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Taxonomic Notes on *Cistanthe* Spach. Sect. *Cistanthe* and other Montiaceae

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ABSTRACT

This work: **(i)** Validates the name *Cistanthe lindleyana* (Walp.) Hershk. for a *C.* sect. *Cistanthe* (Montiaceae) species widespread in the precordillera and coastal ranges of central and near-northern Chile. This species has been included erroneously in *C. grandiflora* (Lindl.) Schltdl. and sometimes in *C. discolor* (Schrad.) Spach. **(ii)** Neotypifies *Cistanthe mucronulata* (Meyen) Carolin ex Hershk. **(iii)** Epitypifies *C. grandiflora* and establishes its original provenance. **(iv)** Lectotypifies *C. aegialitis* (Phil.) Carolin ex Hershk. and *C. crassifolia* (Phil.) Carolin ex Hershk. **(v)** Provides additional critical taxonomic analyses and corrigenda.

Keywords: *Cistanthe* sect. *Cistanthe*, *Philippiamra*, *Silvaea*, Montiaceae, Chile

1. INTRODUCTION

As noted in [1], the taxonomy of the southern South American plant taxon *Cistanthe* sect. *Cistanthe* sensu [2] (Montiaceae) has vexed researchers for more than 125 years [1–5, cf. 6]. The taxonomic difficulty of these species, most originally classified in the genus *Calandrinia* Kunth [2], owes to several factors: **(i)** description of several species in Europe in the early 19th Century based on plants cultivated from seed of imprecise Chilean provenance; **(ii)** absence of Type specimens for several of these early-described species; **(iii)** conceptually redundant descriptions of some species that per the International Code of Botanical Nomenclature (ICN [7]) are heterotypic homonyms and therefore illegitimate names; **(iv)** poor preservation of diagnostic features in herbarium specimens; **(v)** lack of interspecific divergence of DNA sequence markers commonly used for interspecific analyses of other angiosperm taxa; and **(vi)** lack of a comprehensive taxonomic analysis of the section [2, cf. 6]. Hershkovitz [1] cited other factors, as well.

Two longstanding taxonomic problems in *C.* sect. *Cistanthe* will be resolved here. One involves three *Cistanthe* taxa that were named in *Calandrinia* with the same epithet, "discolor." Per [7], the taxa formally are *different*: they are heterotypic (but untypified) *homonyms* sharing the same species epithet. This has created considerable confusion in the taxonomic literature, as researchers have used the oldest of these names, *Calandrinia discolor* Schrad., published in 1831 [8], and apparently presumed that the other newer names are *homotypic* synonyms, viz., that refer to the *same* Type. In fact, most recent references and some local taxonomic databases do not even mention the other two names.

A further complication arises in operational (as opposed to nomenclatural) taxonomy, because current taxonomic and floristic references and databases universally consider *C. discolor* Schrad. as a *taxonomic* synonym (viz. the same *operational* species) of an even *older* name, *Calandrinia grandiflora* Lindl. [now *Cistanthe grandiflora* (Lindl.) Schltdl.]. Thus, these two names refer to different taxa *nomenclaturally*, but taxonomists historically have considered that the Type of the former newer name pertains to the same *taxonomic* species as the Type of latter older name. In other words, in

practice, *all* of the *plants* now are called *Cistanthe grandiflora*. This has obscured further the existence of the other two heterotypic taxa named *Calandrinia discolor*, because botanical researchers in operational practice pay attention to the names of the taxonomically "accepted" species in bold print and do not scrutinize the names of the taxonomic synonyms listed underneath in fine print.

But it turns out that one of the heterotypic synonyms, *Calandrinia discolor* Lindl., published in 1839 [9], is a species markedly distinct from the other *Calandrinia discolor*'s and also from *C. grandiflora*. Moreover, *this* species is both common and broadly distributed in the precordillera and coastal ranges of central and near-northern Chile. Walpers [10] recognized that *C. discolor* Lindl. was homonymous, so he published the replacement name, *C. lindleyana* Walp. But, somewhat coincidentally, this name also has been overlooked in much of the taxonomic literature. Thus, the present work recombines this name as *Cistanthe lindleyana* (Walp.) Hershk. and describes the distinctive characteristics and distribution of this species. The taxonomy of the other two names is discussed briefly, but will be analyzed in a separate work.

The other problem involves the name *Calandrinia mucronulata* Meyen, which, until recombined in 2019 as *Cistanthe mucronulata* (Meyen) Carolin ex Hershk [2], was either overlooked in earlier references or also was considered to be a *C. grandiflora* synonym. It is a species easily distinguished from *C. grandiflora* morphologically and, moreover, it is completely allopatric. It is distributed from the cordillera of San Fernando (Libertador Bernardo O'Higgins [or "LOH"] Region) southwesterly to Talcahuano (Biobío Region). However, there is a problem regarding the presumptive Type of this species, which presumably was destroyed in the Berlin herbarium fire in 1943. More problematic, according to Meyen [11], the plant was collected in herbaceous/suffrutescent Andean steppe at perhaps 2500 m elevation. But all collections/observations of this species are from coastal to montane woodlands ("bosque") or Chilean matorral (similar to savannah), in between ca. 0–1200 m elevation. Nonetheless, *C. mucronulata* here is neotypified with a specimen collected ca. 16 km from the presumptive Type locality, though at much lower elevation.

