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Article

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A reappraisal of *Schoenoplectus muricinux* (Cyperaceae) including *S. confusus* and closely allied taxa in Africa

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Abstract

The macro-morphological variation and geographical distribution of six morphologically similar taxa from the *Schoenoplectus corymbosus* complex with distinctly muricated nutlets (viz *Schoenoplectus confusus* subsp. *confusus* var. *confusus* and var. *rogersii, S. confusus* subsp. *natalitius*, *S. muricinux*, *S. muriculatus* and *Scirpus corymbosus* var. *junciformis*) were thoroughly studied. It is concluded that all these taxa are ill-defined and that alleged distinctive traits are weak or widely overlap. We therefore suggest expanding the description of *S. muricinux* (the binomial which has nomenclatural priority) and reducing the other species and their infraspecific taxa to synonyms of it. "S. sp. A" of Flora of West Tropical Africa (Nigeria, where it is considered a naturalized introduction of man-made habitats) is shown to also belong to *S. muricinux*.

Key words: Cyperaceae, *Schoenoplectus*, *Scirpus*, taxonomy, tropical Africa

Introduction

Schoenoplectus (Rchb.) Palla (1888: 49) is one of the genera that was segregated from the very heterogeneous and un-natural genus *Scirpus* Linnaeus (1753: 47). 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: 20–22) was established. The remainder of *Schoenoplectus* is a well-circumscribed, natural group and counts ca. 25 species. It is monophyletic and sister to *Actinoscirpus* (Ohwi) R.W. Haines & Lye (1971: 481) (Shiels *et al.* 2014). The classification of infrageneric taxa, however, remains unresolved. Two clades with moderate to strong support, corresponding with sections *Schoenoplectus* and *Malacogeton* (Ohwi) S.G. Smith & Hayasaka (2001: 340), were resolved (Shiels *et al.* 2014) but no African species were involved in this study. In his monograph of *Schoenoplectus* s.l., Hayasaka (2002) recognized five sections in *Schoenoplectus* (incl. *Schoenoplectiella*), while 11 species could not be assigned to any of the sections. Eight of these belong to what he called the *Schoenoplectus corymbosus* complex, an assemblage of morphologically similar, probably closely related species. The group includes *S. brachyceras* (Hochst. ex A. Rich.) Lye (1971: 290), *S. confusus* (N.E. Br.) Lye (1971: 290), *S. corymbosus* (Roth ex Roem. & Schult.) J. Raynal (1976a: 538), *S. decipiens* (Nees) J. Raynal (1976a: 540), *S. muricinux* (C.B. Clarke) J. Raynal (1976a: 538), *S. muriculatus* (Kük.) Browning (1991a: 254), *S. paludicola* (Kunth) Palla (1889: 299) and *S. pulchellus* (Kunth) J. Raynal (1976a: 542). The recently described *S. heptangularis* Cabezas & Jiménez Mejías (Jiménez-Mejías & Cabezas 2009: 109) also belongs here. All species are confined to (sub)tropical Africa with *S. brachyceras* and *S. corymbosus* extending to tropical Asia (India and Pakistan). The latter was also discovered in the western Mediterranean region (Morocco and southern Spain), probably as a result of a recent colonization process (absence of historical records) (Jiménez-Mejías & al. 2007).

The taxonomy and nomenclature of the species of the *Schoenoplectus corymbosus* complex have always been contested. Herbarium labels often bear conflicting names and specimens have been moved back and forth over time. Also, species delimitation is controversial: many of the taxa have names at species and various lower taxonomic ranks (varieties and subspecies). This particularly holds true for three species with markedly muricated nutlets: *S. confusus*, *S. muricinux* and *S. muriculatus*. Although they have been accepted as distinct species over the years (see, for example, Haines & Lye 1983, Browning 1991a, Gordon-Gray 1995, Hayasaka 2002, Govaerts & Simpson 2007, Hoenselaar

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& al. 2010), their distinction has often been considered problematic. For instance, Raynal (1976a) thought that *S. muricinux* was not distinct from *S. confusus*. Haines & Lye (1983) noted that *S. muricinux* was indeed closely related to *S. confusus*, and only separated by its smaller glumes and nutlets which were relatively narrower. Gordon-Gray (1995) stated that relationships between these species are very close and specimens require careful investigation. The type specimen of *S. muriculatus* was annotated by A.E. Schuyler in 1974, stating that it should be equated with *S. muricinux*. Determinations on collections indicate that there is great uncertainty as to which name should be applied. There are intermediate specimens, however, the cause of this uncertainty is principally due to the ill-defined characters separating the taxa. The main characters employed being size of glume and of nutlets accompanied with less measured features such as length and shape of overtopping bract, culm thickness and compressibility. This lack of clarity compounded by the frequent presence of hypogynous bristles which may number 4–6 being well developed, or their presence being reduced in both number and size.

Although one of us (J.B.) once supported the delimitation of taxa in this complex (Browning 1991a) based on knowledge of South African populations, it later became clear that in a wider geographical context species boundaries are heavily blurred. This was also demonstrated while trying to assess the identity of 'S. sp. A' in Flora of West Tropical Africa (Hooper 1972). The latter—at that time solely represented by an incomplete and young specimen—was first thought to belong to the *S. confusus-rogersii* alliance. From the same area more material came to light in the intervening years and this was assigned to *S. muricinux* by S.S. Hooper, albeit reluctantly so (as can be seen from her annotations on the corresponding herbarium sheets). In reality, these and other tropical African collections are difficult to place unequivocally in one or another species. Leaving the status of *S. muricinux*, *S. muriculatus* and *S. confusus* unchanged would result in continued muddling of names applied to collections.

