

International Rock Gardener

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I doubt that many people will have reason to look back on this year with any pleasure – as the ‘Year of the Covid19 Pandemic’ there has been too much loss to engender fondness in most hearts. Family members and friends have been taken by the disease, disruptions of all kinds have ruined plans for events, travel and projects around the world in every sphere. Even in the year to come, it is unsure if the way of life for all, including plants lovers will be able to proceed in any form that we have come to regard as ‘usual’ – instead we must continue to find ways and means to discover some form of ‘new normal’ – not the happiest of prospects but there have been great strides made with international internet

meetings which could remain as we get to grips with new possibilities to make our existence bearable. I do believe that those with an interest in plants and the natural world have an advantage in having something so hopeful in these times. Our increased concentration and study of our plants over the recent lockdowns has meant many are understanding the needs of the flora and fauna around us as never before – there also seems to have been a positive explosion in the level of interest in gardening and self-sufficiency over the last few months. How fortunate those of us with our own gardens really are - what a pity it is has taken a pandemic to highlight that!

M.Y.

Cover photo: *Argylia adscendens* var. *adscendens* Christian von Bohlen

This month’s IRG presents an article by John and Anita Flores Watson on *Cistanthe celedoniana* (Montiaceae) which is a new species from Valparaiso Region, Chile, with notes on the genus, including a new combination, and photos of the flora leading up to the type area in the upper Río Aconcagua Valley. It is a pleasure to have Anita and John able to write again after their brush with Covid-19.

Our second submission this month is from [Panayoti Kelaidis](#), one of the most famous of American horticulturists, about Alan McMurtrie, christened by Panayoti as the King of Reticulates! Since 1980 Panayoti has represented [Denver Botanic Gardens](#) in multifarious endeavours as an expert in horticulture. His many other talents include [writing](#) and numerous awards, such as two of the highest honours in American horticulture. Praise from PK, as he affectionately known, is therefore praise indeed!



Panayoti Kelaidis in China



Alan McMurtrie is one of the world's foremost breeders of reticulata Irises. He has received awards for his work from the likes of British Iris Society and his hybrids [excite interest](#) wherever they are seen. Alan has travelled widely to give talks and seek commercial growers for his hybrids. Alan’s website is at <http://www.reticulatas.com>

Alan McMurtrie

Iris ‘Storm’



HAPPY HOLIDAYS

- and good health in 2021!

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--- Species Description ---

***Cistanthe celedoniana* (Montiaceae), a new species from Valparaiso Region, Chile, with notes on the genus, including a new combination, and an illustrated account of the flora leading up to the type locality in the upper Río Aconcagua Valley.**

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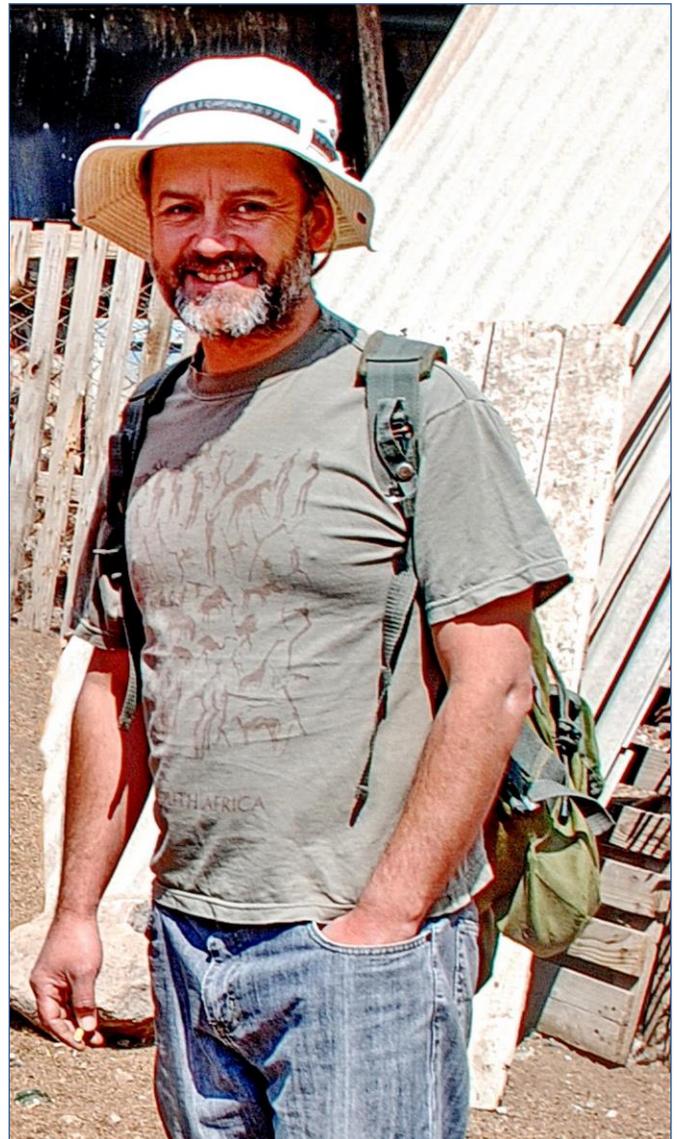
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Summary

We begin by profiling the late Carlos Celedón, who lived close to John and Anita, and who discovered the type site of *Cistanthe celedoniana*, the species presented here - which is named in his memory. It is the last of two species to be described for botanical science as discovered by him while exploring on his own. However, his achievements went well beyond that, He encountered a 'long lost' annual rosulate viola at two sites in the general neighbourhood, and took John and Anita to one of them to identify it for him. While there they recognised three other species in the unique restricted habitat as new to science. It is for these outstanding achievements as a keen amateur naturalist and explorer, and also in memoriam for his lamented early death that we name the novelty *Cistanthe celedoniana* for him.

None of the present authors have seen the plant at the type site, although John and Anita have grown containerised specimens in their garden. However, they, the Watsons, have travelled along its very narrow approach road on several occasions, originally to take Carlos there, and have encountered and photographed wayside plants that flower at the same time as the cistanthe. These and their habitats are narrated in the main part of the introduction and background.

fig.1: Carlos Celedón, the main protagonist, who discovered the species named for him herein. (30 Nov 2014. JMW).



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Very recently a second population was reported by friend, colleague and fellow author here, Christian. It's sited some 70 km to the SSW of the one found by Carlos.

We cover all the formalities of the new plant in the second botanical part, beginning with Taxonomy. Here, friend and colleague, Norwegian academic botanist Arve, joins in. He has made an in-depth study of the cistanthe's systematic context, which is also included here. In this second part we also elaborate on two interesting phenomena observed at the type site: pollination of the flowers by ants, and diurnal movements of the leaves and flower stems, although this last has also been noted by Christian at his location.

Introduction and background

The most important person by a long chalk in this account is the late Carlos Celedón of Los Andes [figs.1, 76, 83]. A fanatical amateur naturalist and fine photographer, he discovered the type site of *C. celedoniana* during his regular explorations in the general area within a roughly 15 km radius from his home, which ranged between due south to due west towards the border with Argentina. It included the high lateral cordillera to 3000 m-plus bordering the upper Aconcagua valley to the south. Regular readers of the IRG have already been introduced to Carlos twice, in 2018 and 2020, and he has appeared earlier in the SRGC journal, in 2014. See the following paragraph for full references of these.

He and the Watsons first met in the second half of 2013, precisely in the context of the last-cited exploit. Carlos was an intrepid and tireless hiker and climber who would walk a fair distance to the foot of an Andean peak, climb to its summit ridge some 2250 m above him, then return back down and home, all in a day, including much photography. In that way he found his exciting new rosulate *Viola regina* [figs.80, 81] (Watson & Flores 2020). But it was to another annual species much lower down, *V. chamaedrys* [fig.78], that he took the Watsons on that first occasion (Watson & Flores 2014). In fact it had not been seen again since shortly after its initial discovery 150 years ago - so a valuable revelation by him. He had first noticed it when young with his father looking for indigenous artefacts, and now wished to know its identity, so he asked a botanical friend who also happened to know John and Anita. He was told he lived next to those who knew more about those violas than anyone else - the Watsons! When they got to know the location, a remarkable close-set group of unique bare clay habitats, they discovered three new species, one the delightful dwarf *Alstroemeria piperata* [fig.79] (Watson and Flores 2018), the other pair still awaiting publication. It's partly in recognition of this significant legacy for botanical science that the new species bears his name.

But the original intention for the specific epithet was *C. gibbosifolia*, referring to the unusual and almost unique leaf formation for a cistanthe. John and Anita encountered the shock news of his death by e-mail while in England visiting their daughters. Apart from being phenomenally active, he was only 46. But unfortunately he'd chain smoked from his teens onwards. Enough said. The Watsons had been looking forward to years to come of cooperation, with him as their legs and eyes and them as his botanists. But alas, it was not to be. The best laid plans ... (an appropriate quote for Scottish Rock!).

The species is endemic not only to Chile [fig.2], but also to that country's Valparaiso Region [fig.3]. Type locality 'A' is situated 25 km due east from Los Andes towards the Chile/Argentina border in the upper Aconcagua River valley, which is hemmed in on both sides by two parallel lateral Andean ranges [fig.4]. The other known location of *C. celedonia* lies well to the SSW - 'B' in the Reserva Ecológica Oasis de La Campana [figs.3, 4]. The two locations are remarkably far from one another, the approximate distance between them being: 70 km [fig.4]. This indicates with little doubt that there must be further undiscovered populations connecting them in unexplored parts of the E-W foothills, probably a significant number.

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fig.2: Southern South America, Chile. Valparaiso Region - where *Cistanthe celedoniana* (circled cross) is endemic - arrowed and marked red.

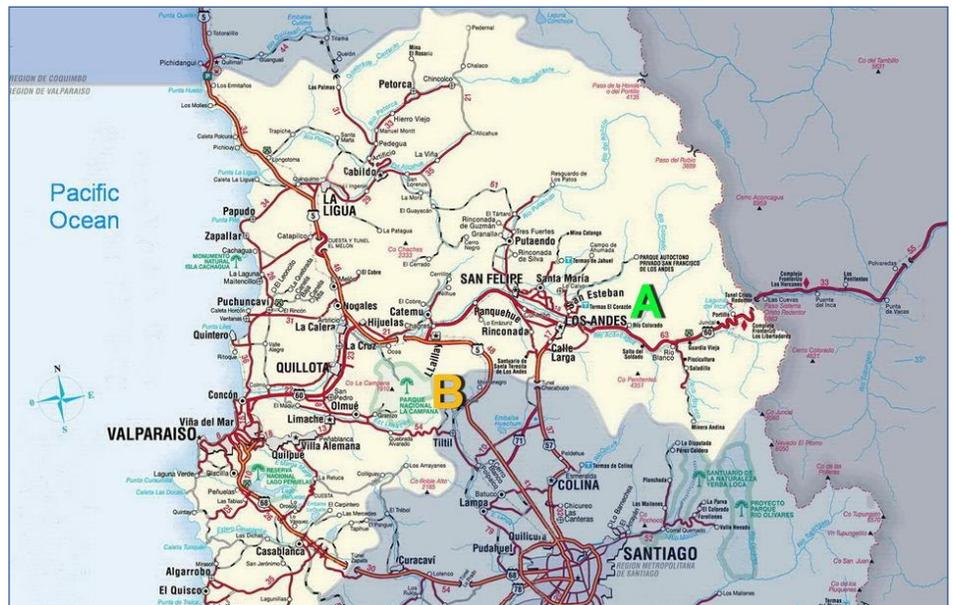


fig.3: Valparaiso Region and the two distinct known locations of *Cistanthe celedoniana* there, A, the type, and B, La Campana. (Courtesy of Touristel, Chile)



fig.4: Type location of *Cistanthe celedoniana* as asterisked green circle and Christian's as asterisked orange circle. (Courtesy of Google Earth)

