



A new rheophytic species of *Syzygium* (Myrtaceae) from the lower Kunene River of Angola and Namibia

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Abstract

Syzygium kuneneense, here described as a new species, is known only from the northern part of the Namib Desert in the Kaokoveld Centre of Endemism, southwestern Angola and adjacent northwestern Namibia. These rheophytic shrubs or small trees grow among rocks on the floodplain and banks of the lower Kunene River on the international boundary between Angola and Namibia. Diagnostic characters for *Syzygium kuneneense* include the oblanceolate or narrowly elliptic leaves, dense flower heads and the pedicellate flowers. A comparison of some of the more prominent morphological features to differentiate between *S. kuneneense* and the morphologically most similar species, *S. guineense*, is provided. Based on IUCN Red List categories and criteria, a conservation assessment of Vulnerable (VU D1) is recommended for the new species.

Keywords: Cunene River, endemism, flora, Kaokoveld Centre of Endemism, Namib Desert, taxonomy

Introduction

Syzygium Gaertner (1788: 166) is not only the largest genus in Myrtaceae (Christenhusz *et al.* 2017), but also the largest woody genus of flowering plants, comprising 1200–1800 species distributed in the Old World tropics and subtropics (SYZWG 2016). Seven species of *Syzygium* presently are recognized in the Flora of southern Africa region (South Africa, Namibia, Botswana, Eswatini, and Lesotho), two of which occur in Namibia: *Syzygium guineense* (Willdenow 1799: 974) Candolle (1828: 259) and *S. cordatum* Hochst. ex Krauss (1844: 425) (Germishuizen & Meyer 2003, Klaassen & Kwembeya 2013, Byng & Pahladsingh 2016). The generic name, according to Clarke & Charters (2016), derives from the Greek *syn-* = together and *zygon* = a yoke, hence *syzygos* = joined, referring to the paired branches and leaves.

In this contribution we describe a new species of *Syzygium* endemic to the Kaokoveld Centre of Endemism, a biogeographical region rich in range-restricted plants and animals in northwestern Namibia and adjacent southwestern Angola (Van Wyk & Smith 2001). During an expedition in January 2020 to the Kunene River Mouth in the Skeleton Coast National Park focusing on biodiversity monitoring in the new Iona Skeleton Coast Transfrontier Park, two of us (WS & VDC) encountered an unfamiliar shrub or small tree with relatively narrow leaves on the floodplain and banks of the Kunene River. On a subsequent visit in September 2020 the plants were in flower and fruit, enabling material to be collected and the plants to be identified as an undescribed species of *Syzygium*. The new species morphologically most closely resembles *Syzygium guineense*. Such an affiliation is suggested by similarities in leaf and floral characters. A study of the *Syzygium* holdings in the National Herbarium of Namibia (WIND) and the National Herbarium of South Africa (PRE) revealed two earlier collections of the new species, both filed under *S. guineense*.

Methods

Morphological descriptions and ecological information presented here are based on field observations and material collected following extensive field work in Namibia. Diagnostic features for *S. kuneneense* were determined through examination of live material and for *S. guineense*, *S. benguelense* (Welw. ex Hiern 1898: 360) Engler (1921: 737), and *S. pondoense* Engler in Engler & Bremer (1917: 341) from high-resolution images (including images of the holotypes) available on the internet through JSTOR Global Plants (<https://plants.jstor.org/>). This was supplemented by the study of herbarium collections and literature, including the relevant protologues (White 1978, Coates Palgrave 2002, Boon 2010, Van Wyk & Van Wyk 2013). The following herbaria were consulted for possible collections of the new species and *S. guineense*: PRE, PRU, and WIND (abbreviations follow Thiers 2020). A 6.5–45.0 magnification stereo microscope was used for determining morphological features. Descriptive terminology follows Beentje (2016). The distribution map was compiled from specimen data using ArcView 3.1 software. For all collections quarter degree grid squares are supplied according to the Degree Reference System proposed by Edwards & Leistner (1971). Conservation assessment follows IUCN (2012) recommendations.

