



## Studies in *Schoenoplectiella* (Cyperaceae) in tropical West Africa

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*Schoenoplectiella patentiglumis*, a species described from Natal (South Africa) and previously known from Mozambique and Zimbabwe only, is reported for the first time from tropical West Africa (Benin, Burkina Faso and Nigeria) where it has been confused with *S. articulata*. *Schoenoplectiella raynaliana*, a rare species only known from the type locality in Togo, is shown to be morphologically conspecific with the widespread African species *S. proxima*. These findings are the result of examining, measuring, photographing, making notes and illustrations from numerous collections of *S. patentiglumis* and *S. proxima* in several different herbaria.

Key words: Cyperaceae, *Schoenoplectiella*, taxonomy, tropical West Africa

### Introduction

*Schoenoplectus* (Rchb.) Palla (1888) is one of the segregate genera of the very heterogeneous and un-natural genus *Scirpus* Linnaeus (1753). Embryological studies by Van der Veken (1965) demonstrated that both genera are in fact not closely related and since then their generic status was no longer questioned. Molecular studies, however, showed *Schoenoplectus* to be polyphyletic (Muasya *et al.* 1998; also: Simpson *et al.* 2007). Based on these results the new genus *Schoenoplectiella* Lye (2003) was described in order to accommodate 26 species formerly placed in *Schoenoplectus*, most of them comparatively small, amphicarpous annuals from Africa and Madagascar. This new genus corresponded with *Schoenoplectus* section *Supini* (Cherm.) J. Raynal (1976) and three oddly placed additional species from section *Actaeogeton* (Rchb.) J. Raynal (1976). Subsequent molecular studies confirmed the generic status of *Schoenoplectiella* but the genus was expanded to include the entire section *Actaeogeton* (Jung & Choi 2010). As such, it comprised 50 species worldwide in warm temperate to tropical regions, divided in two sections: section *Schoenoplectiella* and section *Actaeogeton* (Rchb.) Hayasaka (2012), corresponding respectively with *Schoenoplectus* section *Supini* and section *Actaeogeton* (Hayasaka 2012). These findings subsequently have been corroborated by recent molecular studies although further morphological and molecular data are needed for section diagnosis (Shiels *et al.* 2014).

*Schoenoplectiella* section *Schoenoplectiella* is well-represented in Africa and Madagascar and endemism is particularly notable there (Hayasaka 2012). Yet, some members of the genus are still poorly understood and in need of revision. Our studies on the genus in tropical West Africa have shown that *S. patentiglumis* (Hayasaka) Hayasaka, originally described from southern Africa, also occurs in Benin, Burkina Faso and Nigeria in West Africa. Moreover, we found that *S. raynaliana* (U. Scholz) Lye, a species only known from the type locality in Togo, falls within the variability of *S. proxima* (Steud.) Lye and should be synonymized with it.

### Material and methods

Numerous relevant herbarium collections were examined (partly digitized specimens from online sources such as JSTOR) from the herbaria B, BP, BR, K and P (for herbarium acronyms, see Thiers 2016+). In addition, numerous literature references were examined in order to better understand the distinguishing features useful for the separation of the species of concern.

Floral details and measurements were made of the species from collections. Macro-morphological characters were measured by conventional ruler calibrated in millimeters. Microscopic features were recorded with an Alpha stereomicroscope with graticule at ×40 magnification. Photographs using a Canon Power Shot AS2100 IS on macro setting were taken through a microscope. Digital images were adjusted in Photoshop to improve clarity.

