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Misionella (Iridaceae: Tigridieae) a new genus from Campos eco-region of Southeast South American grasslands

Leonardo Paz Deble[1, 2]

Abstract. *Misionella* (Iridaceae: Tigridieae) a new genus from Campos eco-region of Southeast South America grasslands
It is proposed the new genus *Misionella* belonging to the tribe Tigridieae. *Misionella* is closely related to the genera *Cypella*, *Kelissa* and *Onira*, and vegetative and anatomically also resembles *Herbertia*. *Misionella* is constituted by two species, *Misionella Hauthalii* and *Misionella opalina* (with two subspecies: *opalina* and *minuticristata*). *Misionella* is endemic on grassland areas occurring in northeast Argentina (Corrientes and Misiones provinces), center and northwestern Rio Grande do Sul state, Brazil and southern Paraguay (Itapuã and Paraguari departments). The genus *Misionella* is taxonomically revised, and its species are described and illustrated in detail and its geographic distribution is represented on a map. Data on etymology, geographic distribution, habitat, phenology, conservation, uses and vernacular names are provided, as well as discussions of taxonomic relationships of *Misionella* with related taxa. A dichotomous key for distinguishing the genera of Iridaceae-Tigridieae from South America is presented.
Key words: *Alophia*, Grasslands, *Cypella*, Cypelloid, *Herbertia*, *Kelissa*, *Onira*, Tigridieae.

Resumen. *Misionella* (Iridaceae: Tigridieae) un nuevo género de la eco-región de los Campos del sureste de América del Sur
Misionella es propuesto como un nuevo género perteneciente a la tribu Tigridieae, con relaciones estrechas a los géneros *Cypella, Kelissa* y *Onira* y vegetativamente y anatómicamente es semejante también a *Herbertia*. *Misionella* es constituido de dos especies *Misionella Hauthalii* y *Misionella opalina* (con dos subespecies: *opalina* y *minuticristata*). *Misionella* es endémico en los pastizales ocurrentes en el nordeste de la Argentina (provincias de Corrientes y Misiones), centro y noroeste del estado de Río Grande de Sur, en Brasil y sur del Paraguay (departamentos de Itapuã y Paraguari). *Misionella* es taxonómicamente revisado, sus especies son descriptas e ilustradas en detalle y su distribución geográfica es representada en mapa. Son fornecidos dados sobre etimología, distribución geográfica, hábitat, fenología, conservación, usos y nombres vernáculos, además se discuten las relaciones taxonómicas de *Misionella* con sus taxones afines. Una clave dicotómica para la segregación de los géneros de Iridaceae-Tigridieae ocurrentes en Sudamérica es propuesta.
Palavras-chave: *Alophia*, Campos, *Cypella*, Cypellóide, *Herbertia*, *Kelissa, Onira*, Tigridieae.

The instability in the boundaries of the genus *Cypella* Herbert is well known and, until recently, its treatment in a broad sense was widely accepted, with the subordination of the genera *Hesperoxiphion* Baker, *Larentia* Klatt, *Kelissa* Ravenna, *Onira* Ravenna and *Phalocallis* Herbert (Roitman & Castillo 2007, Roitman et al. 2008, Goldblatt & Manning 2008, Hurrel et al. 2009, Huaylla & Wood 2012, POWO 2024). Ravenna (1964) established *Cypella* in a broad sense and considered four subgenera: *Cypella, Phalocallis* (Herbert 1839: pl. 3710) Ravenna (1964: 53), *Hesperoxiphion* (Baker 1877: 127) Ravenna (1964: 53, not formally published) and *Viruflos* Ravenna (1964: 53). Later, Ravenna (1977) rehabilitated *Phalocallis* and *Hesperoxiphion*, and subsequently treated *Cypella craterantha* (*Viruflos*) as a new genus (Ravenna 1981a), but this taxonomic novelty was never properly published. Chauveau *et al.* (2012) in an important contribution for knowledge of the generic boundaries of Iridaceae family demonstrated the evolutionary trends in the flowers of the subfamily Iridoideae in the New World genera, and proved that the

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[1] Universidade Federal do Pampa – Unipampa campus Dom Pedrito, Rua 21 de abril 80, CEP 96450-000. E-mail: deble.biol@gmail.com (author for correspondence). ORCID: https://orcid.org/0000-0001-5600-3022
[2] Núcleo de Pesquisas Botânicas Balduíno Rambo, Universidade Federal de Santa Maria, Av. Roraima, CEP 97105-900.

tribe Tigridieae is segregated into two large clades and *Hesperoxiphion* Baker, *Larentia* Klatt and *Phalocallis* belong to Trigridieae A, while *Cypella* belongs to Tigridieae B. In this same study, *Cypella* was recognized as polyphyletic and *Cypella Hauthalii* (Kuntze) Foster, *Kelissa brasiliensis* (Baker) Ravenna and *Onira unguiculata* (Baker) Ravenna are in a phylogenetic group distinct from the other *Cypella* species. Deble *et al.* (2012, 2015a, 2015b) and Deble & Alves (2017, 2020) mentioned that the recognition of sections Cypella and Naïs is useful for distinguishing the main species groups within *Cypella*, and only *Cypella Hauthalii, C. opalina* (Ravenna) Deble and *Cypella craterantha* Ravenna cannot be subordinated to none of these sections. In two recent studies, Deble & Alves (2020) and Deble (2021b) demonstrated that anatomical and morphological attributes such as roots, bulbs, shape of the spathe valves and leafy-anatomy corroborate the molecular data found by Chauveau *et al.* (2012) and, therefore, *Kelissa* and *Onira* were considered independent genera of *Cypella*, while *Cypella Hauthalii* and *C. opalina* were treated as uncertain position within *Cypella*.

The grassland ecosystems of Southeast South America (SESA grasslands, following the proposition of Azpiroz *et al.* 2012) comprise the most extensive grassland area in South America and form an arc around the Rio de la Plata, covering *ca*. 1,100,000 km^2, in eastern and northeast Argentina, eastern and southern Paraguay, southern Brazil and all Uruguayan territory and includes the *Pastizales del Río de la Plata* (as defined by Soriano *et al.* 1992), the *Campos de Altitude* of southern Brazil (Overbeck *et al.* 2007), and the *Chaco húmedo* (Clay *et al.* 2008). The region of the *Pastizales del Río de la Plata* includes two eco-regions: *Pampas* and *Campos.* The mentioned eco-regions correspond, in approximate lines, to the phytogeographic province of Pampa, part of Espinal and a small portion of the Paranaense phytogeographic province sensu Cabrera (1976) and Cabrera & Willink (1980). The aforementioned region is extremely rich in biodiversity and ecosystem services (Bilenca & Miñarro 2004, Andrade *et al.* 2018, Andrade *et al.* 2023). The Iris family is one of the best represented, and considering only the tribe Tigridieae, we have ten genera, 65 species, and ten subspecies prospering in these ecosystems, and a total of 87% of the taxa of the tribe occurring in SESA grasslands are restrict, most of them exclusive to the Campos eco-region, of which includes 41 endemic taxa (Deble 2021a). Based on morphological and anatomical data, a new genus of Iridaceae is described from the SESA grasslands to better accommodate *Cypella Hauthalli* and *C. opalina*, and information are inferred about morphologically related genera, ecological data, geographic distribution and the new combinations required are also proposed. Furthermore, a provisionary key to distinguishing the South American Iridaceae-Tigridieae is presented.

Material and Methods

The research was carried out by field surveys, and analysis of herbarium specimens, including digital images (herbaria CTES, FCQ, HDCF, FURG, ICN, MVHM, MVM, MVFA, MVJB, PACA, PY, SI, SMDB; acronyms according to Thiers 2024+). The morphological data mentioned in the text and the terminology used follow Goldblatt & Manning (2008), Beentje (2010) and Eggers et al. (2019). The description of the taxon is based on morphological characteristics of plants observed in natural habitat, cultivated specimens and on dry material. For the elaboration of the figures 1 and 2 were utilized dry and cultivated specimens illustrated in China ink. For the elaboration of Figure 3, was utilized the software ArcMap version 10.7, and the features were created from the base titled Topographic. The elaboration of the figure 4 is based in the methodology mentioned by Santos & Deble (2022, 2024) and the photos were taken with a camera attached to the optical microscope. For the elaboration of Figure 5, were used photographs of specimens in nature or in cultivation and the boards were edited in the Adobe photoshop program, version 23.x.. For the elaboration of the Figure 6, was used watercolor on Bristol paper, and the illustration it is based on specimens cultivated of *Misionella Hauthalii*, *M. opalina* and *M. opalina* subsp. *minuticristata*. The points of occurrence of the species represent specimens mentioned in the material examined or based in populations found by the author.

The generic placement of *Alophia Hauthalii*

Alophia Hauthalii was described by Carl Ernst Otto Kuntze (1843-1907) based in collections performed by Rudolf Johannes Friedrich Hauthal (1854-1928) in Ybytymí [Ibitimi], Paraguarí department, Paraguay (Kuntze 1898: 304-305).

In his treatment, Kuntze (1898) recognized *Herbertia* Sweet as illegitimate, and mentioned *<Da die Lebermoosgattung Herbertia S.F. Gray gilt, ist im Kew Index Herbertia Sweet zu Unrecht erneueurt worden>* In addition to *Alophia Hauthalii*, he cited also the following species: *Alophia amoena, A. brasiliensis, A. pulchella* and *A. unguiculata*. Notwithstanding, Karl Moritz Schumann (1850-1904) transferred *Alophia Hauthalii* to *Herbertia* (Schumann 1900). However, since Kuntze (1898) several authors included *Herbertia* as a later homonym, and in consequence, *Herbertia* was treated below *Alophia* (e.g. Espinosa-Bustos 1922, Hicken 1924, Ravenna 1968).

Robert Foster (1904-1986) analyzing the type of *A. Hauthalii*, evidenced this material as wrongly placed in *Alophia*, mainly based in the androgynoecium features, provide of perpendicular anthers and style with long crests at top *<typical of the genus Cypella>* and, consequently, he proposed the new combination required under *Cypella* (Foster 1950). Peter Goldblatt (1943-) recognized as misinterpreted the type of *Alophia*, and proposed the transference of five species and two subspecies for *Trifurcia* Herbert, including the new combination *Trifurcia Hauthalii* (Kuntze) Goldblatt (Goldblatt 1975). In the same year, Florschultz & Grolle (1975) recommended that *Herbertia* should not have been rejected. Thereafter, Goldblatt (1978) reestablished *Herbertia* as a valid generic name, establishing the list of names, including *Herbertia Hauthalii* (Kuntze) Schumann as an accepted name.

Pierfelice Ravenna (1938-2022) treated *Cypella Hauthalli* as a valid name (e.g. Ravenna 1981a, 1981b, 1981c, 1983), and he proposed the subspecies *opalina* for the taxon (Ravenna 1981c: 21). The author based on morphological peculiarities of *Cypella Hauthalii* placed it into section *Ionella* (Ravenna 2003a). Nevertheless, this name was never formally published by Ravenna because according to him *<the number Onira 8 (13) [9 (1)] was lost in transit to the co-compiler of IK>* (see Ravenna 2009: 5). After, Chauveau et al. (2014) added the subspecies *minuticristata* to *Cypella Hauthalii*. More recently, Deble *in* Deble & Alves (2020) elevated *Cypella Hauthalli* subsp. *opalina* for the specific rank, and treated the subspecies *minuticristata* as an infraespecif entity of *C. opalina*. Currently, the names *Cypella Hauthalii, C. opalina* (Ravenna) Deble and *C. opalina* subsp. *minuticristata* (Chauveau & L. Eggers) Deble are listed as accepted (IBODA 2024, POWO 2024).

Misionella Deble, gen. nov.

= Cypella sect. Ionella Ravenna, nom. nud.
Typus generis: *Misionella Hauthalii* (Kuntze) Deble (=*Alophia Hauthalii* Kuntze, Revis. Gen. Pl. 3(3): 304. 1898).
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Flores regularis erecta, fugax, conspicua. Tepala libera, distincte unguiculata. Tepala exteriora magna, unguiculis erecto-ascendentibus, anguste cuneatis, albo-luteis et atropurpureis maculatis, pilis glandulosis conspersis; lamina opalina vel violacea, late rhombiformi-elliptica modice reflexa ad apicem crenato-apiculata. Tepala interiora distincte breviora, unguiculis erecto-ascendentibus vel suberectus, anguste linear-cuneatis, albo-luteis et atropurpureis maculatis, pilis glandulosis conspersis; lamina geniculato-recurvata, rhombica, apice breve revolutis, uncinatis, margines curva, violacea vel albo-violacea; meatus lipidicus centralibus e basi laminorum, pilis densis, viridis vel luteo-citrinis, paullo translucidis. Filamenta libera, filiformia, base incrassata. Antherae circiter longitudinis filamentorum ad maturitatem, oblongo-lineares, connectivo angustato. Stylus ad base anguste linearibus ad apice trifidus, incrassatibus; styli rami plicatis; cristae adaxiales falcatae, cristae abaxial deltatae, rare obsoletae. Ovarium angulatum, obovatum, pluriovulatum. Capsula obovato-clavata, angulata. semina parva, faveolata.
Plantae bulbosae pumilae. Bulbus tunicatus subglobosus tunicis exterioribus membranaceis, nigrescentis; interioribus albis, translucentis. Folia virecentia, taeniolato-plicata, flaccida. Caulis teres brevis plerumque subterraneus. Spatha bivalvata, biflora, valvis plicatis, ventricosis inaequalibus; valva superior pauce longioris. Pedicellus teres.