Taxonomic treatment

Syzygium kuneneense Swanepoel & A.E.van Wyk, *sp. nov.* (Figs 1–5)

Diagnosis:—Shrub or small tree up to 4 m high, morphologically resembling *S. guineense*, from which it differs in being rheophytic, virgate (*vs.* tree up to 30 m high with drooping canopy, or suffrutex less than 0.3 m); lamina narrowly elliptic or oblanceolate; broadest at middle or at one third to one fifth from apex (*vs.* highly variable: elliptic, ovate, obovate, lanceolate, lanceolate-elliptic or ovate-elliptic; broadest at or near the middle), apex obtuse-acute or obtuse, base attenuate (*vs.* acuminate, acuminate-obtuse, obtuse, rounded, acute, emarginated, base cuneate, acuminate, rounded, truncate, often asymmetric); flowers much larger, receptacle (including pseudopedicel) + calyx (including lobes) = 9.1–14.6 mm long (*vs.* 3.5–6.5 mm), filaments 7–23 mm long (*vs.* 3.5–9.0 mm).

Type:—NAMIBIA. Kunene Region: Skeleton Coast National Park, 11 km ENE of Kunene River mouth, rocky banks of river, 35 m, 1711BB, 26 September 2020, *Swanepoel 398* (holotype WIND!; isotypes K!, PRE!, PRU!).

Dense rheophytic multi-stemmed shrub or small tree up to 4 m high, trunk or stems gnarled, base up to 1 m in diam., all parts glabrous. Bark on trunk and stems cream-brown to dark brown, flaking in places as irregular pieces, under bark green. Old twigs terete, grey- or red-brown, young ones rectangular in transverse section, ca. 1.8 × 2.4 mm, maroon or maroon-green, in herbarium material sometimes winged. *Leaves* opposite or sub-opposite, decussate, coriaceous; petiole 1–9 mm long, 1.5–2.0 mm diam, flat or grooved adaxially, pale yellow, drying brown to dark brown; lamina narrowly elliptic or oblanceolate, 20–105 × 4–22 mm, length:width ratio ca. 3.6–8.2:1, gland-dotted and matte on both sides, discolorous, yellow-green or green (seldom dark green) adaxially (olive-green when dry), pale green abaxially (grey-green when dry), green, maroon or maroon-green when young; apex obtuse-acute or obtuse; base attenuate, sometimes slightly asymmetric; margins entire, revolute or subrevolute, pale green; midrib prominent, especially abaxially (grooved adaxially in herbarium material), conspicuous, especially adaxially, pale yellow; venation brochidodromous, prominent both sides, inner intramarginal vein 0.4–1.4 mm from leaf margin. *Inflorescences* dense thyrsoid-cymes, appearing as globose heads at anthesis, terminal and axillary in upper leaf axils; peduncle 5–22 mm long, peduncle and branchlets rectangular in transverse section, ca. 1.4 × 1.8 mm; bracts and bracteoles narrowly triangular, ca. 1.8 × 0.8 mm, fugaceous. *Flowers* bisexual, pyriform in bud; receptacle (including ca. 2–3 mm long pseudopedicel/anthopodium) + calyx (including lobes) 9.1–14.6 mm, 3.5–7.5 mm diam., pale green to yellow-green; calyx lobes 4, deltoid or pentagonal, 1.0–1.9 × 2.0–4.4 mm, persistent at anthesis, pale green to maroon-green; corolla calyptrate, petals 4, membranous, dimorphic, two petals hemispherical, ca. 4–5 mm diam., other two (innermost) hemispherical, hooded; hood with ca. 3.5 mm long acute apical appendage, clasping a fascicle of stamens when in bud, pale green when in bud, light brown or maroon-brown before falling. Stamens 160–170, inserted in two rows, inwardly curved in bud; filaments white, sometimes with a slight pink tinge, drying red-brown, in outer row 13–23 mm long, in inner row 7–13 mm long; anther thecae ovate, 0.6–0.8 mm long, pale yellow; pollen pale yellow. Ovary 2-locular, cavity ca. 1 mm long, ovules ca. 30, ca. 0.5 mm long; style subterete, white, ca. 23 mm long, equal to or slightly exerted above stamens, tapering from slightly dilated basal portion to simple, acute stigma. *Fruits* berries with sweet

taste, subglobose, ellipsoid or obovoid, usually crowned by calyx lobes and/or upper part of receptacle, yellow-green initially, changing to white and mauve, violet when ripe, 17–25 × 15–20 mm., mesocarp white when ripe. Seed one per fruit, subglobose, 13–20 × 12–17 mm.