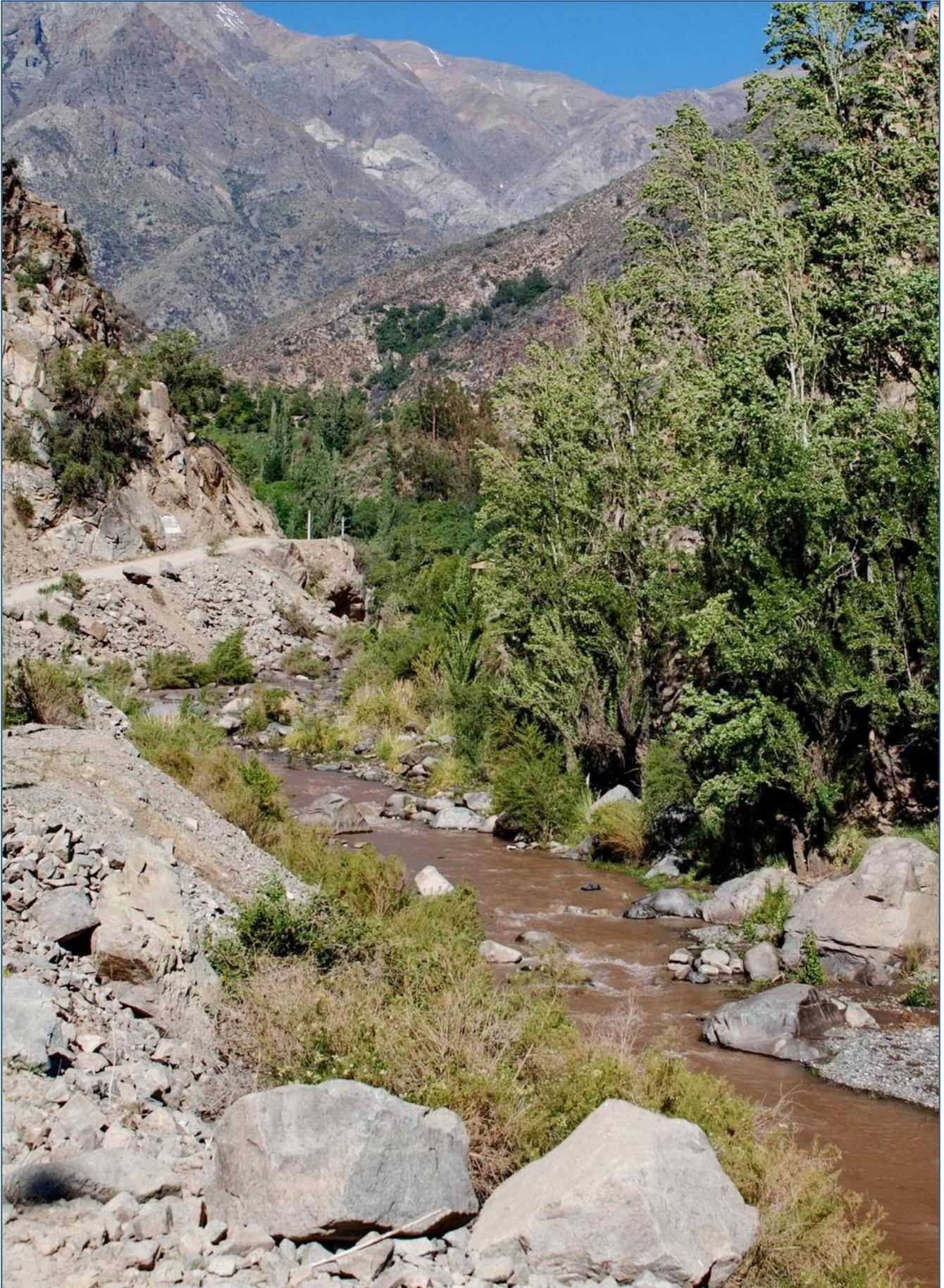


fig.5: The lower Río Colorado seen from the approach road to the river crossing, with the cistanthe type site beyond. (3 Nov 2020. JMW)

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Following the little red river

Natural water courses in Chile which become reddish brown with mud, at least when in full spate, are often called Río Colorado. One such, a large tributary draining down from the Santiago Andes is very well known. But there is a picturesque much smaller Río Colorado closed in by steepish valley sides which flows swiftly from north to south down through the foothills [fig.5] and joins the main Río Aconcagua 25 km to the east of Los Andes and higher up. In fact it's so small it might get called a stream in Britain. On its west bank runs a narrow dead-end adopted road, just about wide enough for two reasonably sized vehicles to pass in most places. It ends its availability as a public thoroughfare after just over two kilometres, when it continues on the east bank as a private unmade access track to a small mining operation [fig.17]. Occasional modest country dwellings are scattered along the way on both sides of the tarmacked stretch. Trees clothe the immediate surrounds of the water in most places, and - if cars can be left in roadside clearings above - it's a favourite picnic spot where people scramble down to level shady spots by the waterside. *C. celedoniana* is reached by following the public road to its limit, obtaining permission to cross the bridge over to the shrub-clad eastern side, walking or driving along the private track for about two and a half kilometres to where the lower, type, population was found in 2012. [figs.19, 20].

Carlos didn't drive, his family had no car, so he used to hitch-hike to his footslog starting points, in this case the small settlement of Río Colorado at the confluence outlet of the tributary of that name, 25 km east of his home. By good fortune he managed to get consent from the owner of the house by the bridge and she opened the gate for him to carry on up along the private track. Although a much shorter sortie and a more level one by far than was his usual wont, it was one of three he visited to yield species new to science.

The only one of us four to have seen *C. celedoniana* in situ is Christian. Nevertheless, John and Anita have travelled up its Río Colorado access road on a number of occasions, including as recently as early November of this year (2020). On several occasions they have carefully passed and greeted traditionally clad and friendly huasos on horseback [fig.6]. They have also carefully noted and photographed all the flora as depicted and described herein, where the taxa are arranged from the first encountered near the start to that seen nearest the public thoroughfare's dead end.

fig.6: A friendly huaso (traditionally dressed Chilean 'cowboy') met along the Río Colorado road. (30 Aug 2020.JMW).



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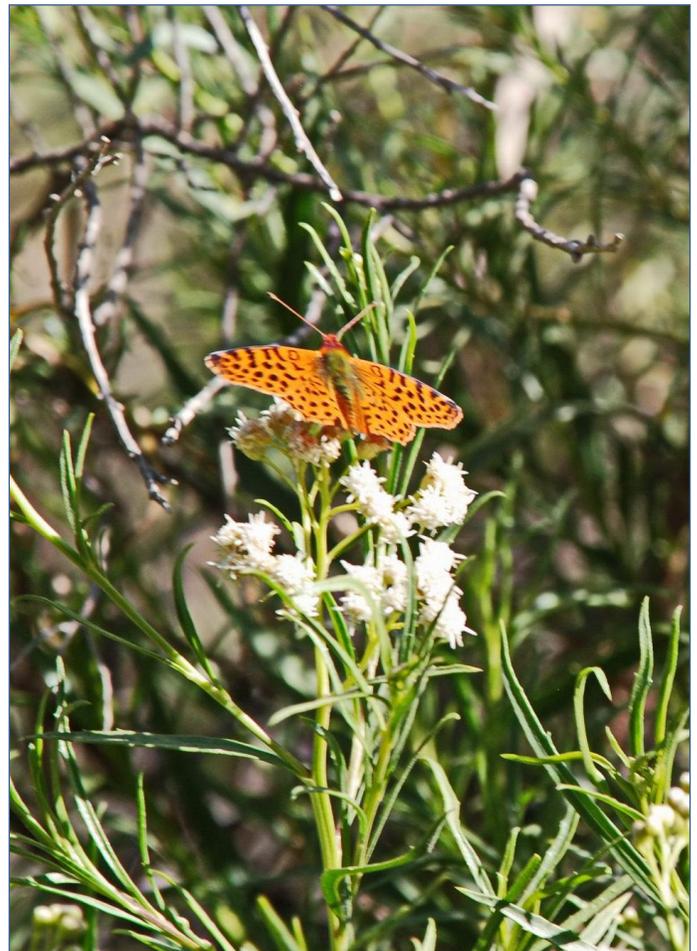


Alstroemeria pulchra subsp. *pulchra* [fig.7] was the first to be seen along the way, but appeared here and there for almost the full extent of the road. Over and above its register in five central regions, making it one of the commonest of the genus in Chile, it has excelled itself this year, appearing in astonishing quantities, especially along the coast. The low, white flowered composite shrub *Baccharis salicifolia* [fig.8], with its bunched inflorescences like tiny untidy brushes, lined the roadside towards the river abundantly here and there, and its late flowering attracted many butterflies of at least three species. One of these was the fritillary *Yrameae cytheris*, [fig.8], whose caterpillars, like all those of its small genus, feed exclusively on violas. It therefore informed the Watsons that those plants, their main focus of study, must be nearby - but none were seen ... then.

fig.7: *Alstroemeria pulchra*, scattered along the higher, more exposed W wayside of the river valley. (31 Oct 2020. ARF)

fig.8: *Yramea cytheris*, the southern fritillary butterfly, on *Baccharis salicifolia*. The fritillary larva feeds on violas. (3 Nov 2020. JMW)

Attractive, familiar *Calceolaria polifolia* [fig.9], a neat, dwarfish shrublet with whitish grey leaves covered densely in short hair, sought higher, drier, shallow rocky inclines - exposed and with little or no competing flora. Another identically sized and equally compact shrublet with pink flowers occupied the same habitat, but the two were never seen together. That second species belongs to a small family endemic to South America below the equator, one which probably nobody who grows plants will have heard of - the Francoaceae. It's also a member of an equally small genus, *Viviania*. Curiously, flowers of these fairly similar pink or white species have five petals, dry, even when fresh, so if they are picked and not put in water, they will still make an everlasting bunch in a small vase. Their main drawback, as can be seen from the photos here, is their untidy-looking inflorescences. The one in the Río Colorado valley is *V. marifolia* [figs.10, 11].



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fig.9: *Calceolaria polifolia*, one of Chile's few small shrubby species, on the upper, exposed roadside bank. (3 Nov 2020. JMW)



fig.10: Another small shrublet, *Viviania marifolia*, in the identical *Calceolaria* habitat. (1 Nov 2020. JMW)



fig.11: A close-up of the papery flowers of *Viviania marifolia*. (7 Nov 2020. ARF)

fig.12: *Haploppapus velutinus* is fairly common at mid-elevations in the upper Aconcagua valley. (7 Sep 2020. JMW)

We're now getting close to the point where the public road ends and continues as a private track across the other side of the river via the small bridge. In that ultimate stretch three petaloid species and two pteridophytes were seen. The first of the flowery trio, *Haploppapus velutinus* [fig.12], a composite, hadn't been seen anywhere before by John and Anita, although it has turned up this season almost everywhere they explored in their sector. However, *Haploppapus* are umpteen and legion and not easy to identify unless one deliberately spends time doing so. This species was a brute to photograph. It produces flower heads in a long succession. The first to appear are few and scattered. When enough have opened to fill a frame effectively those earlier ones have shrunk to unsightly brown, shrivelled blobs, so the only recourse is to 'dead head' the plant thoroughly, otherwise it's a case of just photographing the natural mess!



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fig.13: The well-known *Tropaeolum tricolor*, here in unusual prostrate mode. (30 Aug 2020. JMW)



fig.14: Although recorded from 7 regions up to 2600m, *Adesmia mucronata* doesn't appear to be common. (30 Aug 2020. JMW)

Familiar, common and hummingbird-adapted *Tropaeolum tricolor* [fig.13], with little doubt the most widespread of its genus, has a north-south range of some 2350 km and occurs laterally from near sea level to 2800 m in the Andes, yet remarkably is confined within Chile! It's particularly abundant in the upper Aconcagua Valley sector, where it may be seen draping shrubs and fences by the wayside. Often *T. azureum* grows mixed in with it, but that plant is one of three of their subsection *Chilensia* not to have produced a hybrid, the others being *Tropaeolum austropurpureum* and *T. kingii*. The latter has never been seen with another tropaeolum anywhere near, so hybridization is out of the question. The reason for the failure of the other two to cross with adjacent species is straightforward and obvious. Their markedly different blue-range colour from the rest (which are yellow or red) attracts distinct pollinators, various bees, which do not visit the other colour range any more than the hummingbirds visit the blue or purple flowers. Both species are established in cultivation, and we hope one day someone may try

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crossing them artificially. *T. tricolor* at Río Colorado was interesting to record in that it frequently trailed over the ground, something rarely seen elsewhere. The last species encountered in bloom was a very attractive, erect, herbaceous *Adesmia* with an open spike of typical yellow pea blossoms. Again it was new for the Watsons, and after considerable research they managed to identify it as *A. mucronata* [fig.14]. But difficulties of identification were as nothing compared with trying to photograph the tricky customer between the strands of a barbed-wire fence in the fading light of dusk. To make matters worse, it was way down the bank beneath trees. Both of them took heaps of photos and fortunately one, just one, proved of sufficient quality for publication here.



Of the two ferns we can say little except to identify them. They aren't our speciality, but we know just enough about pteridophytes to assign them to genus level, then sort them out to species level by looking up those genera in our literature and on the Internet. One is *Adiantum chilense* [fig.15], the other *Cheilanthes hypoleuca* [fig.16]. Both were photographed by Anita growing together beneath cool rock overhangs, and clearly did not receive direct sunlight.

fig.15: *Adiantum chilense*, one of the country's most plentiful ferns. (30 Aug 2020. ARF)



fig.16: Another frequent pteridophyte in the Río Aconcagua valley is *Cheilanthes hypoleuca* - here a glaucous form. (30 Aug 2020. ARF)

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fig.17: Looking across the river at the private land to the E, where the new cistanthe was found. (3 Nov 2020. JMW)

From this point, apart from a photo of the private sector, including its notice, taken across the stream on the other side by John [fig.17], we continue perforce with descriptions and photos provided for us by Carlos before he died. On crossing the river he continued to follow its upper course along the track on the east bank. We know little directly about the flora of that sector, except that *Tetraglochin alatum* [fig.18], an unusual shrublet of the Rosaceae, is fairly abundant there. He walked on towards the mountains above [fig.19] through terrain covered by shrub cover and boulders, punctuated by occasional *Echinopsis chiloensis* cacti looking like exclamation marks in the landscape. After continuing for two and a half kilometres without seeing anything of interest, his attention was suddenly caught by several dwarf plants with white flowers growing on an extensive bare, horizontal strip of loose, sandy terrain. He'd discovered the type site of his *Cistanthe celedoniana* [fig.20]!

