BERTERO'S GHOST REVISITED: NEW TYPIFICATIONS OF *TALINUM LINARIA* COLLA AND *CALANDRINIA GAUDICHAUDII* BARNÉOUD (= *CALANDRINIA PILOSIUSCULA* DC; MONTIACEAE)

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ABSTRACT

In a revision of the systematics of *Calandrinia pilosiuscula* DC (including *Calandrinia compressa* Schrad. ex DC; Montiaceae), Hershkovitz recognized a total of ten validly named synonyms, including *Calandrinia gaudichaudii* Barnéoud and *Talinum linaria* Colla. He concluded that these two names were homotypic, both protologs citing a Bertero collection from Valparaiso, which Hershkovitz inferred to be *C. Bertero 1814*. However, the type of *T. linaria* in TO proves to be labeled *C. Bertero 685*, not *1814*. This is problematic for two reasons: **1)** this number corresponds to a series of Bertero's numbers not from Valparaiso, 1830, but Rancagua, 1828; and **2)** sheets elsewhere labeled *C. Bertero 685* are *Cistanthe trigona* (Colla) Hershk. or *Calandrinia nitida* (Ruiz & Pav.) DC, whereas Bertero's Rancagua collection of *Calandrinia pilosiuscula* is *C. Bertero 686*, not *685*. Thus, the present analysis seeks to resolve these and other discrepancies reported previously in the numbering, localities, and dates indicated on sheets of Bertero's Chilean plant collections. The principal conclusion is that Bertero's numbers were not intended as "collection" numbers in the modern sense, but rather merely a minimal "species list" of his Chilean collections numbered alphabetically according to genus and species. This scheme evidences his underlying Platonic idealist taxonomic epistemology. Accordingly, he intentionally combined spatiotemporally distinct gatherings, with the consequence that his numbered collections do not qualify *conceptually* as "specimens" (and/or "duplicates") per current nomenclatural code criteria, hence neither as types. Individual sheets can, however, be qualified as such secondarily, if code criteria are met. The present work also emphasizes other apparently more clerical errors rampant among sheets of Bertero's collections. It also concludes that there are far fewer spatiotemporally distinct and total Bertero Chilean collections than previously believed. Finally, the species *Calandrinia gaudichaudii* and *Talinum linaria* are retypified robustly in view of the present analysis.

KEY WORDS: Chile, Carlo Bertero, *Calandrinia pilosiuscula*, *Calandrinia compressa*, *Calandrinia gaudichaudii*, *Talinum linaria*, Montiaceae, taxonomy, nomenclature.

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Introduction

Preliminary to a general revision of *Calandrinia* sensu Hershkovitz (1993, 2019a) sect. *Calandrinia*, Hershkovitz (2020a) revised the systematics, biogeography, and ecology of *Calandrinia pilosiuscula* DC. The motivation of this and related works (Hershkovitz, 2020b, c) has been to concentrate and parse the copious data in detail in preliminary papers so that the eventual general revision of *Calandrinia* can be more concise, yet fully documented. Hershkovitz (2020a) established,

among other things, that *C. pilosiuscula* has priority over nine other validly named synonyms. One of these is *Calandrinia compressa* Schrad. ex DC, which, for the past 120 years, has been the name nearly universally applied to plants of *C. pilosiuscula*.

Among the other validly named synonyms of *C. pilosiuscula* are *Calandrinia gaudichaudii* Barnéoud (Barnéoud, 1846 ["1847"]) and *Talinum linaria* Colla (Colla, 1834). Hershkovitz (2020a) concluded that one of four collections of the former taxon cited by Barnéoud (1846 ["1847"]) was *C. Bertero 1814* from Valparaiso, collected in 1830. As Colla (1834a, b) cited only a Bertero collection sharing this locality and date, Hershkovitz (2020a) concluded that the type specimen also must have been *C. Bertero 1814*. Supporting this conclusion, Hershkovitz (2020a) cited two sheets of *C. Bertero 1814* in G that had been annotated by I. E. Peralta (MERL) as pertaining to original material of *Talinum linaria*. Hershkovitz (2020a) cited two additional but unnumbered and undated Bertero sheets of *C. pilosiuscula* from Valparaiso, one each in MPU and P. He presumed that these also pertained to *C. Bertero 1814* and that the P specimen, from the herbarium of A. Richard, most likely was the one seen by Barnéoud.

Hershkovitz (2020a) thus elected to lectotypify *Calandrinia gaudichaudii* with *C. Bertero 1814* and consequently considered this name to be a homotypic synonym of *Talinum linaria* and therefore illegitimate. However, owing to the closure of many European herbaria during the 2020 COVID19 pandemic, Hershkovitz (2020a) had not been able to confirm the identity of Colla's specimen in TO.

Unexpectedly and unfortunately, the type material of *Talinum linaria*, bearing Bertero's own label, indicates Valparaiso and the date August 1830, but the number 685 rather than 1814 (Fig. 1). Since the posting of Hershkovitz (2020a), Laura Guglielmone (TO) kindly sent me an image of this specimen. Its authenticity cannot be doubted, because on the reverse of Bertero's own label is Colla's signed description.

This discrepancy in number is problematic, because Bertero's other numbers in this range, including *C. Bertero 682–687*, all Montiaceae (discussed later), are from the Rancagua vicinity and were collected there in 1828 (cf. Delprete et al., 2002; Hershkovitz 2019b: 13–14). Further complicating the matter, other collections labeled *C. Bertero 685* bear material of *Cistanthe trigona* (Colla) Hershk. or *Calandrinia nitida* (Ruiz & Pav.) DC. Bertero's collections of *C. pilosiuscula* from Rancagua otherwise are labeled *C. Bertero 686*. In order to not confuse the TO specimen with heterologous collections labeled with the same number, I hereafter refer to the type of *T. linaria* as *C. Bertero 685* (TO). Interestingly, as noted also later, one sheet of *C. Bertero 686* and another of *C. Bertero 686 & 1814* are admixtures of *C. pilosiuscula* and *C. nitida*. This suggests that the erroneous labeling of plants as *C. Bertero 685* and *C. Bertero 686* was a mutual bookkeeping error.

The evidence suggests that, despite being in Bertero's hand, the label of *C. Bertero 685* (TO) indicates the wrong number and, ¿who knows?, possibly also the wrong locality and date. Errors tend to lead to other errors. The number probably should have been *C. Bertero 686*. But this would imply that the collection is from Rancagua, not Valparaiso. Other Bertero collections of *C. pilosiuscula* were distributed after Bertero's death by C. F. Hochstetter and E. G. Steudel's "Botanische Reiseverein." These bear boilerplate Unio Itinerario labels (Wörz, 2007). These sheets *combine* the collections *C. Bertero 686* (Rancagua, 1828) and *C. Bertero 1814* (Valparaiso, 1830). This suggests that the evidently erroneously numbered TO specimen might correspond to *C. Bertero 686* –or– a misnumbered *C. Bertero 1814*. But none of these possibilities can be ascertained. Later, I argue that that the TO specimen may be a distinct collection.

Regardless of the explanation of the discrepancy between number and locality/date of *C. Bertero 685* (TO), its unequivocal identity as the type of *Talinum linaria* renders questionable and therefore undesirable homotypification of *Talinum linaria* with *Calandrinia gaudichaudii*. This typification based on the plausibility that an unnumbered Bertero collection of *Calandrinia pilosiuscula* from Valparaiso in P was an unnumbered sheet of *C. Bertero 1814*. These collections were cited in Hershkovitz (2020a) and are cited again below. But given *C. Bertero 685* (TO), the correspondence of unnumbered Bertero Valparaiso sheets of *C. pilosiuscula* to *C. Bertero 1814* cannot be presumed.

Meanwhile, the peculiar numbering of *C. Bertero 685* (TO) piqued my curiosity. I tossed and turned all night, and paced back and forth all day in my room throughout the COVID19 quarantine. So I sought to resolve the cited discrepancies with respect to both the locality/date and the correspondence to other collections labeled *C. Bertero 685*. This led me to study in detail, first, all available online Bertero collections of Chilean Montiaceae, and then Bertero's Chilean collections more broadly. I found labeling discrepancies and apparent errors galore. But I also began to see a pattern, a method to the numbering madness.

The critical conclusion of the present analysis is that Bertero's numbers are not "collection numbers" in the modern sense, but "species numbers." When he shipped his specimens to Europe (Delprete et al., 2002), he was in the process of combining and consolidating putatively conspecific but spatiotemporally distinct collections under single numbers, this being the lowest number corresponding to his *first* collection, often from Rancagua. This process reflected Bertero's platonic idealistic view of species as fixed entities. Because Bertero never returned to Europe, he never completed this consolidation. But it is reflected in collections such as *C. Bertero 685* (TO) and others discussed in this work. It also is reflected in many Unio Itinerario sheets that combine more than one number, locality, and date, even as the sheet includes only a single individual. This confusion is aggravated by additional labeling errors common among Bertero collections.

The purposes of the present paper are two-fold. One objective is trivial and purely technical, to revise the typifications of *Calandrinia gaudichaudii* and *Talinum linaria* proposed in Hershkovitz (2020a). The latter have not been validated yet per Article 30.2 of the International Code of Nomenclature for Plants, Algae and Fungi (Turland et al., 2018; hereafter the "Code" or merely reference to Art[icles] therein). But Hershkovitz (2020a) evidently has become widely distributed. To avoid creating disparate versions of that document, revisions of the provisional typifications are better highlighted in a separate document.

The other objective is more important, an elucidation of the relationship between the numbers and provenances of Claudio Bertero's 1828–1830 Chilean collections. This elucidation involved considerable study and analysis of Bertero's material and associated documentation in a historical context. But without this effort, the trivial task of typification of *Calandrinia gaudichaudii* and *Talinum linaria* would not have been possible. But the analytical conclusions can be applied to the typification and/or citation of all of Bertero's Chilean collections. The present analysis also reveals that the number of Bertero's verifiably distinct Chilean collections is only about one third that suggested by the range of his numbers, and that the total number of herbarium sheets ("specimens") is about one half that previously believed.

The present effort is based on data obtained from numerous mostly freely accessible (excepting only JSTOR Global Plants) online resources, including databases of:

C. V. Starr Virtual Herbarium (New York Botanical Garden), Catalogue des herbiers de Genève, GBIF, Harvard University Herbaria and Libraries, International Plant Names Index (IPNI), JSTOR Global Plants (freely accessible data only), Muséum National d'Histoire Naturelle (Paris), National Herbarium of the Netherlands, POWO (Plants of the World Online), Royal Botanic Garden, (Edinburgh), The Herbarium Catalogue (Royal Botanic Gardens, Kew), The Natural History Museum (London), Tropicos, the U.S. National Herbarium, and World Flora Online (WFO).

These resources and their URLs are listed in the Literature Cited section. In addition, standard herbarium codes used in this work follow Index Herbariorum (http://sweetgum.nybg.org/science/ih/).

Bertero's Chilean expedition in historical context

Delprete et al. (2002) reviewed the history of Bertero's two New World expeditions in the context of his life and times. This biographical account emphasizes his passion for botany, his breadth of critical botanical knowledge, and his high esteem among the notable botanists of his day, including A. P. de Candolle. His first expedition to the Antilles and northeastern Colombia (1816–1821) evidently was quite successful and contributed significantly to the knowledge of Neotropical plants. Delprete et al. (2002) highlighted the role of Bertero's detailed field notebook in the success of this expedition. This included a well-organized, hand-written summary. The summary of 14 fascicles includes an enumeration of 1747 taxa, with detailed descriptions and taxonomic commentary.

It is not clear from Delprete et al. (2002) whether Bertero prepared each fascicle contemporaneously with his collecting or composed several or even all of them while curating his collections during "down time" at later dates. Based on evidence from Bertero's Chilean expedition, I suggest the latter. In any case, Bertero's field notebook from his first expedition comprises a major botanical work. Had he published it in the early- to mid-1820s, it would be considered today a seminal text on the botany of the Antillean region, and Bertero's reputation would be not merely as an important collector, but as more significant botanical icon.

Unfortunately, Bertero did not publish this work, and new taxa described therein were published by "armchair" botanists, especially A. P. de Candolle (Delprete et al., 2002), viz. botanists whose fame owes partially to acquisition of collections of other botanists. This usurpation apparently irritated Bertero, who was determined to be the author of the botany of his next expedition (Delprete et al., 2002). This took him first to Chile, then Tahiti, and then to his disappearance and presumed death in the southern Pacific Ocean.

It is not clear whether an eventual Bertero-authored work on his Chilean materials would have had as much impact as would have had a work on Antillean botany. In ´particular, Bertero's fieldwork in mainland Chile was limited to a few localities evidently below 1000 m at the latitudes of ca. 32.5S (Quillota and Quintero) to 34.4°S (San Fernando) and from the coast to the inland valleys just shy of the Andean precordillera. Even a few days exploration of the subalpine and alpine zones at that latitude would have afforded him discovery of 100–200 additional new species (as well as new genera). Even nearly 200 years later, I know of two undescribed high elevation species from this zone. I might or might not get around to describing them, depending upon how many discarded hamburgers I find in McDonald's trash.

Also, Bertero faced considerable contemporaneous "competition" from other collectors in this region, including Thomas Bridges, Alexander Cruckshanks, Hugh Cuming, Charles Gaudichaud, Claudio Gay, John Gillies, Andrew Mathews, John Miers, Franz Meyen, and Eduard Poeppig, as well as the teams of George Lay & Alexander Collie and Jules D'Urville & Renè Lesson (Lasègue, 1845; Turrill, 1920). Even as Bertero was still at sea, Hooker and Arnott (1830 ["1831"] were publishing the

first fascicles of the first accounting of the flora of the Valparaiso vicinity and the fourth accounting of central Chile, following Feuillée (1725), Ruiz and Pavón (1794, 1798) and Molina (1810). Hooker and Arnott's (1830 ["1831"] accounting was based on the collections of Lay and Collie in 1825, during the HMS Blossom expedition (Hershkovitz, 2020a). At the same time, it may be frivolity to speculate on the course of history had Bertero survived. The truth is, despite the massive collections of Chilean plants during the 1820–1830s, followed by descriptions of particular taxa, Claudio Gay's more comprehensive flora was not published until the 1840–1850s.

Overview of Bertero's Chilean collections

I preface my remarks here with technical caveats regarding the terms "specimen" and "duplicate" as they apply (or not) to Bertero's collections. As I detail in this work, Bertero numbered his collections in a peculiar way reflecting his taxonomic notions. As a result, the identically numbered sheets of Bertero's collections actually are intentionally mixed/combined individuals representing spatiotemporally disparate gatherings. Per the Code (Arts. 8, 9, 40 and Glossary), these numbered collections conceptually *are not* "specimens" or "duplicates," because these terms apply to spatiotemporally *single gatherings*. Thus, I avoid the inappropriate use of the terms "specimen" and "duplicate," preferring, where possible, the terms "[numbered] collection" or "sheet, and "duplicate sheet."