FIGURE 1. *Syzygium kuneneense*: habitat and habit. A. Plants (greenish shrubs in foreground) in natural habitat along the lower Kunene River where it traverses the Namib Desert. B. Plants growing as stunted shrubs among rocks in the bed of the Kunene River. Photographs: W. Swanepoel.



FIGURE 2. *Syzygium kuneneense*: habitat. A. Mature tree of more or less maximum height and in flower (human next to tree 1,8 m tall). B. Gnarled stems of old plant among rocks in river bed (ca. 1 m in diameter). Note debris deposited on plant during periodic flooding of the river. Photographs: J.A. Swanepoel (A) & W. Swanepoel (B).

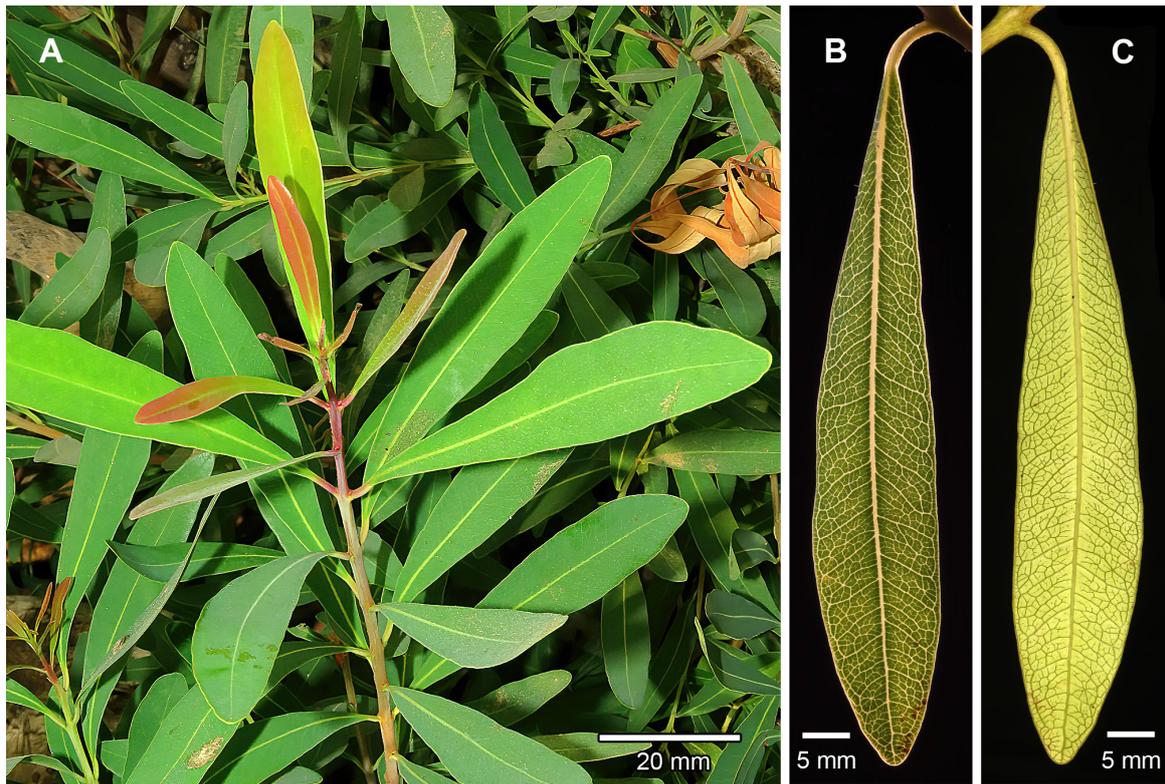


FIGURE 3. *Syzygium kuneneense*: leaf morphology. A. Branchlet with young (maroon-green) and mature leaves. B. Leaf, adaxial view. C. Leaf, abaxial view. Photographs: W. Swanepoel.



