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Taxonomic revision of the tropical African group of *Carex* subsect. *Elatae* (sect. *Spirostachyae*, Cyperaceae)

by

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Abstract

Escudero, M. & Luceño, M. 2011. Taxonomic revision of the tropical African group of *Carex* subsect. *Elatae* (sect. *Spirostachyae*, Cyperaceae). *Anales Jard. Bot. Madrid* 68(2): 225-247.

The tropical African monophyletic group of *Carex* subsect. *Elatae* (sect. *Spirostachyae*) is distributed in continental tropical Africa, Madagascar, the Mascarene archipelago, and Bioko Island (32 km off the coast of West Africa, in the Gulf of Guinea). The first monographic treatment of this *Carex* group, as well as of the tribe Cariceae, was published by Kükenthal (as sect. *Elatae* Kük.). Recently, the first molecular (nrDNA, cpDNA) phylogeny of *Carex* sect. *Elatae* has been published, which also included the species of sect. *Spirostachyae*. In the resulting consensus trees, most species of sect. *Elatae* were embedded within core *Spirostachyae* and so this section was joined with sect. *Spirostachyae* as subsect. *Elatae*. Within subsect. *Elatae*, several groups were described, one of which was termed the "tropical African group". Here we present a taxonomic revision of this group, based on more than 280 vouchers from 29 herbaria as well as in field trips in Tropical Africa. In the revision, we recognise 12 species (16 taxa) within the tropical African group, and so have somewhat modified our previous view, in which 10 species, 12 taxa were listed. One new species from Tanzania is included in this treatment, *C. uluguruensis* Luceño & M. Escudero. Several combinations are made, *C. cyrtosaccus* is treated as a synonym of *C. vallis-rosetto* and, finally, the binomial *C. grennwayi* has been recognised.

Keywords: Bioko, *Elatae*, *Carex*, Cyperaceae, Madagascar, Mascarene Islands, *Spirostachyae*, tropical Africa.

Resumen

Escudero, M. & Luceño, M. 2011. Revisión taxonómica del grupo tropical africano de *Carex* subsect. *Elatae* (sect. *Spirostachyae*, Cyperaceae). *Anales Jard. Bot. Madrid* 68(2): 225-247 (en inglés).

Las especies de la subsección *Elatae* (sección *Spirostachyae*) del género *Carex* que se distribuyen por África tropical continental, Madagascar, el archipiélago de las Mascareñas y la isla de Bioko (a 32 km del litoral de África occidental, en el golfo de Guinea) forman un grupo monofilético. El primer tratamiento taxonómico de este grupo de cárices, así como de la tribu Cariceae en su conjunto, fue elaborado por Kükenthal (sección *Elatae* Kük.); recientemente, se ha publicado el primer estudio de filogenia molecular (nrDNA, cpDNA) de los táxones de este grupo, junto con la inmensa mayoría de las restantes especies que Kükenthal incluyó en las secciones *Elatae* y *Spirostachyae*. Salvo escasas excepciones, los táxones incluidos se agruparon en un clado ("core *Spirostachyae*") que contiene las especies de las dos secciones antes aludidas. En congruencia con estos resultados, la sección *Elatae* fue incluida en la sección *Spirostachyae* como subsección *Elatae*. Dentro de dicha subsección se observaron varios clados; uno de ellos, el denominado "grupo de África tropical", es el objeto del presente trabajo, en el que presentamos una revisión taxonómica basada en el estudio de más de 280 pliegos conservados en 29 herbarios, así como en trabajos de campo llevados a cabo en África tropical. Como resultado del análisis de dichos materiales hemos realizado una profunda reorganización taxonómica, fruto de la cual admitimos 12 especies (16 táxones) dentro del grupo de África tropical. Se describe además una nueva especie del NE de Tanzania, *C. uluguruensis* Luceño & M. Escudero. Asimismo, se llevan a cabo varias combinaciones nomenclaturales, el nombre de *C. cyrtosaccus* es considerado sinónimo de *C. vallis-rosetto*, y se reconoce el binomio *C. grennwayi*.

Palabras clave: Bioko, *Elatae*, *Carex*, Cyperaceae, Madagascar, islas Mascareñas, *Spirostachyae*, África tropical.

Introduction

The tropical African group of *Carex* subsect. *Elatae* (sect. *Spirostachyae*) is a monophyletic group according to nrDNA phylogeny, but not according to cpDNA phylogeny (Escudero & Luceño, 2009). This group is distributed along continental tropical Africa as well as Madagascar and the Mascarene and Bioko Islands. Lamarck (1792) described the first species of this *Carex* group from Reunion Island (*C. borbonica*); other taxa were subsequently described: *C. boryana* (Schkuhr, 1806), *C. petitiiana* and *C. simensis* (Richard, 1850), *C. fischeri*, *C. vallis-rosetto*, and *C. longipedunculata* (Schumann, 1895). Clarke (1902) treated the continental species of this group in his Flora of Tropical Africa (seven species in total, one of them, *C. cyrtosaccus*, as new species; Table 1), but he did not refer them to any supraspecific category. The first monographic treatment of this *Carex* group, as well as of tribe Cariceae, was published by Kükenthal (1909). He included 19 species in the new sect. *Elatae* Kük., eight of which (15 taxa) were from the tropical African group (Table 1). In this monographic work, one new species (*C. mildbraediana*) as well as five new varieties and two new combinations were published (Table 1). Subsequently, Kükenthal (1914, 1925, 1934; Table 1) published numerous modifications to his original taxonomic treatment of sect. *Elatae* (Kükenthal, 1909, Table 1), in which one subspecies, six new varieties and two new forms were described and a new combination was made. Nelmes (1938) revised the group and described four new taxa (three species and one variety) and published a new combination. Subsequent treatments were local, as in the Flora of West Tropical Africa (Hooper & Napper, 1972; two species), or The Sedges and Rushes of East Africa (Haines & Lye, 1983; seven species, Table 1).

More recently, Luceño (1992) and Luceño & Castroviejo (1993) studied five taxa which were included in sect. *Elatae* by Kükenthal (1909) but none were from the tropical African group. Escudero et al. (2008) made the first molecular (nrDNA) phylogeny of *Carex* sect. *Spirostachyae* in a study that also included seven species previously treated in sect. *Elatae* by Kükenthal (1909), one of which was from the tropical African group (*Carex mannii*). These seven species were included in the core *Spirostachyae* in the molecular phylogeny. Escudero & Luceño (2009) performed the first molecular (nrDNA, cpDNA) phylogeny of *Carex* sect. *Elatae* that also included the species of sect. *Spirostachyae*. Again, most species of sect. *Elatae* were embedded within core *Spirostachyae* and accordingly, sect. *Elatae* was included in sect. *Spirostachyae* as subsect. *Elatae*. Therefore, the new

taxonomic concept of this section includes 11 species traditionally considered in sect. *Spirostachyae* and 16 species traditionally included in sect. *Elatae* (Escudero & Luceño, 2009). Within subsect. *Elatae*, several groups were described, among them the tropical African group (Escudero & Luceño, 2009). This group contained ten species, eight (ten taxa) from continental tropical Africa and three species from Madagascar, and the Mascarene and Bioko Islands (one of them in the continent too). In addition, two new combinations were made (*C. mannii* ssp. *thomasii* and *C. mannii* ssp. *friesiorum*) (Table 1). Finally, a checklist of sub-Saharan African *Carex* species has been recently published (Gehrke, 2011). The general goal of this study is to provide a taxonomic treatment of this controversial tropical African group of *Carex*. The specific aims are: 1) to establish the taxa that belong to this group, 2) to specify the taxonomical level of the taxa (species or subspecies), 3) to delineate the morphological differences between the taxa and provide taxonomic keys, 4) to describe the new taxa which are necessary, and 5) to perform a nomenclatural revision.

Material and methods

More than 280 herbarium vouchers were studied for the present taxonomic revision (see Appendix 1). These materials are from 29 herbaria (B, BM, BR, C, E, EA, GOET, H, HUH, K, L, LD, LISC, M, MA, MO, NBG, NU, NY, O, OXF, PRE, U, UPOS, UPS, US, W, WAG, WU; Index Herbariorum, <http://sweetgum.nybg.org/ih/>). In addition the website JSTOR (<http://www.jstor.org/>) which contains images of type material of African species was frequently consulted in the present revision. Seventy morphological characters were considered in the study, comprising 37 qualitative characters and 33 quantitative characters. We paid special attention to the characters previously stated as important in the taxonomy of sect. *Spirostachyae* (Luceño & Escudero, 2008). Quantitative characters were measured using a stereoscopic binocular Nikon SMZ645.

Taxonomic treatment

After revision of the herbarium material, and taking into account our previous molecular results, 12 species (16 taxa) have been accepted. We describe a new species from Tanzania (*C. uluguruensis* Luceño & M. Escudero) and we include an undescribed species, *Carex* spec. nov., endemic from Kitulo Plateau (Tanzania). Additionally, one new subspecies (*C. fischeri* ssp. *recedens*) has been proposed. The morphological

Table 1. Taxonomic treatments by Clarke (1902), Kükenthal (1909, 1914, 1925, 1934), Nelmes (1938), Haines & Lye (1983), Escudero & Luceño (2009) and Gehrke (2011).

