

NOTES ON *CIPURA* (IRIDACEAE) IN SOUTH AND CENTRAL AMERICA, AND A NEW SPECIES FROM VENEZUELA¹

PETER GOLDBLATT² AND JAMES E. HENRICH³

ABSTRACT

Cipura is a small genus of Iridaceae—Tigridieae that is widespread in tropical South and Central America, Mexico, and the West Indies. It comprises at least five species and is at present poorly understood. The type species, *C. paludosa* Aublet, is often treated as including the similar *C. campanulata* Ravenna (syn. *C. inornata* Ravenna), and the differences between the two are detailed. A new species, *C. rupicola*, is described from Territorio Federal Amazonas, Venezuela. It is closely allied to the only other known yellow-flowered species, *C. xanthomelas* Martius ex Klatt (syn. *C. flava* Ravenna), of interior Brazil. The basic chromosome number in *Cipura* is $x = 7$ and chromosome numbers have been established here for *C. xanthomelas* and *C. rupicola*, both tetraploid, $2n = 4x = 28$.

During preparation of treatments of Iridaceae for three regional floras, *Flora Mesoamericana*, *Flora de Nicaragua*, and *Flora of the Venezuelan Guayana*, the genus *Cipura* Aublet posed several problems in typification and delimitation of species. As a result we studied this small genus in some detail. Our conclusions relate to the genus as a whole and are presented in the form of a review. A new species, *C. rupicola*, is described from western Venezuela, and two more undescribed species are included in a key to the genus but are not published as new species here for reasons given below. A complete revision of *Cipura* is being prepared by P. Ravenna as part of a treatment of Iridaceae for *Flora Neotropica*.

Cipura is one of a distinctive group of New World Iridaceae comprising tribe Tigridieae (Goldblatt, 1982), which is characterized by a bulbous rootstock, plicate leaves, and a basic chromosome number of $x = 7$. The first genus in the alliance to be described (Aublet, 1775), it was based on *C. paludosa*, from what is now French Guiana. *Cipura* comprises five or probably a few more species, distributed from southern Mexico in the north to Bolivia, southern Brazil, and Paraguay in the south (Fig. 1). *Cipura paludosa* occurs over almost the entire range of the genus, but the other species have narrower and sometimes very restricted ranges.

Cipura is closely related to the larger genus *Cypella* Herbert from which it differs in having erect inner tepals that partly conceal the stamens and style-stigma apparatus and a large cauline

leaf inserted at the flowering stem apex just below the single or few and closely set rhipidia (spathe-enclosed inflorescence units). As in *Cypella* and several other genera of Tigridieae, the fugacious flowers have broadly clawed outer tepals; inner tepals with an adaxial nectariferous area on the limb (usually concealed by a fold in the tepal surface); free stamens with weak filaments; and anthers adhering to the style branches.

The style divides above into three thickened branches. In the less specialized species there are one or two pairs of erect appendages (crests) which exceed each transverse stigma lobe. Such elaborate style branches are probably basic in *Cipura* and the apparently simpler structure in *C. paludosa* and *C. campanulata*, in which the style branches are not developed and the crests are absent or reduced, is derived.

The species of *Cipura* currently recognized are *C. xanthomelas* Martius ex Klatt, of which *C. flava* Ravenna is almost certainly a synonym; the new *C. rupicola*; *C. paludosa* Aublet; and *C. campanulata* Ravenna. In addition, there are two undescribed species: *Cipura* sp. 1, a large and violet-flowered species, some herbarium specimens of which have been annotated *C. formosa* Ravenna by P. Ravenna; and *Cipura* sp. 2, also with violet flowers, from southwestern Venezuela and adjacent Colombia.

In the review we include the following: 1) typification of *Cipura paludosa*, which involves the delimitation of *C. campanulata*, a largely Central American species often confused with *C. palu-*

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² B. A. Kruckhoff Curator of African Botany, Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

³ Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.