In the present paper all taxa with markedly muricated nutlets from the *Schoenoplectus corymbosus* complex are thoroughly investigated and compared. Our study also includes '*Scirpus corymbosus* var. *junciformis*', a taxon that on account of its nutlets with sharp transverse ridges obviously is not closely related to *S. corymbosus* but rather belongs in the *S. muricinux* group. Diagnostic features of most taxa are illustrated. A new, expanded circumscription of *S. muricinux* is presented and its known distribution is outlined.

Material and methods

Numerous relevant herbarium collections, including several type specimens, were examined from the herbaria BR, K, NU, P, PRE and SRGH (for herbarium acronyms, see Thiers 2017+). For a few also digitized specimens from online sources such as JSTOR Global Plants (https://www.jstor.org/) were studied. In addition, numerous literature references were consulted in order to better understand the distinguishing features used for the separation of the concerned taxa. Floral details and measurements were made from collections (see Table 1 for a character list). Macro-morphological characters were measured by conventional ruler calibrated in millimetres. 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.

TABLE 1. Overview of characters measured

Inflorescence:
Length of lowermost (or overtopping) bract
Glume length
Glume width
Size of mucro (apex of glume)
Color and extent of inverted V on glume
Nutlet:
Length from apex to base (abaxial surface)
Nutlet width at widest part across abaxial surface
Estimated number of rugae and, if noticeable, extension of rugae over nutlet shoulder
Presence or absence of bristles
Approximate length of bristles in relation to nutlet length

Results and discussion

1. Taxa from East, South and Central Africa

The taxa belonging to the *Schoenoplectus corymbosus* complex remained undesignated to a section in Hayasaka's monograph of the genus (Hayasaka 2002). Although they have been thought to belong to section *Schoenoplectus*, these species differ because their nutlets are often rugulose to sharply ridged (muricate) with linear nutlet epidermal cells (Browning 1990, 1991a, 1991b). Also, perianth segments are usually absent, infrequently present and then reduced in number and size. Although all species in this group are superficially alike, a cluster of three closely similar species is discernible: *S. confusus*, *S. muricinux* and *S. muriculatus*. Compared with the other representatives of the *S. corymbosus* complex, these species have nutlets that are markedly muricate, i.e. ornamented with sharp ridges. As suggested by Hayasaka (2002) nutlet gross morphology is a stable character and a reliable basis for the distinction of species in *Schoenoplectus*. Moreover, molecular data also showed nutlet ornamentation to be an important morphological character (Yano & Hoshino 2005).

The emphasis of this study is on these three species and their infraspecific taxa, as well as on '*Scirpus corymbosus* var. *junciformis*', another taxon that—on behalf of its clearly muricated nutlets—also obviously belongs to this group. Diagnostic features that are said to separate these taxa are critically re-assessed, based on a study of type material and corresponding protologues. All are alphabetically listed hereunder.

Scirpus corymbosus Roth[1]
var. *junciformis* A. Peter

This variety was described by Peter based on specimens collected in Tanzania in 1926 (Peter 1936: 124). In the protologue he refers to his number 36444 with collection details: Tanzania, Uvinsa; bei Lugufu westl. bis km 1171,5. Alt.: 1060 m.ü.M., 08.02.1926. Syntypes and isotypes are available in B (B 10 0166771), K (K000416861) and P (MNHN-P-P00462637). The description of this new variety was short but clearly referred to the muricated nutlets ("Nux transversim undulata"). Apparently, Peter was unaware that *S. corymbosus* most often or invariably has smooth to almost smooth nutlets.

In the past decades, var. *junciformis* has been moved back and forth. It was identified as *S. muriculatus* by M. Luceño (annotation on type specimen in B), while the isotype in P has been identified as *S. confusus* (probably by J.H. Kern), subsequently as *S. muricinux* by J. Raynal. In Govaerts *et al.* (2017) it is considered a heterotypic synonym of *S. confusus* subsp. *confusus*, while it was merely mentioned under *S. corymbosus* by Hoenselaar *et al.* (2010).
Closer examination of the syntype held at K shows that the nutlets are nearly black, heavily transversely wrinkled and ca. 1.1–1.4 × 0.8–0.925 mm, including a minute beak up to ca. 0.2 mm. Glumes are relatively pale, except for a darker inverted V in the upper half of the flanks, and vary in length between ca. 2 and 3 mm (short mucro included).

Schoenoplectus confusus (N.E. Br.) Lye
subsp. *confusus*
var. *confusus*

Scirpus confusus was initially described from Amogai in Abyssinia (current-day Eritrea), based on *Schimper* 253 (holotype in K) (Brown 1921: 300). Brown opposed his new species to *S. supinus* Linnaeus (1753: 49) var. *uninodis* (Delile) Ascherson & Schweinfurth (1887: 157), a species it "very conspicuously differs from". Obviously, he was unaware of the very similar *S. muricinux* that was described 16 years before from near Bulawayo in Rhodesia (now Zimbabwe). His description of *S. confusus* is very detailed and refers, among others, to the distinctly muricated blackish nutlets and the absence of perianth bristles ("Setae nullae. Nux … angulis prominente transversim rugosis, nigra"). An isotype at P (MNHN-P-P00462636) was identified by J. Raynal as *S. muricinux*, while the type in K (K000416857) was annotated by S.S. Hooper: "… larger in glume and achene than *S. muricinux* but approaches it closely."