Clarke (1902) 7 spp. (1 new sp.)	Kükenthal (1909) 8 spp. 15 taxa (1 new sp., 5 new var., 2 new comb.)	Kükenthal (1914+, 1925*, 1934x), x 1 new var., + 1 new f., * 1 rearrangement, 1 new f., 1 new ssp., 5 new var.	Nelmes (1938) 9 spp., 11 taxa (3 new spp., 1 new var., 1 comb.)	Haines & Lye (1983) 7 spp.	Escudero & Luceño (2009) 10 spp., 12 taxa (2 new comb.)	Gehrke (2011) 9 spp., 11 taxa
<i>C. vallis-rosetto</i> K. Schum.	<i>C. vallis-rosetto</i> K. Schum. var. <i>vallis-rosetto</i>	x <i>C. longipedunculata</i> subsp. <i>cuprea</i> var. <i>atrennata</i> Kük.	<i>C. vallis-rosetto</i> K. Schum.	<i>C. mannii</i> E.A. Bruce	<i>C. mannii</i> E.A. Bruce	<i>C. elgonensis</i> Nelmes
<i>C. simensis</i> Hochst. ex A. Rich.	<i>C. vallis-rosetto</i> var. <i>purpurea</i> Kük.	+ <i>C. longipedunculata</i> K. Schum. f. <i>recedens</i> Kük.	<i>C. cyrtosaccus</i> C.B. Clarke as <i>species dubiae</i>	<i>C. thomasi</i> Nelmes	<i>C. mannii</i> ssp. <i>thomasi</i> (Nelmes) Luceño & M. Escudero	<i>C. mannii</i> E.A. Bruce
<i>C. longipedunculata</i> K. Schum.	<i>C. boryana</i> Schkuhr var. <i>boryana</i>	* <i>C. vallis-rosetto</i> K. Schum. (incl. var. <i>purpurea</i> Kük.)	<i>C. greenwayi</i> Nelmes (= <i>C. vallis-rosetto</i> var. <i>purpurea</i> Kük.)	<i>C. elgonensis</i> Nelmes	<i>C. mannii</i> subsp. <i>friesiorum</i> (Kük.) Luceño & M. Escudero	<i>C. mannii</i> ssp. <i>thomasi</i> (Nelmes) Luceño & M. Escudero
<i>C. petitiana</i> A. Rich.	<i>C. boryana</i> var. <i>simplicissima</i> Kük	* <i>C. vallis-rosetto</i> f. <i>ramosa</i> Kük.	<i>C. thomasi</i> Nelmes	<i>C. vallis-rosetto</i> K. Schum.	<i>C. elgonensis</i> Nelmes	<i>C. mannii</i> ssp. <i>friesiorum</i> (Kük.) Luceño & M. Escudero
<i>C. fischeri</i> K. Schum.	<i>C. cyrtosaccus</i> C.B. Clarke	* <i>C. vallis-rosetto</i> var. <i>heterostachya</i> Kük.	<i>C. elgonensis</i> Nelmes	<i>C. cyrtosaccus</i> C.B. Clarke	<i>C. vallis-rosetto</i> K. Schum.	<i>C. petitiana</i> A. Rich.
<i>C. boryana</i> Schkuhr	<i>C. fischeri</i> K. Schum.	* <i>C. mildbraediana</i> var. <i>friesiorum</i> Kük.	<i>C. mildbraediana</i> Kük.	<i>C. petitiana</i> A. Rich.	<i>C. cyrtosaccus</i> C.B. Clarke	<i>C. preussii</i> K. Schum.
<i>C. cyrtosaccus</i> C.B. Clarke	<i>C. longipedunculata</i> K. Schum. var. <i>longipedunculata</i>	* <i>C. mildbraediana</i> var. <i>alpicola</i> Kük.	<i>C. longipedunculata</i> K. Schum.	<i>C. simensis</i> Hochst. ex A. Rich.	<i>C. petitiana</i> A. Rich.	<i>C. simensis</i> Hochst. ex A. Rich.
	<i>C. longipedunculata</i> var. <i>preussii</i> (K. Schum.) Kük	* <i>C. fischeri</i> var. <i>basandra</i> Kük.	<i>C. simensis</i> Hochst. ex A. Rich.		<i>C. simensis</i> Hochst. ex A. Rich.	<i>C. fischeri</i> K. Schum.
	<i>C. longipedunculata</i> var. <i>ninagongensis</i> Kük.	* <i>C. longipedunculata</i> subsp. <i>cuprea</i> Kük.	<i>C. preussii</i> K. Schum.		<i>C. mildbraediana</i> Kük.	<i>C. ninagongensis</i> (Kük.) Nelmes
	<i>C. simensis</i> Hochst. ex A. Rich. var. <i>simensis</i>	* <i>C. simensis</i> var. <i>longispitata</i> Kük.	<i>C. preussii</i> var. <i>camerunensis</i> Nelmes		<i>C. fischeri</i> K. Schum.	<i>C. vallis-rosetto</i> K. Schum

Table 1. Taxonomic treatments by Clarke (1902), Kükenthal (1909, 1914, 1925, 1934), Nelmes (1938), Haines & Lye (1983), Escudero & Luceño (2009) and Gehrke (2011).

Clarke (1902) 7 spp. (1 new sp.)	Kükenthal (1909) 8 spp. 15 taxa (1 new sp., 5 new var., 2 new comb.)	Kükenthal (1914*, 1925*, 1934x), × 1 new var., + 1 new f., * 1 rearrangement, 1 new f., 1 new sp., 5 new var.	Nelmes (1938) 9 spp., 11 taxa (3 new spp., 1 new var., 1 comb.)	Haines & Lye (1983) 7 spp.	Escudero & Luceño (2009) 10 spp., 12 taxa (2 new comb.)	Gehrke (2011) 9 spp., 11 taxa
	<i>C. simensis</i> var. <i>stolonifera</i> (Boeck.) Kük.	* <i>C. simensis</i> var. <i>ninagongensis</i> (Kük.) Kük.	<i>C. cuprea</i> (Kük.) Nelmes (= <i>C. simensis</i> var. <i>stolonifera</i> (Boeck.) Kük. = <i>C. longipedunculata</i> subsp. <i>cuprea</i> Kük.)		<i>C. boryana</i> Schkuhr	<i>C. boryana</i> Schkuhr
	<i>C. simensis</i> var. <i>mauensis</i> Kük.				<i>C. borbonica</i> Lam.	
	<i>C. borbonica</i> Lam. var. <i>borbonica</i>					
	<i>C. borbonica</i> var. <i>pallidior</i> Kük.					
	<i>C. mildbraediana</i> Kük.					

differences of this new subspecies were noted in Escudero & Luceño (2009), but this new taxon was not formally described in that study. The populations of *C. petitiana* from Zimbabwe and Malawi have been referred to *C. petitiana* subsp. *attenuata* (Kük.) Luceño & M. Escudero, *C. cyrtosaccus* has been treated as a synonym of *C. vallis-rosetto*, and the binomial *C. greenwayi* has been accepted following Nelmes (1938).

KEY TO THE TROPICAL AFRICAN GROUP
OF *CAREX* SUBSECT. *ELATAE*

1. Plants with rhizome creeping, with ± long internodes; spikes never gynecandrous..... **8. *C. spec. nov.***
1. Plants caespitose, rhizome with short internodes; very exceptionally rhizome creeping, with ± long internodes, but then gynecandrous spikes are present 2
2. Utricles clearly curved **12. *C. vallis-rosetto***
2. Utricles straight 3
3. Most female glumes with an arista or mucro longer than 2.5 mm **2. *C. boryana***
3. Most female glumes with an arista or mucro shorter than 2.5 mm 4
4. Beak of the utricle truncate or bidentate (dorsal sinus rarely more than 0.1 mm deep) 5
4. Beak of the utricle more or less bifid (dorsal sinus more than 0.2 mm deep) 6
5. Leaves more than 11 mm wide; at least some of the spikes arising in groups of three **7. *C. mildbraediana***
5. Leaves less than 10 mm wide; all spikes arising in pairs or singly **11. *C. uluguruensis***
6. Female glumes dark blackish-purple without midribs or with midribs that are indistinct and thin **9. *C. elgonensis***
6. Female glumes rarely dark blackish-purple, but then with distinct midribs that are straw coloured or greenish 7
7. Basal sheaths and sheath of the lowest leaves purplish-red to dark purplish or blackish tinted 8
7. Basal sheaths and sheath of the lowest leaves straw coloured, brown or reddish-brown 12
8. All spikes androgynous (only a few male flowers at the top) and homomorphic or sub-homomorphic (similar number of male flowers at the top of all spikes); leaves wider than 8 mm **5. *C. greenwayi***
8. Some spikes not androgynous and homomorphic or subhomomorphic; when so, leaves up to 8 mm wide 9
9. Female glumes hyaline, brown or reddish brown **4. *C. fischeri***
9. Male glumes medium to dark purple or blackish 10
10. Female glumes blackish; basal sheaths blackish and coriaceous **10. *C. simensis***
10. Female glumes brown to dark purplish; basal sheaths variable 11
11. Leaves markedly coriaceous **1. *C. borbonica***
11. Leaves non-coriaceous **6. *C. mannii***
12. Two or more lateral spikes gynecandrous (sometimes these spikes bear only a few male flowers at the base); spikes widely terete or clavate; utricle beak aculeolate (very exceptionally smooth) **9. *C. petitiana***
12. None, or only one, lateral spike gynecandrous (rarely two); spikes narrowly terete or clavate; utricle beak smooth **4. *C. fischeri***

Species descriptions

1. *Carex borbonica* Lam., Encycl. 3: 387. 1792.

Ind. loc.: “Commerson a trouvé cette spèce dans l’isle de Bourbon”.

Lectotype (designated here): P 307290 (Herb. Lamarck) photo!; isotypes: P 346058 photo!, P 346059 photo!

= *Carex typhoides* Bory, Voy. îles Afrique 3: 24 (1804).
Unknown type.

Rhizome caespitose, with short internodes. Stems 15-59 cm, stout, trigonous, green to yellowish-green, smooth, sometimes purplish-red spotted. Leaves 10-18 cm × 4-8 mm, keeled, sometimes slightly plicate in the upper half, rigid and markedly coriaceous, scabrid on the edges and apical parts; lower sheaths dark purplish-red; ligule 0.5-5.5 mm, obtuse to acute; anteligule edge concave to flat. Inflorescence 6.2-18.5 cm, lowest internode 0.8-3.5 cm and second one 0.5-2.5 cm. Lowest bract 5.5-17 cm × 2.5-6 mm, longer or shorter than inflorescence; sheath 1-7.5 cm long, the inner side purplish-red. Spikes 3-10, heteromorphic to subhomomorphic, with 0-2 male or gynecandrous spikes at the apex, and 3-9 female lateral spikes; male or gynecandrous spikes 3-6 cm × 6-12 mm, terete to widely ellipsoid or obovoid, the terminal one sessile or with a peduncle up to 1.2 cm; female spikes, 1-6.5 cm × 6-10 mm, arising singly, dense-flowered, terete to obovoid, sessile or with a peduncle up to 1(3.5) cm. Male glumes (4.5)5.5-9 × 1.2-2 mm, oblong-elliptic to oblong-obovate, dark purplish-red with a wide, green or straw coloured midrib, mucronate or aristate, with a mucro or arista up to 1.7 mm or, more rarely, obtuse. Female glumes (4)5.5-6.5 × 1.1-2.2 mm, ovate-elliptic, dark purplish-red with a wide, green or straw coloured midrib, with an arista or mucro 0.5-2.3 mm. Utricles (4)4.5-6.2 × (1.2)1.4-2(2.1) mm, ellipsoid-trigonus, straight, plurinerved (with 2 more prominent veins), tapered to beak, brown with purplish speckles to entirely purplish; beak (0.9)1.2-1.6 mm, deeply bifid, with ± similar dorsal and ventral sinus 0.4-0.6 mm, densely aculeolate. Achenes 2.2-2.3 × 0.9-1.2 mm, trigonous, elliptic or elliptic-obovate in outline. $2n = ?$

Oct.-May. Dry, sunny and sandy places on volcanic soils; 2250-2400 m; Reunion [and Mauritius?].

