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# *Cistanthe Reshetiana* (*C.* Sect. *Cistanthe*; Montiaceae) – A New Species from the Coquimbo Region, Chile

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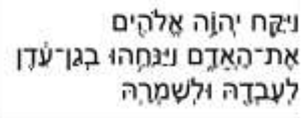
**ABSTRACT**

*Cistanthe reshetiana* Hershk. is recognized as a new species of *C.* sect. *Cistanthe* (Montiaceae) from the coastal Coquimbo Region of Chile. The species previously was confused with *C. philhershkovitziana* Hershk., which it superficially resembles and has a similar distribution. However, *C. philhershkovitziana* is a much smaller and more succulent plant and it is more restricted to the littoral zone, whereas *C. reshetiana* occurs in adjacent more xerophytic semidesert coastal vegetation. In addition, *C. reshetiana* is self-incompatible, whereas *C. philhershkovitziana* is spontaneously autogamous.

Keywords: *Cistanthe*, Montiaceae, Chile

## 1. Introduction



וַיִּקַּח יְהוָה אֱלֹהִים
אֶת־הָאָדָם וַיַּנִּחֵהוּ בְגַן־עֵדֶן
לְעָבְדָהּ וּלְשָׁמְרָהּ

*Cistanthe* sect. *Cistanthe* sensu Hershkovitz [1], formerly classified in *Calandrinia* Kunth, includes ca. 12 facultatively annual or perennial herbaceous to shrubby succulent species of the Chilean Floristic Region [1, 2], principally Chile. Its taxonomy has vexed researchers for more than 125 years [1, 3–5, cf. 6]. The taxonomic difficulty owes to several factors: **(i)** description of several species in Europe in the early 19th Century based on plants cultivated from seed of imprecise Chilean provenance; **(ii)** absence of Type specimens for several of these early-described species; **(iii)** conceptually redundant descriptions of some species that per the International Code of Botanical Nomenclature (ICN [7]) are heterotypic homonyms and therefore illegitimate names; **(iv)** poor preservation of diagnostic features in herbarium specimens; **(v)** lack of interspecific divergence of DNA sequence markers commonly used for interspecific analyses of other angiosperm taxa [8]; and **(vi)** lack of a comprehensive taxonomic analysis of the section [1, cf. 6]. Besides these factors, some species manifest considerable phenotypic variability consequent to their shithappenous developmental plasticity. This blurs taxonomic distinctions based purely on comparative morphology. Taxonomic analysis of this section requires conceptualization of species not in terms of fixed phenotypic traits, but rather in terms of their dynamical behavior or epigenesis sensu [9] or ontogenetic phenotype sensu [10, 11].

A case in point is the new species described here. On 13 September, 2024, I was exploring coastal semidesert scrub near the Type locality of *Cistanthe josetomasallendeana* Hershk. [12] near Puerto Oscuro, Choapa Province, Coquimbo Region, Chile (Fig. 1). This was a "good year" for flowers at this locality, which had received ca. 120 mm of austral winter rain, compared to perhaps 20 mm in 2023. At the peak of a ridge (ca. 230 m elev.) separating the moister western slope from the drier eastern slope, I spotted some plants of *Cistanthe* that at first sight I believed to be *C. philhershkovitziana* Hershk. growing on flat, dry scrub vegetation (Fig. 2). *Cistanthe philhershkovitziana*, originally erroneously described as an annual

[13], is a short-lived facultatively annual species [2], whose distribution I have described as spanning some 600 km latitudinally along the coast in between southern Valparaiso Region and the central Atacama Region [2, 14]. I have described its habitat as comprising both the littoral zone and adjacent uplands up to several km inland [2, 13, 14]. So the occurrence of *C. philhershkovitziana* here was not unexpected theoretically.