In Schimper's type specimen (Fig. 1) glumes are ca. 2.6–2.8 mm, including a mucro of 0.375–0.4 mm which is dark maroon-black. On either side there is an inverted V, the characteristic glume coloration of *S. muricinux*. Nutlets are ca. 1.5–1.8 × 1.20–1.25 mm but it should be noted that not all nuts are of the same shape or size in any one inflorescence; the development of rugae also varies.

1 *Scirpus corymbosus* Roth (1821: 28) is an illegitimate name, since it is a homonym of *S. corymbosus* L. (1756: 7). The latter is the basionym for the species now known as *Rhynchospora corymbosa* (L.) Britton.

In both subspecies of *S. confusus* (see also below) spikelets generally are a pale color with patches of brown, but in some cases—including *Schimper* 253—the spikelets are almost uniformly brown.
Schoenoplectus confusus subsp. *confusus* var. *confusus* is the taxon with the most northern distribution of the complex.

var. *rogersii* (N.E. Br.) Lye

In the same paper Brown (1921: 301) also described *Scirpus rogersii* with type from Matopos in Southern Rhodesia (current-day Zimbabwe) (*F.A. Rogers* 7914, with two original collections in K, K000416864 and K000416865). It was distinguished from *S. confusus* by the presence of long perianth bristles, the shorter style and smooth angles of the nutlet (Fig. 1). Also, both were geographically separated, *S. rogersii* only being known from Kenya and southern Tanzania in East Africa and further south. It was initially accepted by Lye (1971) as a distinct species but later (Lye 1983) reduced to a variety of *S. confusus*, from which it mainly differs in the presence of 4–5 perianth bristles per floret (Browning 1991a).

This variety was thought to be known only from Kenya and southern Tanzania in eastern Africa and from Zambia, Zimbabwe and Botswana in southern Africa. However, during our study we also found a collection from Democratic Republic of Congo (Katanga, à 19 km au SW de Kabunda, bord rivière Kibeleshi au pont de la route de Sakania, 1150 m, 14 April 1966, *J.J. Symoens* 12525, BR).

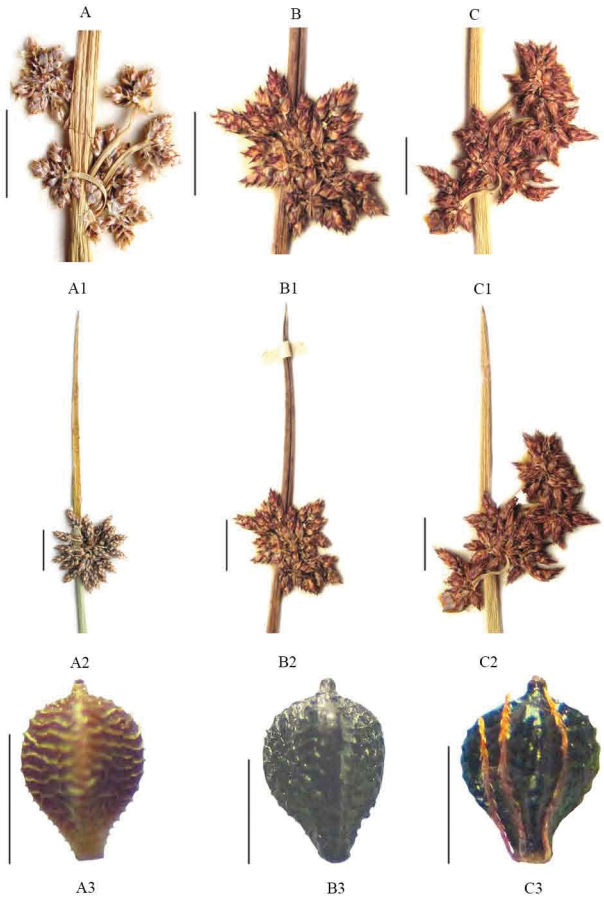


FIGURE 1. A, *Schoenoplectus muricinux*; B, *S. confusus* subsp. *confusus* var. *confusus*; C, *S. confusus* subsp. *confusus* var. *rogersii*. A1, A3, from type *Eyles* 1202, Bulawayo, Zimbabwe; A2, from *Cross* 343, Bulawayo, Zimbabwe; B1–B3, from type *Schimper* 253, Eritrea; C1–C3, from type *Rogers* 7914, Bulawayo, Zimbabwe (all K). Scale bars: inflorescences 10 mm; nutlets 1mm (J. Browning).

subsp. *natalitius* Browning

This subspecies of *S. confusus* was described from Maputaland in South Africa, based on *Goodman* 1237 with types in NU (holo) and BM, K, PRE (iso) (Browning 1991a: 258). It was initially distinguished from subsp. *confusus* var. *confusus* by its smaller spikelets, paler glumes, anthers with slightly longer microscopic terminal crests and restricted distribution. From var. *rogersii* it differed by the absence of perianth bristles.