Comments: Some specimens display intermediate features between *C. boryana* and *C. borbonica*, suggesting hybridization, and probably introgression, between these two taxa. We have observed in the field (Le Maïdo, near Malfate circus) both pure species in their typical habitats, with neighbouring populations

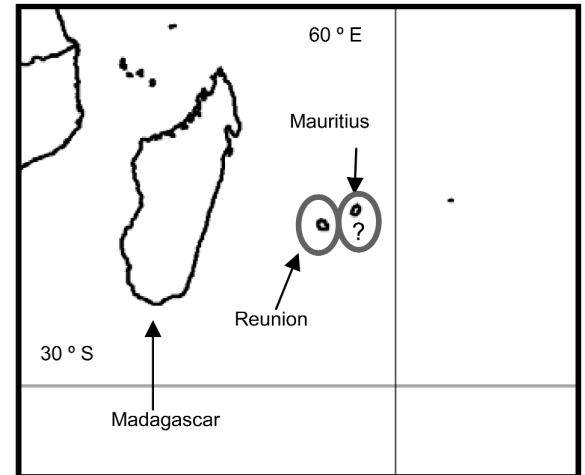


Fig. 1. Distribution of *Carex borbonica*.

growing in intermediate habitats (open and stony scrublands of *Philippia montana*) whose individuals showed a gradient of characters between the putative parentals. This hybridization hypothesis is in agreement with our molecular data (Escudero & Luceño, 2009). Many of these morphologically intermediate specimens have been described as different taxa:

– *Carex borbonica* var. *pallidior* Kük., Engl. (ed.), Pflanzenr. IV, 20(38): 655. 1909.

Sine ind. loc.

Lectotype (designated here): *Boivin* 997 K!

– *Carex boryana* var. *rigidifolia* Boeck., Linnaea 41: 285. 1877.

Sine ind. loc.

Lectotype (designated here): *Boivin* 996 UPS!

– *Carex musei* Steud., Syn. Pl. Glumac. 2: 205. 1855.

Ind. loc.: “ins. Borbon” [Reunion].

Lectotype (designated here): s.c. (P 541690 photo!).

Although the type material of *C. musei* (P 541690!) is very similar to pure individuals of *C. boryana*, the short female glume aristas and most spikes arising near the apex of the stem lead us to think it is an introgressive form of the latter species with *C. borbonica*.

Carex borbonica was thought to be also distributed on Mauritius island by Kükenthal (1909; “Mauritius (in herb. Lamarck!)”). However, all studied materials of *C. borbonica* from Lamarck’s herbarium were collected from Reunion where this species grows on volcanic soil above 2250 m, while on Mauritius the highest point is the Piton de la Petite Rivière Noire (828 m). Moreover, although Baker (1877) included *C. bor-*

bonica in his Flora of Mauritius, this author indicated: “I have not seen Mauritian specimens”. For all these reasons, the references of this species for Mauritius are most likely mistaken.

Selected specimens

FRANCE. Reunion, Piton de la Fournaise, Plaine des Sables, 2250 m, 9-11-1966, H.J. Schlieben, 10894 (BR, PRE, M 124775, B 100240041). Reunion, Plateu des Basaltes (sur Plaine des Remparts-Région du Volcan), 2400 m, 30-5-1966, T. Cadet, 451 (K). Reunion, 10-1875, I.B. Balfour (K). Reunion, just below Maidho W of St. Paul, 2-11-1968, C. Barclay, 1334 (K). Reunion, 15-2-1847, Boivin, 23bis (K). Reunion, Bory, 1003 (BM 898021). Reunion, Plaine des Remparts, Commerzon Crater, 2280 m, 1-1-2009, M. Luceño & M. Guzmán, 1ML09 (UPOS 3635).

2. *Carex boryana* Schkuhr, Beschr. Riedgräs. 2: 43, fig. 191. 1806.

Ind. loc.: “*In Insula Franciae*”.

Lectotype (designated here): J.B.G.G.M. Bory de St. Vicent [Reunion] (HAL 103608, Herb. C. Schkuhr, photo!); isotypes: P 459767 photo!

= *Carex subulata* Wahlenb., Kongl. Vetensk. Acad. Nya Handl. 24: 152. 1803, nom. illeg., non J.F. Gmel., Syst. Nat. 2(1): 138. 1791 (homonym post.).

= *Carex boryana* var. *minor* Boott, Ill. Carex 3: 111. 1862.

Ind. loc.: “*Ile de la Réunion*”.

Lectotype (designated in Gehrke, 2011) L.H. Boivin (P 459763 photo!); isotype: P 459765 photo!; paratype: Boivin, 997 p.p. (P).

= *Carex giraudiana* Steud., Syn. Pl. Glumac. 2: 209. 1855.

Ind. loc.: “*Ile Bourbon*”.

Lectotype (designated here): H. Giraudy (P 459766 photo!).

Rhizome densely caespitose, with short internodes. Stems 75-163 cm, ± stout, trigonous, smooth, green to yellowish-green, sometimes purplish-red spotted. Leaves 25-48(63) cm × (2)4-15 mm, keeled to plicate, slightly scabrid on the edges and apical parts; lower sheaths dark purplish-red; ligule 2-2.5(9) mm, obtuse; anteligule edge concave to convex. Inflorescence (14)26-80(90) cm, lowest internode 8-30(45) cm and second one 1-24.5 cm. Lowest bract 17.5-56 cm × 2-9 mm, longer or shorter than the inflorescence; sheath 2.3-12.5(20.5) cm long, the inner side purplish-red. Spikes 5-14, sub-homomorphic, sometimes heteromorphic, all of them androgynous, with the male part increasing in length along the stem, exceptionally 1-5 whole male spikes at the top; terminal spike 1-9.5 cm × 2-8(12) mm, linear to narrowly terete, sessil

or with a peduncle up to 1.2 cm; lateral spikes, 1.5-9.5(11) cm × 4.5-8 mm, arising singly, in pairs or in groups of three, lax to subdense-flowered, linear to narrowly terete, usually bearing a few short branches at the base of the largest spikes, sessile or with a peduncle up to 4(6) cm. Male glumes 5.5-8.5(10) × (0.8)1-1.8 (2.1) mm, oblong-lanceolate, brown to reddish-brown with a wide, green or straw coloured midrib, aristate, with an arista 0.5-2.5 mm. Female glumes 4.5-8(9) × (0.8)1-1.6(2.2) mm, oblong-lanceolate to ovate, brown to reddish-brown with a wide, green or straw coloured midrib, with an arista or mucro (0.5)2.5-4.5(8) mm. Utricles (4)4.5-5.5 × 1.2-1.6 mm, ellipsoid-trigonus, straight, plurinerved (with 2 or more prominent veins), gradually or abruptly narrowed into a beak, light-green or brown with purplish-red speckles; beak (1)1.2-2.5 mm, deeply bifid, with ± similar dorsal and ventral sinus 0.4-0.6 mm depth, smooth or aculeolate. Achenes (1.7) 2.2-2.5 × 1.1-1.4 mm, trigonous, oblong-ellipsoid (exceptionally oblongo-bovoid or subspheroid). $2n = 68$.

Sept.-Jan. In wet forests and other shady places; 1300-2350 m; Reunion, [Mauritius and Madagascar?].

Comments: Kükenthal (1909) described *C. boryana* var. *boryana* as distributed in Reunion, Madagascar (“*Perville P! in herb. Musei Paris*”, material not seen in the present study) and Mauritius (no materials were cited for this island). In addition, Baker (1877) included this taxon in his Flora of Mauritius. However, we have not seen any material of *C. boryana* from Madagascar or Mauritius, although the presence of this species on the latter island is plausible.

No *Carex* material studied by us from Madagascar

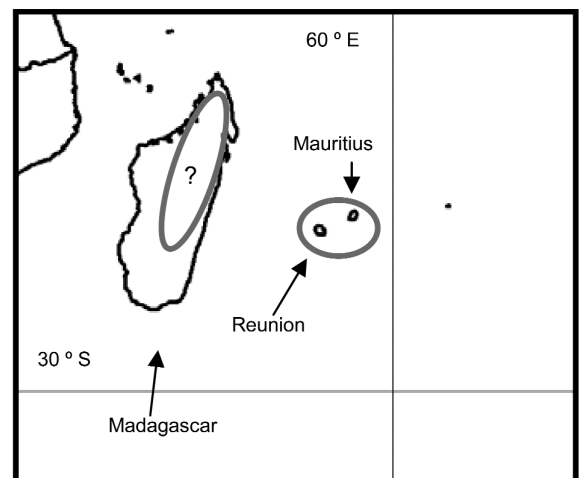


Fig. 2. Distribution of *Carex boryana*.

belongs to subsect. *Elatae* except perhaps the specimen “P. de la Bathie 13391 [at K], Ankaratra, Tsiafajavona Mts”; but this material is somewhat similar to *C. elgonensis* and therefore very different to *C. boryana*.

Some of the specimens used by Kükenthal (1909) to describe *C. boryana* var. *simplicissima* have been included in our concept of *C. manni* (Mann, 1478 photo!), whilst others (Boivin 997 K!) are intermediate forms between *C. boryana* and *C. borbonica*.

Selected specimens

FRANCE. Reunion, *Boivin*, 996 (UPS). Reunion, le Tévelave, near Les Avirons, Westcoast, Mistforest, 1300 m, 4-11-1966, *H.J. Schlieben*, 10834a (PRE). Reunion, 1837, *M. Richard*, 530, (K). Reunion, 24-1-1952, *Spach* (K). Reunion, 1867, *Hooker* (K). Reunion, 11-1921, *Hientbmay*, 10162 (M 124764). Reunion, Herville, Nossi-Bi, 2-12-1906, *C.H. D'Alleizette* (L 625308). Reunion, 9-1851, *M. Boivin* (US 2493537). Reunion, 1877, *R.J. Shuttleworth* (BM 898005). Reunion (C). Reunion, Curepipe, 21-11-1888, *H.H. Johnston* (E 219443). Reunion, between La Plaine des Cafres and La Plaine des Palmistes, Col de Bellevue, 1615 m, 31-12-2008, *M. Luceño & M. Guzmán*, 127ML08 (UPOS 3732). Reunion, Piton de la Fournaise, crater, 2350 m, 1-1-2009, *M. Luceño & M. Guzmán*, 2ML09 (UPOS 3636). Reunion, cirque Cilaos, Bras Sec, 1315 m, 4-1-2009, *M. Luceño & M. Guzmán*, 13ML09 (UPOS). Reunion, Les Makes, La Fenetre, 1650 m, 5-1-2009, *M. Luceño & M. Guzmán*, 14ML09 (UPOS 3637 to 3641). Reunion, W cirque Malfate, Le Maido, 2200 m, 6-1-2009, *M. Luceño & M. Guzmán*, 21ML09(1) (UPOS).