However, the preceding is not to say that particular sheets of Bertero's collections, or at least the individuals that they include, cannot be *qualified* as specimens. Indeed, many *sheets* themselves do not qualify, e.g., the Unio Itinerario sheets that clearly indicate mixed numbers, hence distinct spatiotemporal gatherings. But any individual or fragment thereof on any sheet can be recognized as a distinct taxon and designated as a holotype *specimen*. At least one individual or fragment thereof on a sheet axiomatically represents a single gathering. Individuals or fragments likewise can be designated as lectotypes, syntypes, paratypes, or epitypes. However, the intentional and rampant mixing of distinct gatherings challenges the diagnosis of true duplicates, hence designation of any sort of isotype.

Although Bertero's numbered collections and duplicate sheets often represent spatiotemporally mixed collections, most technically are not "admixtures." Per the Code (Art. 8 and Glossary), this term, while formally undefined, refers to *unintentional* and generally taxonomic mixtures. Bertero *intentionally* assigned the same number to spatiotemporally mixed collections. But, indeed, there are among Bertero's numbered collections true admixtures. Some examples involve collections with more than one species that Bertero thought to be the same. Others involve apparently accidently mixed collections sharing the same number. The obvious example is the previously mentioned *C. Bertero 685*, different sheets of which include three species in two genera. Additional examples are cited later.

Finally, I emphasize that the numbers that appear on the labels of Bertero's collections are not "collection numbers" in the modern sense (i.e., chronologically numbered vouchers). As I elaborate below, Bertero did not intend for his numbers to be chronological or to represent voucher numbers. He assigned and edited numbers according to putative species taxonomy. For this reason, I also avoid misleading use of the term "collection number[s]," preferring the term "Bertero['s] number[s]."

As for Bertero's collections, based on herbarium specimen labels in TO and comparison with Bertero's correspondence, Delprete et al. (2002) reported difficulty in determining Bertero's itinerary and collection dates. Although initially optimistic towards refining the correspondence between labels, localities, and dates, I report below that these can be even more ambiguous than Delprete et al. (2002) appreciated, though for different reasons. Delprete et al. (2002: 635, Table 2) published an inferred itinerary highlighting his principal Chilean collection destinations. Hershkovitz (2018: 2–3) concluded

that this table transposed Bertero's time in Quillota and the Juan Fernandez Islands (hereafter "JF"). In terms of actual fieldwork, the correct sequence should be Santiago (early 1828), Rancagua (and San Fernando; mid- to late 1828), Quillota (mid- to late 1829), JF (March–May, 1830), and Valparaiso (July–September, 1830).

Delprete et al. (2002: 634) separately reported narratively that Bertero "first….botanized in Valparaiso, and then in Viña del Mar and Quillota, on his way to Santiago; from there he traveled south to Rancagua." Indeed, this was the principal (and circuitous) land route at that time between Valparaiso and Santiago and thence Rancagua. But this itinerary does not reflect his actual collecting activity. His first collections are from the Santiago area in fall/winter, 1828, followed by Rancagua to San Fernando area collections in spring/summer. Quillota collections do not appear earlier than 1829, following his return to Valparaiso from Rancagua. Delprete et al.'s (2002) interpretation possibly is artifact to Bertero's peculiar numbering of his many his collections, discussed below, which sometimes suggests misleadingly that later itinerary localities were collected relatively earlier. Delprete et al. (2002) reported that they studied only the set of Bertero collections available in TO. The availability of additional and duplicate sheets in online collections representing numerous herbaria permits refinement of Delprete et al.'s (2002) interpretations.

As related by Delprete et al. (2002), Bertero shipped his Chilean collections to B. Delessert in Geneva, who, in turn, was to distribute sets to G. Baldis (TO), L. Colla (TO), and A. P. de Candolle (G). In addition, Bertero had sent seeds to G. Moris (TO), who later cultivated and described several species, possibly redundantly to species described by other botanists using the actual collections (e.g., Hershkovitz, 2019a: 35). Delprete et al. (2002) also reported the distribution of additional sets of collections to various individuals/institutions. The bulk of the shipment was to be retained by Delessert pending Bertero's return.

When Bertero was deemed dead, the remaining undistributed collections were sold by Delessert's heirs to C. F. Hochstetter and E. G. Steudel's "Botanische Reiseverein," a private botanical collection acquisition/distribution firm. This firm dismantled and fragmented Bertero's collections and distributed these, bearing their boilerplate "Unio Itinerario" labels, to personal and institutional herbaria throughout Europe. Many later also were acquired secondarily by certain US herbaria, especially MO.

Material from Delessert's preliminary distribution of Bertero's collections usually can be distinguished from Unio Itinerario "specimens" by their handwritten labels, although a few handwritten labels do indicate Unio Itinerario. Some specimens in G bear De Candolle's labels. These and some labels in different script distributed elsewhere indicate the collector as "M. Bertero." Others common in G and P and elsewhere share a common script and give the collector as "D. Bertero." (cf. REF). I suspect that these labels were prepared by Delessert.

Especially valuable are those collections with Bertero's own original label indicating locality and date. These collections generally qualify as "true" specimens per Art. 8. It is irrelevant in this case whether the number is the same as that found on labels of spatiotemporally distinct collections (or gatherings). All collections I have seen with Bertero labels include only a single number, locality, and date, although I have found one with Bertero's characteristically underlined number followed by "cfr." to a different number (discussed later). Comparison with material in TO will be necessary determine if there are collections here with original Bertero labels and more than one number/locality/date.

A problematic but not insignificant characteristic of the "Unio Itinerario" collections is that, as noted, a large proportion of the labels combine 2–3 numbers and/or localities and/or dates. These are

mixed collections, though conceptually not admixtures (except sometimes coincidentally). I will return to this peculiarity several times in this work. In most cases, I have located corresponding singlet (not combined) sheets with handwritten labels with the numbers, localities, and dates separated. These presumably are collections distributed by Delessert before he died.

A further characteristic of the combined collections is that many include only a single individual or fragment thereof. In this case, the actual provenance of the material generally cannot be determined. Thus, while an individual in such a deliberately mixed collection might be designated as a holotype, without verifying the provenance, it cannot be an isotype. Nevertheless, the Unio Itinerario labels bearing multiple numbers/localities/dates might remain informative to the degree that they document that Bertero indeed collected the material from *at least one* of the indicated localities/dates.

According to Delprete et al. (2002), Bertero's Chilean collections comprise a total of 15,000 nominal specimens distributed today in a total of 26 institutional herbaria, including separate herbaria within these institutions. In fact, I believe that the total number of specimens is far less (see below). Delprete et al. (2002) also indicated that nominal duplicate sets were distributed to B, BM, E, G, K, L, MB, NCY, P (2 sets), and TO (2 sets?). Except for G and P, I cannot here confirm the (full) extent of Bertero collections in these herbaria. The B collections likely were destroyed, while data from MB and NCY collections, like TO, are not available online. At this writing, the L database search engine is not fully operational (see also below). I can verify on the order of 100 Bertero Chilean specimens (including duplicates) in each of BM, E, and K (see also below). These are rather modest numbers, although I cannot verify if they represent the true institutional totals.

Combining Delprete et al (2002) with institutional and JSTOR Plants data, I have located Bertero Chilean collections in a total of 43 institutions, including separate herbaria within these: A, B, BAA, BM, BR, CGE, CN, CORD, E, F, FI, G, GH, GOET, H, HAL, HBG, JE, K, KEIL, L, LE, LP, M, MB, MEL, MICH, MO, MPU, NCY, NY, OXF, P, PUR, S, SGO, SI, TCD, TO, TUB, US, W, and WAG. About one half (1398/2849) of the JSTOR Bertero Chilean records pertain to sheets in P and G (incl. GDC). However, the JSTOR records amount to only 80% of the records available from the P and G databases. About 60% and 30% of, respectively, the P and G collections represent duplicated numbers within these collections (see below). The remaining herbaria represented in JSTOR include 1–184 differently numbered JSTOR Bertero Chilean records, and only BM, GH, MPU, M, NY, SGO, and TUB include more than 97 such records. However, these totals may represent incompleteness of both JSTOR Plants and institutional data. For example, JSTOR includes only 55 differently numbered Bertero Chilean collections in MO, whereas the TROPICOS database lists 311 (see also below).

Delprete et al. (2002) noted that Turrill (1920: 60) claimed that P held 5000 of Bertero's Chile collections with labels and descriptions. This number is so exaggerated that it is possibly a "misprint" for the true number. The entire P collection has been imaged and classified according to taxon (Vanessa Invernon, written comm., 10 Jan 2019), although not all collection data has been entered in the database. The P data are invaluable; aside from holding the two (evidently partial) duplicate sets mentioned by Delprete et al. (2002), P includes Bertero collections from the herbaria of D. E. Boissier, J. B. A. Guillemin, A. L. de Jussieu, R. Maire, A. Richard, and also many from Steudel's personal herbarium. Thus, the P holdings should be as numerically complete as those in TO. Also, because of high redundancy, they should be a good indicator of the totality of Bertero´s Chilean collections (see also below).

The P database returns 1256 records for Bertero and Chile (out of 1384 for Bertero alone). But these include only 500 (obviously <<5000) differently numbered collections, plus 63 "truly" unnumbered collections. I distinguish the latter from the many more unnumbered Bertero collections

in P and other herbaria that, nonetheless, can be assigned to a numbered collection based on locality/date. And most of the "truly" unnumbered collections pertain to pteridophytes, bryophytes, and lichens, along with a few especially weedy angiosperms.

In any case, the order of magnitude discrepancy between 500 and 5000 leads me to speculate that Turrill´s (1920) figure was a misprint. More importantly, the inferred completeness and high redundancy of the material in P suggests that the figure of 500 likely approximates the magnitude of Bertero's distinctly numbered Chilean collections. For reasons elaborated below, I doubt that the total number is more than 600. As I discuss later, however, many distinctly numbered collections actually represent spatiotemporally distinct gatherings, especially from the Rancagua vicinity.

The P data are complemented by data from G, which includes material from the herbaria of Delessert and De Candolle (see above), as well as some later Unio Itinerario collections. Although only about 30% of the collection data is available online, I suggest that Bertero's collections likely were prioritized the G databasing effort because of their historical importance. In the G database, I find 597 records of Bertero Chilean collections, these representing 414 distinct numbers. Fifty-four collections are plausibly "truly" unnumbered, again mostly non-angiosperms. The third largest online collection of Bertero's Chilean material appears to be that of MO, with 311 differently numbered collections in TROPICOS. There are also 35 unnumbered collections, but I did not study these sufficiently to determine how many are "truly" unnumbered.

Non-P collections corroborate the relative completeness of the Bertero's Chilean collections in P alone. These overwhelmingly are duplicate sheets redundant with those in P. Likewise, it can be inferred that the combined material in P, G and MO includes all but a few of the total collections. For example, later, I tabulate and analyze Bertero collections of specific taxa (Table 1, 2). I list a total of 133 specimens found in online collections of 12 herbaria, although, as I explain later, the labeling of many of them is ambiguous, erroneous, or otherwise problematic. Still, the labels permit identification of 24 distinct collections differing by the combination of species and indicated locality. Technically there are only 22 verifiable localities, because one collection, *C. Bertero 682*, is represented only in the mixed Unio Itinerario collection as *C. Bertero 682 & 1816*. This collection indicates three localities corresponding to the two numbers. The material must be from at least *one* of the localities, but, as noted, it cannot be determined whether it is from one or the other indicated locality. The figures for L, the herbarium with the fourth largest online Bertero Chilean collection, are lower than for G or MO.

In any case, P holds material of as many of 20/24 of the distinct collections, or 18/22 excluding *C. Bertero 682 & 1816*. Of the four collections not in P, two are in G, one in MO, and one in US. The G and MO specimens in Tables 1 and 2 represent, respectively, as many as 9/24 and 17/24 of the distinct collections. But the MO figure is misleading, as six specimens are Unio Itinerario specimens that variously combine a total of 11 of the 24 differently numbered collections. Correcting for this, G documents eight verifiable collections and MO only six. P and G together hold as many as 22/24 of the distinct collections, and 20/22 verifiable collections. P, G, and MO together hold as many as 23/24 of the distinct collections and 21/22 verifiable collections. In terms of strictly "differently numbered" collections, P holds as many as 16/18, 15/17 verifiable. G and MO hold as many as, respectively 7/18 and 16/18, but both only 6/17 verifiable. Thus, clearly P has by far the most complete of Bertero's Chilean Montiaceae collections. But adding together P, G, and MO, the collections are nearly complete, lacking only one collection that I have found only in US.

Given the above, I consider unlikely that the total number of distinctly numbered Bertero Chilean collections is greater than 20% more than the total of 500 in P alone, and therefore not likely

greater than 600. This seems corroborated by adding the G and MO records, which nearly complete the collection. Adding L material to this did not increase the overall representation. Thus, I suspect that all additional herbaria together would add only a few numbers not in P, G, and MO. I reiterate also that the number of *distinct* collections is higher than the number of *distinctly numbered* collections. In the case of Montiaceae, the former figure is about 20% higher than the latter, mainly because of multiple Rancagua area collections assigned the same number. Even so, the representation in P and in P, G, and MO combined is high by either criterion.

I emphasize that my estimate of no more than 600 total Bertero Chilean distinctly numbered collections is somewhat seat-of-the-pants. For example, because of technical limitations, I did not examine all 2164 specimen images available in G, MO, and P. This at least would have allowed me to calculate a total number of distinct collections from these three herbaria. Moreover, as noted, I cannot access the 2849 images from the commercial database JSTOR Plants except for those available independently from other online sites. But analyses of specimen images are necessary to corroborate database data. For example, the database data often do not indicate all of the 2–3 numbers of many Unio Itinerario collections. The specimen must be examined to deduce these. Nevertheless, I believe that my overall estimate is accurate. This is especially because of the high redundancy of the P collection. Also, of the total of 13 Bertero numbers variously combined in Unio Itinerario specimens listed in Tables 1 and 2, only one number, *C. Bertero 682*, is not represented in P as a *separately* numbered collection. And I cannot locate this separated collection in *any* herbarium.

As noted above, Delprete et al. (2002) reported that nominally duplicate sets of Bertero collections were distributed also to BM and L. At this writing, I find that the database engines of BM and L have limited functionality for studying their Bertero Chilean collections. I do not know if the problem is due to the server or memory limitations on my side. JSTOR includes only 112 BM collections. Via GBIF, I found only one BM collection among the 133 listed in Tables 1 and 2. In contrast, JSTOR lists only four L collections. The L database returns 262 records, but these include numerous duplicated numbers. The advanced data grid did not load for me, so I was unable to determine the number of differently numbered collections. From GBIF, I located 15 L collections among the 133 listed in Tables 1 and 2. These represent eight of the 26 distinct collections, i.e., nearly half of the total are duplicated numbers. Thus, I would estimate the number of differently numbered Bertero collections in L to be on the order of 150. In any case, available data suggests that the total number of BM and L specimens is far lower than especially those of P and G, and probably no more than half of that of MO.

My analysis suggests that the reported total number of 15,000 Bertero Chilean "specimens" (Delprete et al., 2002) also is exaggerated. This is notwithstanding the absence of data for nominally duplicate sets reportedly in MB, NCY, and TO, and the presumed destruction of the set in B. The largest collection, that in P, comprises 1256 sheets, which includes two original sets received from Delessert (Delprete et al., 2002) plus collections later accessioned from multiple private herbaria. The second and third largest collections with online data are G and MO; combined with P, these sum to 2164 sheets. Adding to this available data from ten additional herbaria evidently with significant holdings (BM, E, GH, HAL, L, M, MPU, NY, SGO, TUB, US) brings the total to about 3450. About 200 additional sheets in smaller collections can be inferred from JSTOR. Thus, online databases include about 3700 Bertero Chilean specimens.