Gordon-Gray (1995) already expressed her doubts about these Natal plants that are mainly segregated from var. *confusus* because of the distributional hiatus that appears to exist between them and known records of var. *confusus* further north in Africa. She considered it possible that both might be connected by way of the Mozambique plain and that a more exhaustive study of *S. confusus* in Africa may show whether the Natal plants require infraspecific status under that species.

Schoenoplectus muricinux (C.B. Clarke) J. Raynal

This species was originally described from near Buluwayo [Bulawayo] in Rhodesia (current-day Zimbabwe) as *Scirpus muricinux* C.B. Clarke (1906: 135) with type in K (lecto), SRGH (iso) (*Eyles* 1202), and syntype from Orange State, South Africa in K (*Buchanan* 163). It is the oldest of all names relevant to our study. The species was separated from *S. paludicola* Kunth (1837: 163) by its paler, shiny nutlets ("… nucem lucide castaneam levem …") and the absence of perianth bristles. In his description Clarke also referred to the heavily muricated nutlets ("nuce … transversim alte muricata").

In the type material (*Eyles* 1202; Fig. 1) nutlet measurements are 1.4 × 0.9 mm. Rough measurement of glume length is ca. 2.05 mm including a mucro ca. 0.25 mm; coloration of the glumes is pale whitish-yellow. Perianth bristles are lacking.

Schoenoplectus muriculatus (Kük.) Browning

Scirpus muriculatus was described from Victoria, Ndanga (Rhodesia, current-day Zimbabwe), based on *Fries, Nordlindh & Weimark* 2137 (Kükenthal 1934: 75). It was considered most closely related to *S. corymbosus* from which species it differed, among others, in possessing distinctly muricated nutlets ("… nux valde transversim muriculato-rugosa …"). Kükenthal, however, was not aware of *S. muricinux* (Browning 1991a), another species with such nutlets and also in other respects similar to *S. muriculatus*. Plants of the latter usually are more slender with narrower culms, have darker spikelets and ligules tend to be slightly shorter (Browning 1991a, Gordon-Gray 1995). Relationships were considered very close and distinguishing features mostly quantitative.

2. The case of "S. sp. A" from Flora of West Tropical Africa (Fig. 2)

In the Flora of West Tropical Africa, Hooper (1972) distinguished "S[cirpus]. sp. A". Compared with the other West African species it was similar to *S. brachyceras* Hochst. ex A. Rich. but it was characterized in having a contracted inflorescence of dark spikelets that was exceeded by the erect stem-like bract and a transversely ridged nutlet. It was found in or near water in Jos in Plateau State in Nigeria (*Lely* P485, K). According to Hooper l.c. it probably belonged to a species of the *S. confusus* N.E. Br. - *S. rogersii* C.B. Clarke alliance from East Africa, but the specimen was too incomplete to allow certain identification. Hooper wrote in pencil on collection *Lely* P485 the following suggestions for the affinity of S. sp. A.: *S. muricinux*, *S. confusus* or *S. corymbosus* var. *junciformis* and, ultimately (in 1980): "Scirpus (Schoenoplectus) muricinux C.B. Cl. but the S African material has bicolored glumes". In subsequent years it became clear that identical but better developed plants were collected in the same area in Nigeria, before as well as since the publication of Hooper (1972), for instance *J.B. Hall* 2225 (K) or *D.E.S. King* 11/74 (K). The latter collection was also annotated by Hooper in 1980: "Scirpus (Schoenoplectus) muricinux C.B. Cl. or confusus N.E. Br. Depauperate bristles, achene clearly ridged but small, glumes dark. Introduced weed?". Lowe & Stanfield (1974) considered these plants similar to *S. brachyceras* but with a longer bract, smaller inflorescences and spikelets.

Identification attempts with various African floras (e.g. Gordon-Gray 1995, Hoenselaar & al. 2010) indeed lead to conflicting results (*S. confusus* subsp. *confusus* var. *confusus*, *S. muricinux*, *S. muriculatus*) and highlight the absence of clear-cut characters differentiating these taxa.

All taxa mentioned above are characterized by possessing distinctly muricated nutlets, a feature not encountered in the other members of the *Schoenoplectus corymbosus* group. Mutual differences, however, are quantitative rather than qualitative or overlap considerably (see Table 2 for a comparison of three key characters). *Schoenoplectus confusus* often is a more vigorous species with thicker and taller culms but this is quite variable: plants growing in tropical regions or in wetter habitats usually grow taller. Ligules of the upper leaf sheath tend to be slightly shorter in *S. muriculatus* but there is considerable overlap, especially with *S. confusus*. The overtopping bract usually is shortest in *S. muriculatus* and longest in *S. muricinux*, while more or less intermediate in *S. confusus*. Glumes can range in color from fairly pale (like in typical plants of *S. muricinux*) to darker brown (like in *S. muriculatus*) and often show an inverted darker V on either side of the keel. However, from our observations, it becomes clear that glume coloration is quite variable: for