***Carex borbonica* × *boryana*.** FRANCE. Reunion, 6-2-1856, *Boivin*, 997 (K). Reunion, Cirque de Cilaos, Forest-trail to Piton des Neiges, 2260 m, *F.I. van Nek*, 2203 (WAG 112766). Reunion, W cirque Malfate, Le Maido, 2200 m, 6-1-2009, *M. Luceño & M. Guzmán*, 20ML09 (UPOS 3724 to 3729).

3. *Carex elgonensis* Nelmes in Bull. Misc. Inform. Kew 1938: 245-246. 1938.

Lectotype (designated in Haines & Lye, 1983): *G. Taylor* 3474 (BM 898027!); isotype: K 363578 photo!

Rhizome caespitose, with short internodes. Stems 23-107 cm, ± stout, trigonous, smooth, green to yellowish-green. Leaves 8-21 cm × 3-6 mm, keeled to plicate, some rigid, slightly scabrid on the edges and apical parts; sheaths straw coloured to dark purplish to blackish; ligule 2.5-4 mm, obtuse or acute; antiligule edge concave to convex. Inflorescence 8.5-27.5 cm, lowest internode 3-11.5 cm and second one 1.5-8 cm. Lowest bract 6.5-20 cm × 2-5 mm, shorter than or as long as the inflorescence; sheath 1-7.5 cm long, the inner side purplish-red. Spikes 5-7, heteromorphic, 1-3 male spikes at the upper part and 3-6 female lateral spikes, frequently with a few male flowers at the top; male spikes 1-4 cm × 4-8 mm, linear to terete, the terminal one sessile or with a peduncle up to 2.3 cm; lateral female or androgynous spikes, 2.5-5.5 cm × 7-10 mm, arising singly (exceptionally in pairs), subdense-flowered, oblong-terete to ovoid-terete, peduncle up

to 5 cm. Male glumes 5.5-9.2 × 1.2-1.8 mm, oblong, dark purplish to blackish without midrib or with a very narrow and straw coloured midrib, acuminate or aristate, acumen or arista up to 1.6 mm. Female glumes 4.5-6.5 × 0.9-1.9 mm, oblong-lanceolate, dark purplish to blackish, without midrib or with a very narrow and straw coloured midrib, acuminate or aristate, acumen or arista up to 1 mm. Utricles 4-6.2 × 1-1.5 mm, ellipsoid to obovoid-trigonus, straight, plurinerved, gradually to abruptly narrowed into a beak, straw coloured in the lower portion and dark purplish to blackish in upper parts, sometimes entirely dark purplish or blackish; beak 0.8-1.9 mm, bifid, with ± similar dorsal and ventral sinus 0.2-0.5 mm depth, smooth or with disperse and short pricklets. Achenes 2-2.3 × 0.9-1.1 mm, trigonus, ellipsoid to obovoid. $2n = ?$

Sept.-Feb. Banks of streams and borders of peat bogs; 3290-3810 m; Kenya and Uganda (Mt. Elgon).

Comments: Nelmes (1938) described *C. elgonensis* from Kenyan Mount Elgon. Nevertheless, other authors, such as Haines & Lye (1983), considered *C. mildbraedinana* var. *friesiorum* Kük. to be a synonym of *C. elgonensis*. Therefore, they considered *C. elgonensis* as distributed in all Kenyan uplands. Following Nelmes (1938), we have considered *C. elgonensis* as endemic to Mount Elgon, and in contrast to Haines & Lye (1983), we think that *C. mildbraedinana* var. *friesiorum* should be treated as a subspecies of *C. manni* (see below).

Selected specimens

KENYA. Mt. Elgon, eastern slope above Japata estate, Erica-cious belt, 3200 m, 9-5-1948, *O. Hedberg*, 854 (UPS, K). Trans

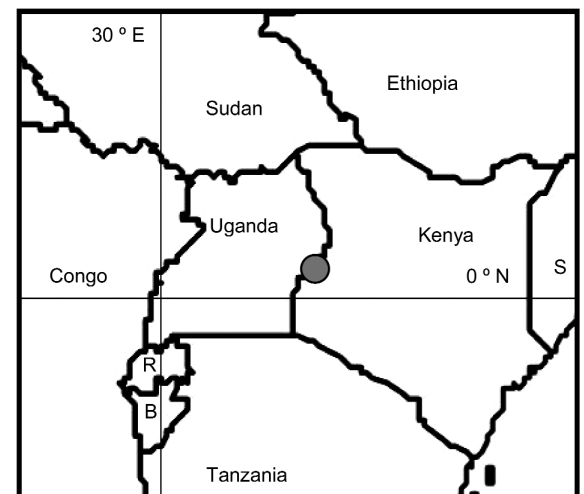


Fig. 3. Distribution of *Carex elgonensis*: R, Rwanda; B, Burundi; S, Somalia.

Nzoia, Mt. Elgon, c. 9 miles SW of the Suam Saw Mills, 3810 m, 22-12-1967, *O.M. Mwangangi & F. Kariuki*, 373 (K, LISC). Nyanza, Trans-Nzoia, Mount Elgon, 3290 m, 22-2-1935, *G. Taylor*, 3474 (BM 898027). Mt. Elgon National Park, Kambi, Mtamayua, 3561 m, 22-7-2007, *M.L. Buide & al.*, 31UPO-K (UPOS 3273).

UGANDA. Mt. Elgon, W slope above Butadiri, along the track via Mudangi through the Caldera, Hagenia Hypericum zone, on moist ground near "Mountain Hut", 3200 m, 4-12-1967, *O. Hedberg*, 4555 (UPS).

4. *Carex fischeri* K. Schum. in Engl. (ed.), Pflanzenw. Ost-Afrikas, C: 130. 1895.

Ind. loc.: "Abori" [Kenya].

Lectotype (designated in Gehrke, 2011): *Fischer* 640 (B 100240038!); isotype: K 363588 photo!

= *Carex simensis* var. *mauensis* Kük. in Engl. (ed.), Pflanzenr. IV, 20(38): 654. 1909.

Holotype: s.c. (B 100240026!).

= *Carex fischeri* var. *basianandra* Kük. in Notizbl. Bot. Gart. Berlin-Dahlem 9: 314. 1925.

Ind. loc.: "Mount Elgon: Bambus-Zone, 11000 ft".

Lectotype (designated Gehrke, 2011): *R.E. Fries & T.C.E. Fries* 1462 (UPS); isotypes: B 100240034!, K; paratypes: *R.E. Fries & T.C.E. Fries* 659 (UPS), *R.A. Dummer* 3465 (B 100240036!).

Rhizome caespitose, with short internodes. Stems (30)40-90(115) cm, ± stout, trigonous, smooth, green to yellowish-green. Leaves (15)24-50(65) cm × 3-8.5(10) mm, keeled to plicate, ± rigid, ± scabrid; sheaths dark brown, reddish-brown or purplish-red; ligule 1-8(12) mm, obtuse or acute; anteligule edge concave to convex. Inflorescence (11.5)13-37(54) cm, lowest internode 4-14(20) cm and second one (1)2.2-10(13) cm. Lowest bract (8)15-41(52) cm × 2.5-7(8) mm wide, longer or shorter than the inflorescence; sheath 2.5-7.5(10) cm long, the inner side dark brown, reddish-brown or purplish-red. Spikes 4-10, heteromorphic, 1 male or gynecandrous terminal spike, exceptionally 2 male or gynecandrous spikes at the top, and 3-9 female lateral spikes; male or gynecandrous spikes (2)2.5-5.5(6) cm × 2-6.5(8) mm, linear to terete or clavate (when gynecandrous), sessile or with a peduncle up to 1.5(3.5) cm; female spikes, (1)2-6.5(8) cm × 4-9(10) mm, arising singly, lax- to dense-flowered, largely terete, exceptionally bearing a few short branches at the base of largest spikes, peduncle up to 5(8) cm. Male glumes (4)4.5-7.5(8.5) × (0.8) 1-2 mm, oblong-ellipsoid to oblong-obovoid, membranaceous, brown, reddish-brown or purplish with straw or green coloured midrib, acuminate, mucronate or aristate, acumen, mucro or arista up to 2(2.3) mm, exceptionally obtuse. Female glumes (2.8)3-5.5(6.5) ×

(0.8)1-2(2.2) mm, ovate-elliptic, hyaline, brown, reddish-brown or purplish with straw or green coloured midrib, acuminate or aristate, acumen or arista up to 1.7(2.2) mm. Utricles (3)3.3-5.5(6) × 1.1-1.7(2) mm, ellipsoid, straight, plurinerved, tapered to beak, brown or greenish-brown with reddish or purplish speckles; beak (0.8)1.1-1.7(2) mm, ± deeply bifid, ± similar dorsal and ventral sinus 0.2-0.5 mm depth, smooth. Achenes 1.9-2.6 × 0.9-1.3 mm, trigonous, ellipsoid or ellipsoid-obovoid. $2n = 68, 70, 72$.

Jan.-Dec. Wet and open or shady places (forests, meadows, swamps, peat bogs, stream banks); 2150-4300 m; D.R. Congo, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda.

Comments: In view of the variability of the studied materials, we have considered two subspecies. However, we have seen several specimens that exhibit intermediate morphological features, but most of these materials can be classified in one of the two races.

It is also interesting to note that some individuals studied show intermediate characters between this species and *C. mannii* (e.g. spikes arising in pairs and aculeolate beaks and red basal sheaths). Some additional studies may be necessary to know if these forms are the result of sporadic hybridization with the latter species or a third race of this highly polymorphic species.

