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Sansevieria pfennigii (Ruscaceae, Asparagales): Confirmation of existence, emendation of description, and tentative threat assessment

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Abstract

Sansevieria pfennigii, which to date has been a doubtful species, is confirmed as extant by a recent collection from the Lindi Region in southern Tanzania. The original description of the species, which is based on herbarium material only, is here emended based on additional observations recorded from living plants, including fruits that were previously unknown. *Sansevieria pfennigii* distinguishes from *S. canaliculata*, to which it was repeatedly assigned, by its capitate instead of elongate inflorescence, rough rather than smooth leaves, non-pungent instead of pungent leaf tips, dull green leaf colour, more delicate overall appearance, alongside other traits. The difference in inflorescence architecture indicates that these species belong to different groups within *Sansevieria* and are not closely related; the closest relatives of *S. pfennigii* are probably *S. fischeri* and *S. stuckyi*. *Sansevieria pfennigii* occurs on well-drained soil in forests, close to *S. canaliculata* populations. According to the extent of the population seen and the species' overall rarity, it is tentatively assessed as critically endangered.

Introduction

Sansevieria as a genus was established by Thunberg (1794: 65) based on two species, *S. thyrsiflora* Thunberg (1794: 65) and *S. aethiopica* Thunberg (1794: 65). The generic name *Sansevieria* was taken by Thunberg from a letter from Petagna (Menale *et al*. 2013, Mangani 2015), but the spelling was changed from Petagna's "*Sanseverina*" (Mangani 2015). Up to 1915, *Sansevieria* already included 54 species, many of which were newly described by Brown (1915) in his landmark monograph. Brown (1914) had previously discussed the difficulties of separating *Sansevieria* from *Dracaena* Linné (1767: 229, 246), noticeably its closest relative, stating that the only reliable difference between the two genera was the leaf succulence of the former, but sought a solution based on floral morphology by separating *Pleomele* Salisbury (1796: 245) from *Dracaena*. The case was taken up by Bos (1984, 1998) who claimed to merge all dracaenoids, as the group is often named informally, under *Dracaena* (Bos 1998), although he did not formally provide the taxonomic recombinations needed. These were finally done by Mabberley (2017), Byng & Christenhusz (2018) and Takawira-Nyenya *et al*. (2018). The latter also presented a phylogeny based on 19 *Dracaena* and 26 *Sansevieria* species (covering about 20 % of the taxonomic diversity within the group), demonstrating that *Sansevieria* is a monophyletic clade nested within a larger tree of *Dracaena*, but with poorly resolved relationships within *Dracaena* itself. An earlier attempt to address this matter (Lu & Morden 2014) had also failed to resolve relationships within *Dracaena* in a convincing manner, but had also showed *Sansevieria* as monophyletic and nested within *Dracaena*. Apart from this fundamental structure, the phylogenetic tree in Lu & Morden (2014) has little in common with that in Takawira-Nyenya *et al*. (2018), neither for *Sansevieria* nor for *Dracaena*, and another tree presented by Kleinwee (2018) for *Sansevieria* alone is different from both of them. As a consequence, we consider it premature to unite all dracaenoids in one genus without understanding their evolutionary relationships in at least some detail, and therefore uphold *Sansevieria* as a well-defined and monophyletic genus, as Christenhusz *et al*. (2017), Martin *et al*. (2019) and Newton (2020) did. According to the latter, *Sansevieria* currently includes 84 species and 13 infraspecific taxa.

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Sansevieria pfennigii Mbugua (2007: 33) was first, and to our knowledge only once, collected by Hans Joachim Schlieben in 1935 in Tanzania, Lindi Region, near Lake Lutamba. Therefore, it is a species described with a delay of more than 70 years after the collection of the type specimen (Mbugua 2007), honouring the German *Sansevieria* enthusiast Horst Pfennig (1933–1994); although Mbugua had already described this species in his PhD thesis, submitted to the University of Reading in 1995, this work remained unpublished.

Hans Joachim Schlieben was a very successful plant collector. In his five years in East Africa, 1930–1935, he collected plant material amounting to 6,932 field numbers, many of them in replicates of ten or more which were to be distributed among herbaria (Mildbraed 1932, Schlieben 1941, Leistner 1976). Several hundreds of his collections turned out to represent taxa new to science, and many were named "*schliebenii*" in honour of the collector (Leistner 1976, IPNI 2020+). In the Lindi Region alone, where he stayed from Aug 20th 1934 to Jul 15th 1935, Schlieben collected more than 800 different taxa (field numbers 5784 to 6610; Leistner 1976). The later *Sansevieria pfennigii*, with number *5917*, was collected in January 1935. Schlieben also recorded an indigenous name of the plant, "Ukongimito" (in Kimuera on the label in B).

