# Idiosyncrasies of *Cistanthe ipniana* Hershk. (*C.* sect. *Rosulatae*; Montiaceae)

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## ABSTRACT

*Cistanthe ipniana* Hershk. [*C.* sect. *Rosulatae* (Reiche) Hershk.; Montiaceae] was described briefly based on collections from Huasco Province, Atacama Region, Chile. The species is distinctive in having flower morphology essentially identical to that of *C. litoralis* and *C. longiscapa*, to which it is very closely related genetically, but a distinctive vegetative form identical to that of *C. thyrsoidea* (Reiche) Peralta & D.I.Ford of the more distantly related *C.* sect. *Thyrsoideae* Hershk. Although sympatric, there is no evidence for potential or historical gene flow between these species. Additional collections and observations of collected plants cultivated ex situ permits a more detailed description of the species, taking into account variation, fruit and seed characters, and senescence behavior. The floral bracts in *C. ipniana* are described as being not only unique to this among all *Cistanthe* species, but remarkably similar to the floral bracts of some more remotely related *Philippiamra* Kuntze and *Calyptridium* Nutt. species (Cistantheae; Calyptridinae). But the latter taxa have much smaller flowers. The similarities in vegetative habit and distinctive floral bracts of *C. ipniana* to remotely related Cistantheae is attributed to convergent evolution, and the difference between these traits in *C. ipniana* and its closest relatives is attributed not to some sort of "adaptive" evolution that might be presumed by mainstream evolutionary biology, but to evolutionary "natural drift" and its corollary, the Principle of Evolutionary Idiosyncraticity.
**Key words:** *Cistanthe*, Montiaceae, Chile, taxonomy

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## Introduction

Hershkovitz (2025a) described the annual herbaceous species *Cistanthe ipniana* Hershk. [*C.* sect. *Rosulatae* (Reiche) Hershk. sensu Hershkovitz, 2025b contra 2019, 2020; Montiaceae] from southwestern Huasco Province (Atacama Region) and northwestern Elqui Province (Coquimbo Region). In fact, Hershkovitz (2006) mentioned four collections of this species collected in 2000–2002. But, owing to a tragic and scandalous history, all collections, photos, and most notes related to this research, and much more, eventually were destroyed. Owing to consequent health and economic circumstances, it was not until 2025 that I was able to replace the original collections for formal description.

The original description of *C. ipniana* was, as advertised in Hershkovitz (2025a), concise but adequate for validating the name for use in subsequent papers. I did not appreciate how soon that "subsequent" would be. A week following publication of Hershkovitz (2025a), Chomentowska et al. (2025a) published a preprint article that included a phylogenomic analysis of Montiaceae § Cistantheae Hershk. Scrutiny of this work and supplemental data revealed to me that two samples identified as "*Cistanthe* sp." represented *C. ipniana* (Hershkovitz, 2025b). The various phylogenetic trees showed these samples as sister to a clade comprising the "*Cistanthe longiscapa* complex" sensu Hershkovitz (2025a; non Chomentowska et al., 2025a). Extrapolating from Chomentowska et al. (2025a), I included in this complex *C. longiscapa* (Barnéoud) Carolin ex Hershk., *C. litoralis* (Phil.) Carolin ex Hershk., *C. chrysantha* (I.M.Johnst.) Peralta & D.I.Ford, *C. cymosa* (Phil.) Carolin ex Hershk., and *C. sitiens* (I.M.Johnst.) Peralta & D.I.Ford (Hershkovitz, 2025b). In some trees in Chomentowska et al. (2025a), *C. ipniana* was nested within this complex. The *C. longiscapa* complex clade, in turn, is nested within *C.* sect. *Rosulatae*.

In the context of its phylogenetic relations, the morphology of *C. ipniana* appears strikingly peculiar: **(i)** its erect habit and linear leaves are indistinguishable from the small-flowered species *C. thyrsoidea* (Reiche) Peralta & D.I.Ford (*C.* sect. *Thyrsoideae* Hershk.), but the large flowers are nearly identical to those of *C. longiscapa* (Barnéoud) Carolin ex Hershk. and *C. litoralis* (Phil.) Carolin ex Hershk.; and **(ii)** its large and disproportionately unequal papery floral bracts are unlike those of any (closely or distantly related) *Cistanthe* species, but are very similar to those of more remotely related *Philippiamra* Kuntze and *Calyptridium* Nutt. species (Cistantheae; Calyptridinae). Especially because of these peculiarities, I take the opportunity here to provide an amended and expanded description of *C. ipniana* and a brief commentary on its manifestation of evolutionary idiosyncraticity.