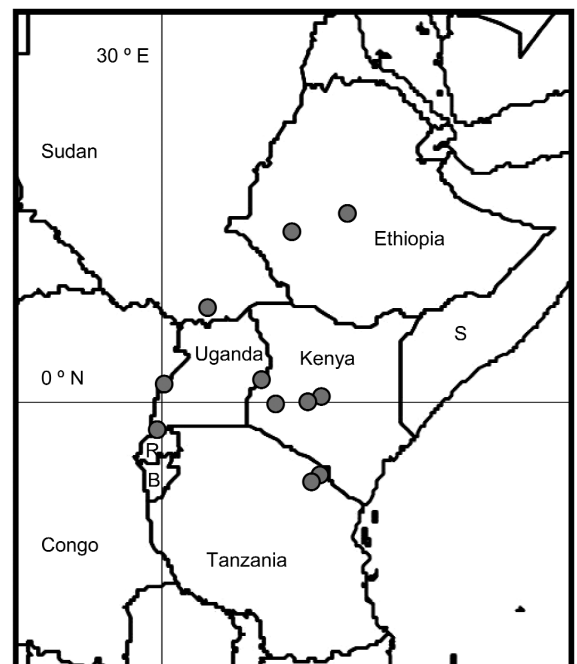


Fig. 4. Distribution of *Carex fischeri* subsp. *fischeri*: **R**, Rwanda; **B**, Burundi; **S**, Somalia.

We would like to emphasise that although the type materials of *Carex fischeri* var. *basiandra*: R.E. Fries & T.C.E. Fries 2210 (K 363579 photo!) and R.E. Fries & T.C.E. Fries 1462 (K 363580 photo!) each consist of only a few utricles, we are confident of their inclusion in this species.

KEY TO THE SUBSPECIES OF *CAREX FISCHERI*

1. Female glumes hyaline, pale brown or light reddish-brown, never purplish; leaves non-rigid **4a. *C. fischeri* subsp. *fischeri***
1. Female glumes, dark reddish-brown or purplish; leaves rigid **4b. *C. fischeri* subsp. *recedens***

4a. *Carex fischeri* subsp. *fischeri*

Stems (30)40-90(115) cm long, ± stout. Leaves up to 8.5(10) mm wide, slightly scabrid on the edges and apical parts; basal sheaths dark brown, reddish-brown or purplish-red. Inflorescence (11.5)17-37(54) cm, lowest internode 4-14(16) cm and second one (1)3-9.5(10.5) cm. Lowest bract 2.5-7 mm wide; sheath (2.5)4-7.5(10) cm long, the inner side dark brown, reddish-brown or purplish-red. Spikes 5-10; female spikes, 4-7(8) mm wide, lax-flowered to dense-flowered, terete, peduncle up to 5(8) cm. Female glumes (2.8)3-4.8(5.5) × (0.8)1-1.6(1.8) mm, hyaline, pale brown to reddish-brown. Utricles (3)3.3-4.8(5) long, light brown to greenish-brown with reddish or purplish speckles. $2n = 68, 70, 72$.

Jan.-Dec. Wet and open places; 2350-3450 m; Kenya, Sudan, Tanzania, and Uganda.

Comments: Plants collected in Tanzania are usually bigger in all their parts.

Selected specimens

ETHIOPIA. Mt. Uociacia, about 15 Km W of Addis Ababa, 2500 m, 27-10-1965, *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes*, 8542 (WAG 112501, WAG 112502). Sidamo, 82 Km S of Agere Selam along road to Kebre Mengist, 2150 m, *J.J.F.E. De Wilde & M.G. Gilbert*, 317 (WAG 112496, WAG 112497). Addis Abeba, about 2 Km NE of Italian Embassy, 2400 m, 31-7-1965, *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes*, 7409 (WAG 112505, WAG 112504, WAG 112505). About 25 Km W of Addis Ababa, 2600 m, 24-4-1965, *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyfjes*, 6423 (WAG 112506, WAG 112507).

KENYA. Nyanza, Londiani, Tinderet Forest Reserve, Camp 6, about 6 Km SSE of Timboros Station, 2800 m, *R.A. Maas Geesteranus*, 5475 (MO, PRE, L 625310). Rift Valley, Nakuru, eastern Mau Forest Reserve, camp 10, 2650 m, 30-8-1949, *R.A. Maas Geesteranus*, 5966 (MO 1731309, PRE, L 625311, WAG 112520, US 2247255). Mt. Kenya occid., 2300 m, 29-12-1921, *R.E. Fries & T.C.E. Fries*, 493 (BR, B 100240023). Mt. Aberdare, 2300 m, 12-3-1922, *R.E. Fries & T.C.E. Fries*, 2210 (B 100240035). Nyanza, Trans-Nzoia, Mount Elgon, 2400 m, 19-2-1935, *G. Taylor*, 3424 (MO 2128965). Mt. Kenya, Westhang, bei Met.- Station, 3050 m, 25-9-1980, *H. Rehder* (M 124770, M 124772). Nyeri, Mount Kenya

National Park, area near Percival's Bridge along the park road E of Naro Moru, 2740 m, 5-3-1974, *G. Davidse*, 7031 (WAG 122522, WAG 122521). Bamboo zone, western slopes of Mount Kenya, along the trail from West Kenya Forest Station to summit, British East Africa, 3000 m, 28-9 to 7-10-1909, *E.A. Mearns*, 1765 (US 631719, C). Bamboo zone, western slopes of Mount Kenya, along the trail from West Kenya Forest Station to summit, British East Africa, 3000 m, 28-9 to 7-10-1909, *E.A. Mearns*, 1674 (US 631625). Mau – Plateau, 3000 m, 8-5-1906 (B 100240026). West Kenya, Liki-River, in moist Stelle am Bache, 2500 m, 11-2-1922, *R.E. Fries & T.C.E. Fries*, 1462 (B 100240034). Bamboo zone, western slopes of Mount Kenya, along the trail from West Kenya Forest Station to summit, British East Africa, 3000 m, 28-9 to 7-10-1909, *E.A. Mearns*, 1736 (C). Central, Nanyuki, Mt. Kenya, W slope, National Park Road (Naro Moru Track), 3450 m, 23-1-1970, *L. Ryvardeen*, 5576 (O). Aberdares National Park, Mutubio road, 3106 m, 26-7-2007, *M.L. Buide & al.*, 83UPO-K (UPOS 3289). Mt. Kenya National Park, Naro Moru route, 2974 m, 28-7-2007, *M.L. Buide & al.*, 104UPO-K (UPOS 3300).

SUDAN. Equatoria, Torit, Mt. Dumuso, 1-6-1950, *J.K. Jackson*, 1550 (K).

TANZANIA. Arusha, Arusha National Park, the crater Mt. Meru, E. side, 2600 m, 23-4-1968, *P.J. Greenway & Kanuri*, 13502 (MO 1991585). Arusha, Arumeru, Mt. Meru, 2820 m, 11-1-1985, *R.E. Gereau*, 1667 (MO 3204851, MO 5106243). Tanganyika Territory, Mt. Meru, eastern slopes above Olkakola estate, 3150 m, 31-10-1948, *O. Hedberg*, 2420 (UPS). Mt. Meru, Crater, montane meadow inside the crater, 2700 m, 23-1-1976, *K. Szczepanek & B. Zemanek*, 820 (UPS). Kilimanjaro, Morlow above rain gauge, 2800 m, 4-8-1993, *JMG*, 93521 (K). Kilimanjaro, forest above Kilimanjaro timbers, 2500 m, 13-1-1994, *JMG*, 9464 (K). Tanganjika, Kilimandscharo, Güterwald, 2360 m, 4-1-1934, *H.J. Schlieben*, 4487 (M 124774, B 100240046, B 100240048). Kilimandscharo, Urwald-zone zwischen Marangu und der Bismarckhütte, 2800 m, 12-1929, *Fr.u.R. Wettstein* (M 124773, WU 3029). Kilimandscharo, 3000 m, 2-10-1909, *R. Endlich*, 626 (B 100240037).

UGANDA. Western, Toro, Rwenzori, Namwamba Valley, 2750 m, 6-6-1935, *G. Taylor*, 2944 (MO 2128967). Ruwenzori, Bukuku Valley, near Bigo camp, along a small path close to the camp site, 3400 m, 22-3-1948, *O. Hedberg*, 397 (UPS). Kigezi, Mt. Muhavura, W slopes, 3350 m, 7-10-1948, *O. Hedberg*, 2179 (UPS). Mt. Elgon, eastern slope above Japata estate, 3000 m, 1-3-1948, *O. Hedberg*, 193 (UPS). Kigezi, Mt. Muhavura, W slopes, 3350 m, 7-10-1948, *O. Hedberg*, 2179 (UPS). Mt. Elgon, bamboo forest along the bank of the Sasa River, close to the Bumagaluba - Mountain Hut Trail, 2500 m, 22-2-1974, *S. Lisowski*, 10936 (BR). Toro U2, Mt. Ruwenzori, near Nyamileju (2 nd) Hut, 3300 m, 30-12-1968, *K.A. Lye*, 1259 (K). Mt. Ruwenzori, 2870 m, 8-1938, *J.W. Pursglove*, 325a (K). Mt. Elgon, 3350 m, 1-1918, *R.A. Dummer*, 3465 (US 1172896, B 100240036).

4b. *Carex fischeri* subsp. *recedens* (Kük.) Luceño & M. Escudero, **comb. nov.**

≡ *Carex longipedunculata* K. Schum. var. *ninagonensis* Kük. f. *recedens* Kük. in Mildbr. (ed.), *Wiss. Erg. Deut. Zentr.-Afr. Exped., Bot.: 53*. 1914, *basyonimus*.

Ind. loc: "Vulkan – Gebiet: *Karisimbi, Güterwald von Hagenia über dem Bambus*".

Lectotype (designated in Gehrke, 2011): *Mildbraed 1578* (B 100240021!); isotype: K.

Stems (35)40-68(85) cm, stout. Leaves up to 8(9) mm wide, rigid to very rigid, scabrid; basal sheaths brown or reddish-brown. Inflorescence 17-37(50) cm, lowest internode 5.5-14(20) cm and second one 3-10(13) cm. Lowest bract 4-7(8) mm wide; sheath (3)4-7(8.5) cm long, the inner side reddish-brown to purplish-red. Spikes 4-8; female spikes, 6-9(10) mm wide, subdense-flowered to dense-flowered, terete, peduncle up to 5(7.5) cm. Female glumes (3)4-5.5(6.5) × (1)1.2-2(2.2) mm, dark reddish-brown or purplish. Utricles (4)4.5-5.5(6) mm long, brown to greenish-brown with purplish speckles. $2n = ?$

Jan.-Dec. Wet places; 2800-4300 m; D.R. Congo, Uganda and Rwanda.

Comments: The putative isotype of *Carex longipedunculata* K. Schum. f. *recedens* Kük. "Mildbraed 1578 (K363483 photo!)" consists of just a few utricles.

