A REVIEW OF THE NEW WORLD SPECIES OF *ORTHROSANTHUS* SWEET (IRIDACEAE)[1]

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ABSTRACT

Orthrosanthus, a genus of some 9 species of Iridaceae—Sisyrinchieae, occurs in Australia and South and Mesoamerica. This review, arising out of research for floristic treatments for *Flora Mesoamericana* and *Flora de Nicaragua,* deals with the systematics and nomenclature of the New World species. We recognize five American species: *O. acorifolius* and *O. occissapungus* are endemic in South America; *O. chimboracensis* occurs in South and Mesoamerica; and *O. monadelphus* and *O. exsertus* are restricted to Mesoamerica and Mexico. The taxonomic history of *Orthrosanthus* in the New World is outlined followed by a key, and the nomenclature, brief descriptions, and distribution ranges for each species are provided.

The genus *Orthrosanthus* comprises nine species of Iridaceae, tribe Sisyrinchieae Baker. It has an unusual disjunct distribution, occurring in Australia and central Mexico to South America, a pattern shared in the family only with *Libertia,* although the latter does not extend into Mesoamerica. In the New World the taxonomy of *Orthrosanthus* has long been confused, with several authors recognizing different numbers of species, subspecies, and varieties (Baker, 1892; Steyermark, 1948; Ravenna, 1977). *Orthrosanthus* is usually regarded as closely allied with *Libertia* and *Sisyrinchium* and is distinguished from them by an oblong to cylindric, included, and often sessile to subsessile ovary and capsule. *Sisyrinchium* and *Libertia* have globose to subglobose capsules borne on slender pedicels, typically well exserted from the subtending bracts and spathes. Further, *Orthrosanthus* has angular seeds, whereas *Libertia* and *Sisyrinchium* have spherical seeds without prominent angular ridges.

Preparing a treatment of Iridaceae for *Flora Mesoamericana* and *Flora de Nicaragua,* we have reviewed the literature dealing with *Orthrosanthus* and have examined the ample herbarium material now available. Our conclusions regarding the systematics of *Orthrosanthus* appear to merit the review presented here, since they differ extensively from currently accepted taxonomy, as represented in most major herbaria. Also, information about *Orthrosanthus* is scattered in the literature and there is no modern summary of the systematics and geography of the genus in the New World. Cooke (1986) treated *Orthrosanthus* for *Flora of Australia,* where four species are now admitted. We recognize five New World species (Fig. 1): *O. acorifolius* (Kunth) Ravenna, *O. chimboracensis* (Kunth) Baker, *O. exsertus* (R. Foster) Ravenna, *O. monadelphus* Ravenna, and *O. occissapungus* (Ruiz ex Klatt) Diels. A short history of *Orthrosanthus* in the New World is outlined below, followed by a diagnostic key for the species and a review of their systematics and nomenclature.

HISTORICAL REVIEW

Orthrosanthus was erected by Robert Sweet (1827) for the Australian *O. multiflorus* Sweet. The first New World species ultimately assigned to *Orthrosanthus* were described by Kunth (1815) as *Moraea* (a distantly related African genus, tribe Irideae). Kunth described three species now recognized as *Orthrosanthus*: *Moraea chimboracensis, M. gladioloides,* and *M. acorifolia.* Baker (1876: 113) was the first to include New World species in *Orthrosanthus,* recognizing *O. chimboracensis* (Kunth) Baker (with *M. acorifolia* as a synonym and *M. gladioloides* as a variety) and a second species *O. spicatus* (Baker) Baker from South America. The latter is a short plant with a winged flowering stem and congested, sessile inflorescence units (rhipidia). The flowers have a short perianth tube, and the globose capsules are carried on slender pedicels above the subtending bracts as in *Sisyrinchium* and *Phaiophleps.* Ravenna (1968) placed the species in *Phaiophleps* as *P. brasiliensis,* but we doubt that it belongs in this heterogeneous alliance. It should

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be referred back to *Sisyrinchium*, pending critical study of its affinities. Baker's (1892) later, more detailed treatment recognized seven species in *Orthrosanthus*, the same two in the New World and five in Australia.