Above, I estimated that the total number of distinctly numbered collections is no more than 600. Thus, a generous estimate of 600 collections for each of B, L, MB, NCY, and TO would amount to an additional 3000 sheets, quite likely rather higher than the real figures for these herbaria. There is no reason to believe that all of the remaining 22 herbaria cited above collectively hold more than 500

sheets. Thus, my highball estimate for the total number of Bertero Chilean sheets is perhaps 7000–8000. And this ignores that many sheets I have seen include sparse material, often just a fragment of an individual, even in Unio Itinerario collections that indicate 2–3 different localities.

The preceding analysis is as problematic as it is enlightening. From the database searches, I have found that Bertero's Chilean numbers span (at least) 1–1870. This ignores putatively "truly" unnumbered collections, but I suspect that these amount to only 5–10% of total collections. The problem, obviously, is that my estimate of the total number of distinctly numbered Bertero Chilean collections is no more than 600, and this is only about one third of 1870. Where are the rest of the numbers? Is it possible that there is (or was) somewhere a stash of the "missing" 1200 collections, and furthermore, that these and their nominal duplicates account for the "missing" 7000 or so collections? I, along with anyone keen on Bertero and/or Chilean botany, would welcome discovery of a trove of unstudied collections. But, as I conclude below, I doubt that such exists. Bertero evidently systematically consolidated different collections that he considered to be conspecific. He effectively "decommissioned" the missing numbers during curation (see below).

Relation of Bertero's numbers to his collection itinerary

Bertero collections can be classified into four number series (the first three "major" and the final "minor"), reflecting more or less his collection itinerary (Santiago/Rancagua/San Fernando, Quillota/Valparaiso, JF, and again, briefly, Valparaiso). But Bertero did not assign numbers chronologically at the moment of collection. He did not even assign numbers at the end of a particular day or at any time *during* a major collection effort. Lacking Bertero's fieldbook, of course, it cannot be determined exactly how Bertero annotated his specimens at the moment of collection. He might have bundled the baled hay from particular localities without annotating individual specimens.

I conjecture that the numbers were assigned following the each collection effort during "down time," the lapses between fieldwork. The first *numbering* effort evidently took place during the austral autumn-winter of 1829 (following Rancagua), another prior to departing for JF in the late austral summer of 1830, then another following his return to Valparaiso from JF in the latest austral autumn of 1830, with a final numbered series prepared in latest austral winter, 1830. Again, I emphasize that Bertero's numbers are not "collection" numbers in the modern sense (see also below).

Collections spanning the numbers 1–748 mostly indicate localities in the area spanning Santiago and San Fernando, about 136 km latitudinally. The overwhelming majority of collections are from near Rancagua, so I call these numbers the "[1828] Rancagua series." At least eight Bertero numbers interspersed in the Rancagua series (187, 205, 231, 275, 303, 320, 464, 681) are collections from the Santiago vicinity and the dates, if indicated, are February–March, 1828. I explain below why these chronologically earliest collections are not numerically earliest, i.e., why they are interspersed with chronologically later collections. Otherwise, the collections are from Rancagua to San Fernando (ca. 78–136 km S of central Santiago). Their dates range from July, 1828 to January, 1829. However, duplicate sheets of many collections indicate erroneous dates, especially the year 1829.

Rancagua to San Fernando specimens indicate several localities. Among these, two are closest to Rancagua city proper: the generalized locality Río Cachapoal (which runs through Rancagua) and Punta Cortes (< 10 km W of central Rancagua). Three commonly cited localities are about halfway between Rancagua and San Fernando, near the city of Rengo (ca. 106 km S of central Santiago): Corcolen, La Quinta [de Tilcoco], and [San Vicente de] Tagua Tagua, Besides San Fernando proper, another nearby locality commonly cited is Cerro La Leona, a 1000 m "hill" in between San Vicente de Tagua Tagua and San Fernando.

Collection dates for the various Rancagua – San Fernando localities betray no particular chronological pattern. Searching JSTOR Plants for the collector "Bertero" and the specific locality term "Leona" (for "La Leona" or synonym) retrieved 88 differently-numbered collections whose collection date (month only) is indicated and seems reliable. In fact, the search returned a total of 302 *records* (including nominal duplicates), in which the date of *most* of them is missing or *wrong*. In the 88 plausibly reliably dated specimens, the collection months breakdown as follows: July, 1828 (1), August (5), September (28), October (35), November (14), December (1), and January, 1829 (4).

These results, of course, simply reflect the floristic phenology of the zone, which peaks normally in early to mid-October. But, more to the point, the data, if indeed reliable, indicate that Bertero visited Cerro La Leona during every month of his 1828–1829 Rancagua area excursion. The chronological data for other localities are similar. The data are not terribly surprising given the length of Bertero's visit and relatively short distances and flat topography (by Chilean standards!) in between the various Rancagua – San Fernando localities. Evidently, he returned to most localities repeatedly.

There are in the Rancagua number series many collections that do not pertain to the Santiago to San Fernando span, e.g., indicating Valparaiso, 1829 or 1830. Also, I have located four numbers (82, 366, 393, 675) that indicate JF and 1830. But essentially invariably in these cases there also are other collections with the same number indicating Rancagua and 1828 and/or cognate Unio Itinerario collections indicating two (or three) numbers and localities/dates, earlier ones corresponding to the Rancagua series plus later ones corresponding to later series (see also below). Thus, for specimens with Rancagua series numbers indicating Valparaiso or JF, there is *also* a corresponding Rancagua vicinity collection that Bertero believed to be conspecific. As I explain later, this is why *some* collections indicating different localities/dates share the same number.

In addition to the above, the P database includes an "anomalous" series of Bertero JF collections, 14 in total, bearing numbers in the range of 2–35. The database indicates that they pertained to the ex-Boissier herbarium (G). No images are available. The indicated taxa and localities of these specimens conflict with other like-numbered collections in the Rancagua series. Especially without the images, I am unable to parse these specimens in relation to the collections from the numbered series delineated here. But clearly the numbers are not Bertero's.

Collections spanning the numbers 756–1404 mostly indicate only Quillota, although many interspersed numbers indicate only Valparaiso or other coastal locality. I call this number range the "Quillota series." Most of the dates indicate 1829, but several interspersed Valparaiso collections are dated 1830. As with Rancagua series collections, the dates sometimes conflict among duplicate sheets. At least seven Bertero numbers (808, 886, 950, 961, 1219, 1306, 1337) indicate the locality JF. The dates of these, if indicated, mostly are October or December, 1829. The labels indicate that these are not Bertero's own later JF collections. They were sent to him in 1829 by "D. Larrain," whose identity I am otherwise not able to determine. There was in those years (and still is!) an influential Larrain family in central Chile, but I cannot determine how "D. Larrain" figured into it. However, Bertero did intend to name a JF species for Larrain, *Campanula larrainii* Bertero ex Colla (= *Wahlenbergia fernandeziana* A.DC.).

The Quillota series is followed by a few numbers, 1409–1415, collections from Valparaiso and nearby coastal localities. These apparently represent final mainland collections before departure to JF. An odd feature of a few of these collections is that their dates erroneously indicate March–June, 1830, when Bertero already was in JF. The number range 1427–1742 all are JF collections, and their dates, March–May, 1830, seem to correspond with Bertero's itinerary. Following this is the fourth and final "minor" series. These numbers, 1747–1823, almost all indicate Valparaiso, July and August,

1830, with a very few (only four collections among JSTOR Plants records) indicating September, 1830. Presumably these represent Bertero's final collections as he prepared to leave Chile. Then there are three additional numbers, 1833, 1837, and 1870, from JF, undated or with March–May, 1830 dates. I offer no explanation for these, except that I presume that the numbers were assigned after the bulk of the JF collections had been processed and numbered. Perhaps Bertero belatedly discovered them as he packed and shipped his collections.

Reconstruction of Bertero´s numbering scheme

A key observation is that in each of the three major numbering series, the collections are not numbered chronologically, but alphabetically according to putative genus. And this explains why, e.g., the numbers of earlier Santiago area collections are interspersed with later Rancagua area collections. The fourth number series also is numbered somewhat alphabetically, but less perfectly so. This alphabetic ordering is not entirely obvious from secondary herbarium labels, which often do not indicate the genus supposed by Bertero. Bertero's numbering system groups species of nominally the same genus, as is most clear in the case of, e.g., *Adesmia* and *Oxalis*.

In cases where genera as currently classified appear to be out of alphabetical order, inspection of an original Bertero label invariably demonstrates that he classified those specimens differently at the generic level. As an example, within a series, almost all of Bertero's Montiaceae collections currently classified as *Calandrinia* Kunth, *Cistanthe* Spach, and *Montiopsis* Kuntze are numbered successively and adjacent to genera beginning with the letter "T." Bertero classified these taxa as *Talinum* Adans. Numbered remotely from these series is Bertero's collection currently classified as *Montiopsis berteroana* (Phil.) Peralta & D.I. Ford. Fortuitously, I located a corresponding original Bertero label, and this specimen he classified as *Pharnaceum* L. (Molluginaceae). Indeed, this collection is numbered adjacent to genera beginning with "P."

Among the numerous other examples, within the Rancagua numbering series, *C. Bertero 210* is currently classified in *Tweedia* Hook & Arn. (Apocynaceae), while *C. Bertero 473–475* are currently classified in *Chaetanthera* Less. (Asteraceae). The numbering seems out of alphabetical order, but Bertero's own labels classify these taxa in, respectively, *Cynanchum* L. (Apocynaceae) and "*Perdicieum*" (= *Perdicium* L.; Asteraceae). Order reversed, problem solved.

The preceding reconstruction of Bertero's numbering system is corroborated by his preliminary publications of his botanical findings in the periodical "El Mercurio Chileno," 1828–1829, not to be confused with Chile's major daily newspaper, the once conservative but now substantially progressive-Marxist ("fake news") El Mercurio (cf. Looser, 1933–1936: 5, footnote 5). The first installment was published in July, 1828, and includes only fungi and lichens, evidently collected near Santiago. Evidently it was a rainy year (cf. Delprete et al., 2002: 633). The remaining installations were published monthly in between March and July, 1829, prior to Bertero's excursion to Quillota. Thus, Bertero evidently numbered his 1828 collections from Santiago, Rancagua, and San Fernando in early 1829. Indeed, the collection dates for the Rancagua series seem to end in January, 1829. At the relatively low elevations explored by Bertero near Rancagua, by late December, the summer heat and drought of Chile's mediterranean climate have dried out the vegetation, and flowering even of native Asteraceae has terminated.

The taxa are not numbered in Bertero's publication, but their alphabetical listing correlates with Bertero's numbers, e.g., *C. Bertero 1* is "*Acacia cavenia* Bertero" [nom. nudum.; = *Vachellia caven* (Molina) Seigler & Ebinger], and this is the first taxon listed in his March publication (Looser, 1933–1936: 11). In fact, this species *also* occupies *C. Bertero 756*, the first number of Bertero's 1829 Quillota series. It has been noted that Bertero's alphabetical listing of genera in El Mercurio Chileno

terminated with "P" (Looser, 1933–1936; Delprete et al., 2002). I emphasize that the publications include *only* the Rancagua series collections. The publications thus do not include additional genera beginning with A to P collected later in Quillota, Valparaiso, or JF.

Another key observation, mentioned above, is that especially the Unio Itinerario specimen labels combine two or three Bertero numbers and, correspondingly, localities and dates of specimens of the same supposed species from *different* series (as noted already in Hershkovitz, 2019b: 13–14). These specimens are critical to interpret specimens with only handwritten labels, which generally include only a single Bertero number and locality/date. However, in many cases, different specimens sharing the same *single* Bertero number *also* indicate the *same* different localities/dates indicated on combined Unio Itinerario sheets. As I have noted and document later, Bertero himself combined these spatiotemporally heterogeneous gatherings that he believed to be conspecific and, furthermore, did not take care to assure that combined collections could be separated later according to number, locality, and date. In other words, he did not ensure that his specimens were "vouchers" in the modern sense (see below). Clearly the alphabetic sorting and numbering itself was Bertero's. I have seen no evidence and have no reason to suspect that Delessert or "Botanische Reiseverein" went through Bertero's material and combined the heterogeneous gatherings. It would not have made sense for "Botanische Reiseverein" to combine these, since the monetary value of the separate collections would have been double.

A further observation is that the discrepancy in handwritten labels always favors the *lower* of the possible Bertero numbers. I have not studied the collections exhaustively, but in all examined cases, the chronological discrepancies involve handwritten labels indicating Quillota, 1829, or Valparaiso, 1830, but assigned a lower Bertero number in the range of the Rancagua, 1828 series. This is the case with the apparent type of *Talinum linaria*, which bears the 1828 Rancagua series number, 685, but the locality and date, Valparaiso, 1830. I have not located, e.g., specimens with *later* Quillota, JF, or Valparaiso series numbers but indicating the chronologically earlier locality Rancagua.

Numbering and data discrepancies among Bertero's Chilean collections

The examples of discrepancy between number and locality/date among Bertero collections are too numerous to list here. I review Montiaceae examples later. But to demonstrate that such discrepancies are the rule rather than the exception, I here illustrate with an example involving Bertero's collections of plants currently classified in *Tweedia* (Apocynaceae; Asclepiadoideae).

Bertero's material of *Tweedia* is assigned to three numbers representing at least four gatherings representing each of his major mainland collecting destinations, one gathering each from Rancagua (*C. Bertero 210*) and Quillota (*C. Bertero 942*), and two from Valparaiso (*C. Bertero 210* and *C. Bertero 941*). Yes, *C. Bertero 210* includes plants from both Rancagua in 1828 and Valparaiso in 1830. Unio Itinerario sheets bear combined collections, *C. Bertero 210 & 942*, indicating that that Bertero himself considered that plants from all three major localities were the same species.

I have located a total of 24 sheets (including duplicated sheets) of Bertero collections of *Tweedia* (Table 1). I presume that there are more. These sheets are distributed in seven herbaria (G/GDC, GH, L, MO, MPU, P, S). The Bertero numbers (and number of sheets) are *C. Bertero 210* (12), *941* (1), *942* (6), *210 & 942* (3), and without number (2). However, locality data suggests that one of the unnumbered collections is *C. Bertero 210* from Rancagua.

Of the 13 sheets of *C. Bertero 210* (one unnumbered), 12 have handwritten labels and one has an Unio Itinerario boilerplate label. Eight indicate *only* a locality near Rancagua and four indicate *only* Valparaiso, and one is without locality. The collections indicating Valparaiso all indicate 1830, but the

dates on the Rancagua sheets range from 1828–1830. Based on one particular collection, P00642566, I infer October 1828 as the most likely correct date, but the month is not critical to this discussion.

