'*Cistanthe* sp. subsp. *subspeciosa*,' a specioid from the Atacama Desert, with comments on the taxonomy, ecology, and evolution of *Cistanthe* sect. *Cistanthe* (Montiaceae)

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ABSTRACT

Cistanthe subspeciosa Hershk. (*Cistanthe* Spach sect. *Cistanthe*; Montiaceae) here is described as a herbaceous to suffruticose perennial from the vicinity of Copiapó, Chile. Its epithet is juxtaposed with its rank in order to highlight its subspecific aesthetic. In particular, the specioid is infrequent, locally restricted, and lacks unique diagnostic traits. Rather, it is diagnosed by a combination of traits characteristic of different *Cistanthe* species from the region, none of which can be identified as the referential species to which *Cs. subspeciosa* might be considered subspecific. The intersection between species nomenclature and species ontology thus is discussed. I hypothesize that *Cs. subspeciosa* is irrigated primarily by mountain runoff rather than localized precipitation, and that it might be both resistant to and dependent upon high substrate metal concentrations characteristic of the Copiapó region. The ornamental value of this and other *Cistanthe* species is discussed. Finally, additional historical details pertaining to *Calandrinia spectabilis* Otto & Dietr. and *Cistanthe philhershkovitziana* are provided.
KEY WORDS: *Cistanthe*, Chilean Floristic Region, species, specioids, taxonomy, nomenclature.

Introduction

This tantalizingly-titled paper emerges as a sequel to a previous paper (Hershkovitz, 2019a), which reconstructed the discombobulated taxonomic history of the name *Calandrinia speciosa* Lehm. (Montiaceae), a mythical species known only from its protolog in an 1831 commercial seed catalog. For over 170 years, this name was applied haphazardly in reference to various species of *Cistanthe* Spach sect. *Cistanthe*, a taxon largely endemic to the Chilean Floristic Region (Hershkovitz, 2019b). Among the references to *Ca. speciosa* Lehm.is Muñoz Schick (1985), who published photos and a description of a so-identified plant growing in the Atacama Desert near Copiapó. No diagnostic basis was provided. The distribution was described as (effectively) 'growing in isolation in the interior of Atacama Province, sometimes with *Cistanthe longiscapa* (Barnéoud) Carolin ex Hershk.'

In 2000, I collected a similar plant from desert flats near Copiapó, ca. 400 m elevation. Based *only* on the photo in Muñoz Schick (1985), I identified it as "*Cistanthe* sp., cf. C[*alandrinia*] *speciosa* Lehm." (Hershkovitz, 2006). But my knowledge of *Cistanthe* species diagnostics at *that* time, was, at best, rudimentary. My prior (though fruitful) research had focused only supraspecific-level diagnostics and phylogeny (Hershkovitz, 1991a, 1993; Hershkovitz and Zimmer, 2000; reviewed in Hershkovitz, 2019b). In 2018, I located photos of similar plants, also identified as *Ca. speciosa*, in an internet blog of an amateur botanist, Joachim, Zora (see below). The locality evidently is near Copiapó, and the plants are similar to *Werdermann 405*, a 1924 collection from the same general locality. Notwithstanding its low elevation (700 m), Peralta and Ford-Werntz (2008) cited *Werdermann 405* as *Cistanthe cabrerae* (Añon) Peralta, a montane amphi-Andean species whose elevational range they listed as 1800–2500 m.

Reexamination of the evidence led me to conclude that the Copiapó area plants are similar to but distinct from other species of *Cistanthe* sect. *Cistanthe* (sensu Hershkovitz, 2006, 2018a, 2019b; contra 1991a, b; 1993). For example, besides the 1000+ m elevational discrepancy, they differ from *Cs.*

cabrerae in having 80–100 stamens, rather than "más de 30(–70)" (more than 30, sometimes up to 70; Peralta, 1994). The Copiapó plants represent a "specioid" (Hershkovitz, 2019b). They seem to have the ontological "aura" of a subspecies. But which species? I am not certain. Of course, the hierarchical nomenclatural code (McNeill et al., 2012) does not permit formal recognition of a subspecies with no referential species. Thus, I am constrained to describe the specioid formally as a species. I name it aptly as *Cistanthe subspeciosa* Hershk. The name captures the essence of the subspecific quality of the specioid, alludes to its historical link to the taxonomy of *Calandrinia speciosa* Lehm. (Hershkovitz, 2019a), and incarnates the underlying enigma of the ontology of species. The present work describes this specioid and discusses its taxonomic/evolutionary/geographic relations to other species, as well as commenting on its ecology and ornamental value. This work is part of an ongoing taxonomic examination of *Cistanthe*, and addenda to prior works (Hershkovitz, 2018b, c; 2019a) also are included,

Materials and methods

Literature, herbarium databases, other internet resources, and my own field notes were studied in order to gather information directly and indirectly related to the morphology, ecology, and geography of *Cs. subspeciosa* and related species of *Cistanthe* sect. *Cistanthe* generally. The information was synthesized logically.

Results

Synthesis of available information suggests recognition of a distinct taxon, which, pending further analysis, must be recognized at the species level:

Cistanthe subspeciosa Hershk., **sp. nov.** LECTOTYPE (designated here): **CHILE**. Atacama Region. Tierra Amarilla Province. Tierra Amarilla: ca. 700 m elevation. September, 1924, *Werdermann 405* (E, image! http://data.rbge.org.uk/herb/E00033178; Fig. 1); ISOTYPES: F!, U! (image! http://data.biodiversitydata.nl/naturalis/specimen/U.1523945), US!). = ?*Calandrinia corymbosa* Walp., Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 19 (Suppl. 1): 341. 1843. (https://www.biodiversitylibrary.org/item/132270) **CHILE.** Atacama Region. Tierra Amarilla Province. TYPE: not located.

Diagnosis. Plants resembling various species of *Cistanthe* sect. *Cistanthe*, but distinct from: **(1)** *Cistanthe cabrerae* (Añon) Peralta in having normally 80–100 rather than ca. 50 stamens in fully developed flowers, style conspicuously longer, and in growing in desert flats and adjacent pre-cordilleran canyons, ca. 400–700 m, rather than subalpine habitats, 1700–2500 m elevation; **(2)** *Cistanthe grandiflora* (Lindl.) Schltdl. [incl. *Cs. cachinalensis* (Phil.) Peralta & D.I. Ford and probably *Calandrinia taltalensis* I. M. Johnst.] in having normally 80–100 rather than ca. 50 stamens in fully developed flowers, style conspicuously longer, and stems less conspicuously or not angled; and **(3)** *Cistanthe lamprosperma* (I.M. Johnst.) Peralta & D.I. Ford and *Cistanthe laxiflora* (Phil.) Peralta & D. I. Ford in having a herbaceous to suffruticose rather than fruticose habit, broadly ovate rather than narrowly obovate to lanceolate (and more succulent) leaves, and leafy inflorescence stems, and from *Cs. lamprosperma* also in lacking leaf surface papillae. Available information is inadequate to confirm differences from *Ca. corymbosa* and *Calandrinia taltalensis*, but the taxonomic status of the last two remains to be verified.