Horst Pfennig collected *Sansevieria* extensively in East Africa in the 1970s and 1980s to cultivate the plants in his private estate in Herford, Germany. He visited the Lindi region in 1975 (Pfennig 2019) to look for the enigmatic plant he had already seen in several herbaria, *Schlieben 5917* (Pfennig 1981), which was later called *S. pfennigii*. However, he was satisfied with finding *S. canaliculata* Carriere (1861: 449) there, believing to have, thereby, correctly identified plants under *Schlieben 5917* (Pfennig 1981). Pfennig never published a proper report on the issue but only mentioned it in nine scant lines of a paper dedicated to something different, although he indicated to write an explicit report later (Pfennig 1981).

After publication of the description of *S. pfennigii* in Flora of Tropical East Africa (Mbugua 2007), the existence of *S. pfennigii* as a species separate from *S. canaliculata* was rejected by many botanists, including Butler & Jankalski (2010), Mansfeld (2013), Jankalski (2015), Webb & Newton (2018), and Newton (2020), possibly because they agreed with Pfennig's interpretation of the *Schlieben 5917* collection. Furthermore, in several works *S. canaliculata* is not mentioned as a species occurring in mainland East Africa (e.g. Mbugua 2007, Newton 2001), although it is present in both Tanzania and Mozambique (WCSP 2019, Newton 2020). The name *Sansevieria pfennigii* was also given erroneously to plants in cultivation, thus increasing the confusion around these names.

To elucidate this matter, the first author of this paper visited the Lindi Region in Tanzania, in March 2018, where Schlieben had collected the later type specimen of *S. pfennigii*. Indeed, *S. pfennigii* was found there, growing in close vicinity to *S. canaliculata*. This is the first documented recollection of *S. pfennigii* since Schlieben's collection in the 1930s.

Material and Methods

Field trips were conducted in March 2018 in the Lindi Region, Tanzania, where living specimens were measured *in situ* and collected for herbarium specimens preparation and cultivation. Herbarium specimens are kept at Potsdam Botanical Garden Herbarium. Measurements were made on four individuals, using a folding rule and a digital hand calliper. Our data were compared to those reported in the relevant literature on *Sansevieria* (Brown 1915, Chahinian 2005, Mbugua 2007, La Croix 2010, Mansfeld 2013, Newton 2020), as well as to the protologue and type material of *S. pfennigii* (Mbugua 2007), in order to assess the identity of our plants. The original description (Mbugua 2007) is based on dried herbarium material only, as nothing else was hitherto available. Finally, we provide a brief characterisation of the habitat and the population *in situ*. Elevation was measured by Garmin GPSmap 60CSx.

Results

Our plants were morphologically congruent with the circumscription of *S. pfennigii*, for which we provide here an emended description based on our observations of living plants, both in the wild and in cultivation, and add photographs of them. Our own observations are reported in bold. Also, we describe here fresh fruits and seeds that were up to now unknown to science.

Description:—Rhizome underground, **colour yellowish brown**, **ca. 1 cm** to 1.8 cm wide, **sometimes conspicuously (up to 30 cm) deep in the ground** (Figure 1c). **Leaf solitary**, cylindric, **erect to arching** (Figures 1a–c, 3b), **up to**