Flowers straight, fugacious, conspicuous, with a deep central depression. Tepals mostly free, deeply clawed towards the base; outer tepals distinctly larger than the inner tepals; claws narrowly cuneate, ascending-erect; blades ascending, then revolute in its distal half. Inner tepals with ascending-erect claws, linear; claws with glandular trichomes scattered; blades nearly rhombic in shape, with a carpet of one-celled lipidic trichomes in a central stripe, apex revolute, uncinated at top. Staminal filaments free, erect or slightly porrect, filiform, at base dilated and slightly adnate; anthers erect,

oblong with narrow connective, dehiscence longitudinal, which initiates the opening near at the apex; darker thecae; pollen cyan or ochraceous. Ovary angled, claviform, trilocular, pluriovulate. Style slender towards the base, at apex thickened, 3-branched in its distal half; branches ascending or erect-ascending, crested at top; crests three, two adaxial and one abaxial, stigmatic portion adaxial, transverse just below the adaxial crest. Capsule obovate-clavate, angled, with thickened walls, opening through an apical fissure. Seeds reddish brown, obconical or triangular, epidermis minutely faveolate.

Plants herbaceous, bulbous, with fibrous and thin roots and nearly globose or depressed-globose bulbs; cataphylls papery, the outermost darker, the innermost white-cream. Leaves plicate, flaccid. Spathes pedunculate, two-flowered, two-valved, the outer one smaller than the inner one, both plicate in cross section.

Two species occurring in central and northwestern Rio Grande do Sul state, Brazil, northeast Argentina (eastern, northeastern and north Corrientes province, and southern Misiones province) and southern Paraguay (Itapuã and Paraguarí Departments) in natural grasslands comprising ecotones in northern Pampa, easternmost Chaco and southwestern Paranaense region (Phytogeographic regions sensu Cabrera 1976, Cabrera & Willink 1980). Both species of the genus occur on the grassland areas being adapted to grazing, as it is evidenced by its leaves, which normally present herbivory action. Flowering is very abundant, similar to that observed in *Herbertia* species, in which the flowers rise from the flowering branch at a low height and are associated with field grasses.

Etymology–Contraction of the words ***Mision****ero* + *Cyp****ella***. *Misionero* means an inhabitant or belonging to the former Jesuit missions, established in lands in the northeast of Argentina, the western portion of Rio Grande do Sul state (Brazil) and Paraguay, which perfectly corresponds to the geographic range of the two known species of the genus.

Key to distinguish the species and subspecies of Misionella

1. Flowers pallid lilac-blue, 48–75 mm diameter; central concavity 20–26 mm diameter, and 14–18 mm depth. Outer tepals ascendant in proximal half; inner tepals longer than the central concavity. Style (including style branches and crests) 18–23 mm long ..... *Misionella Hauthalii*
– Flowers white, white-cream or bluish-white, 33–50 mm diameter; central concavity 14–18 mm diameter, and 24–33 mm depth. Outer tepals almost erect in proximal half; inner tepals shorter than the central concavity. Style (including style branches and crests) 13–17 mm long 2
2. Crests of style branches 2.5–5 mm long ..... *Misionella opalina* subsp. *opalina*
– Crests of style branches 0.1–2 mm long ..... *Misionella opalina* subsp. *minuticristata*

Misionella Hauthalii (Kuntze) Deble, *comb. nova.* Basyonim: *Alophia Hauthalii* Kuntze, Revis. Gen. Pl. 3(3): 304. 1898. ≡ *Herbertia Hauthalii* (Kuntze) Schumann, Bot. Jahresber. (Just) 26, pt. 1: 331. 1900. ≡ *Cypella Hauthalii* (Kuntze) Foster, Contr. Gray Herb. 171: 23. 1950. ≡ *Trifurcia Hauthalii* (Kuntze) Goldblatt, Brittonia 27(4): 384. 1975. Typus: PARAGUAY. Paraguarí: Ybitimí, October 1892, *R. Hauthal s.n.* [n. 9] (holotypus NY03228996! isotypi SI000300!, CTES000235!). Figure 1(A-K), 3, 4D, 5(I-J), 6
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Plant up to 8–22 cm high above the soil, underground stems up to 4 cm long. Bulb nearly globose or ovate, 18–26 × 16–22 mm, prolonged in a short collar, 10–25 mm long; cataphylls dark-brown, broadly ovate, apex acuminate. Leaves at anthesis: 2–8; blades linear-elliptic 11–19 ×0.3–0.8 cm. Most basal cauline leaf linear-ensiform, 8–14 cm long, base sheathing the stem; blades 6–12 × 0.4–0.8 cm, the distal bracteiform, elliptic-lanceolate, 20–35× 0.6–0.9 cm. Flowering stems 6–19 cm long, 1–2-branched. Spathes 1–4 per branch, 3.4–5.5 × 0.5–0.8 cm, herbaceous, pallid-green, bivalved, two-flowered, pedunculate, peduncles 1.4–4.5 cm long; outer valve 25–33 mm long, the inner 33–53 mm long, both plicate

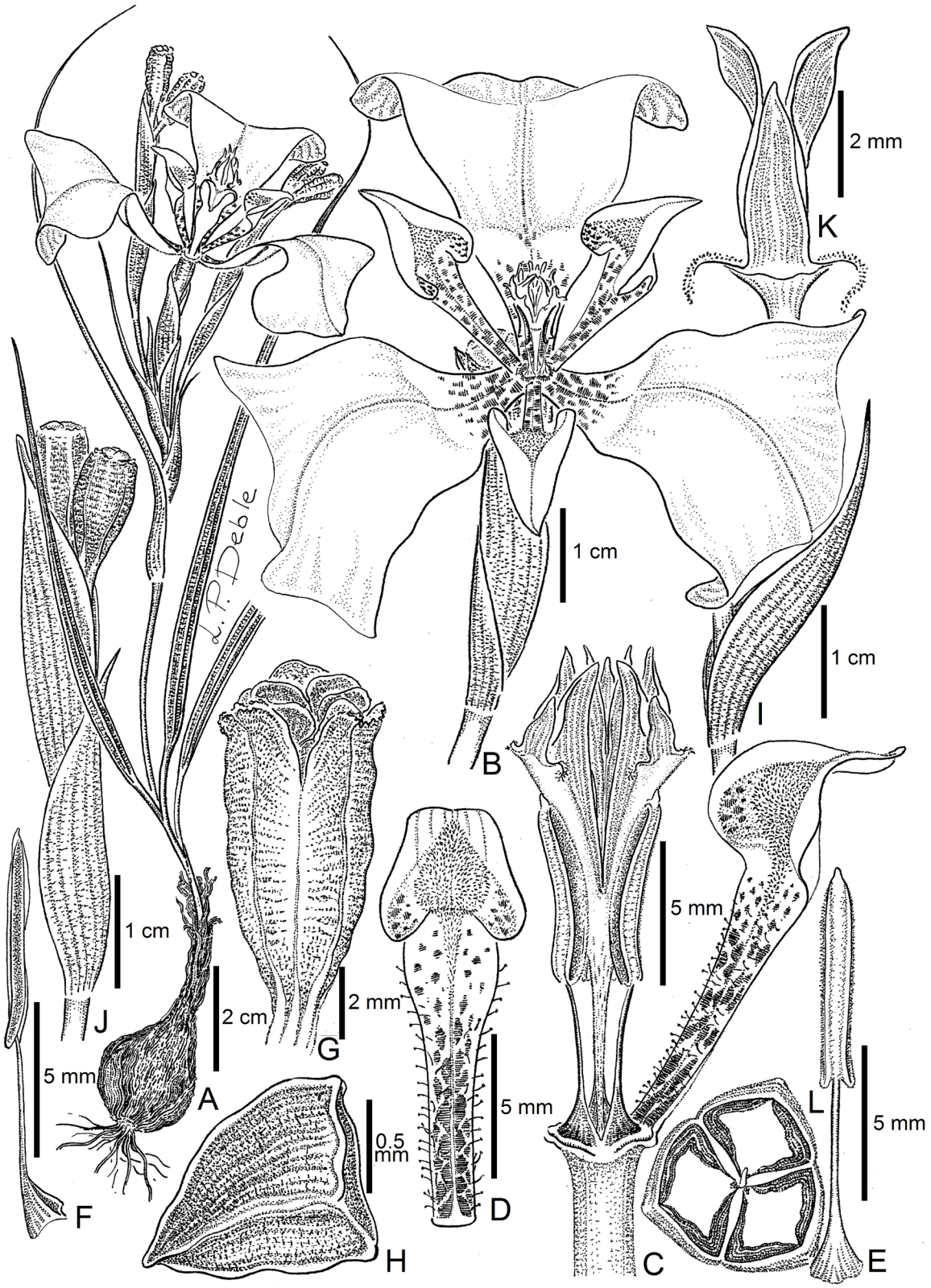

Figure 1. *Misionella Hauthalii*. A, Habit. B, Flower. C, Flower, with perigone removed, except one inner tepal. D, Inner tepal, upper view. E. Stamen, dorsal view. F, Stamen, lateral view. G, Capsule. H. Seed. I, Bract. J, Spathe, with two immature fruits. K, Distal portion of style branches, showing crests and stigmtic region. L, Cross-section of capsule (Drawing made by L.P. Deble).

in cross-section, with membranous edges covered with sparse parallel dark brown longitudinal glandular strips; pedicel shorter than the spathe, filiform, 25–45 mm long. Flowers pallid lilac-blue, purplish stained, 48–75 mm diameter; central concavity 20–26 mm diameter, and 14–18 mm depth. Tepals whorls sharply dissimilar: outer tepals oblong-spathulate, 38–50 mm long, then revolute and slightly patent distally; outer tepal blades pallid lilac-blue, with a small yellow macula reddish-brown striped at the base, 25–32 × 21–28 mm, erect in proximal half, then patent and slightly revolute, apices truncate or rounded, apiculate; outer tepal claws cuneate, 13–16 mm long, 4–5 mm wide at the base, and 8–10 mm wide at the apex, dull-yellow and reddish-brown striped, lipidic trichomes abundant. Inner tepals arcuate-recurved, 22–28 mm long, the proximal half ascendant, slightly porrect, then curved upward, the distal one-third incurved and reclined; inner tepal blades 7–8 mm wide, rhomboid, at apex apiculate, pale lilac-blue, with a yellow central portion lanceolate in shape, and densely clothed by glandular trichomes, surrounded by a lateral part, yellow with red spots; claws narrowly cuneate, 13–16 mm long, 2–2.5 mm wide at the base, and 4–4.5 mm wide at the apex, dull yellow, with reddish-brown stripes, lipidic trichomes abundant. Filaments filiform 7–9 mm long, slightly porrect, translucent, light-blue at apex, and purple in proximal half, base dilated, slightly adnate for *ca*. 0.2–0.3 mm; anthers linear-oblong 6.5–7.5 × 1.1–1.4 mm; connective pallid-blue, 0.8–1 mm, locules grey, pollen bluish. Ovary pallid-green, 6–8 mm × 2–2.5 mm. Style 18–23 mm long. Style branches channeled, slightly porrect, 6–7 mm long, crests at the apex 3, translucent and violet-blue, adaxial crests lanceolate, 4–5.5 mm long, abaxial crest deltate or lanceolate, 2–3.5 mm long, at apex acute. Capsule obovate, 9–12 × 4–5 mm, angled, with glandular spots and stripes. Seeds oblong to obconical, 2–2.5 mm long, angled, light brown, epidermis minutely faveolate.

Eponymy– In honor of the German geologist and paleontologist Rudolf Johannes Friedrich Hauthal (1854-1928) who spent several years collecting zoological and botanical specimens in South America (Lanjouw & Stafleu 1954).

Phenology–The specimens flowers between September and November and bears fruit between September and November. The flowers open only once, in the morning (9–9:45am) and wither close to noon or early afternoon. In cloudy days, the flowers remain opened up to middle afternoon. The specimens flowering fullness, and its bigger and pallid-blue flowers ensures a beautiful sight in the sites in the region at which it occurs.

Vernacular name and uses–Misionella Hauthalii is known as < bibi >. Local populations use the bulbs as food, prepared raw or cooked, they have a pleasant hazelnut flavor. The species is appreciated by herbivores. In addition, it is quite ornamental and easily grown in pots with a mixture of organic matter and sand in a 1:1 ratio. For greater flowering in cultivation and also to prevent the bulbs from rotting, it is important to remove the bulbs from the pots at the beginning of winter and leave them to rest for 3-10 days before replanting them.