FIGURE 1. Geographical distribution of the species of *Cipura*. The occurrence of *C. paludosa* in Nicaragua, Honduras, El Salvador, Guatemala, and the Yucatán Peninsula has not been established. Some specimens from western Mexico are difficult to determine, owing to absence of properly preserved flowers. Both *C. campanulata* and *C. paludosa* appear to occur there but more and better preserved material is needed to establish accurately the distribution of *Cipura* in this area.

dosa; 2) description of *C. rupicola* and a discussion of its differences from the closely related *C. xanthomelas*; 3) brief discussion of the two violet-flowered species; 4) key to the species; and 5) synonymy and description of *C. paludosa*.

TYPIFICATION AND DELIMITATION OF *CIPURA PALUDOSA*

Cipura paludosa, described by Aublet in 1775 from plants growing near Cayenne, is the most widespread and common species in the genus. It has pale bluish, or sometimes white, flowers with a cylindric-fusiform ovary included in the spathes and non-clawed, broad, closely imbricate inner tepals about half as long as the outer tepals (Fig.

2A). They conceal, except from above, the stamens, style, and stigma. The style branches are hardly differentiated but the style is thickened above and weakly three-lobed apically (Fig. 2A). The stigmas are simply expanded lobes located opposite and above the anthers which form a tube enclosing the upper part of the style. Obscure crestlike appendages extending above the stigmas can sometimes be seen, but they are often microscopic. The inner tepals of *C. paludosa* are concave below and have a conspicuous central zone of yellow nectariferous tissue outlined in violet.

Identification of the type of *Cipura paludosa* with living populations is not without problems. The type collection was made by Aublet in wet

savannas at the foot of Mt. Kourou in what is now French Guiana. The illustration accompanying the description conforms best with blue-flowered plants that are fairly widespread in the Guianas and Brazil, which generally have short stems, relatively broad leaves, and 2–3 flowers in each rhipidium. The flowers are clearly illustrated by Aublet as having erect and imbricate inner tepals and a style with short stigmatic lobes (flowers are not present on the specimen that we have designated lectotype in the Rousseau Collection in the Paris Herbarium). In the type figure the stigmatic lobes are also most unusual. They are drawn as large, ascending and acute structures, quite unlike those in any living plants of any species of *Cipura*. We assume that these strange structures were included in error.

A species described by Kunth (1816) from eastern Colombia, *Cipura graminea*, is regarded here as conspecific with *C. paludosa*. The type specimen lacks flowers but has comparatively narrow leaves and elongate included capsules, of which there are two in some rhipidia. The Bolivian species *Cipura major*, described by Rusby (1910), and a plant from Peru, *C. goodspeediana* (Vargas) R. Foster (1962), based on *Cypella goodspeediana* Vargas (1945), with pale blue flowers and short flowering stems 7–10 cm long, also conform with *C. paludosa*. Following Foster (1946), we regard both as synonyms of *C. paludosa*. *Cipura major* differs mainly in having very narrow leaves, but similar leaves are known on some specimens of *C. paludosa*.

Similar and closely related is a species common in Mesoamerica which almost always has white flowers. When dried it is difficult to distinguish from the often violet- or pale blue-flowered *Cipura paludosa*, with which it was included or confused in the several local and national floras for Mesoamerica. Living plants that we examined display some important differences not apparent in most dry specimens. The inner tepals are initially more or less erect but soon become semipatent and are held well away from the stamens and style-stigma apparatus (Fig. 2B). Also, the inner tepals lack nectariferous tissue and, at least to the unaided eye, have no glands. In addition the Mesoamerican species almost always has only one flower in each rhipidium (two or three in *C. paludosa*), and the flower emerges laterally from the spathes and is thus somewhat secund. The leaves are often very narrow, and the flowers have comparatively short pedicels 5–7 mm long. Names in the literature that appear