In contrast to Baker's treatment, Klatt (1861) first placed New World species of *Orthrosanthus* in *Sisyrinchium*. He described the distinctive central Andean *O. occissapungus* and a synonym of *O. chimboracensis*, *S. moritzianum*. Later, Klatt (1882) placed New World *Orthrosanthus* in *Solenomelus* Miers, recognizing *Solenomelus chimboracensis* (including *M. acorifolia* and *Sisyrinchium moritzianum*) and *Solenomelus gladioloides* (including *Sisyrinchium occissapungum*). At the close of the nineteenth century Rusby (1896) described *O. nigrorhynchus*, not realizing that *Sisyrinchium occissapungum* was an earlier name for the plant, and two years later Kuntze described the conspecific *O. tunariensis*. *Orthrosanthus occissapungus* has white flowers, characteristic long narrow capsules, and typically single- to few-flowered rhipidia.

A review of *Orthrosanthus* by Steyermark (1948) is consistent with Baker's earlier treatment in recognizing only one American species (at least he makes no reference to *O. occissapungus* or its synonyms). Steyermark's contribution is noteworthy for recognizing four varieties and two forms distinguished by capsule size, degree of exsertion of the capsule from the subtending bracts, flower color, inflorescence characters, leaf dimensions, and geographical distribution.

Recently, Ravenna (1965) described *Orthrosanthus monadelphus* (= *O. chimboracensis* var. *centro-americanus* Steyerm.) and made the combination *O. monadelphus* subsp. *exsertus* (R. Foster) Ravenna. Ravenna (1969) also reduced *O. occissapungus* to subspecific status as *O. chimboracensis* subsp. *tunariensis* (Kuntze) Ravenna. Without mentioning Steyermark's (1948) treatment of the genus, in particular *O. chimboracensis* var. *acorifolius*, Ravenna (1977) transferred *Moraea acorifolia* to *Orthrosanthus* as *O. acorifolius* (Kunth) Ravenna. In 1981 he indicated that he regarded *Orthrosanthus* as comprising four species and one subspecies.

TAXONOMY

Orthrosanthus Sweet, Flora Australasica, t. 11. 1827; Baker, Handbk. Irid. 117–119. 1892; Cooke, Fl. Australia 46: 10–13. 1986. TYPE: *O. multiflorus* Sweet.

Elvetria Raf., Fl. Telluriana 4: 30. 1838. TYPE: *E. multiflora* (Sweet) Raf. (= *O. multiflorus* Sweet).

Evergreen tufted perennials with short, persistent, creeping rhizomes. Leaves several, mostly basal, ensiform and equitant, linear to linear-lanceolate, coriaceous, without a midvein, crowded at the apex of the rhizome. Flowering stem erect, branched, the branches ascending, either long or short, terminating in single rhipidia, or the branches crowded distally. Rhipidia relatively short; spathes subequal. Flowers actinomorphic, subsessile or shortly stalked, blue or white; tepals free (united in a short tube in some Australian species), subequal, spreading horizontally from the base; filaments free or united in the lower half; anthers erect; ovary included in the spathes, ± sessile, or exserted in *O. exsertus*; style short, dividing into 3 relatively long branches extending between the stamens, the branches stigmatic apically. Capsules ellipsoid to cylindric, sometimes pubescent, included or exserted; seeds angular to fusiform.

Species: 9; highland areas from Mexico to Panama, the Coastal Cordillera of Venezuela, and through Andean South America to Bolivia and northern Argentina (Fig. 1), and in Australia.

KEY TO THE NEW WORLD SPECIES

1a. Capsules with pedicels (vestigial–)5–15(–25) mm long; capsule glabrous.
  2a. Spathes usually enclosing a single flower; capsules slender, (15–)22–30 mm long; seeds elongate-angular, 2.5–3 mm long, 0.5 mm wide (Peru, Bolivia, and northern Argentina) ..... 5. *O. occissapungus*
  2b. Spathes enclosing (2–)3 or more flowers; capsules oblong to ellipsoid, 10–18 mm long; seeds angular to irregularly globose, 1.2–2 mm long and wide.
    3a. Mature capsules borne well above the subtending bracts; pedicels 15–25 mm long (central Mexico: Mexico, Puebla, Distrito Federal, Tamaulipas, Nuevo León, Michoacán) ..... 3. *O. exsertus*
    3b. Mature capsules usually included; pedicels 5–10 mm long (Costa Rica, Venezuela, Colombia, Ecuador, Peru) ..... 2. *O. chimboracensis*
1b. Capsules sessile or with short pedicels less than 5 mm long; capsule surface pubescent, sometimes densely so.
  4a. Capsules 7–13 mm long; leaves 2–4 mm wide (southern Mexico to northern Panama, except Belize and Nicaragua) ..... 4. *O. monadelphus*
  4b. Capsules 8–11 mm long; leaves 4–12 mm wide (Venezuela) ..... 1. *O. acorifolius*

FIGURE 1. Distribution of the species of *Orthrosanthus* in the New World.