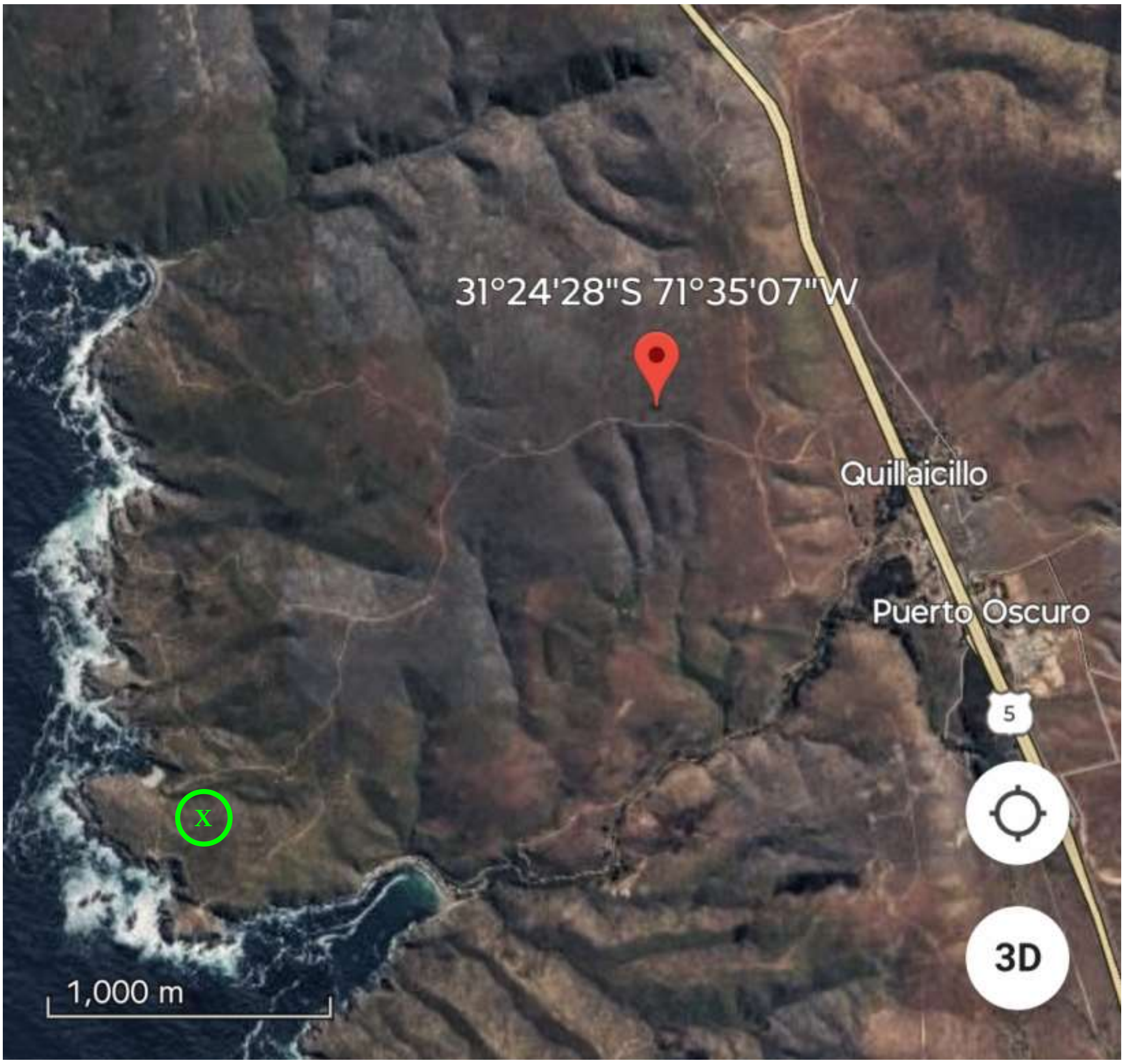


**Fig. 1 –** Map of coastal geography near Puerto Oscuro, Choapa Province, Coquimbo Region, Chile. The Type locality of *C. reshetiana* and approximate coordinates are indicated with a teardrop. A green "X" on the lower left is the Type locality of *C. josetomasallendeana*.