Description. Herbaceous to suffruticose perennials, glabrous, glaucous, caudiciform. **Roots** not examined. **Metameric stems** branching near the plant base, several, ascending to erect, up to 1.6 m long, leafy at the base and in the basal non-flowering portion. **Leaves** simple, succulent, glaucous,

broadly ovate, up to 20 cm long, decreasing in length apically, abaxial surface with the major veins conspicuously ridged, leaf base decurrent, broadened at the node, apex acute. **Inflorescence** cymose, 2–3-branched, bracteate, basal nodes sterile, 1-bracteate, flowering nodes 8-10, Bracts 2, markedly unequal, 10–12 mm long, imbricate, amplexicaul, ovate, apex acute, becoming papery with age, striate with black resinous lines. **Pedicels** elongate, erect in flower, somewhat reflexed in fruit, up to 4 cm long. **Flowers** perfect, actinomorphic, bowl-shaped. **Sepals** 2, erect, imbricate, 10-12 mm long, ovate, acute, striate with black resinous lines, persistent, becoming papery and enveloping the fruit. **Petals** 5, free, spreading, imbricate, flabellate, 25–35 mm long, pink to nearly mauve, twisting about the ovary after pollination, deciduous. **Stamens** free, (40–)80–100 in ca. 4 whorls, the outer whorls spreading, the inner more erect, 10–20 mm long, the outermost whorl much longer than the innermost, filaments mauve, anthers 1.5 mm long, dorsifixed, pollen yellow. **Pistil** epigynous, syncarpellate, ca. 20 mm long. **Ovary** greenish, ovate, ca. 5 mm long, 3-loculate, placentation axile. **Ovules** numerous. **Style** single, ca. 15 mm long. **Stigma** globular, 3-lobed, green to yellow-green. **Fruit** a valvate capsule, ca. 12 mm long, dehiscing basipetally. **Seeds** black, hairy (rarely glabrous).

The above bases on the description and photos in Muñoz Schick (1985), images of *Werdermann 405*, blog-published images of live plants, and my notes and recollections. Additional investigation is needed to provide a more thorough description. Some critical data are missing, especially details of the stem geometry in vivo and the ovule/seed number.

Distribution and habitats. *Cistanthe subspeciosa* is infrequent in desert flats and low-elevation canyons, 400–700 m elevation, in the vicinity of Copiapó and Tierra Amarilla. Possibly it grows/flowers here only during El Niño years, when this region receives considerable precipitation and, more importantly, mountain runoff. The flowering frequency, however, remains to be confirmed by additional study. I tentatively include in the species a plant I collected in the littoral zone north of Taltal (Antofagasta Region; see below).

Additional observations. CHILE: Atacama Region. Copiapó Province: road from Paipote to Diego de Almagro ca. 9 km north of Paipote, roadside, sandy soil, 27°20'S, 70°11'W, 500 m, 11 September 2000, *Hershkovitz 00-91* [Specimen and photos destroyed; habit, flower, and habitat were identical to those in Muñoz Schick's (1985) photo; recorded as having ca., 100 stamens, 15 mm style, and hairy seeds]. ?Antofagasta Region. Antofagasta Province. Taltal Community: beach area along road between Taltal and Paposo ca. 26 km north of Taltal, rocky sandy disturbed flat on east side of road, 24°10'S, 70°26'W, 10 m, *Hershkovitz 00-51* [Specimen and photos destroyed; *Hershkovitz 00-51* appeared superficially similar to am individual evidently of *Cistanthe grandiflora* growing alongside (*Hershkovitz 00-61*); field notes highlighted the contrasts between these individuals, the latter having conspicuously angled stems, ca. 40 stamens, and hairy seeds, while *Hershkovitz 00-51* was recorded as having ca. 100 stamens a 15 mm long (exserted) style, and glabrous seeds.]

Illustrations. (i) Muñoz Schick (1985: *78*),two photos of a plant and flower in a desert flat near Copiapó. The specific locality/elevation are not indicated. **(ii)** Personal blog of Joachim Zora (http://www.joachim.cl/desierto_florido/html2/flora/calandrinia_speciosa.htm), seven photos of plants and flowers. The locality/elevation are not indicated, but the blog indicates 2017 exploration of Quebrada de Paipote and Quebrada Cerrillos (= Quebrada Carrizalillo). The former is a dry wash originating ca. 10 km E of the *Hershkovitz 00-91* locality and extending into the High Andes. Quebrada Carrizalillo originates south of Tierra Amarilla and also extends into the High Andes. *Werdermann 405* is from this general region. Exsertion of the style and flowers with (40–)80–100 stamens are evident in Zora's photos. I e-mailed the contact address of Zora's blog requesting precise locality data and permission to reproduce

his photos, but received no reply. **(iii)** Hershkovitz (1991c: *Figs. 8, 44, 63, 68, 79, 80*) illustrated leaf venation and epidermal morphology of *Werdermann 405*.

Etymology. The epithet *subspeciosa* is derived from appending the prefix *sub-* (less than) to the feminine form of the adjective *speciosa* (attractive, showy). Thus, *subspeciosa* is a valid Latin term meaning "less than attractive/showy." Its applicability to *Cistanthe subspeciosa* is a matter of opinion. But the epithet was chosen for different aesthetics. Firstly, it refers to one of several forms of *Cistanthe* historically erroneously referred to as *Cistanthe speciosa* Lehm. [viz., by Muñoz Schick (1985) and, following this reference, Hershkovitz (2006), Squeo et al. (incl. Muñoz Schick; 2008), and Joachim Zora's blog (see above), which references Muñoz Schick (1985). Hershkovitz (2019a) traced the taxonomic history of the name *Ca. speciosa* Lehm. and determined that it has not been typified but probably refers to plants of *Cs. laxiflora* (Phil.) Peralta & D.I. Ford (see below). The epithet *subspeciosa* also refers aesthetically, but not literally, to the subspecific quality of *Cs. subspeciosa*, viz., an infrequent form that, while distinct, might be perceived as a subspecies, except that in this case, the referential species is not certain (see below). Finally, the epithet calls attention the millennially and perpetually irresolvable ontology of species and subspecies and the boundaries between them.

Discussion

Morphological/ecological diagnostics of *Cs. subspeciosa*. Morphologically, *Cs. subspeciosa* most closely resembles *Cs. grandiflora* (sensu Hershkovitz, 2018a; including *Cs. cachinalensis* and possibly *Ca. taltalensis*), *Cs. cabrerae*, *Cs. lamprosperma*, and *Cs. laxiflora*. The similarities/differences are elaborated in detail below. In addition, the possibility of synonymy of *Cs. subspeciosa* with *Ca. speciosa* Lehm. and *Ca. corymbosa* Walp. is discussed.

1.　　*Cistanthe grandiflora*, *Cs. cachinalensis*, and *Calandrinia taltalensis*: *Cistanthe subspeciosa* shares with *Cs. grandiflora* (as conceived here) its degree of succulence and glaucous texture, somewhat sloppy habit with large, rubbery ovate leaves crowded at the base and along the lower portion of ascending branches. It differs in having less conspicuously or not angled stems and flowers with 80–100 stamens and long, exserted styles.

As discussed in Hershkovitz (2018a, 2019a, b; cf. Muñoz Pizarro, 1966), the historically haphazard application of the name *Cs. grandiflora* has been a major encumbrance in advancing understanding of species taxonomy of *Cs.* sect. *Cistanthe*. Much of the problem traces to Reiche (1898a), who lumped all then-named species of the section into a single polymorphic *Cs. grandiflora*. Taxonomists/floristicians (and, worse, ecologists, biogeographers, and phylogeneticists, including myself) ever since have followed Reiche (1898a) erratically and inconsistently. As a disclaimer, however, my earlier work focused on supraspecific-level diagnostics and relationships. I deferred species identifications to the expertise of numerous contemporary and historical card-carrying species/floristic taxonomists. In the case of *Cistanthe*, however, nominally "expert" identifications were not much better.