## Results and discussion

### *1. Schoenoplectiella patentiglumis*, new to the flora of tropical West Africa

While preparing a monograph of the genus *Schoenoplectus* (Hayasaka 2002) a new species turned up from southern Africa, *S. patentiglumis* Hayasaka, subsequently transferred to *Schoenoplectiella* as *S. patentiglumis* (Hayasaka) Hayasaka (Hayasaka 2012). The type material was from Natal, South Africa, but additional collections were seen by Hayasaka from Mozambique and Zimbabwe (Hayasaka 2003). Herbarium research on South African collections proved that this species was in fact quite widespread in Zambia, Namibia (incl. Caprivi Strip), Botswana, Swaziland and various parts of South Africa (Limpopo, Kwazulu-Natal) (pers. comm. C. Archer March 2016). This new species was assigned to *Schoenoplectus* section *Supini* and, more precisely, to the *S. articulatus* (L.) Palla complex. *S. patentiglumis* was separated from *S. articulatus* by its narrowly to broadly ovate, stramineous glumes that are spreading at maturity, partly exposing the rachilla (vs. broadly ovate-triangular, reddish-brown glumes that are appressed at maturity); the shorter anthers (0.7–1 vs. 1.1–2 mm long); the lower number of spikelets per inflorescence (up to 12 vs. up to ca. 100) and the narrower culms (1–3(–4) mm vs. (2.5–)3–8 mm wide) (Hayasaka 2003).

Raynal, during his revisions of this section (Raynal 1976), was already aware of the problems posed by *Schoenoplectus articulatus*. He drew the attention to aberrant plants seen in Rhodesia with pale, more acute glumes that are remarkably patent at maturity. He annotated a collection from Zambia, preserved in K, as follows: “*Schoenoplectus articulatus* (L.) Palla (the ‘Rhodesian’ form with pale glumes) despite the mostly 2-sided nuts (a few normal 3-sided can be seen)”. This collection also belongs to *Schoenoplectiella patentiglumis* and emphasizes the fact that achenes can be either trigonous (from trifid styles), like in the original description, or partly to mostly plano- or biconvex (from bifid styles).

During the preparation of an account of *Schoenoplectiella* and *Schoenoplectus* of West Tropical Africa (Browning & Mesterházy, in prep.) one of us (A.M.) identified one of his own collections from Benin as *Schoenoplectiella patentiglumis*, an identity that was subsequently confirmed by E. Hayasaka (pers. comm. March 2016). A further examination of specimens of *S. articulata* from tropical West Africa in the (digital) National Herbarium in Paris, France (P), where Raynal’s collections are preserved, yielded an additional record from Burkina Faso (Haute Volta). The first author, alerted by these findings, critically revised the collections of *S. articulata* in the herbarium of the Botanic Garden of Meise, Belgium (BR) and found yet another collection, this time from Nigeria. These records considerably extend the species’ known distribution area.

The following description is slightly modified from Hayasaka (2003) in order to also apply to plants found in tropical West Africa. Interestingly, in the collections from Benin and Nigeria (the collection from Burkina Faso could not be examined more closely) nutlets are almost exclusively bi- or planoconvex while they are trigonous in the type material. Since both bi- and trifid styles can be found within a single inflorescence it does not seem advisable to assign special status to these collections from West Africa within *Schoenoplectiella patentiglumis*. However, Hayasaka (2002) considered style branch number to be species-specific in most species and distinguished infraspecific taxa almost exclusively based on this character (e.g. varieties of *S. proxima* (Steud.) Lye).

***Schoenoplectiella patentiglumis*** (Hayasaka) Hayasaka, J. Jap. Bot. 87(3): 181. 2012. (Figure 1)

≡ *Schoenoplectus patentiglumis* Hayasaka, J. Jap. Bot. 78: 65. 2003.

TYPUS: South Africa: KwaZulu-Natal: Lower Umfolozi District, Umfolozi Game Reserve, ca. 700 ft, 16 Augustus 1957, *C.J. Ward 3137* (holotypus: NU).