Inspection of the plants immediately revealed some phenotypic traits that differed from *C. philhershkovitziana* plants growing in the littoral zone [2]. These included root morphology, leaf texture, leaf surface morphology, leaf position, and stem morphology. Still, I believed that the plants pertained to *C. philhershkovitziana*, and that the differences reflected shithappenous developmental plasticity associated with the site conditions. I collected some live plants for further study in my rented-room-slash-laboratory. It was only after subsequent behavioral observations that I realized that these plants represent a distinct, undescribed species, which I name as *Cistanthe reshetiana* Hershk. Moreover, I believe now that many of the records of *C. philhershkovitziana* documented in [13, 14] actually pertain to *C. reshetiana*, such that there are two superficially similar species in the Coquimbo Region with proximal parallel distributions: *C. philhershkovitziana* in sandy inorganic substrate in the littoral zone, and *C. reshetiana* in sandy but more organic substrates in adjacent drier vegetation up to several km inland. I describe below the research and analysis that yielded these conclusions.

**Fig. 2 –** *Cistanthe reshetiana* plant in its natural habitat at the Type locality. A – *Cistanthe reshetiana*. B – *Bahia ambrosioides* Lag. (white flowers). C – *Haplopappus foliolosus* DC (dentate leaves). D – *Flourensia thurifera* DC (yellow flowers).

## 2. Methodology

I collected eight individuals of the Puerto Oscuro plants, each including a significant portion of root organ. These were washed with tap water and placed in plastic water containers for further photographic documentation and analysis of their morphology. The plants were kept outside in natural and generally cloudless sunlight. Daytime temperatures generally reached 20C. The water was changed ca. every two days to prevent stagnation and bacterial growth. The plants continued to produce new flowers for the succeeding three weeks. For the first week, flowers were only self-pollinated, as each plant had several flowering stems, so that multiple flowers on the same plant opened in synchrony. Beginning the second week, flowers (without emasculation) were cross pollinated with other individuals. Flower behavior following pollination and capsule development were monitored. After flowering terminated, the plants were maintained in water for the succeeding three weeks to monitor root development. As little or no new root development occurred (and two individuals succumbed to root rot), the remaining six individuals were washed, rotting tissue was cut away, and the now leafless stems/roots were allowed to dry on the surface without desiccation of the remaining live tissue. After adequate drying, the plants were placed in plastic beverage cups containing local beach sand washed with tap water (Fig.3A). The sand was kept moist but not overly wet. These plants were kept indoors on a windowsill with eastern exposure. Root development was monitored every few days. Fine roots began to develop, but these often subsequently rotted because of excess moisture. Two of the six individuals succumbed to rotting. By May, 2025, a fine root system had developed in the remaining four individuals, and these were transplanted sequentially to transparent plastic containers containing a mix of sandy garden loam containing substantial organic composted material. (Evidently insufficient) care was taken to avoid underwatering or overwatering. By this time, day length was much shorter, daytime temperatures lower, and nighttime temperatures usually dipped below 10C. Thus, the plants were placed outside in direct sun each morning and returned indoors late in the afternoon. As midwinter approached, during the dark hours, I placed the plants within a foil-draped enclosure illuminated by 21W of warm LED light. I moved the plants outside only on “warmer” (12–15C) sunny days. Following adequate cultivation, the phenotypes of the living plants and the photos of the plants taken at the time of collection were reanalyzed

## 3. Results and Discussion

### *3.1 Behavior of C. reshetiana plants following collection and transplanting*

**Pollination and fertility.** During the first two weeks in cultivation (in late September, 2024) flowers were self-pollinated. During this time, the first behavioral differences between *C. reshetiana* and *C. philhershkovitziana* became evident. In *C. philhershkovitziana*, the flowers last one day, and they close by de-aestivation, viz. the petals twisting close in the same way that they untwist open, followed by petal deliquescence and fusion. Capsule development is apparent by the following day. In contrast, *C. reshetiana* flowers remained fully opened for up to four days following self-pollination, and they eventually closed via involution and basipetal deliquescence. Capsules did not develop. Thus, *C. reshetiana* appears to be completely self-incompatible (SI), whereas *C. philhershkovitziana* is not only fully self-compatible, it self-pollinates spontaneously [2]. Beginning the second week, flowers (without emasculation) were cross-pollinated with other individuals. Flower behavior following pollination and capsule development were monitored. With cross-pollination, some (but not all) flowers de-aestivated normally after two days, and capsules began to develop. However, when capsules matured, they contained ca. 50% fully-formed seeds and 50% aborted ovules. This low crossing fertility likely reflects sharing of SI alleles by genetically very closely related individuals.