Finally, this work also: **(i)** adds new information to the taxonomy of *C. grandiflora* and epitypifies this species; **(ii)** formally lectotypifies per [7] two species that thus far have been lectotypified only informally, *Calandrinia aegialitis* Phil. [≡ *Cistanthe aegialitis* (Phil.) Carolin ex Hershk.] and *Calandrinia crassifolia* Phil. [≡ *Cistanthe crassifolia* (Phil.) Carolin ex Hershk.]; and **(iii)** includes additional corrigenda of earlier publications,

2. METHODOLOGY

The present work synthesizes information from both historical and recent published taxonomic and floristic literature, only a few of the most current and relevant examples of which are cited here. In addition, both local and global taxonomic and specimen databases [12-18] were consulted. The principal queries resolved were: **(i)** which of the taxonomic names of interest were or were not mentioned in each reference; **(ii)** what taxonomic status was ascribed to the names (viz. accepted species or taxonomic synonym); and, of course, **(iii)** what are the characteristics and distributions of the species.

The images used in the Figures in this work are available in higher resolution via the Supplemental File link.

3. RESULTS AND DISCUSSION

3.1 Taxonomy of the three species named Calandrinia discolor

In 1831, Schrader [8] first published the name *Calandrinia discolor* in a commercial seed catalog distributed by the Gottingen Botanic Garden. This he accompanied with a brief Latin diagnosis, then already conventional in plant taxonomic science, but not then formally required. Nonetheless, retroactively per [7] for names published at that time, *Calandrinia discolor* Schrad. was validly published as a species for purposes of all subsequent nomenclatural operations. For names published currently, the rules also require designation of a physical Type specimen. Conventionally, but not obligatorily, modern taxonomy also indicates the geographic provenance of that Type and, if possible, the geographic distribution of the species and an illustration. Schrader [8] did not indicate the original geographic provenance of the seeds, but he did indicate that they were from a plant growing in "Hort. Paris."

In 1832, Jacques [19] published a name, description, and illustration (Fig. 1) of a plant he also called *Calandrinia discolor*, and he indicated that the plant was cultivated in gardens in Paris since 1830. But he did not mention Schrader's formal authorship or publication. It cannot be established that Jacque's plant is the exact same individual that Schrader described (viz. the unknown Type of *C. discolor* Schrad.). Thus, per [7], Jacque's name is a validly published but illegitimate heterotypic homonym of Schrader's name. Even though the circumstantial evidence suggests that it is the same taxonomic species, for nomenclatural purposes, is a different species. If Jacques [19] had referred to Schrader's authority or publication, then his name would be identical nomenclaturally, but not necessarily taxonomically. The ICN [7] regulates only nomenclature and not taxonomy per se. These rules are not merely bureaucratic technicalities, because, in those days, it was not uncommon to publish the same name twice for different taxa. This is especially because there were no online taxonomic databases to verify the legitimacy of new names.

Fig. 1 – Original illustration of *Calandrinia discolor* Jacques published in 1832 in [19].

In 1834, Hooker [20] published a name, description, and illustration (Fig. 2) of a plant he called *C. discolor* "Hort. Goett." which is an indirect reference to Schrader, and therefore *C. discolor* Schrad. He did not refer to Jacques [19].

In 1839, Lindley [9] published another description and illustration (Fig. 3) of a plant he also called *Calandrinia discolor*. He did not mention Schrader or Jacques so, again, per [7], his name is a validly published but heterotypic illegitimate homonym, *Calandrinia discolor* Lindl. And this case demonstrates the utility of the rules. Superficially, Lindley's description of the plant is sufficiently similar to the two previous *Calandrinia discolor*'s as to lead one to believe that all three, if not homotypic, are taxonomically the same species.

Fig. 2 – Original illustration of *Calandrinia discolor* Schrad. published in 1834 in [20].

Fig. 3 – Original illustration of *Calandrinia discolor* Lindl. published in 1839 in [9].

In fact, Lindley's *C. discolor* is not taxonomically the same as the other two. One minor difference is that Lindley reported that his plant was received from the Berlin Botanical Garden in 1835, viz. not Paris or Gottingen. But in 1840, Loudon [21], a close associate of Lindley, noted that the leaves of *C. discolor* Lindl. were different from those of Hooker's *C. discolor* Schrad. illustration. In particular, she noted that the leaves were "somewhat discolored" abaxially and had a "strange mottled color" (presumably) adaxially. She remarked that Hooker's [20] illustration (Fig. 2) showed "not mottled," oblanceolate, apically acute leaves that were "bright pink" (rather than purple) abaxially. Lindley's [9] illustration (Fig. 3) shows a broader, elliptical leaf blade with a more obtuse apex.

In addition to the above, the illustrations show another distinction in the leaf morphology. Lindley's [9] illustration of the "Berlin" *C. discolor* (Fig. 3) also shows the 2° leaf veins emergent ("embossed") on the adaxial leaf surface forming closed loops (viz. *brochidodromous* venation) as well intercostal "relief." Jacque's [19] (Fig. 1) and Hooker's [20] (Fig. 2) illustrations of "Paris" *C. discolor* show the adaxial leaf surface as perfectly smooth except for the primary leaf vein, which appears as a *depression* adaxially and as a ridge abaxially.

The leaf morphology described by Lindley [9] is evident in an illustration of a plant called *Calandrinia discolor* (without authority) in Muñoz Pizarro [22, cf. 23], and the leaves in this illustration are identical to that of a species that is widespread in central Chile, particularly on somewhat dry slopes from the precordillera to the coastal ranges, 800–1500 m elevation, in between the LOH and Coquimbo Regions (Figures 4–5). This plant, therefore, is *C. discolor* Lindl., hence *C. lindleyana* Walp., and not *C. discolor* Schrad. or its heterotypic homonymous but taxonomically synonymous taxon, *C. discolor* Jacques. And, of course, it is not *C. grandiflora* (see below).

Remarkable given its distinctiveness and ubiquity, the names *Calandrinia discolor* Lindl. and *C. lindleyana* are essentially absent from Chilean floristic literature up to including the most recent comprehensive plant species lists for southern South America [24] and Chile [25] and their respective continuously updated online databases [12, 13]. These references all list only *Calandrinia discolor* Schrad. as a *C. grandiflora* synonym of. Global taxonomic databases, which are taxonomically more thorough, also list *Calandrinia discolor* Lindl. and *C. lindleyana* as *C. grandiflora* synonyms.