1. **Orthrosanthus acorifolius** (Kunth) Ravenna, Mus. Nac. Hist. Nat. Santiago Notic. Mens. 21: 7–9. 1977. *Moraea acorifolia* Kunth, Nov. Gen. & Sp. Pl. 1: 323. 1815. *Orthrosanthus chimboracensis* var. *acorifolius* (Kunth) Steyerm., Lloydia 11: 19. 1948. *Marica acorifolia* (Kunth) Martens & Galeotti, Bull. Acad. Brux. 10: 110. 1843 (misapplied, probably to *O. monadelphus*). TYPE: Venezuela. Distrito Federal: in crepidinibus montis Silla de Caracas, ca. 1,250 m, *Bonpland & Humboldt s.n.* (lectotype, P—General Herbarium; the sheet is designated "Herbier Bonpland," here designated). The lectotype specimen has locality data, "Silla de Caracas," approximating that published in the protologue, but also the number *1129*; more type material probably existed and may be found.

Orthrosanthus chimboracensis var. *acorifolius* f. *albus* Steyerm., Lloydia 11: 19. 1948. TYPE: Venezuela. Trujillo: La Quebrada Cortijo, by boundary line Lara-Trujillo, above Humocaro Bajo, *Steyermark 55339a* (holotype, F).

Plants to 65 cm tall. Leaves to 50 cm long, (0.4–)0.9–1.2 cm wide, broadly linear, gradually acuminate. Flowering stem about as long as the leaves; rhipidia several-flowered. Flowers ca. 3 cm diam., blue or rarely white. Capsules 8–11 mm long, sessile or with short pedicels to 5 mm long, pubescent; seeds angular to somewhat rounded, ca. 1–1.2 mm at the widest diameter.

Distribution. *Orthrosanthus acorifolius* is apparently restricted to the Coastal Cordillera and Andes of Venezuela and eastern Colombia.

This species is usually very robust and has comparatively broad leaves sometimes matched

in *Orthrosanthus* by those of *O. chimboracensis*. The ovary and young capsules are heavily pubescent, as in *O. monadelphus*, to which *O. acorifolius* is probably most closely related.

2. **Orthrosanthus chimboracensis** (Kunth) Baker, Gard. Chron. n. ser. 6: 67–68. 1876. *Orthrosanthus chimboracensis* var. *typicus* Steyerm., Lloydia 11: 15–16. 1948. *Moraea chimboracensis* Kunth, Nov. Gen. & Sp. Pl. 1: 322. 1815. TYPE: Ecuador. Tunguragua: regni Quitensis ad radices montis Chimborazo inter pagum Calpi et rupem Yana-Urcu, ca. 1,640 m, *Bonpland & Humboldt s.n.* (lectotype, P—Herb. Bonpland, here designated). More type material may be found; the sheet we have designated as lectotype has the data "Chimborazo" only and the number *3188*.

Moraea gladioloides Kunth, Nov. Gen & Sp. Pl. 1: 322. 1815. TYPE: Peru. Cajamarca: locis frigidis Peruviae inter Caxamarcam et Micuipampam, ca. 1,480 m, *Bonpland & Humboldt s.n.* (lectotype, P—Herb. Bonpland, here designated). The lectotype specimen has the locality data "Peruvia," partially corresponding to the protologue; we expect that other type material may exist, hence the designation of a lectotype.

Sisyrinchium moritzianum Klotzsch ex Klatt, Linnaea 31: 378. 1861. TYPE: Venezuela (as Colombia). Merida: Paramo de la Culata, *Moritz 1204* (isotype, K).

Plants (20–)60–115 cm tall. Leaves 15–70 cm long, 8–12 mm wide, narrowly lanceolate to linear. Flowering stem longer than the leaves; rhipidia several-flowered and regularly spaced; spathe margins hyaline. Flowers 2–2.6 cm diam., blue. Capsules 14–18 mm long, glabrous, the pedicels 5–10(–15) mm long; seeds angular, 1.2–2 mm at the longest axis.

Distribution. *Orthrosanthus chimboracensis* ranges from Costa Rica and Venezuela southward through the Andes from Colombia to Peru. It is a montane species seldom occurring below 2,000 m.

Plants are typically less robust than *Orthrosanthus acorifolius* and can be recognized by a sparsely pubescent to glabrous ovary and completely glabrous capsule with a short pedicel 5–10 mm long.