For the next two years, the last complete ones of his all too short life, Carlos continued on further up the valley towards the snow-capped peaks above and found another population of 'his plant', adding more photos of it [e.g. figs.67-70]. By great good fortune he also photographed a plant of the accompanying flora in flower, *Viola pusilla* [fig.21], a small, yellow-flowered endemic annual rosulate viola with loose foliage, which is plentiful throughout central and central northern Chile, with a considerable extension to the south. It inhabits the littoral and inland areas to the Andean foothills at 1500 m. This detection by Carlos is particularly gratifying for the Watsons, whose principle focus of study is the Andean violas, as it explains the presence in the valley of the monophagous fritillary butterfly *Yramea cytheris* [fig.8]. Fritillary caterpillars only consume plants of that genus.

But Carlos left a further clue in a photograph he took there showing several other Andean herbs yet to flower growing close to a small cistanthe [fig.22]. We've managed to identify one to species level, the very variable *Cristaria dissecta* [fig.23]. It can be tall or short, glabrous, as here, or covered in

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indumentum. Perennial calandrinias are familiar enough to those who've visited South America or read several of the many accounts of travels and explorations there. A few are even in cultivation. Much less well known are the several quite different annuals of the genus, five of which occur in Chile. We've been unable to fully identify the one not yet flowering [fig. 22]. *Cistanthe grandiflora* [fig.70] might be seen as a Gulliver of the genus, whereas *C. celedoniana* is one of its Lilliputians. We believe the small, glaucous-succulent, innocent-looking, recently germinated plant with broad leaves [fig. 22] cannot be anything but the former. It's alarming to realise that if this great dominant 'bully' were to colonise the sandy stretch it would probably extinguish all the small plants there, including *C. celedoniana*.

fig.18: *Tetraglochin alatum* is one of the shrubby elements of the general cistanthe habitat. (8 Aug 22013. Marijn van den Brink)



fig.19: Nearing the type location of *Cistanthe celedoniana*. (5 Oct 2014. Carlos Celedón)

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fig.20: *Cistanthe celedoniana* at the type site on the day of its discovery. (30 Sep 2012. C. Celedón)



fig.21: The early flowering annual *Viola pusilla*, the only plant that Carlos saw immediately accompanying *Cistanthe celedoniana*. (5 Oct 2014. Carlos Celedón)

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fig.22: A small *Cistanthe celedoniana* (in flower, far right) and accompanying taxa out of flower. (5 Oct 2014. Carlos Celedón)

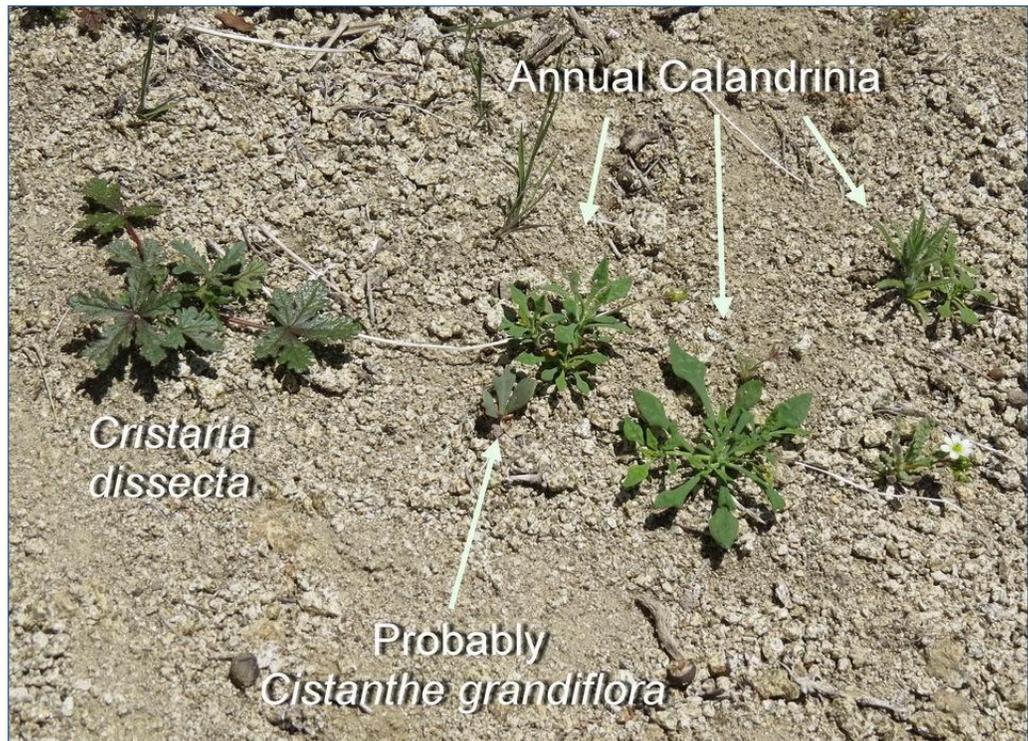


fig.23: *Cristaria dissecta*, seen as a glabrous form in leaf by the cistanthe, here in its taller, hirsute form. (5 Sep 2020. JMW)

That covers all we know about the relevant fieldwork of Carlos, but Christian can add valuable detailed information and illustrations of the flora that grows near, or in the immediate vicinity of his location of *C. celedoniana* in the Reserva Ecológica [figs.24, 25], albeit very distant from Río Colorado.

Slightly lower down from the cistanthe populations, a most unusual member of its genus was noted in flower. *Malesherbia fasciculata* [fig.26] from an equally unlikely herbaceous genus of the Passion flower family ranges from Peru to Chile and Argentina and is mainly Andean - with a few along the central and northern temperate Pacific coast. *M. fasciculata* looks even less like a passion flower, or indeed like other taxa of its genus, as its relevant unique morphology consists of a tightly compressed head of many very small flowers.



fig.24: *Cistanthe celedoniana* habitat at the La Campana National Park.
(18 Nov 2020. Christian von Bohlen)

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fig.25: A more immediate view of a La Campana National Park *Cistanthe celedoniana* habitat. (18 Nov 2020. C. von Bohlen)



fig.26: *Malesherbia fasciculata*, a very atypical member of its genus. They usually have much larger, separate flowers. (22 Aug 2018. JMW)

At the north-exposed lower site (965 m) the Reserva shares with Río Colorado the presence of an annual *Calandrinia*, also not yet identified for certain, and five more taxa besides. *Montiopsis trifida* [fig.27] is the most plentiful and widespread of its genus by far, but despite inhabiting the length of Chile - bar the extreme south - from near the coast to 3300 m in the high Andes, it's again endemic. In common with *C. celedoniana* and most or all of that species' immediate accompanying flora it's an annual, as per the rather less frequent congeneric species, *M. ramosissima* [fig.28], another endemic, which accompanies them both in the Reserva locality.



The last three we know which grow in the immediately lower vicinity of *C. celedoniana*, again annual and Chilean endemics, are far less widely known. All occur in the same three central regions, two of them extending a bit beyond. *Calycera sessiliflora* [fig.29] belongs in the homonymous family, which is restricted in distribution to the southern end of South America. Systematically, Calyceraceae is closely related to the composites and teasels, not least for its tightly bunched, multi-flowered inflorescences. *C. sessiliflora* has a fairly limited elevational range from 700 to 1900 m.



fig.27: *Montipopsis trifida*, quite often seen by the authors in the general vicinity of their homes.
(22 Oct 2015. JMW)

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fig.28: *Montiopsis ramosissima*, easy to tell from other species of its genus by the prostrate radiating inflorescence 'spokes'. (Photo courtesy of Peter Peterson)



fig.29: *Calycera sessiliflora*, one of the less spectacular of the 'Andean cauliflowers'. (Photo - Michail Belov)

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fig.30:
*Homalocarpus
dichotomus*
(Apiaceae),
neatly midway
in stature
between
hemlock and
azorellas.
(Photo -
Michail Belov)



fig.31: *Microphytes minima* (Caryophyllaceae). This representative of a little-known genus looks perennial. Sadly, it isn't. (Photo - Patricio Novoa)

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A very dwarf and attractive species of the large family Apiaceae, *Homalocarpus dichotomus* [fig.30], would surely appeal to alpine gardeners. Along with delightful little *Microphytes minima* [fig.31] of the Caryophyllaceae, the final species known to the present authors which shares the immediate lower habitat of *C. celedoniana*, it too reaches alpine levels. *Microphytes* makes one want to pick it up and stroke it. Without doubt, if available it would be an even greater desideratum to add to the choicest alpiners in cultivation (sad it's only annual though). Curse all those who've put an end to responsible (and we mean responsible) plant introduction! Would private vehicles be banned because there are bad drivers and accidents, including when public figures are killed? Over time plants in general cultivation have undeniably added greatly to botanical knowledge and significantly extended ex situ conservation (Watson 2009).



fig:32: *Argylia adscendens* var. *adscendens*. A remarkable location of this usually Andean taxon at its lower elevation limit. (17 Oct 2020. C. von Bohlen)

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The higher site at 1603 m faces west. It possesses the flora of the lower site, but with the addition of two perennials, both of which are more frequent and familiar at significantly higher elevations in the main Andes to the east. Variable *Argylia adscendens* [fig.32] (Bignoniaceae) with its large broad lobed, wide-tubed corolla, as well as the hummingbird adapted, tubular red amaryllid *Zephyranthes tenuiflora* [fig.33] are further frustratingly mouth-watering desiderata.



fig.33: Handsome *Zephyranthes tenuifolia* is better known by its synonym *Rhodophiala andina*.
(17 Oct 2020. C. von Bohlen)



fig.33:
Type specimens
of *Cistanthe
celandoniana*
(A. Elvebakk)

Taxonomy (1)

Cistanthe celedoniana J.M. Watson, A.R. Flores & Elvebakk, sp. nov.

[figs.20, 33-61, 66]

Type: CHILE, Región de Valparaíso: Provincia de Los Andes, N side of Río Aconcagua Valley, 22 km E of Los Andes, ca. 5 km NE of Río Colorado, 32°50'S 70°21'W, 1360 m, 30 Sept. 2012, leg. C. Celedón, F& W 12801 (holotype CONC! isotypes CONC, SGO!).

Diagnosis:—The taxon described here differs from all other species of *Cistanthe* by its strongly and regularly gibbose leaves, together with the combination of white petaloids, sepaloids equal in length to the petaloids, and its regularly mottled seed indumentum.

Description:—Annual, rosette-forming subcaulicous, glabrous herb, branched basally into 2–10 lax, fertile shoots, forming plant 5–15 cm wide and up to 15 cm tall from fusiform tap-root to 10–12 cm long and 3(–5) mm diam. Leaves thickly succulent, glaucous, margins sinuous; strongly gibbose, gibbae 3–4 mm wide × 1–2 mm high formed pairwise, at times obliquely so, on adaxial surface only, these developed on all leaves; base decurrent, subamplexicaul; apex rounded, tip acute to apiculate, occasionally reddish brown in some allopatric populations. Rosette leaves 15–40 × 5–10 mm, simple, linear-oblongate, acute; cauline leaves similar, but shorter and narrower. Stipules 3–4 × 2–3 mm, amplexicaul, entire, triangular, apex acute, striated with black irregular lines, becoming hyaline. Inflorescence ca. 3–3.5 cm, thickened basally, dark maroon-red apically, at times branched, with 3–10 flowers in terminal, lax racemes; basal node sterile, 1-bracteose, 3–7 floral nodes with 2 unequal bracts; peduncles arranged radially, 5–10 × 2–3 mm, at anthesis ascending to erect diurnally, prostrate nocturnally. Pedicels to 6 mm, ascending to erect diurnally, prostrate nocturnally. Flowers perfect. Sepaloids 5–6 × 6–7 mm, comprised of 2 unequal involucral bracts embracing the petaloids in a form equivalent to sepals, non-keeled, strongly concave, broadly ovoid, apex acute with rounded tip, intense green, strikingly and densely black-mottled and lined, partly along mid-vein, partly irregularly; black markings very rarely absent, persistent. Petaloids 4–7 × 3–5 mm, 6–7, occasionally as few as 5, arranged radially and symmetrically, free, imbricate basally, obovate, obtuse, emarginate, with apical indentation 0.5 mm deep, pale greenish white with yellow base. Stamens free, 7–14, 3 mm long; filaments yellow, gradually flattened towards 0.5 mm wide base; anthers 0.4–0.5 mm, dorsifixed, yellow, pollen orange. Pistil superior, equal to or shorter than the stamens, syncarpous. Ovary ca. 2 mm long × 1 mm diam., globose-ovoid, unilocular, placentation central, greenish-yellow at anthesis; style 0.5–1 mm long, pale green; stigma opening into 3 oblong greenish lobes, finely papillose. Fruit septidial capsule 5–6 mm, with 19–23 seeds part-concealed by persistent sepaloids, ovoid, dehiscing longitudinally as 3 papery valves, these pale brown, nerves well marked. Seeds resembling a snail shell, 1–1.4 mm diam., lenticular to subglobose, weakly compressed, outline subcircular to reniform, pale brownish yellow with outer circular marking radiating blackish brown lines to margin, densely covered in minute transparent indumentum. Elaiosomes present, c. 0.3 mm wide, pale ochraceous.