FIGURE 4. *Syzygium kuneneense*: flower buds and inflorescences. A. Leafy branchlet with young flower buds. B. Inflorescences with open flowers; appearing as globose heads. Photographs: W. Swanepoel.

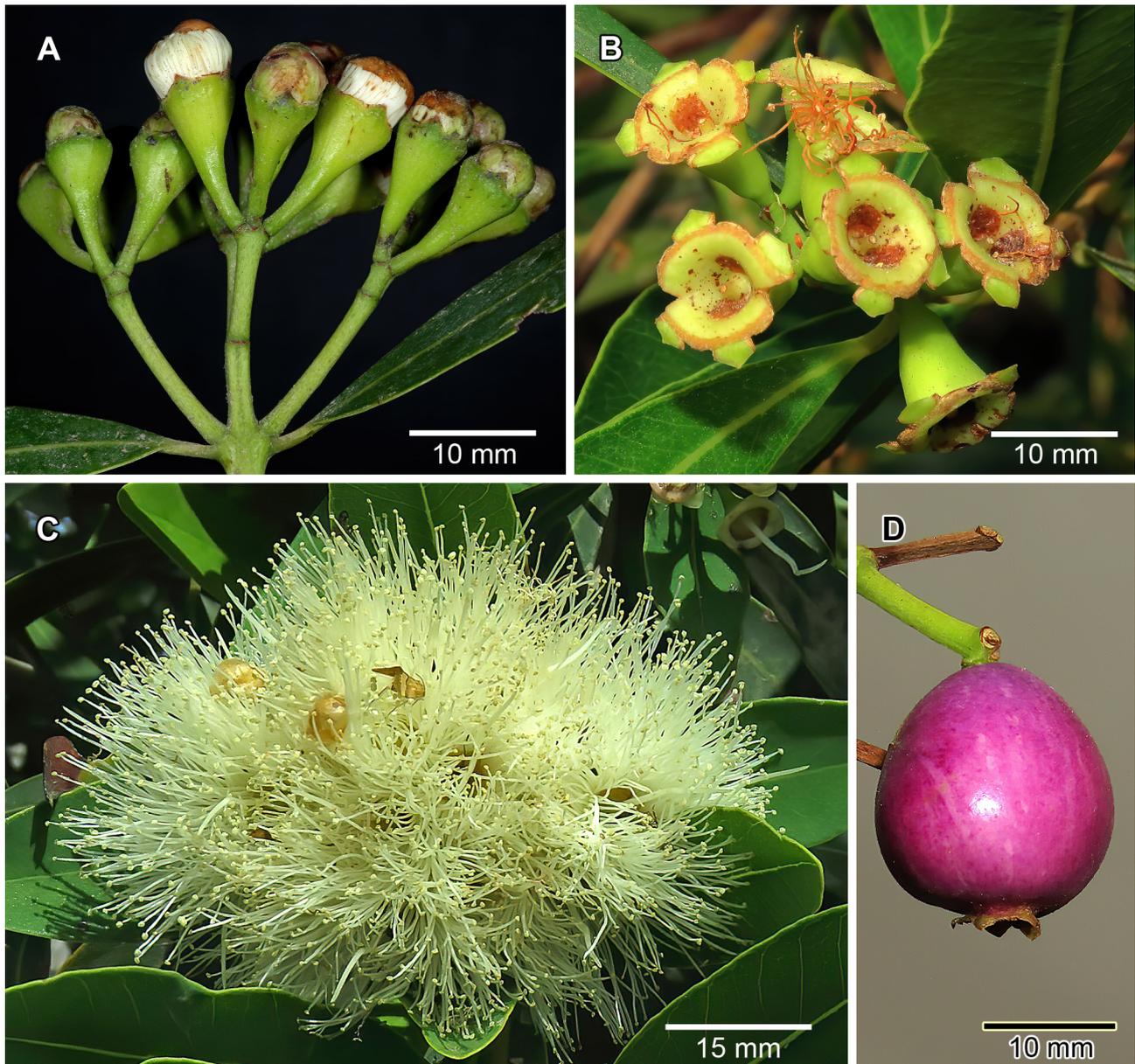


FIGURE 5. *Syzygium kuneneense*: flower and fruit morphology. A. Inflorescence with flower buds, some of the latter starting to open with whitish stamens lifting the brownish calyptrae. B. Old flowers after shedding of stamens and showing persistent short calyx lobes. C. Inflorescence with open flowers. D. Ripe fruit. Photographs: W. Swanepoel.

Phenology:—Flowers were recorded in January and September on some plants. Within the population, flowers will most probably be found throughout the year.

Distribution and habitat:—At present *Syzygium kuneneense* is known only from the lower Kunene River on the international boundary between Angola and Namibia (Figs 1 & 6). The new species occurs in small colonies of a few plants each on the specific section of the river below the Great Escarpment. This section falls within the Namib Desert zone of the Kaokoveld Centre of Endemism, a biogeographical region known for its many restricted-range plants and animals, and extending from northwestern Namibia to southwestern Angola (Van Wyk & Smith 2001). *Syzygium kuneneense* occurs approximately 7–74 km from the coast at elevations of 20–240 m a.s.l. The average annual rainfall in the area is 50–100 mm, occurs in summer and is highly erratic. However, the western part of the area regularly receives fog from the bordering Atlantic Ocean with a relative occurrence of 7% to 19% (mean 11%) fog and low clouds (Mendelsohn *et al.* 2002, Andersen & Cermak 2018). The species grows on the rocky banks of the perennial Kunene River and its adjacent floodplain. Environmental conditions in the general area are extremely harsh, with low rainfall, high temperature variation and strong winds [calm for only 14% of the time as measured at Mōwe Bay to the south (Mendelsohn *et al.* 2002)]. However, these conditions probably have little influence on the plants