85 cm long, up to 1.3 cm in diam., 4–6 major and some minor furrows (Figures 2a-d), no main sulcus ("channel") present (as remnant of the adaxial leaf surface, like in *S. stuckyi* Godefroy-Lebeuf [1903: 173], *S. bacularis* Pfennig ex Butler & Jankalski [2010: 3] and *S. fischeri* [Baker 1898: 577] Marais [1986: 58]); **slightly to conspicuously rough by cross wrinkles** (not smooth, Figures 2a, 2c), toward apex slightly narrowing into a thorny tip (but not pungent) ca. 3–4 mm long, tip reddish brown at base, **stramineous towards the apex**; **underground leaf parts yellow** (Figure 1c), **above ground in natural habitat uniformly blackish to bluish green** (Figures 2c, 3b), in cultivation bearing lighter green to whitish spots and rings on, at least, the youngest leaves (further observation is needed). **Peduncle length depending on the depth of the rhizome** (7 cm long in our specimen, Figure 1c), axis 0.5–0.7 cm in diam., **bracts along the peduncle 1–4**, ca. 1.5 cm long, **ca. 2 cm wide**, acute, **nearly amplexicaul**; **lower inflorescence bracts** (just below the fertile part of the inflorescence) large (Figure 1c), **1.0–1.2 cm long, 0.5–0.6 cm wide**. **Fertile part of the inflorescence appearing just above ground** (Figure 1a), resting on the soil (possibly mimicking a flower laying on the ground, similar to *Sansevieria hallii* Chahinian [1996: 7] and *S. humiflora* Richards [2004: 3]). Flowers in a head-like (capitate) arrangement, **fertile part of the inflorescence ca. 8 cm long, ca. 7 cm wide** (taken from the type specimen in B), one flower per cluster, white and rose (further observation is needed). **Fruit a 1–3-lobed berry (globose only if one-seeded), up to 1.8 cm wide, unripe surface slightly rugose, ripe surface smooth, unripe berries deep bluish green, mature berries bright orange *in vivo*, blackish *in sicco*, surface with small whitish dots** (Figures 1a, 1g). **Seeds ovoid to subglobose, about 6.5 mm long and 6 mm thick, light brown, with a significant chalaza that is darker brown than the rest of the seed and striate** (Figure 1d).

An overview of the traits is given in Table 1.

TABLE 1. Characteristics of *Sansevieria pfennigii* and *S. canaliculata.*

	S. pfennigii	***S. canaliculata***
leaf	arching, flexible	erect, stiff, rigid
leaf colour	blackish to bluish green, dull	medium green, somewhat shiny
leaf surface texture	rough by wrinkles perpendicular to leaf axis	Smooth
leaf apex	barely pungent, slightly tapering towards apex	pungent, abruptly narrowing towards apex
furrows	distinct but not prominent	very prominent
inflorescence	capitate, resting on the ground	spike-like, well above the ground
bracts	1.0–1.2 cm long, 0.5–0.6 cm wide	ca. 0.4 cm long
flowers per cluster	1	3
flower measurements	perianth 3.5–4.2 cm long, lobes 0.2 cm wide (Mbugua 2007); further observation is needed	perianth ca. 3.5–4.2 cm long, tube 2.0–2.5 cm, lobes 1.5–1.7 cm long (Newton 2020, Chahinian 2005, own observation)
general appearance	delicate (compared to *S. canaliculata*)	stout (compared to *S. pfennigii*)

Specimens seen:—TANZANIA. Lindi Prov.: Rutamba, Lake Lutamba, 28 January 1935, *Schlieben 5917* (holotype MO!; isotypes B!, HBG!, K!); 23 March 2018, *U. Scharf & K.A. Khamis Sspf12* (Potsdam Botanical Garden Herbarium!).

Geography and site conditions:—*Sansevieria pfennigii* was found in Tanzania, Lindi Region, near Lake Lutamba, in March 2018 (Figure 3c). It grows within an undulating landscape, characterised by hills with well-drained soil on bedrock. We measured elevations from 169 to 206 m above sea level. The plants were found growing under the canopy of medium-sized trees and shrubs which impose shade onto them in a more or less patchy manner. The intensity of light might change throughout the day according to this patchiness, and it generally differs depending on the season. On the highest point of the hills, dense stands of *S. canaliculata* were found (Figure 3a), some of which consisted of several hundred more or less uniform leaves. *Sansevieria pfennigii* grows sympatric with *S. canaliculata*, always lower in number, preferring the margins of the *S. canaliculata* stands and the more inclined banks of the hills (Figure 3b). In contrast to *S. canaliculata*, *S. pfennigii* is very variable regarding length, diameter and orientation of the leaves (Figure 3b). The occurrence is within a forest reserve.