## Materials and methods

Plants of *C. ipniana* were observed and collected on 20 September and 13 October 2025 at a site 50 km w of Domeyko (Huasco Province, Atacama Region) along highway C-496 in the direction of Sarco. Plants collected on both occasions were cultivated in both water and a primarily sand soil mixture. The behavior of the plants was monitored until, well, today, as not all of the collected plants have senesced completely. Additional observations were recorded from notes, memory, and online resources. The species description elaborated in Hershkovitz (2025a) was amended accordingly.

## Results

Characteristics of plants of *C. ipniana* collected at the Type locality are illustrated in Figures 1–12. A description of the species amended and appended from Hershkovitz (2025a) is provided below. Following that are additional observations of the behavior of the plants ex situ.

***Cistanthe ipniana*** Hershk., Int. J. Adv. Res. Publ. Rev. 2(10) 28. 2025. Holotype: CHILE: Atacama Region, Huasco Province, Freirina Comuna, highway C-496 ca. 10 km west of the junction with highway C-500, in comparatively moist herbaceous patches in washes on south side of road, -28.903 -71.383, 280 m elev., 22 September 2025, *Hershkovitz s.n.* (SGO).

**Annual herbs** succulent, erect, strict, occasionally branching from the base, up to 40 cm high. **Taproot** slender, linear, stiff, whitish, up to ca. 4 mm broad, up to 10 cm long. **Stems** terminating in cymes, branches swollen at the base, internodes expanding to 4 – 6 cm. **1° stem** becoming naked basally following senescence of seedling leaves and elongation of the internodes, leafless in the unbranched sterile basal 10 cm, then forming brachyblastic leaves (viz. ± a rosette) in the middle portion that subtends the 20–25 cm long fertile apical (viz. inflorescence proper) portion; pale yellow-green, tinged reddish. **2° branches** ca. 5–10, branching at acute to ± right angles, ascending, otherwise similar to the 1° stem. **Leaves** usually linear, in some populations of possible hybrids with *C. litoralis* oblanceolate to obovate, green to gray-green-glaucous, sometimes tinged reddish abaxially, slightly inrolled along the margin, adaxial surface ± smooth, apex acute to oblique, up to 8 cm long and 12 mm broad, petioles indistinct. **Inflorescence** a compound cyme, the peduncle swollen at the base where it emerged from the stem rosette, sterile in the unbranched basal portion, 2–5 nodes bearing single sessile leaves basally transitioning to single bracts apically. **Cymules** 6–10-flowered, congested up to anthesis, the internodes elongating to ca. 2 mm afterward, subtended by two amplexicaul, subequal, and sometimes unilaterally congenitally fused papery bracts, often tinged red, marked with black lines along the veins, broadly ovate, acute to acuminate, 5–10 mm long; floral nodes subtended by markedly unequal sessile bracts, one amplexicaul, broadly ovate, the other trichome-like, both 5–10(–12) mm long. **Flowers** hypogynous, bisexual, self-incompatible, forming a nectar drop basally at anthesis, deciduous after anthesis if not pollinated, otherwise deciduous after fruit dehiscence. **Pedicels** 5–10 mm at anthesis, filiform but swelling towards the apex during fruit maturation; oriented ± upward at anthesis, ± descending after pollination, and again ± upward at fruit dehiscence, but the reorientations not as marked/rigid as in other large-flowered *Cistanthe* species. **(Pseudo-)sepals** 2, thin, broadly ovate, 8–11 mm long, broadly ovate, the abaxial larger and enclosing but not clasping the adaxial, the adaxial with the margins congenitally fused near the apex, both ± carinate, initially pale green and lustrous, marked with black lines, becoming ± scarious by anthesis, persistent in fruit. **Petals** 5, aestivation quincuncial, broadly spathulate, apex truncate, up to ca. 25 mm long and broad, rose adaxially, paler abaxially, whitish towards the base, greenish at the claw, partially de-aestivating at night and opening again on up to three successive days, four if not pollinated, effectively pollinated flowers de-aestivating, twisting about the ovary into a cap, drying, the cap breaking off in the middle during fruit maturation or dehiscence; petals of unsuccessfully pollinated flowers inrolling basipetally and deliquescing. **Stamens** 15–30, filaments whitish to rose, 3–6 mm long, anthers dorsifixed, versatile, reddish, 1.5 mm long. **Gynoecium** syncarpous, tricarpellate, ovary broadly ovate, green, ca. 2 mm long, style 5–8 mm long, white, initially erect but reflexing laterally by late in the second day; stigma branches 3, 1.5 mm long, magenta. **Fruit** a loculicidal capsule, valves slightly woody, somewhat reflexed at the apex dehiscence, ca. 5 mm long. **Seeds** ca. 90, subglobose, hooked and strophiolate at the micropyle, surface shiny, microscopically sculpted, partially pusticulate-tomentose to evidently completely glabrous in some populations, maximum dimension ca. 0.9 mm.