since they are dependent on the reliable supply of sub-surface water from the Kunene River. The habitat is subject to seasonal flooding and plants are subsequently frequently damaged as evident by the thick and gnarled main stem on older plants, and the accumulation of driftwood and other debris on the stems. In former times, waterlogging probably took place on an annual basis, but since the 1970s has been less frequent on account of the construction of several dams upstream in Angola. Due to these dams and the regulated water flow for *inter alia* the Ruacana Hydro-electric Power Station, flooding is also much less severe (pers. comm. from several elderly Ovahimba local inhabitants), which probably accounts for the younger plants that lack the gnarled stems.

TABLE 1. Prominent morphological differences between *Syzygium kuneneense* and *S. guineense*.

Character	<i>S. kuneneense</i>	<i>S. guineense</i>
Habit	Rheophytic shrub or small virgate tree, up to 4 m tall	Small to large drooping tree up to 30 m tall or suffrutex less than 0.3 m
Aerial roots	Absent	Sometimes present (subsp. <i>barotsense</i>)
Bark	Cream-brown to dark brown	Dark brown, silvery grey to grey-brown (pale grey or greyish white in subsp. <i>barotsense</i>)
Leaf (lamina)		
Shape	Narrowly elliptic or oblanceolate; broadest at middle or at one third to one fifth from apex	Very variable: elliptic, ovate, obovate, lanceolate, lanceolate-elliptic or ovate-elliptic; broadest at or near middle
Apex	Obtuse-acute or obtuse	Acuminate, acuminate-obtuse, obtuse, rounded, acute, emarginate
Base	Attenuate	Cuneate, acuminate, rounded, truncate; often asymmetric
Size (length × width)	20–105 × 4–22 mm	40–140 × 20–70 mm
Colour	Yellow-green or green (seldom a few dark green) adaxially, paler abaxially	Bright green or dark green adaxially with grey bloom, green abaxially
Petiole (length)	1–9 mm	2–25 mm
Flowers		
Receptacle length (including pseudopedicel) + calyx (including lobes)	9.1–14.6 mm	3.5–6.5 mm
Filament length	7–23 mm	3.5–9.0 mm
Fruit		
Shape	Obovoid, subglobose or ellipsoid	Ovoid, subglobose or ellipsoid
Size (length × width)	17–25 × 15–20 mm	13–35 × 12–25 mm
Mature colour	Violet	Purple-black, reddish purple, dark purple, cerise, almost white or purple and white
Distribution	Lower Kunene River, Angola, and Namibia	Widespread in Africa, from Senegal to Somalia, and southwards to Angola, Namibia, Botswana, and South Africa