As conceived here, *Cs. grandiflora* includes essentially all *Cistanthe* sect. *Cistanthe* with the conspicuously angled stems, ovate leaves along the lower portion of the inflorescence stems, ca. 50 stamens, and styles not exserted. It is distributed continuously between the Aconcagua and Antofagasta Regions, below 1000 m, especially near the coast. I have seen evidence of possible (but unconfirmed) occurrences in the O'Higgins and Maule Regions, but not south of this (i.e., to Araucania; cf. Peralta and Ford-Werntz, 2008; Rodríguez et al., 2018). Such occurrences are not

impossible, though, because the species is weedy and can flower in its first season (Hershkovitz, 2018b; cf. Loudon, 1840).

Peralta and Ford-Werntz (2008) listed the distribution of *Cs. grandiflora* as ranging from Chile's Coquimbo to Araucania Regions, but they included therein *Cistanthe discolor* (Schrad.) Spach and, implicitly, the southerly-distributed *Cistanthe mucronulata* (Meyen) Carolin ex. Hershk. (Hershkovitz, 2018a). This taxonomy is untenable (Hershkovitz, 2018a). Peralta and Ford-Werntz (2008) recognized as distinct *Cs. cachinalensis* (including *Ca. taltalensis*) in the Antofagasta and Atacama Regions, and in the Antofagasta Region also *Cs. lamprosperma*. Rodríguez et al. (2018) more or less followed Peralta and Ford-Werntz (2008), but they extended the range of *Cs. grandiflora* northward to the Antofagasta Region and *Cs. cachinalensis* southward to the Coquimbo Region. Thus, according to Peralta and Ford-Werntz (2008), the species are parapatric, whereas in Rodríguez et al. (2018), they are sympatric, which begs the question of their distinction.

Although I have vacillated on this point (Hershkovitz, 2018a), I am inclined (today) to **incl**ude *Cs. cachinalensis* in *Cs. grandiflora*, because I cannot discriminate the corresponding specioids (cf. Rosas and Estévez, 2010). Philippi (1893) did not characterize the stem geometry of *Cs. cachinalensis*. Numerous internet photos identify individuals from the Antofagasta Region as *Cs. cachinalensis*, most of which appear within the range of variation of *Cs. grandiflora* in the Coquimbo and Atacama Regions.

Possibly there has been a tendency to consider by default all Antofagasta plants to be *Cs. cachinalensis* or *Ca., taltalensis* and not *Cs. grandifora* (e.g., Finger and Tellier, 2010; Orrego et al., 2013). Watson (2019) includes photos of inflorescence termini of plants identified as *Cs. cachinalensis* (*Fig. 57*, cf. *Figs. 58–59*) from the Antofagasta Region and *Cs. grandiflora* (*Fig. 60*) from the Coquimbo Region. The former appears to be coarser, but otherwise I see no difference. Watson (2019) also includes a photo of a whole plant identified as *Cs. grandiflora* (*Fig. 50*) from the Atacama Region, but this plant is a common non-pachycaulescent form (or stage) of *Cs. crassifolia* (Phil.) Carolin ex Hershk. However, as I will consider in a later work, this form might have experienced gene exchange with *Cs. grandiflora*. My interpretation at present is that the coarser *Cs. cachinalensis* forms represent plastic variability corresponding to a stressful habitat and/or developmental mutants ("apospecies;" Hershkovitz, 2019b) likely to interbreed with "normal" *Cs. grandiflora* in the same zone.

The taxonomy of the specioid *Ca. taltalensis* remains problematic (cf. Finger and Teillier, 2010; Rosas and Estévez, 2010). Johnston (1929) did not describe the stem geometry and stamen number. He discriminated *Ca. taltalensis* from *Cs. grandiflora* mainly on the basis of its coarser inflorescence bracts and short and not reflexed pedicels. I am inclined to believe that these traits are both developmentally plastic in response to environmental conditions and/or genetically easily mutable. In particular, a defunct blog created by Chileans Juan Acosta and Florencia Senoret contains a photo of a plant from Cuesta Paposo they identified as *Ca. taltalensis*. It appears to be a developmental mutant of *Cs. grandiflora* with an unelongated but fully mature, flowering and fruiting "capitate" inflorescence (http://blog.spiniflores.com/archives/tag/desierto-florido). Again, my effort to communicate with the authors was unsuccessful.

The *Hershkovitz 00-51* tentative *Cs. subspeciosa* collection from the Taltal area also might be considered a candidate for *Ca. taltalensis*, but the former has 100 stamens and glabrous seeds and the latter hairy seeds (Johnston, 1929). It seems unlikely that *Ca. taltalensis* had 100

stamens, or Johnston likely would have noted this. Analysis of Johnston's specimen should resolve this question.

A propos *Cs. subspeciosa*, had I conceived in 2000 what I conceive currently, I would have recognized *Hershkovitz 00-61* as *Cs. grandiflora* and *Hershkovitz 00-51* as a distinct species. Similarly, while I recognized that *Hershkovitz 00-91* from near Copiapó was distinct from *Cs. grandiflora*, I did not appreciate that true *Cs. grandiflora* grew nearby, in particular *Hershkovitz 00-114*, collected on sandy flats ca. 30 km SSW. Hershkovitz (2006) identified this only as "*Cistanthe* sp." My field notes indicate "plants 80 cm, *stems angular*, petals 3 cm, bright fuchsia [obs.: more accurately rose-magenta], yellow at claw, *stamens ca. 40*, filaments red, yellow toward base, anthers red, *style 2 mm*, pink, stigma green, seeds hairy." Thus, this plant differs from *Cs. subspeciosa* in all of the diagnostic traits. The observation demonstrates that *Cs. subspeciosa* and *Cs. grandiflora* s. str. occur geographically proximally. It is not clear whether they may occur "side-by-side," especially at higher elevations in Tierra Amarilla Province.

2.   *Cistanthe cabrerae***: This amphi-Andean disjunct species shares the habit and foliar characteristics of both *Cs. grandiflora* and *Cs. subspeciosa*, differing from the former in stem geometry and geography, and the latter in stamen number, "más de 30(–70)" (more than 30, sometimes up to 70; Peralta, 1994). Based on habit and leaf characteristics, I am inclined to believe that *Cs. cabrerae*, *Cs. grandiflora*, and *Cs. subspeciosa* form a species group. *Cistanthe cabrerae* was described from the Monte vegetation near Calingasta, San Juan Province, Argentina (Peralta, 1993; cf. Peralta, 1994; Delmasso and Márquez, 2018). It is absent in the higher elevation Puna and High Andean vegetations (ca. 3000–7000 m; cf. Delmasso and Márquez, 2018).

Cistanthe cabrerae is disjunct in Chile's Atacama Region, the closest encounter at most ca. 275 km to the NNW of Calingasta (following South America's Arid Diagonal; cf. Peralta, 1993). This locality corresponds to *Hershkovitz 01-33* [**CHILE.** Atacama Region. Huasco Province, roadside ca. 5 km south of Chollay, 29°06'S, 70°07'W, 2217 m, 8 February 2001 (specimen and photos destroyed; field notes indicate "plants erect, ca. 120 cm tall with ca. 8 ascending branches, leaves glaucous, broadly obovate, bases notably amplexicaul, petals pink adaxially, slightly paler at margins and base, nearly white abaxially, pale green at the claw, filaments lavender-pink, anthers yellow, seeds hairy")].