instance, the dark 'form' is mainly distributed in Central Zimbabwe and commonly found around the capital, Harare. Further towards the west, and towards Bulawayo, the inflorescences are lighter and more in keeping with that described by Clarke for *S. muricinux*. Glumes tend to be smallest in *S. muricinux* and largest in *S. confusus*, with *S. muriculatus* being more or less intermediate in this respect. A mucro is always present and varies in length, tending to be longer and more attenuate in *S. confusus*. Anthers have a minute crest with or without marginal microscopic projections. These were thought to be lacking in *S. muricinux* and longest in *S. confusus* subsp. *natalitius* (Browning 1991a). However, on closer examination this also proves to be a variable and non-diagnostic feature; even in *Eyles* 1202, an isotype of *S. muricinux*, such projections are discernible. Based on style length *S. muricinux* and *S. confusus* can be differentiated but *S. muriculatus* has styles that are intermediate in length. *Schoenoplectus confusus* subsp. *confusus* var. *rogersii* is the only taxon in the complex that always has 4–5 well-developed hypogynous bristles. During our study we have quite frequently found bristles, often remnants, but sometimes almost nutlet length in *S. muricinux* as well, both in South African and more northern collections. The presence or absence of bristles is probably of little significance (see also Raynal's comments when dealing with section *Supini*; Raynal 1976b) and heavily complicates the separation of *S. muricinux* and *S. confusus* subsp. *confusus* var. *rogersii*.

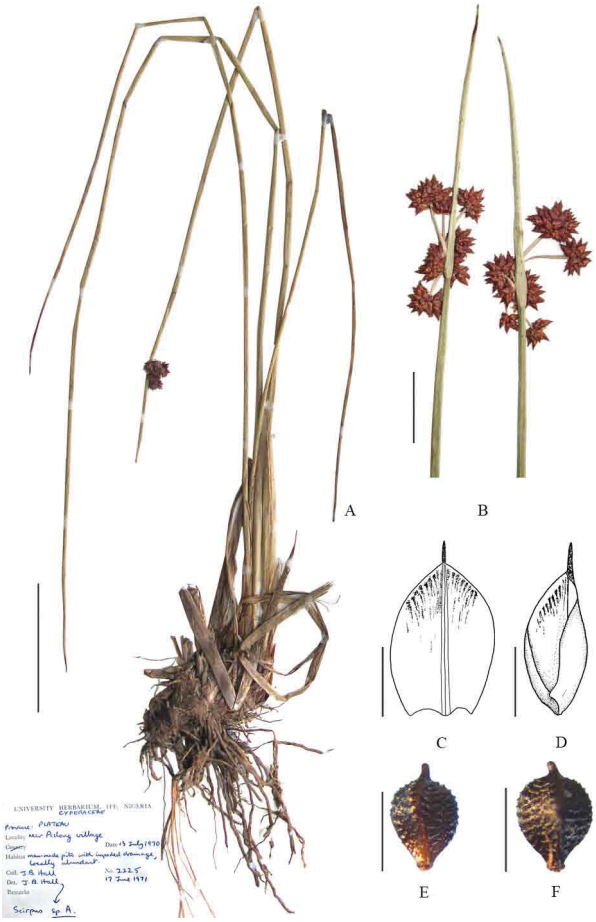


FIGURE 2. *Schoenoplectus muricinux* ('*Scirpus* sp. A'). A, habit; B, inflorescences; C, glume, adaxial view; D, glume, semi lateral view; E, nutlet, without bristle; F, nutlet with bristle. A from *Hall* 2225, B–F from *King* 11/74 (all K). Scale bars A, 50 mm, B, 20 mm, C–F, 1 mm (J. Browning).

Inflorescences, nutlets, overtopping bract and other characters are most consistent in the southern part of the range of the group in sub-Saharan Africa. Northwards towards East Africa and in more tropical regions the variation becomes much greater in all respects. This is recorded for other cyperaceous genera with wide distribution where greatest variation is seen in tropical countries, for instance in *Bulbostylis* Kunth (1837: 205). There may also be some 'genetic involvement' between *S. muricinux* /*confusus* and *S. brachyceras*/*corymbosus*. Far too many of the identified *S. confusus* collections from northern Zambia and Malawi and particularly from East Africa have short, leaf-like overtopping bracts unlike the *S. muricinux* /*confusus* in the middle of the range.

All this accounts for great uncertainty as to whether the name *S. confusus*, *S. muricinux* or *S. muriculatus* should be applied. This is further emphasized by *Scirpus corymbosus* var. *junciformis*, a taxon that has been assigned to

Schoenoplectus confusus, *S. muricinux* ánd *S. muriculatus* by various experts of the genus. It is, indeed, more or less intermediate and difficult to be ascribed unequivocally to one of the taxa here concerned. Thus, none of the described taxa is clearly morphologically discontinuous from the remainder.