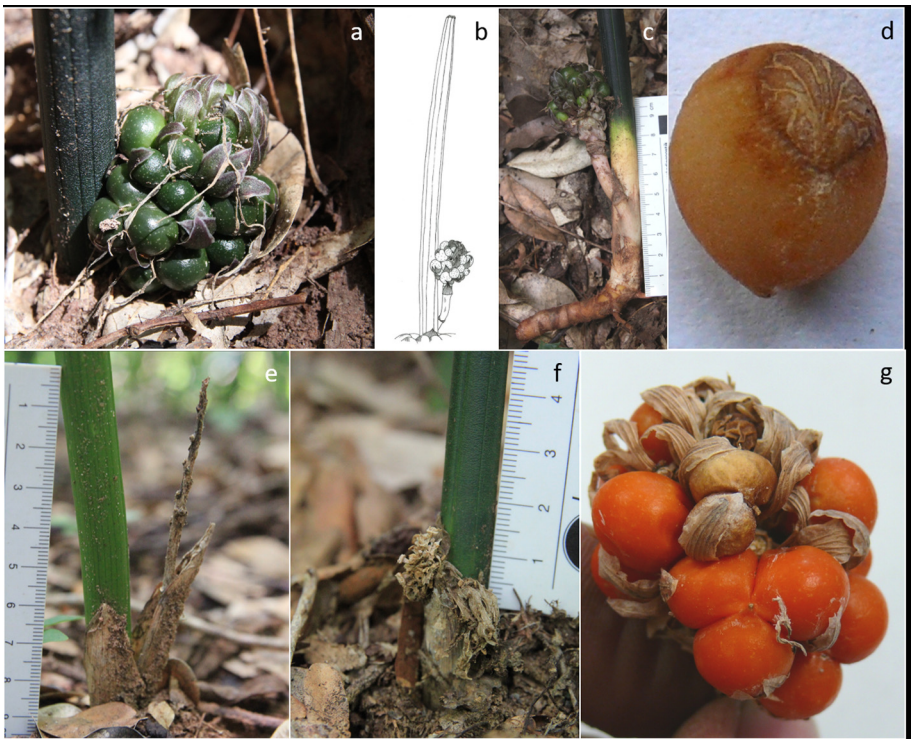

FIGURE 1. Rhizome, infructescence, fruit and seed. a: Young infructescence of *S. pfennigii in situ*, Lindi Region, *U. Scharf & K.A. Khamis Sspf12*. Note colour and surface structure of the leaf. b: Fruiting *S. pfennigii*. Note that the original soil surface was close beneath the infructescence (same plant as in figure 1a). The leaf is 30 cm long. c: The same plant as in figure 1a, uprooted. Note colour and thickness of the rhizome. d: Seed of *S. pfennigii*. e: Leaf base and old infructescence of *S. canaliculata in situ*, Lindi Region. f: Leaf base and old infructescence of *S. pfennigii in situ*, Lindi Region. g: Ripe infructescence of *S. pfennigii*, *U. Scharf & K.A. Khamis Sspf12*. Note three-lobed berry in the center and large bracts in the upper part of the picture. a, c, e, f: Photos U. Scharf, b: drawing J. Roßberg, d, g: Photos M. Burkart.