The collection labeled *C. Bertero 941* indicates Valparaiso and is dated 1829. Collections labeled *C. Bertero 942* all indicate Quillota and, if dated, [August or without month] 1829. There are three Unio Itinerario combined *C. Bertero 210 & 942* sheets. These sheets bear *two* numbers but *three* localities: Viña del Mar/Valparaiso, Rancagua and Quillota. The dates indicated are "September–December. 1828. 1829. 1830." In other words, these sheets indicate the localities and dates for all three of Bertero's mainland excursions, but the numbers from only two series. The only way to explain this is by the observation that different *C. Bertero 210* sheets indicate Rancagua or Valparaiso. Thus, adding *C. Bertero 942* from Quillota yields a composite sheet with two numbers and three localities.

But the combined collections bear only one or two plant fragments. In the latter case, the two fragments appear to be cut from the same individual. Obviously the material cannot represent three localities. It should be noted that, while the Unio Itinerario sheets include the locality Viña del Mar/Valparaiso, they *do not* list the number *C. Bertero 941*. This seems significant, because singlet collections of the latter two indicate Valparaiso, whereas singlet collections labeled *C. Bertero 942* indicate *only* Quillota. But, as noted, singlet collections labeled *C. Bertero 210* indicate *only* Rancagua or *only* Valparaiso. This suggests that Bertero believed that the plants he labeled as *C. Bertero 210* from Valparaiso were distinct from the Valparaiso plants he labeled as *C. Bertero 941*. Yet he believed that the Valparaiso plants were the same species as the Rancagua plants labeled *C. Bertero 210* and Quillota plants labeled *C. Bertero 942*.

All four of Bertero's distinct gatherings of *Tweedia* were described as distinct species. Without specifying the number *C. Bertero 210*, Colla (1836–1837 ["1835"]) described the Rancagua collection as *Gonolobus obliquifolius* Colla. Also without specifying a number, he described a collection from Valparaiso as *Gonolobus voquicilla* Colla. This could be *C. Bertero 210* (Valparaiso/Viña del Mar) or *C. Bertero 941* (Valparaiso). While I have not seen the described material in TO, a sheet in G demonstrates that this species based on *C. Bertero 941*. In agreement with the protolog, the label indicates the origin on a hill in Valparaiso rather than, as *C. Bertero 210*, a beach in Viña. This specimen also agrees better with Colla's (1835) description and illustration.

Citing *C. Bertero 210* (Rancagua), Decaisne (1844) later illegitimately renamed *Gonolobus obliquifolius* as *Oxypetalum saxatile* Decne. (Art. 11.4, 52.1). He also described *Oxypetalum confertiflorum* Decne., based on three collections, including *C. Bertero 210* (Valparaiso/Viña del Mar), as well as *Oxypetalum hookeri* based on four collections, including *C. Bertero 942*. Decaisne (1844) also considered *Cynachum birostratum* Hook. & Arn. [≡ *T. birostrata* (Hook. & Arn.) Hook. & Arn.] as a synonym of *Oxypetalum hookeri* (see below).

Databases and literature suggest some disagreement as to the current accepted taxonomic identities of Bertero's *Tweedia* collections. I cannot at present resolve this disagreement, but its resolution does not alter the thesis of the present discussion. According to GBIF, WFO, and Rodriguez et al. (2018), evidently following Rua (1989), Bertero's collections pertain to two currently accepted species: *T. andina* (Phil.) G.H. Rua and *T. birostrata* (cf. Calviño et al., 2014). As currently conceived, the species are endemic to central Chile. Their ranges are largely separated, approaching parapatry, but they do overlap (Calviño et al., 2014: 1270, Fig. 3). At ca. 32–34°S (where Bertero collected), plants identified as *T. andina* are distributed mostly east of and at higher elevation than *T. birostrata*, which is a lower elevation and most commonly coastal species. But at these latitudes, the two intermix, *T. birostrata* indeed extending inland to Rancagua. The range of *T. andina* is broader south of ca. 37°S, but here is more southerly than *T. birostrata*.

The disagreement involves the taxonomic identity of *Oxypetalum hookeri* Decne [in A. P. de Candolle, Prodr. 8: 587. 1844; syn. *Tweedia hookeri* (Decne) Malme], as well as the legitimacy of this name. Original material of *O. hookeri* includes *C. Bertero 942* (Quillota; Table 1). POWO lists *Oxypetalum hookeri* as a synonym of *Tweedia birostrata*. But GBIF, WFO, Rodriguez et al. (2018) list this name as a synonym of *Tweedia andina* (basionym: *Oxypetalum andinum* Phil., Anales Univ. Chile 110: 204. 1895). This evidently owes to a revision by Rua (1989), a work I have not been able to access. Rua (1989) must have determined that, while *T. hookeri* and *T. andina* are taxonomic synonyms, the earlier name *O. hookeri* was either invalid or illegitimate. Indeed, illegitimacy is indicated on three sheets annotated by M. A. Farinaccio (Table 1). Malme (1904) listed *Tweedia andina* as a synonym of *T. hookeri* and considered *T. birostrata* as a possible synonym. Reiche (1907 ["1910"]) followed Malme's (1904) revision. Rua (1989) accepted *T. andina* and listed the older name *O. hookeri* (and thus *T. hookeri*) as the synonym.

I interject here that all six duplicated sheets of *C. Bertero 942* (Table 1) agree morphologically with *T. andina* and differ from *T. birostrata*. And G. H. Rua (written comm., 3 Sept 2020) confirmed that C. Bertero 942 is from Quillota and is the type of *Oxypetalum hookeri* and pertains to *T. andina*. However, the distribution map of *T. birostrata* and *T. andina* (Calviño et al., 2014: 1270, Fig. 3) does not show a collection of *T. andina* in the Quillota area or anywhere close to the coast north of 36°S. It seems peculiar that this species was collected only once in this area in 1829.

The question of the nomenclature of *T. andina* and *T. hookeri* is moot in the context of the present discussion. Since I have not seen Rua (1989), I cannot address it, except to say that the literature on the matter appears complicated. The matter critical here is that Bertero intentionally assigned spatiotemporally disparate gatherings to the single number *C. Bertero 210*, and evidently intended to combine these, in turn, with *C. Bertero 942*, as evidenced by their combination in the Unio Itinerario sheets. Combination of these disparate collections reflects Bertero's prioritization of the species identity over its spatiotemporal realization (see below).

It is fortunate, if not fortuitous, that many of Bertero's collections survive presumably uncorrupted by later curation. These are the collections associated with Bertero's original labels and derivatives thereof. These specify single numbers and localities, even if the number is shared with collections from other localities. However, the specter is raised as to whether individuals on such sheets indeed represent the indicated locality or whether individuals from different localities were intermixed and distributed with wrong labels. While I have not demonstrated such mixing in the case of sheets with single numbers, the Unio Itinerario sheets demonstrate that this possibility is not unreal. These sheets typically bear single individuals, and different duplicate sheets bear individuals from different localities (Table 1). But besides these problems, Table 1 demonstrates how different and nominally "duplicate" sheets sometimes indicate wrong collection years, and that many indicate only general and not specific collecting localities. Later in my analysis of Bertero's Montiaceae collections, these problems resurge.

To summarize, the *Tweedia* data provide a simple example of why Bertero's Chilean collections cannot be interpreted in the modern sense of collections, viz., as spatiotemporal vouchers of single gatherings ("specimens" per Art. 8) numbered at the time of collection. Bertero intentionally combined under common numbers collections separated by up to two years and more than 100 km. Given modern sensibilities, it is understandable how this practice would obfuscate efforts to reconstruct his Chilean itinerary (cf. Delprete et al., 2002). More importantly, it raises doubts as to the actual spatiotemporal provenance of individuals mounted on herbarium sheets. It also challenges the modern notions of specimens, duplicates, and admixtures. Clearly, sheets sharing the number *C.*

Bertero 210 represent spatiotemporally disparate gatherings, hence are not duplicates. But as deliberately combined disparate collections, they are not either admixtures. At the same time, Bertero presumed that deliberately combined collections represented the same taxon. The combination of distinct taxa was *not* intentional. In such cases, these combined collections *also* represent admixtures.

Just as importantly, the *Tweedia* data demonstrate the inadequacy of single sheets in the interpretation of Bertero's collections. Table 1 lists 13 sheets of *C. Bertero 210* (one unnumbered). Those originating in Rancagua do not, by themselves, anticipate those originating Valparaiso or vice versa. Eight of the sheets indicate a Rancagua origin, but only one of these indicates *both* the precise locality, La Quinta [de Tilcoco], and the correct collection date, October, 1828. Locality and date data on *all* of the remaining seven sheets are variously missing, more ambiguous, or incorrect. Meanwhile, Table 1 lists only a *single* sheet of *C. Bertero 941*. No other sheet is available to confirm its data. One might wonder justifiably whether the label data are correct. These inadequacies/discrepancies likely reflect Bertero's unexpected demise, hence his inability to curate his collections to completion. At the same time, it is not clear whether his consummation of this process (i.e., combining spatiotemporally heterogeneous gatherings) would have ameliorated or aggravated the situation, since a principal cause of ambiguity was itself this uncompleted combinatorial process.

As I argue below, the evidence from Bertero's *Tweedia* collections indicate that he consolidated (or was in the process of consolidating) collections that he believed to be conspecific, reassigning later-collected and later-numbered plants to earlier Rancagua series numbers. This effort, in turn, reflected his taxonomic epistemology. I conclude that his objective was to reduce his numbers to a single series, one number per distinct *idealized* species, each number lumping specimens from all localities, without concern for conserving the relationship between the collection and its provenance.

A possible epistemological explanation of discrepancies among Bertero's numbers

Although not obvious at all from superficial examination of collections of particular taxa, the available evidence offers critical insight into Bertero's taxonomic thinking and, hence, the basis for his numbering scheme. This, in turn, proves to be the crux of the problem in interpreting localities and dates of his collections. At least in his first two numbering series, Bertero did not apply a criterion of higher classification. The rule was alphabetic by genus, with lichens and angiosperms intermixed. This possibly is a clue to Bertero's taxonomic philosophy.

For angiosperms, Bertero's work seems to offer no hint of either the Linnaean sexual system or any emerging natural system, such as developed by A. Jussieu and advanced by De Candolle. Considering Bertero's history (Delprete et al., 2002), he could not possibly have been unfamiliar with these, but I have not attempted to locate any historical record of his higher taxonomic philosophy. In his third numbered series, comprising JF collections, Bertero did separate numerically angiosperms from ferns, bryophytes, and lichens, but the collections of the last three were intermixed. In other words, he seems to have separated plants that were "higher" and "lower" in the Aristotelian sense.

I suggest that Bertero's taxonomic concept was Platonic idealist, as opposed to the modern typological concept, which is materialistic. In the Platonic idealist concept, the taxon is conceived as a real and fixed entity. In this case, the collections, localities, and dates merely are realized instances of an ideal entity. The ideal determines the realized. The realizations have no bearing on the ontology of the idealized taxon that they manifest. Collections, localities, and dates thus have no more intrinsic value than, say, the same book published in different places and years or sold in different shops.

With these observations and ideas in mind, it appears that Bertero's objective was to derive a minimal list of the "true" genera and species in the explored region, central Chile. After cataloguing

the collections from one region, he moved on to the next. He continued the existing numbering, but reset the alphabet to "A." Eventually, he combined later and earlier collections he believed to be conspecific. Or, more to the point, he mapped later "redundant" numbers to earlier ones, possibly with the objective of deriving a unique set of numbers, one per species, each indicating *all* of the localities where that species was collected. This seems to be evident in at least some handwritten labels with "Rancagua" numbers and "Valparaiso" localities and dates. I suggest that Bertero had only begun this process at the time he shipped his collections and departed Chile, evidently prematurely owing to the ongoing political violence (Delprete et al. 2002). And it is clear that he intended to return to Europe to continue to curate and study his collections in order to fulfill his objective of being author of his work.

We will never know what was Bertero´s intention, but based on the evidence, I suggest that he would have renumbered all of his collections, either eliminating all infraspecific redundancies or possibly even creating from scratch a new series of successive/contiguous numbers. The "collection numbers" were simply for bookkeeping purposes and had no other significance. The taxon descriptions would have included mention of all of the localities, but I believe that it is possible that Bertero saw no reason to physically associate the specimen with its locality. In particular, in the idealist view, the species is fixed, hence it is not important whether a "specimen" indicating, e.g., Valparaiso, actually included the individual collected there or somewhere else. A collection in this idealist sense might not be a voucher in the modern sense, but simply *any* example of the idealized fixed species that was collected at any and all particular localities.

The interpretation above might shed light on the two thirds of Bertero's Chile numbers that I cannot locate. As noted, virtual herbaria are far from complete and tend to emphasize type material. Still, intriguing are the missing numbers and the often large gaps between represented numbers. I suggest that many, perhaps most, of the missing Bertero numbers existed but no longer exist. As I have argued, Bertero's collections suggest that he intended to reduce numbers to a minimum, one per recognized species. Thus, I suggest that, during collection, Bertero deliberately erred on the side of redundancy, collecting possibly the same species several times in proximal or even the same exact locality. He postponed the eventual decision of whether two collections were the same species or not. This is not unusual; it is the way most of us collect. Following each collection effort, he sorted and numbered his collections alphabetically according to genus. Then evidently he decided that some such numbered collections were conspecific with others. He combined these and simply discarded or "decommissioned" the redundant number. As this process was dynamic, one might not find any rhyme or reason in the pattern of gaps between Bertero's numbers, which sometimes are larger or smaller. My interpretation here, of course, is just an educated guess based on the evidence.

As an aside, given a less sophisticated taxonomy, one might be conditioned to accept the genus (the "thing") as the fundamental ontological unit, and the species as, tautologically, a special case of the genus. With greater conceptual emphasis on the uniqueness of "things," the nature of their higher level classification becomes moot. This is the default human conceptualization that emerges in the popular binomial taxonomy of any and all objects, usually referred to by a noun and adjective, as well as in the standard form of human names (family and given). And as human names are listed in a directory alphabetically by family and given name, so are Bertero's collections by genus and species. Not a classification, but an operational convenience.

Bertero's apparent taxonomic epistemology contrasts with the typological materialistic concept inherent in the Code. In the latter, the taxon is conceived as an arbitrary nondimensional entity embodied in the material type, its supposed realization. The type itself represents a *conceptual* ideal or, effectively, not a fixed reality, but a taxonomic supposition, subject to acceptance or rejection. In practice, it is just a permanent material reference for this supposition, i.e., its name at its designated

rank. In this concept, the type ideally is materially unique, a holotype or lectotype. Only following strict guidelines can it be materially replaced by a different individual. Its material uniqueness extends to its material realization, i.e., its collecting locality and date. While these need not be known, axiomatically they must be unique (a *single* spatiotemporal gathering). Likewise, type locality and date information cannot be modified except as data correction or in the case the type itself is replaced.

Thus, while the Code does not predicate to be taxonomically epistemologically biased, its underlying epistemology is not compatible with Bertero's. Bertero evidently afforded no special significance to a particular gathering of an idealized species. This understanding is important for interpretation of his collections. Modern taxonomists likely interpret collections according to modern concepts and practices, in which single gatherings are numbered distinctly and labeled with their corresponding and correct localities and dates. Bertero's way of thinking is not obvious from individual sheets of his collections, which appear for all the world similar to modern collections, bearing numbers, localities, and dates. Only broader analysis of his collections betrays his noncompliance with the modern Code and conventions.