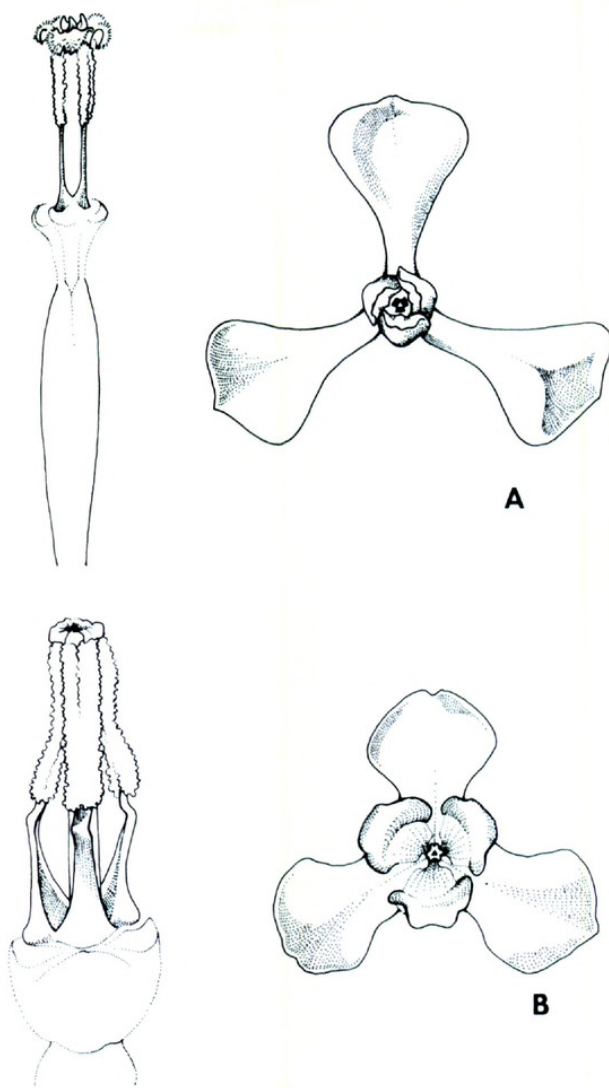


FIGURE 2. Dorsal views of the flowers ($\times 2$) and detail of the stamens and style from the side ($\times 6$), of *Cipura paludosa* (A), and *C. campanulata* (B).

to apply to this species are *C. campanulata* Ravenna (1964), the type of which is from Yucatán, and *C. inornata* Ravenna (1984) from Caracas, Venezuela. We have been unable to see the types of either of the species described by Ravenna. Holotypes are in the private herbarium of P. Ravenna who is unwilling to loan them to us. An isotype of *C. campanulata*, cited as at the Kew Herbarium (Ravenna, 1964), has not yet been received there.

From the description, *Cipura inornata* appears to differ hardly at all from *C. campanulata* and is reduced to synonymy here. Ravenna distinguished it, although not expressly, by the absence of style appendages but these are also lacking in *C. campanulata*. Ravenna (1964) explicitly distinguished *C. campanulata* from *C. paludosa* by

its cernuous (i.e., secund) rather than erect flowers and by the inner tepals being nearly equal to the outer, his measurements being 19 mm long for the inner tepals and 21 mm for the outer.

We have four living collections of the white-flowered Mesoamerican *Cipura* and thus are able to assess, to some extent at least, its floral variation. The size, shape, and orientation of the inner tepals are most like the outer tepals of any of the species of *Cipura* and are about three-quarters as long (Fig. 2B), thus usually shorter by some 4–5 mm and are reasonably close to the dimensions given by Ravenna for *C. campanulata*. Moreover, the flowers are nearly always displaced to one side because they emerge laterally from the spathes rather than apically. Thus, there seems little to distinguish this plant from *C. campanulata* and, despite not having seen the type material, we feel that the name applies to the widespread Mesoamerican species. We must note, however, that several specimens from Yucatán that we have seen are somewhat more robust and have broad, strongly plicate leaves that are distinctly striated when dry. Nevertheless, we prefer not to recognize this form as a distinct taxon.

