriogonums* and germinate the hosts and paintbrush separately. One friend of mine feels that seedlings may parasitize one another.



Recently I put tiny *Castilleja miniata* with *Penstemon davidsonii*, something that happens in nature.

---International Rock Gardener---



And here they are together in nature - I remember this better because a friend, [David Sellars](#) took a candid shot of me looking at this.



Short but rugged *Eriogonum porteri* makes a great adaptable host for a number of dry american *Castilleja* from pot to crevice garden. Nurseries have long used *Artemisia frigida* or *Bouteloua gracilis* for *Castilleja integra*, which is one of the easiest species.

---International Rock Gardener---

8. Plant out, barerooted, in April/May/June when the plants are still in active growth but before summer heat (And therefore potential semi-dormancy) has set in. If the plants are pretty leafy and grown when you do plant, I suggest pruning half of their tops off to reduce stress to their roots. Water and watch closely as well as protect from chewing bugs who will take away the other half of the plant. I like to shade them for at least two weeks until they show growth. Now, water sparingly or to match their homeland rainfall.

9. Enjoy and boast to friends. Really, savour it. Because plenty of species are not terribly long lived or just don't persist in gardens. Many species are only permanent in fairly exact conditions in nature, or in disturbed soil which inevitably settle and mature, excluding those pioneer plants. *Castilleja* from dry places often go summer dormant, so don't freak out if they turn brown in summer. That dryness and sleep might be what keeps them safe from rotting.

Or:

Alternatively, you can grow them alone until they are sturdy little lone seedlings and you pair them with a host when you plant them in ground in April. I also like to plant them next to multiple plants to give them diverse backup. Seems to help.

Also alternately, if you do not have a greenhouse or cold frame, you can do your pricking and pairing just a few months later where they grow outdoors, and plant them either the next fall or spring. I think they don't like life in a pot so that's why I shoot to get them planted as soon as possible.

Castilleja flava lived for three, bloomed for two. Maybe I let it get too dry?





Castilleja integra with *Echinocereus triglochidiatus*. Seems the cactus is not happy about this.

---International Rock Gardener---



I almost hoed this poor volunteer paintbrush. Don't worry, an earwig ate it a few days later.



Nothing like a big, wild, unapologetic Rimrock Paintbrush, *Castilleja scabrida*.

---International Rock Gardener---

Direct sowing. This works if that seed is absolutely ideally suited to your site. I cannot underscore enough the danger that slugs and chewing bugs pose on paintbrush- they must be as uniquely tasty as they are uniquely beautiful. One night and one slug can take out my entire year's crop of seedlings if I'm not religiously vigilant. Troughs or crevice gardens seem particularly helpful in accommodating species from dry climates and mineral soils.

Some folks have used GA3 - gibberelic acid - to bypass cold stratification. I've never been good with acid. Some folks use the fridge, but you must watch them carefully in there. Paul Cumbleton in the UK wrote a great article for *The Plantsman*** about growing them without a host, by taking good care of the plants from the early stages, forcing them to make their own food, and having them live and bloom this way.

As hemiparasites, they all seem to have half the root system a plant should have, so they are just more delicate against any kind of stress you give them. In the end, they are elusive for a reason - wonderful and wild. And in [wildness is the preservation of the world](#), right?



Castilleja integra reseeds around the APEX crevice garden, photo by Tom Freeth.

** "Castilleja: Saying Goodbye to The Host" in *The Plantsman*, Dec 2008, pp. 218-221. Courtesy of 'The Plantsman', you can download a free copy of the *Castilleja* article by Paul Cumbleton mentioned by Kenton [from this link](#).

Paul Cumbleton and Colin Everett showed the construction and development of a raised bed to accommodate a crevice garden in the [IRG 114 of June 2019](#), where they showed some of the *Castilleja* they are growing in Somerset in England.