Additional specimens studied, including of related taxa:—*Cistanthe celedoniana* J.M. Watson & A.R. Flores. CHILE. Valparaíso Región, Provincia de Quillota, Palmas de Ocoa, Reserva Ecológica Oasis de La Campana, sendero La Chusquilla, en terrano con suelo de maicillo, ladera exposición norte, 32°56'28"S 71°01'52"W, 965 m, 5 Oct 2020, von Bohlen 2501 (paratypes CONC, SGO); *Cistanthe arenaria* (Cham.) Carolin ex Hershk. CHILE, Coquimbo Region, Chungungo, 20 m, 15 Sept. 2008, M. Belov Z8226 (TROM); *Cistanthe crassifolia* (Phil.) Carolin ex Hershk. CHILE, Atacama Region, Carrizal Bajo, 5–100 m, 30 Oct. 2008, M. Belov 1190 (TROM); *Cistanthe grandiflora* (Lindl.) Schlecht. CHILE, Maule Region, Laguna Maule, 1300–2100 m, 2 Sept. 2006, M. Belov 0161 (TROM).

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Distribution:— All known populations are confined to the Chilean region of Valparaíso. As seen by the Watsons the type site and one other are situated in the Andean foothills beside the Río Colorado, a tributary of the upper Río Aconcagua, on gently west sloping terrain at 1360 m and ca. 1500 m on the north valley side of the Río Colorado where it passes down through the Andean foothills. The locations discovered by von Bohlen face north (lower) and west (upper), being ca. 70 km distant to the SSW of Río Colorado and situated in the hills of the Reserva Ecológica de La Campana at 965 and 1603 m on a gradient of 30° and with north and west exposures respectively.[figs.2-4]

General and immediate flora at cistanthe habitats:— The overall vegetation cover of the two known locations is classified by Gajardo (1994) as Matorral Esclerófilo (Mediterranean esclerophyll shrub land), and consists of biodiverse and widely dispersed low xerophytic taxa, including *Baccharis paniculata* (Asteraceae), reduced forms of *Lithrea caustica* (Anacardiaceae), *Kageneckia oblonga* (Rosaceae), *Podanthus mitique* (Asteraceae), *Tetraglochin alata* (Rosaceae) [fig.18], *Trevoa trinervis* (Rhamnaceae) and others. Taxa of *Haplopappus* and *Senecio* (both Asteraceae) have not been identified to species level. The cactus *Echinopsis chiloensis* was also observed.



fig.35: A pressed flower of the type specimen of *Cistanthe celedoniana*. (A. Elvebakk)

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Both populations at Río Colorado and the two at the Reserva inhabit extensive almost bare stretches of deep, fine to coarse grained and compacted but readily permeable sand. At times it is interspersed with occasional small rocks. The *Cistanthe* and its accompanying flora were scattered over this terrain. The latter consists of *Calandrinia* sp. (Montiaceae) [fig.22], possibly another *Cistanthe* sp. [fig.22], *Cristaria dissecta* (Malvaceae) [figs. 22, 23], and *Viola pusilla* (Violaceae) [fig.21] at least, according to what can be seen on the photographs of Celedón. The accompanying Reserva flora has been surveyed and identified more thoroughly, and as seen consists of *Calandrinia* sp (Montiaceae), *Calycera sessiliflora* (Calyceraceae) [fig.29], *Homalocarpus dichotomus* (Apiaceae) [fig.30], *Malesherbia fasciculata* (Passifloraceae) [fig.26], *Microphyes minima* (Caryophyllaceae) [fig.31], *Montiopsis ramosissima* [fig.28] and *M. trifida* (Montiaceae) [fig.27] at the lower site, with the addition of *Argylia adscendens* [fig.32] and *Zephyranthes tenuiflora* [fig.33] at the second higher up. There is a significant difference in the composition of the relevant floras at both the above locations, and this may well apply to any others found in future, which are equally distant.

Phenology:— Based on observations in the wild and in cultivation, we deduce that anthesis commences in September and continues into November, with seed dispersal following at a short interval after each individual flowering.

Etymology:— This species is named in memoriam for our late friend and amateur naturalist Carlos Celedón (1969–2015), and also commemorates his significant botanical achievements. He was an indefatigable field explorer who discovered the present new species as well as another and provided us with plant material, information and photographs. Regrettably he passed away at much too early an age.

Considered conservation status:— The two populations known to the authors contain relatively few individual plants. The type location apparently comprised ca. 50 when visited, and the nearby higher second population fewer, perhaps no more than 30, both populations close-set (C. Celedón, pers. comm.). Its known extent of occurrence (EOO) would be about 2-3 km, its total area of occupancy (AOO) being linear, can scarcely be any wider. The number of observed plants was therefore somewhat fewer than 100 individuals.

The Reserva Ecológica de La Campana location, 70 km distant, consists of two closely separated populations, the lower of which is estimated to contain at least 40 to 50, and the higher 25 to 30 individuals of *C. celedoniana*, (C. von Bohlen pers. obs.). Although situated in a private nature reserve, there is no guarantee of assured, permanent protection.

Given the close similarity of these statistics at both these very widely separated main locations, perhaps adding up to slightly more than 200 individuals between them over an EEO of 70 km, it seems reasonable to assume that any undiscovered intermediates or extensions of the species' range would be similarly composed and disposed. Accordingly, by applying IUCN Red List criteria and guidelines (IUCN 2012), a conservation status of CR (critically endangered) based on present knowledge is proposed here.

Seed morphology

All *Cistanthe* species studied have a black, glossy surface with irregularly hexagonal and weakly convex areoles, separated by a tissue forming a reticulate network of distinct and strongly convex lines ca. 4 µm wide. In *C. celedoniana* [figs.52-61, 66] the 15–20 µm wide areoles consist of a central plate of concentric structures, surrounded by transparent tissue, resembling a fried egg. The central part of a scale produces a trichome, first papillose and brown, later conical-spathulate, constricted at the base and flattened, then becoming white-transparent when fully developed in the elongated part. These trichomes form dark patches of short papillose trichomes, alternating with other patches where the trichomes have white-transparent elongations. In *C. grandiflora* [figs.62, 63, 66] the areoles are

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20–40 µm wide with distinctly radiating patterns. The trichomes are digitiform, whitish and transparent, pale brown only at the base where some have weak dilations. Trichomes of *C. crassifolia* [figs.64-66] are similar to those of *C. grandiflora*. Those of *C. arenaria* are very different insofar as they possess coralloid branching.

Pollinator activity, pollination and pollen dispersal

In the field at Río Colorado ants were observed to feed frequently on nectar in the flowers. Some arrived at plants with nothing adhering to them [fig.67], but as they moved around the flowers feeding [fig.68] they became progressively covered in pollen grains, which, as they exited, covered their legs, head, thorax and abdomen [fig.69]. On entering flowers, some already had a covering of pollen, which clearly derived from visiting another corolla (*C. Celedón pers. comm.*). Thus cross-pollination of the cistanthe is achieved.

Ant pollination was reviewed by Del-Claro and coauthors (2019), who indicated that it is a rare but partly overlooked exclusive insect and plant interaction, involving plants with near-ground inflorescences, often with white flowers, and concentrated on relatively arid habitats.

Although this species is pollinated by ants, as thoroughly observed [figs.67-69], it is not exclusively so. Two beetles were also photographed visiting the flowers [fig.70] at the Río Colorado upper location. By contrast, no ant activity at all has been observed at the Reserva Ecológica de La Campana, whereas other unidentified insects were noticed there on the upwards-facing flowers of erect stems (*C. von Bohlen obs.*). These flowers are evidently positioned to attract passing arthropods on the wing.

Diurnal plant tropism

Cultivated specimens transplanted from in situ seedlings flourished and flowered freely, synchronously with their cycle in the wild, but presented some unexpected diurnal rhythms as observed several times. From late afternoon onwards until noon the following day stems were declined [figs.36, 39, 40, 43]. However, by 2 pm they had ascended [figs.42, 44]. A similar pattern can be noted in photographs taken in the wild [figs.20, 39, 40, 41]. Available seeds from the ex-situ pot plants did not germinate, so the species is no longer in cultivation to provide further observations.

Plant stems as shown in [figs.36-40, 43] may perhaps partly at least involve - or have evolved from - myrmecotrophism, defined as plant movement to attract ants. The horizontal and early morning position of the branches at ground level would place the conspicuous mottled contrast pattern of the sepaloids close to the ground and clearly visible to ants, attracting them initially to the easily accessible corollas as these are opening under the influence of light (photonasty). An erect or sub-erect branch position with its conspicuous flowers later in the day would then cater to a normal selection of pollinating insects, although ants do in fact continue to visit then (*C. Celedón, obs.*). These foliar and floral actions have been recorded from the wild as well as cultivation (*Watson & Flores obs.*), so cannot be attributed to some artificial effect of the latter. The lowering of the shoots and closing of the flowers is a nocturnal (nyctinastic) circadian rhythm induced by the onset of dusk and possibly also by reduction of air temperature.

Minorsky (2018) reviewed existing hypotheses explaining the evolutionary function of this tropism and added the idea that it might be an adaptation to protect plants from nocturnal herbivores. That could offer three possible benefits: making the plant as inconspicuous as possible; removing its stems from the erect position favoured by mammalian herbivores; and increasing the possibility of revealing arthropod herbivores to their predators. The phenomenon may well serve both these purposes at least. Interestingly, the Watsons deduced the same possibility from pure observation. Well organised future investigation is needed to discover what lies behind this remarkable adaptation.

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Left, fig.36: Wild-transferred plants in the morning prostrate position with closed flowers. (13 Nov 2014. JMW) Right, fig.37: A wild *C. celedoniana*, totally prostrate with closed flowers in the evening of a dull day. (4 Oct 2020. C. von Bohlen)



Left, fig.38: *Cistanthe celedoniana* in habitat at mid-day, part prostrate still but with flowers open. (4 Oct 2013. Carlos Celedón) Right, fig.39: Successful cultivation of plants from the wild, here rising from the prostrate posture. (12 Oct 2014. JMW)



Far left, fig.40: Wild collected individuals with flowers open in the plant's prostrate phase. (29 Oct 2014. ARF) Left, fig.41: A wild plant in the erect daytime position. (17 Oct 2020. C. von Bohlen)

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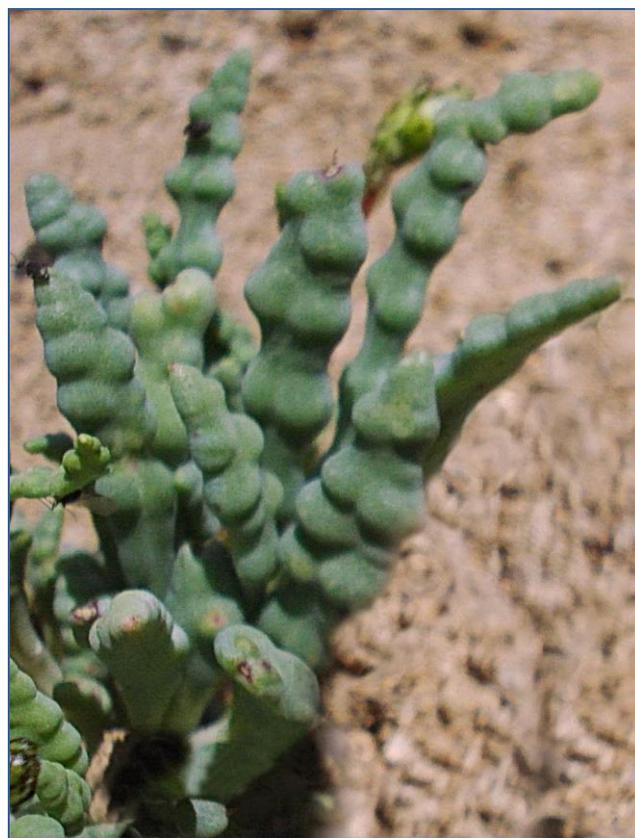
fig.42: Cultivated individual transferred from the wild in fully erect posture. (29 Oct 2014. ARF)

fig.43: *Cistanthe celedoniana*. A collected plant in cultivation showing depressed overnight pre-flowering position at 11.48 a.m. (13 Nov 2014. JMW)



Left, fig.44: *Cistanthe celedoniana*. The same cultivated individual (as in fig.43) in erect flowering position at 2.36 p.m. on the same day. (13 Nov 2014. JMW)

Right, fig.45: *Cistanthe celedoniana* in habitat. Foliage presentation and gibbose structure. (30 Sep 2012. Carlos Celedón)