Regardless of the explanation for the state of Bertero's collections, one thing is certain: there is ample reason to question localities/dates indicated on sheets of Bertero's Chilean collections. I suggest that in no case can "face value" be extended to the information on a single sheet. This assessment applies mainly to Bertero´s mainland Chile collections and less to his collections of at least endemic JF species. But it applies in some cases also to his non-endemic JF collections. Underlying ambiguity of localities is evidenced especially by collections indicating the same number, yet vastly different localities/dates.

It is axiomatic in the of case Unio Itinerario sheets indicating two or three localities/dates that the actual provenance of the material, often a single individual, cannot be ascertained. Obviously, the purveyor of such a collection could not be unaware that a single individual representing two or more localities cannot be a true voucher for either of them. This and other evidence discussed precisely underlie my suspicion that even collections with handwritten labels indicating single localities/dates also might raise suspicion of inaccuracy.

Bertero's "missing" collection numbers, about two thirds of those spanning 1–1870, raise a more subtle point. If, as I conclude, many of Bertero's numbered collections represent spatiotemporally heterogeneous gatherings from *different* regions, then even those collections from a *single* region possibly represent mixed gatherings. And this might explain the missing numbers, although they also might represent *single* gatherings of variable individuals that were initially numbered separately and later combined.

Although I cannot confirm my suspicion that the missing numbers correspond to consolidation of collections within regions, I can confirm that such consolidations exist. This is evident among Bertero's Montiaceae collections, which I analyze in the next section. But I include in this section mention of Bertero's consolidations of spatiotemporally heterogeneous gatherings within a single collection region.

Bertero's Montiaceae collections from the Rancagua vicinity comprise seven of his collection numbers (see below and Table 2). Four of the numbers include sheets indicating more than one Rancagua area locality: **(1)** As noted, different sheets of *Calandrinia nitida* labeled as *C. Bertero 685* or *C. Bertero 685 & 1345 & 1815* indicate variously two different Rancagua area localities and dates, Corcolen in September, 1828, and Cerro La Leona in October, 1828; **(2)** *C. Bertero 683*, different sheets give the locality and date as "La Quinta [de Tilcoco]," September, 1828, and "Río Cachapoal,"

November, 1828; **(3)** *C. Bertero 686*, different *original Bertero* labels indicate Cerro La Leona, September, 1828, and Punta de Cortés, October, 1828; **(4)** *C. Bertero 687*, one sheet indicates "San Fernando/Rancagua," all others indicate Río Cachapoal, near Rancagua.

A fifth example is the Unio Itinerario material of *C. Bertero 682 & 1816* (Table 2), which indicate corresponding localities in Rancagua and Valparaiso, but also indicate JF in parenthesis. It is not clear whether this means that material was collected in JF, but if it was, there is no number for this collection. A sixth possible example is a collection of *Calandrinia pilosiuscula* from Quillota, *C. Bertero 1344*. All of the sheets I have located are Unio Itinerario collections indicating the collection date as September–October, 1829. Obviously, a single gathering could not have been made in both months. This material might represent more than one gathering. It is possible, however, that the indicated date merely reflects Bertero's uncertainty in recalling the exact date of a single gathering.

In any case, Bertero's evident practice of combing spatiotemporally heterogeneous gatherings both among and within regions, along with evidence for his idealistic epistemology, provide circumstantial evidence that the large number of "missing" collections represent spatiotemporally distinct gatherings that later were consolidated into the surviving numbered collections. In some cases, the spatiotemporal distinctions (localities and dates) survived Bertero's uncompleted consolidation process. These like-numbered but distinct gatherings may account for some of missing numbers. The remaining might be cases where the spatiotemporal distinction data were discarded. This may be speculative, but it is consistent with the evidence. In any case, I have at present no other plausible explanation for the large number of missing collections.

Summary of Bertero's Montiaceae collections

In light of the preceding observations and ideas, Bertero's Chilean Montiaceae collections can be reevaluated. This, in turn, permits reevaluation of the typification of the taxa here in question. I have located a total of 17 Bertero numbers for Montiaceae. As noted, C. Bertero 682 & 1816 Unio Itinerario sheets indicate an apparently unnumbered third locality, JF. In addition there is a "truly" unnumbered collection in MO that appears to be *Calandrinia menziesii* (Hook.) Torr. & A.Gray from Valparaiso (Table 2). So there should be 18 or 19 numbers.

Also, as noted above and evident in Table 2, some of Bertero's Montiaceae numbers include heterogeneous gatherings from within (four) and among (three) regions. Thus, Bertero's Montiaceae collections document 24 spatiotemporally distinct gatherings. But per Bertero's taxonomic judgment, these 24 gatherings and 17 numbers comprised only 11 species: he later consolidated gatherings from different localities into five putative species, while six numbers represented species he recognized from single localities.

In the present work, I recognize a total of 12 species among Bertero's Chilean collections (Table 2). These are: *Calandrinia monandra* (Ruiz & Pav.) DC, *C. nitida*, *C. pilosiuscula*, *Cistanthe chamissoi*, *C. grandiflora* (Lindl.) Schltdl., *C. mucronulata* (Meyen) Carolin ex Hershk., *C. philhershkovitziana*, *C. trigona*, *Montia fontana* L., *Montiopsis berteroana*, *M. trifida*, and *M. umbellata* (Ruiz & Pav.) D.I. Ford.

Bertero's few collections of Chilean Montiaceae mostly are historically "significant." Three are types of currently accepted species. *C*[*laudio*]. *Bertero 535* is the lectotype and oldest collection of *Montiopsis berteroana*. Likewise *C. Bertero 683* is the type of *Cistanthe trigona* and *C. Bertero 1448* of *Cistanthe chamissoi* (Barnéoud) Carolin ex Hershk. *C*[*laudio*]. *Bertero 687* is the type of *Calandrinia aurea* Phil., which is a synonym of *Montiopsis trifida* (Hook. & Arn.) D. I. Ford. The type of the latter is an undated collection, *H. Cuming 422*. This collection is more or less

contemporaneous with Bertero's, but I have not the information to determine whether it would have been earlier or later (cf. Dance, 1980: 482; see also below).

Hershkovitz (2019b: 13–14) concluded that *C. Bertero 684* most likely is *Cistanthe mucronulata* (Meyen) Carolin ex Hershk., and it represents the first collection of this species. It probably is the basis for *Calandrinia spectabilis* Otto & Dietr., which would have priority *Cistanthe mucronulata*. However, Hershkovitz (2019b) could not verify definitively the identity of *C. Bertero 684* nor rule out that *Calandrinia spectabilis* was based on an as-yet hypothetical Bertero collection of *Cistanthe laxiflora* (Phil.) Peralta & D.I. Ford. *C*[laudio]. *Bertero 1349* is the oldest documented collection of *Cistanthe philhershkovitziana* Hershk. (cf. Hershkovitz, 2018: 3). Thus, of Bertero's 17 numbered Montiaceae collections, nine figure as type material of described species and/or first-collected specimens of currently accepted species.

Most of Bertero's Chilean Montiaceae are numerically clustered, reflecting Bertero's classification of these species in *Talinum*. The relevant Rancagua series numbers are: {…**535**…682–**683–687**–688–[*689–696*]–697…}. Montiaceae taxa are in bold font, numbers for other taxa normal, long dashes span series of one or more numbers, and "missing" collection numbers (or number ranges) are in italics in brackets. As noted, *C. Bertero 535* is *Montiopsis berteroana*, which Bertero misclassified in *Pharnaceum*, accounting for its disparate number. The number 688 is underlined, because it corresponds to a Caryophyllaceae species that Bertero classified in *Talinum*, *Microphyes minima* (Miers ex Colla) Briq. (syn. *Talinum minimum* Miers ex Colla). Thus, Bertero's range of putative *Talinum* numbers in the Rancagua series spanned 683–688.

Following 688, I have located no numbered collections until *C. Bertero 697*. The collections of the intervening numbers are "missing." As noted, I suspect that these numbers originally were assigned to collections that Bertero eventually consolidated with differently-numbered nominally conspecific specimens. It is possible, therefore, that numbers in the 689–696 range also corresponded to some putative *Talinum* collections later consolidated with other numbers.

The relevant Quillota series numbers for Montiaceae are:{…1341–[*1342–1343*]–**1344–1345**–[*1346*]–**1347–1349**–1350…}. I cannot locate *C. Bertero 1346*. However, if it did or does exist, it is or would have been a plant Bertero classified as *Talinum*. The same possibly is true for the missing numbers 1342 and 1343.

As noted, the Valparaiso series is numbered more irregularly, several numbers not in alphabetical order according to Bertero´s generic classification. The relevant numbers are: {…1785–[*1786*]–1787–[*1788–1791*]–**1792**–1793–[*1794–1799*]–1800–1802–[*1803–1807*]–**1808**–[*1809–1813*]–**1814–1816**–[*1817–1818*]–1819…}.

The number 1787 is underlined, because it corresponds to a Valparaiso collection of *Microphyes minima*, which Bertero classified as *Talinum* (see above). Thus, Bertero did not cluster this with other putative *Talinum* collections, although conceivably might (and certainly ought to) have had doubts as to this classification. Possibly the classification as *Talinum* was an afterthought. The number 1792 is *Montia fontana*, which Bertero did not classify as *Talinum* and reservedly referred instead to *Elatine* L. (Elatinaceae; Table 2). The remaining Montiaceae (four collections) indeed are clustered in the range of 1808–1816, though with five intervening numbers "missing."

While the Valparaiso series is numbered irregularly, it is conceivable that the entire range 1808–1816 corresponded to putative *Talinum* collections, the missing numbers later consolidated with other numbers. This would make sense given Bertero's modus operandi. In particular, Bertero had

already collected and numbered Montiaceae from the Rancagua vicinity and Quillota, localities not far from, nor, for that matter, markedly biogeographically dissimilar to Valparaiso. This rendered all the more likely that additional Montiaceae collections from Valparaiso would have been taxonomically the same (at least in Bertero's view) as those already numbered. It is conceivable also that missing numbers immediately before and after the 1808–1816 range correspondeded to putative *Talinum* collections.

The Montiaceae collections exemplify all sorts of the discrepancies described previously. These would have been impossible to explain except in light of the analysis presented here. These discrepancies include: (re-)assignment of chronologically later collections to numbers corresponding to earlier collections from different localities, numbers not assigned to some collections from divergent localities, like-numbered collections representing explicitly spatiotemporally heterogeneous gatherings, admixtures, incorrectly assigned numbers, and wrong dates on labels. Some examples are articulated below.

A simple example involves the various duplicates of *C. Bertero 683*, one of which is the holotype of *Talinum trigonum* Colla [= *Cistanthe trigonum* (Colla) Carolin ex Hershk.]. Most sheets indicate the locality as "in saxosis arenosisque secus flumen Cachapual Rancagua Chili" (more or less, in sands of the rocky Río Cachapoal, which runs through Rancagua). These collections give the date as November 1828. The holotype itself (TO) indicates Cachapoal, but indicates the date erroneously as November, *1830*. But this (axiomatically bona fide) specimen, presumably sent to Colla by Delessert (Delprete et al., 2002), lacks Bertero's original label, which presumably would have indicated the correct date. The date 1830 must have been incorrectly presumed by Colla. However, one cognate collection of *C. Bertero 683* in G (G00440473) bearing *Bertero's own* label and description gives a *different* locality, "La Quinta [de Tilcoco]," and the date as *September*, 1828. As noted in the last section, given the discrepancy also in collection month, it is clear that Bertero assigned plants from both localities (and different months) to the same number.

The preceding example is not unique. As noted previously, from Table 2, it can be seen that collections of *Calandrinia nitida* numbered as *C. Bertero 685* (alone or in combination with *1345* and *1815*) also represent two different Rancagua-area localities, Corcolen and Cerro La Leona. Complicating matters further, as noted in the introduction, different collections labeled *C. Bertero 685* bear three different species in two genera. This presumably reflects unintentional error, hence *C. Bertero 685* is an admixture. In parallel, one sheet each of *C. Bertero 686* and *C. Bertero 686 & 1814* include plants of *C. nitida*, which pertains to *C. Bertero 685*. As noted previously, this suggests that the erroneous assignment of plants to *C. Bertero 685* may have been part of a reciprocal clerical error.

Also problematic in the case of *C. Bertero 683*, one duplicate sheet in P (P019003301) bears only individuals of not *Cistanthe trigona*, but a different species, *Cistanthe chamissoi*. Thus *C. Bertero 683* also is an admixture. At the risk of overcomplicating this example, *Cistanthe trigona* is an annual species historically confused with the perennial *Cistanthe arenaria* (Cham.) Carolin ex Hershk., which is from Concepción in Chile's Bío Bío Region (Hershkovitz, 2018a: 21–22; 2019a: 57). This confusion owes to Barnéoud (1847 ["1846"]), who cited Bertero's Rancagua collection of *C. trigona* in his treatment of *C. arenaria*. *Cistanthe chamissoi* likewise is an annual, and historically it has been considered conspecific with *C. arenaria* sensu Barnéoud. Except that this is *C. trigona*. In fact, there are other distinct annual species currently misclassified/misidentified as *C. arenaria*, but this quagmire will be addressed in a later work.

The question here is not whether *C. chamissoi* is distinct, but whether these individuals pertain to *C. Bertero 683*. Bertero collected *C. chamissoi* in Quillota and assigned it the number *C. Bertero*

1348, of which I have found five duplicate sheets. This species has been collected many times in the coast ranges and near the coast. I have seen no sheets from Rancagua, although it may well occur there. It is, after all, a weedy annual. However, it seems odd that I have located 15 sheet duplicates of C. *Bertero 683* that include *only* material of *C. trigona*, and then only *one* sheet that includes *only* material of *C. chamissoi*. Given the pattern of rampant discrepancies involving identifications, localities, and dates among Bertero's Chilean collections, I am inclined to believe that the material on P019003301 actually pertains to *C. Bertero 1348* from Quillota (1829), and that it accidently or deliberately wound up on a sheet labeled as *C. Bertero 683* from Rancagua (1828). However, at this point, no firm conclusion can be drawn.

The Unio Itinerario combined collection of *Calandrinia monandra*, *C. Bertero 682 & 1816*, illustrates another sort of problem. Expectedly given the numbers, the localities indicated are Rancagua and Valparaiso. But these are followed by "(etiam ex insula Juan Fernandez)." It is clear from this that no number was assigned to a JF collection. But it is not clear whether Bertero's collections include individuals from JF or, alternatively, whether the label merely *reports* his finding this species in JF. The ambiguity follows from Bertero's mindset, in that he did not consider his collections as spatiotemporal vouchers per se, but merely as physical examples of putative species that he collected/observed in one or more localities. Moot are the actual origin of the individuals of specimens of *C. Bertero 682 & 1816* and whether or not there are individuals from JF.

Besides the above, the Montiaceae collections manifest all other manner of discrepancies that plague all of Bertero's Chilean collections. As evident from Table 2, several collections bear conflicting and/or wrong dates. This is common in the case of, e.g., collections labeled as Valparaiso in 1830 but assigned 1828 Rancagua series numbers for the same putative species. If the individual actually was collected in Valparaiso in 1830, then the date technically is not erroneous. Rather, the assigned number is misleading. But there are instances also, e.g., where some Rancagua collections indicate 1829 dates, yet duplicate sheets bear the correct 1828 dates. Table 2 also reveals four cases of collections bearing material of the "wrong species" for that number, i.e., those species are represented on other sheets by *other* numbers. These are one of two types of admixtures among Bertero's Montiaceae collections, the other type involving material of different taxa that Bertero otherwise did not recognize as distinct (see below).