Because *C. discolor* Lindl. indeed represents a species distinct from the other two *C. discolor* taxa, and because the epithet 'discolor' is not available in *Cistanthe*, the name is transferred here to *Cistanthe* as *C. lindleyana* (Walp). Hershk.

Cistanthe lindleyana (Walp.) Hershk., comb. nov. **Basionym:** *Calandrinia lindleyana* Walp., Repert. Bot. Syst. (Walp.) ii: 235. 1843. ≡ *Calandrinia discolor* Lindl., Edwards's Bot. Reg. 25: t. 4. 1839. nom. illegit. **Type:** not located, perhaps in CGE, otherwise could be the illustration in [9]. **Illustrations:** [9, 22, 23]. **Diagnosis:** subrosettiform hemicryptophytic facultatively annual perennial herbs; leaves succulent, leathery, brachyblastic, heteroblastic leaves very few or often lacking; obovate to elliptical to ovate with obtuse to mucronulate apices, adaxial surface sculpted ("embossed"), the vasculature eleva*ted* relative to the intercostal regions, mottled, the vasculature pale, the intercostal regions deep green, abaxial surface usually deep magenta; inflorescence scapose, the stems subangular to terete; inflorescence and flowers otherwise similar to those of *Cistanthe grandiflora*, but, in the precordillera and some but not all of the coastal range populations, the petals are white rather than variously colored at the base. **Breeding system:** Ca. 70% self-compatible [26, cf. 27]. **Distribution and ecology:** seasonally dry slopes, usually 800–1500 m elev., precordillera and coastal ranges, southernmost Cachapoal Province just N and NW of San Fernando city (LOH Region) to Elqui Province (Coquimbo Region). *Cistanthe lindleyana* is allopatric with *C. mucronulata* but parapatric with *C. grandiflora* in the Valparaiso and Coquimbo Regions, with the latter growing on lower elevation and moister sites, even on the same slopes. I have found only one instance of site co-occurrence along the Río Choapa in central Salamanca. Evidently frost-hardy in native habitats, but reportedly not in cultivation [9], probably because the former plants are drought-desiccated while the latter are fully hydrated when subjected to freezing. **Phenology:** In the native habitat in central Chile's Mediterranean climate, the perennating rosettes emerge if and when (late Apr-Aug) adequate winter rains arrive, and then the plants typically flower ca. Sept-Oct and go dormant as summer drought ensues. Under optimized aseasonal conditions, as in similar *C.* sect. *Cistanthe* species [27], the plants are probably evergreen and flower episodically or continually throughout the year. There are no data on seed germination in native conditions; in cultivation, *C. lindleyana* flowers ca. four months following seed germination [9]. **Other observations:** Plants referred to as *Cistanthe discolor* (Schrad.) Spach in [2, 24-26] actually are *C. lindleyana*. As noted in [2, 27-30], specimens misidentified as *C. discolor* in the molecular phylogenetic analysis of [31] actually pertain to *C. grandiflora*. Plants of *C. lindleyana* usually are distinguished easily by their unusual leaf venation, but hybrids with *C. grandiflora* occur, and it might be confused (not coincidentally) with less common plants in the coastal ranges that are similar to those illustrated as *C. discolor* Jacques (Fig. 1) and *C. discolor* Schrad. (Fig. 2). But I defer to a subsequent work analysis of the other *C. discolor* taxa.

Fig. 4 – *Cistanthe lindleyana* plants with developing inflorescences. Note the extreme embossing of the lighter-colored leaf venation on the adaxial surface contrasting with the darker green intercostal regions, and also the purplish abaxial surface (top left). Plant observed in the precordillera of the Metropolitana Region, Chile. Photo 436972288, © Maxi, some rights reserved (CC BY-NC), uploaded by Maxi · iNaturalist Chile, https://inaturalist.mma.gob.cl/photos/436972288

Fig. 5 – *Cistanthe lindleyana* plant in the precordillera of the Metropolitana Region, Chile. Photo 239139601, (c) Diego Aguayo, some rights reserved (CC BY-NC), uploaded Diego Aguayo · iNaturalist Chile. https://inaturalist.mma.gob.cl/photos/239139601

3.2 Taxonomy of Cistanthe mucronulata

Cistanthe mucronulata is another species largely overlooked in Flora of Chile literature. But this oversight is surprising, since, unlike *Calandrinia discolor* Lindl., the name *Calandrinia mucronulata* is not a homonym of any, much less two, heterotypic names. The most recently print-published (2008) comprehensive list of southern South American *Cistanthe* species [24] referred to *Calandrinia mucronulata* as a "*doubtful name…probably related to C. grandiflora, but with a more southerly distribution.*" An even more recent (2018) comprehensive listing of all Chilean vascular plants [25] did not mention *C. mucronulata* at all. However, following the 2019 publication of the combination in *Cistanthe* [2], *C. mucronulata* has become an "accepted" species in online taxonomic databases [12, 14-18] except, ironically given its Chilean endemism, for the *Chilean* floristic database [13], which is based on [25], and is abysmally curated. During 2025, the iNaturalist web site (www.inaturalist.org) added *C. mucronulata* to their database, and several littoral zone observations previously identified as *Cistanthe* sp. or *C. grandiflora* were so re-identified. This evidently is consequent to my identification of some of these observations in [27]. However, at this writing, all iNaturalist observations of *C. mucronulata* from interior localities remain identified as *Cistanthe* sp. or *C. grandiflora*.