Selected specimens

CONGO. Karisimbi, Rukumi, 8-1957, *J. Louis*, 5404 (MO 1639075, BR, NY, B 100240040, C). Kivu, Kabara, SE base of Mt Mikeno, 3150 m, 15-3-1977, *W.G. D'Arcy*, 8520 (MO 2403571). Kivu, Rutshuru, Parc national des Virunga, Kbara, entre Mikeno et Karisimbi, 23-1-1972, *G. Troupin*, 14300 (MO 2421977, WAG 112518). Nyiragongo, Shaheru (Parc National Albert), 11-1937, *J. Lebrun*, 8780 (MO 1639019). Parc National Albert (Virunga National Park), Plateau du Rukumi, versant N du Karisimbi, 3700 m, 8-1937, *J. Lebrun*, 7450 (BR). Parc National Albert (Virunga National Park), Karisimbi, 3500 m, 3-4-1945, *Germain*, 3723 (PRE, BM 898013, C). Ruwenzori-Kivu, Lukumi meadow, north slope of Mt. Karisimbi, 3700 m, 14-6-1926, *J.P. Chapin* (NY). Parc National Albert (Virunga National Park), Karisimbi, 3500 m, 3-4-1945, *Germain*, 3724 (NY). Kivu, Parc des Virunga, Karisimbi, plateau de Rukumi, 3500 m, 22-1-1972, *P. van der Keken*, 9126 (WAG 112524, C). Kivu, Karisimbi, 3000 m, 11-1907, *J. Milbraed*, 1578

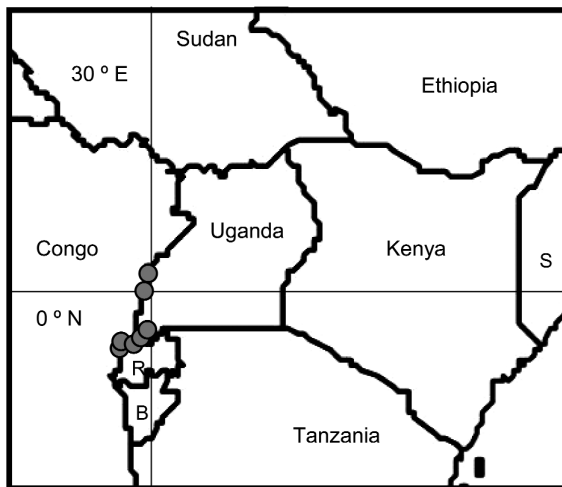


Fig. 5. Distribution of *Carex fischeri* subsp. *recedens*: R, Rwanda; B, Burundi; S, Somalia.

(B 100240021). Mt. Karisimbi, Camp Lukumi, N slope, 3450 m, 18-3-1927, *D.H. Linder*, 2364 (B 100240020).

RWANDA. Hagenia Zone, Karisimbi/Visoke saddle, 3000 m, 4-2-1977, *W.G. D'Arcy*, 7574 (MO 2403569, MO 3126325). S. side of Mt. Visoke, 3200 m, 9-3-1975, *W.G. D'Arcy*, 8317 (MO 2403710). Ruhengeri, Flanc sud du Sabyinyo, 3050 m, 3-2-1972, *P. Bamps*, 3064 (BR, LISC, W 6139). Karisimbi volcano, S.W. - side, 3600 m, 11-10-1974, *J. Rammeloo*, 5016 (BR). Camp Rueru, southwest slope of Mt. Mikeno, 2895 m, 11-3-1927, *D.H. Linder*, 2252 (HUH 246042).

UGANDA. Kasese, Busongora County, around Bigo camp, 3050 m, 21-1-1981, *A. Katende*, 3004 (MO 3257248, BR, US 3398838). Western, Kigezi, Virunga-Kette, Sattel zwischen Muhura und Mgahinga, 3000 m, 18-11-1954, *H.U. Stauffer*, 836 (PRE, WAG 112790, WAG 112788). Ruwenzori, Bigo Hut, 3350 m, 1-1-1969, *R.W. Haines*, 274 (K, E 219442).

5. *Carex greenwayi* Nelmes in Bull. Misc. Inform. Kew 1938: 244. 1938.

Ind. loc.: "Tanganyika Territory: Kilimanjaro, Bismarck Hill, damp places, with ferns, in dense shade of *Philippia excelsa*- *Hagenia abyssinica* and *Podocarpus* forest and woodland, 3000 m" [Tanzania].

Lectotype (designated in Gehrke, 2011): *Greenway* 3840 (BR 8639721 photo!); isotype: K 363447!

= *Carex vallis-rosetto* var. *purpurea* Kük. in Engl. (ed.), Pflanzenr. IV, 20(38): 647. 1909.

Ind. loc.: "*Kilimandscharo, am Fuss des Kifinika Vulkans, 2800 m*".

Lectotype (designated in Gehrke, 2011): *Volkens* 1342 (B 100240043!); isotypes: BM 898002!, K 363444 photo!; paratypes: *Volkens* 1291 (K 363445 photo!, BM 898002!, B 100240049!, E 219437!).

= *Carex vallis-rosetto* f. *ramosa* Kük., Notizbl. Bot. Gart. Berlin-Dahlem 9: 314. 1925.

Ind. loc.: "*West-Kenia Forest Station am Waldesrande, 2300*".

Lectotype (designated in Gehrke, 2011): *R.E. Fries & T.C.E. Fries* 1158 (K 363448 photo!); isotype: UPS!; paratype: *R.E. Fries & T.C.E. Fries* 676 (UPS!).

– *Carex vallis-rosetto* sensu auct. pl., non K. Schum. p.p. (see comments below).

Rhizome caespitose, with short internodes. Stems (66)127-153 cm, very stout, trigonous, smooth, green to yellowish-green, but densely dark purplish-red spotted or tinted towards the base. Leaves 44-98 cm × 8-14 mm, plicate, slightly scabrid on the edges and apical parts; sheaths dark purplish; ligule 2.5-5 mm, obtuse; anteligule edge concave. Inflorescence 32-64 cm, lowest internode 8-25 cm and second one 8-17 cm. Lowest bract 36-56 cm × 6-9.5 mm, shorter than inflorescence, exceptionally longer; sheath 6-8.5 cm long, the inner side purplish. Spikes 9-24, homomor-

phic to sub-homomorphic, androgynous, bearing only a few male flowers at the top of the spikes; terminal spike 3.5-11.4 cm × 4-8 mm, terete, peduncle up to 2 cm; lateral spikes, 2-11 cm × 5-8 mm, subdense to dense-flowered, terete, arising in pairs (sometimes in groups of three), at least some of them with a few short branches at the base, peduncle up to 7.5 cm. Male glumes 4-6.5 × 0.9-1.7 mm, oblong-lanceolate, reddish-brown with green midrib, mucronate or acuminate, mucro or acumen up to 0.6 mm, or, more rarely, obtuse. Female glumes 3.5-5.5 × 0.8-2 mm, oblong-lanceolate, reddish-brown to purplish-red, with green or straw coloured midrib, acuminate to aristate, acumen or arista up to 1.7 mm. Utricles 4-5.5 × 1-1.5 mm, elliptic to lanceolate in outline, straight, plurinerved, tapered to beak, from greyish-green with reddish or purplish speckles to entirely purplish coloured; beak 1.1-1.5 mm, ± bifid, with ventral sinus usually deeper than the dorsal one, the latter 0.2-0.4 mm depth, smooth. Achenes 2.2-2.6 × 0.9-1.2 mm, trigonous, oblong-ellipsoid. $2n = ?$

Jul.-Feb. Wet and open or shady places (forest, swamp, river bank); 1900-3050 m; Kenya, and Tanzania.

Comments: Schumman (1895) described *C. vallis-rosetto* based on Volkens (1291 and 1342) and Holst's (3823) materials. Later, Clarke (1902), who studied only the original material of *C. vallis-rosetto* collected by Volkens, described a new species from eastern tropical Africa (*C. cyrtosaccus*) based on material collected by White. Subsequently, Kükenthal (1909) described *C. vallis-rosetto* var. *purpurea* Kük. based on the materials collected by Volkens, and he assigned Holst's material to the typical variety. Nelmes (1938) designated Holst's collection as the type material of

C. vallis-rosetto K. Schum. on the grounds that (1) this material was collected in the Rosetto Valley, and (2) Kükenthal's (1909) view. In his work, Nelmes described a new species, *C. greenwayi*, and he treated *C. vallis-rosetto* var. *purpurea* as a synonym of this new species. Following Nelmes (1938), we consider these plants from the uplands of Kenya, D.R. Congo and northern Tanzania as *C. greenwayi*. We also agree with the doubts expressed by Nelmes (1938) regarding the status of *C. cyrtosaccus*, which we treat here as a synonym of *C. vallis-rosetto*. The nomenclatural complexity of this group was the cause of our previously mistaken view of these taxa (Escudero & Luceño, 2009).

Selected specimens

KENYA. Mt. Kenya occid., pr. West-Kenya Forest Station am Wadelsrande, 2300 m, 22-1-1922, R.E. Fries & T.C.E. Fries, 1158 (UPS). Mt. Kenya occid., 2350 m, 3-1-1922, R.E. Fries & T.C.E. Fries, 676 (UPS). Aberdares National Park, Mutubio road, just after junction to Ruhuruini Gate, 2515 m, 26-7-2007, M.L. Buide & al., 75UPO-K (UPOS 3283).

TANZANIA. Kilimanjaro, S slope on Mweke route, 3050 m, 14-9-1966, S.W. Bie, 66246 (UPS). Tanganjika, Kilimandscharo, 2360 m, 4-1-1934, H.J. Schlieben, 4487 (BR, BM 898001, B 100240047, B 100240046, B 100240048). Tanganjika, Kilimanjaro, 2900 m, 7-12-1932, Geilinger, 4374 (K). Arusha, Mbulu, Mt. Hanang, Nangwa river, 1890 m, 26-10-1968, W. Charmichael, 1549 (K). Kilimanjaro, forest above Mandara Hut, 2800 m, 15-10-1993, JMG, 93937 (K). Kilimandscharo, Marangu, [Gurnelwuld], 10-1893, G. Volkens, 1291 (BM 898002, B 100240049, E 219437). Kilimandscharo, Fuss des Kipinika, 11-1893, G. Volkens, 1342 (BM 898002, B 100240043). Kilimandscharo, urwald riber Moschi, 2700 m, 6-2-1914, A. Peter, 1298 (B 100240050). Tanganjika, Kilimandscharo, Urwaldrand bei der Bismarckheite, 2500 m, 28-1-1914, A. Peter, 792 (B 100240045, B 100240044). Kilimandscharo, 3000 m, 2-10-1909, R. Endlich, 626 (B 100240037). Kilimanjaro, S slope on Mweke route, 3050 m, 14-9-1966, S.W. Bie, 66246 (O).