## Additional observations

1. Plants collected on 20 September retained more or less their original size after transferred to water or solid substrate. Larger and more mature plants collected on 13 October were 2–3X larger in overall size (owing to stem length) but only ca. 0.5X larger in most organ dimensions and the same size in “highly conserved” structures, e.g., anthers, ovary, stigma, seeds. In total, behavior of ca. 30 collected individuals, apportioned among six containers, was studied ex situ.

2. The thickened portion of the taproot lacked lateral roots when unearthed in the field, but rapidly produced abundant lateral roots when transplanted to water or solid substrate.

3. Self-pollinated and at least half of cross-pollinated (without emasculation) flowers failed to produce fruits. Otherwise, I left these and my other *Cistanthe* plants outside, where their pollen habitually was foraged by a local dipteran that I failed to capture for identification purposes. Still, overall, I would estimate total fruit set at less than 50%.

4. With continuous watering, several of the original plants remain alive at this writing, some two months after collection, and still are producing a few flowers. Some senescent inflorescences were trimmed during the course of observation, but this was irregular, because I also wanted to collect seed. Regardless, new growth consisted of new rosettes (without subtending sterile stems) forming irregularly at various nodes. The plants thus acquired a bushier appearance. Several new rosettes indeed produced inflorescences, but these were smaller than those of the original 1° stem and 2° branches, and the flowers often were smaller and/or otherwise deformed. In addition, the taproots of some plants cultivated in water still were producing new lateral roots after even as the water became more or less stagnant and filled with algae.

## Discussion

For nearly two centuries following description of the first species currently classified in *Cistanthe* sensu Hershkovitz (2019), viz. *C. grandiflora* (Lindl.) Schltdl. (Lindley, 1828), there was relatively little scientific interest in this genus. But especially because of the "adaptedness" of many species to "one of the most arid landscapes on earth" (Chomentowska et al., 2025b), interest increased rather abruptly with the past ten years. Besides the 19 publications dealing with *Cistanthe* taxonomy (including this one, and 17 others cited in Hershkovitz, 2025b), the interest has expanded into the areas of ecology, physiology, and evolutionary and functional genomics (Stoll et al., 2017; Astorga-Elo et al., 2020; Holtum et al., 2021; Martinez et al., 2022; Chomentowska et al., 2025a, 2025b; Ossa et al., 2025). Much of this interest involves the *C. longiscapa* complex.

Because of its genetic and biogeographic intimacies with the *C. longiscapa* complex, *C. ipniana* should be considered a species of special interest. But, morphologically, *C. ipniana* is an enigmatic species. Its floral morphology is practically indistinguishable from that of C. *litoralis*/*longiscapa*, to which it evidently is very closely related (Chomentowska et al., 2025a; cf. Hershkovitz, 2025b). But its vegetative morphology is essentially indistinguishable from that of *C. thyrsoidea*, which is more distantly related. One might suspect hybridization, but the expected genomic evidence for this is not found. Thus, a hybridization scenario would implicate subsequent thorough purging of genetic elements unique to the *C. thyrsoidea* lineage. Not impossible, but not very likely, either.

Discarding hybridization leaves a morphological convergence scenario. But this also has significant implications. *Cistanthe litoralis*/*longiscapa* pertains to the *C. longiscapa* complex clade, which is nested within *C.* sect. *Rosulatae* sensu Hershkovitz (2025b), which includes at least 13 species spanning ca. 18° of latitude (ca. 2000 km), in environments ranging from nearly absolute desert to moist cool temperate forest. All species besides *C. ipniana* are rosettiform (viz. have brachyblastic basal leaves) and most have oblanceolate to orbicular leaves. The rosettiform habit is shared also by all species of *C.* sect. *Cistanthe*, and it seems to be the ancestral form of *Cistanthe*, Cistantheae, and Montiaceae. A convergence scenario means that the differences between the rosettiform habit and the erect habit of *C. ipniana* and *C. thyrsoidea* are not difficult to transcend developmentally. Whether or not the changes occurred abruptly or stepwise is not clear. Likewise, therefore, is not clear whether plants observed with oblanceolate to obovate leaves are hybrids (Hershkovitz, 2025b) or, alternatively, intermediate evolutionary stages.