Interestingly, several specimens of *Cistanthe mucronulata* in [16] were annotated ca. 1990 as *Calandrinia mucronulata* by Donna Ford-Werntz (WVU). It is my personal recollection that, at that time, she accepted this species as distinct from *C. grandiflora*. It is peculiar, therefore, that Ford-Werntz in 2008 [24] *coauthored* (together with I. E. Peralta (MERL), the opinion that *Calandrinia mucronulata* is a "*doubtful name*" (see above). The online reference [12], based on [24], now accepts *Cistanthe mucronulata* as a distinct species.

Perhaps the oversight of *C. mucronulata* is consequent to its publication as a footnote "buried" in a (very interesting!) travelogue [11] rather than, as is more common, in a taxonomic publication, or at least a taxonomic conspectus in a travelogue separated from the narrative. Another reason is the probable loss of the original material in 1943. But perhaps another reason owes to the peculiar provenance of the original material. Meyen [11] reported the species from a (still poorly collected) locality that, from the itinerary, I estimate to be ca. 2500 m elevation. From both the itinerary and list of co-occurring species, the vegetation here must be Andean steppe, a vegetation comprising herbs and very low (sub)shrubs with elevation below that of the "alpine" zone but above what would be "treeline" if "trees" actually were present. At this latitude in Chile, the "bosque" adjacent to the steppe comprises large shrubs and small trees rather more sparsely distributed than in a typical forest. Consequently, the altitudinal limit for bosque does not form a well-defined treeline. Also, bosque and steppe intermingle extensively here, because the steep river canyons in the steppe zone can descend 1000+ m over 1 km in distance.

However, 2500 m is mostly well above the verifiable elevational limit for any *C.* sect. *Cistanthe* species. *Cistanthe cabrerae* (Añon) Peralta (incl. *C. subspeciosa* Hershk. [27, cf. 29]) reportedly reaches 2500 m [24], but that elevation, if accurate, is from ca. 5 degrees latitude further north. As is well known, vegetational belts increase in altitude with decreasing latitude. Other specimens in [16] are consistent with my personal observations that the elevational limit of *C. mucronulata* is ca. 1200 m, in bosque vegetation. So this yields three possibilities: **(i)** Meyen [11] grossly misidentified his plant, and it is not *Cistanthe* or even Montiaceae. Without providing details here, I discount this possibility. **(ii)** Meyen correctly identified the plant but erred in recording its precise locality. This is plausible because, from [11], it can be determined that Meyen began his journey on that particular day in the Río del Azufre canyon at ca. 1200 m, perhaps 10 km east of a verifiable *C. mucronulata* collection locality (Fig. 6; see also below). **(iii)** Meyen correctly identified the plant and correctly recorded the precise locality, but the plants were waifs from nearby lower elevation localities that would not have survived the winter. This is plausible because this species, like all other herbaceous *Cistanthe* sect. *Cistanthe* species [27], probably is a facultative annual. Also, Meyen collected his plant in early February, or midsummer, whereas lower elevation collections of this species flower in late spring. So I accept that Meyen's *Calandrinia mucronulata* actually corresponds to the same species as the widespread plants that occur in between ca. 0–1200 m.

The relatively sharp boundary between the ranges of *C. lindleyana* and *C. mucronulata* is worthy of note. It coincides with an abrupt transition in average annual precipitation, such that Santiago (Metropolitana Region) receives only about half

that of San Fernando. In fact, normally the difference is more marked, because the "average" averages extremes associated with the Southern Oscillation (ENSO), which affects the position of Pacific Ocean low pressure systems, hence the latitude at which rain arrives in Chile. In El Niño years, the low pressure systems are displaced northward, such that precipitation arrives to central Chile from the W/SW. Santiago and San Fernando precipitation is more equalized. In La Niña years, the low pressure systems are displaced southward, such that moisture arrives to central Chile from the south. However, at the latitude of San Fernando, the separation between the coastal ranges and precordillera is narrow, on the order of 20 km. This obstructs the passage of moisture from the south, such that San Fernando and Curicó (Maule Region) receive up to 4X the rainfall as Santiago. Thus, *C. mucronulata* may be restricted to the south by moisture availability. Since *C. lindleyana* does well in cultivation in England [9], I doubt that it *requires* the aridity of its more northerly range. More likely, it is less frost-tolerant when more hydrated, as it would be in the *C. mucronulata* range.

Here, I neotypify *C. mucronulata* with a specimen collected 16 km east of Meyen's [11] reported locality, and also elaborate a diagnosis and description.

Cistanthe mucronulata (Meyen) Carolin ex Hershk., Phytoneuron 2019-27: 56. 2019. ≡ *Calandrinia mucronulata* Meyen, Riese Erde 1: 314. 1834. ≡ Claytonia mucronulata (Meyen.) Kuntze, Revis. Gen. pl. 1: 57. 1891. **Type** (inferred from publication)**:** CHILE, LOH Region, Colchagua Province, plains near the Río del Azufre WSW of Cerro del Azufre and WNW of Volcán Tinguirrica, ca. 34.8S 70.4W, ca. 2500 m, 6 Feb 1831, *Meyen*. (not located and presumably destroyed in Berlin). **Neotype** (here designated)**:** CHILE, LOH Region, Colchagua Province, 41.3 km E of San Fernando on road to Termas del Flaco [ca. 16 km W of original Type locality]; N facing rock cliff; 34°48'S 70°36'W 870 m elev, 13 Dec 1987, *D. I. Ford*[-Werntz] *& C. Smith 359* (MO[barcode MO-1938178; accession 4319027]). **Diagnosis:** subrosettiform hemicryptophytic facultatively annual perennial herbs to chamaephytic shrubs with fleshy stems; leaves somewhat (in drier zones) to markedly (in littoral zone) succulent, brachyblastic, heteroblastic leaves very few or lacking, usually obovate with rounded but sometimes acute apices, adaxial surface smooth, uniformly green, the 1° vein evident as a depression, abaxial surface somewhat sculpted, 1-2° veins usually elevated ("embossed"), paler green than adaxial surface; inflorescence scapose, the stems subangular to terete. **Breeding system:** unknown. **Distribution and ecology:** precordillera in bosques and matorral, ca. 500-1200 m elev. from Colchagua Province E of San Fernando city (LOH Region) S to the Ñuble Region; lower elevations coastal range matorral from Maule (LOH?) Region S to the Ñuble Region; littoral zone from ca. Pichilemu (LOH Region) S to Talcahuano (Biobío Region). Allopatric with both *C. lindleyana* and *C. grandiflora*, occurring within 30 km of the former near San Fernando and 50 km of the latter north of Pichilemu. **Phenology:** Year-round behavior of interior bosque and matorral plants not observed, but likely the same as for *C. lindleyana*, though leafing out earlier and flowering later because of the more southerly and rainier climate; littoral zone chamaephytic plants nearly evergreen, with a longer flowering period, dying back in the coldest months [27]; probably evergreen and episodically to continuously flowering in optimized aseasonal conditions. **Observation:** *Calandrinia bracteosa* Phil., from Chillan, possibly pertains to *C. mucronulata* [32]. But unless the Type is located, its identity may never be known.