6. *Carex mannii* E.A. Bruce in Bull. Misc. Inform. Kew 1933: 150. 1933.

Ind. loc.: "Fernando Po: Clarence Peak, 7500 ft" [Bioko, Equatorial Guinea].

Lectotype (designated here): Mann 1478 (K 363442!); isotypes: K 363443!, K 363444!

= *Carex boryana* var. *simplicissima* Kük. in Engl. (ed.), Pflanzenr. IV, 20(38): 651. 1909.

Ind. loc.: "Tropiches Westafrika: Fernando Po, Clarence Peak, 2500-2800 m".

Lectotype (designated here): Mann 1478 (K 363442!); isotypes: K 363443!, K 363444!

= *Carex longipedunculata* var. *ninagongensis* Kük. in Engl. (ed.), Pflanzenr. IV, 20(38): 767. 1909.

Ind. loc.: "Deutsch-Ostafrika: Station Kissenye, Ninagongo, oberer lichter Cornuswald, 2900 m".

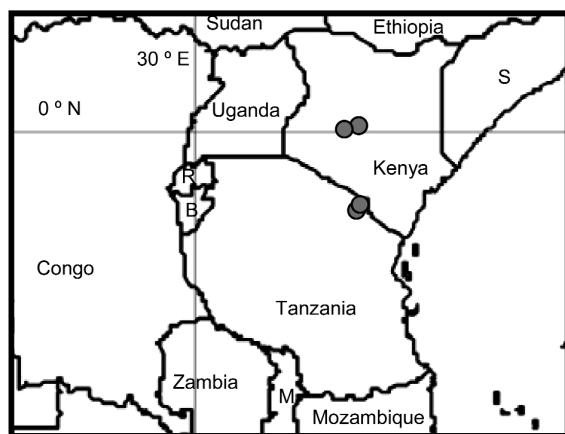


Fig. 6. Distribution of *Carex greenwayi*: R, Rwanda; B, Burundi; M, Malawi; S, Somalia.

Lectotype (designated in Gehrke, 2011): *J. Milbraed 1338* (K 363482 photo!); isotype: B 100166184! *Carex simensis* var. *ninagongensis* (Kük.) Kük. in Notizbl. Bot. Gart. Berlin-Dahlem 9: 316 (1925). *Carex ninagongensis* (Kük.) Nemes ex Robyns & Tournay in W. Robyns, Fl. Spermatophyt. Parc Nat. Albert 3: 292. 1955.

Rhizome caespitose, with short internodes. Stems 40-150 cm, ± stout, trigonous, smooth, green to yellowish-green usually with dark purplish-red spotting or tinted towards the base. Leaves (10)15-55(60) cm × (3) 4.5-9.5 mm, keeled to plicate, sometimes slightly rigid, ± scabrid on the edges and apical parts; sheaths dark purplish-red; ligule (1)1.8-6 mm, obtuse to acute; anteligule edge concave to convex. Inflorescence (9)12-59 cm, lowest internode (3)4-20(22) cm and second one 1-15 cm. Lowest bract (5.9)7-65 cm × (1.5) 2-7 mm, shorter or longer than the inflorescence; sheath 2-9.5 cm long, the inner side dark purplish-red. Spikes 4-13, heteromorphic to sub-homomorphic, 0-2 male, gynecandrous or androgynecandrous spikes at the top, up to 12 female or androgynous lateral spikes; terminal spike 2-8 cm × (3)4-10(13) mm, terete, ovoid or ellipsoid, sessile or with a peduncle up to 3(3.5) cm; lateral, female or androgynous spikes, 1-7.5(8.9) cm × 5-11 mm, subdense to dense-flowered, terete to ovoid-terete, arising singly or in pairs, at least some of them with a few short branches at the base of the largest spikes, peduncle up to 5.5(7) cm. Male glumes 4-9 × 1-2(2.2) mm, oblong-elliptic to oblong-obovate, dark reddish-brown to purplish-red with wide, straw or green coloured midrib, mucronate, acuminate or aristate, mucro, acumen or arista up to 1.6 mm, sometimes obtuse. Female glumes (3)3.5-6.5(8) × (0.8)1.1-2(2.2) mm, oblong-elliptic, purplish-red, with green or straw coloured midrib, acuminate or aristate, acumen or arista up to 2.3 mm. Utricles (3.5)3.7-5.2(6) × (1)1.1-1.7(2) mm, elliptic in outline, straight, plurinerved, gradually to abruptly narrowed into a beak, greenish-brown or yellowish-green with many purplish-red speckles; beak 1-2.1 mm, bidentate to bifid, with ± similar ventral and dorsal sinus 0.2-0.5 mm depth, smooth or with short, scattered prickles. Achenes (1.8)2-3 × 0.8-1.4 mm, oblong-ellipsoid to oblong-obovoid. $2n = 70$.

Jan.-Dec. Wet and open places: edges of streams, swamps, wet meadows, bogs; 2200-3500 m; Cameroon, D.R. Congo, Equatorial Guinea (Bioko), Ethiopia, Kenya, Rwanda, Sudan and Uganda.

KEY TO THE SUBSPECIES OF *CAREX MANNII*

1. Stems 100-150 cm, widest leaves more than 7.5 mm; utricles 5-6 mm long **6c. *C. mannii* subsp. thomasi**

1. Stems 40-100 (120) cm, widest leaves up to 7.5 mm; utricles 3.5-5.2 (6) mm long 2
2. Lateral spikes (6)7-10(11) mm wide, narrowly ovoid or ellipsoid; female glumes dark purplish-red; beak of the utricles ± densely aculeolate **6b. *C. mannii* subsp. friesiorum**
2. Lateral spikes 5-8(10) mm wide, ± terete; female glumes pale to medium purplish-red to purplish; beak of the utricles smooth or sometimes with some short, scattered prickles **6a. *C. mannii* subsp. mannii**

6a. *Carex mannii* subsp. mannii

Stems (40)50-100(120) cm, ± stout. Leaves (3)4.5-6.5(7.5) mm wide, ± scabrid. Inflorescence (9.5)14-30(46) cm, lowest internode (3)4-14(21) cm and second one (1)2-7(11) cm. Lowest bract (8)11-30(44) cm × 2-4.5(6) mm; sheath 2-5.5(6.5) cm long. Lateral spikes (1)2-6(8.9) cm × 5-8(10) mm, ± terete. Male glumes 4-7 × 1-1.6(1.8) mm, dark reddish-brown to purplish-red. Female glumes, (3)3.5-5.5(6) × (0.8)1.1-1.7(2) mm, pale to medium purplish-red to purplish. Utricles (3.5)4-5(5.5) mm long; beak 1.2-2.1 mm, smooth or sometime with short, scattered, minute prickles. $2n = 70$.

Jan.-Dec. Open and wet places: stream banks, wet meadows, peat bogs, swamps; 2400-3500 m; Cameroon, D.R. Congo, Equatorial Guinea (Bioko), Kenya, Rwanda and Uganda.

Comments: Some specimens of *C. mannii* ssp. *mannii* from the Aberdare Ranges are similar to forms of *C. greenwayi*, but are smaller than plants of this species and at least some spikes are not androgynous.

Selected specimens

CAMEROON. Dschang, Mélétan, Nordöstlich des Mélétan, in Kleiner Sumpfwiese, 2500 m, 11-7-1955, A. Saxer, 166 (WAG 112525). Dime, Ekondo, 6-5-1938, Domke, 231 (B 100240018).

CONGO. Kivu, lower slopes of Mt. Visoke facit Mt. Mikeno, 3000 m, 17-2-1975, W.G. D'Arcy, 7889 (MO 2403565). Ruwenzori, Lanuri, 3000 m, 3-6-1914, Bequaert, 4680 (BR). Parc Natinal Albert (Virunga National Park), Versant E du Ninagongo, cratere

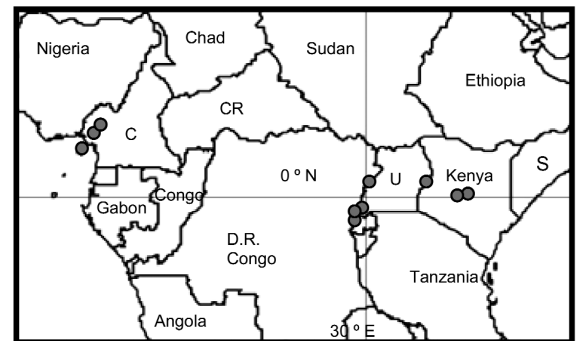


Fig. 7. Distribution of *Carex mannii* subsp. *mannii*: **C**, Cameroon; **U**, Uganda; **CR**, Central African Republic; **S**, Somalia.

du Shaheru, 3000 m, 11-1937, *J. Lebrun*, 8747 (BR). Kivu, Mikeno, 4-1929, *H. Humbert*, 7999 (BR, US1529897, B 100240028). Camp Rueru, southwest slope of Mt. Mikeno, 2900 m, 14-3-1927, 2317 (K, LD). Mt. Ninagongo, 2950 m, 16-2-1926, *D.H. Linder*, 2076 (K, HUH 246041). Ninagongo, Kisenye, 2900 m, 4-6-1907, *J. Mildbraed*, 1338 (B 100166184).

EQUATORIAL GUINEA. Bioko, road to peak Basilé, Km 18-19, source of Cope river, 2470 m, 1-11-1988, *Carvalho*, 3677 (MA 512419, MO 4320166, UPS, U 227744, BM 898010, B 100014064, H 1667997).

KENYA. Nyeri, Mount Kenya National Park, area near Percival's Bridge along the park road E of Naro Moru, 2740 m, 5-3-1974, *G. Davidse*, 7031 (MO 2302382). Mt. Aberdare, Kinangop, northern slope, 3300 m, 17-7-1948, *O. Hedberg*, 1633 (UPS). Mt. Aberdare occid., regio bambusina inferior, 16-3-1922, *R.E. Fries & T.C.E. Fries*, 2533 (UPS). Aberdares, 2740 m, 21-12-1969, *R.W. Haines*, 4315 (K, NY). Bamboo zone, western slopes of Mount Kenya, along the trail from West Kenya Forest Station to summit, British East Africa, 3000 m, 28-9 to 7-10-1909, *E.A. Mearns*, 1765 (NY). W Mt. Kenya, Moorlands, 250 m S of Naro Moru Route, 3500 m, 14-2-1983, *H. Rehder* (M 124771). Nyeri, Mt. Kenya National Park vicinity, 3200 m, 11-1-1975, *T.B. Croat*, 28307 (WAG 112798). Aberdares National Park, Mutubio road, 3106 m, 26-7-2007, *M.L. Buide & al.*, 79UPO-K(4) (UPOS 3286). Aberdares National Park, Mutubio road, 3000 m, 26-7-2007, *M.L. Buide & al.*, 76UPO-K (UPOS 3285, UPOS 3284).