I note here parenthetically that another enigmatic species, *C. floresiorum* J.M.Watson, also has an erect habit and is not rosettiform and otherwise lacks brachyblastic leaves. It also lacks swollen nodes (Hershkovitz, 2025b). It occurs within the range of both *C. ipniana* and *C. longiscapa* complex species, though it is not sympatric at the ecological level. It is known only from a single population on iron-rich substrate located along the Panamerican Highway at the peak of Cuesta Pajonales, which separates the Coquimbo and Atacama Regions. Collected several times since the 1950s and documented by multiple specimens in ULS, CONC and SGO collected beginning in the 1950s, *C. floresiorum* was diagnosed informally as a distinct species by Hershkovitz (2006) and later described formally by Watson (2019) who, while acknowledging Hershkovitz (2006) and ignoring older herbarium specimens, nonetheless maintained (Watson et al., 2020) that the species was "discovered" by his wife's parents. Based on molecular evidence, Hershkovitz (2019) effectively classified the species in *C.* sect. *Rosulatae* sensu Hershkovitz (2020), but Hershkovitz (2006) noted morphological similarities also with *C.* sect. *Cistanthe* species. I now consider that the species probably pertains to the broader clade of *Cistanthe* that is sister to *C.* sect. *Cistanthe*, but that its relations otherwise are unresolved (Hershkovitz, 2025b).

Although I have not appreciated it before, the floral bract morphology of *C. ipniana* is at least as enigmatic as the vegetative morphology. In particular, the floral bracts not only envelop the flower completely, collectively they envelop the entire developing inflorescence. The bracts are unique among. all *Cistanthe* species in terms of their actual size, their size relative to sepal size, and the size inequality between the larger and smaller bract. Remarkably, in these respects, they resemble the bracts of some *Philippiamra* Kuntze (Cistantheae; Calyptridinae) species (Hershkovitz, 1991), e.g., *P. celosioides* Phil. and *P. salsoloides* (Barnéoud) Hershk. They also resemble the floral bracts in some *Calyptridium* species (Hershkovitz, 1991). Although all are Cistantheae, these taxa are more remotely related to *C. ipniana* than is *C. thyrsoidea*, hence the resemblance must be convergence.

However, in the Calyptridinae taxa, the large, disproportionately unequal papery bracts are associated with compact cymules of very small flowers with very short pedicels, these combined on the order of 5 mm long. In this case, one might conceive of coordinated stepwise evolution in which flower size decreased (accompanied by self-compatibility) and bract size increased (for protection against aridity and excess radiation). This might be interpreted as “adaptation” for extreme desert conditions, not only for physical environmental parameters, but also for the consequently low population density.

Meanwhile, the pedicels and sepals of *C. ipniana* are *each* ca. 10 mm long, and adding the open petals yields a combined length of ca. 30 mm. Moreover, while *C. ipniana* technically is an Atacama Desert species, it really is borderline, restricted to relatively humid (and often foggy and/or overcast) southwestern Huasco Province and extending into the northwestern Coquimbo Region. Hence, the bracts would not seem to function in protection against radiation or aridity. Moreover, the species is sympatric with very closely related species *C. chrysantha*, *C. cymosa*, and *C. litoralis* (Chomentowska et al., 2025a). The last three species occur at all Atacama Desert latitudes and well into the drier, sunnier interior desert valleys. These species have relatively small floral bracts. If the large bracts of *C. ipniana* afforded drought/radiation protection, it seems that they would have evolved also in the other three species.

I will not speculate here further on the developmental or biophysical cause or evolutionary ecological explanation for either the peculiar vegetative habit or the peculiar floral bracts of *C. ipniana*. Per a biologically defensible and otherwise realistic evolutionary theory, viz. natural drift (ND; Maturana & Mpodozis, 2000; Mpodozis, 2022), no particular explanation is necessary. Per the Principle of Evolutionary Idiosyncrasy (Hershkovitz, 2025b and earlier references), based in part on ND theory, the explanation is that, during the course of evolution, “*shit happens*.” Meanwhile, the anthropocentric, teleological, and/or otherwise specious explanations proffered by overpaid mainstream academic evolutionists inherently are wrong. If there is any point at all to investigating further the habit and bracts of *C. ipniana*, it would be precisely to demonstrate this fact.