3.3 Observations on the taxonomy of C. grandiflora

As noted, *C. lindleyana* historically has been overlooked in the literature and some databases, probably because it has been confused with *C. discolor* Schrad., which has been considered in current literature and databases as a *C. grandiflora* synonym. Even current databases that list *Calandrinia discolor* Lindl. and *C. lindleyana* also consider these as *C. grandiflora* synonyms. *Cistanthe mucronulata* likewise either has been overlooked or considered a *C. grandiflora* synonym, though some current databases now accept it as distinct, evidently owing to my publications [2, 27]. The reasons for these historical synonymizations were enumerated in the introduction.

But the role of poor preservation of diagnostic vegetative characteristics also is important [3-5], especially because, historically, taxonomists emphasized differences in the number and size of floral organs. It turns out that the flowers of most *C.* sect. *Cistanthe* species lack diagnostic characteristics. Nonetheless, differences evident in live plants led Hooker

[20] to remark (already in 1834) that "*Similar…as they are in aspect, they are totally different species.*" So, what are the characteristics that permit distinction of *C. grandiflora* from species subsequently lumped into it?

At least in the ranges of concern here, the Coquimbo to Biobío Regions, the most important distinction was described in 1834 by Otto & Dietrich [33] and reiterated in 1836 by Spach [34], and it remains remarkably diagnostic almost two centuries later. In particular, the flowering stems of *C. grandiflora* are distinctly angled, while those of all other species in the area of interest are subangular to terete. This distinction was not mentioned in other contemporary literature (e.g., [9]) and overlooked in subsequent taxonomic literature until perhaps 2019 [24, 25]. This possibly is the main reason that so many species became lumped in *C. grandiflora*. But part of the reason that the distinction was overlooked is that [33] and [34] are somewhat "obscure" publications, the former because it was published in a horticultural journal, the latter because Spach's segregation of *Cistanthe* from *Calandrinia* was largely ignored until the end of the 20th Century, again consequent mainly to my publications, 1990 to the present.