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fig.46: *Cistanthe celedoniana*. Lamina, showing gibbosities and their tendency to alternate at times. (7 Nov 2014. JMW)



fig.47: *Cistanthe celedoniana* in habitat, the sepaloids typically striated. A less common cruciform corolla is evident. (30 Sep 2012. Carlos Celedón)



fig.48: Inflorescence of *C. celedoniana* from La Campana National Park the Reserva Ecológica de La Campana. Note smaller flower. (15 Oct 2020. C. von Bohlen)

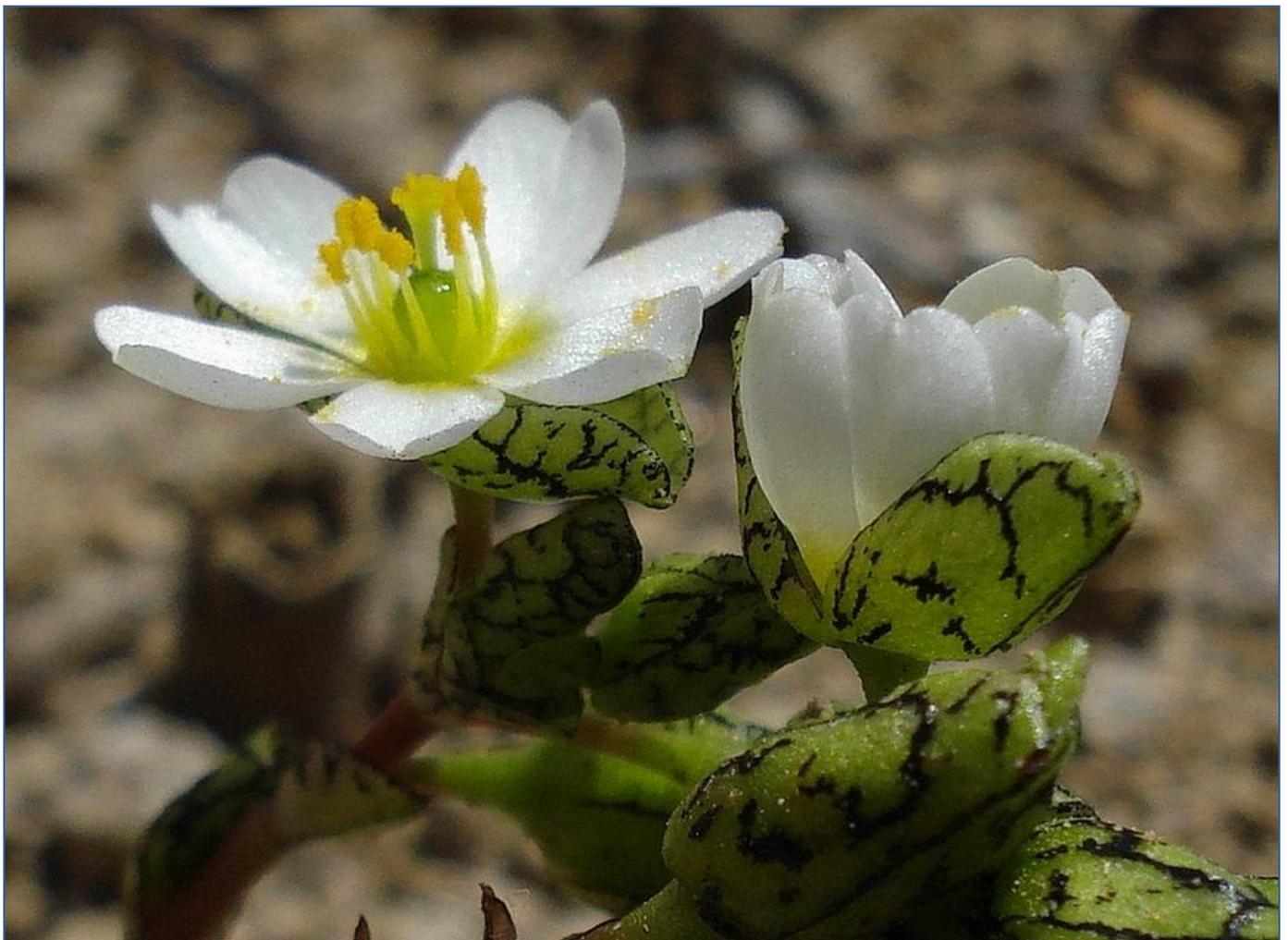


fig.49: *Cistanthe celedoniana* in habitat. Fully open and unfolding corollas, the latter showing the similar lengths of sepals and petals. (30 Sep 2012. Carlos Celedón)



fig.50: *Cistanthe celedoniana* in habitat. An atypical rare specimen with unmarked sepaloids.
(4 Oct 2013. Carlos Celedón)



fig.51: A dense inflorescence of *C. celedoniana* showing sepaloid marking and an open capsule with seeds. (15 Oct 2020. C. von Bohlen)



fig.52: *Cistanthe celodoniana* seeds.
(Photo - Mari Karlstad)

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Seed vectoring

The concurrence of elaiosomes and mottled sepaloids in most species of *Cistanthe*, as compared with absence of that morphology in neighbouring Montiaceae genera, is more probably a myrmecochory syndrome. Whether or not they have pollinated *Cistanthe* taxa in flower, it is likely that ants represent the main agents for dispersing seeds of them all. This may also be the case with the hirsute seeds of most species of the section. As outlined by Gómez et al. (2005), surface seed structures functioning as a handle may aid dispersal after the elaiosomes have been consumed by the ants, the latter a process which might also promote scarification, thereby improving germination (Hughes & Westoby 1992).

Cistanthe celedoniana apparently also has a further adaptation to myrmecochory as represented by its distinctly mottled seeds [fig.52]. This pattern is obtained by short brownish trichomes being extended into white longer forms distributed in regularly alternating patches [figs.57-61]. *Cistanthe celedoniana* would evidently be an excellent subject for future in-depth studies on interactions between plants and ants.

[The following nine images (figs.53 – 61) are of seed of *Cistanthe celedoniana*, μm (micrometre) by Arve Elvebakk.]

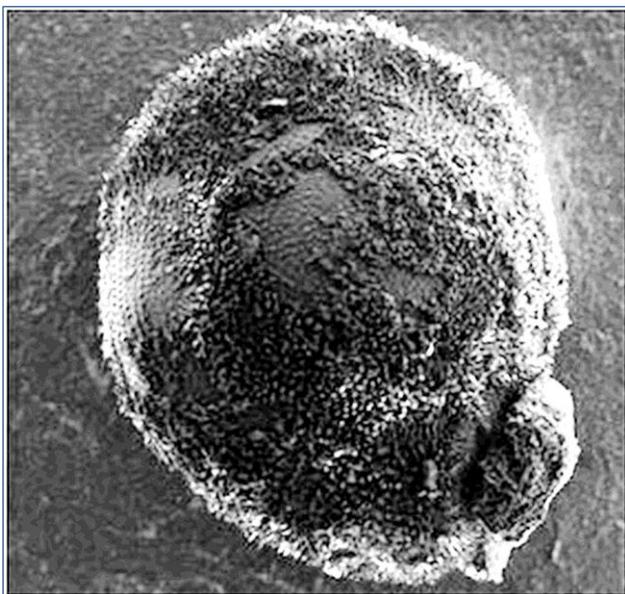


fig.53: (a) *Cistanthe celedoniana*

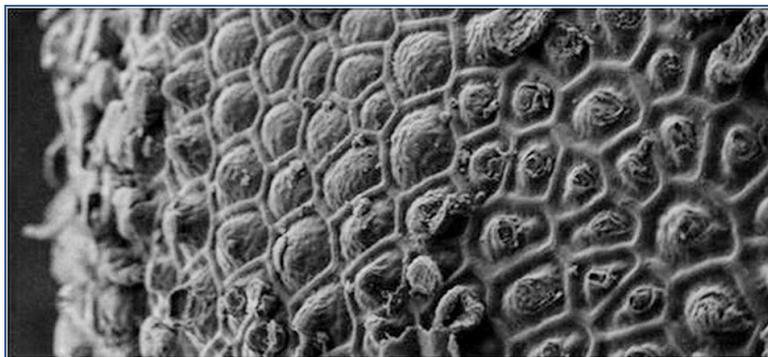


fig.54: (b) *Cistanthe celedoniana*

fig.55: (c) *Cistanthe celedoniana*

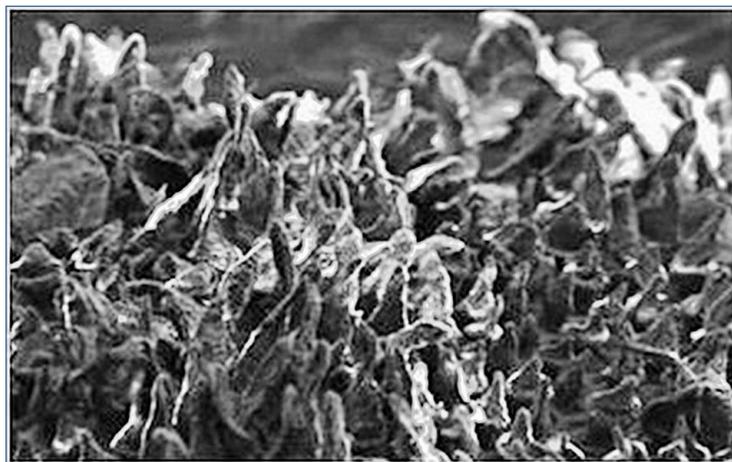
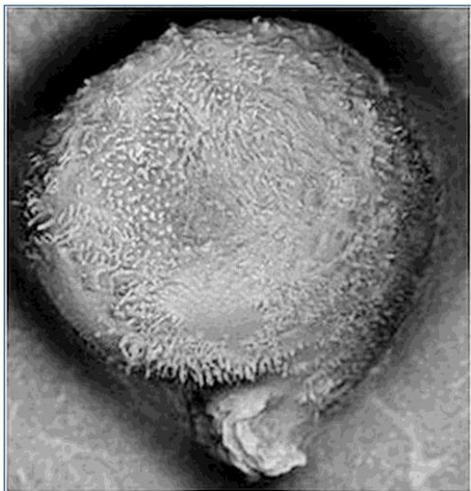


fig.56: (d) *Cistanthe celedoniana*

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fig.57: (e) *Cistanthe celedoniana*

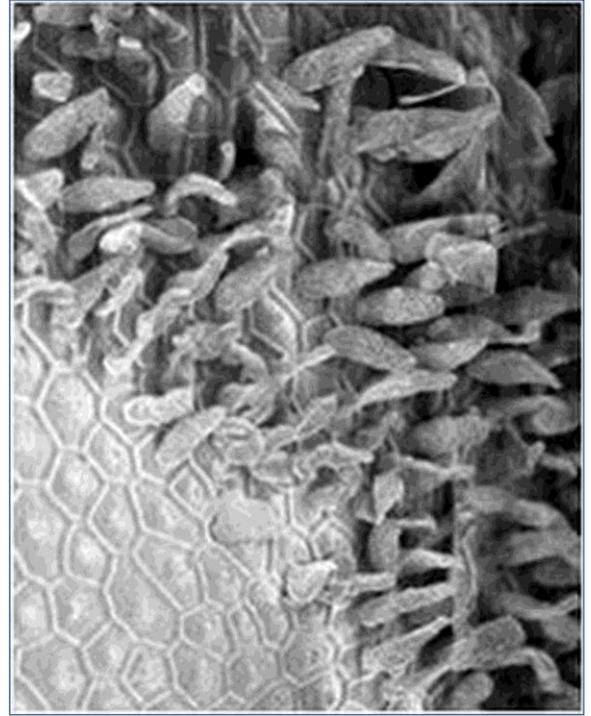
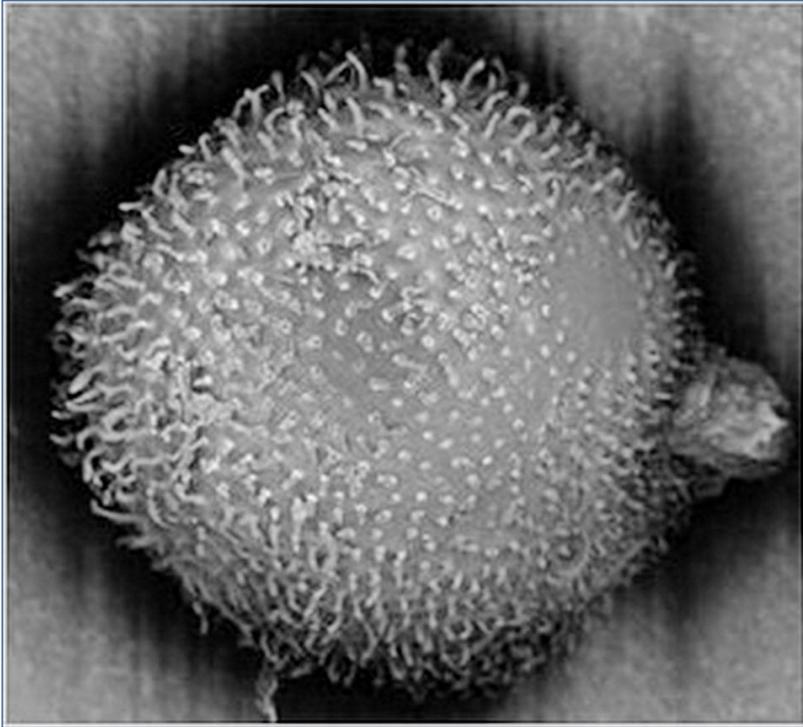