The "pièce de résistance" in this discussion involves *C. Bertero 684* (1828 Rancagua series) and C. *Bertero 1349* (1829 Quillota series) and the Unio Itinerario combination *C. Bertero 684 & 1349*. These perplexing collections were discussed in Hershkovitz (2019b: 13), but additional insight is offered in light of the present analysis. The material pertains to three species of *Cistanthe* sect. *Cistanthe* collected in three different years (1828, 1829, 1830) from three different localities (Rancagua, Quillota, Valparaiso).

Thus, *C. Bertero 684*, *C. Bertero 1349*, and *C. Bertero 684 & 1349* all are erroneously combined admixtures, and *C. Bertero 684* and *C. Bertero 684 & 1349* also are intentionally combined spatiotemporally heterogeneous gatherings. Strangely, the combined specimen *C. Bertero 684 & 1349* indicates only *one* locality, Quillota, but *two* years, 1829 and 1830. And even though the numbers correspond to the Rancagua and Quillota series (1828 and 1829), the indicated years correspond to Quillota and Valparaiso series (1829 and 1830).

Bertero annotated all of these collections (three species) as "*Talinum crassifolia*" (nom. inval.). But this is the least of Bertero's sins, given that, especially owing to Reiche (1898a, 1898b), throughout the 20th century and even more recently, all species of *Cistanthe* sect. *Cistanthe* have most

commonly been considered to be conspecific and classified as *Cistanthe grandiflora* (Hershkovitz, 2018a, b; 2019a, b, c).

I have located seven herbarium sheets of material of *C. Bertero 684* and *C. Bertero 1349* and their combination. Two sheets of *C. Bertero 684* (P; P04583007, P04583008) indicate the corresponding Rancagua series locality, "La Quinta [de Tilcoco]." The first of these also indicates the corresponding and presumably correct date, September, 1828. If the locality is correct, these probably are *Cistanthe mucronulata*. The type locality of *C. mucronulata* is from near San Fernando (Hershkovitz, 2019a: 56), ca. 20 km to the south. I cannot find evidence for *Cistanthe grandiflora* here. However, a *third* sheet (P; P04583006) indicates the locality *Valparaiso*, and date September, *1830*, and, moreover, it includes *two* species, *Cistanthe grandiflora* (assuming the correct locality and date) and *C. philhershkovitziana*.

There are two sheets of *C. Bertero 1349* (P; P04583003, P04583004). Both indicate the locality Quillota, and the second the corresponding Quillota series date, October, 1829. The first sheet includes material of both *C. grandiflora* (if the locality and date are correct) and *C. philhershkovitziana*, while the second includes only *C. grandiflora*. Thus, not appreciated by Hershkovitz (2018c: 2–3), Bertero's collections include material of *C. philhershkovitziana* indicating not just Quillota, but *also* Valparaiso. But given the pattern of discrepancies and reordering/disordering of Bertero's collections, one justifiably wonders if the plants were collected in only one locality and later assigned also the other number (but see below). Indeed, the plants might have originated from both localities, but if they originated from only one of them, it is not clear which.

Finally, there are two Unio Itinerario sheets, *C. Bertero 684 & 1349*. One of these (MO; MO-2434551) includes only material of a plant that, if "true" *C. Bertero 684* from near Rancagua, must be *C. mucronulata*. If it is from Quillota (i.e., corresponding to the number 1349), then it must be *C. grandiflora*. And if it is from Valparaiso but labeled as *C. Bertero 684*, also it must be *C. grandiflora*. Unfortunately, from the specimen images, these possibilities cannot be distinguished. In fact, *C. grandiflora* and *C. mucronulata* are difficult to distinguish even with the actual herbarium specimens, as the distinguishing features often are inadequately or not preserved. Again, the Unio Itinerario boilerplate label gives the locality of only Quillota, and the dates corresponding to the 1829 Quillota and 1830 Valparaiso series numbers, even though the number 684 corresponds to the 1828 Rancagua series. The other Unio Itinerario specimen of *C. Bertero 684 & 1349* (NY; 02065851) includes only an individual of *Cistanthe philhershkovitziana*. This was the only collection I had located when I wrote Hershkovitz (2018c).

Perhaps the key to resolving the discrepancies is the sheet P04583006, the 1830 Valparaiso collection of *C. grandiflora* labeled *C. Bertero 684*. The label of this specimen is *Bertero's* original. Next to the main number 684, bearing Bertero's characteristic underline, is in smaller script the annotation "cfr. 1349." This label is a "smoking gun." It demonstrates definitively that indeed it was *Bertero* that assigned 1828 Rancagua series numbers to later collections, in this case Valparaiso, 1830. In other words, these reassignments were not the result of *subsequent* curation by Delessert or "Botanische Reiseverein." In this case, Bertero did not even assign a Valparaiso series number to this collection, possibly because he already had finished his Valparaiso catalog and was in the final stages of preparing his herbarium for shipment and for his departure from Chile. Regardless, the number assignment demonstrates Bertero's idealistic taxonomic epistemology. To him, *C. Bertero 684* and, in fact, all of his numbers, were not *collections*, but idealized *species*.

Bertero's annotation "cfr. 1349" also is tantalizing, especially given that one sheet of *C. Bertero 1349* includes both *C. grandiflora* and *C. philhershkovitziana*. To which plant did Bertero

refer? But there is no evidence that Bertero distinguished between these remarkably different species, though, to be fair, neither did any other botanists for nearly 200 years thereafter (Hershkovitz, 2018c, 2019b). In fact, Hershkovitz (2018c) illustrated two non-Bertero sheets in K that also combined individuals of *C. grandiflora* and *C. philhershkovitziana*.

This example underscores the inadequacy of single sheets in the interpretation of Bertero's Chilean collections. Obviously, it would not be possible on the basis of a single sheet of *C. Bertero 684* to appreciate the complexity of the other sheets. Hershkovitz (2018c: 2–3) cited a single Unio Itinerario sheet of *C. Bertero 684 & 1349* (NY; 02065851) as a *voucher* of *Cistanthe philhershkovitziana* for Quillota. But is it really a voucher? At best, coincidentally. Bertero did not intend for it to be a voucher. Is it possible that the Unio Itinerario sheets *C. Bertero 684 & 1349* are just "duplicates" of admixtures of *C. Bertero 684* from *Valparaiso*, one annotated by Bertero as "684 cfr. 1349." This hypothesis is somewhat appealing, but does not explain why the Unio Itinerario sheets indicate Quillota, not Valparaiso, although they do include the Valparaiso series *year*, 1830. It also does not explain the sheet of *C. Bertero 1349* (P04583003), indicating *only* Quillota and 1829, and *also* including C. *philhershkovitziana*. It is difficult to imagine that material from Valparaiso could have been so-labeled.

However, not even all of the sheets of *C. Bertero 684*, *C. Bertero 1349*, and *C. Bertero 684 & 1349* together adequately facilitate their interpretation. They merely reveal, with no obvious explanation, the severe discrepancies among them, e.g., *C. Bertero 684* from both Rancagua, 1828 and Valparaiso, 1830, and the peculiar locality and dates indicated on *C. Bertero 684 & 1349*. The interpretation requires the analysis presented here, a detailed reconstruction of Bertero's Chilean itinerary and circumstances, and the later distribution of his collections. It also requires study not only of specimens of particular taxonomic interest, but of all of his collections, especially to appreciate that for two thirds of the implied collection numbers, there are no specimens.

Only from analysis of all of Bertero's Chilean collections can it be appreciated how his preliminary numbered series were not chronological according to locality and date, but alphabetical according to putative genus. And then only on the basis of comparative analysis of numerous collection labels, one can appreciate that his eventual objective was to consolidate his collections into a single numbered series, one number per putative species, combining those from different localities and years. In *some* cases, this understanding, along with knowledge of Chilean botany and geography, will facilitate greater precision in identifying the localities and dates. But perhaps more often than not, the consequence will be the reverse. With more information, it can be appreciated that the localities and dates indicated on Bertero's Chilean specimens often are more *ambiguous* than they appear.

Retypification of *Talinum linaria* and *Calandrinia gaudichaudii*

In light of the preceding "brief introduction" to Carlo Bertero's Chilean collections, the question of typification of two taxonomic synonyms of *Calandrinia pilosiuscula* can be addressed. Typification of *Talinum linaria* becomes straightforward. Sort of. At least there is no question as to the material that Colla examined, as the single sheet bears Bertero's original label and number, 685, and, on the reverse side, Colla's description and signature (Fig. 1). The specimen includes four complete individuals in different stages of maturity.

Notwithstanding its possession of four individuals, per the Code, the specimen *C. Bertero 685* (TO) qualifies as a holotype of *T. linaria*. However, I have demonstrated here that, as a matter of protocol, Bertero intentionally combined spatiotemporally heterogeneous gatherings. These cannot comprise collectively a type. Moreover, I have demonstrated that many Bertero collections unintentionally were assigned incorrect numbers, including *C. Bertero 685* (TO). Many are labeled

with incorrect collection dates. These last two attributes do not disqualify type status, but they demonstrate poor specimen "quality control" by modern standards and deflate the "face value" of collection label data.

There is no evidence that *C. Bertero 685* (TO) is a heterogeneous gathering, nor that the locality and date are incorrect. However, given the history and nature of Bertero's Chilean collections, I believe that it is justified to designate one individual of this specimen as a lectotype and designate the remaining as syntypes. This will eliminate any residual doubt as to what is the type of *T. linaria*. Thus, I designate the specimen on the furthest right side of the *C. Bertero 685* (TO) as the lectotype (Fig. 1).

Most importantly, while *C. Bertero 685* (TO) indicates the locality Valparaiso and the year 1830, it does not bear the number *C. Bertero 1814*, as anticipated by Hershkovitz (2020a). This expectation based on annotations to this effect of G collections (G00446778, G00446778) by I. E. Peralta (MERL), as well as the number 1814, which pertains to the Valparaiso, 1830 series. Unexpectedly, Colla's material bears a number from the Rancagua, 1828 series. In Unio Itinerario collections, the putatively conspecific Valparaiso series number of *C. Bertero 685* (TO) is *C. Bertero 1815*. But, unfortunately, this number is pertinent to collections of *C. nitida* and not *C. pilosiuscula*.

The broader analysis of Bertero's Chilean collections helps to parse the peculiar number of the type of *T. linaria*. The explanation possibly is the same as that for the Rancagua series number *C. Bertero 684* on a Valparaiso collection of *Cistanthe grandiflora*, described above. As noted, Bertero did not assign a "Valparaiso series" number to this collection. Had he assigned a number, presumably it would have been in the range of 1808–1816 (see above). I suspect, therefore, that *both* of the collections of *Cistanthe grandiflora* and the type of *T. linaria* were "last minute." He collected these and probably other plants in his final and hectic days in Valparaiso, *after* he had completed curation of his Valparaiso series collections. Again, this curation involved numbering sets of collections in alphabetical order according to genus. I have suggested that his eventual plan was to consolidate later series numbers with putatively conspecific earlier ones. In the case of the Valparaiso *Cistanthe grandiflora* and *T. linaria* collections, he obviated assignment of new Valparaiso series numbers and assigned them directly the number of the Rancagua series cognate. As for the erroneous number 685, this would have been a bookkeeping error. I doubt that he intended to convey conspecificity with *Calandrinia nitida*.

A critical question vis-à-vis the relationship between the type of *Talinum linaria* and *Calandrinia gaudichaudii* is whether the individuals of the former are the same gathering as those of *C. Bertero 1814*, the widely distributed sheets of *C. pilosiuscula* that also indicate Valparaiso and August 1830. The point is somewhat moot. There appears to be no positive evidence that they are the same collection, hence now there is no justification for my erstwhile conjecture that the two species are homotypic. However, as explained above, I am inclined to believe that the gatherings were different. Otherwise I can think of no reason for Bertero to assign the same gatherings two different numbers, viz., *C. Bertero 685* (TO) and *C. Bertero 1814*. He assigned 1814 to *other* individuals, but not *this* one. This species and *Cistanthe grandiflora* are both weedy, and in 1830, both likely were common in what is today central Valparaiso. Neither required a special excursion to find.

As for *C. gaudichaudii*, the typification of *T. linaria* by *C. Bertero 685* (TO) renders problematic homotypification of these taxa. As noted by Hershkovitz (2020a), Barnéoud (1846 ["1847"]) cited plants collected by M. Gaudichaud and Carlos Bertero from Quillota and Valparaiso. He did not cite particular specimens. The wording rendered ambiguous whether Barnéoud referred to Bertero's collections from both localities or only from Quillota. The broadly distributed Bertero

collection of *C. pilosiuscula* from Valparaiso is labeled *C. Bertero 1814*. But there is no sheet labeled *C. Bertero 1814* in P, so it is possible that Barnéoud never saw one.

There is in P an unnumbered and undated Bertero collection of *C. pilosiuscula* from Valparaiso, P05276881 (Table 2). While evidently not accessioned by P at the time of Barnéoud's work, Hershkovitz (2020a) concluded that Barnéoud likely saw it. It pertained then to the A. Richard herbarium, which was located in Paris, if not physically in P. Hershkovitz (2020a) presumed that this sheet and another unnumbered/undated collection in MPU pertained to *C. Bertero 1814*, as no other possibility was apparent. However, the existence of *C. Bertero 685* (TO) means that unnumbered/undated Bertero specimens of *C. pilosiuscula* from Valparaiso could pertain to *either* of these two numbers.

Regardless, it is unlikely that Barnéoud saw *C. Bertero 685* (TO), and, vis-à-vis *T. linaria*, this is the only sheet that matters. And, as discussed above, there is no evidence that it is the same gathering as plants represented in *C. Bertero 1814*, and there is reason to believe that it is not the same gathering. For this reason and the uncertainty of the true number of P05276881, homotypification of *C. gaudichaudii* and *T. linaria* here is rescinded.

In this light, the best course of action is to typify *C. gaudichaudii* with a specimen that Barnéoud must have seen. He referred to collections of Gaudichaud, and there are two collections evidently accessioned in P at the time of Barnéoud's work, *M. Gaudichaud 220* and *M. Gaudichaud 221*, both from Valparaiso. I arbitrarily select the first of these as the lectotype and the second as a syntype.

Paradoxically, the new evidence suggests that *C. gaudichaudii* and *T. linaria* species may indeed be homotypic, but for a different reason. Hershkovitz (2020a) based homotypification on the assumption that P05276881 was *C. Bertero 1814*. If this and other assumptions of Hershkovitz (2020a) are correct, then C. *gaudichaudii* and *T. linaria* cannot be homotypic. But P05276881 then must be a syntype of C. *gaudichaudii*, because it seems most likely that Barnéoud referred to it.