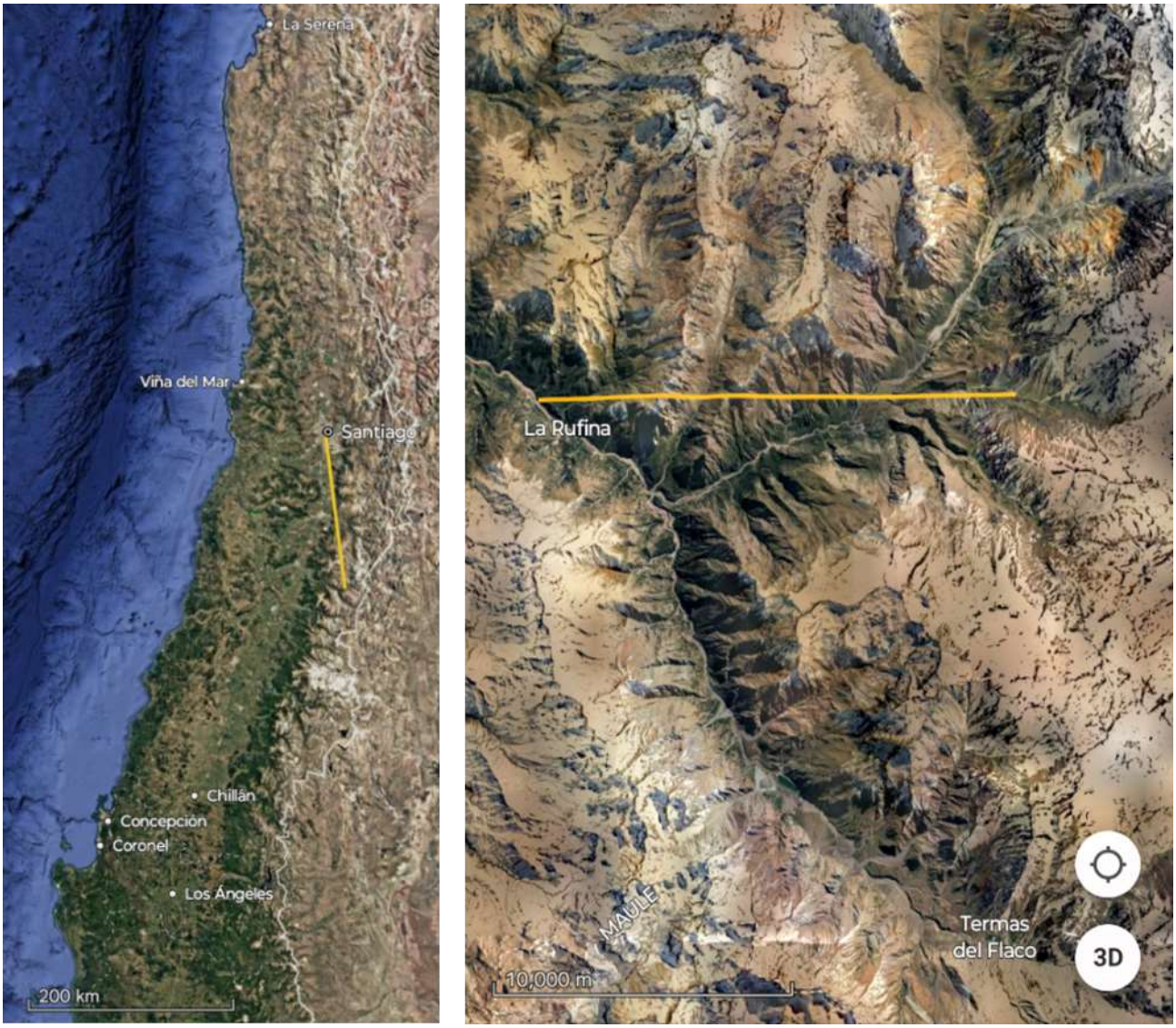

Fig. 6 – *Cistanthe mucronulata* Type and epitype localities. **Left:** vicinity of the localities (yellow line bottom terminus) ca. 150 km SSE of Santiago, Chile. **Right:** Yellow line showing the ca. 16 km separation between the epitype locality (left side, 870 m elev.) and supposed Type locality (right side, ca. 2500 m elev.). Note the Río del Azufre crossing the line ca. 5 km W of the Type locality. The elevation here is ca. 1200 m.

But the distinction was overlooked also for another reason. Lindley's [35] original description not only failed to mention this trait, but his illustration shows heteroblastic stems that appear cylindrical and scapes that appear only vaguely angular (Fig. 7). Naturally, this work was the primary reference for subsequent taxonomic accounts, especially the still influential 1828 work of Candolle [36]. The terete stem might make one suspect that maybe *C. grandiflora* is not the species that one believes. Maybe it is a different *Cistanthe* species. But this concern can be dispelled by the 1834 description and illustration of *C. grandiflora* by Hooker [37]. Hooker [20] reported that he received his *C. grandifora* material directly from Lindley. His illustration [37] is similar to that of Lindley's [35], except that the stems are shown as *markedly* angular (Fig. 8). So it is not clear why Lindley's [35] illustration did not show this. It also is not clear why Hooker's [37] *description* of the plant did not mention this character so obvious and otherwise unusual in the illustration. Again, however, since [37] was not the original description for this species, it probably was overlooked by subsequent researchers. Still, the evidence suggests that the illustration in Hooker [37] is an appropriate epitype for *C. grandiflora*.

Fig. 7 – Original illustration of *Calandrinia grandiflora* Lindl. published in 1828 in [35].

Fig 8 – Hooker's illustration of *Calandrinia grandiflora* Lindl. published in 1834 in [37].

Other differences between the species in the area of interest pertain to plant habit. Among the 7–8 *C.* sect. *Cistanthe* species in the area spanning the Coquimbo to Biobío Regions, *C. grandiflora* is the only one that, in addition to brachyblastic leaves in the basal rosette, also characteristically possesses heteroblastic leaves along vegetative stems and towards the base of the scape [1]. This gives the plants a sloppy appearance similar to that of common ruderal and urban Asteraceae and Brassicaceae weeds. And, indeed, *C. grandiflora* often establishes in anthropogenically modified sites. Leaves of all other species usually are completely brachyblastic, even those distributed along long vegetative stems, as in *C. laxiflora*

(Phil.) Peralta & D.I.Ford. Sometimes only one, rarely two, heteroblastic leaves may develop at the base of the inflorescence [1]. Hence the other species appear "neater" than *C. grandiflora.*

In the course of this work, I uncovered another bit of "juicy" information. As described in detail by Veldcamp [38], the original material *C. grandiflora* was collected (somewhere) in Chile by James Macrae ("M'Rae") during the voyage of the HMS Blonde, 1824–1826 (see [39]). The Type is located in the Lindley herbarium at Cambridge University (CGE), Cambridge, UK. Veldcamp [38] did not indicate a precise locality in Chile, so presumably none is indicated on the specimen, and no image is available. It is not clear whether that specimen was field-collected or cultivated from seed. Lindley's [35] description and illustration appear to represent a cultivated specimen.

Meanwhile, I located in the BR herbarium (Meise Botanic Garden, Meise, Belgium) another specimen of *C. grandiflora* collected by Macrae indicating "Coquimbo, 1825" (Fig. 9). It is not clear how, when, or why this material arrived in Belgium, or (again) whether this specimen was field-collected or cultivated from seed, or even if it is from the same original material studied by Lindley. In particular, per Byron & Bloxam's [39] compilation of HMS Blonde journals, the crew docked in Valparaiso three times in 1825 and remained there a total of 15 weeks. *Cistanthe grandiflora* would have been flowering there at any of these times, more so from September to December. The crew docked in Coquimbo (Elqui Province) for only one week, 5–13 December, 1825. The species would have been present there also. Still, it seems peculiar that Macrae would have collected the species in the place where he spent only a week and not in the place where he spent 15 weeks.

But speculation is useless. The evidence must be taken at face value. There are two known specimens of *C. grandiflora* collected by Macrae in Chile sometime during 1825. One indicates Coquimbo, and the other (judging from [38]) does not indicate locality. So there is no evidence that Macrae collected *C. grandiflora* from any locality other than Coquimbo. Pending evidence to the contrary, the provenance of the original material of *C. grandiflora* must be considered as Coquimbo.