Cipura cubensis Griseb., based on *Wright s.n.*, anno 1865, is also white-flowered (Grisebach, 1866) and is sometimes regarded as separate from *C. paludosa*. We have been unable to locate the type, and it is impossible to tell from the protologue whether *C. cubensis* corresponds better with *C. campanulata* or *C. paludosa*, the presence of only the latter being established in Cuba. The name *C. cubensis* must for the present be excluded. We note, incidentally, that *C. paludosa* sensu Grisebach which is based on the cited collection, *Wright 3256*, is a species of *Cypella*.

Cipura paludosa and *C. campanulata* are probably the most specialized and least representative species of *Cipura*. They are distinct in their linear to fusiform ovaries, included in the rhipidia, and inner tepals lacking distinct claws. Both species are autogamous, unlike other members of *Cipura*, and have broad inner tepals, style branches represented by short stigmatic lobes, and anthers coherent around the thickened upper part of the style. The thickened part of the style probably represents fused style branches, which are present and free in other species of *Cipura*. *Cipura paludosa* is apparently a diploid species (Goldblatt, 1982), $2n = 14$, although structural heterozygosity and derived numbers of 13 and 12 have been recorded in plants of horticultural origin. The only count for *C. campanulata* is

tetraploid, $2n = 28$ (reported by Goldblatt in 1982 as *C. paludosa*).

Cipura paludosa is the most widespread species in the genus, extending from northern Bolivia in the south to the Caribbean, Mesoamerica, and the West Indies in the north (Fig. 1). It varies in vegetative features. The stem is often quite short, reaching less than 8 cm from the ground, but in some plants may be up to 15 cm long. The leaves are usually relatively broad, 4–10 mm wide, but they may occasionally be only 1–2 mm wide. Its most distinctive features seem to be the number of flowers (and hence capsules) produced in each rhipidium, usually two or three, rarely more or fewer, and the closely imbricate inner tepals with conspicuous nectar guides.

In contrast, *Cipura campanulata* has pure white or rarely pale blue flowers without yellow nectar guides, and the inner tepals are initially erect (parallel to the axis of the flower) but later become somewhat outcurving. The style branches and stamens are similar to those of *C. paludosa* but always lack appendages. *Cipura campanulata* occurs in seasonally wet or marshy sites from Nayarit and Vera Cruz, Mexico through Mesoamerica to northern Venezuela and Colombia (Fig. 1).

YELLOW-FLOWERED SPECIES

A yellow-flowered species of *Cipura*, *C. xanthomelas*, was described by Klatt in 1882, based on collections made by Martius and Regnell in Brazil. It is characterized by globose, exserted capsules and yellow flowers. The relatively large yellow flowers have outer tepals 30–35 mm long. The inner tepals are about half as long as the outer, ca. 14 mm long, and have distinct claws ca. 8 mm long with red striations on the inner surface and dark markings on the knee and apex. The style branches are long and have well-developed crests ca. 2.8 mm long. *Cipura flava* (Ravenna, 1964) appears to be conspecific and pending examination of the type, deposited in the private herbarium of P. Ravenna, we are provisionally regarding it as a synonym. Bulbs of *C. xanthomelas* are quite large, usually 2–2.5 cm in diameter, with blackish resinous tunics, the spathes are (2.5–)3–5 cm long, and the nearly globose capsules are exserted and typically 12–14 mm long. The species is known to us from numerous herbarium specimens mostly with poorly preserved flowers and from a living collection grown at the Missouri Botanical Garden. The diploid chromosome number in this collec-

tion (Plowman *et al.* 9306, MO) is $2n = 28$, and the species thus appears to be tetraploid. Details of the karyotype of this and the following species will be reported elsewhere. The flowers of our living collection appeared to differ significantly from other material in having partly united filaments, a feature that we have not seen in other specimens. *Cipura xanthomelas* is centered in the Brazilian state of Goiás (Fig. 1) and extends into the neighboring states of Mato Grosso, Minas Gerais, Maranhão, and possibly Piauí, while an unusual variant is recorded from western Pernambuco, adjacent to Piauí.