Additional evidence that *Schoenoplectus muricinux* should incorporate all the taxa mentioned above can be gained from distributional patterns of these taxa. *S. muricinux* is present in South Africa from 17°–31° S latitude and 15°–33°E longitude at elevations ranging between 550–1400 m (Browning 1991a). It extends northwards into the Flora Zambesiaca area, from where it has been confirmed for Botswana, Malawi, Mozambique, Zambia and Zimbabwe (in part Fl. Zambesiaca, unpublished manuscript). It is also known from Congo and Rwanda in Central Africa. Although according to Haines & Lye (1983) and Hoenselaar & al. (2010) *S. muricinux* is absent from East Africa, there are some collections in P that demonstrate its presence in, for instance, Kenya, Tanzania and Uganda. *Schoenplectus muriculatus* is distributed in South Africa from 23°–30° S latitude and 25°–31° E longitude and further north in Zimbabwe. This distribution entirely falls within the range of *S. muricinux*. *S. confusus* subsp. *confusus* var. *confusus* has the northernmost distribution of all taxa concerned, its type being from Eritrea. However, it extends southwards through East Africa to the Flora Zambesiaca area. Its subsp. *natalitius* is confined to KwaZulu-Natal in South Africa. The type of *S. rogersii* (*S. confusus* subsp. *confusus* var. *rogersii*) comes from Matopos, Zimbabwe, i.e. within the known range of *S. muricinux*. Thus, *S. confusus* subsp. *confusus* var. *rogersii* also is sympatric with *S. muricinux*. *Scirpus corymbosus* var. *junciformis*, described from Uvinsa in Tanzania, evidently also originates from within the range circumscribed above. If considered a single, variable species *S. muricinux* covers an extended, contiguous distributional range from Eritrea to South Africa.

TABLE 2. Comparison of three key characters of *Schoenoplectus muricinux* and allied taxa in Africa.

	Nutlet	Glume	Perianth bristles
Scirpus corymbosus var. *junciformis*	Heavily transversely wrinkled and ca. 1.1–1.4 × 0.8–0.925 mm, including a minute beak up to ca. 0.2 mm.	Relatively pale, except for a darker inverted V in the upper half of the flanks, varying in length between ca. 2 and 3 mm (short mucro included).	Absent.
Scirpus sp. A	Clearly transversely ridged, 1.3–1.4 × 0.9 mm (including a quite long beak), black.	Reddish brown, ca. 2.5 mm (including a mucro of 0.275 mm).	Absent or depauperate.
Schoenoplectus confusus subsp. *confusus* var. *confusus*	Transversely wavy, ca. 1.5–1.8 × 1.20–1.25 mm, shining dark brown to black at maturity.	On either side an inverted V, ca. 2.6–2.8 mm, (including a mucro of 0.375–0.4 mm which is dark maroon-black).	Absent.
S. confusus subsp. *confusus* var. *rogersii*	Irregularly transversely wrinkled, 1.25 × 1.5 mm, shining dark brown to black at maturity.	Pale brown, ca. 3 mm long.	Always well-developed.
S. confusus subsp. *natalitius*	Transversely wavy, 1.1–1.5 mm × 1.0–1.1 mm, ovate to obovate, trigonous with short beak, shining dark brown to black at maturity.	Pale whitish-yellow with or without pronounced dark brown streaking forming an inverted V, 2.4–3.4 mm × 1.6–2.5 mm.	Absent.
S. muricinux s.str.	Markedly transversely wavy, 1.2–1.6 mm × 0.9–1.2 mm, ovate to obovate, trigonous with short beak, shining black at maturity.	Pale whitish-yellow, frequently green along the keel, flanked by a dark brown-blackish inverted V, 1.8–2.6 mm × 1.5–2.3 mm, ovate, convex, glabrous.	Absent.
S. muriculatus	Transversely ridged, 1.2–1.6 mm × 0.9–1.2 mm, ovate to obovate, trigonous with short beak, shining dark brown or black at maturity.	Streaked reddish-brown with pallid keel, 2.3–2.6 mm × 1.5–2.3 mm, ovate, glabrous.	Absent.
***S. muricinux* (new circumscription)**	Markedly transversely wavy (rugose) with 8–16 ridges extending over the nutlet shoulders, 1.1–1.6(–1.8) mm (from apex of beak to nutlet base) × 0.8–1.3(–1.4) mm, ovate to obovate in outline, trigonous with short beak, shining dark brown or black at maturity.	Pale whitish-yellow to reddish brown, frequently green or pallid along the keel, with or without pronounced dark brown-blackish streaking forming an inverted V on the flanks, margins narrow transparent, 1.8–3(–3.5) mm × 1.5–2.5 mm, ovate, convex, glabrous, apex acute to mucronate (mucro pale or dark, either straight or recurved with apical scabrid hairs).	Absent to well-developed, 4–6 in number.

Several solutions to cope with these uncertainties have been considered. Leaving the status of all these taxa unchanged would result in continued muddling of names applied to collections in herbaria. Considering *Schoenoplectus muricinux* as a species (with an expanded description) and subsuming all related taxa to subspecific or varietal rank would allow for regional distribution but does not prevent that all taxa remain ill-defined and thus not easily told apart. Finally, *S. muricinux* could be considered a single, variable species that includes all other taxa related to it (as mere synonyms).

Therefore, we suggest expanding the description of *S. muricinux* (the binomial which has nomenclatural priority) and reduce the other species and their infraspecific taxa to synonyms.

In its new circumscription *S. muricinux* is a relatively widespread species in southern and eastern Africa and in parts of Central Africa.

Conclusion: expanded circumscription and revised distribution of *S. muricinux*

Schoenoplectus muricinux (C.B. Clarke) J. Raynal, Adansonia n.s. 15(4): 538. 1976.
≡ *Scirpus muricinux* C.B. Clarke, Bot. Jahrb. Syst. 38: 135. 1906.