3. **Orthrosanthus exsertus** (R. Foster) Ravenna, Wrightia 7: 10. 1981. *Orthrosanthus chimboracensis* var. *exsertus* R. Foster, Contr. Gray Herb. 155: 49. 1945. TYPE: Mexico. Distrito Federal: on the sides of ravines near Eslava, *Pringle 8827* (holotype, G; isotypes, C, CAS, F, G, GH, MEXU, MO, NY, O, S, TEX, UC, US).

Orthrosanthus chimboracensis var. *exsertus* f. *albus* Steyerm., Lloydia 11: 17. 1948. TYPE: Mexico. Tamaulipas: Santa Rita, Ranch Tamaulipas, 1,500 m, *Runyon 875* (holotype, US; isotype, TEX).

Plants 40–70 cm tall. Leaves 40–55 cm long, 3–8 mm wide, narrowly acuminate. Flowering stem somewhat longer than the leaves; rhipidia several-flowered. Flowers to 2.5 cm diam., blue, or occasionally white; ovary exserted from the spathes shortly after anthesis. Capsules 1–1.7 cm long, glabrous, broadly acuminate apically, well exserted from the spathes on pedicels 15–25 cm long; seeds angular to somewhat rounded, 1.2–1.5 mm at the widest diameter.

Distribution. *Orthrosanthus exsertus* is endemic to highland areas of southern and central Mexico (Nuevo León, Tamaulipas, Puebla, Michoacán, Distrito Federal, México).

The smallest of the New World species of *Orthrosanthus*, *O. exsertus* is distinctive in having comparatively narrow leaves and glabrous capsules exserted from the spathes and bracts on pedicels 15–25 mm long. Recognized only in 1981 as a distinct species, and first as a variety in 1948, *Orthrosanthus exsertus* was recorded as early as 1829 or 1830 by Schiede and a few years later by Liebmann. Their collections are among the three syntypes cited by Klatt for *Sisyrinchium occissapungum*, now *O. occissapungus*, and neotypified here by a collection from Peru.

4. **Orthrosanthus monadelphus** Ravenna, Bol. Soc. Argentina Bot. 10: 317. 1965. TYPE: Guatemala. Baja Verapaz: cumbre El Chol, ca. 2,200–2,500 m, *Ravenna 266* (holotype, Herb. Ravenna, not seen; isotypes, F, HBG).

Orthrosanthus chimboracensis var. *centro-americanus* Steyerm. Lloydia 11: 19. 1948. TYPE: Guatemala. Jutiapa: exposed rocky slopes on summit, Volcán Suchitán, northwest of Asunción Mita, *Steyermark 31913* (holotype, F).

Orthrosanthus chimboracensis var. *intermedius* Steyerm., Lloydia 11: 19–20. 1948. TYPE: Costa Rica. Cartago: Volcán Irazu, *Allen 674* (holotype, F).

Plants (15–)30–60 cm tall. Leaves 30–45 cm long, 8–10 mm wide, linear. Flowering stem to 60 cm; rhipidia several-flowered and spaced somewhat irregularly along the stem; spathe

margins narrowly hyaline. Flowers 1.4–3 cm diam., blue. Capsules 10–13 mm long, usually pubescent, sessile or nearly so, only the apices exceeding the spathes; seeds angular to somewhat rounded, 1.2–1.5 mm at the widest diameter.

Distribution. *Orthrosanthus monadelphus* is common in highland areas of Mesoamerica. It is recorded from southern Mexico to Guatemala and El Salvador, and locally to the south in Costa Rica and northern Panama.

This species is probably most closely allied to the Venezuelan *Orthrosanthus acorifolius,* with which it shares a similar, nearly sessile, and pubescent ovary and capsule. The filaments are united in the lower half, not much more so than in the other American species. Although first recognized as a distinct subspecies in 1948, and as a species in 1965, it is interesting to note that the collection cited by Martens & Galeotti (1843) as *Marica acorifolia* may be the first record for *Orthrosanthus monadelphus* [Mexico: Oaxaca, rochers gneissiques de Penoles, Misteca alta, ca. 2,150–2,300 m, *Galeotti 5368* (?BR, not seen)].