Additional specimens examined– ARGENTINA. **Misiones**. "entre Garupá e Candelária", 9 October 1943, *Gavio* (BAB!). Posadas, ruta 12, direção Ituzaigó, 16 October 2013, *L. Eggers et al. 820* (fl) (ICN!). Posadas, ruta 12, ca. 20 km W of Posadas, 27º 31' 12.1"S and 56º 05' 47.5"W, 4 October 2015 (fl, fr), *L. P. Deble, F. S. Alves & H. Keller 15801* (CTES!). **Corrientes**. Ituzaingó, 27º 40' 53.7"S and 56º 09' 35.9"W, 27 November 2014 (fl), *H. A. Keller, F. E. Gatti & G. Morillo 12291* (CTES!). Mercedes, Ea. Itaá Caabó, 14 October 1961, *T.M. Pedersen 6130* (CTES, U). Rincón de Santa María, Júpiter, 27 November 1988 (fr), *S. G. Tressens et al. 3525* (CTES!); Estância Santa Tecla, 40 km E de Ituzaingó, 1 km S de ruta 12, 23/24 October 1974 (fr), *S. G. Tressens et al. 474* (CTES!); ruta 41, aprox. 7 km al S de ruta 12, *M. M. Arbo et al. 6503* (CTES!). PARAGUAY. **Itapuá**. Fran, ruta 1, 27º 7'50.5"S and 56º 01' 10.8" W, 31 November 2012 (fr), *L. P. Deble & F. S. Alves 13856* (SI!).

According my field activities *Misionella Hauthalii* was also recorded near Apóstoles, Provincial road 1 (27º 56' 47.7"S and 55º 43'32.6"W), and near Gobernador Virasoro (27º56'38"S and 56º04'12"W).

Distribution and Habitat– Misionella Hauthalii occurs in northern Corrientes and southern Misiones, northeast Argentina, and southern Paraguay (Figure 3). In the latter country few collections are known and are reported to Paraguarí and Itapuã departments. From Argentina the populations are fragmented but often composed by many individuals who grow on natural grasslands developed preferentially on lateritic and deep soils developed on volcanic rocks. In the same

environments of occurrence of *M. Hauthalii* are registered the bulbous Iridaceae *Herbertia amoena* Griseb. and *H. Darwinii* Roitman & Castillo, and several others species typical from the Campos eco-region, among them *Calibrachoa longistyla* Stehmann & Greppi and *Petunia Scheideana* L.B. Smith & Downs (Solanaceae), *Galactia benthamiana* Micheli, *Macroptilium atropurpureum* (Moq. & Sessé ex DC.) Urb. and *Poiretia latifolia* Vogel (Fabaceae), *Alternanthera* spp., *Gomphrena perennis* L. and *Pfaffia tuberosa* (Spreng.) Moq. (Amaranthaceae), *Manihot hunzikeriana* Mart.-Grov. (Euphorbiaceae), *Ruellia Morongii* Britton and *Stenandrium dulce* Nees (Acanthaceae), *Nothoscordum gracile* (Aiton) Stearn (Amaryllidaceae), *Sisyrinchium marchioides* Ravenna (Iridaceae), many small and herbaceous species of Asteraceae, among them *Chaptalia* spp., *Chevreulia acuminata* Less. and *Gamochaeta chionestes* G.L. Nesom, the Poaceae *Axonopus compressus* (Sw.) P. Beauv. and *Paspalum notatum* Flùgge, among other grass species.

Conservation– *Misionella Hauthalii* occurs on grasslands in Southern Paraguay and Northeast Argentina, where few populations are known, but usually containing many individuals. Despite its reduced geographic range of occurrence and few populations known the specimens produce many fruits and seeds, and according my ecological observations, this species is tolerating to anthropic action, since was observed in slope near to road and in gardens, associated with the grassy. However, the urban expansion, the agriculture, and the reduction of the grasslands result threats to this species, and according to IUCN Red List assessment protocol (2012, 2019) the species can be assigned as Vulnerable category (VU), based in the following criteria: B1, B2bc (i, ii, iii).

Observations– *Misionella Hauthalii* is morphologically separated to *M. opalina* by its bigger and wider spathes, and larger pallid lilac-blue flowers, size and shape of inner tepals, and bigger size of all floral organs. During my field activities, no intermediary forms between both species are found, despite populations of both species occur close together in the department of Apóstoles (Misiones, Argentina). Additional features to distinguish *M. Hauthalii* and *M. opalina* are summarized in the Table 1.

Misionella opalina

Misionella opalina (Ravenna) Deble, *comb. nova.* Basyonim: *Cypella Hauthalii* subsp. *opalina* Ravenna Wrightia 7(1): 21. 1981. ≡ *Cypella opalina* (Ravenna) Deble, Balduinia 66: 19. 2020. Typus: Argentina. Corrientes: Santo Tomé, Garruchos, <*Culta in Santiago ex bulbo ad ripas fluminis Uruguay pr. Garruchos prov. Corrientes Argentinae collecto*> October 1980, *P.F. Ravenna 3300* (holotypus Herb. Rav., not localized, according Deble (2024) probably destroyed by fire). Lectotypus (designated by Deble & Alves 2020: 19): Argentina. Corrientes: Santo Tomé, Garruchos: "Estancia San Juan Bautista, costa del río Uruguay, campo bajo inundado" 20 November 1974, *A. Krapovickas et al. 25807* (CTES0000225!).
Figure 2(A-M), 3, 5 (K-L), 6
Iconography– Eggers et al. (2019: 758, figure 10 [A-I]).
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Plant up to 6–20 cm high above the soil, underground stems up to 4 cm long. Bulb nearly globose or ovoid, 10–18 × 9–15 mm, prolonged in a short collar, 7–15 mm long; cataphylls dark-brown, broadly ovate, apex acute. Green leaves at anthesis 2–5; blades linear-elliptic 5–14 × 0.2–0.6 cm. Most basal cauline leaf linear-ensiform, 4–8 (12) cm long, base sheathing the stem; blades 3–6 (9) × 0.2–0.6 cm; the most distal bracteiform, ovate-lanceolate, 18–25× 0.3–0.5 cm. Flowering stems 4–15 cm long, 1–2-branched. Spathes 1–5 per branch, 2.4–4.8 × 0.4–0.5 cm, herbaceous, pallid-green, bivalved, two-flowered, pedunculate, peduncles 0.6–2.8 cm long; outer valve 15–29 mm long, the inner 24–41 mm long, both plicate in cross section, with membranous edges covered with sparse parallel dark brown longitudinal glandular strips; pedicel shorter than the spathe, filiform, 20–35 mm long. Flowers white, white-cream in the beginning of the anthesis, become bluish at end of the anthesis, purplish stained, and 33–50 mm diameter; central concavity 14–18 mm diameter, and 24–33 mm depth. Tepals whorls sharply dissimilar: outer tepals white, spathulate or obdeltate, 26–35 mm long, erect for ½ of total length, then patent or slightly revolute distally; outer tepal blades white, subtly tinged of white-cream in the beginning of the anthesis, become bluish at the end of the anthesis, more tinged in the proximal half and margins, with a small yellow macula reddish-brown striped at the

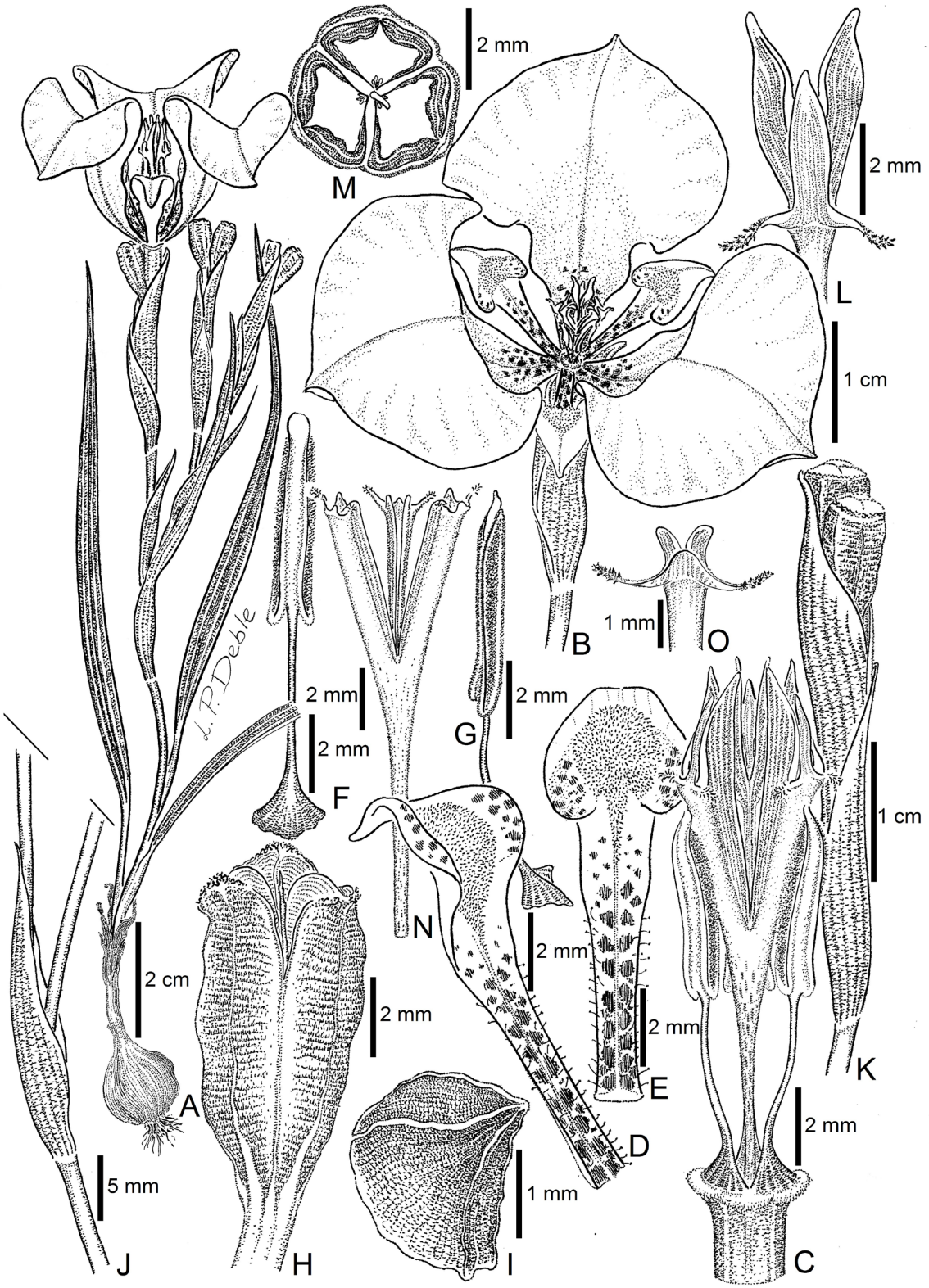

Figure 2. *Misionella opalina*. A, Habit. B, Flower. C, Flower, with perigone removed. D, Inner tepal, lateral view. E, Inner tepal, upper view. F, Stamen, dorsal view. G, Stamen, lateral view. H, Capsule. I, Seed. J, Bract. K, Spathe, wih two immature fruits. L, Distal portion of style branches, showing crests and stigmtic region. M, Cross-section of capsule. *Misionella opalina* subsp. *minuticristata*. N, Style. O, Distal portion of style branches, showing crests and stigmtic region (Drawing made by L.P. Deble).

base, 14–23× 17–28 mm, erect in proximal part, then slightly revolute, apices truncate or rounded, apiculate; outer tepal claws cuneate, 13–15 mm long, 4–5 mm wide at the base, and 8–10 mm wide at the apex, dull-yellow and reddish-brown striped, trichomes abundant. Inner tepals arcuate-recurved, 14–17 mm long, the proximal half ascendant, slightly porrect, then curved upward, the distal one-third incurved and reclined; inner tepal blades 5–6 mm wide, rhomboid, at apex apiculate, white or bluish-white, with a yellow central portion nearly circular in shape, and densely clothed by a carpet of lipidic trichomes, surrounded by a lateral part, yellow with red spots; claws narrowly cuneate, 9–10 mm long, 1.5–2.1 mm wide at the base, and 3.6–4.1 mm wide at the apex, dull yellow, with reddish-brown stripes, lipidic trichomes abundant. Filaments filiform 5–6.5 mm long, slightly porrect, translucent, and white at apex, and purple in proximal half, base dilated, free; anthers oblong 4.6–6 × 1.2–1.6 mm; connective cream-white or whitish, 1–1.2 mm, locules gray, pollen ochraceous or yellow. Ovary pallid-green, 5–6 × 1.8–2.1 mm. Style 13–17 mm long. Style branches channeled, slightly porrect, 3–4.5 mm long, crests at the apex 3, translucent and white or bluish, adaxial crests lanceolate, 2.5–5 mm long, abaxial crest deltate, 1–2.5 mm long, at apex acute. Capsule obovate, 8–10 mm × 4–5 mm, with glandular spots and stripes. Seeds oblong to obconical, 2–2.5 mm long, angulate, light brown, epidermis minutely faveolate.