Conservation status:—Although rare and known from a small area with an Extent of Occurrence (EOO) of 5 km², *Syzygium kuneneense* is probably not threatened at present as the bulk of the known population occurs in the Iona National Park (Angola) and the adjacent Skeleton Coast National Park (Namibia), together forming the newly proclaimed Iona Skeleton Coast Transfrontier Park. It is a remote and protected area with limited access to humans, which is especially true for the Namibian part. No signs of damage caused by animals or humans could be found on any of the *in situ* specimens examined and all plants were in good condition. It should be considered as Vulnerable (VU D1) due to the small known population size (IUCN 2012).

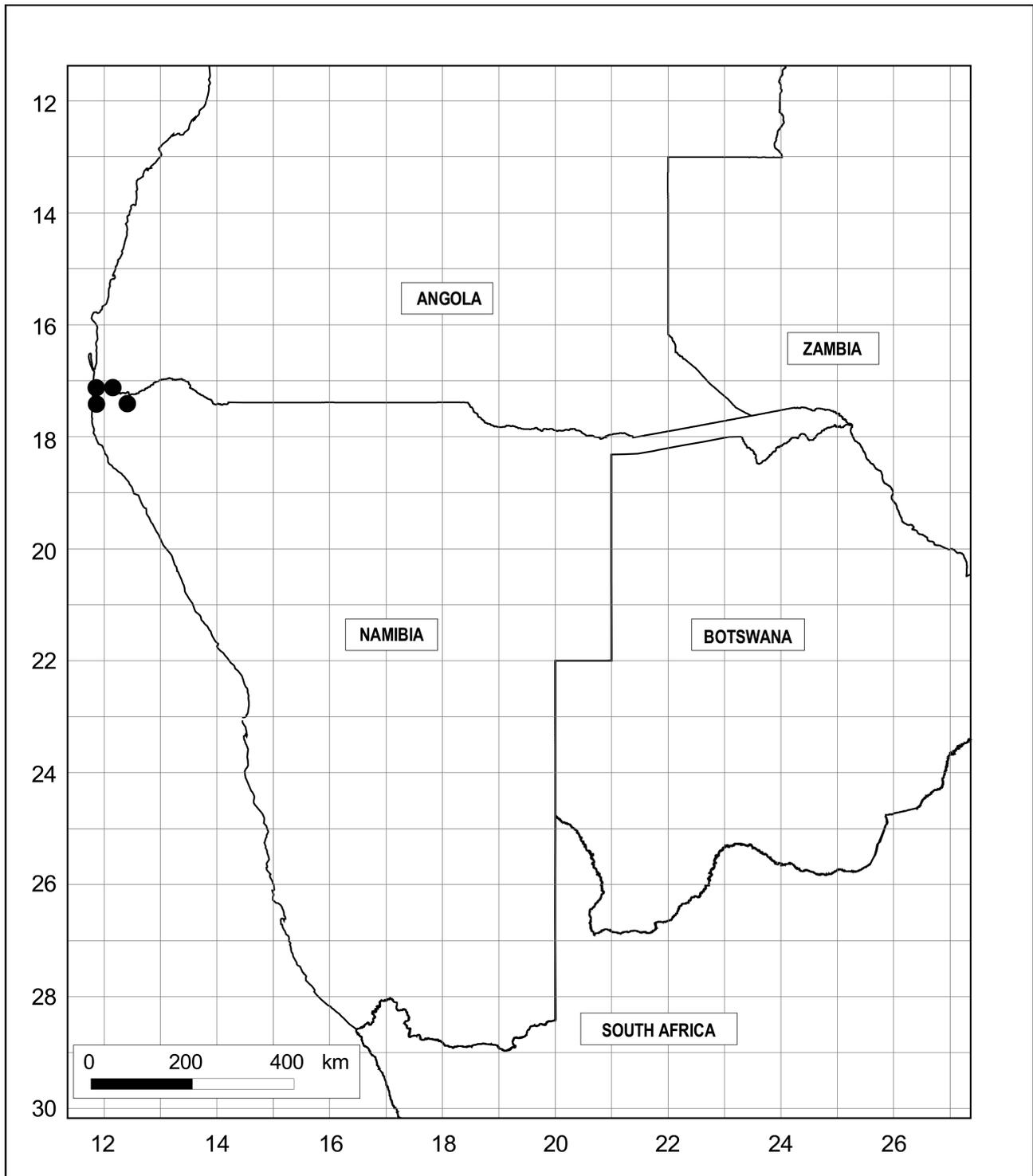


FIGURE 6. Known distribution (black dots) of *Syzygium kuneneense*. Based on herbarium collections in PRE, PRU, and WIND.

Etymology:—The specific epithet refers to the Kunene River (spelt “Cunene” in Angola), which forms the international boundary between Angola and Namibia.

Notes:—*Syzygium kuneneense* morphologically resembles and may be closely related to *Syzygium guineense*, a widespread species with which it has hitherto been confused. It differs from *S. guineense* in habit, leaf, and floral characters. Both species occur on the lower Kunene River, but distribution ranges do not overlap: *S. kuneneense* occurs west of the Great Escarpment downstream almost to the Kunene Mouth, and *S. guineense* subsp. *barotsense* White (1962: 455) above the escarpment, upstream from Epupa Falls and into Angola towards the upper reaches of the river. The morphological distinction between the two species is quite obvious when the two are compared. They also occupy different habitats; *S. kuneneense* grows in rocky places, whereas *S. guineense* occupies sandy alluvial areas. Within