5. **Orthrosanthus occissapungus** (as *O. ocisapunga*) (Ruiz ex Klatt) Diels, Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15a: 478. 1930. *Sisyrinchium occissapungum* Ruiz ex Klatt, Linnaea 31: 379. 1861. NEOTYPE: Peru. La Libertad: along the Río Negro 3 km south of Huamachuco, *West 8113* (neotype, MO; isoneotypes, GH, UC). The three cited syntypes of *S. occissapungum* have not been found and are presumed destroyed, hence our designation of a neotype. For completeness, the syntypes are cited here as follows: Peru. Huanuco: ad Pillao etc., *Ruiz* ex Herb. Lambertii (B, not seen); Mexico. Oaxaca: Chinantla, *Liebmann 310* (location unknown) (? = *O. exsertus*); Mexico. Veracruz: Jalapa, *Schiede 1029* (location unknown) (? = *O. exsertus*).

Orthrosanthus nigrorhynchus Rusby, Mem. Torrey Bot. Club 6: 126. 1896. TYPE: Bolivia. Cochabamba: near Cochabamba, *Bang 1074* (lectotype, NY, here designated as the best preserved and most complete of three sheets at NY, the institution where Rusby worked; isolectotypes, BM, F, G, GH, K, MO, NY).

Orthrosanthus tunariensis Kuntze, Rev. Gen. Pl. 3: 309. 1898. TYPE: Bolivia. Cochabamba: im Tunarigebirge, 3,600 m (collector and location of the type not in the protologue and unknown to us).

Orthrosanthus chimboracensis subsp. *tunariensis* (Kuntze) Ravenna, Revista Inst. Munic. Bot. (Buenos Aires) 2: 30. 1969.

Orthrosanthus chimboracensis sensu Rusby, non (Kunth) Baker, in Bull. Torrey Bot. Club 29: 224. 1901.

Plants to 80 cm tall. Leaves 30–50 cm long, 3–8 mm wide, narrowly linear, sharply acute. Flowering stem to 80 cm; rhipidia typically single-flowered. Flowers 2.6–3.4 cm diam., white. Capsules (15–)22–30 mm long, glabrous, extending above the spathes on pedicels to 5 mm long; seeds elongate-angular, 2.5–3 mm at the longest axis.

Distribution. *Orthrosanthus occissapungus* is restricted to northwestern Argentina, Bolivia, and Peru, where it grows at elevations above 3,200 m.

The most unusual of the New World species of *Orthrosanthus, O. occissapungus* can be recognized by its one- to few-flowered spathes, long slender capsules, and elongate seeds. The flowers are always white in *O. occissapungus* and only occasionally so in other species in the New World.

As indicated in the nomenclature above, we have been unable to locate the original type material of *Sisyrinchium occissapungum.* The syntype from Peru, collected by Ruiz, had the manuscript epithet "*occissapungum*" according to Klatt. It was housed in the Berlin Herbarium and must be presumed destroyed. It was almost certainly conspecific with *O. nigrorhynchus* described in 1896. The two other specimens cited in the protologue are from Mexico: *Schiede 1029* (also presumed destroyed) from Jalapa in Veracruz, and *Liebmann 310* from Chinantla, Oaxaca. The latter specimen is cited as "Herb. mihi" by Klatt, that is, in his own herbarium, which was at one time at Berlin but is now at Stockholm. No Liebmann collection with this number has, however, been located at either place. Duplicates of the Liebmann collection at Copenhagen, where Liebmann's main collection is preserved, likewise do not include the missing type number. Other Liebmann specimens at Copenhagen and at Paris collected at the same locality and time are the Mexican *Orthrosanthus exsertus* and represent the first collections of that species.

We are regarding *Orthrosanthus occissapungus* as a valid combination made by Diels (1930: 478) but recognize that it would not be accepted according to the current Code of Botanical Nomenclature if made today. Diels did not cite a basionym or indicate in any way that he was making a combination in citing the species as *O. ocisapunga* (sic) Ruiz. Nevertheless, there can be

no doubt that he was placing *Sisyrinchium occissapungum* Ruiz ex Klatt in *Orthrosanthus* as the earliest name for the species known until this time as either *O. nigrorhynchus* or *O. tunariensis*, neither of which he mentioned in his enumeration of the species of *Orthrosanthus*. The name *O. occissapungus* was accepted by Macbride (1936) and Vargas (1944) but was attributed by both authors to Diels (as *O. ocisapunga* Ruiz ex Diels). We do not believe that Diels intended to describe the species, and therefore we cannot accept this treatment. We also note that it was not Diels's practice to cite the authors of species in later combinations e.g., his listing of *O. chimboracensis* Bak. [instead of (Kunth) Baker], and so there is no inconsistency in his not mentioning the authors of the basionym for *O. occissapungus*.

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