Etymology– The epithet is a reference to white-opaline color of the perigone.

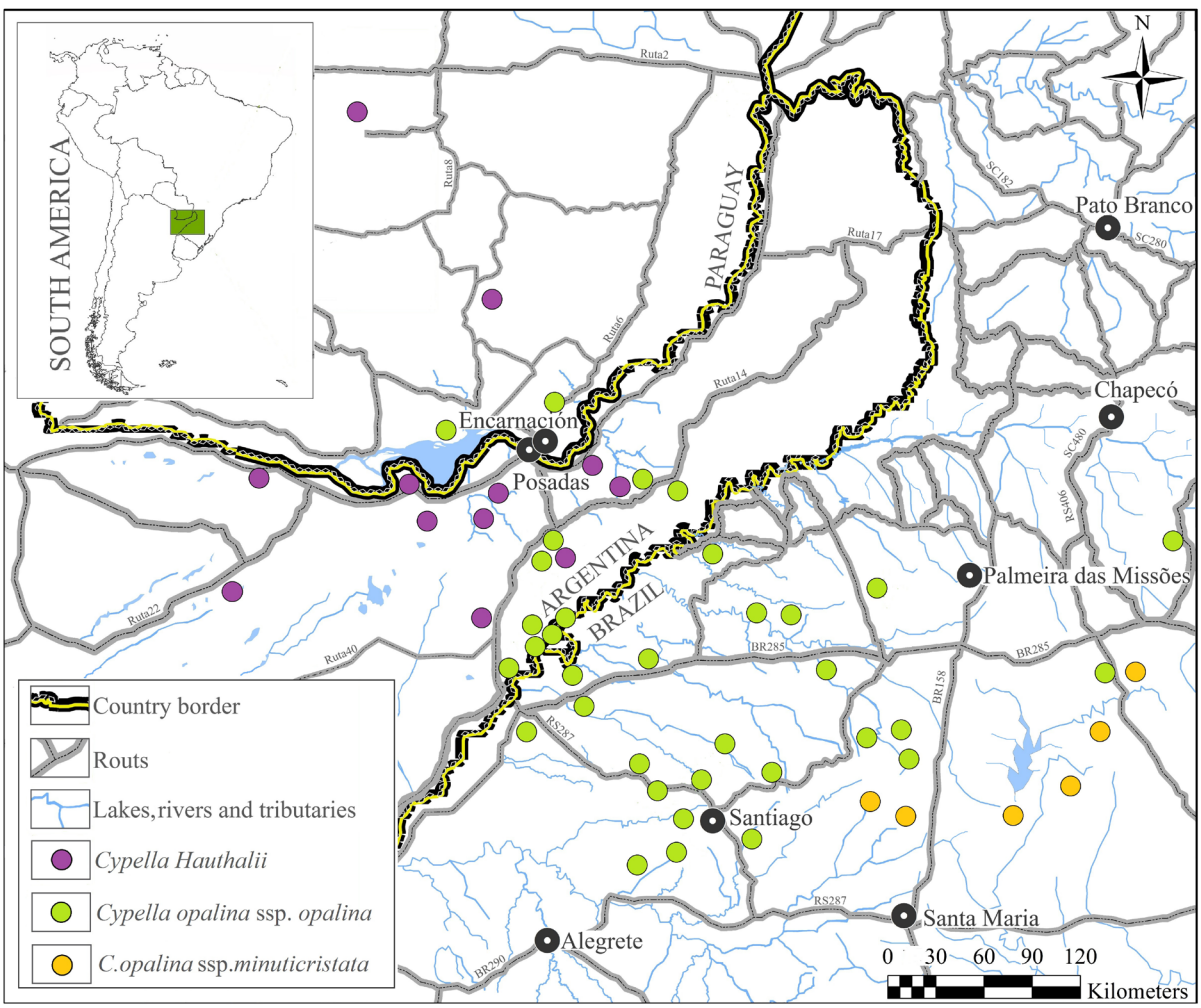

Figure 3. Map of geographic distribution of *Misionella Hauthalii*, *M. opalina* and *M. opalina* subsp. *minuticristata*.

Phenology– Specimens with flowers and capsules can be found between September-December. The flowers open only in one day in the middle morning (9:30–10 am) and wither in the middle afternoon (2–4 pm). In cloudy days, the flowers remain opened up to late afternoon. In favorable years the specimens flowering fullness, and its white-opaline flowers ensures a beautiful sight in the region at which it occurs.

Vernacular name and uses–Misionella opalina is known as < bibi, bibi-branco or bibi-blanco>. Local populations use the bulbs as food, prepared raw or cooked, they have a pleasant hazelnut flavor. The species is appreciated by herbivores. The cultivation information is the same as that indicated for *Misionella Hauthalii*.

*Additional Specimens Examined–*ARGENTINA. **Corrientes**. Santo Tomé, Garruchos, "destacamiento de Prefectura, a orillas del río Uruguay, borde de selva marginal", 6 September 1993 (fl), *M. M. Arbo et al. 5822* (CTES!); Arroyo Chimiray y río Uruguay, 3 December 1981 (fr), *S. G. Tressens 1492* (CTES!); "entrada al pueblo, desde ruta 40, 28º 09'S and 55º 41'W", 7 December 1997 (fr), *M. E. Múlgura-Romero 1585* (SI!). Estancia San Juan Bauptista, on grasslands, 28º 10' 34"S and 55º 38' 07"W, 3 October 2015 (fl, fr), *L. P. Deble & F. S. Alves 15613* (SI!); San Juan Bauptista, 18 November 2003 (fl, fr), *Barboza et al. 814* (ICN). **Misiones:** Apóstoles, flor blanca, tépalos jaspeados, 18 September 2000 (fl, fr), *M. E. Múlgura-Romero 2016* (SI!). Oberá, cesped al borde de camiño, 4 November 1970 (fr), *L. Z. Ahumada 1935* (SI!). BRAZIL. **Rio Grande do Sul**: without precise place [Granja Sodol, Giruá municipality], *K. Hagelund s.n.* (ICN193981). Bossoroca, 12 km antes do município, 28º 41' 58"S and 54º 50' 08"W, 17 October 2013, *E.M. Stiehl-Alves et al. 42* (fl) (ICN!). Garruchos, 28º12' 30.8" S and 55º 31' 37.5" W, 12 November 2015 (fr), *L. P. Deble, F. S. Alves & A. S. de Oliveira 15655* (SI!). Itacurubí, state road - RS 541, on stony, 28º 50'S and 55º 08'W, 17 October 2013 (fl), *L. P. Deble & M. I. Paz-Deble 15656* (SI!), idem, 28º 49'S and 55º 11'W, RS 541, entre Bossoroca e Itacurubí, October 2013 (fl), *E.M. Stiehl-Alves et al. 4517* (ICN!). Manoel Viana, estrada entre Manoel Viana e Encruzilhada RS 176, 29º32'06"S and 55º28'29"W, 14 October 2014 (fl, fr), *T. Pastori et al. 128* (ICN198110!).

Table 1. A comparison of selected characters differing among the species and subspecies of *Misionella.*

Character/taxon	***Misionella Hauthalii***	***Misionella opalina* subsp. *opalina***	***Misionella opalina* subsp. *minuticristata***
Size of spathes (cm)	3.4-5.5 × 0.5-0.8	2.4-4.8 × 0.4-0.5	2.9-4 × 0.3-0.4
Peduncles of spathes length (cm)	1.4-4.5	0.6-2.8	0.9-2.6
General aspect of flowers	outer tepals ascendant in proximal half; inner tepals longer than the central concavity; central concavity few deep and wider	outer tepals almost erect in distal half; inner tepals shorter than the central concavity; central concavity many deep and narrower	idem subsp. *opalina*
Perigone color	pallid lilac-blue, more darker at the end of the anthesis	white, subtly tinged of white-cream at beginning of the anthesis become bluish at the end of the anthesis	White, subtly tinged of white-blue at beginning of the anthesis become more blue at the end of the anthesis
Perigone diameter (mm)	48-75	33-50	35-50
Outer tepal shape and length (mm)	oblong-spathulate, 38-45	Spathulate or obdeltate, 25-35	idem subsp. *opalina*
Inner tepal size	22-28 × 7-8.5	15-17 × 5-6	14-16 × 3.5-4.5
Anthers length (mm)	6.5-7.5 × 1.1-1.4	5-6 × 1.2-1.6	4.5-6 × 1.1-1.5
Pollen color	bluish grey	ochraceous or yellow	idem subsp. *opalina*
Filaments color and length (mm)	light blue at apices, then purple at the base, 7-9	white, with parallel stripes in proximal half and purple at the base, 5-6.5	idem subsp. *opalina*
Style length (including style branches) (mm)	18-23	14-17	13-15
Style branches color and length (mm)	light-blue, 6-7	white or bluish at top,3-4	bluish at top, 2-3.5
Adaxial crests length (mm)	4-5.5	2.5-5	0.1-2

Passo Fundo, canteiro frente ao aeroporto, 28º14'12"S and 52º19'46"W, 6 November 2022 (fl.), *J.G. Dani, C. Guzati & H.M. Bueneker 376* (ICN202851). Santiago, state road - RS 168, 28º 54'S and 54º 58'W, 17 December 2013 (fl), *L. P. Deble & M. I. Paz-Deble 15657* (SI!). Santo Antônio das Missões, locality of Itaroquem, on stony grasslands, 28° 38'S and 55° 17'W, 9 November 2013 (fl, fr)*, L. P. Deble & M. I. Paz-Deble 15601* (SI!); idem, Estrada entre Santo Antônio das Missões e São Nicolau, 191m, flores branca, 28º 28' 01"S and 55º 16' 43"W, 18 October 2013, *E. M. Stiehl-Alves et al. 50*, (ICN!); São Inacio, 28º27'40.4"S and 55º16'08.3W, 6 December 2007, *I. Boldrini, R. Trevisan & A.A. Schneider 1477* (ICN); estrada para São Borja, 28º29'35"S and 55º22'04"W, 14 October 2015 (fl), *L. Eggers & T.T. Souza-Chies 113*(ICN!); BR 285, aprox.. km 572, 29 October 2009, *L. Eggers & Souza-Chies 541* (ICN). São Borja, estrada secundária, RS 176, antes da BR 285, 28º 42' 49"S and 55º 35' 05.3"W, 8 November 2012 (fl), *L. Eggers et al. 764* (ICN!). São Francisco de Assis, 22 September 2023 (fl), *R.M. Senna, J.Z. Matos, R.A. Ramos & M. Pairet 2807* (HAS106527). São Nicolau, estrada entre Santo Antônio das Missões e São Nicolau, próximo da balsa, 28º 12' 29"S and 55º 19' 13"W, 18 October 2013 (fl, fr), *E.M. Stiehl-Alves et al. 51* (ICN!). Soledade, 28° 55' 13.9"S and 52° 33' 41.3"W, crests up to 4.5 mm long, 7 November 2015 (fl), *L. P. Deble & A. S. de Oliveira-Deble 16178* (SI!). Tupanciretã, fazenda Santa Lídia, 9 November 1946, *A. Schultz 501* (ICN). Unistalda, Serra do Iguariaçá, sítio do sr. Orlando Zanella, beira Floresta, 27 October 2010, *R.A. Zachia & Portalet, A.A. 6209* (SMDB19077); idem, BR287, km 430, 30 October 2009 (fl), *L. Eggers & T.T. Souza-Chies 553* (ICN). PARAGUAY. **Itapuá**: Encarnación, "campos altura Encarnación", September 1915 (fl, fr), *E. Hassler 1397* (SI!).

According with me field activities *Misionella opalina* was also recorded in the municipalities of Nova Esperança do Sul, locality of "Gruta da Linha 1" (29º 21' 09.7"S and 54° 47' 52.5"W), Santiago, in the locality of Florida (29º 17' 06.8"S and 54º 33' 17.5"W), São Borja near to Uruguay river (28º 37' 40.4"S and 55º 57' 25.5"W), and Tupanciretã (29º 07' 09.7"S 53º 57' 39.2"W). From Argentina was recorded near Apóstoles, Provincial road 1 (27º 56' 47.7"S and 55º 43'32.6"W), and between Oberá and Leandro Alem, in National road 14 (27º 33' 26.8"S and 55º 13'55.8"W). From Paraguay was found by Baltezan et al. (2019) in Caraguatá, near Paraná river, Itapuá department (27°14'35.9"S 56°04'47.2»W).