fig.58: (f) *Cistanthe celedoniana*

fig.59: (g) *Cistanthe celedoniana*

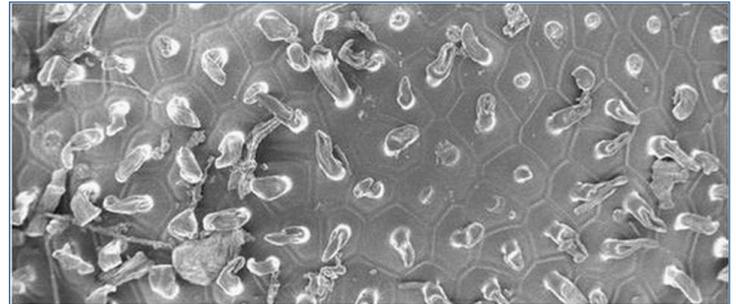
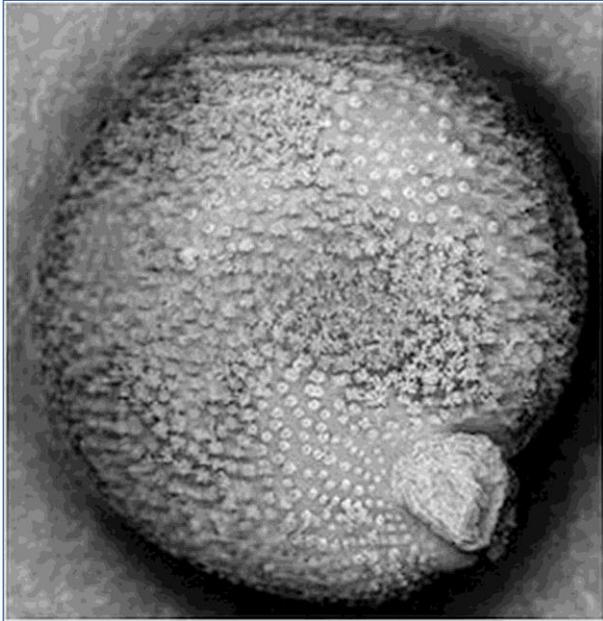
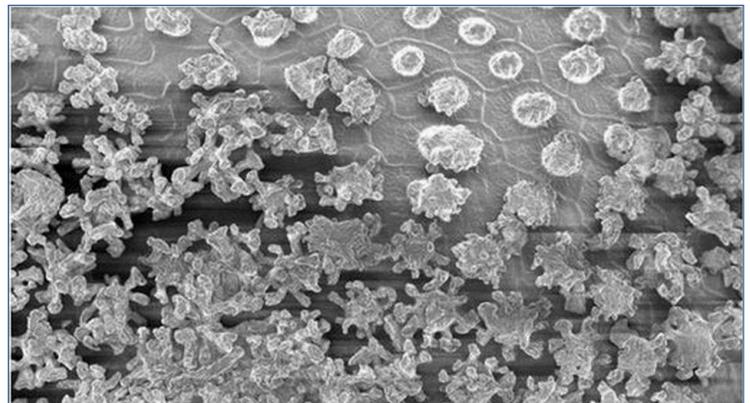
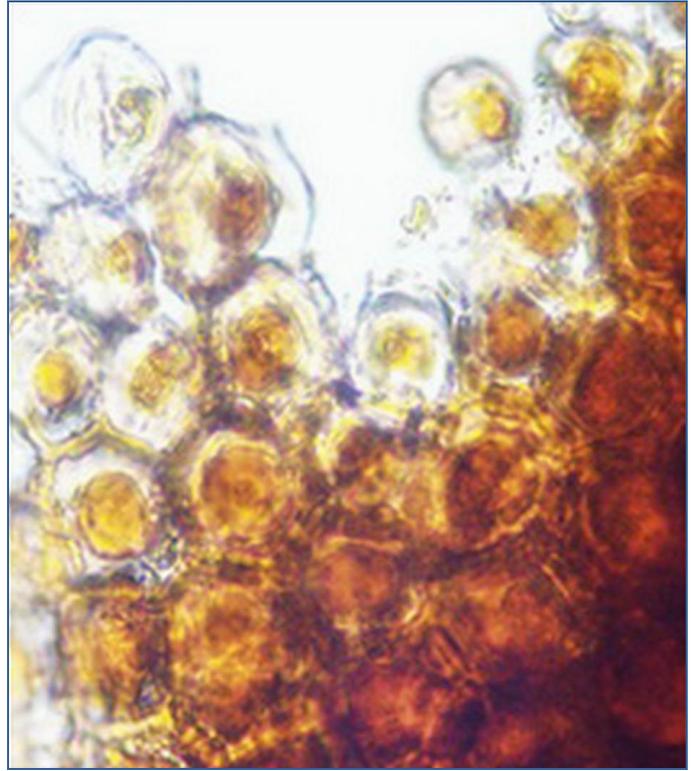
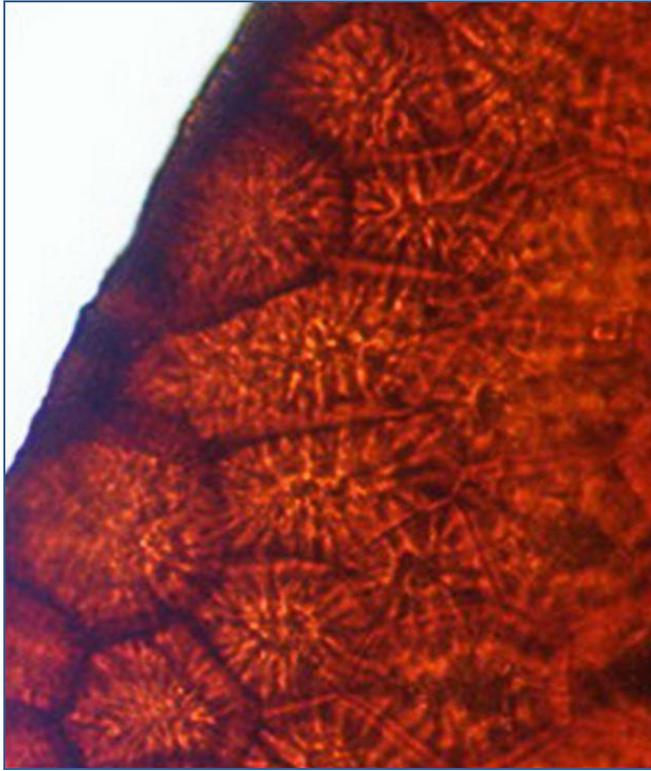


fig.60: (h) *Cistanthe celedoniana*

fig.61: (i) *Cistanthe celedoniana*



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Left, fig.62: (j) *Cistanthe grandiflora*, μm (micrometer) photograph of seed. (A. Elvebakk)

Right, fig.63: (k) *Cistanthe grandiflora*, μm (micrometer) photograph of seed. (A. Elvebakk)



Left, fig.64: (l) *Cistanthe crassifolia*, μm (micrometre) photograph of seed. (A. Elvebakk)

Right, fig.65: (m) *Cistanthe crassifolia*, μm (micrometre) photograph of seed. (A. Elvebakk)

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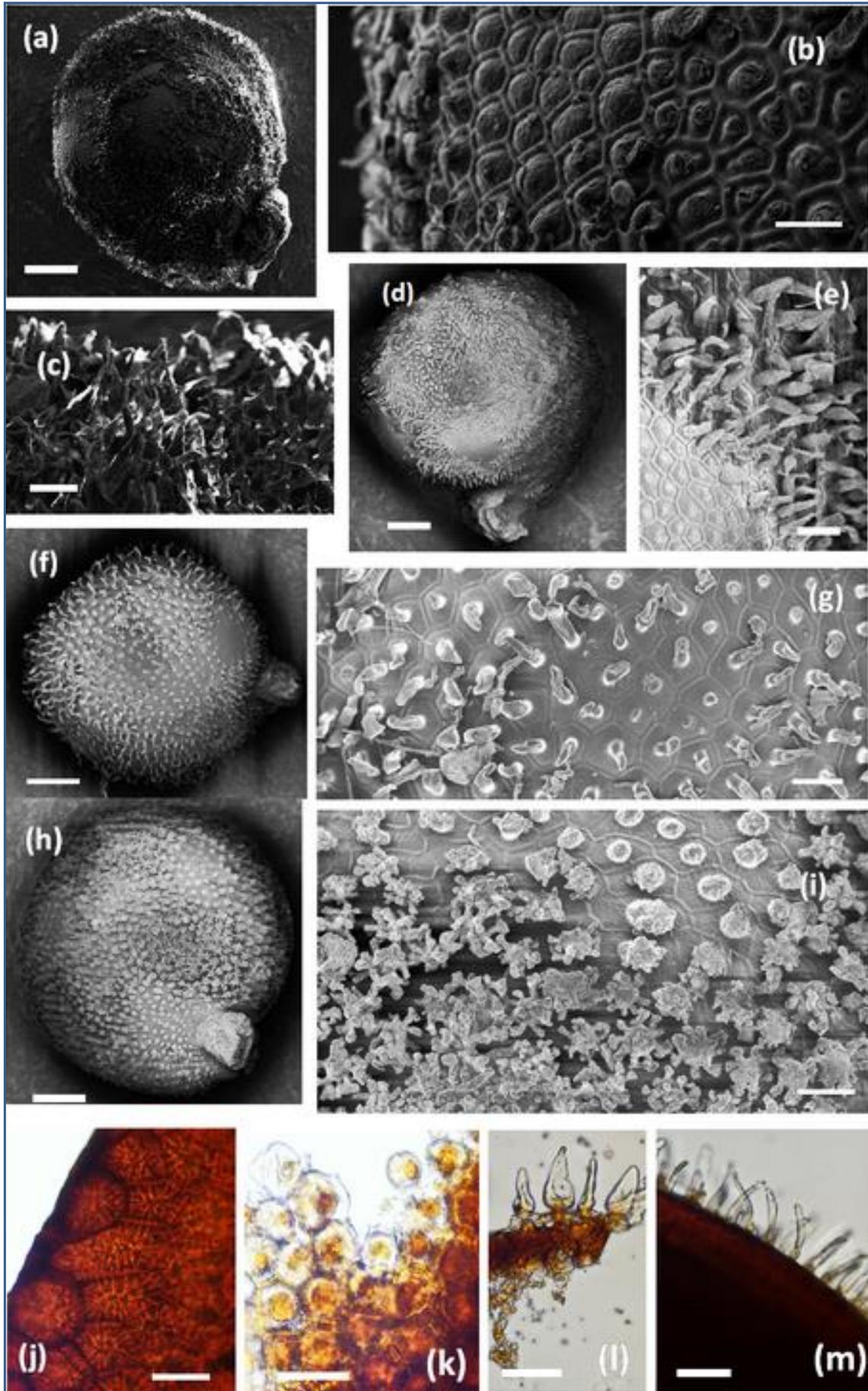


fig.66: The same figures with bars showing the scale in μm (micrometres) \sim a, d, f, h = 200 μm \sim b, c, g, i-m = 30 μm . (A. Elvebakk)

Taxonomic context with selected references

Shortly after its inconspicuous start as just two species, the genus *Cistanthe* Spach (1836) was soon sunk into synonymy with *Calandrinia* Kunth (1823) and treated as such by all later important studies for almost 150 years. These include, inter alia, Barnéoud in 1846 (by implication of taxa cited, as he did not in fact mention the name *Cistanthe*); Reiche (1897) (still the best monograph of the Chilean species); Pax and Hoffmann (1934); Añon Suarez in her 1953 monograph of *Calandrinia* in Argentina; vol. 2 of Flora de la Cuenca de Santiago de Chile by Navas (1976); Marticorena & Quezada (1985); Peralta (1988); and Marticorena (1992).

A revision process was initiated by Carolin (1987), who highlighted the high heterogeneity of *Calandrinia*. Based on the evaluation of many morphological and anatomical characters and a cladistic analysis, he proposed splitting *Calandrinia* into five genera. He himself continued to treat *Calandrinia* collectively though, but with indications of proposed future generic affiliations of the major groups within existing *Calandrinia* sens. lat.

Subsequently, *Cistanthe* was resurrected as a separate genus by Hershkovitz (1990). He supported the conclusions reached by Carolin (1987), but also included the North American genus *Calyptridium* with its eight species as a separate section of *Cistanthe*, and the monotypic section *Strophiolium*, previously assigned to *Lewisia*, as another section. This treatment is still followed by Kelly, Miller and Packer in the Flora of North America in its present 2019 version. Hershkovitz (1990) also included two small South American alliances, the genus *Philippiamra* Kuntze and *Calandrinia* sect. *Amarantoideae* Reiche as new sections within *Cistanthe*. He dealt with all five sections more thoroughly in 1991. The largest group within the genus was *Cistanthe* sect. *Cistanthe*, which, after recombinations made by Hershkovitz in 1991 and subsequently by others up to 2008, amounted to 27 taxa. Peralta & Ford-Werntz (2008) and Peralta (1993) augmented the total with another five species in the remaining sections in South America.