southwestern Africa, the new species can also be confused with *Syzygium benguellense* from southwestern Angola. The latter is a tree up to 12 m high, has broadly elliptic or elliptic-oblong leaves with apices obtuse, rounded, obtuse-acute, acute or emarginated, leaf bases obtuse, rounded or truncate and very short petioles, 2.0–2.5 mm long (vs. a shrub or tree up to 4 m tall, leaves narrowly elliptic or oblanceolate, apices obtuse or obtuse-acute, leaf bases attenuate and petioles 1–9 mm long). *Syzygium kuneneense* can also be confused with *S. pondoense*, the only other strictly rheophytic species from the Flora of southern Africa region, due to the relatively narrow leaves. *Syzygium pondoense*, however, has grey bark, narrowly oblong, shiny leaves with sharply acute or obtuse leaf apices (vs. cream-brown to dark brown bark, narrowly elliptic or oblanceolate, matte leaves, apex obtuse-acute or obtuse); it is endemic to the Pondoland Centre of Endemism (Van Wyk & Smith 2001). Some of the more prominent morphological features to distinguish between *S. kuneneense* and *S. guineense* are provided in Table 1.

Additional collections (paratypes):—ANGOLA. Namibe Province: Kunene rapids, 20 m from mouth, 1711BB, June 1973, *Smith GOS 568* (PRE!; WIND!).

NAMIBIA. Kunene Region: Kunene River, 7.5 km east of mouth, rocky river bank, 1711BD, 27 January 2020, *Swanepoel & De Cauwer 397* (WIND!); Kunene River, 23 km ENE of mouth, 1712AA, 28 September 2020, *Swanepoel 399* (WIND!); Cunene River. Angola/Namibia border, 1712AD, 15 November 2009, *Reinecke 30* (PRE!).

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