= *Schoenoplectus confusus* (N.E. Br.) Lye, Bot. Not. 124: 290. 1971. **syn. nov.**
≡ *Scirpus confusus* N.E. Br., Bull. Misc. Inform. Kew 1921: 300. 1921.
= *Schoenoplectus confusus* subsp. *natalitius* Browning, S. African J. Bot. 57(5): 258, f. 3, 7. 1991. **syn. nov.**
= *Schoenoplectus confusus* var. *rogersii* (N.E. Br.) Lye, Nordic J. Bot. 3(2): 242. 1983. **syn. nov.**
≡ *Schoenoplectus rogersii* (N.E. Br.) Lye, Bot. Not. 124: 290. 1971.
≡ *Scirpus rogersii* N.E. Br., Bull. Misc. Inform. Kew 1921: 301. 1921.

= *Schoenoplectus muriculatus* (Kük.) Browning, S. African J. Bot. 57(5): 254, f. 2, 4b, 6. 1991. **syn. nov.**
≡ *Scirpus muriculatus* Kük., Bot. Not. 1934: 75. 1934.

= *Scirpus corymbosus* Roth ex Roem. & Schult. var. *junciformis* A. Peter, Repert. Spec. Nov. Regni Veg. Beih. 40(1 Anh.): 124. 1936. **syn. nov.**

Description

Tufted perennial. Rhizome abbreviated, woody, 2–7 mm in diameter, holding together contiguous tufted stem bases clothed with persistent erect scale leaves and leaf sheaths. Roots numerous, 0.2–1.3 mm wide. Culms (13–)20–110 cm × 1–3.6(–5.8) mm, often compressible when dry, terete, glabrous, many-ridged. Leaf blades absent; sheaths 2–3, obliquely truncate at the top, with or without a glabrous or scabrid-margined reduced leaf blade 0.5–20 mm long. Mouth of uppermost leaf sheath at origin of reduced leaf blade 0.6–2.5 mm across, with or without a hyaline margin and a tendency to strip forming a ladder around the culm, sometimes with red or brown spots and streaks; ligule 0.3–1.8 mm high, or absent. Inflorescence a pseudo-lateral head or a contracted anthela of clusters of spikelets on 1–8 slender, unequal, scabridulous branches 10–50 mm long, overtopped by a 20–150 mm tapering bract appearing as a continuation of the culm. Spikelets sessile, 4–9(–10) mm × 2–3 mm, shortly conical or ovoid to cylindrical, many flowered, pale yellow to chestnut brown or rust colored, with or without dark brown markings. Glumes all fertile, 1.8–3(–3.5) mm × 1.5–2.5 mm, ovate, convex, glabrous, pale whitish-yellow to reddish brown, frequently green or pallid along the keel, with or without pronounced dark brown-blackish streaking forming an inverted V on the flanks, margins narrow transparent, apex acute to mucronate (mucro pale or dark, either straight or recurved with apical scabrid hairs). Lower glumes and bracts usually bearing scabrid hairs distally on keels and mucros. Perianth most often absent, if present either 4–6 well defined bristles, or very reduced in size and number. Stamens 3, anthers including minute crest 0.3–1.3 mm, oblong. Style linear, 0.5–2 mm, stigma branches 3, 1–2.3 mm long, papillate. Nutlet 1.1–1.6(–1.8) mm (from apex of beak to nutlet base) × 0.8–1.3(–1.4) mm, ovate to obovate in outline, trigonous with short beak, shining dark brown or black at maturity, surface markedly transversely wavy (rugose) with 8–16 ridges extending over the nutlet shoulders (markings visible on immature nutlets).

Distribution (adapted and modified from Brummitt 2001) (Fig. 3):

Native in Southern Africa (Botswana, Lesotho, Namibia, South Africa and Swaziland), South Tropical Africa (southern Angola, Malawi, Mozambique, Zambia and Zimbabwe), West-Central Tropical Africa (Democratic Republic of Congo and Rwanda), East Tropical Africa (Kenya, Tanzania and Uganda) and Northeast Tropical Africa (Eritrea and Ethiopia). Probably introduced in West Tropical Africa (Central Nigeria: Plateau State). Based on its currently known distribution the presence of *Schoenoplectus muricinux* in Burundi seems likely.



FIGURE 3. Global distribution of *Schoenoplectus muricinux* in its expanded circumscription. Black and grey color indicates native and (presumably) introduced range respectively.

Habitat

In black clay soils, on mud or sand (or without preference for any particular soil) of vleis and pool edges of shallow dams, seasonal pans or papyrus swamps, in water up to 0.5 m deep, sometimes in hygrophilous grassland, roadside ditches, stream banks, riverine backwaters, dambos or near drainage lines in grassland and bushland; 550–2,250 m. In West Africa (Nigeria), where it is most likely an introduction, it grows in man-made pits with impeded drainage (e.g., *J.B. Hall* 2225 in K) and in paddy fields (*D.E.S. King* 11/74 in K).

Selection of specimens examined:

In addition to the collections cited hereunder, many more have been studied in the past by one of us (J.B.), especially from Southern Africa.