Former support for the monophyly of *Cistanthe* sens. lat., including its sections, was found to be weak by Hershkovitz and Zimmer in 2000, and already in 1999 the monotypic section *Strophiolium* (B. Mathew) Hershk. was treated as the new genus *Lewisiopsis* by Govaerts. In 2015 *Calyptridium* Nuttall was resurrected as a separate genus, rendering remaining *Cistanthe* taxa less heterogeneous, except that they rejected *Lewisiopsis* as a separate genus.

Hershkovitz recently produced a monograph of the Montiaceae (Hershkovitz 2019). He now defined *Cistanthe* as only including its previous sect. *Cistanthe*, which he divided into a more narrowly defined sect. *Cistanthe*, consisting primarily of perennial species, and the new *Cistanthe* sect. *Rosulatae* (Reiche) Hershk., mainly of annuals. The latter was divided into two subsections, subsect. *Rosulatae* (Reiche) Hershk. and subsect. *Thyrsoideae* Hershk. He considered the genus to total at least 38 species, including six new recombinations and his own *Cistanthe subspeciosa* Hershk. He has also recently described *Cistanthe philhershkovitziana* from the northern Mediterranean zone of Chile, and named it in honour of his father. Another to be recently described, *Cistanthe floresiorum* J.M. Watson [fig.72], from a pass in the Atacama Region of Chile to the north of La Serena, is named after the family of the author's wife, principally her parents, who discovered it at the type locality (Watson 2019).

The information presented by Peralta & Ford-Werntz (2008) shows that 11 species are endemic to the northern Atacama Desert of Chile. Of these, *Cistanthe longiscapa* (Barneoud) Carolin ex Hershk. is a primary contributor to the extensive magenta coloration of the Flowering Atacama Desert phenomenon. Another four species also occur both there and in adjacent provinces of Argentina, while five species are endemic to the mediterranean zone of Central Chile. Finally, four much smaller and more depressed species are Andine, occurring between altitudes of 2000 and 5000 m, and are also again shared by Chile and Argentina.

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Cistanthe, with such a strong evolutionary centre in northern Chile, is still badly in need of renewed in-depth studies, and to that end Hershkovitz (2019) cited its section *Rosulatae* as 'woefully inadequately' known. Without doubt, for most interested parties that assessment could equally be applied to sect. *Cistanthe* as a whole! As an example of this unfamiliarity, the 2019 updated presentation of *Cistanthe* species endemic to Chile by the Royal Botanic Garden at Edinburgh included 24 species when consulted, but only six were illustrated.

The present work describes another newly discovered, distinct *Cistanthe* species, at present known from two general localities in Valparaiso Region, central Chile. We also include a recombination of another species, originally intended for a now cancelled guide to the Atacama Flowering Desert, which - as Vol. 2 - was to have covered the dicotyledons of the country's northern Pacific coast and adjacent interior lowland, the monocotyledons having been already published (Hoffmann et al. 2015).

Systematic relationships

Cistanthe is readily separated from its neighbouring genera *Calandrinia* and *Montiopsis*, all now included in the family Montiaceae (Nyffeler & Egli 2010); e.g. by a combination of its strongly succulent leaves, its characteristic black blotched and striated sepals, and its seeds, which are mostly tomentose and strophiolate with elaiosomes, and not compressed laterally. *Cistanthe celedoniana* differs from all other species by its strongly gibbose leaves, which would probably make the species attractive in any specialist succulent collection.

The only *Cistanthe* species which at times bears a certain resemblance to *C. celedoniana*, is *C. arenaria* [fig.75] as presently interpreted; i.e. extremely polymorphic (Ford-Werntz & Peralta 2002, inter alia). This widespread species from the same biogeographic region is usually strongly erect, and with different foliage, but some of its forms have slightly but significantly gibbose adaxial leaf surfaces, as can be seen in fig.75. Its flower colour is primarily magenta, although white-flowered forms do occur occasionally in most magenta species. However, the long sepals of *C. celedoniana*, equally long as the petals, present a key character separating it from all forms of *C. arenaria*. It should be borne in mind that Hershkovitz (2019) advocated a revised interpretation of *C. arenaria* a topic he then planned to deal with in more detail later.

The annual life cycle of *C. celedoniana* indicates that it belongs in section *Rosulatae*. Hershkovitz (2019) did not cite any other characters than this when defining the section, which comprises several of the former sections of *Calandrinia* sensu Reiche (1998). Hershkovitz (2006) indicated that the other recently described new annual species *C. floresiorum* (Watson 2019) resembled a reduced version of perennial *C. grandiflora*. However, *C. floresiorum* had already been analysed genetically by him (Hershkovitz 2006) as '*Cistanthe* sp. 02 80' and confirmed then to be a species in sect. *Rosulatae* (Reiche) Hershk. as was proposed by Watson (2019), also as based primarily on its annual life cycle.

Those of Nyanano in 1988 (but with no *Cistanthe* species included) and Peralta (1996) are the only previous SEM based studies of seed morphology in the families Montiaceae and Portulacaceae, apart from illustrations of seeds of the four Patagonian group *Calandrinia* species. These were presented by Elvebakk et al. (2015) in their paper which included the new species *C. ranunculina*. *Cistanthe grandiflora* and *C. crassifolia* are related species, although the latter was not treated as a separate taxon of *Cistanthe* until very recently (Hershkovitz 2019). Both being sect. *Grandiflorae* members, they share an analogous seed micro-morphology [figs.62-66], i.e. dominated by long, transparent and finger-like trichomes, sometimes with weak basal swellings. *Cistanthe picta* (Arn.) Carolin ex Hershk. [fig.73], *Cistanthe frigida*, (Barnéoud) Peralta and *Cistanthe humilis* (Phil.) Peralta [fig.74], deviating and perennial Andine members of sect. *Rosulatae* (Hershk.), were shown to have short outgrowths on the seed exterior, in the first club-shaped ('en forma de porra'), in the second like a glove finger ('en forma de dedo de guante'). *C. humilis* has not been analysed. In *C. arenaria* [fig.75] they are coralloid and very different. Concerning the flattened trichomes with basal

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constrictions possessed by *C. celedoniana* [figs.57, 58], they most resemble those of sect. *Cistanthe*. The radiating structure of the seed scale plate of *C. grandiflora* [fig.64] is surprisingly different from the 'fried egg' structure with concentric structures in *C. celedoniana* [figs.57, 58]. So far, these microscopic characters have been studied in too few species to reveal patterns within *Cistanthe*. However, the high diversity in seed ultrastructure shown so far appears to be a promising analytical character in Montiaceae/Portulacaceae taxonomy. The morphological differences between the studied representatives of sect. *Grandiflora* vs. sect. *Cistanthe* should be investigated further to settle whether they might represent new synapomorphies for these two sections.



fig.67: Ant entering *Cistanthe celedoniana* flower at 11.21.57 a.m. (5 Oct 2014. C. Celedón)



fig.68: Ant now covered in pollen while moving and feeding. 11.24.32 am (2 mins 35 seconds later). (5 Oct 2014. C. Celedón)

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fig.69: Ant dusted with pollen leaving flower at 11. 25.53. Duration of stay was 3 minutes 36 seconds. (5 Oct 2014. C. Celedón)



fig.70: Beetles on *Cistanthe celedoniana* flowers. (30 Sep 2013. C. Celedón)



fig.71: In contrast to *Cistanthe celedonium*, *C. grandiflora* is a vigorous, large-flowered perennial.
(9 Oct 2010. JMW)

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fig.72: F.& W. 11750 *Cistanthe floresiorum*, illustrating the cymose presentation. Pajonales Pass. (19 Oct 2008. JMW)



fig.73: *Cistanthe picta* is low growing, like *C. celedoniana*, and sometimes white-flowered, but perennial. (29 Jan 2009. Michail Belov)



fig.74: The tiny, always white-flowered Andean, *Cistanthe humilis*, is also perennial.
(10 Feb 2011. JMW)



fig.75: M.R. 8838 *Cistanthe arenaria*. Note gibbose leaves of this form as in *C. celedoniana*.
(14 Oct 2014. Marcelo Rosas)

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Concluding thoughts

It may seem quite amazing that such a distinct local endemic species has remained undescribed until now, growing as it does a mere 60 km away from Santiago at the type location, and in a widely populated geopolitical region which had apparently been well-explored botanically. However, there are several other examples of recent discoveries of striking plants from this area of central Chile with its very high level of endemism, e.g. the beautiful *Alstroemeria piperata* A.R. Flores & J.M. Watson (Watson et al. 2018) [fig.79] and the unique and magnificent *Viola regina* (Watson & Flores 2020) [figs.80, 81], both also involving Carlos. No less relevant in this context are many rediscoveries, including of famous *Tecophilaea cyanocrocus* in the Santiago Andes (2001).



Carlos Celedón was among those amateur wildflower enthusiasts who've played an important role in making known such rare plants, often threatened by land-use and other factors. Remember too: he did it all for 'love', and didn't receive a peso, penny or dime for his efforts. As a lay naturalist he did not have or need a C.V. to boost a career either.

It is to be hoped this publication may initiate further searches for *Cistanthe celedoniana*, perhaps interconnecting the present widely separated populations as known and even finding other undescribed plants. We feel it's appropriate to end the review of his *cistanthe* with portraits of Carlos [figs.76, 83], and the five species [figs.77-82] that have been contributed to the world of science thanks to his devotion and tireless energy.

fig.76: Carlos in head-down plant hunting posture. (18 Aug 2013. JMW)

Taxonomy (2)

A new combination

***Cistanthe sitiens* (I.M. Johnst.) A.R. Flores and J.M. Watson, comb. nov.**

Basionym:— *Calandrinia sitiens* I.M. Johnst., Contrib. Gray Herb. 85: 35. 1929.

This rare species is only known from the Tocopilla area (22°05'S 70°12'W) in the Atacama Flowering Desert of Antofagasta Region in northern Chile. It was reported and illustrated by Finger & Tellier (2010), as *Calandrinia sitiens*, but is clearly a *Cistanthe* species. This was evident to the authors of the new combination who intended to publish it in the aforementioned and cancelled field guide. Instead, that taxonomic change is effected here.

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“The five species that have been contributed to the world of science thanks to his devotion and tireless energy.”



fig.77: The yet unpublished *Oxalis ranchillos*, found by the Watsons at Carlos's original site. (24 Oct 2015. ARF)



fig.78: Originally Carlos took us to the 'long lost' *Viola chamaedrys* of Leybold. So began the flowering of our co-operation. (8 Sep 22013. JMW)



fig.79: *Alstroemeria piperata*, a little beauty also found by John and Anita at the *Viola chamaedrys* site. (20 Dec 2015. ARF)



fig.80: Carlos's most exciting discovery, *Viola regina*, 'Queen of the Violas'. (28 Nov 2013. C. Celedón)



fig.81: Edited photograph of the unique and unmistakable *Viola regina* flower. (C. Celedon)



fig.82: *Cistanthe celedoniana* (17 Oct 2020. C. von Bohlen)

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We owe the late Carlos Celedón immeasurable posthumous gratitude for sharing all his information and photographs of the new species with us. Local landowners of the Río Colorado area also graciously allowed him to pass across their private land to reach its habitat. John and Anita particularly wish to thank two staff members of the company which owns the land across the Río Colorado, who casually met them and then drove them in their pick-up along the track taken by Carlos. They have expressed the wish to remain anonymous. Marcelo Rosas of Coquimbo kindly supplied a photograph of *Cistanthe arenaria*. Mari Karlstad, UiT – Arctic University of Norway, was responsible for the seed illustration shown as [fig.52]. Others whose photos illustrate this presentation are acknowledged in the captions. Tom-Ivar Eilertsen, gave us permission to use the Advanced Microscopy Core Facility (AMCF) at the University of Tromsø, the Arctic University of Norway, where the SEM equipment was operated by Augusta Hlin Aspar Sundbø.



fig.83: A parting shot of Carlos when he was prepared for a short exploratory excursion at Los Ranchillos. (30 Nov 2014. JMW)