A similar yellow-flowered species, here described as *Cipura rupicola*, has come to our attention from Venezuela. It has pale yellow flowers with unusual inner tepals having slender claws, between which the anthers can be seen, but the long style branches are partly concealed by the erect tepal limbs (Fig. 3). *Cipura rupicola* differs from *C. xanthomelas* in being less robust, in its non-resinous bulbs 1.5–2.5 cm in diameter, and shorter spathes 2.6–3.6 cm long. The flowers are also smaller and lack the markings on the inner tepals and the red striations on the claw characteristic of *C. xanthomelas*. The outer tepals are 25–28 mm long and the inner tepals have claws ca. 9 mm long and limbs ca. 8 mm long. The style branches lack crests. Like *C. xanthomelas*, *C. rupicola* has exserted capsules, globose in shape and usually 8–11 mm long, thus somewhat smaller than its relative. Chromosome number in *C. rupicola* is $2n = 28$ and it thus appears to be tetraploid like *C. xanthomelas*.

***Cipura rupicola* Goldblatt & Henrich, sp. nov.**

TYPE: Venezuela. T.F.A., Dept. Atures: near Puerto Ayacucho, *Davidse & Miller 26437* (holotype, MO; isotypes, COL, K, NY, VEN). Figure 3.

Plantae 12–40 cm altae, tunicis nigribus non resinosis, floribus flavis, tepalis exterioribus 25–28 mm longis, interioribus ca. 18 mm longis unguibus angustis, filamentis liberis 3 mm longis, antheris 3.5 mm longis, ramis styli 5 mm longis sine cristis, capsulis obovoideis 8–11 mm longis exsertis.

Plants 12–40 cm tall. *Bulb* 1.5–2.5 cm diam.; tunics dark brown to blackish, brittle-papery but not noticeably resinous. *Leaves* 3–5, all but one basal, strongly plicate, narrowly lanceolate, about as long to slightly longer than the flowering stem, (6–)9–14 mm wide; subterminal cauline leaf solitary (second smaller leaf occasionally present), smaller than the basal, 7–15 cm long, about 12

mm wide. *Flowering stems* 1–3 per plant, erect, lateral to the basal leaves, 8–20(–35) cm long, bearing 2–several crowded rhipidia either sessile or on short branches. *Inner spathes* 2.6–3.5 cm long; *outer* $\frac{1}{2}$ – $\frac{2}{3}$ as long. *Flowers* bright yellow, with a more or less distinct perianth tube ca. 2 mm long; *outer tepals* 25–28 mm long, oblong, tapering slightly near the base, somewhat distally twisted from horizontal, weakly divided into limb and claw, the claw ascending, plane, the margins becoming transparent, the limb horizontal, channeled, ca. 20 mm long, to 10 mm wide; *inner tepals* ca. 18 mm long, the claws ca. 2.5 mm wide, narrower towards the base, ascending and widely separated from one another and thus forming broad windows making the anthers visible, curving inwards above to become horizontal at the apex, the limbs erect, imbricate, the apex rolled abaxially, ca. 8 mm long, ca. 8 mm wide, bearing a small circular yellow zone at the base, running on to the apex of the claw. *Filaments* free, erect, thickened below, 3 mm long; *anthers* ca. 3.5 mm long, free from the style, latrorse, with a broad connective wider than the anther lobes; pollen yellow. *Ovary* included in the spathes at anthesis, ca. 4.5 mm long; *style* ca. 4 mm long, dividing into 3 erect branches, these hidden laterally by the inner tepal limbs; *style branches* 5 mm long, plane, truncate, without apical appendages, expanded apically into bilobed papillose stigmas. *Capsules* exserted from the spathes, obovoid, 8–11 mm long; *seeds* angular, to 2 mm at the longest axis. *Chromosome number* $2n = 28$. *Flowering time* June–July.