Somewhat further away is *Zöllner 4079* [**CHILE.** Atacama Region. Tierra Amarilla Province, Valle Jorquera, (obs.: probably 2000–2800 m), 11 January 1979 (L!, NA!)]. From the specimens, I cannot diagnose the floral morphology. I presume they represent *Cs. cabrerae* because of the elevation. The Copiapó area plants of *Cs. subspeciosa* are only ca. 70 km WNW of the Zöllner collection, but the elevational difference is >1000 m and the ecology correspondingly drastically distinct. Equally importantly, I have not located *Cs.* sect. *Cistanthe* collections in the intervening elevational zone, 1000–2000 m, of the Atacama Region.

Peralta (1993) listed the Chilean distribution of *Cs. cabrerae* as Antofagasta and Atacama Provinces, 1700–2000 m. Peralta and Ford-Werntz (2008) listed its Chile-Argentina elevational range as 1800–2500 m. Inexplicably, they cited *Werdermann 405*, from 700 m, as *the* representative Chilean specimen. The distribution in the Antofagasta Region evidently owes to an unidentified locality indicated on a map in Peralta (1993), ca. 550 km NNW (along the Arid Diagonal) of bona fide *Cs. cabrerae* localities in Atacama Province. The indicated locality is perhaps 25 km NNE of the city of Antofagasta. An elevation above 1700 m is possible in that region, but, in light of the present work, the locality and identification of the specimen beg

reexamination. It is intriguing that both *Cs. cabrerae* and *Cs. subspeciosa* are putatively disjunct to the Antofagasta Region (see also below).

3.   ***Cistanthe laxiflora*** and ***Cs. lamprosperma***. *Cistanthe laxiflora* shares with *Cs. subspeciosa* its relatively large flowers, 80+ stamens, and exserted style. Otherwise, the fruticose habit and narrower leaves and leaf disposition are very different. I regard *Cs. laxiflora* and *Cs. lamprosperma* as close relatives, sharing a coastal niche and fruticose Crassulaceae-like habit [compare Hooker's (1835) description of *Calandrinia speciosa* Hook. non Lehm. (= *Cs. laxiflora*; Hershkovitz, 2019a) with Johnston (1929: *38*)]. Flowers of *Cs. lamprosperma* are somewhat smaller, hence have fewer stamens and a less conspicuously exserted style. *Cistanthe laxiflora* is frequent between ca. 30.5–33.5S, whereas *Cs. lamprosperma* is restricted to ca. 24S. It also differs from *Cs. laxiflora* in having glabrous seeds and a conspicuously papillate epidermis. The papillae superficially resemble the bladder cell idioblasts characteristic of Aizoaceae. This trait, essentially unique to this species among Montiaceae, merits anatomical, physiological, biochemical, and molecular genetic analysis. [Hershkovitz (1991c) illustrated "sub"-papillate epidermal cells of an individual misidentified as *Cs. lamprosperma*. This plant is a form of *Cs. longiscapa*].

          Cistanthe lamprosperma evidently is rare and endemic to the coast near Paposo, the same general area as *Hershkovitz 00-51* and *00-61* described above. An individual is well-illustrated on the evidently defunct botanical/commercial website of Mikhail Belov, http://www.chileflora.com/Florachilena/FloraSpanish/HighResPages/SH1212.htm. Again, my attempt to communicate with the author was unsuccessful. It is similar to *Cs. subspeciosa* in stamen number, style length, and, perhaps less importantly, petal color. It differs in having the habit/leaves/texture of *Cs. laxiflora* rather than that of *Cs. subspeciosa/grandiflora/cabrerae*. The seeds are glabrous, but so are those of *Hershkovitz 00-51*, a putative *Cs. subspeciosa* from the same area (see above).

          Given the habit, leaf form, and leaf disposition, an especially close relation of *Cs. subspeciosa* with *Cs. laxiflora/lamprosperma* seems less plausible than with the *grandiflora/cabrerae/cachinalensis* group. However, in cultivation, evidently the lower portion of the inflorescence stem of *Cs. laxiflora* can be leafy, as illustrated in an online newspaper (Redlands Daily Facts, 2016). Except for the rose-magenta flower color typical of *Cs. laxiflora*, this plant in cultivation resembles a very succulent form of *Cs. subspeciosa*.

4.   ***Calandrinia speciosa*** Lehm. *Calandrinia speciosa* Lehm. was described from a plant cultivated from seed obtained in the Paris botanical garden (Lehmann, 1831; see Hershkovitz, 2019a). It is extremely unlikely that this, in turn, originated from Copiapó, since the first botanical account of this vicinity appears to be Meyen (1834; see below), and the destination of his 1830–1832 collections was Berlin. It seems significant that Muñoz Schick (1985) recognized that the Copiapó plants were different from *Cistanthe grandiflora* and its various segregates from northern Chile. But why did she apply name *Cs. speciosa* Lehm.? Nothing in Lehmann's (1831) protolog suggests special similarity. To the contrary, Lehmann (1831) indicated that the plants lacked stem leaves, which the Copiapó plants clearly have. Possibly the identification reflects name elimination, i.e., other identities could be ruled out, and the ambiguous *Cs. speciosa* Lehm. remained. I used this method in Hershkovitz (2006; cf. Hershkovitz, 2018b).

          Muñoz Schick's (1985) identification had a peculiar consequence, besides its propagation to Hershkovitz (2006) and Joachim Zora's blog (see above). Squeo et al. (incl. Muñoz Schick,; 2008), listed this species for the Atacama Region, in particular Copiapó and Tierra Amarilla Provinces. Marticorena et al. (incl. Muñoz Schick; 2000) did not list this species for the adjacent

Coquimbo Region. I am not aware of inclusion of *Cs. speciosa* Lehm. in other contemporary local floristic listings, and Marticorena and Quezada's (1985) national list did not mention the name at all. This might render the impression that *Cs. speciosa* Lehm. is endemic to the Atacama Region. Ironically, the specioid itself is possibly endemic. It simply had been misidentified as *Cs. speciosa*, which is part of the reason I chose the new epithet *subspeciosa*.

5.   ***Calandrinia corymbosa*:** Walpers (1843a; cf. Walpers, 1843b) described this species as originating in Copiapó, evidently what Meyen (1834: *400*) referred to as "*Thalinum* (*glauca*?)" and described only as a plant with thick, succulent leaves. Walpers' (1843a, b) description was more elaborate, but still did not serve to distinguish *Ca. corymbosa* from other species of *Cistanthe* sect. *Cistanthe*. The only trait that was supposed to distinguish *Ca. corymbosa* from *Cistanthe glauca* (Schrad) Lilja (= *Cs. grandiflora*; Hershkovitz, 2018a; 2019a, b) was green rather than glaucous leaves. This trait does not seem to have taxonomic value, as I have found that essentially all species of *Cs.* sect. *Cistanthe* vary from more green to more glaucous depending upon conditions.

Other than that, Walpers' (1843a, b) description applies to *Cs. cabrerae*, *Cs. grandiflora*, and *Cs. subspeciosa*. The diagnostic trait of *Cs. subspeciosa* is the high stamen number and long style. But Walpers (1843a, b) indicated that the flower of *Ca. corymbosa* was unknown. Paradoxically, Walpers (1843a) indicated that its (*northern* hemisphere) flowering time was May. This and the diagnostic trait (green versus glaucous) suggests that the species was described from a cultivated plant. But, why would the flower be then "unknown"?