**Cultivation.** Under conditions described in the Methodology, by mid-July, one of the plants had formed a well-developed root and shoot system, with three active rosette axes with leaves expanding to 7+ cm long (Fig 3B), and with leafy branches beginning to form in the apical leaf axils. Most of the leaves of this plant are the same ones as in Fig. 3A. They lengthened and expanded gradually over the course of six weeks. The leaves are notably stiffer, darker green, less succulent and less undulating than in field-grown conditions. The remaining three plants had undergone repeated cycles of preliminary fine root formation followed by root necrosis and repotting in fresh medium. Those three plants remain alive, but still show no sign of growth resumption. Meanwhile, collected rootstocks of *C. philhershkovitziana* are highly resistant, surviving (and producing abundant new etiolated shoots) after more than a year stored in plastic bags, and they reestablish new growth very easily when potted in soil.

### *3.2 Morphological comparison of C. reshetiana with C. philhershkovitziana and other C. sect. Cistanthe species*

*Cistanthe reshetiana* and *C. philhershkovitziana* are both subrosettiform herbs. Table 1 compares the traits of large well-developed plants of both species, viz. plants with multiple caudex branches that correspondingly give rise to multiple flowering stems in a given season. The traits themselves are illustrated in Fig. 4 for *C. reshetiana*. These figures can be compared with those of *C. philhershkovitziana* in [2, 13]. Some of the traits of *C. reshetiana* appear to be intermediate between those of *C. philhershkovitziana* and *C. grandiflora* (Lindl.) Schltdl., including plant/stem height and shape, leaf size and surface morphology, and inflorescence stem leaf/bract morphology. But otherwise, divergence from *C. grandiflora*, which is self-compatible (!), is much greater. Moreover, “typical” tall *C. grandiflora* (1+ m high) is common in the canyon leading to Caleta Puerto Oscuro, bottom left in Fig. 1. Inflorescence stem shape and leaves/bracts in *C. grandiflora* are illustrated in Fig. 5.

**Fig. 3 –** Cultivated transplants of *C. reshetiana* plants collected in the field. **A –** Plants on 7 June 2025, ca. six months after transplanting to sand. The rosettes are 15 – 25 mm broad. Development appears to be about the same in all plants, but the plant on the bottom right appears somewhat better developed. This was the first plant transplanted to sandy loam. An arrow points to a leaf with a split apex, probably the result of primordia injury. Here, the leaf is ca. 1 cm long. **B –** Plants on 16 July 2025, 3–6 weeks after transplanting to sandy loam. The best developed plant in Fig. 3A is growing rapidly, its largest rosette ca. 120 mm broad (cf. Fig. 3A, middle right), while the other plants have deteriorated, though they are not (yet) dead. An arrow points to the same leaf with the split apex as in Fig. 3A. In Fig. 3B, the leaf is ca. 5 cm long and also much wider than in Fig. 3A. This expansion occurred gradually over the course of six weeks.

**Table 1 – Comparison of traits of *C. reshetiana* and *C. philhershkovitziana*.** Note that the traits of *C. philhershkovitziana* described here differ from those in the original description [13]. This is because that description also reflected some misidentified plants of *C. reshetiana*.

| Traits | *C. reshetiana* | *C. philhershkovitziana* |
|---|---|---|
| **Habitat/substrate** | low elevation coastal scrub; in sandy loam | littoral zone dunes and drainages; in sand/gravel |
| **Life form** | subrosettiform hemicryptophyte | subrosettiform hemicryptophyte to geophyte |
| **Root shape** | linear | fusiform |
| **Root texture** | slightly fleshy | Fleshy |
| **Flowering stem length** | 40–60 cm | 15–25 cm |
| **Flowering stem shape** | subangular to terete | terete |
| **Basal leaf length (max)** | 8–10 cm | 5–7 cm |
| **Basal leaf blade shape** | oblanceolate to narrowly elliptical | usually obovate to spathulate to rhombic |