Annual, 30–60 cm tall. Culm terete, septate, 1–4 mm wide. Involucral bract septate, 20–40 cm long. Spikelets 1–12, sessile, 7–15 × 6–8 mm, stramineous. Glumes broadly ovate, 4–5 × 2–4 mm, spreading, leaving parts of rachilla exposed. Perianth 0. Stamens 3. Styles 2-branched or 3-branched. Nutlet biconvex to plano-convex (from 2-branched styles), 2.1–1.9 mm; and/or equilaterally trigonous (from 3-branched styles), obovoid, 1.6–1.8 × 1.3–1.5 mm; surface smooth to faintly longitudinally sinuate. Nutlet in basal florets (if present) 3–4 × 3 mm.

Habitat: at the edge of temporary pools.

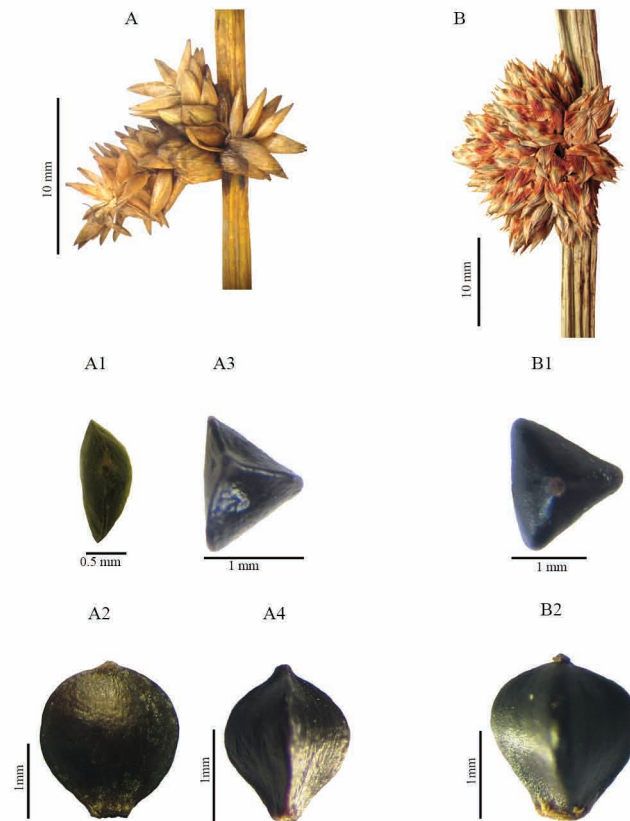
Distribution: Southern Africa (Botswana, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe), tropical West Africa (Benin, Burkina Faso, Nigeria). Possibly overlooked elsewhere in (sub-) tropical Africa.

Examined specimens (from West Africa):

BENIN, wet mud at the edge of laterite pool near Férou, 453 m, 10°55′09″N, 01°48′56″W, 5 December 2009, *A. Mesterházy BEN86* (BP).

BURKINA FASO, Oudalan-Oursi, nord-ouest de la montagne de Warga, petite mare sur la piste vers « le bois aux éléphants », environ 14°33′ nord, 0°32′ ouest, 320 m, 6 October 1976, *P.A. Schäfer 6299* (P 00525147; sub *Schoenoplectus* cf. *articulatus*).

NIGERIA, Bauchi State, Yankari Game Reserve, Sha'aman Track c. 2.5, temporary waterhole, c. 9°45' N, 10°30' E, in tufts, plant dark green, inflorescence green, anthers and stigmata white, 22 October 1970, C. Geerling 3014 (BR 0000021165405, dupl. from WAG-L; sub *Schoenoplectus* spec.).



**FIGURE 1.** Comparison between inflorescences and nutlets (apical and adaxial views) of *Schoenoplectiella patentiglumis* (A) and *S. articulata* (B). A, A1, A2, Mesterházy BEN 86, Benin (BP); A3, A4, Robinson 2849, Zambia (K); B, Enti & Hall 1310, Ghana (K); B1, B2, Morton 6324, Ghana (K). (Photographs: J. Browning).