Barnéoud (1846) accepted *Ca. corymbosa* without critical comment, but it appears that he had not seen a specimen. Philippi (1893) included with a question mark the name *Ca. corymbosa* in his list of segregates of *Cs. grandiflora*, not describing/discussing it further. Reiche (1898) listed it among "problematic" species of *Calandrinia* s. l., there reproducing Walpers' (1843a, b) description. The only subsequent mention of *Ca. corymbosa* that I have located is Squeo et al. (incl. Muñoz Schick; 2008), which lists the species as possibly extinct in Copiapó Province. As noted above, this work listed *Ca. speciosa* Lehm. as, effectively, endemic to Copiapó and Tierra Amarilla Provinces. The authors apparently did not notice that the plants identified as *Ca. speciosa* Lehm. conformed better to the description of *C, corymbosa*. For that matter, they did not consider whether *Ca. corymbosa* might refer to *Cs. cabrerae*, since the descriptions agree and Squeo et al. (2008) listed *Cs. cabrerae* for Copiapó Province. Peralta and Ford-Werntz (2008) listed *Cs. corymbosa* as a doubtful name, and Rodríguez et al. (2018) did not mention this name.

Meyen (1834) did not indicate precisely the locality or the elevation of his plant. The general locality is an unnamed canyon from "Ramillas," a place name I cannot locate, to Mina Checo. The latter might refer to any of many mines in the historical "Checo mining district," these spanning considerable elevational range and distances from Copiapó (https://www.geovirtual2.cl/minas/Atacama-Checo-de-Cobre-minas-01.htm). Comparison of Meyen's (1834) chronicle with a later English summary (Royal Geographical Society, 1836) implicates an elevation below 1000 m somewhere between Nantuco and Los Hornitos (**CHILE.** Atacama Region. Tierra Amarilla Province). This approximates the inferred localities of *Werdermann 405* and Joachim Zora's plant (see above). But the presence of *Cs. grandiflora* in this range cannot be ruled out. Meyen evidently continued on to rather high elevations, where *Cs. cabrerae* might be found.

An argument might be made for revalidation/neotypification of *Ca. corymbosa* with *Werdermann 405*. It well might be the same as Meyen's plant. But here, I will follow the precedent of Ricardi (1967), who rejected *Malesherbia solanoides* Meyen, based on a plant

Meyen (1834: *403*) evidently collected collaterally with his "*Thalinum.*" Although both Gay (1846) and Reiche (1898b) accepted *M. solanoides*, Ricardi (1967) regarded Meyen's description, locality information, and photo of the type as essentially useless for diagnostic purposes. Current references (Zuloaga et al., 2008; Rodríguez et al., 2018) follow Ricardi (1967).

Yet, there seems to be a better case for accepting *M. solanoides* than *Ca. corymbosa*. In the latter case, there is not even a type photo. The description is not Meyen's (1834) original, but Walpers' (1843a) second hand, and possibly based on a cultivated specimen. Description of the diagnostic androecial and gynoecial traits is missing. If the origin indeed is from > 1000 m, it might be *Cs. grandifora*. If it is from higher up, it might be *Cs. cabrerae*. Thus, here I reject the name *Ca. corymbosa*.

Molecular diagnostics of *Cistanthe* species. Available molecular phylogenetic data shed no light on the diagnostics and relationships of *Cs. subspeciosa*. Hershkovitz' (2006) analysis included 22 samples of *Cs. sect. Cistanthe*, including two of putative *Cs. subspeciosa* (*Hershkovitz 00-51* and *00-91*), one *Cs. cabrerae*, and several each of *Cs. laxiflora* and *Cs. grandiflora*. However, many samples are misidentified in that work. Those identified as *Cs. grandiflora* are *Cs. philhershkovitziana* Hershk., and those identified as *Cs. discolor* are *Cs. grandiflora* (Hershkovitz. 2018b). In addition, I now can identify as *Cs. grandiflora* most samples in Hershkovitz (2006) identified as "*C.* sect. *Cistanthe* sp. [##-##]."

Unfortunately, although nominally interspecific-level DNA markers were employed, sequence divergence among *Cistanthe* sect. *Cistanthe* species was extremely low and revealed no significant phylogenetic or taxonomic structure. The relationships illustrated graphically might be consequent to homoplasy, lineage sorting, or gene flow. The two samples here purported to represent *Cs. subspeciosa* (*Hershkovitz 00-51 & 00-91*) indeed shared both nuclear and plastid marker genotypes, but these were shared also by a sample here identified as *Cs. grandiflora* (*Hershkovitz 00-214*) from a ruderal locality ca. 30 km E of La Serena in the Coquimbo Region. Hershkovitz (2019b) noted that *Cs. grandiflora* is an especially weedy species, usually found in disturbed sites throughout its extensive range, < 1000 m between at least 24 – 33S. Hershkovitz (2006) demonstrates that the genotypes of samples *Cs. grandiflora* (when correctly identified) are highly variable and shared variously with other species.

Ontology of *Cs. subspeciosa*. I conceive of *Cs. subspeciosa* typologically, i.e., as a type-referenced specioid that comprises all individuals considered to be conspecific to *Werdermann 405* and to the type of no other named species. As articulated in Hershkovitz (2019b), I do not presume that this or any specioid conforms to any of the numerous ontological "species concepts," least of all the "phylogenetic species concept" (PSC). The PSC appeals to an affirmation that "species are…clades" (i.e., terminal branches of phylogenetic trees; David Baum, U. Wisconsin, written comm., 25 December 2015). The PSC became and possibly remains popular among systematic biology's institutional socioeconomic/political elite. Yet, prior species theory/data (e.g., for gene flow, lineage sorting) already betrayed the PSC idealization as a concept dead-on-arrival. Its subsequent and persistent popularity possibly owes to the operational/mathematical convenience of reducing species to single dimensions for phylogenetic zealots challenged to count any higher.

A type-referenced specioid is non-dimensional (cf. Brooks and M cClennan, 1999), but there is no limit to the number of dimensions in which its existence might be corroborated. *Cistanthe subspeciosa* here is distinguished from an apospecific variant in its morphological and spatiotemporal geographic dimensions. In particular, the morphologically distinctive plants have been recorded in the Copiapó vicinity on at least four occasions spanning nearly a century: 1924, some few years before 1985, 2000, and 2017. The putative Taltal-area observation is not germane here. The observations suggest that the specioid is locally transitionally stable.

The Copiapó vicinity geography itself explains the infrequency of collection. Significant precipitation arrives to the Atacama Region central valley only during El Niño years, often 10+ years apart. This spawns Chile's "desierto florido" phenomenon, in which perhaps 5000 km^2 of normally barren earth rapidly transforms into a carpet of flowers. *This* is when botanists flock to the desert to collect plants. But even during such years, rain concentrates in the southerly Huasco Province and decreases precipitously towards and north of Copiapó. Naturally, botanical collection concentrates in the vegetated region, which distracts attention from the fewer and isolated individuals of specioids like *Cs. subspeciosa* in the otherwise barren margins. Moreover, the more floriferous the desert, the more likely rare and distinct individuals will fall through the collection net. This is especially true in the case of *Cistanthe* sect. *Cistanthe*, given the 120 year-old conventional wisdom that they all are the same species (Hershkovitz, 2019a, b). In this context, the four Copiapó-area records of *Cs. subspeciosa* spread over a century are significant.