Distribution. Venezuela, T.F.A., Dept. Atures, in the vicinity of Puerto Ayacucho, growing on shallow soils of granite hills and outcrops and on the surrounding dry stony savannas (Fig. 1).

Additional specimens examined. VENEZUELA. TERRITORIO FEDERAL AMAZONAS: DEPT. ATURES: alrededores de Puerto Ayacucho, *Huber & Tillett 932* (MO, VEN); between Puerto Ayacucho and airport, laja and adjacent flats, *Gentry & Berry 14430* (MO); alrededores de las rocas, Puerto Ayacucho, *Williams 13099* (K, US, VEN); se abren en medio de las rocas, Puerto Ayacucho, *Williams 12967* (F, VEN); medio y alto Orinoco, *Pannier & Schwabe 926* (VEN); prope Mayapures, ad flumen Orenoco, *Spruce 3596* (BM, K, NY); bords de l'Orenoque, *Gaillard 118* (P); Oripopos, 3.5 km N of Puerto Ayacucho, *Romero 1254* (MO).

VIOLET-FLOWERED SPECIES

There are two violet-flowered species known to us. One, *Cipura* sp. 1, fairly well represented



FIGURE 3. *Cipura rupicola*. Habit ($\times 0.5$), lateral view of the flower ($\times 1$), and detail of the stamens and style branches from the side including a dorsal view of the stigmatic region ($\times 4$).

in some herbaria, is native to Brazil, occurring in Bahia, Goiás, and Mato Grosso. It is easily recognized by the unusually large bulbs with resinous tunics, relatively broad rigid leaves, a short cauline leaf which is typically shorter than the spathes, and only one or sometimes two rhipidia. The flowers are unusual in their violet color and large size. The outer tepals are ca. 40–45 mm

long and 30 mm wide, and the inner tepals are ca. 22 mm long, with a long ascending claw to ca. 18 mm long and a limb that curves forward over the claw and then is rolled outwards distally. The style branches are flattened and petaloid but fairly narrow and have two pairs of crests, the adaxial ca. 5 mm long and the abaxial about half as long. The species is known to us only from

dry specimens and details of the inner tepals and style branches are not completely clear.

The second violet-flowered species, *Cipura* sp. 2, of which we have seen only two specimens, is from southwestern Venezuela (*Huber 5711*, VEN) and adjacent eastern Colombia (*Vincelli 1230*, MO). It also has resinous bulb tunics, but is taller than *C. sp. 1*, ca. 45 cm high, and has two to five

rhypidia at the stem apex subtended by a cauline leaf about three times as long as the spathes. The flowers are much smaller than those of *C. sp. 1* with outer tepals ca. 18 mm long. They are comparable with those of *C. paludosa* and *C. campanulata*, and it is probably most closely related to these two species. Floral details are obscure owing to poor preservation.