| | | |
|---|---|---|
| **Basal leaf margin** | distinctly narrowly involute | not or indistinctly involute |
| **Basal leaf apex** | sharply acute | obtuse to rounded |
| **Basal leaf surface** | smooth to slightly undulate | undulate to rugose |
| **Basal leaf texture** | stiff, not to slightly succulent | flexible or turgid and markedly succulent |
| **Inflorescence stem foliar leaves** | 1(– 2), scarcely petiolate, narrowly elliptical | usually absent |
| **Inflorescence stem foliaceous bracts** | 2 – 3, sessile, striate marks at the base | usually absent |
| **Petal length** | 23–25 m | 10–20 mm |
| **Self-fertility** | self-incompatible | spontaneously autogamous |

### *3.3 Distribution of C. reshetiana*

Hershkovitz [14] analyzed in detail the distribution of records of *C. philhershkovitziana*. The data comprised principally records of plants that appeared to me to be *C. philhershkovitziana* in images of records in the iNaturalist.org website. Some records, however, were from plants I found in the period of 2000–2010, the specimens, photos, and detailed records of which were destroyed. Thus, some records were only partially documented or undocumented recollections. Many records of *C. philhershkovitziana* in [14] are likely to be *C. reshetiana,* in particular those outside of the littoral zone. These data must be reanalyzed in detail. I have no doubt that some records are indeed *C. reshetiana*. For example, [15] published photos of plants identified as *C. philhershkovitziana* from Canela Baja, a small town some 15 km east of Puerto Oscuro. In fact, Canela also in the name of the broader “comuna” that includes Puerto Oscuro. It is clear to me now that the plants illustrated in [15] are *C. reshetiana*, as they conform perfectly to the description and occur in the same dry vegetation as the Type locality. For all I know, these photos were taken near the Type locality. However, the flowers in these images have bright red throats, whereas the Type locality population flowers are rose throughout. Hershkovitz [14] also reported that *C. philhershkovitziana* was common along the Panamerican Highway roadcut between the Maitencillo and Peña Blanca highway exits in Limarí Province. The Maitencillo exit is only ca. 14 km north of the *C. reshetiana* Type locality. I am certain now that these plants are all *C. reshetiana*. Aside from being in a relatively dry locality, the plants had the same characteristics of plants from the Type locality. Thus, at present, I would characterize the distribution of *C. reshetiana* as comprising semidesert coastal scrub throughout the Coquimbo Region.

### *3.4 Evolution of C. reshetiana*

The morphological intermediacy between *C. reshetiana*, *C. philhershkovitziana*, and *C. grandiflora* is reminiscent of the case of *C. josetomasallendeana,* described from barely one km away from this locality. That species shares traits with the annual herbs *C. chamissoi* (Barnéoud) Carolin ex Hershk. and *C. vicina* (Phil.) Carolin ex Hershk., which grow together in the same population [12]. In that case, I suggested that *C. josetomasallendeana* originated at that or a similar locality as an interspecific hybrid between the two other species. That hypothesis remains speculative. Since then, other records of *C. josetomasallendeana* have emerged from Limarí and Elqui Provinces, more than 100 km from Puerto Oscuro. It is tempting to believe that *C. reshetiana* also originated as an interspecific hybrid, but, at the population level, it is not sympatric with *C. philhershkovitziana* or *C. grandiflora*. The former occurs only in littoral zone drainages where beaches are adequately developed. The closest known locality to Puerto Oscuro is some 20 km away. Meanwhile, *C. grandiflora* does occur at Puerto Oscuro, but at decidedly moister microhabitats and not on open scrub vegetation. It also occurs occasionally nearby on roadcuts of the Panamerican Highway, but evidently always associated with seasonally wet drainages. But however tempting it may be to hypothesize hybridization, it must be recalled that all species, to one or another degree, tend to manifest similarities with multiple closely related species. This should be no surprise when the species share a relatively recent common ancestor that axiomatically was capable of evolving the suite of observed traits. And available evidence [8] suggests that *C.* sect. *Cistanthe* species, however divergent morphologically and ecologically, indeed are very closely related genetically. Thus, it is possible that *C. reshetiana* represents an independent lineage that evolved consequent to Natural Drift [10, 11], or shithappenous evolution. In this scenario, the ancestor simply behaved the way it did under the ecological circumstances in which it found itself, which are distinct from those of the other species. And with that behavior and in those circumstances, it continued to live, systemically reproduce, disperse, and repeat this behavior at other localities.