Available evidence offers little insight into the history of this specioid. But the impulse to interpret *Cs. subspeciosa* or any specioid as a static or statistical entity must be resisted. In terms of the nonlinear wave model of species (Hershkovitz, 2019b), it represents a transitionally stable entity, but its present state might be explained by innumerable histories, e.g., a recently-evolved offshoot, a hybrid arising one more times, or a vestige of a once widespread form. It might have migrated/dispersed from elsewhere, or it might be a relict. In terms of the Principle of Evolutionary Idiosyncraticity (Hershkovitz, 2019b), its history and future are determined not extrinsically, but intrinsically and nonlinearly owing to the capacity of living beings to enact their *own* history via self-organized metabolism, growth, development, and reproduction structurally coupled to a dynamic hierarchically-organized physical milieu (cf. Maturana and Varela; 1992; Varela et al., 1992; Salthe and Matsuno, 1995; Mpodozis and Maturana, 2000; Hershkovitz, 2019b). Evolutionary history in a nutshell.

For formal taxonomic purposes, as intimated above, *Cs. subspeciosa* projects a "subspecific" aesthetic. While unique, it lacks unique diagnostic characteristics, its range is relatively small, and its frequency is low. Its collectively distinctive character emerges from its combination of traits individually shared by other geographically proximal and more broadly distributed species of *Cs.* sect. *Cistanthe*. But a subspecific aesthetic also emerges from its taxonomic history. In particular, identification notwithstanding, Muñoz Schick (1985) and myself (Hershkovitz, 2006) indeed recognized that the morphology of the Copiapó plants was distinct from that of other (geopolitically) Chilean-endemic species of *Cistanthe* sect. *Cistanthe*. Peralta and Ford-Werntz (2008) identified at least the Tierra Amarilla plants as *Cs. cabrerae*, while listing *Ca. speciosa* as a synonym of *Cs. grandiflora*. In this perspective, the Copiapó-area plants lost their taxonomic distinction. This history is typical of taxonomically subspecific specioids.

My initial sensibility was to describe *Cs. subspeciosa* as a subspecies of *Cs. cabrerae*, no, wait, maybe *Cs. grandiflora*, but then again, etc. I then mused over the formally invalid name "*Cistanthe* sp. subsp. *subspeciosa*." After all, anyone familiar with the taxonomic, floristic, and broader scientific literature would appreciate that "*Cistanthe* sp." is by far the most common and broadly distributed species of this genus. The epithet "*subspeciosa*" has been published validly twice in the botanical realm: *Rhynchospora consanguinea* f. *subspeciosa* Kük (Cyperaceae) and *Dicranopteris linearis* (Burm. f.) Underw. var. *subspeciosa* Holtt. (Gleicheniaceae). But, in both cases, the epithet has been applied to a subspecific entity. The present instance is the only time the epithet has been applied at and in juxtaposition to the nominal species level. Further investigation might change this status. The name might be reduced to synonymy, or indeed it might be recombined at the subspecific level.

It is intriguing in this context to recall that, while the botanical nomenclatural Code prohibits "species-free" taxa, the International Code of Nomenclature for Cultivated Plants (Brickell et al., 2016)

does not. It formally recognizes, e.g., "*Genus* 'Cultigen,'" which does not imply conspecificity with the type species of that genus. The cultivated Code, however, does defer to the botanical Code as to the legitimacy of application all botanical names in cultivated plant taxonomy. But the relation of the botanical and cultivated Codes is not hierarchical ontologically. They merely intersect operationally. The botanical code is agnostic towards the ontology of biological species, nevertheless obligates species as the universal fundamental biological taxonomic unit. The cultivated Code permits recognition of specioids exclusive of taxonomic species. Paradoxically, per the wave model, the cultivated Code is correct biologically (viz., "not all water pertains to a wave;" Hershkovitz, 2019b). In truth, however, there is no philosophical conflict to the degree that the botanical Code obligates species only nomenclaturally and not ontologically. In no other sense does it specify species ontological equivalency.

Ecology of *Cs. subspeciosa*. As noted above, Muñoz Schick (1985) indicated that *Cs. subspeciosa* (as *Ca. speciosa* Lehm.) grew isolated or together with *Cistanthe longiscapa* (Barnéoud) Carolin ex Hershk. When I encountered a single individual near Paipote in early September 2000, it was isolated, so strikingly so that I do not recall whether any plants at all grew nearby. 2000 was an El Niño year that yielded an impressive desierto florido in the Huasco Province interior, but the effect gradually decreased northwards. By perhaps 50 km S of Copiapó, the interior desert was fairly barren, the plants, mainly perennials/geophytes and unworldly annual *Philippiamra* spp., few and far between. Meteorological records (Gobierno de Chile, 2019) corroborate my observations. Precipitation decreased from 73 mm to a mere 37 mm between Vallenar and Copiapó.

However, precipitation is only part of the story of Chile's desert flora, and, in the case of Copiapó-area perennials like *Cs. subspeciosa*, not the greater part. The greater part is runoff from the Andes, where, with increasing elevation, precipitation becomes several-fold higher (see, e.g., AGRIMED, 2019, and note that rainfall averages combine El Niño, La Niña, and "normal" year totals). Given the height and steepness of the Andes, even a 10 mm sprinkling in Vallenar or Copiapó raises the specter of catastrophic flooding. Thus, if it seems fantastic that a large, succulent individual of *Cs. subspeciosa* can thrive on less than 40 mm of precipitation, it is because indeed it is fantastic. The proportion of irrigation that a *Cs. subspeciosa* individual receives from a one-meter radius of rainfall is probably very small. Of the larger remaining proportion, I will not speculate how much represents surface versus aquifer irrigation. For the purposes of this paper, I have not researched literature on the contribution of broader area geological hydrology to the historical origin and episodic maintenance of Chile's desierto florido. I put this on my "to do" list.

Water, however, is not everything, The central and southern Andes are known for their rich deposits of metals, copper being the most abundant in Chile, but also gold, silver, among others, and the Atacama Desert region is said to harbor the world's largest deposits of lithium. Presumably the last helps plants in this challenging environment overcome at least their emotional stress. Rocks of the high Andes east of the Vallenar-Copiapó valley are exceptionally rich in gold, its commercial exploitation politically highly contentious. In fact, *Cs. cabrerae* is endemic to montane zones immediately beneath the gold-rich peaks on both sides of the Andes. For the purposes of this paper, I have not researched literature on the degree to which the distributions of *Cs. subspeciosa* and *Cs. cabrerae* might relate to the quantity/quality of metals filtering in runoff/aquifers. The specioids might be especially resistant to or, via genetic assimilation, dependent upon localized mineral concentrations. This relation might be direct or indirect, i.e., via mineral metabolism of co-localized microbes.

It seems clear that *Cs. subspeciosa* hyperarid Atacama perennials depend upon hydrological more than direct climatological irrigation. In this context, Hershkovitz (2019b) criticized a slough of "Big Data" research papers published in "high impact" journals purporting to explain ecological, evolutionary, and biogeographical phenomena in terms of correlations with fine-scale global rainfall data. Much of my

criticism was epistemological, but, epistemology aside, in situ natural history betrays the farce of this research program. For the benefit of some of (nominal) plant physiological ecologists, Hershkovitz (2019b) explained his admittedly rudimentary understanding that "mean annual precipitation" and "moisture availability" are not the same thing. The popularity of this trendy approach seems to owe less to science than to the ease with which downloaded Big Data can be analyzed with downloaded Big Software, facilitated by artificial intelligence tools that aid researchers deficient in the real thing. Expectedly, the approach [de-]generates [into] numerous "high impact" publications, the Bitcoins of modern institutional science. The ecology of *Cs. subspeciosa* and the lengthy periodicity of Atacama rains provide just two of innumerable examples that demonstrate the absurdity of mean annual precipitation-based hypotheses.