Distribution and Habitat–Misionella opalina subsp. *opalina* occurs in western and northwestern Rio Grande do Sul state, Brazil, northeast Corrientes and southern Misiones provinces, Argentina, and Itapuã department, Paraguay (Figure 3). The specimens develop in grasslands and rocky grasslands developed on basalts and rhyolites of the Mesozoic fissure volcanic domain (CPRM 2009). *Misionella opalina* subsp. *opalina* is the most common bulbous Iris in the Missions region, often associated with several other Iridaceae, among them *Cypella fucata* Ravenna, *C. lapidosa* Ravenna, *C. pusilla* (Link and Otto) Benth. and Hook.f. ex B.D. Jacks., *C. Ravenniana* Deble and F.S. Alves, and *Kelissa brasiliensis* (Baker) Ravenna. Others rare and interesting species characteristics of the region are *Aloysia chamaedrifolia* Cham. (Verbenaceae), *Aspicarpa pulchella* (Griseb. ex Mart.) O'Donell and Lourteig (Malpighiaceae), *Borreria poaya* DC. (Rubiaceae), *Croton subpannosus* Griseb. (Euphorbiaceae), *Galactia australis* (Malme) Ceolin and Miotto (Fabaceae), *Rhynchosia Hauthalii* Harms ex Kuntze (Fabaceae), *Lippia misionera* Deble & B.P. Moreira (Verbenaceae), *Notocactus oxycostatus* Buining and Brederoo (Cactaceae), *Oxypetalum aurantiacum* Malme and *O. coccineum* Griseb. (Apocynaceae), *Sida rubifolia* A. St.-Hil. (Malvaceae), *Piriqueta suborbicularis* (A. St.-Hil. and Naudin) Arbo (Turneraceae), several Asteraceae (among them *Chrysolaena propinqua* (Hieron.) H. Rob., *Praxelis missionum* (Malme) R.M. King and H. Rob., *Trichocline macrocephala* Less., and *Vernonanthura chamaedrys* (Less.) H. Rob.), and many Amaryllidaceae, among them *Nothoscordum basalticum* Ravenna, *N. patricium* Ravenna, *Zephyranthes americana* (Hoffmanns.) Ravenna*, Z. caerulea* Baker*, Z. mesochloa* Herb. and *Z. tubispatha* (L'Hér.) Herb.

Conservation–Misionella opalina subsp. *opalina* occurs on grasslands in Southern Paraguay (Itapuã department), Northeastern Argentina (Corrientes and Misiones provinces) and northwestern Rio Grande do Sul state, Brazil. *Misionella opalina* subsp. *opalina* displays an extent of occurrence estimated in more than 20,000 km², the area of occupancy is more than 2,000 km², where numerous populations are known, and containing many individuals, and in some places, more than 1,000 individuals were observed in a single population (e.g. San Juan Bauptista, Garruchos, Corrientes province, Argentina). The specimens produce many fruits and seeds, and according my ecological observations, this subspecies is tolerating to anthropic action, since was observed in slope near to road and in gardens, associated with the grassy. Even so, the reduction of the grasslands areas results threats to this subspecies, and according to IUCN Red List assessment protocol (2012, 2019) *Misionella opalina* subsp. *opalina* can be assigned as Near Threatened (NT), and can be qualifying for a threatened category in a near future, since the observed threats increase.

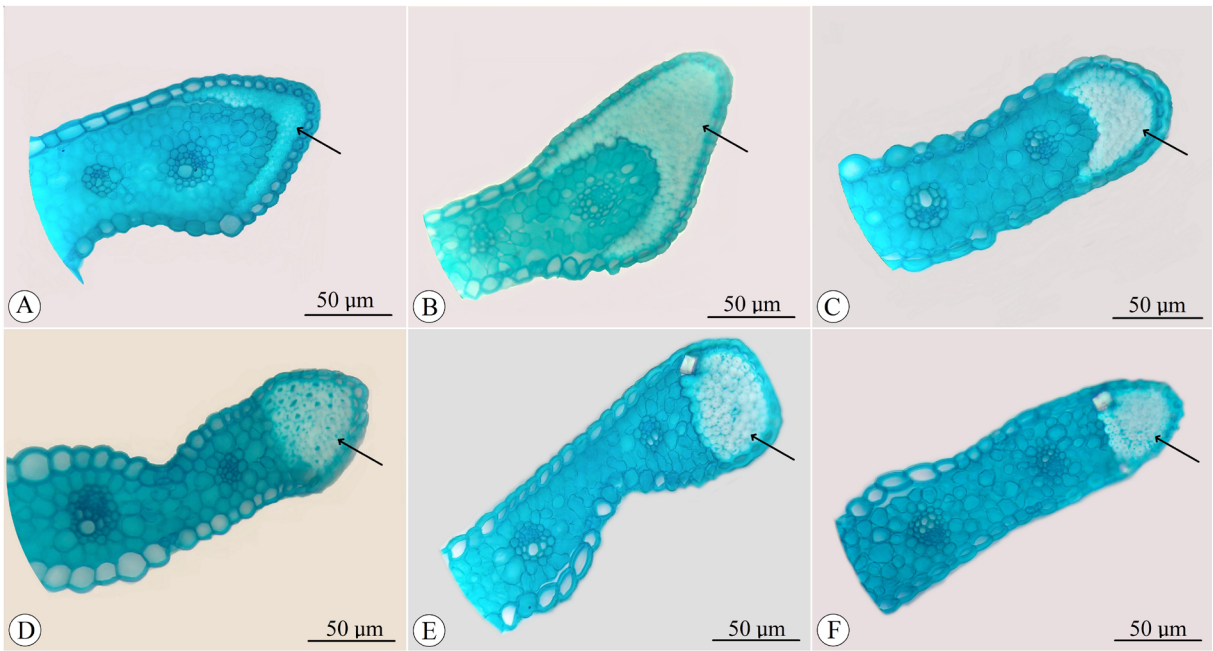

Figure 4. Leaf anatomy in cross-section of species of *Cypella, Herbertia, Kelissa, Misionella* and *Onira*. A, *Cypella Herbertii* (*Cypella* sect. Cypella). B, *Cypella Discolor* (Cypella sect. Naïs). C, *Herbertia pulchella.* D, *Kelissa brasiliensis*. E, *Misionella Hauthalii*. F, *Onira unguiculata*.

Misionella opalina subsp. **minuticristata** (Chauveau & L. Eggers) Deble, *comb. nova*. Basyonim: *Cypella Hauthalii* subsp. *minuticristata* Chauveau & L. Eggers, Phytotaxa 174 (1): 33. 2014. ≡ *Cypella opalina* (Ravenna) Deble subsp. *minuticristata* (Chauveau & L. Eggers) Deble, Balduinia 66: 19. 2020. Typus: Brazil. Rio Grande do Sul: Soledade, "Comunidade Margem São Bento, propriedade particular do sr. Waldemar Freitag, 534m, 28º48'52.8"S and 52º38'38.9"W, 2 November 2013, *L. Eggers et al. 833* (holotypus ICN180016! isotypi P00781091! SI!).
Figure 2 (N-O), 3, 5(M-N), 6
Iconography–Chauveau et al. (2014: 34, figure 6, 2014: 35, figure 7 [A-I]), Eggers et al. (2019: 751, figure 6 [D-E]).
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Differs from the typical subspecies by its inner tepals markedly bluish tinged, with blades 3.5–4.5 mm wide, claws 8–9 mm long, 1.1–1.6 mm wide at the base, and 3–3.5 mm wide at the apex, and by its style branches 2–3.5 mm long, with crests markedly bluish tinged at top, and adaxial crests 0.1–2 mm long, and abaxial crest obsolete, *ca.* 0.05–0.2 mm long.

Etymology–From the Latin *minutis* = diminutive + *cristata* = crested, in a reference to the gynoecium crests, which are quite short.

Phenology–Specimens with flowers and capsules can be found between October-December. The flowers open only in one day in the middle morning (9:30–10am) and wither in the middle afternoon (2–4 pm). In cloudy days, the flowers remain opened up to late afternoon.

Vernacular name and uses–Unknown, probably the same of *Misionella opalina* subsp. *opalina.* For cultivation, the same techniques described for the previous taxa are suggested.

Additional Specimens Examined–BRAZIL. **Rio Grande do Sul:** Jari, "em campo montanhoso, rara, cristas de 2 mm" 29º 16' 14.4"S and 54º 05"42.7"W, 11-XI-2014 (fl, fr), *L. P. Deble, A.S. de Oliveira et J.N.C. Marchiori 13409* (SI!). Júlio de Castilhos, "no campo, solo argiloso, profundo", 29º 18' 34"S and 53º 49' 98"W, 12-XI-2015, *L. P. Deble & F. S. Alves 15774* (SI!). idem, exemplares com cristas de 2 mm, 12-XI-2015, *L.P. Deble & F. S. Alves 15775* (SI!). Salto do Jacuí, trevo da BR 481 para barragem, 397m, 28º 59' 39.1"S and 53º 16' 35.7"W, 20-X-2012, (fl), *L. Eggers et al. 727* (ICN!); "Praça em frente ao Hotel Bela Vista" 29º 05' 01.5"S and 53º 13' 36.1"W, 19-X-2013 (fl, fr) , *L. Eggers et al. 827* (ICN!).

Distribution and Habitat–*Misionella opalina* subsp. *minuticristata* occurs in central Rio Grande

do Sul state, Brazil. The specimens develop in grasslands and rocky grasslands developed on sedimentary rocks of the undifferentiated Cenozoic sediments domain, and also on basalts of the Mesozoic fissure volcanic domain (CPRM 2009). *Misionella opalina* subsp. *minuticristata* displays reduced geographic distribution; nevertheless, the populations contain many individuals. This subspecies is often associated with many other Iridaceae, among them *Cypella exilis* Ravenna, *Herbertia amabilis* Deble & F.S. Alves, *Sisyrinchium* spp. (as *S. palmifolium* L., *S. micranthum* Cav., *S. minutiflorum* Klatt, *S. sellowianum* Klatt). Others species characteristics of the same places of the region of occurrence of *C. opalina* subsp. *minuticristata* are the palms *Butia Witeckii* K.Soares & S.J. Longhi and *Thritrinax brasiliensis* Mart., and many small shrubs and herbs as *Aloysia polygalifolia* Cham. (Verbenaceae), *Aspicarpa pulchella* (Griseb. ex Mart.) O'Donell and Lourteig (Malpighiaceae), *Campomanesia Hatschbachii* DC. (Myrtaceae), *Dyckia Selloa* (K. Koch) Baker (Bromeliaceae), *Oxalis subvillosa* Norlind (Oxalidaceae), *Paspalum Rawitscheri* Parodi & Chase ex G.H. Rua & Valls (Poaceae), *Pomaria rubicunda* (Vogel) B.B. Simpson & G.P.Lewis (Fabaceae), *Mimosa cerifera* Schmidt-Silveira & Miotto and *Rhynchosia Hauthalii* Harms ex Kuntze (Fabaceae), *Oxypetalum coccineum* Griseb. (Apocynaceae), *Rhamnidium riograndense* Figueira (Rhamnaceae), *Zygostigma australe* (Gentianaceae), and several Asteraceae (among them *Moquiniastrum ramboi* (Cabrera) G. Sancho, *Trichocline catharinensis* Cabrera and an undescribed species of *Grindelia*). *Misionella opalina* subsp. *minuticristata* and all of these taxa are endemic and noteworthy, as they occur in the last remaining native grasslands in the central region of Rio Grande do Sul state, Brazil.

Conservation–Misionella opalina subsp. *minuticristata* occurs on natural grasslands in central Rio Grande do Sul state, Brazil an extent of occurrence estimated in less than 5,000 km², the area of occupancy is less than 100 km². The population may contain many individuals, but they can disappear completely with the replacement of native vegetation by crops. The strong decrease of the natural grasslands areas results threats to this subspecies, and according to IUCN Red List assessment protocol (2012, 2019) *Misionella opalina* subsp. *minuticristata* can be assigned as Critically Endangered (CR) with subcriteria B1 (a) and (biii) as firstly suggested by Chauveau et al. (2014: 35).

Discussion

Misionella is a genus raised on a set of unique morphological characteristics. Its leaves and spathes are morphologically and anatomically very similar to the leaves and spathes found in *Kelissa brasiliensis, Onira unguiculata* and in most species of *Herbertia* (e.g. *Herbertia caerulea* Herbert, *H. Darwinii* Roitman & Castillo) and quite distinct from the leaves and spathes of *Calydorea* s.l. and *Cypella*. The flowers of *Misionella* have tepals forming an urn, which resembles that found in *Cypella* sect. Naïs. On the other hand, the shape of its inner tepals are very different and the inclusion of *Misionella* in *Cypella* is not very consistent and morphological and anatomical data are in agreement with molecular data found by Chauveau et al. (2012). These authors indicate that the inclusion of *Cypella Hauthalii*, *Kelissa brasiliensis* and *Onira unguiculata* makes the genus *Cypella* paraphyletic.