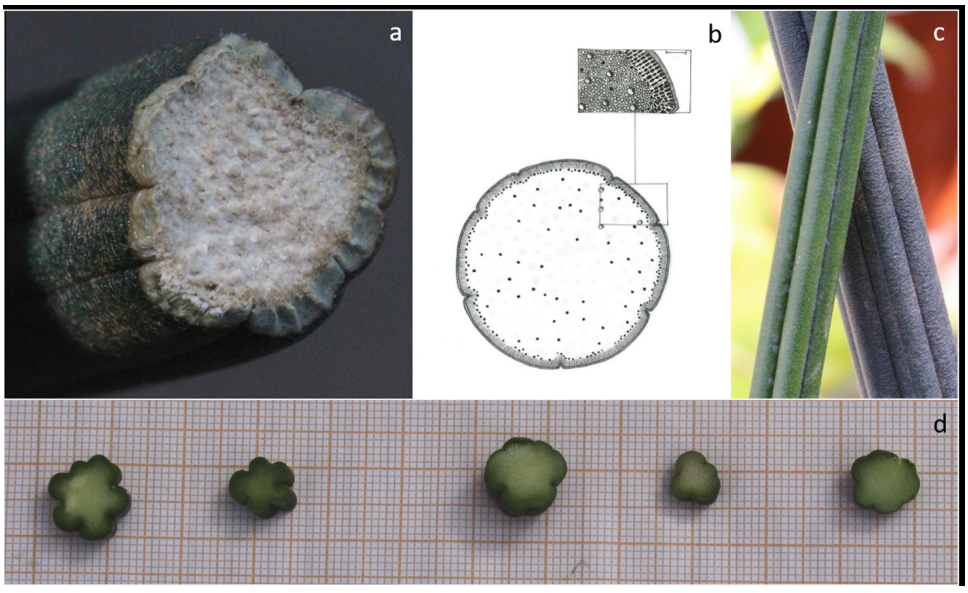

FIGURE 2. Leaves of *S. pfennigii* and *S. canaliculata*. a: Partially dried cross section of a *S. pfennigii* leaf. Note dull green colour and cross wrinkles on the leaf surface. The contrasting tissue to the right is part of the epidermis. b: Leaf cross section of *S. pfennigii*. The length of the bar in the upper right corner of the detail section is 1 mm. c: Fresh leaves of *S. canaliculata* (front) and *S. pfennigii* (back), grown *in situ*. d: Cross sections of fully turgescent leaves of *S. canaliculata* (two to the left) and *S. pfennigii* (three to the right). The difference in the longitudinal furrows is clearly visible. Photos M. Burkart, drawing J. Roßberg.

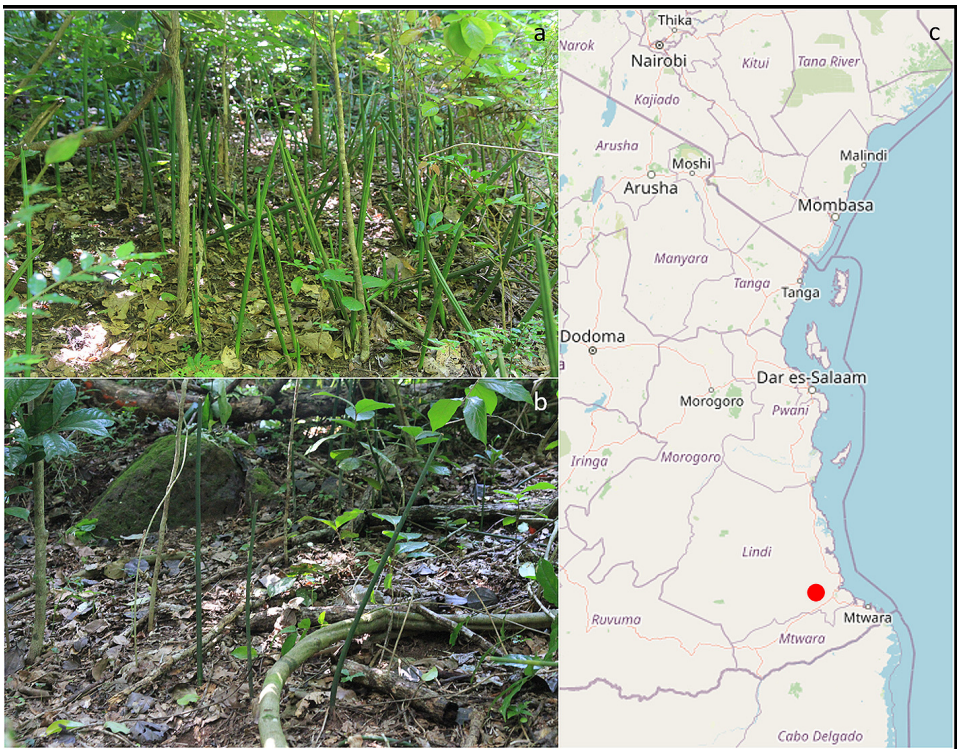

FIGURE 3. Habitat and map of occurrence. a: *S. canaliculata* in its natural habitat, Lindi Region. Note shiny green foliage and pungent leaf apices. b: *S. pfennigii* in its natural habitat, Lindi Region. c: Map of E Tanzania with the location of the *S. pfennigii* population studied (red dot). Photos U. Scharf, map from © OpenStreetMap contributors, download 4.1.2021 from openstreetmap.org, modified.