Ornamental value of *Cs. subspeciosa*. As noted, the epithet *subspeciosa* literally means "less than attractive/showy." This hardly applies to the flowers of *Cs. subspeciosa*, which are among the largest in the genus. With its 80+ yellow anthers contrasting the pink-mauve petals, it is more appealing than the occasionally cultivated "true" *Cs. grandiflora*. Presumably, *Cs. subspeciosa* is not hardy, but, like other *Cs.* sect. *Cistanthe* spp., it probably can be grown as an annual (cf. Loudon, 1840) or, alternatively, indoors. But the sloppy vegetative architecture shared by *Cs. subspeciosa* and *Cs. grandiflora* indeed demands a mother's love. On the balance, *Cs. subspeciosa* offers a conspicuous accent for low-maintenance water-conserving wildflower gardens. Its form might be better controlled in a container planting. Without the flowers, however, it might be better suited for greening up landfills, homeless camps, and artillery ranges.

The most widely cultivated species of *Cs.* sect. *Cistanthe* is *Cs. laxiflora*, though this species usually has been distributed incorrectly as *Cs. grandiflora* or *Ca. spectabilis* Otto & Dietr. (Hershkovitz, 2019a). Within the past 20 years, cultivation of this species has gone viral especially in southern California, where possibly it has become adventive. Underexploited horticulturally is *Cs. discolor* (Schrad.) Peralta & D.I. Ford, which has neat rosettes of succulent coriaceous leaves deep green and white-mottled adaxially and literally beet-red (rarely green) abaxially. Given its relatively high-altitude native range in central Chile (1000–2000 m), this species presumably is hardy but, in any case, also can be grown as an annual (Loudon, 1840). One would suppose that the montane *Cs. cabrerae* also is hardy.

Much of the early taxonomic literature on *Cs.* sect. *Cistanthe* was oriented not towards botanical science, but horticulture. This likely contributed to the taxonomic ambiguity and confusion that persists to the present day, as persistence of popularized Latin names diverges from the evolving botanical taxonomy. As noted in Hershkovitz (2019a), the taxa *Ca. speciosa* Lehm. and *Ca. spectabilis* were published in horticultural literature, as was Loudon's (1840) early taxonomic summary of Montiaceae species. But even the taxa described/illustrated in nominally botanical literature (Lindley, 1828, 1833, 1839; Hooker, 1834a, b, 1835) emphasized cultivation instructions and not natural history. Like Lehman (1831) and Otto and Dietrich (1833), most of the descriptions were based not on field-collected specimens, but on plants cultivated from acquired seeds. As Loudon (1840) noted, some of the botanical publications did not state even the country of origin. Possibly the emphasis on horticulture owes to economics. Botanical research in this period was financed partially by the sale of ornamental plants and literature to an emerging petit bourgeois that would not have found appeal in the minutia that excites taxonomists.

Addenda to Hershkovitz, 2018c, 2019a

Otto and Dietrich (1833) noted that the plant they described as *Ca. spectabilis* originated from seed of a plant collected by Carlo Bertero. Based on the protolog and Bertero's itinerary in Chile

(Delprete et al., 2002), Hershkovitz (2019a) surmised that *Ca. spectabilis* might refer to *Cistanthe grandiflora* s. str., *Cs. laxiflora*, or *Cs. mucronulata*. Since posting Hershkovitz (2019a), I located two additional Bertero collections pertaining to *Cs.* sect. *Cistanthe*. All bear variations of the identification "*Talinum crassifolium*." One is *Bertero 684* evidently from mountains along the Río Claro in the Rancagua area [**CHILE.** O'Higgins Region. Cachapoal Province [P: P04583007 (Fig. 2); P04583008]. P04583007 indicates an 1828 date, and this accords with Bertero's itinerary. P04583008 indicates a November, 1829 date, consistent with a notion that dates/specimens (understandably) may have been mixed/corrupted by recipients of these collections. In any case, this collection would seem to solve the riddle of the "missing" *Bertero 684* on the "*Bertero 684* [and] *1349*" (NY: 02065851) sheet of *Cistanthe philhershkovitziana* (Hershkovitz, 2018c). *Bertero 684* appears to be *Cs. mucronulata*, confirming my speculation. But it possibly is *Cs. grandiflora*. Its identity must be confirmed by physical examination and by surveying plants near its locality.

Another collection is *Bertero 1349* from Quillota [**CHILE.** Aconcagua Region. Quillota Province [P: P04583004 (Fig. 3), P04583005 (Fig. 4); see also below]. The first indicates an 1829 collection date, again agreeing with Bertero's itinerary. The second includes an individual of *Cs. philhershkovitziana*. The large plants appear to me to resemble *Cs. grandiflora* s. str. rather than *Cs. laxiflora*, and indeed they cannot be the latter littoral zone species unless sea levels were *much* higher in those days, or at least there had been one hell of a tidal wave.

But these *Bertero 1349* sheets are problematic, because this is the *same* collection number as the NY sheet of *Cs. philhershkovitziana*! This suggests that the various curators of the martyred Bertero's Chilean haul did not appreciate how strikingly different was the herbaceous *Cs. philhershkovitziana* from its large, suffruticose congeners, hence mounted them on the same sheet believing them to be the same. Evidence supporting this hypothesis includes the two mixed collections at K (Hershkovitz, 2018c), the misidentification of *Werdermann 39* (E: E00033182) by noted *Cistanthe* expert I. E. Peralta (MERL), and the nearly two-century oversight of this conspicuous and conspicuously-distributed seaside species by all other botanists, Chilean and non-Chilean alike. All of this history involving so many distinguished botanists, and all these years I believed that it was *me* that was the crappy *Cistanthe* taxonomist!

However, another of the *Bertero* sheets is perplexing, P04583006 (Fig. 5). Like NY: 02065851, it is labeled as *Bertero 684* [and] *1349*, and it is a mixed collection that includes *Cs. philhershkovitziana*. Also like NY: 02065851, a date of 1830 is indicated. But the collection locality is given as Valparaiso, and indeed Bertero was in Valparaiso in 1830. Superficially, this at least hints that a *Cs. laxiflora* collection from Valparaiso was possible. Another twist is a secondary dual identification, "*Calandrinia speciosa* Lehm." ´presumably for the larger plant and "[*Calandrinia*] *picta* Gill." presumably for the smaller individual of *Cs. philhershkovitziana*. This manifests curator recognition that the two plants were distinct. Whether it implicates the original source of *Ca. speciosa* Lehm. is another question.

However, to me, the large plant of P04583006 also resembles *Cs. grandiflora* more than *Cs. laxiflora*, though physical examination is desirable. I am inclined to believe that the label is not Bertero's, and that it is erroneous. Hershkovitz (2018c) noted that *Bertero 683* indicates Rancagua and Bertero *1348* and *1350* both indicate Quillota, so it is unlikely that *Bertero 684* or *1349* could be from Valparaiso. Also, Bertero departed Chile in September, 1830 (Delprete et al. 2002), whereas *Cs. laxiflora* is a comparatively belated bloomer, not busting blossoms in the Valparaiso region until latest October and continuing through summer.