Leaf anatomy

Characteristics of leaf anatomy are important for the recognition of the main taxonomic lineages in Iridaceae (Rudall 1990, Rudall 1991, Rudall 1994, Pastori et al. 2018, Santos & Deble 2022). Regarding this aspect, the vegetative similarity of all members of the tribe Tigridieae is notable, due to the presence of plicated leaves, often narrowly linear and flexible blades among other similar aspects. However, anatomical analysis reveals important differences that have not yet been satisfactorily addressed (Santos & Deble 2022, 2024). The species belonging to the Tigridieae clade A presents lignified fibers in its leafy anatomy, while in Tigridieae clade B they are non-lignified (Santos & Deble 2022: 27 [Figure 1A-F] and 29 [Figure 2A-F]). Whiten the clade B the taxa can be divided into two distinct groups. In the first one, here called <Herbertia type>, the bundles of non-lignified fibers have a semi-spherical shape and do not extend into the intervascular spaces in the transversal section (Figure 4C-F). This pattern is found in *Herbertia*, *Onira* and *Kelissa*. The second group, designated here as <Cypella type>, the non-lignified fiber bundles have a horseshoe shape and often extend into the intervascular spaces (Figure 4A-B). This pattern

is found in *Calydorea* s.l., *Cypella*, *Tucma* and some species of *Tigridia* (Santos & Deble 2024: 7 [Figure 1A-F] and 9 [Figure 2A-F]) . The absence of lignified fibers securely separates the new genus from Tigridieae clade A. The *Herbertia* type gives the leaf a softer and less fibrous appearance. *Misionella* has a <Herbertia-type> leaf anatomy pattern (Figure 4C), an important anatomical characteristic as it separates *Misionella* from *Cypella* and *Calydorea*.

Flowering stem

When comparing the genera of Tigridieae, a certain homogeneity in the pattern of flowering stem is observed. It is possible to recognize some distinctive characteristics, which may be characteristic of a certain genus, as is the case with cauline leaf.For example, in *Cipura*, *Eleutherine* and *Larentia* the cauline leaf is single and well developed, often exceeding the length of the inflorescence (Ravenna 1988, Ravenna 2003, Ravenna 2009, Celis et al. 2003).

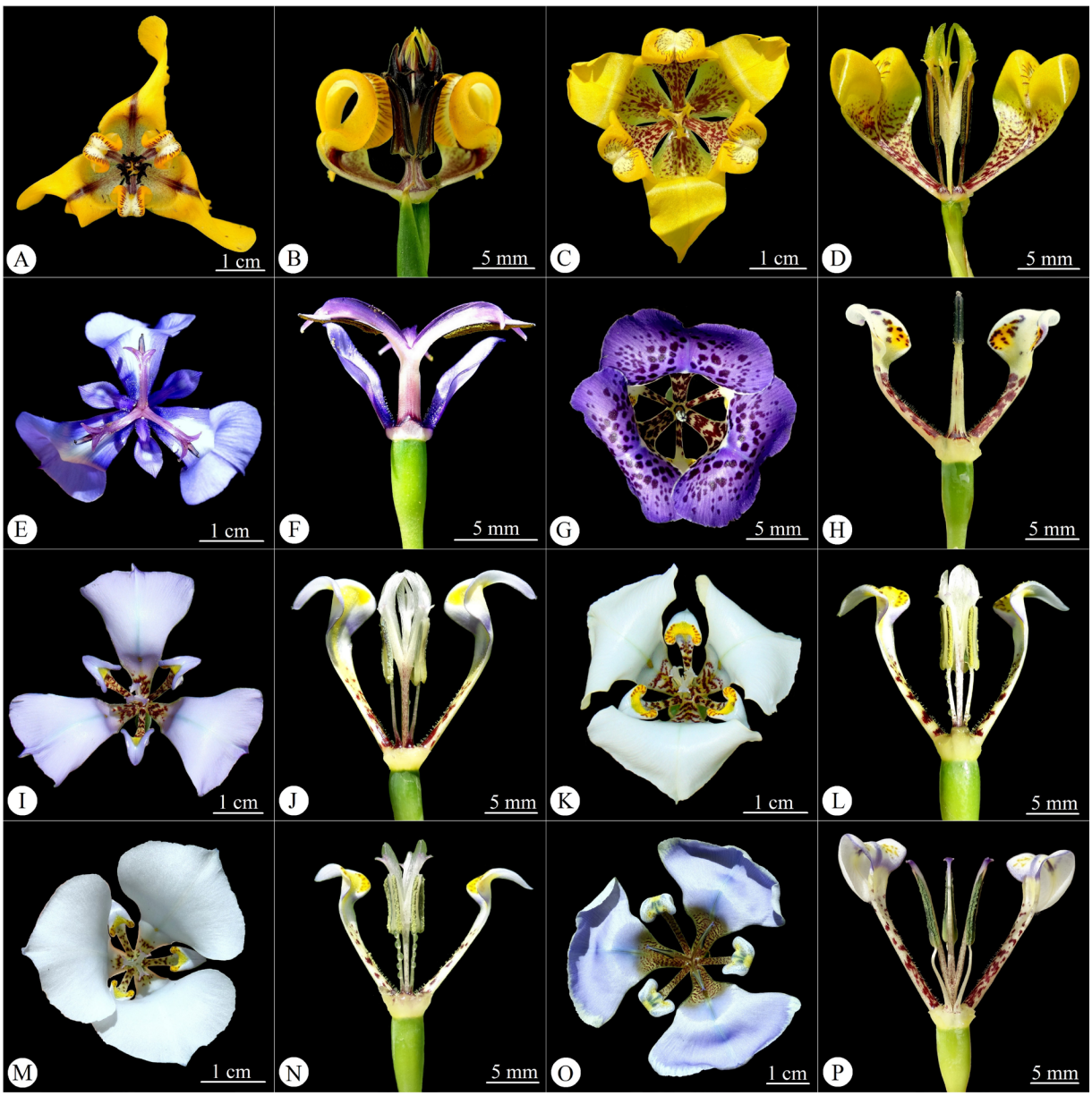

Figure 5. Flowers in upper view and flowers in lateral view, with all outer tepals and one inner tepal removed of species of *Cypella, Herbertia, Kelissa, Misionella* and *Onira.* A-B, *Cypella Herbertii* (Cypella sect. Cypella). C-D, *Cypella aquatilis* (Cypella sect. Naïs). E-F, *Herbertia pulchella.* G-H, *Kelissa brasiliensis*. I-J, *Misionella Hauthalii*. K-L, *Misionella opalina* subsp. *opalina.* M-N, *Misionella opalina* subsp. *minuticristata*. O-P, *Onira unguiculata*.

In *Cypella*, on the contrary, the stem leaf is poorly developed and the upper cauline leaves are often bracteiform, although the stem leaf may be unique in some species (as *Cypella pusilla* and *C. gloriana*) and the inflorescence is fascicular, resembling the inflorescence of the genera *Cipura* and *Larentia* (Deble & Alves 2020). In *Misionella*, the flowering branch is similar to that found in the genera *Herbertia*, *Kelissa* and *Onira*, as it is generally short and branched only in the inflorescence, and the cauline leaf is single, flaccid and well developed, from which depart one or several pedicels of the spathes.

Spathes

In the genus *Misionella* the spathes are two-flowered and the valves are subequal in size, the outer one being shorter and reaching approximately ⅔ to ¾ of the length of the inner valve, both being plicated in cross section, as occurs in *Herbertia* spp., *Kelissa brasiliensis* and *Onira unguiculata*. In *Cypella*, the spathes are often one-flowered (two-flowered spathes are found only in *Cypella Alonsoana* Deble & F.S. Alves, *C. aquatilis* Ravenna, *C. laeta* Ravenna, *C. Osteniana* Beauverd and *C. suffusa* Ravenna), and the outer valves reaching up to ⅔ of the length of the inner valves, and the inner valves are convolute in cross-section (Deble & Alves 2020).

Perigonium

The shape of the perigonium is an important character for the distinction of genera within the tribe Tigridieae. Among the most striking characteristics are the proportional size between the series of inner and outer tepals, the shape and arrangement of the inner and outer tepals and the position of the lipidic trichomes (Ravenna 1983, Ravenna 1986, Goldblatt & Manning 2008, Ravenna 2009, Chauveau et al. 2012). In *Misionella* the outer tepals are distinctly larger and with a long and narrow claw towards the base (Figure 5I-N). In *Misionella Hauthalii* the central depression is shallower than that found in *Misionella opalina*. The shape of the external tepals of *M. Hauthalii* is similar to that found in *Onira unguiculata* (Figure 5I-J, O-P), while the external tepals of *M. opalina* are morphologically similar to that found in *Kelissa brasilensis* and *Cypella charruana* (Figure 5G-H, K-L). The inner tepals are quite peculiar, and display rhombic blades with an uncinate apex, while the claws are narrowly linear-cuneate, erect-ascending, and the margins are gently folded and the auricular portion is slightly raised (Figure 5J, L, N). The carpet of lipidic trichomes is in a central portion of the blade (Figure 5J, L, N). The morphological aspect of the inner tepals is similar to that found in *Herbertia*, although in this genus the claws are shorter and cuneate and the carped of lipidic trichomes occurs in a central depression that extends along the claw (Figure 5E-F). In *Cypella* sect. Cypella the inner tepals are patent and geniculate-recurved and the claws are broadly cuneate, while the carpet of lipidic trichomes occurs in a perpendicular fissure (Figure 5A-B). In *Cypella* sect. Naïs the inner tepals are ascending-recurved and the carpet of lipidic trichomes is at the top of the blade (Figure 5C-D). In *Kelissa brasiliensis* and *Onira unguiculata* the tepals have rhombic blades, and the claws is narrowly linear-cuneate, as in *Misionella* (Figure 5G-H, O-P). However, the inner tepal blade of *Kelissa* and *Onira* are flat, and the carpet of lipidic trichomes occurs along an elevated central portion (Ravenna 1981b, Ravenna 1983, Deble 2021b).

Androecium and Gynoecium

The shape and arrangement of the androecium and gynoecium have been important for the distinction of taxa within <Cypelloid> genera (Ravenna 2009). In *Cypella* sect. Cypella the stamens are close related to gynoecium, and the filaments may be united or partially united, forming a column that hides the unbranched part of the gynoecium (as *Cypella Herbertii*) (Figure 5B). However, in most species of section Naïs the filaments are filiform, bulbiform towards the base and united only at the base, and the unbranched part of the gynoecium is visible (Figure 5D). The anthers are erect or slightly porrect, with the connective attached at the top of style branches. In *Cipura* the arrangement of the andro-gynoecium is similar to that observed in *Cypella*, however the anthers are elliptical and are attached to the unbranched part of the gynoecium. In *Onira* the anthers are linear-sagittate and the gynoecium has deeply trifid branches, ending in a thicker, lobed portion, while the filaments are filiform in its distal half and become thicker and gradually wider towards the base, but are free (Figure 5P). In *Kelissa*, the androecium has filaments united in a bottle-shaped column and the anthers are attached to each other, this structure completely hides the gynoecium (sometimes only the stigmatic lobes are visible) (Figure 5H) (see also Deble 2021b).