The above information suggests two modifications to the taxonomy of *C. grandiflora*, one to add the original material provenance, the other to epitypify the Type:

Cistanthe grandiflora (Lindl.) Schltdl., Hort. Hal. 10. 1841. **Basionym:** *Calandrinia grandiflora* Lindl., Bot. Reg. 14: t. 1194. 1828 nom. conserv. **Type:** CHILE: Coquimbo Region, Elqui Province, somewhere between the port of Coquimbo and Condoriaco, 0 to probably < 500 m , 5–13 Dec 1825, ex? *Macrae* ("*M'Rae*") *s.n.* (CGE [CGE 05286; not seen]). It is not clear whether the Type is original material or cultivated from seed of original material. In the latter case, the Type provenance is "cultivated, London, UK., ex Macrae" **Epitypes** (designated here): **(i)** CHILE: Coquimbo Region, Elqui Province, somewhere between the port of Coquimbo and Condoriaco, 0–1300 m, 5–13 Dec 1825, ex? *Macrae* ("*M'Rae*") *s.n.* (BR [BR0000031436342; image!]). Again, it is not clear whether the epitype is original material (thus, an isotype), cultivated in BR from seed of original material, or a specimen prepared from material cultivated in London, in either case "ex Macrae." Thus, the epitype provenance is not established. **(ii)** Cultivated. UK: Glasgow, ex Type, illustration in Hooker, Bot. Mag. 8 (new series). t. 3369. 1834. It is possible that the physical specimen is preserved in either GL or K, in which case this also would be an appropriate epitype. **Homotypic synonyms:** ≡ *Cistanthe anceps* Spach, Hist. Nat. Vég. (Spach) 5: 230. 1836. nom. illegit. ≡ *Claytonia grandifora* (Lindl.) Kuntze, Revis. Gen. pl. 1: 57. 1891. ≡ *Cistanthe. grandiflora* (Lindl.) Carolin ex Hershk. Phytologia 68(4): 269. 1990. Isonym.

3.4 Typification of Cistanthe aegialitis and C. crassifolia

In [2], I validated the combinations *Cistanthe aegialitis* (F. Phil.) Carolin ex Hershk. (as 'aegitalis') and *C. crassifolia* (Phil.) Carolin ex Hershk. There, I incompletely lectotypified the species, not indicating which of multiple sheets in SGO was the lectotype. In both cases, the sheets were, via annotation, informally lectotypified by I. E. Peralta (MERL). Here, I formally lectotypify these species per [7], selecting the sheets annotated by Peralta.