### *3.5 Taxonomy of C. reshetiana*

וַיִּצֶר֩ יְהוָ֨ה אֱלֹהִ֜ים מִן־הָֽאֲדָמָ֗ה כָּל־חַיַּ֤ת הַשָּׂדֶה֙ וְאֵת֙ כָּל־ע֣וֹף
הַשָּׁמַ֔יִם וַיָּבֵא֙ אֶל־הָ֣אָדָ֔ם לִרְא֖וֹת מַה־יִּקְרָא־ל֑וֹ וְכֹל֩ אֲשֶׁ֨ר
יִקְרָא־ל֧וֹ הָֽאָדָ֛ם נֶ֥פֶשׁ חַיָּ֖ה ה֥וּא שְׁמֽוֹ

***Cistanthe reshetiana*** Hershk., sp. nov. Holotype: CHILE: Coquimbo Region, Choapa Province, Canela Comuna, Puerto Oscuro, semidesert scrub at the peak of a hill along a trail from a diner along the Panamerican Highway to the ocean, 31.4078S 71.5852W 230 m elev, 13 September 2024, *Hershkovitz s.n.* (SGO).

**Diagnosis:** subrosettiform hemicryptophytic perennial herbs different from *C. philhershkovitziana* in having more slender and less succulent taproots; less succulent basal leaves ca. 2X longer, basal leaves with acute rather than obtuse to rounded apices and with a smoother surface; flowering stems partially subangular rather than terete and about twice as long in comparably sized plants, with 1(–2) rather than no heteroblastic foliage leaves, with several rather than no foliaceous bracts; with petals ca. twice as long; self-incompatible rather than autogamous; and occurring in dry scrub vegetation rather than the littoral zone. Differing also from *C. grandiflora* in being herbaceous and never suffrutescent, maximally ca.0.6 m rather than 1+ m height/length, having oblanceolate to elliptic and not ovate or rhombic foliage leaves maximally ca. 10 cm rather than ca. 30 cm long; flowering stems subangular rather than angular and with 1(–2) rather than several heteroblastic leaves, and self-incompatible rather than autogamous.

**Description:** Subrosettiform hemicryptophytic perennial, glabrous herbs. **Taproot** linear, up to ca. 1 cm broad, not spongy-succulent. **Basal leaves** not (especially in cultivation) or only slightly succulent, somewhat glaucous, tinged magenta abaxially when young, oblanceolate, apices acute; apical hydathode thorn-like, red; leaf surface undulating to smooth, midrib slightly depressed adaxially, expressed abaxially, secondary veins indistinct externally. **Flowering stems** spreading to ascending to erect, 10+ emerging from rosette axils, up to 60 cm long, unbranched or 1-branched above the middle, golden, subangular especially near the nodes, more terete in the internodes, 1(–2) elliptical heteroblastic foliage leaves at the lowest nodes, scarcely petiolate, the 3–4 more apical nonflowering nodes bearing sessile foliaceous bracts with black abaxial striations basally, intergrading more apically with striate, amplexicaul, membranous bracts. **Inflorescence** a racemose or 1-branched cyme, recurved during development, become erect at maturity; bracts membranous, amplexicaul, prominently striate, paired at flowering nodes, markedly unequal, apices acute to acuminate **Flowers** up to ca. 10 per racemose branch, hermaphroditic, nectiferous at anthesis; pedicels ca. 3 cm at anthesis, sharply recurving following pollination and lengthening to 5–6 cm. **Pseudosepalous bracts** 2, free, unequal, imbricate, the abaxial clasping the adaxial in bud, slightly succulent, glaucous with black striate markings, broadly ovate, acute, ca. 10 mm long. **Petals** free, flabellate-cuneate, emarginate, ca. 25 x 25 mm, rose-pink throughout or bright red basally. **Stamens** ca. 50, filaments narrowly subulate, magenta, papillate along the margins, ca. 11 mm long, anthers dorsifixed, orange-gold, 1.5 mm long, dehiscence longitudinal. **Gynoecium** hypogenous, syncarpellate, carpels 3; ovary ovate-pyramidal, green, 4 mm long; style whitish, tinged rose towards the base, 5(–8) mm long; stigma plicate, 3-lobed, or 3-branched, papillate, red-magenta, 1 mm high, 2 mm broad. Fruits capsular, dehiscence loculicidal, ca. 11 mm long at dehiscence, seeds potentially up to 100, subglobose, strophiolate, black, ca. 8 mm, seed surface hairy.