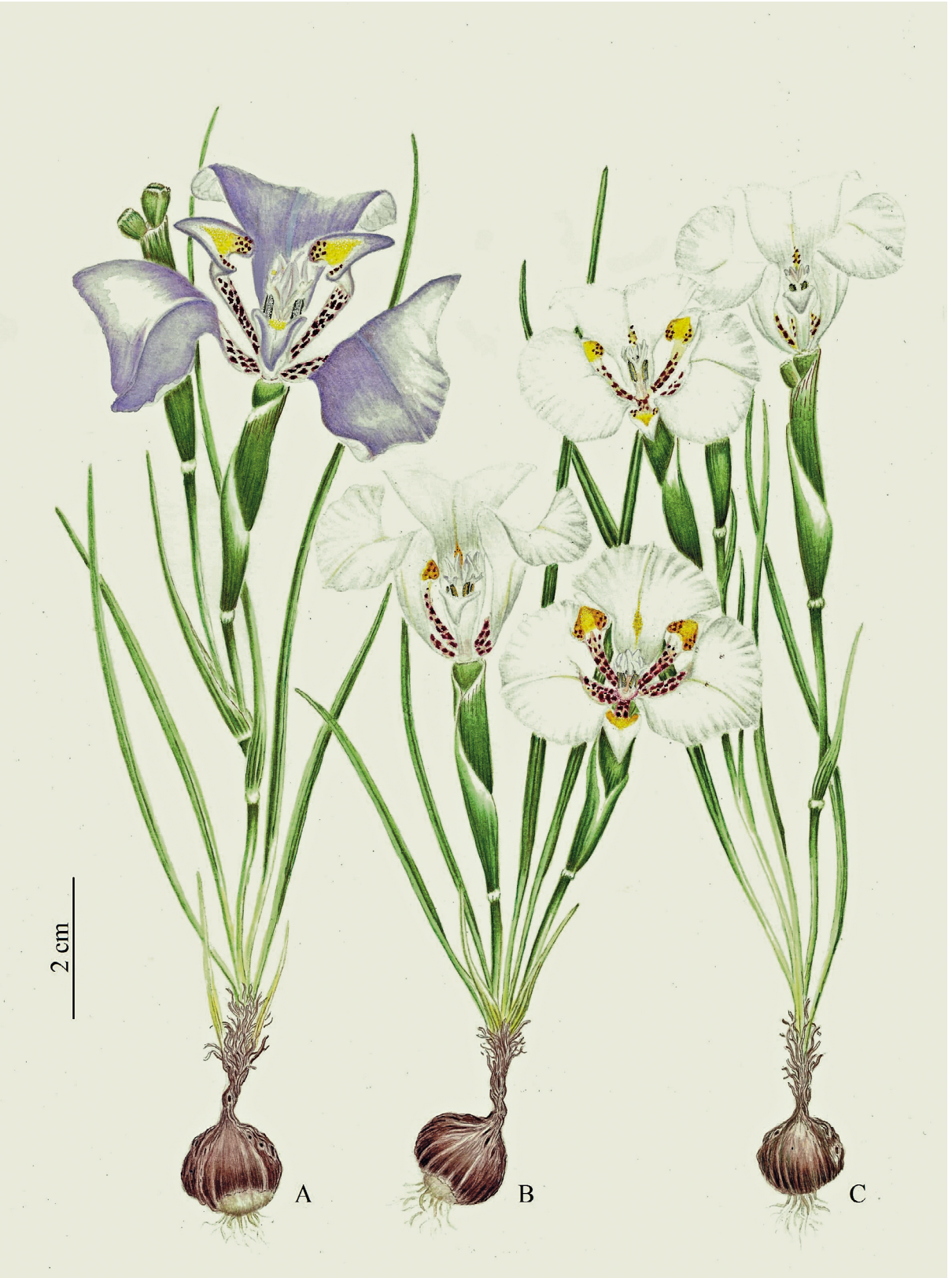

Figure 6. *Misionella Hauthalii, M. opalina* and *M. opalina* subsp. *minuticristata* (Drawing made by L.P. Deble).

In *Misionella*, the stamens have anthers with a narrow connective, and filiform filaments, free from the base. The connective is adhered to the distal half of the style branch (Figure 5J, L, N). These morphological characteristics are similar to those found in several species of *Cypella* sect. Naïs. *Misionella* presents the style branches completely free. This morphological characteristic is reported for *Onira unguiculata, Cypella charruana* (*Cypella* sect. Naïs), *Cypella armosa* and *C. magnicristata* (both *Cypella* sect. Cypella). The other characteristics, such as the stigmatic portion extending in an adaxial transverse line, which has an auricular elevation and the translucent and falcate adaxial crests are commonly found in *Cypella* sect. Naïs.

Fruits and seeds

Few studies have demonstrated the importance of fruits and seeds for taxonomic distinction within the tribe Tigridieae. Deble (2021) highlighted the morphological particularities of the capsules of *Kelissa brasiliensis* and *Onira unguiculata*, as they have thick and markedly angled walls, while Deble et al. (2015) and Deble et al. (2018) indicated that the seed texture (honeycomb or smooth) is a character for distinguishing species in *Cypella* and *Calydorea*, respectively. In *Cypella*, the capsules are obovate or oblong, with non-angled margins and a thin or membranous wall. In *Misionella*, the capsules are largely obovate or obtrulated, with angled margins and a thick wall, similar to that observed in some species of *Herbertia*, *Kelissa brasiliensis* and *Onira unguiculata*. The seeds of *Misionella* are indistinguishable from those found in most species of *Cypella*, *Herbertia*, *Kelissa brasiliensis* and *Onira unguiculata*.

Key to distinguish the South American genera of Iridaceae-Tigridieae

1. Outer and inner tepals equal or subequal in size (rare inner tepals with ca. of ½ of total length of the outer tepals; so, the blades are of the same color, texture and glabrous). One-celled lipidic trichomes absent 2
– Inner tepals much smaller than the outer tepals. Blade of the inner tepals with a carpet of one-celled lipidic trichomes, rarely absent 5
2. Plants robust, leaves rigid with fiber bundles with lignin on the margins and in the most caliber veins. Spathes 4–12-flora. Bulbous with cataphylls fleshy, reddish-yellow, reddish-brown or purplish-brown in fresh 3
– Plants delicate, leaves tender without fiber bundles with lignin. Spathes 1–2 (5)-flora. Bulbous with cataphylls papery, pallid-brow or dark-brow 4
3. Style columnar, shortly trifid apically; stigmatic region one for each branch, reniform in shape in upper view .... *Gelasine* p.p.
– Style trifid at apex, with secondaries division deeply bifid and subulate; stigmatic region two for each branch .... *Eleutherine*
4. Stamens with anthers adnate towards the base, its distal half thrown back at the dehiscence. Style columnar, at apex shortly trifid, with branches erect ..... *Itysa* Ravenna
– Stamens with anthers free, curved or twisted at the dehiscence. Style often trifid at apex, with branches patent or ascendant (rarely with branches adnate, forming a columnar style: *Calydorea charruana* and *C. nuda*) ..... *Calydorea* Herbert (including *Tamia* Ravenna)
5. Style branches filiform, ending in a short stigmatic portion at top 6
– Style branches plicate, thicker than the style, stigmatic region two for each branch 9
6. Central concavity of perigone shallow or deep. Outer and inner tepals with claws few pronounced. Inner tepals with one-celled lipidic trichomes absent or few, scattered on the claw 7
– Central concavity of perigone deep. Outer and inner tepals markedly clawed. Inner tepals with a dense carpet of one-celled lipidic trichomes on a central stripe of the blade 8
7. Inner tepals geniculate recurved. Stamens with filaments shortly adnate towards the base, anthers horizontal or patent. Style branches horizontal or patent, emarginated at top ..... *Catila* Ravenna
– Inner tepals elliptic, oblanceolate or cucullate. Stamens with filaments adnate in a column, anthers erect. Style columnar or shortly trifid apically; stigmatic region transversely reniform in shape ..... *Gelasine* p.p.
8. Style columnar, hidden by the stamens; stamens with adnate filaments, forming a column, anthers adnate to each other ..... *Kelissa* Ravenna

– Style deeply trifid, visible among the stamens; stamens with free filaments ..... *Onira* Ravenna
9. Inner tepals with long and abundant glandular trichomes on the blade 9
– Inner tepals without long glandular trichomes (or if present, few and scattered along the claws). One-celled lipidic trichomes forming dense carpets in specific parts of the blade, rarely absent 10
9. Flowers opening in the middle or late afternoon. Inner tepal blade with long glandular trichomes in a central stripe along the top. Style branches ending in three crests, two adaxial and one abaxial, crests not petaloid ..... *Hesperoxiphion* Baker
– Flowers opening in the morning. Inner tepal blade with glandular trichomes in two lateral bands along the top. Style branches ending in two rounded and petaloid crests ..... *Phalocallis* Herbert
10. Stamens with filaments adnate in a cylindric or bottle shaped column. Style branches with secondary divisions emarginated or bifid, ending in a nearly spherical stigmatic portion 11
– Stamens free, partially adnate or adnate in a conical column. Style branches with secondary divisions rounded, peltate or crested 15
11. Unbranched part of style with ⅔ or more of total length of style; style branches shorter, ending in an emarginated stigmatic portion ..... *Lethia*
– Unbranched part of style with up to ½ of total length of style, rarely more; style branches well-developed 12
12. Style branches with secondary divisions subulate, deeply bifid for ⅔ or more of total length of the style branch 13
– Style branches with secondary divisions emarginated or bifid for up to ½ of total length of the style branch 14
13. Stamens with anthers horizontal or patent (rarely ascending or erect in North America species: *Tigridia imaculata; T. inusitata; T. orthanta; T. pavonia*). Style-branches horizontal or patent ..... *Tigridia*
– Stamens with erect anthers; Style branches with secondary divisions ascending-erect or erect, above the anthers .... *Alophia* Herbert
14. Inner tepals with a central concavity darker and densely covered by one-celled lipidic trichomes ..... *Herbertia* Sweet
- Inner tepals smooth, without one-celled lipidic trichomes ..... *Mastigostyla* Johnston (including *Cardenanthus* Foster)
15. Stamens with filaments entirely adnate in a conical column, longer than the anthers. Style-branches peltate with fimbriate margin; stigmatic portion along the margin ..... *Ennealophus*
– Stamens with filaments free, partially adnate or adnate, of equal length or shorter than the anthers. Style-branches crested or rounded, stigmatic portion in a transverse dorsal stripe or in two lateral ear-like appendices 16
16. Anthers with connective prolonged and apically firm attached to the style arms. Style branches with two crests .... *Larentia* Klatt
– Anthers with connective not prolonged. Style branches with three crests, two adaxial and one abaxial, sometimes reduced 17
17. Cauline leaf subapical inserted at the base of subterminal inflorescence. Inflorescence fasciculate. Inner tepals erect, forming a cup (rarely inner tepals arcuate-recurved: *Cipura formosa*, *C. xanthomelas*) ..... *Cipura*
– Cauline leaf in the basal third. Inflorescence supported by peduncles, non-fasciculate (rarely fasciculate, so the leaf inserted at the base of the inflorescence is bracteiform and of equal length or smaller than the spathes.) 18
18. Spathes with inner valves convolute. Inner tepals with cuneate claws; blades not hastate, recurvate-reflexes or ascendant reflexes ..... *Cypella* Herbert
– Spathes with outer and inner valves plicate. Inner tepals with linear claws; blades hastate, erect-ascendant, and then uncinated ..... *Misionella* Deble

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Declaration of competing of interest

The author declares that him have no known competing financial interests or personal relationships that could have appeared to undermine the objectivity or integrity of the work reported in this paper.

References

Andrade, B. O., Marchesi, E., Burkart, S., Setubal, R. B., Lezama, F., Perelman, S., Scheneider, A. A., Trevisan,

R., Overbeck, G. E. & I.I. Boldrini. 2018. Vascular plant species richness and distribution in the Río de la Plata grasslands. Botanical Journal of the Linnean Society, London, 188: 250-256.

Andrade, B.O., Dröse, W., Aguiar, C.A., Aires, E.T., Alvares, D.J., Barbieri, R.L., Carvalho, C.J.B., Bartz, M., Becker, F.G., Bencke, G.A., Beneduzi, A., Silva, J.B., Blochtein, B., Boldrini, I.I., Boll, P.K., Bordin, J., Silveira, R.M.B., Martins, M.B., Bosenbecker, C., Braccini, J., Braun, B., Brito, R., Brown, G.G., Büneker, H.M., Buzatto, C.R., Cavalleri, A., Cechin, S.Z., Colombo, P., Constantino, R., Costa, C.F., Dalzochio, M.S., Oliveira, M.G., Dias, R.A., Santos, L.A., Duarte, A.F., Duarte, J.L.P., Durigon, J., da Silva, M.E., Ferreira, P.P.A., Ferreira, T., Ferrer, J., Ferro, V.G., Fontana, C.S., Freire, M.D., Freitas, T.R.O., Galiano, D., Garcia, M., dos Santos, T.G., Heydrich, I., Iop, S., Jarenkow, J.A., Jungbluth, P., Käffer, M.I., Kaminski, L.A., Kenne, D.C., Kirst, F.D., Krolow, T.K., Krüger, R.F., Kubiak, B.B., Leal-Zanchet, A.M., Loebmann, D., Lucas, D.B., Lucas, E.M., Luza, A.L., Machado, I.F., Madalozzo, B., Maestri, R., Malabarba, L.R., Maneyro, R., Marinho, M.A.T., Marques, R., Marta, K.S., Martins, D.S., Martins, G.S., Martins, T.R., Mello, A.S., Mello, R.L., Mendonça Junior, M.S., Morais, A.B.B., Moreira, F.F.F., Moreira, L.F.B., Moura, L.A., Nervo, M.H., Ott, R., Paludo, P., Passaglia, L.M.P., Périco, E., Petzhold, E.S., Pires, M.M., Poppe, J.L., Quintela, F.M., Ragusse-Quadros, M., Pereira, M.J.R., Renner, S., Ribeiro, F.B., Ribeiro, J.R.I., Romanowski, H.P., Ruschel, T.P., Saccol, S.S.A., Savaris, M., Schmitz, H.J., Silva Filho, P.J.S., Soares, A.G., Somavilla, A., Sperotto, P., Spies, M.R., Tirelli, F.P., Tozetti, A.M., Verrastro, L., Vogel Ely, C., da Silva, Â.Z., Zank, C., Zefa, E. & Overbeck, G.E. 2023. 12,500+ and counting: biodiversity of the Brazilian Pampa. Frontiers of Biogeography: 1-16. https://doi.org/10.21425/F5FBG59288

Azpiroz, A.B., J.P. Isacch, R.A. Dias, A.S. Di Giacomo, C.S. Fontana, & C.M. Palarea. 2012. Ecology and conservation of grassland birds in southeastern South America: a review. Journal of Field Ornithology 83 (3): 217-246. http://dx.doi.org/10.1111/j.1557-9263.2012.00372.x

Baker, J.G. 1877. Systema Iridacearum. Journal of Linnean Society, Botany 16: 61-180.