KEY TO THE SPECIES OF *CIPURA*

- 1a. Flowers yellow; capsules globose and exserted from the spathes.
 - 2a. Inner tepals yellow with blackish markings on the knee and at the apex, less than half as long as the outer tepals, to 14 mm long *C. xanthomelas*
 - 2b. Inner tepals entirely pale yellow; somewhat more than half as long as the outer, to 18 mm long *C. rupicola*
- 1b. Flowers shades of blue to violet or white; capsules cylindric-fusiform or nearly globose; included in the spathes.
 - 3a. Rhypidia solitary or two and subtended by a cauline leaf shorter than or about as long as the spathes *C. sp. 1*
 - 3b. Rhypidia usually more than one and subtended by a cauline leaf usually at least twice as long as the spathes.
 - 4a. Bulbs 15–20 mm in diameter, with tunics not or only slightly resinous.
 - 5a. Flowers white, rarely pale blue; inner tepals without yellow nectar guides or a zone of nectariferous tissue; flowers solitary in each rhypidium; inner tepals about $\frac{3}{4}$ the length of the outer and not imbricate *C. campanulata*
 - 5b. Flowers usually pale bluish to violet, rarely white; inner tepals with a yellow nectar guide and a zone of nectariferous tissue, often outlined in violet; flowers (1–)2–3 in each rhypidium; inner tepals closely imbricate, about half as long as the outer *C. paludosa*
 - 4b. Bulbs about 30 mm in diameter, with tunics heavily resinous *C. sp. 2*

NOMENCLATURE AND DESCRIPTION OF *C. PALUDOSA*

***Cipura paludosa* Aublet, Hist. Pl. Guiane 38–39. 1775.** TYPE: French Guiana: near Mt. Kourou (as Courou), *Aublet s.n.* (lectotype, P—Herb. Rousseau, designated here). Figure 2.

Cipura graminea Kunth, Nov. Gen. Sp. 1: 320. 1816. TYPE: Colombia: ripa Orinoco propter urbem Santo Thomas del Angostura, *Humboldt & Bonpland s.n.* (lectotype, P, designated here; isolectotype, P—Herb. Bonpland).

Cipura major Rusby, Bull. New York Bot. Gard. 6: 493. 1910. TYPE: Bolivia: Tamupasa, 1,800 ft., *Williams 546* (lectotype, NY, designated here; isotypes, BM, K).

Cypella goodspeediana Vargas, Revista Univ. Cuzco 33: 171. 1944. TYPE: Peru. Convencion: Hda. Potrero, *Vargas 2509* (holotype, CUZ, not seen; isotype, GH); *Cipura goodspeediana* (Vargas) R. Foster, Rhodora 64: 311. 1962.

Cipura paludosa subsp. *mexicana* Ravenna, Phytologia 56: 195–196. 1984. TYPE: Mexico. Sinaloa: *Ravenna 278* (holotype, Herb. Ravenna, not seen).

Plants 16–27 cm tall. *Bulb* 12–20 mm diam.; tunics dry and brittle-papery, rarely slightly resinous. *Leaves* finely plicate, linear-lanceolate, 1–3 basal, 16–27 cm long, 2–5 mm wide; subterminal cauline leaf single, largest, clasping the

spathes below, 16–23 cm long. *Flowering stem* 3.5–8(–15) cm long, bearing several crowded rhypidia, either sessile or on short branches. *Inner spathes* 30–35 mm long; *outer* ca. $\frac{2}{3}$ as long as the inner. *Flowers* pale to bright blue, or white, the tepals connate into a distinct tube ca. 2 mm long; *outer tepals* fading to white at the base, oblanceolate, ascending to nearly horizontal, distally twisted ca. 30°, the margins rolled outward, the right more so than the left, 2.5–2.8 cm long, 1.3–1.5 cm wide, with a white nectary in a central zone ca. 1 cm above the base; *inner tepals* 1.5 cm long, 8–10 mm wide, light blue with a white apex, darkest at the margins, more or less obovate, erect and imbricate, the apex rolled outwards, strongly concave, with a yellow nectary in a median band extending ca. 2 mm from apex to 2–3 mm from the base, broadening to 4 mm at the widest, surrounding a white to light blue, raised nonglandular area, sometimes with semiparallel dark blue bands extending at right angles to the nectariferous zone. *Filaments* 2–3 mm long, thickened and sometimes contiguous at the base for up to 1 mm, free and threadlike above; *anthers* adhering to the style, 3.5–4 mm long, latrorse with a slender connective broadest at the base and tapering to the apex, pollen white. *Ovary*



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