Southern Africa:
BOTSWANA: *A. & R. Heath* 1682 and 1725 (K); *P.A. Smith* 774 (P, SRGH); *P.A. Smith* 1764 (P, SRGH); *P.A. Smith* 2051 (K, P, SRGH); *P.A. Smith* 2423 (K, SRGH); *P.A. Smith* 3848 (BR, SRGH); *G.E. Gibbs Russell* 2320 (P); *P.J. Mott* 736 (P); *H. Hiemstra* 276 (P); *J. Terry* & al. 212 (K); *B. Farrington* & al. MSB 181 (K);
LESOTHO: *A. Dieterlen* 769 (P);
NAMIBIA: *O.H. Volk* 11809 (BR ex M); *O.H. Volk* 12330 (BR ex M);
SOUTH AFRICA: *P.S. Goodman* 1237 (K, NU, PRE); *J. Buchanan* 163 (K); *P. Goetghebeur* 4330 (BR ex GENT); *P. Goetghebeur* 4384 (BR ex GENT); *P.C.V. du Toit* 844 (P); *P.C.V. du Toit* 2327 (BR ex PRE); *T.G. O'Connor* 41 (P); *P. de Beer* 98 (P); *A.O.D. Mogg* s.n. (P);

South Tropical Africa:
ANGOLA: *Henriques* 800 (K);
MALAWI: *L.J. Brass* 17448 (BR, K); *L.J. Brass* 17541 (BR); *R.K. Brummitt* 11829 (K); *D.E.F. Vesey-Fitzgerald* 3053 (K);
MOZAMBIQUE: *L. Macuáca* 1427 (K);
ZAMBIA: *E.A. Robinson* 243 (K); *E.A. Robinson* 916 (K); *E.A. Robinson* 1126 (BR, K); *E.A. Robinson* 1170 (K); *E.A. Robinson* 1248 (BR, K); *E.A. Robinson* 1291 (K); *E.A. Robinson* 5641 (K, P); *E. Milne-Redhead* 3297 (BR, K); *N.K.B. Robson* 16 (BR, K); *Richards* 18217 (P); *Richards* 18817 (K); *L. Merrett* 985 (K); *W.C. Verboom* 2726 (K); *B.K. Simon & G. Williamson* 1024 (K); *A. Angus* 1778 (K);
ZIMBABWE: *F. Eyles* 1202 (K, SRGH); *F.A. Rogers* 7914 (K, SRGH); *T.C.E. Fries* & al. 2137 (LD, via JSTOR); *O.B. Miller* 5436 (K, SRGH); *O.B. Miller* 5633 (BR, SRGH); *R.L. Lennon* 43 (BR, SRGH); *E.A. Robinson* 739 (K); *E.A. Robinson* 1801 (BR, K, SRGH); *E.A. Robinson* 1802 (P, SRGH); *R.B. Drummond* 4899 (BR, K, P, SRGH); *R.B. Drummond* 5132 (BR, P, SRGH); *H. Wild* 5927 (K, P, SRGH); *H. Wild* 6417 (K, SRGH); *H. Wild* 6484 (BR, P, SRGH); *H.M. Biegel* 2092 (P); *B. Bezuidenhout* 212 (K, SRGH); *L.C. Cross* 343 (K, SRGH); *Bingham* 592 (K, SRGH); *G.E. Gibbs Russell* 2515 (K, SRGH);

West-Central Tropical Africa:
DEMOCRATIC REPUBLIC OF CONGO: *E. Detilleux* 287 (BR, P); *Keremera* 368 (BR); *S. Lisowski* 455 (BR); *F. Malaisse* 4488 (BR); *J.-J. Symoens* 12525 (BR); *A. Schmitz* 5477 (BR); *J.-J. Symoens* 8358 (P); *G.F. de Witte* 6754 (P);
RWANDA: *J. Raynal* 20706 (BR, K, P); *J.-J. Symoens* 5413 (BR); *G. Troupin* 6096 (BR); *G. Bouxin & M. Radoux* INRS/430 (BR); *G. Troupin* 6941 (BR); *G. Troupin* 14020 (BR); *G. Troupin* 14904 (BR); *D. Van Der Ben* 2538 (BR); *P. Auquier* 2375 (P);

East Tropical Africa:
KENYA: *P.E. Glover* & al. 1824 (BR, K); *S. Taiti* 1844 (BR); *P. Bamps* 6414 (BR); *B. Verdcourt & R.M. Polhill* 4004 (K, P); *P. Kirika* & al. GBK 05 (K); *K.A. Lye* 6299 (K); *Conrads* 5757 (K); *T. Jarrett* 254 (K); *A. Bogdan* 1085a (K);
TANZANIA: *A. Peter* 36444 (K, P); *R.B. Faden* & al. 96/102 (K); *R.B. Faden* & al. 96/202 (K, BR); *R.B. Faden* & al. 96/478 (K, BR); *R. Polhill & S. Paulo* 1233 (P); *S. Bidgood* & al. 6399 (K); *S. Bidgood* & al. 5286 (K, P); *S.S. Hooper & C.C. Townsend* 896 (K); *S.S. Hooper & C.C. Townsend* 1784 (K); *B.D. Burtt* 2654 (K);
UGANDA: *R.W. Haines* 47 (P); *R.W. Haines* 211 (K); *K.A. Lye* 5598 (K); *P.K. Rwaburindore* 3667 (K ex MO);

West Tropical Africa:
NIGERIA: *H.V. Lely* P485 (K); *J.B. Hall* 2225 (K); *D.E.S. King* 11/74 (K).

Northeast Tropical Africa:
ERITREA: *W. Schimper* 253 (K, P).

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