Discussion

Distinguishing characteristics and taxonomic position:—*Sansevieria pfennigii* possesses characteristics that distinguish it from all other known species. Based on the capitate inflorescence type, it clearly belongs to the section *Cephalantha* Jankalski (2015), corresponding to the subgenus *Capitulatus* in Mbugua (2007) which was, according to Jankalski (2015), invalidly published. *Sansevieria canaliculata* however, which is most similar to *S. pfennigii* vegetatively (although not identical, Table 1), has spike-like inflorescences (see illustration in Mansfeld 2013, p. 54) and therefore belongs to the section *Sansevieria* Thunb. Therefore, a close relationship between these two species is unlikely. The difference can still be seen easily on dry remnants of the inflorescences a long time after flowering (Figures 1e, 1f). *Sansevieria canaliculata* is also different from *S. pfennigii* by its smooth, shiny, stiff, medium-green leaves (Figure 2c) with pungent leaf apices and more prominent furrows (Figure 2d), inflorescences born well above the ground, bracts that are only 0.4 cm long, up to 3 flowers per flower cluster, and a more stout general appearance. In the section *Cephalantha*, there are two other species with cylindrical leaves: *Sansevieria stuckyi* and *S. fischeri*. Both have a more or less yellow colouration of their underground parts, similar to *S. pfennigii*, and both occur in East or South-East Africa. On the other hand, both are much larger in all parts, especially leaf diameter (about 3–6 cm at the leaf base, in contrast to *S. pfennigii* with only 0.4–1.3 cm at the leaf base) and leaf length (up to 3 m in both species), and both have a "channel" to their leaves as a remnant of the leaf adaxial surface which is lacking in *S. pfennigii*. *Sansevieria fischeri*, found north of *S. pfennigii*, also has rough leaves which are solitary, inflorescences resting on the ground, and relatively small flowers (Mbugua 2007); *Sansevieria stuckyi*, located south of *S. pfennigii*, also has smooth fruits (Jankalski 2015) and prefers shaded sites. Regarding these morphological, ecological, and distributional traits, it is easy to suppose that all three of them form a group of closely related species, but it is difficult to decide what the specific relationship among them could be. *Sansevieria fischeri* has more traits in common with *S. pfennigii* than *S. stuckyi* and therefore might be its closest extant relative. Alternatively, the two larger species might be closest to each other, and the much smaller *S. pfennigii* more distantly related.

Geography and site conditions:—The type locality described by Schlieben (1941, *Schlieben 5917*) is today either populated area, rice fields or orchards. The habitat we found *S. pfennigii* in is not the type locality of Schlieben,

but is located in another part of the surroundings of Lake Lutamba. The elevations we measured (169 to 206 m above sea level) correspond to Schlieben's records of 160 to 210 m elevation, according to the labels in B, HBG, K, and MO. The ecology of the forests in that region is described in Mildbraed (1935) and Schlieben (1941), who characterise the forest floor as more or less shady according to season.

Preliminary threat assessment:—The population of *S. pfennigii* was found in a forest reserve of ca. 10 km² size. Few people visit these hills; in contrast to the populated areas at Lake Lutamba, some wild animals like forest hogs and monkeys live in the hills. As *S. pfennigii* seems to depend on undisturbed places under the canopy of trees, we think that this preserved area is the last hiding place and most probably the only reason why this species is still alive in the Lindi Region and not already extinct in the wild. In the few days we were in the field, it was not possible to find a similar place. No answer can be given to the question whether or not there are other populations elsewhere.
Since 1935, no other population was discovered and, to date, this species has not been in cultivation. Therefore, we expect a very small recent distribution area for *S. pfennigii*, which could be restricted to this single population.
Therefore, we tentatively consider *S. pfennigii* to be critically endangered (CR); both IUCN criteria B1—Extent of occurrence < 100 km² and B2—Area of occupancy < 10 km² apply, and there is only one population known (IUCN 2012).

Conclusions and prospects:—The new collection *Scharf & Khamis Sspf12* (stored in the Potsdam Botanical Garden Herbarium and living collection) belongs to *S. pfennigii*, and is very similar to the type, *Schlieben 5917*. It is the second known collection of this species, collected more than 80 years after the first. This proves both the existence of *S. pfennigii* as a valid species and its extant occurrence in its natural habitat. The combination of characteristics is unique in the genus and enables unambiguous identification with flowers or fruits as well as without them. The capitate inflorescence makes any close relationship to *S. canaliculata* unlikely. The similarity in leaf traits of these two species seems to be a consequence of their common habitat preference.

Of the collections cited in Mbugua (2007) for *S. pfennigii*, only *Schlieben 5917* represents this taxon. The others we comment as follows: *Stuhlmann 1126a* (HBG!) from Pangani is situated on the border to Kenya in about 600 km distance. It represents most probably *S. fischeri*, having cylindrical but much thicker leaves than *S. pfennigii*. *Luke & Kibure 9773* (MO!) from Mto Nyangi Hippo Pools, Lat 0934 S Long 3917 E, is most probably *S. canaliculata*.

To protect *S. pfennigii*, we informed the conservation authorities of the forest reserve in the Lindi Region to prevent any unauthorised collection of that population. We further recommend establishing an ex situ cultivation in an appropriate botanical garden in East Africa.

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