However, if the assumption of Hershkovitz (2020a) is *wrong*, then P05276881 must be a duplicate of *C. Bertero 685* (TO), hence its syntype. And *this* would render C. *gaudichaudii* and *T. linaria* as homotypic! The trouble is that, at present, the number of this unnumbered collection, as well as another in MPU (MPU 764760), cannot be established. Thus, P05276881 must be considered both a syntype of *C. gaudichaudii* and a *possible* syntype of *T. linaria*. Indeed, depending upon the numerical identity P05276881, it could be a syntype of both. Meanwhile, MPU 764760 likewise must be flagged as a possible syntype of either species. Sheets of *C. Bertero 1814* are at best only possible isosyntypes of *C. gaudichaudii*, but only in the case that P05276881 pertains to *C. Bertero 1814*.

The only Bertero collection of *C. pilosiuscula* from Quillota is *C. Bertero 1344*. Material of this presumably comprises the syntype and isosyntypes of *C. gaudichaudii*. However, the only exemplar of *C. Bertero 1344* in P was accessioned from the Drake Herbarium, which E. Drake amassed in the late 19th Century and was acquired by P in 1913 (Stafleu and Cowan, 1976). Although this exemplar is an Unio Itinerario sheet distributed in 1835, there is no evidence that Barnéoud would have seen it. Thus, it is not clear to which Bertero Quillota collection Barnéoud referred, hence no basis for designating a syntype. And, as noted, because all sheets of *C. Bertero 1344* indicate the collection date as September–October, 1829, it is possible that this material includes more than one gathering. Still, all sheets of *C. Bertero 1344* must be flagged as possible syntypes.

Unio Itinerario sheets of *C. Bertero 686 & 1814* are even more problematic, firstly because it is not clear that *C. Bertero 1814* is a syntype, and secondly, because the pertinence of individuals to the former or the latter number cannot be determined. Moreover, one of the sheets is an admixture (Table 2). Sheets of *C. Bertero 686*, apparently two separate gatherings, all indicate provenance from the Rancagua vicinity, hence cannot be original material of *C. gaudichaudii*. Still, it is possible that *C. Bertero 1814* is a syntype and that an individual on a sheet of *C. Bertero 686 & 1814* pertains to *C. Bertero 1814*. For this reason, sheets of *C. Bertero 686 & 1814* also must be flagged as possible syntypes.

Meanwhile, Barnéoud evidently identified a collection *C. Bertero 686* as *Calandrinia compressa*. He did not mention Bertero as the collector, but he identified the locality as Cerro La Leona, which is one of the two localities indicated on labels of sheets of *C. Bertero 686*. This proves to be the locality indicated on a collection of *C. Bertero 686* in P (P05276863). This pertained to the herbarium of Guillemin, but evidently Barnéoud saw it. I know of no other collection of this species from this particular locality that would have been available to Barnéoud. As noted in Hershkovitz (2020a), *Calandrinia compressa* is not yet typified. The original dried material cited by De Candolle was sent to him by Schrader, and this was cultivated in Göttingen from seed of unspecified provenance.

Articulated below are the revised typifications of *Calandrinia gaudichaudii* and *Talinum linaria*, both synonyms of *Calandrinia pilosiuscula*, as modified from Hershkovitz (2020a). Note that P05276881 is designated as a syntype of *C. gaudichaudii* and also as a possible syntype of *T. linaria*. Note also that MPU 764760 is listed as a possible syntype of both *C. gaudichaudii* and *T. linaria*, whereas collections numbered as *C. Bertero 686 & 1814* are listed as possible syntypes of *C. gaudichaudii*. These ambiguities cannot be resolved here or possibly at all, but meanwhile the typification possibilities cannot be ignored.

Calandrinia gaudichaudii Barnéoud, in Gay, Fl. Chil. 2(4): 490. May–June 1847.

CHILE: Region, Valparaiso Province, Valparaiso, 1832, *M. Gaudichaud 220* (LECTOTYPE, designated here: P, [P01903319 {"1831–1833;" image!}]; four ISOLECTOTYPES designated here: G [G00440510 {with 1832 date; image!}, G00440509 {with erroneous "1834" date; image!}], K [K000424680 {without date; image!}], P [P01903320 {ex herb Drake; without date; image!}]). — *Gaudichaud 221* (SYNTYPE, designated here: [P01903321 {"1831–1833;" image!}]). —August, 1830, *C. Bertero s.n.* (possible SYNTYPE, P [P05276881{pertains to either *C. Bertero 685* (TO) or *C. Bertero 1814*; original label annotated "Herbarium Richard" and in different ink "*Talinum*, Valparaiso, (Bertero);" this seems to be most likely the specimen available to Barnéoud; image!}]); (four possible ISOSYNTYPES, G [G00446777 {annotation by I. E. Peralta (MERL), 21 Dec. 1992, as "probable paratypus de *Calandrinia gaudichaudii* Barn.; exsiccata usada por Colla para describer *Talinum linaria* Colla;" image!; photo F, neg. 27671; image!}; [G00446778 {annotation by I. E. Peralta (MERL), 21 Dec. 1992, as "probable paratypus de *Calandrinia gaudichaudii* Barn.; exsiccata usada por Colla para describer *Talinum linaria* Colla;"; image!}]; MPU [MPU 764760 {pertains to either *C. Bertero 685* (TO) *or C. Bertero 1814*; its type status depends upon the numerical identity of *C. Bertero s.n.* in P (P05276881); image!}]. —Without date, *C. Bertero s.n.* (SYNTYPE, designated here, P [P05276881 {pertains to either *C. Bertero 685* (TO) or *C. Bertero 1814*; original label annotated "Herbarium Richard" and in different ink "*Talinum*, Valparaiso, (Bertero);" most likely the specimen seen by Barnéoud; image!}]). *C. Bertero s.n.* (possible ISOSYNTYPE, MPU [MPU 764760 {pertains to either *C. Bertero 685* (TO) *or C. Bertero 1814*; its type status depends upon the numerical identity of *C. Bertero s.n.* in P (P05276881); image!}]. — *C. Bertero 686 & 1814* (only material pertinent to *C. Bertero 1814* possible ISOSYNTYPES, depending upon the numerical identity of *C.*

Bertero s.n. in P [P05276881]; mixed Unio Itinerario collections indicating "In sterilibus montis la Leona Rancagua collium Valparaiso Chile Aug. Sptbr. 1829. 1830. Hrbr. *Bertero* no. *686* (ex parte) et *1814*;" the 1829 date for Rancagua is erroneous and should be 1828, G [G00446776 {annotated by I. E. Peralta (MERL), 21 Dec. 1992, as "probable paratypus de *Calandrinia gaudichaudii* Barn.; image!}]; MO [MO-2434537 {image!}], NY [NY02065849 {the sheet includes two individuals, one of *Calandrinia nitida* and the other *Calandrinia pilosiuscula*; however Bertero collected both species in both localities; Bertero's numbers 686 and 1814 both correspond to collections of *C. pilosiuscula*, so one of the collection numbers indicated is incorrect; however, it cannot be determined whether the *C. pilosiuscula* specimen pertains to *Bertero 686* or *1814*; image!}]). —Quillota, "in pascuis saxosis apricis collium Quillota," September–October, 1829, *C. Bertero 1344* (SYNTYPE, the specimen referred to by Barnéoud is not identified); (five possible ISOSYNTYPES, L [L1687701 {"Unio Itiner," image!}, L1687705 {image!}, L1687709 {"Unio Itiner.;" image!}], MO [MO-2434547{ex herb. Steudel "Unio Itiner," image!}], P [P05276739 {ex herb Drake, "Unio Itiner.;" image!}]).

Talinum linaria Bertero ex Colla, Mem. Reale Accad. Sci. Torino 37: *70*. May 1833 ["1834"] (cf. Herb. Pedem. 2: 461. July 1834.).

CHILE: Region, Valparaiso Province, Valparaiso, August, 1830, *C. Bertero 685* (LECTOTYPE, designated here, TO, the individual on the furthest right side of the sheet; SYNTYPES, designated here, the remaining three individuals on this sheet {other collections elsewhere labeled *C. Bertero 685* do not pertain to this species; image!}. —Without date, *C. Bertero s.n.* (possible SYNTYPE, P [P05276881 {pertains to either *C. Bertero 685* (TO) or *C. Bertero 1814*; original label annotated "Herbarium Richard" and in different ink "*Talinum*, Valparaiso, (Bertero);" most likely the specimen cited by Barnéoud as *C. gaudichaudii*; image!}]). *C. Bertero s.n.* (possible ISOSYNTYPE, MPU [MPU 764760 {pertains to either *C. Bertero 685 (TO) or C. Bertero 1814*; image!}].

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dedicated to biodiversity research cooperate/collaborate only with database operations offering freely accessible data.

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Table 1. Specimens of Bertero's Chilean collections of *Tweedia* (Apocynaceae; Asclepiadoideae) located in online herbarium specimen databases. Herbarium codes follow Index Herbariorum (http://sweetgum.nybg.org/science/ih/). Sheets indicating the collector as "D. Bertero" have handwritten labels presumably prepared by Benjamin Delessert (see text).

Bertero no.	Herb. Code	Herb. barcode	Indicated locality	Indicated date	Comment
210	G	G00343703	Valparaiso	Sept 1830	Coll. "D. Bertero;" det. as *Tweedia birostrata* by M.A. Farinaccio, 2005.
"	G-DC	G00136846	"	Sept "1820" [= 1830]; "1833"	De Candolle label?; label indicates "M. Bertero 1833;" 1833 must be a curation date; det. as *Tweedia confertiflora* by M.A. Farinaccio, 2005; *T. confertiflora* is considered a synonym of *T. birostrata*.
"	"	G00136850	La Quinta, Río Claro (ca. Rengo, in between Rancagua and San Fernando)	1830	De Candolle label?; det. as *Tweedia birostrata* by M.A. Farinaccio, 2005.
"	GH	G0076628	Valparaiso/Viña del Mar; "in arena mobilis ad maris litus"	Sept 1830	Coll. "D. Bertero."
"	"	G0076629	Valparaiso	"	Ex BM; Handwritten blue label indicates coll. "D. Bertero;" other handwritten label indicates an Unio Itinerario specimen, but not a combined specimen and without boilerplate label.
"	L	L2726192	s.d.	s.d.	–
"	MO	MO-072493	Rancagua	"	Unio Itinerario boilerplate, not combined with *C. Bertero 942*; two stem fragments; det. as *Tweedia obliquifolia* (Colla) Malme by W.D. Stevens, 1998; *Tweedia obliquifolius* considered a synonym of *T. birostrata*.
"	MPU	MPU013066	La Quinta, Río Claro (ca. Rengo, in between Rancagua and San Fernando)	Oct 1829	The year is erroneous for this locality
"	"	MPU013067	"	s.d.	–
"	P	P00642565	"	Oct 1829	Ex herb. Jussieu; the label indicates the locality and month and, separately below, "M. Bertero. 1829;" the year must be erroneous; det. as *Tweedia birostrata* by M.A. Farinaccio, 2005.
"	"	P00642566	Rancagua	Oct 1828	ex herb. Guillemin; coll. "D. Bertero;" the month and year correspond with Bertero's itinerary; det. as *Tweedia birostrata* by M.A. Farinaccio, 2005.

Table 1, continued.

Bertero no.	Herb. Code	Herb. barcode	Indicated locality	Indicated date	Comment
210	P	P00642567	Rancagua	s.d.	Label does not indicate collector; det. as *Tweedia birostrata* by M.A. Farinaccio, 2005.
210? (s.n.)	MPU	MPU0130 67	La Quinta, Río Claro (ca. Rengo, in between Rancagua and San Fernando)	s.d.	–
210 & 942	MO	MO-2107355	Viña del Mar/Valparaiso, Rancagua, Quillota	Sept–Dec 1828 1829 1830	Unio Itinerario boilerplate with handwritten annotation "ex herb. Steud.;" two stem fragments; det. as *Tweedia andina* by M.A. Farinaccio, 2005.
"	NY	00318744	"	"	Unio Itinerario boilerplate; one individual; det. as *Tweedia birostrata* by M.A. Farinaccio, 2005.
"	P	P00631858	"	"	Unio Itinerario boilerplate with handwritten annotation "ex herb. Steud.;" one individual; det. as *Tweedia andina* by M.A. Farinaccio, 2005; annotated as "*Oxypetalum hookeri* Decne., nom illegit." by M.A. Farinaccio,
941	GDC	G00136928	Valparaiso; "collium"	Sept 1829 1830	One label with description and sketch, the other indicating coll. "D. Bertero" includes the both the 1829 and 1830 dates, but the latter is written following "D. Bertero" in a different ink; det. as *Tweedia confertiflora* by M.A. Farinaccio, 2005; *T. confertiflora* is considered a synonym of *T. birostrata*.
942	G	G00343704	Quillota	Oct 1829	Coll. "D. Bertero;" det. as *Tweedia andina* by M.A. Farinaccio, 2005.
"	GDC	G00136937	"	Oct-Nov 1829 1830	The label indicating coll. "D. Bertero" includes the both the 1829 and 1830 dates, but the latter is written following "D. Bertero" in a different ink; annotated as "*Oxypetalum hookeri* Decne., nom illegit." by M.A. Farinaccio, but there is no determination of species of *Tweedia*.
"	GH	GH00076634	"	s.d.	Coll. "D. Bertero."
"	"	GH00076635	"	Oct 1829	Coll. "D. Bertero."
"	P	P00631856	"	s.d.	–

Table 1, continued.

Bertero no.	Herb. Code	Herb. barcode	Indicated locality	Indicated date	Comment
942	P	P00631857	Quillota	1829	Mixed specimen with three stem fragments; on the left, a handwritten label indicating "D. Bertero" and Quillota, 1829; above this is a morphological sketch, likely Decaisne's; on the far right, a similar plant fragment, below this a boilerplate label "ex Herb. Mus. Paris," with the annotation "*Tweedia*," below this "*Oxypetalum hookeri* Dne," and the locality "Chile;" in the center a stem fragment of *Tweedia birostrata* with a label indicating "R. A. Philippi, Pl. Chil, Ed. R. F. Hohenacker and IDd as *Oxypetalum hookeri*; two additional annotations by M.A. Farinaccio, 2005, one indicating *T. andina*, the other indicating "*Oxypetalum hookeri* Decne., nom illegit."
s.n.	P	P03902693	s.d.	s.d.	Ex herb. Maire; coll. "Bertero;" det. as *Tweedia birostrata* by M.A. Farinaccio, 2005.

Table 2. Specimens of Bertero's Chilean collections of Montiaceae located in online herbarium specimen databases. Herbarium codes follow Index Herbariorum (http://sweetgum.nybg.org/science/ih/). Sheets indicating the collector as "D. Bertero" have handwritten labels presumably prepared by Benjamin Delessert (see text).