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References

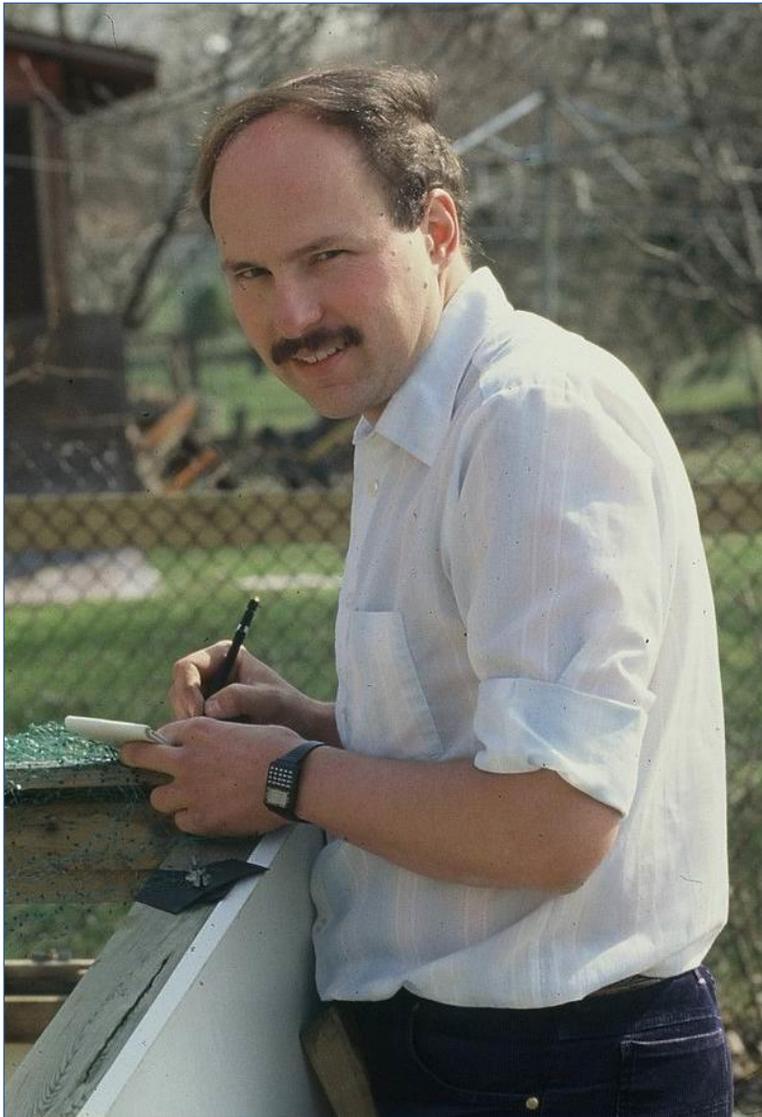
- Carolin, R.C. 1987. A review of the family Portulacaceae. *Austral. J. Bot.* 35: 383–412.
- Del-Claro, K., Rodriguez-Morales, D., Calixta, E.S., Martins, A.S. & Torezan-Silingardi, H.M. 2019. Ant pollination of *Paepalanthus lundii* (Eriocaulaceae) in Brazilian savanna. *Ann. Bot.* 123: 1159–1165. [doi: 10.1093/aob/mcz021](https://doi.org/10.1093/aob/mcz021).
- Elvebakk, A., Flores, A.R. & Watson, J.M. 2015. Revisions in the South American *Calandrinia caespitosa* complex (Montiaceae). *Phytotaxa* 203: 91–23.
- Finger, K. & Teillier, S. 2010. Contribución al conocimiento de la flora endémica de Taltal y Paposo, Región de Antofagasta (II), Chile. *Chloris Chil.* 13, 2. <http://www.chlorischile.cl>.
- Ford-Werntz, D. & Peralta, I. E. 2002. *Cistanthe*. In: Egli, U. (ed.), *Illustrated handbook of succulent plants: dicotyledons*, vol. 2: 380–386. Springer Verlag, Berlin, Heidelberg & New York.
- Gajardo, R. 1994. *La vegetación natural de Chile*. Editorial Universitaria, Santiago, 165 pp.
- Gómez, C. Espadaler, W & Bas, J.M: 2005. Ant behaviour and seed morphology: a missing link of myrmecochory. *Oecologia* 146: 244–246. [doi: 10.1007/s00442-005-0200-7](https://doi.org/10.1007/s00442-005-0200-7).
- HersHKovitz, M.A. 1990. Nomenclatural changes in Portulacaceae. *Phytologia* 68: 267- 270.
- HersHKovitz, M.A. 2019. Systematics, evolution, and phylogeography of Montiaceae (Portulacineae). [Phytoneuron 2019-27: 1–77](https://doi.org/10.1007/s12249-019-0001-7).
- Hoffmann, A.E., Watson, J.M. & Flores, A.R. 2015. *Flora silvestre de Chile: cuando el desierto florece volumen 1: monocotyledones y otros taxones*. Fundación Claudio Gay, Santiago de Chile. 261 pp.
- Hughes, L. & Westoby, M. 1992. Fate of seeds adapted for dispersal by ants in Australian sclerophyll vegetation. *Ecology* 73: 1285–1299.
- IUCN. 2012. *International Union for Conservation of Nature red list categories and criteria: Version 3.1. Second edition*.
- Minorsky, P.V. 2018. The functions of foliar nyctinasty: a review and hypothesis. *Biol. Rev. Cambridge Phil. Soc.* 94: 216-229. [doi:10.1111/brv.12444](https://doi.org/10.1111/brv.12444).
- Nyffeler, R. & Egli, U. 2010. Disintegrating Portulacaceae: a new familial classification of the suborder Portulacineae (Caryophyllales) based on molecular and morphological data. [Taxon 59: 227–240](https://doi.org/10.1007/s11692-010-9127-1).
- Peralta, I.E. 1993. Distribución del género *Cistanthe* Spach (Portulacaceae) en Sudamérica. [Parodiana 8: 153–158](https://doi.org/10.1007/BF02631918).
- Peralta, I.E. & Ford-Werntz, D.I. 2008. Portulacaceae. In: Zuloaga, F.O., Morrone, O. & Belgrano, M.J. (eds.), *Catálogo de las plantas vasculares del Cono Sur (Argentina, Sur de Brasil, Chile, Paraguay y Uruguay)*. Dicotyledoneae: Fabaceae (Senna-Zygia) Zygophyllaceae 3. *Monogr. Syst. Bot. Miss. Bot. Gard.* 107: 2796–2817.
- Reiche K.F. 1897. Zur systematik der chilenischen Arten der Gattung *Calandrinia*. *Ber. Deutsch. Bot. Gesellsch.* 15: 493–503. <https://www.biodiversity.org/page/5001588>.
- Watson, J.M. 2009. *Tecophilaea cyanocrocus*: demolishing bad science. *Herbertia* 62: 37, 209-240.
- Watson, J.M. 2019. Flores means flowers ... of course! A new *Cistanthe* species (Montiaceae) from Chile's springtime north. [IRG 109: 2–42](https://doi.org/10.1007/s12249-019-0001-7).
- Watson, J.M. & Flores, A.R. 2014. *Viola* hunting season kicks off with a bang. [The Rock Garden, J. Scot. Rock Gard. Club 133: 97-101](https://doi.org/10.1007/s12249-014-0001-7)

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--- World of Iris ---

The King of Reticulata By Panayoti Kelaidis

Sometimes we get lucky. In March of 1987 I flew to Toronto for the first time for a horticultural presentation at Edwards Gardens (now the [Toronto Botanical Garden](#)). Although my specialty has always been alpine plants and rock gardening, I have a strong interest in the genus *Iris*, and I have been a long time member of SIGNA ([Species iris Group of North America](#)) - one of the branches of the [American Iris Society](#). In their newsletters I had noted that Alan McMurtrie had been growing and writing about species iris. I contacted him before my trip thinking perhaps he might have a few *Iris* to see even early in the season during my visit. All this was conducted by mail and post offices back then: remember, this is before email and the internet invaded our lives!



Alan McMurtrie in 1987: photo P. Kelaidis

I rented a car while in Toronto and devoted a day to driving out to the suburb where Alan lived and fortunately it was a sunny day and sure enough, he had lots of irises blooming—many of them for the first time: he'd taken two collecting trips to Turkey the years prior to my visit, and I saw for the first time wild collected specimens of *Iris danfordiae* and *Iris histrioides* blooming—altogether different from the plants we grow under these names in our gardens. I had come to see species, but Alan's talk was all about his plans one day to hybridize plants in the Iridioctyon family of the genus (roughly a dozen species of plants we loosely refer to as "the reticulata section"). I listened to his rather grandiose descriptions of what he had in mind at the time and I only wish I'd had recorded what he said on a tape recorder. Although I thought what he was describing was rather far-fetched, I listened patiently. Little did I suspect the reality of what Alan went on to achieve in the years after my visit have far exceeded anything he might have imagined in 1987. It is all lovingly documented in amazing detail on his enormous and wonderful [website](http://reticulatas.com): reticulatas.com.

Alan was employed at the time I visited him (and for many years thereafter) as an electrical engineer working for the Canadian Power company - a job with great responsibility requiring specialized skills. He was already married and had two sons who also occupied a great deal of his time and energy. I find it remarkable that in his spare time he was able to create from scratch the most ambitious hybridization program that I am aware of in the entire realm of hardy bulbs, crossing hundreds and ultimately producing thousands of seedlings, the best of which he has had the vision and business skills to market in the Netherlands where he has partnered with many Dutch growers to ultimately produce many of his best hybrids for the retail market.

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Iris sopenensis x *Iris danfordiae*, photo Alan McMurtrie

The year of my visit he began his first wide crosses between the fertile wild *Iris danfordiae* and *Iris sopenensis* that provided his first major breakthrough in his breeding. After that beginning, his program has literally sky-rocketed with breakthroughs and new colors.

Alan and I stayed in contact in subsequent years, and I followed his career with great interest. I was dazzled when he published pictures of his first wide crosses where the dramatic orange, bronze and multicolored iris flowers were like nothing I'd ever seen before. I simply had to get my hands on some of these bulbs.

Alan realized that the semi-arid steppe climate of Denver might especially suit his hybrids. Over the last decade Denver Botanic Gardens has purchased large quantities of McMurtrie irises directly from Holland to grow in our collections and also to sell at our large autumn plant and bulb sale (which this year sold nearly \$100,000 in bulbs and plants). The McMurtrie iris offerings have become a major magnet for plant connoisseurs at this sale, and hundreds of Denver area gardeners are now enjoying these in their private gardens.

I have been lucky to be able to obtain a large number of Alan's most recently marketed hybrids which I've grown in various parts of my home garden. The pictures accompanying this piece show how beautiful they can be in a rock garden setting. In Denver they grow well in any well drained soil -

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although I find they seem to like soils that have some loam rather than a sterile scree. They do need moisture in the springtime (when Denver often has frequent, heavy snowfall in late winter), I have had some of Alan's hybrids be snowed upon several times in a single spring: they are so sturdy they can go through two or three snows and keep on blooming!



Iris x denticulata 'Happiness' in the snow.

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Each of Alan's hybrids has its own personality - but I have to admit that when 'Mars Landing' first bloomed for me, I had a sort of shiver of amazement: it was even stranger and more wonderful than I'd imagined! But 'North Star' or 'Sea Breeze' have every bit as much panache. I want them all! In our sunny, steppe climate we can have bulbs blooming throughout the winter months: snowdrops for instance bloom from October and November (*Galanthus peshmenii* and *G. elwesii* var. *monostictus*) and by December and January the "spring" crocus are already emerging and starting to bloom. *Crocus*, *Cyclamen*, *Sternbergia* and *Colchicum* all bridge the fall to spring season—effectively shortening our otherwise long winter season. Although we do not yet have autumn blooming Iris, the Iridioctyon section are among the earliest bulbs to open in the new year -occasionally during a warm spell in January we have had *Iris danfordiae* open a flower, but by mid February there are many *reticulatas* starting to bloom in the warmest microclimates. Late February to mid March is usually the peak season (invariably interrupted by two or three snowstorms - although the snow usually melts quickly that time of year). There are usually a few *reticulata* section iris still blooming into the first week of April - giving them almost three months when there is little competition in the rock garden except for a few other "minor" bulbs.



Left:
Iris 'Mars
Landing'



Right:
Iris 'Sea
Breeze'



Iris 'Painted Lady'

Each year there seem to be a few more McMurtrie irises showing up in specialist bulb catalogues, and his older hybrids are starting to become "bread and butter" - which is to say standard plants even in the mass market bulb catalogues.

Ed.: Alan McMurtrie has been awarded the British Iris Society's Foster Memorial Plaque (2010) and their Hybridisers Award (2016) as well as the American Iris Society's Hybridiser Award (2019).

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Iris 'Happiness' – this time in full flower in sunshine.

They are comprising a more and more important element in my personal garden - they are the stars of the winter garden for me along with *Galanthus*, *Adonis* and *Helleborus*. But the McMurtie iris have far more flamboyant colors and a huge range of variability. If you can succeed with the old Dutch selections like *Iris reticulata* 'Harmony' or 'J.S. Dijt' I know you will welcome Alan McMurtie's remarkable new assemblage of rock garden gems.



Iris 'Sunshine'



Iris reticulata 'White Caucasus' and *Tulipa humilis*

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Iris 'Finola'



Iris 'Katharine's Gold'



Iris 'North Star'

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Iris x reticulata 'Eyecatcher' and 'Blue Hill'



Above right: Alan speaking at the SRGC Early Bulb Event in 2016.



Left: A selection of his iris hybrids at an RHS London Show where Alan McMurtrie was able to chat with members of the public.