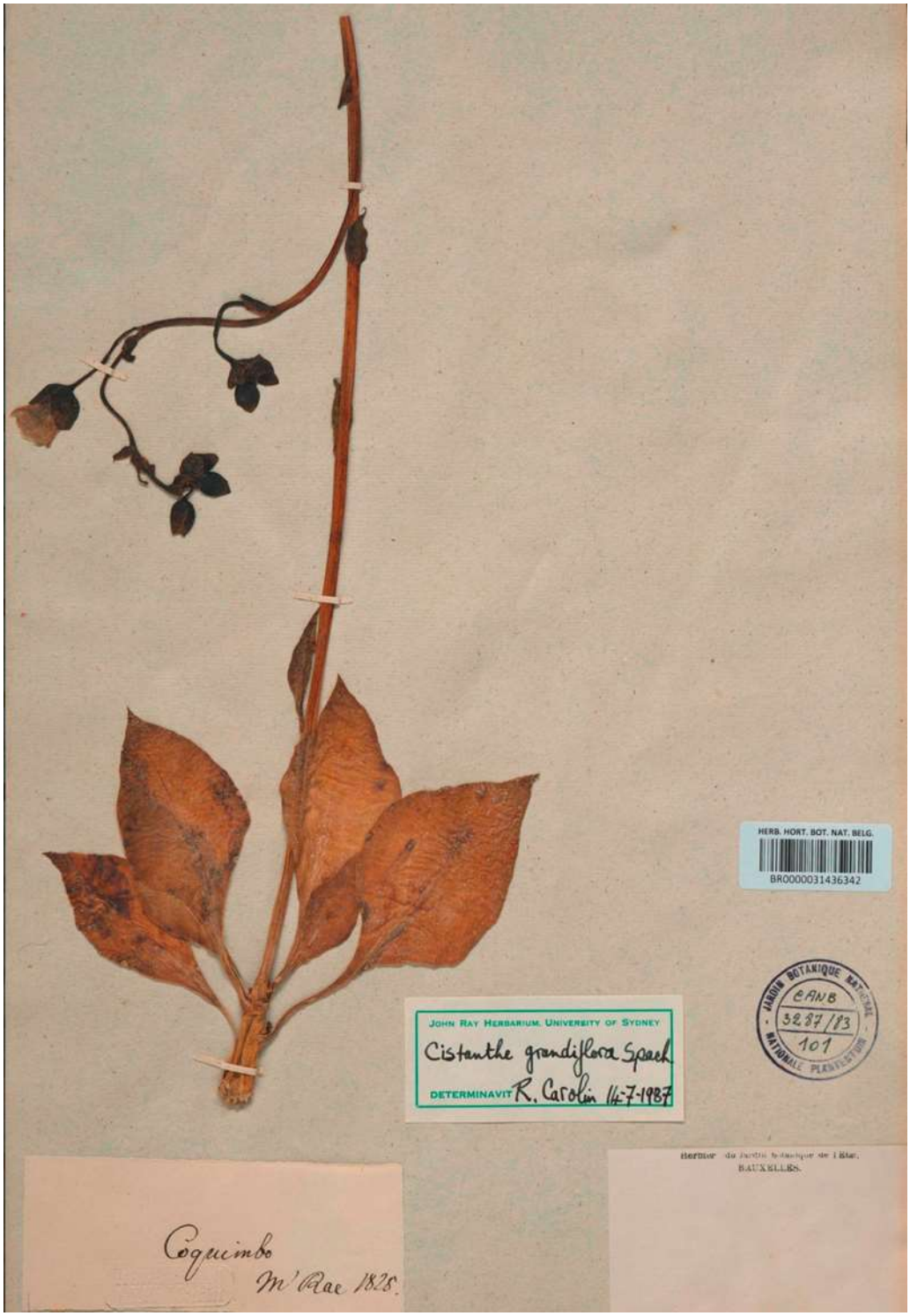

Fig. 9 – *Calandrinia grandiflora* collected in the Coquimbo vicinity by James Macrae in December, 1825.

Cistanthe aegialitis (F. Phil.) Carolin ex Hershk., Phytoneuron 2019-27: 56. 2019. [as 'aegitalis']. **Basionym:** *Calandrinia aegialitis* F.Phil. in Phil., Anales Univ. Chile 85: 184. 1893. **Lectotype** (designated here): CHILE: [now] Region IV [Coquimbo], Limarí Province, Fray Jorge, "*litt. maris*.," 22 Sept 1893, *F. Philippi s.n.* (SGO [SGO000001817]!). **Isolectotype:** SGO [SGO000001818]!]. A third sheet annotated by Peralta as isolectotype indicates a different locality, "*ad ostium flumen Limarí*," and therefore is not an isotype per [7].

Cistanthe crassifolia (Phil.) Carolin ex Hershk., Phytoneuron 2019-27: 56. 2019. **Basionym:** *Calandrinia crassifolia* Phil., Anales Univ. Chile 85: 180. 1893. **Lectotype:** CHILE: [now] Region III [Atacama], Huasco Province, Carrizal, Sept 1885, *Philippi s.n.* (SGO [SGO000001820]!). **Isolectotypes:** SGO [SGO000001820]!; K [K000424714; image!]

3.5 Other corrigenda

I have discovered two errors in my previously published work. One is the figure for petal length in the original description of *Cistanthe philhershkovitziana* Hershk. [30]. The given measurement, 2–4 cm, corresponds to the floral diameter, not the petal length. The other is the petal length figure for *Cistanthe reshetiana* Hershk. given in Table 1 in [1], which should be 23–25 mm and not 23–25 m. As I have advertised previously, anyone dissatisfied with any of my publications for any reason can return it to me for a full refund of the purchase price. Alternatively, a formal complaint can be filed with SERNAC (www.sernac.cl).

On a matter related to other Chilean Montiaceae, I reported in [2] and [40] that the generic name *Silvaea* Phil. (Fl. Atacam. 21, t. 1C. 1860) was illegitimate per [7] because it was a later homonym of *Silvaea* Hook. & Arn. (Bot. Beechy Voy. 211. 1837. Euphorbiaceae). The International Plant Names Index (IPNI; www.ipni.org) at that time agreed. But since then, Rafaël Govaërts (written comm.) at [15] informed me that Index Nominum Genericorum (ING) [41], in an entry dated 4 Apr 2019, reclassified *Silvaea* Hook. & Arn. as not validly published per Art. 36.1 of [7]. Govaerts explained to me that this was because the authors used the word "probable" in the protolog, specifically, "*It is probable that C*[*luytia*] *semperflorens* Roxb.*...must form a new genus,* (*Silvaea Hook. & Arn.*), *distinct from either* [genus]."

However, Govaerts also pointed out that the name was validated later by Baillon as *Silvaea* Hook. & Arn. ex Baill. (Étude Euphorb. 341. 1858). IPNI has revised its data to reflect this determination. More to the point, this name *still* is older than *Silvaea* Phil., which remains an illegitimate homonym. Both ING and Tropicos [42] also currently list *Philippiamra* as an illegitimate superfluous name, this presumably owing to [43], who evidently was unaware of the existence of *Silvaea* Hook. & Arn. Tropicos also currently lists some but not all *Philippiamra* binomials as illegitimate. Interestingly, they do not flag *Silvaea* Hook. & Arn. as illegitimate.

My opinion differs. Linguistic analysis of the two predicates, "*It is probable* [that something] *must be*" suggests that the sense is subjunctive, which indeed expresses uncertainty. But the predicate is somewhat nonsensical, as demonstrated by the counterfactual construction "*It is improbable* [that something] *must not be.*" This suggests to me that "*It is probable...*" was used rhetorically, such that the authors indeed intended to consummate publication of the genus that they named and diagnosed. At the same time, no, they did not publish the combination *Silvaea semperflorens* (Roxb.) Hook. & Arn., and they did not, as Hooker seemingly invariably did throughout his massive bibliography, publish a *Latin* diagnosis.

For several reasons, my inclination would be to accept *Silvaea* Hook. &Arn. as valid: **(i)** it has no bearing on Euphorbiaceae taxonomy, since, historically, except in one other 19th Century work, the genus has been considered a synonym; **(ii)** before 2019, *nobody* questioned the valid publication of this genus; **(iii)** manifestly, the different databases, each authored by different but nonetheless expert taxonomists, historically and currently have differed on the status of these genera, and manifestly none of them adequately researched the problem; **(iv)** the only *practical* effect of invalidating *Silvaea* Hook. & Arn. was to destabilize the taxonomy of a different family, Montiaceae, whereas the principal objective of [7] is to stabilize, not destabilize, taxonomy. Perhaps a binding decision needs to be requested per [7].

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Supplemental file

https://osf.io/gcpmb/files/osfstorage/6890590366e201c72110753a

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