**Etymology.** *Cistanthe reshetiana* gratefully acknowledges support and care I have received from Fundación Reshet in Chile (reshet.cl). In January, 2017, eight and a half years and 42 publications (and >1000 pages) ago, Fundación Reshet intervened during a critical moment in my life, this some ten years following my dismissal, for academic incompetence, from my brief assistant professorship in the Faculty of Science of the University of Chile, where I was recruited in 1999 and then subjected to seven years of unspeakable and unforgivable abuse (see [16]), which itself resulted in a total cognitive collapse in January, 2005, and later PTSD and other severe health problems. Unable thereafter to find any sort of academic employment in Chile, not even in the lamest of its “universities” with no PhD faculty, I continued to deteriorate, losing almost the entirety of my research materials (much on *Cistanthe*) dating back to the early 1980s, and eventually facing homelessness. Reshet stepped in and assured that at least I had a place to sleep off the street. Remarkably, under these circumstances, my “pre-Chile” cognition began to return. I remembered who I was and from whence I came. Reshet was patient with me when I later eschewed their advice to pursue purely socioeconomic objectives and opted instead to once again do botanical research. I realized, as my father once taught me, that pursuit of socioeconomic objectives – salaries, grants, titles, gratuitous coauthorships/mentorships, honors, and political influence – is *not* itself the pursuit of *science* – which is the passionate pursuit of the unknown truths adrift in the vast seas of ignorance and deceit. So, on the damp floor of a windowless 4 $m^2$ hovel in an old house filled with alcoholics, drug addicts, and undocumented migrant illegal street vendors, in pursuit of *science*, with nothing but an old cell phone for internet, an old notebook for writing, and a small plastic stool for a desk, I opted to supplement Reshet’s monetary support with food harvested from the garbage. This existence recalled my father’s tales of his life in Ecuador in the 1930s, where he moved because he had no money to pay his US university tuition. Reshet kindly sent me the additional US$20 I needed for bus fare to collect a plant in the field, which was the Type of *Cistanthe philhershkovitziana* [13]. As conditions improved somewhat, I was able to find slightly better lodgings, and, upon reaching 65 years of age, received an additional small pension. Reflecting on this, I can state unequivocally that Reshet’s intervention and sustained assistance has been the difference between 42 publications and…*zero*…as well as the fuel and spark for significant contributions to the knowledge of *Cistanthe* and other taxa in Chile and throughout the world. For this reason, it is my humble privilege to have been led to discover this species, to name it, and to have it forever after called *Cistanthe reshetiana*.

**Fig. 4 –** *Cistanthe reshetiana*. **A –** whole field-collected plant. Note that a “normal” foliage leaf occurs at the lowest heteroblastic node of each flowering stem. Note also the small size and girth of the taproot compared to much smaller

plants of *C. philhershkovitziana* (see [2, 13]). **B –** portion of a flowering stem showing the sessile foliaceous bract at the heteroblastic node second from the basalmost. Note the black striations near the base. **C –** an open flower.

**Fig. 5 –** *Cistanthe grandiflora* plant cultivated in a municipal street garden in El Quisco, Chile, showing a single flowering stem with numerous heteroblastic leaves. Note the pronounced stem angles.

***Acknowledgements***

In addition to Fundación Reshet, I thank Dr. José Elias Duran Lima (CEPAL) and his wife Susana Yolanda Roa Ferreira for allowing me to use their home in Santiago as a pit stop in between Puerto Oscuro and El Quisco.

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