But the P04583006 sheet raises another possibility. In particular, there seems to be a missing collection number, since *Bertero 684* now is accounted for, while there are *two* species sharing *Bertero 1349*. Since P04583006 has *two* plants and *two* numbers (*Bertero 684* and *Bertero 1349*), possibly the larger plant is *Bertero 684* from Rancagua and the smaller *Cs. philhershkovitziana* is *Bertero 1349* from

Quillota. However, there are two sheets with only large plants labeled *Bertero 1349*. But given the manifest mix-ups in the curation of these collections, no hypothesis can be discarded. Again, forensic physical examination is needed to resolve these questions.

The upshot is that there is positive evidence that the Bertero collection spawning the name *Ca. spectabilis* could be *Cs. grandiflora* or *Cs. mucronulata*, but only circumstantial evidence that it could be *Cs. laxiflora*. Nonetheless, in horticulture, the name *Ca. spectabilis* historically has been applied commonly to *Cs. laxiflora* (Hershkovitz, 2019a). Such things happen in horticultural taxonomic history. I have seen herbarium specimens of cultivated plants of *Cs. grandiflora* labeled as *Calandrinia elegans*, whereas no species of this genus ever has been named thusly formally. The only *elegans* validly published in *Calandrinia* is *Ca. elegans* Spach, a synonym of the small annual California red maids, *Calandrinia menziesii* (Hook.) Torrey & A. Gray (Hershkovitz, 2019a). And the name *Calandrinia speciosa*, referring to *Ca. speciosa* Lindl. non Lehm., was applied popularly to *Calandrinia menziesii* (Hook.) Torrey & A. Gray well into the 20th century. This is even though the illegitimacy of Lindley's name was recognized by the mid-19th century (e.g., Walpers, 1846). Thus, effectively, in horticultural usage, the genera corresponding to the epithets *elegans* and *speciosa* were swapped. Vernacular transfer of epithets from one to another species of the same genus is all the more common. The identity of *Ca. spectabilis* thus remains unresolved.

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Fig. 1. Lectotype of *Cistanthe subspeciosa*, **CHILE**. Atacama Region. Tierra Amarilla Province: Tierra Amarilla. Ca. 700 m elevation. September, 1924, *Werdermann 405* (E [image! http://data.rbge.org.uk/herb/E00033178].

Fig. 2. *Bertero 684* [**CHILE.** O'Higgins Region. Cachapoal Province: La Quinta, Río Claro, 1828. (P: P04583007, http://mediaphoto.mnhn.fr/media/1441380989872Gg0T8JyQ8pkccL5Z)].

Fig. 3. *Bertero 1349* [**CHILE.** Aconcagua Region. Quillota Province: Quillota, 1829. (P: P04583004, http://mediaphoto.mnhn.fr/media/1441380989812IPoar1iPyCnwiLgt)].

Fig. 4. *Bertero 1349* [**CHILE.** Aconcagua Region. Quillota Province: Quillota, 1829. (P: P04583005, http://mediaphoto.mnhn.fr/media/1441380989812IPoar1iPyCnwiLgt)]. The plant in the center is *Cistanthe philhershkovitziana*. The outer fragments on either side likely are *C. grandiflora*.
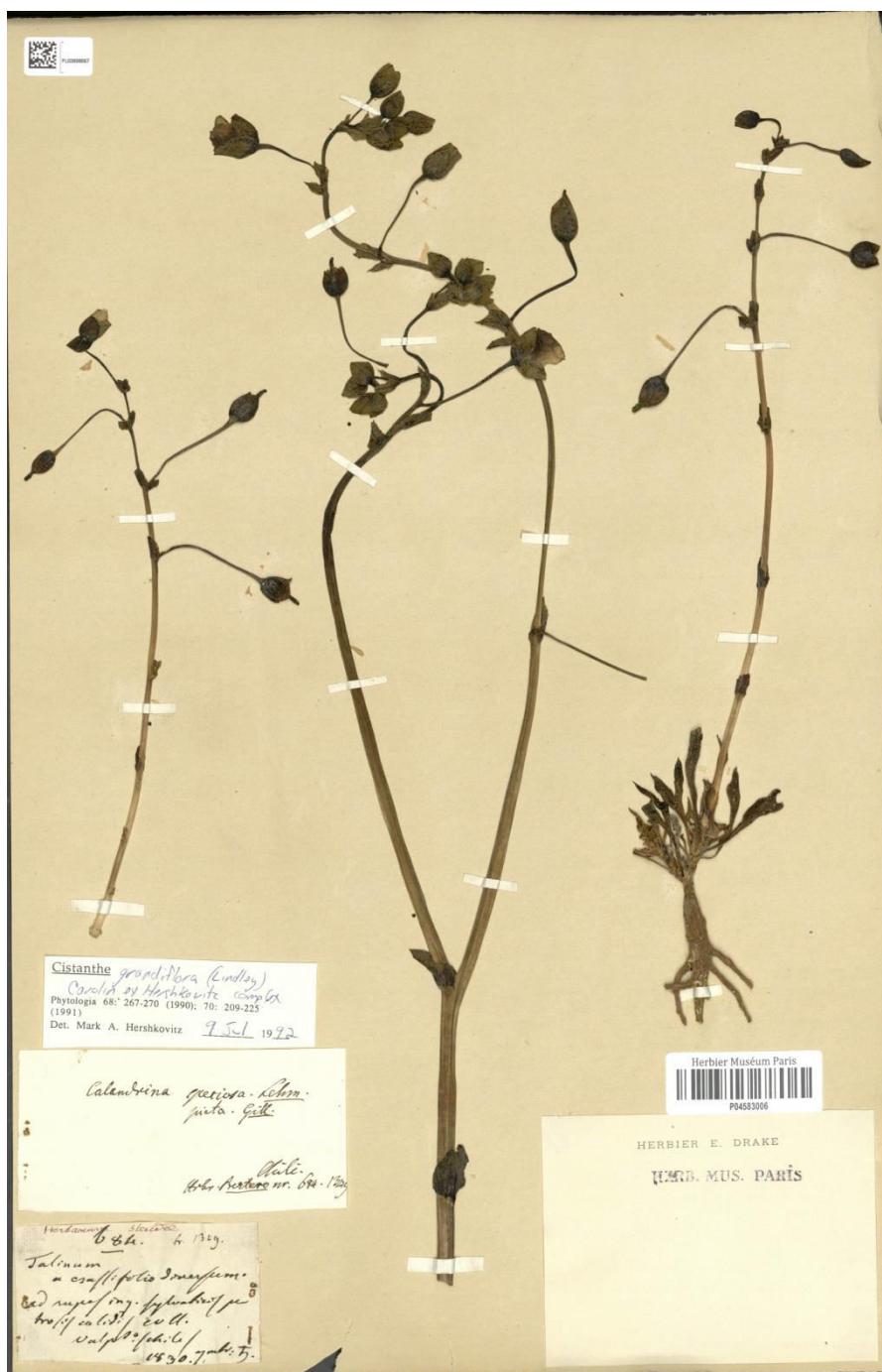
Fig. 5. "*Bertero 684* [and] *1349*" (P: P04583006,
http://mediaphoto.mnhn.fr/media/1441380989851DEkXl7A9TLaoCACc)]. The locality
(Valparaiso) and date (1830) probably are erroneous. The plant on the left probably is *Cistanthe grandiflora* from either the Rancagua or Quillota areas, and on the right is *Cistanthe philhershkovitziana* from Quillota.