## Disclosure statement

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## FIGURES

**Fig. 1.**Whole plants in flower at the Type locality, 13 October, 2025.

**Fig. 2.** Multiple plants in flower transplanted to a container of water.

**Fig. 3.** Plants collected in flower on 13 October, 2025, senescing but still producing flowers on 17 December. Some inflorescences had been pruned and new rosettes emerged from other nodes.

**Fig. 4.** Dried specimen of an individual collected in flower from the Type locality on 13 October, 2025.

**Fig. 5.** Lateral roots formed on taproot after transplanting to water. The lateral roots were absent at the time of collection (e.g., as in Fig. 4). The root-shoot node is evident at the red line on the left.

**Fig. 6.** Floral bracts. **6A.** Lateral view of the cymule. The small pubic-hairlike structures at the nodes are the smaller bracts. **6B.** Dorsal view.

**Fig. 7.** Petal, adaxial view. **Fig. 8.** Flower showing style reflexed during the second day after anthesis.

**Fig. 9.** Corolla involution in unpollinated flowers. **A.** Lateral view. **B.** Polar view.

**Fig. 10.** Green capsule just prior to final maturation. Note the swelling of the pedicel near the receptacle.
**Fig. 11.** Dehisced capsule.

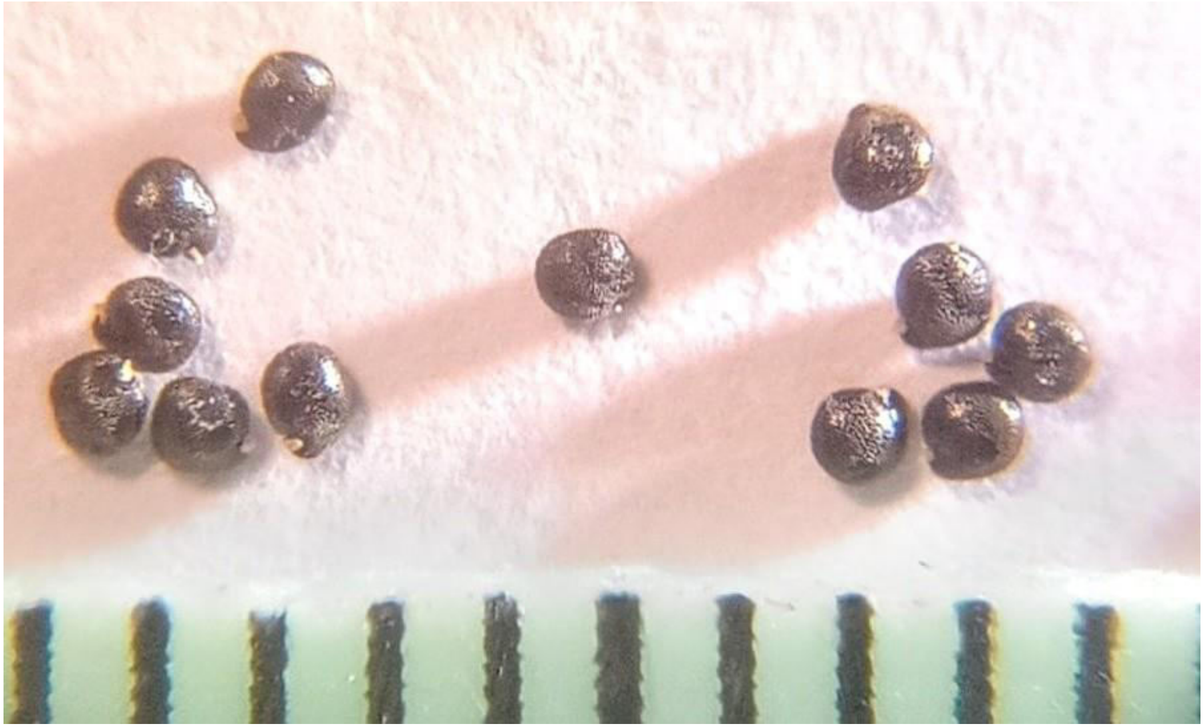

**Fig. 12.** Seeds. This photo was taken by holding my cell phone screen-up in my palm and, in between two fingers, holding a cheap plastic 10X jeweler's loupe against the camera lens. The improvised LED lighting created excess diffraction. The seeds are mainly glabrous and lustrous, but microsculpture is evident. Some of the whitish surface is diffraction of the microsculpture, but patches of pusticulate tomentum is evident.