Beentje, H. 2010. The Kew Plant Glossary: an illustrated dictionary of plant terms. Royal Botanic Gardens, Kew, 160 pp.

Bilenca, D. & F. Miñarro. 2004. Identificación de áreas valiosas de pastizal en las Pampas y Campos de Argentina, Uruguay y Sur de Brasil.Buenos Aires: Fundación vida silvestre, 353 pp.

Celis, M., Goldblatt, P., Betancur, J. 2003. A new species of *Cipura* (Iridaceae) from Colombia and Venezuela. *Novon* 13: 419-422.

Cabrera, Á.L. 1976. Regiones Fitogeográficas Argentinas. Enciclopedia Argentina de Agricultura y Jardinería Tomo II, Fascículo 1. Acme, Buenos Aires, 85 pp.

Cabrera, Á.L. & A. Willink. 1980. Biogeografía de América Latina. Secretaría General de la OEA, Monografía, 13, 122pp.

Chauveau, O., L. Eggers, T.T. Souza-Chies & S. Nadot. 2012. Oil-producing flowers within the Iridoideae (Iridaceae): evolutionary trends in the flowers of the New World genera. *Annals of Botany London* 110: 713-729. http://dx.doi.org/10.1093/aob/mcs134

Chauveau, O., T. Pastori, T.T. Souza-Chies & L. Eggers. 2014. Overlooked diversity in Brazilian Cypella (Iridaceae, Iridoideae): four new taxa from the Río de la Plata grasslands. Phytotaxa 174 (1): 25-42.

Clay, R. P., H. Del Castillo & J. De Egea. 2008. Paraguay: contextos eco-regionales, geográficos y socioeconómicos. In: Áreas importantes para la conservación de las aves del Paraguay, Guyra Paraguay, Asunción: 31-44.

CPRM (Serviço Geológico do Brasil). 2009. Escala 1: 15 km. Mapa de Geodiversidade do Estado do Rio Grande do Sul. Brasília.

De Baltezan, M.M., dos Santos, A.M. & L.P. Deble. 2019. *Cypella hauthalii* (Kuntze) Foster subsp. *opalina* Ravenna, nueva cita para el Paraguay. Balduinia 65: 35-39.

Deble, L.P., A.S. de Oliveira & F.S. Alves. 2012. Novo Registro de Cypella sect. Cypella (Iridaceae: Tigridieae). Balduinia 35: 19-26.

Deble, L.P., F.S. Alves, A. González & A.S. de Oliveira. 2015a. Three new species of Cypella (Iridaceae) from South America, and taxonomic delimitation of C. suffusa Ravenna. Phytotaxa 236 (2): 101-120. http://dx.doi.org/10.11646/phytotaxa.236.2.1

Deble, L.P., F.S. Alves & A.S. de Oliveira. 2015b. Three new species of the genus *Cypella* (Iridaceae, Tigridieae). Darwiniana, nueva serie 3 (2): 235-253. http://dx.doi.org 10.14522/darwiniana.2015.31.666

Deble, L.P. & F.S. Alves. 2017. Taxonomic novelties for the genus *Cypella* (Iridaceae): new species, synonymies and nomenclatural types. Kew Bulletin, Kew 72 (41): 1-18.

Deble, L.P., Oliveira, A.S. de, Alves, F. da S., Garcia, L.F. & Refiel-Lopes, S.A.O. 2018. Taxonomy, geographic distribution, conservation and species boundaries in *Calydorea azurea* group (Iridaceae: Tigridieae). *Balduinia* 64: 19-33.

Deble, L.P. & F.S. Alves. 2020. *Cypella* (Iridaceae) What do we know about the diversity of the genus? *Balduinia* 66: 2-27.

Deble, L. P. 2021a. Survey on the tribe Tigridieae (Iridaceae) in the Campos of Southeast South America. Balduinia 68: 14-33. https://doi.org/10.5902/2358198069388

Deble, L.P. 2021b. Taxonomic review of the genus *Kelissa* (Iridaceae). *Balduinia* 68: 34-44.

Deble, L. P. 2024. Pedro Felix [Pierfelice] Ravenna, ¿un gigante incomprendido?. Balduinia 72: 11-28. https://doi.org/10.5902/2358198086630

Eggers, L., Marchioretto, R., Souza-Chies, T.T. & O. Chauveau. 2019. A Taxonomic synopsis of Cypella (Iridaceae) in Brazil. Acta Botánica brasílica 33: 741-769.

Espinosa-Bustos, R. 1922. Dos Plantas Chilenas de bulbos comestibles. Revista Chilena de Historia Natural 26: 8-26.

Florschutz, P.A. & Grolle, R. 1975. *Herbertus* Gray 1821, *Herbertia* Sweet 1827 and *Herberta* Gray mut. Lindb. 1875. *Journal Bryology* 8: 479-481.

Foster, R.C. 1950. Studies in the Iridaceae VI, Miscelaneous novelties and transfers. Contributions from the Gray Herbarium of Harvard University 171: 22-28.

Goldblatt, P. 1975. Revision of the bulbous Iridaceae of North America. Brittonia 27: 373–385.

Goldblatt, P. 1978. *Herbertia* (Iridaceae) reinstated as a valid generic name. Annals of the Missouri Botanic Garden 64: 378–379.

Goldblatt, P. & J.C. Manning. 2008. The Iris Family. Natural History and Classification. Portland: Timber Press. 290pp.

Herbert, W. 1839. Phalocallis plumbea lead-coloured Phalocallis. Botanical Magazine 65 (n. ser. v. 12): pl. 3710.

Hicken, C.M. 1924. Plantae Vattuonei. Darwiniana 1: 95-153.

Kuntze, O. 1898. Revisio Generum Plantarum: vascularium omnium atque cellularium multarum secundum leges nomeclaturae internationales cum enumeratione plantarum exoticarum in itinere mundi collectarum ... Leipzig 3: 1-576. http://dx.doi.org/10.5962/bhl.title.327

Hurrel, J.A., G.G. Roitman & G. Delucchi. 2009. Iridaceae: 251-326. In: Hurrel, J.A. Flora Rioplatense, Sistemática, ecologia y etnobotánica de las plantas vasculares rio-platenses. Parte 3 Monocotiledóneas, v. 4.

Huaylla, H. & Wood, J.R.I. 2012. *Cypella boliviana* (Iridaceae) a new species from Bolivia. Kew Bulletin 67 (4): 797-800.

IBODA (Instituto de Botánica Darwinion). 2024. Iridaceae. Published on: http://www.darwin.edu.ar/Proyectos/FloraArgentina/BuscarEspecies.asp. Acessed 26 October 2024

IUCN Standards and Petitions Committee. 2012. Guidelines for Application of IUCN Red List Criteria at Regional and National Levels: Version 4.0. IUCN Species Survival Commission, International Union for the Conservation of Nature. Gland, Switzerland and Cambridge, UK. iii + 41 pp. https://portals.iucn.org/library/sites/library/files/documents/RL-2012-002.pdf. Accessed 20 october 2024.

IUCN Standards and Petitions Committee. 2019. Guidelines for Using the IUCN Red List Categories and Criteria, version 14. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK. https://nc.iucnredlist.org/redlist/content/attachment_files/RedListGuidelines.pdf. Accessed 21 July 2024.

Lanjow, J. & Stafleu, F. A. 1954. Taxonomic Literature: a selective guide to botanical publications and collections with dates, commentaries and types, part II 1, A–L. Bohn, Scheltema & Holkema, Utrecht.

Overbeck G.E., S.C. Muller, A. Fidelis, J. Pfadenhauer, V.P. Pillar, C.C. Blanco, I.I. Boldrini, R. Both & E.D. Forneck. 2007. Brazil's neglected biome: the South Brazilian Campos. Perspectives in Plant Ecology, Evolution and Systematics 9: 101-116.

Pastori, T., Chauveau, O., Souza-Chies, T.T., Eggers, L., Mariath, J.E. de A. 2018. Leaf anatomy in Tigridieae reveals a diagnostic character for subtribes Cipurinae and Tigridiinae (Iridoideae: Iridaceae). 6th International Conference on Comparative Biology of Monocotyledons, Natal-RN.

POWO 2024. "Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Published on http://www.plantsoftheworldonline.org/. Accessed on 04 July 2024.

Ravenna, P.F. 1964. Notas sobre Iridaceae. Revista del Instituto Municipal de Botánica, Buenos Aires 2: 51-60.

Ravenna, P.F. 1968. Notas sobre Iridaceae III. Bonplandia 2: 273–291.

Ravenna, P.F. 1977. Notas sobre Iridaceae V. Noticário Mensual Museo Nacional História Natural 21: 7-9.

Ravenna, P.F. 1981a. A submerged new species of *Cypella* (Iridaceae), and a new section for the genus (s.str.). Nordic Journal of Botany 1: 489-492. http://dx.doi.org/10.1111/j.1756-1051.1981.tb00714.x

Ravenna, P.F. 1981b. Eight new species and two new subspecies of *Cypella* (Iridaceae). Wrightia 7 (1): 13-21.

Ravenna, P.F. 1981c. *Kelissa* a new genus of Iridaceae from South Brazil. *Adansonia* 1: 105-110.

Ravenna, P.F. 1981d. *Sympa* a new genus of Iridaceae from Rio Grande do Sul, Brazil. *Wrightia* 7 (1): 10-11.

Ravenna, P.F. 1983a. *Catila* and *Onira,* two new genera of South American Iridaceae. *Nordic Journal of Botany* 3: 197-205.

Ravenna, P.F. 1986. *Itysa* and *Lethia* two new genera of neotripal Iridaceae. Nordic Journal of Botany 6: 581-588. https://doi.org/10.1111/j.1756-1051.1986.tb00457.x

Ravenna, P.F. 1988. Revisional studies in the genus *Cipura* (Iridaceae). *Onira Botanical Leaflets* 1 (5): 35-44.

Ravenna, P.F. 2003a. Flora de Paraguay. Iridaceae. Botanica Australis4: 1-60.

Ravenna, P.F. 2003b. A new *Eleutherine* species (Iridaceae) from Brazil and Paraguay. *Onira Botanical Leaflets* 8 (14): 55-56.

Ravenna, P.F. 2009. A survey in the genus *Cypella* and its allies (Iridaceae). *Onira Botanical Leaflets* 12 (1): 1-11.

Roitman, G.G. & Castillo, J.A. 2007. Novedades taxonómicas y nomenclaturales para la flora vascular del cono sur de Sudamérica: nuevas combinaciones en Iridaceae. *Darwiniana* 45: 236-241.

Roitman, G.G., I. Maza & J.A. Castillo. 2008. Iridaceae. In: Zuloaga, F.O., O. Morrone & M.J. Belgrano (eds.) Catálogo de Plantas Vasculares del Cono Sur 1. Monographs in Botany from the Missouri Botanical Garden 107: 423-453.

Rudall, P. 1990. Comparative leaf morphogenesis in Iridaceae. *Botanische Jahrbucher* 112: 241–260.

Rudall, P. 1991. Leaf anatomy in Tigridieae (Iridaceae). *Plants Systematic and Evolution* 175:1-10.

Rudall, P. 1994. Anatomy and Systematics of Iridaceae. *Botanical Journal of the Linnean Society* 114: 01–21.

Santos, S.R. dos & Deble, L.P. 2022. Anatomia foliar de duas espécies de *Phalocallis* Herbert (Iridaceae). *Balduinia* 69: 24-31. doi: 10.5902/2358198071429

Santos, S.R. dos & Deble, L.P. 2024. Anatomia foliar de três espécies de *Calydorea* Herb. (Tigridieae, Iridaceae). *Balduinia* 73: 4-11.

Schumann, K. 1900. VI. Neue Arten der Siphonogamen 1898. *Just's botanischer jahresbericht. Systematisch geordnetes repertorium der botanischen liter* 26 (1): 323-396.

Soriano, A., R.J.C. León, O.E. Sala, R.S. Lavado, V.A. Deregibus, O. Cahuepé, A. Scaglia, C.A.Velazquez, & J.H. Lemcoff. 1992. Río de la Plata grasslands. In: Coupland, R.T. (Ed.) Ecosystems of the World. Natural Grasslands. Introduction and Western Hemisphere. Elsevier, Amsterdam, p. 367-407.

Thiers, B. [continuing database]. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden´s Virtual Herbarium. Available from: http://sweetgum.nybg.org/ih/. Accessed in 18 June 2024.