## 2. *Schoenoplectiella raynaliana* and *S. proxima* are conspecific

*Schoenoplectiella raynaliana* (U. Scholz) Lye (syn.: *Schoenoplectus raynalianus* U. Scholz ) was described based on a single collection from a rice field in northern Togo (Scholz 1981). The species was accepted by recent workers (e.g., Lye 2003, Hayasaka 2002, Govaerts & Simpson 2007). It was said to be part of *Schoenoplectus* sect. *Supini*, its closest relatives probably being *S. lateriflorus* (J.F. Gmel.) Lye, *S. erectus* (Poir.) Palla ex J. Raynal and *S. oxyjulos* (S.S. Hooper) J. Raynal. However, U. Scholz may not have been aware of *S. proxima* (Steud.) Lye, an African species with a widespread but scattered occurrence (Hayasaka 2002), since no mention was made of it. The latter corresponds in every detail with Scholz' *S. raynalianus*, except for the number of stamens (respectively 3 vs. 2). In *Schoenoplectiella* stamen number may serve as additional criterion in distinguishing species although the number is sometimes difficult to assess since stamens easily fall off, especially in small annuals (Hayasaka 2002). Moreover, the number of stamens may vary within a single species (e.g., in *S. roylei* (Nees) Lye; Haines & Lye 1983, Hoenselaar *et al.* 2010). Thus, stamen number can be indicative but not decisive to separate closely similar species in *Schoenoplectiella*.

Hayasaka (2002) accepted *Schoenoplectus raynalianus* in his monographic study of *Schoenoplectus* but had not seen a voucher specimen. The holotype is stored at B and an image is available online at <http://plants.jstor.org/stable/history/10.5555/al.ap.specimen.b%2010%200166775>. A photograph of a nutlet was kindly sent from the Berlin Herbarium. Our contention is that *Schoenoplectiella raynaliana* should not be recorded as a separate species but that it corresponds in all probability with *S. proxima*.

For convenience a table of comparison enumerating diagnostic features for both species is presented here under (mostly based on Scholz 1981, Haines & Lye 1983, Hoenselaar *et al.* 2010).

***Schoenoplectiella proxima*** (Steud.) Lye, Lidia 6(1): 26. 2003.

≡ *Schoenoplectus proximus* (Steud.) J. Raynal, Adansonia n.s. 16(1): 144. 1976.

= *Schoenoplectiella raynaliana* (U. Scholz) Lye, Lidia 6(1): 26. 2003, **syn. nov.**

= *Schoenoplectus raynalianus* U. Scholz, Willdenowia 11: 91. 1981.

*Schoenoplectiella proxima* has a widespread but very scattered distribution in Africa. Hayasaka (2002) reports it from Botswana, Chad, Egypt, Ethiopia, Namibia, South Africa and Tanzania. It is unknown if this disjunct pattern is genuine or merely the result of being poorly understood (see also Raynal 1976). It is here reported for the first time from West Africa but it may have been overlooked before. Taken into account the habitat in which it was found in Togo (rice field) *S. proxima* may as well be an introduction there.

**TABLE 1.** Comparison of diagnostic features of *Schoenoplectiella raynaliana* and *S. proxima*

	<i>S. raynaliana</i>	<i>S. proxima</i>
size of plant (cm)	4–5	2–6
leaves	reduced	reduced
spikelet (mm)	3.3 × 2.2–2.6	2–5 × 1.5–2
number of spikelets	1	1
glume (mm)	1.9–2.2	1.5–2
shape of glume	elliptic or slightly ovate, acuminate	ovate, mucronate
number of stamens	2	3
number of style branches	probably 3	3 (sometimes 2)
nutlet (mm)	1.9 (this is according to the original description; however, the image of the nutlet sent from Berlin shows a much smaller size (ca. 1 mm). Thus, ‘1.9’ probably is a typographic error and Scholz most likely meant ‘0.9’)	0.9–1.1
color of nutlet	grey to brown	dark grey to brown
shape of nutlet	trigonous, transversely wrinkled	trigonous, transversely wrinkled

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