Bert-ero no.	Herb. Code	Herb. barcode	Taxon	Indicated locality	Indi-cated date	Comment
535	BM	BM000629159	*Montiopsis berteroana*	Tagua Tagua (in between Rancagua and San Fernando)	Oct 1828	Unio Itinerario boilerplate label with generic ID as *Pharnaceum*.
"	G	G00440485	"	"	"	"
"	MO	MO-1939664	"	"	"	TWO labels; glued label indicates *Poeppig 111*; loose label same as above.
"	G	G00440486	"	"	"	Ex herb. De Candolle.
"	"	G00440484	"	"	"	Coll. "D. Bertero."
"	P	P032600	"	"	1828	Handwritten label identical to G00440484 but not indicating collector; Bertero is indicated on later MNHN boilerplate.
"	"	P03286095	"	"	Oct 1829	Ex herb. Jussieu; the year is incorrect.
535? (s.n.)	SGO	SGO000001846	"	"	Oct 1828	JSTOR record, image not available to me.
"	SGO	SGO000001846	"	"	"	"
682 & 1816 (cf. 1816)	L	L1687450	*Calandrinia monandra*	Río Cachapoal (ca. Rancagua), Valparaiso, "etiam ex" JF	Oct 1828 Aug 1830	Unio Itinerario boilerplate label.
"	"	L1687454	"	"	"	"
"	MO	MO-2434536	"	"	"	"
"	P	P05248844	"	"	"	"
"	"	P05248847	"	"	"	"
"	"	P05249528	"	"	"	"
"	L	L1687453	"	"	"	Handwritten label with same data as Unio Itinerario label.
"	E	E00033165	*Calandrinia pilosiuscula*	"	"	Unio Itinerario boilerplate label; evidently this specimen assigned this number erroneously

Table 2, continued.

Bert-ero no.	Herb. Code	Herb. barcode	Taxon	Indicated locality	Indi-cated date	Comment
683	G	G00440472	*Cistanthe trigona*	La Quinta, Río Claro (ca. Rengo, in between Rancagua and San Fernando)	Sept 1828	Appears to be Bertero´s original label with brief description.
"	"	G00440473	"	s.d.	s.d.	Ex herb. De Candolle.
"	L	L1687704	"	Rancagua	Nov 1828	Coll. "D. Bertero."
"	P	P0458277	"	"	"	"
"	"	P0458278	"	Río Cachapoal (ca. Rancagua)	s.d.	Ex herb. Jussieu.
"	"	P0458279	"	"	Nov 1829	"
"	"	P0458280	"	"		Ex herví. Richard.
"	TO	s.n.	"	"	1830	Holotype of *Talinum trigonum* bearing Colla's (but not Bertero's) description and labels, one indicating "Ex herb. Bertero 1830." The year is wrong.
"	G	G00440471	"	"	Nov 1828	Unio Itinerario boilerplate label.
"	"	G00440474	"	"	"	"
"	L	L1687708	"	"	"	"
"	NY	02065853	"	"	"	"
"	MO	MO-1939567	"	"	"	"
"	P	P04582982	"	"	"	"
683? (cf. 1348)	P	P019003301	*Cistanthe chamissoi*	Rancagua	1828	Coll. "D. Bertero;" possibly numbered incorrectly, perhaps a specimen of *C. Bertero 1348* (see this entry) presumed to be the same as *C. trigona* and thus reassigned the lower number *C. Bertero 683*
684 (cf. 1349, 684 & 1349)	P	P04583007	*Cistanthe mucronulata*?	La Quinta, Río Claro (ca. Rengo, in between Rancagua and San Fernando)	Sept 1828	The locality suggests *Cistanthe mucronulata*, but without examining the actual specimen, *C. grandiflora* cannot be ruled out; coll. "D. Bertero;" cf. Hershkovitz, 2019c: 13).
"	"	P04583008	"	"	Sept 1829	Ex herb. Richard; probably the same collection as P04583007; the date is erroneous; cf. Hershkovitz, 2019c: 13).

Table 2, continued.

Bert-ero no.	Herb. Code	Herb. barcode	Taxon	Indicated locality	Indi-cated date	Comment
684 "cfr. 1349" (cf. 1349, 684 & 1349)	P	P04583006	*Cistanthe grandiflora* & *Cistanthe philhershkovitz-iana*	Valparaiso	Sept 1830	Mixed collection; Bertero label with his number 684 followed by "cfr. 1349;" the localities Rancagua and Quillota not mentioned on the label.
684 & 1349 (cf. 684, 1349)	MO	MO-2434551	*Cistanthe* sect. *Cistanthe* sp.	Quillota	Sept–Nov 1829 1830	Unio Itinerario boilerplate label, no reference to Rancagua – OR – to Valparaiso, notwithstanding these localities indicated on different specimens of *C. Bertero 684*, and 1830 date; the correct year for Quillota is 1829; the range Sept–Nov is peculiar in the context of the year 1830, as Bertero departed Chile in September 1830, and *C. Bertero 1349* is dated only Oct 1829; without studying the specimen, I cannot determine if this plant corresponds to Rancagua (*Cistanthe mucronulata*) or Quillota or Valparaiso (*Cistanthe grandiflora*).
"	NY	02065851	*Cistanthe philhershkovitz-iana*	"	"	. See comments for the other specimens of *C. Bertero 684* and *1349*. I ´presume that this plant actually is from Quillota, 1829.
685 (cf. 1345 & 1815)	P	P00219848	*Calandrinia nitida*	Corcolen (in between Rancagua and San Fernando)	Sept 1828	Coll. "D. Bertero."
"	"	P05276806	"	La Leona (ca. San Fernando)	Oct 1829	The month and locality differ from P00219848 and the year is erroneous.
"	"	P05276861	"	"	"	
"	"	P05276862	"	"	1829	Ex herb. Richard; the month is not indicated; the locality differs from P00219848 and the year is erroneous.

Table 2, continued.

Bert-ero no.	Herb. Code	Herb. barcode	Taxon	Indicated locality	Indi-cated date	Comment
685? (cf. 683)	NY	020655853	*Cistanthe trigona*	Río Cachapoal (ca. Rancagua)	Nov 1828	Unio Itinerario boilerplate label; probably numbered incorrectly; the ID and locality agrees with some collections of *C. Bertero 683* and not with other collections of *C. Bertero 685*.
685? (cf. 686, 1814, 686 & 1814)	TO	–	*Calandrinia pilosiuscula*	Valparaiso	1830	Bertero label; probably numbered incorrectly; Bertero seems to have assigned this 1830 Valparaiso collection to the conspecific number from the Rancagua series, but that number should be *C. Bertero 686*.
685 & 1345 & 1815 (cf. 685, 1345, 1815)	MO	MO-2434532	*Calandrinia nitida*	Corcolen & Valparaiso	Sept 1828 1830	Unio Itinerario boilerplate label; the number *C. Bertero 1345* (see this entry) corresponds to the 1829 Quillota series, but this locality/date not indicated on the label
"	P	P05276864	"	"	"	"
686 (cf. 1814, 686 & 1814)	P	P05276863	*Calandrinia nitida* & *Calandrinia pilosiuscula*	La Leona (ca. San Fernando)	s.d.	Ex herb. Guillemin; mixed specimen, one individual of each species, presumably *C. Bertero 685* & *686*.
"	G	G00446774	*Calandrinia pilosiuscula*	"	1830	Ex herb. De Candolle; number and locality agree but year does not.
"	"	G00446775	"	Punta de Cortés (ca. Rancagua)	Sept 1828	Original Bertero label.
"	MPU	MPU764757	"	"	1829	–
686?	MO	MO-1987890	"	La Leona (ca. San Fernando)	Oct 1828	Sheet with TWO labels; the glued label indicates the collection *E. Poeppig 110*; a loose original Bertero label indicates *C. Bertero 686*; regardless of the pertinence of the specimen, the Bertero label documents his collection of a plant he numbered as *C. Bertero 686* with the indicated locality and date.
686 & 1814 (cf. 686, 1814)	G	G0044776	"	La Leona (ca. San Fernando) & Valparaiso	Aug Sept 1829 1830	Unio Itinerario boilerplate label; Rancagua number and locality agree but year does not.
"	MO	MO-2434537	"	"	"	"

Table 2, continued.

Bert-ero no.	Herb. Code	Herb. barcode	Taxon	Indicated locality	Indi-cated date	Comment
686 & 1814 (cf. 686, 1814)	NY	02065849	*Calandrinia nitida* & *Calandrinia pilosiuscula*	La Leona (ca. San Fernando) & Valparaiso	Aug Sept 1829 1830	Unio Itinerario boilerplate label; mixed specimen, one individual of each species, presumably *C. Bertero 685* & *686*; Rancagua number and locality agree but year does not.
687	L	L1686457	*Montiopsis umbellata*	Río Cachapoal (ca. Rancagua)	s.d.	–
"	MPU	MPU764770	"	Rancagua	s.d.	–
"	"	MPU764771	"	Río Cachapoal (ca. Rancagua)	1829	The year is incorrect.
"	P	P032543	"	"	s.d.	–
"	"	P04583032	"	San Fernando/ Rancagua	1829	Ex herb. Richard; the year is incorrect.
"	"	P04583037	"	Rancagua	Dec 1828	Ex herb. Guillemin; coll. "D. Bertero;" the year corresponds to Bertero's itinerary.
"	"	P04583049	"	"	1828	The year corresponds to Bertero's itinerary.
"	L	L1686456	"	Río Cachapoal (ca. Rancagua)	Dec 1829	Unio Itinerario boilerplate label; the year is incorrect.
"	MO	MO-1938425	"	"	"	"
"	NY	02065852	"	"	"	"
"	P	P04583034	"	"	"	"
687? (s.n.)	P	P04583047	"	s.d.	s.d.	Ex herb. Maire.
1344	L	L1687705	*Calandrinia pilosiuscula*	Quillota	Sept Oct 1829	Handwritten label but data the same as Unio Itinerario specimens
"	"	L1687701	"	"	"	Unio Itinerario boilerplate label.
"	"	L1687709	"	"	"	".
"	MO	MO-2434547	"	"	"	"
"	P	P05276739	"	"	"	Unio Itinerario boilerplate label; ex herb. E. Drake.
"	E	E00230570	*Calandrinia monandra*	"	"	Same Unio Itinerario boilerplate label as above, but with wrong species on sheet.

Table 2, continued.

Bert-ero no.	Herb. Code	Herb. barcode	Taxon	Indicated locality	Indi-cated date	Comment
1345 (cf. 685, 1815, 685 &1345 & 1815)	P	P05276861	*Calandrinia nitida*	Quillota	Oct 1829	Ex herb. Steudel.
1347 (cf. 1808, 1347 & 1808)	G	G00440478	*Montiopsis trifida*	"	Oct 1829	Ex herb. De Candolle.
1347 (cf. 1808, 1347 & 1808)	L	L1686640	*Montiopsis trifida*	"	1829	Coll. "D. Bertero."
"	P	P01900012	"	"	¿	Ex herb. Guillemin; coll. "D. Bertero."
1347 & 1808 (cf. 1347, 1808)	G	G00440478	"	Quillota & Valparaiso	Aug Oct 1829 1830	Unio Itinerario boilerplate label; mis-ID "*Calandrinia pilosiuscula* DC;" (cf. Hershkovitz, 2020a:38).
"	L	L1686544	"	"	"	"
"	MO	MO-2434553	"	"	"	"
"	P	P04583056	"	"	"	"
"	"	P05249507	"	"	"	"
"	L	L1686544	"	"	s.d.	Handwritten label with both Bertero numbers indicated, thus possibly an Unio Itinerario distribution.
1348 (cf. 683)	G	G00440495	*Cistanthe chamissoi*	Quillota	Oct 1829	–
"	"	G00440496	"	"	Nov 1829	Coll."D. Bertero."
"	"	G00440494	"	"	Oct Nov 1829	Unio Itinerario boilerplate label.
"	MO	MO-1939549	"	"	"	"
"	P	P04582981	"	"	"	"
1348? (s.n.)	P	P04582976	"	"	s.d.	Ex herb. Richard.

Table 2, continued.

Bert-ero no.	Herb. Code	Herb. barcode	Taxon	Indicated locality	Indi-cated date	Comment
1349 (cf. 684, 684 & 1349)	P	P04583004	*Cistanthe grandiflora*	Quillota	Oct 1829	Ex herb. Steudel; Bertero label.
"	"	P04583003	*Cistanthe grandiflora* & *Cistanthe philhershkovitz-iana*	"	1829	Mixed collection; coll. "D. Bertero;" the smaller plant is *Cistanthe philhershkovitziana*; if the larger plant was collected at low elevation at the same location and date, then it is *Cistanthe grandiflora*; there remains the possibility, given Bertero's reassignment of collections to chronological numbers, that the plant actually is *C. Bertero 684* from Rancagua.
1792	US	03605737	*Montia fontana*	Valparaiso	Aug 1830	Unio Itinerario boilerplate label; the only specimen of this number that I have located.
1808 (cf. 1347, 1347 & 1808)	P	P04583055	*Montiopsis trifida*	"	Aug 1830	Ex herb. Steudel; mis-ID as *Calandrinia pilosiuscula* (cf. Hershkovitz, 2020a: 38).
"	TO	s.n.	"	"	"	Ex herb. Colla; mis-ID as *Calandrinia pilosiuscula*.
1808? (s.n.)	P	P04583058	"	"	s.d.	Ex herb. Richard; mis-ID as *Calandrinia pilosiuscula* (cf. Hershkovitz, 2020a: 38).
"	"	P04583061	"		s.d.	Ex herb. Richard.
1814 (cf. 686, 686 & 1814)	G	G00446777	*Calandrinia pilosiuscula*	"	Aug 1830	Coll. "D. Bertero."
"	"	G00446778	"	"	1833	Ex herb. De Candolle; coll. "D. Bertero;" year erroneous.
1814? (s.n.)	MPU	MPU764760	"	"	s.d.	–
"	P	P05276881	"	"	s.d.	Ex herb. Richard.
1815? (s.n.; cf. 685 & 1345 & 1815)	P	P05276807	*Calandrinia nitida*	"	s.d.	Ex herb. Richard; the locality "in pascuis Valparaiso" suggests that this is a singlet collection corresponding to the Unio Itinerario specimen *C. Bertero 685 & 1345 & 1815*.

Table 2, continued.

Bert-ero no.	Herb. Code	Herb. barcode	Taxon	Indicated locality	Indi-cated date	Comment
1816 (cf. 682 & 1816)	L	L1687452	*Calandrinia monandra*	Valparaiso	s.d.	–
"	MPU	MPU764755	"	"	s.d.	–
1816 (cf. 682 & 1816)	P	P05248850	*Calandrinia monandra*	"	Aug 1830	Bertero label.
"	"	P05248838	"	"	1829	Coll. "D. Bertero;" the year is incorrect.
"	"	P05248845	"	"	s.d.	Ex herb. Richard.
"	TO	s.n.	"	"	Aug 1830	Ex herb. Colla; two sheets.
"	P	P05248858	"	s.d.	s.d.	Ex herb. Maire.
1816? (s.n.)	P	P05248843	"	Valparaiso	Sept 1830	Ex herb. Jussieu, the month is conflicting and unlikely.
s.n.	MO	MO-1987883	*Calandrinia menziesii?*	"	Nov 1830	The indicated date cannot be correct.
"	P	P04583062	*Montiopsis trifida*	s.d.	s.d.	Ex herb. Maire; without locality or date; cannot determine whether it corresponds to *C. Bertero 1347* or *1808*

Fig. 1. Type of *Talinum linaria* Colla, "*C. Bertero 685* (TO)." Note the underlined "685," characteristic of Bertero's labels. To the right of Bertero's label is the reverse side, showing Colla's description. I designate the individual on the right hand side as the lectotype; the remaining three individuals are designated here as syntypes. Image courtesy of Laura Guglielmone (TO).