RWANDA. Parc des Volcans, by river Sousa, 2700 m, 6-3-1975, *W.G. D'Arcy*, 8280 (MO 3184710). Ruhengeli, Volcan Gahinga, 3100 m, *B. Runyinya*, 738 (BR).

UGANDA. Bufumbira, Kigezi, bog on Gahinga-Muhavura saddle, 24-4-1979, *K.A. Lye & A. Katende*, 5287 (UPS). Ruwenzori, Vallée de la Mubuku, near the mouth of the Bujuku, 2550 m, 10-2-1974, *S. Lisowski*, 10956 (BR). Western, Kigezi, Virunga-Ostgruppe, Sattel zwischen Muhavura and Mgahinga, 3000 m, 14-11-1954, *H.U. Stauffer*, 777 (PRE, K, WAG 112789, WAG 112786). Kigezi, Bufumbira, Gahinga, east side, 3100 m, 24-4-1970, *K.A. Lye & A. Katende*, 5271 (K). Kigezi U2, Bufumbira, N-slope of Gahinga-Muhavura saddle, in Forest Reserve, 2800 m, 24-4-1970, *K.A. Lye & A. Katende*, 5300 (K). Between Ingahinga and Muhavura, 2530 m, *W.J. Eggeling*, 1070 (K). Kigezi, Bufumbira, col. between Mts. Muhavura and Mgahinga, 3050 m, 9-9-1952, *E.M. Norman*, 164 (K). Frontier between Kenya and Uganda, Mt. Elgon, 2740 m, 4-1930, *L.C. Liebenberg*, 1708 (US 1575093). Mt. Elgon, 3050 m, 1-1918, *R.A. Dummer*, 3459 (US 1172892).

6b. *Carex mannii* subsp. *friesiorum* (Kük.) Luceño & M. Escudero, **comb. nov.**

≡ *Carex mildbraediana* var. *friesiorum* Kük. in Notizbl. Bot. Gart. Berlin-Dahlem 9: 316-317. 1925, basyonimus.

Ind. loc.: “West-Kenia: Untere Bambusregion, an einer offenen grasigen, etwas feuchten Stelle, 2500 m”.

Lectotype (designated in Gehrke, 2011): *R.E. Fries & T.C.E. Fries* 1228 (UPS!); isotype K, paratypes: *R.E. Fries & T.C.E. Fries* 2652 (UPS!), *R.E. Fries & T.C.E. Fries* 2553 (UPS!), *R.E. Fries & T.C.E. Fries* 2703 (UPS!).

Note: *Escudero & Luceño (2009) cited wrongly the basyonimus due to a slip.*

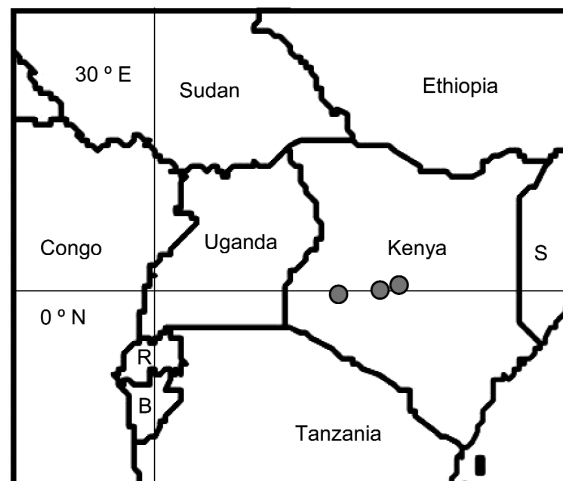


Fig. 8. Distribution of *Carex mannii* subsp. *friesiorum*: **R**, Rwanda; **B**, Burundi; **S**, Somalia.

= *Carex vallis-rosetto* var. *heterostachya* Kük. in Notizbl. Bot. Gart. Berlin-Dahlem 9: 314. 1925.

Ind. loc.: “West-Kenia Forest Station, an einer Bachufer im Walde, 2350 M”.

Lectotype (designated in Gehrke, 2011): *R.E. Fries & T.C.E. Fries* 769 (UPS); isotypes: BR8644633 photo! K363583 photo!

Stems, 42-100 cm, ± stout. Leaves 4.5-7.5 mm wide, ± scabrid. Inflorescence (9)12-28(35) cm, lowest internode (3.2)4.5-14(22) cm and second one 1-8(12) cm. Lowest bract (5.9)7-23(27) cm × (1.5)2-5(6) mm; sheath 2-8.5 cm long. Lateral spikes 1-5.5 cm × (6)7-10(11) mm, narrowly ovoid or ellipsoid. Male glumes (4)4.5-7.5(8) × 1.4-2(2.2) mm, dark purplish. Female glumes (4)4.5-6.5(8) × (1.2)1.4-2(2.2) mm, dark purplish-red. Utricles 3.7-5.2(6) mm long; beak 1-1.5 mm, ± densely aculeolate. $2n = 70$.

Jan.-Dec. Open and wet places, streams, wet meadows, peat bogs, swamps; 2300-3500 m; Kenya (Aberdare, Kenya and Mau Mounts).

Selected specimens

KENYA. Rift Valley, Nakuru, eastern Mau Forest Reserve, camp 9, Sasaru, 2750 m, 25-8-1949, *R.A. Maas Geesteranus*, 5882 (MO 1731743, BR, WAG 112527, US 2247235). Rift Valley, Nakuru, eastern Mau Forest Reserve, camp 10, Songei, 2650 m, 1-9-1949, *R.A. Maas Geesteranus*, 6015 (MO 1731410, BR, PRE, L 625314). Mt. Kenya, 3000 m, 11-12-1957, *B. Verdcourt*, 2005 (UPS, BR). Mt. Kenya occid., regio bambusina inferior, 2500 m, 28-1-1922, *R.E. Fries & T.C.E. Fries*, 1228 (UPS). Mt. Aberdare, pr. Kinangop, 3300 m, 2-4-1922, *R.E. Fries & T.C.E. Fries*, 2703 (UPS). Mt. Aberdare orient., regio bambusina, in swamp, 2700 m, 31-3-1922, *R.E. Fries & T.C.E. Fries*, 2553 (UPS). Aberdare Range, near W part of the Nyeri track, moorlands, 3070 m, 16-7-1948,

O. Hedberg, 1600 (UPS). Mt. Aberdare, prope cacuminen Sattima, 3300 m, 15-3-1922, *R.E. Fries & T.C.E. Fries*, 2552 (UPS). Mt. Kenya National Park, 3350 m, 2-1971, *W. Marien*, 678 (WAG 112515, WAG 112514). Mt. Kenya, 3500 m, 13-10-1927, *R.L. Piemeisel & L.W. Kephart*, 599 (US 1373346, BM 898015). Nyeri, Aberdare National Park, near Karuru Falls, 3050 m, 9-4-1975, *Hepper & al.*, 4962 (E 219441). Aberdares National Park, Karuru waterfalls, 2951 m, 27-7-2007, *M.L. Buide & al.*, 103UPO-K (UPOS 3299). Aberdares National Park, Chania river near Chania falls, 2998 m, 26-7-2007, *M.L. Buide & al.*, 92UPO-K (UPOS 3295). Mt. Kenya National Park, Naro Moru route, 2974 m, 28-7-2007, *M.L. Buide & al.*, 105UPO-K (UPOS 3301). Mt. Kenya National Park, Sirimon route to Old Moses, 3357 m, 29-7-2007, *M.L. Buide & al.*, 132UPO-K (UPOS 3316).

6c. *Carex mannii* subsp. *thomasii* (Nelmes) Luceño & M. Escudero in *Pl. Syst. Evol.* 249: 187. 2009.

≡ *Carex thomasii* Nelmes in *Bull. Misc. Inform. Kew* 1938: 245. 1938.

Ind. loc.: “Anglo-Egyptian Sudan: Mongolla, Imatong Mountains, Lomuleng, forest, common, 4 ft., 2400 m”.

Lectotype (designated in Haines & Lye, 1983): *Thomas* 1794 (K 363461!).

Stems 100-150 cm, stout. Leaves 7.5-9.5 mm, scabrid. Inflorescence 25-59 cm, lowest internode 6-20 cm and second one 5-15 cm. Lowest bract 35-65 cm × 5-7 mm wide; sheath 6.5-9 cm long. Lateral spikes 5-7.5 cm × 8-11 mm, widely terete. Male glumes 5.5-9 × 1-1.9 mm, purplish-red. Female glumes 4.5-6 × 1.2-2 mm, purplish-red. Utricles 5-6 mm long; beak 1.2-2.1 mm, ± aculeolate. $2n = ?$

Nov.-Feb. Streams; 2200-2800 m; Sudan and Ethiopia.

Selected specimens

ETHIOPIA. Illubabor, 25 Km north of Tepi, along the new road to Gore, 2350 m, 15-11-1995, *I. Friis & al.*, 7150 (BR).

SUDAN. Mongalla, Mts. Imatong, 2-1936, *H.B. Johnston*, 1408 (K). Southern Sudan, Imatong Mountains, 2800 m, 13-12-1980, *I.*

Friis & K. Vollesen, 853 (K). Imatong Mountains, Ngairisi Basin, 13-2-1976, *W.J. Howard*, 32 (K). Kaffa, 38 Km from Jimma at the Sheki-Gorge river-road, 2600 m, 8-12-1972, *I. Friis & al.*, 1640 (WAG 112530).

7. *Carex mildbraediana* Kük. in Engl. (ed.), *Pflanzenr.* IV, 20(38): 767. 1909.

Ind. loc.: “*Deutsch-Östafrika: Rukarara, Rugege Wald, Quellbrach im Moor, 1800 m*”.

Holotype: *Mildbraed* 966 (B 100166187!).

= *Carex ramosipes* Cherm., *Bull. Soc. Bot. France* 82: 343. 1935.

Ind. loc.: “*Volcan Ninagongo, kivu, 2500 m*”.

Lectotype (designated in Gehrke, 2011): *H. Humbert* 7939 (P466081 photo!); isotypes: B100166186 photo!, BR, K363481 photo!, P466080 photo!, P466082 photo!, BR8644572 photo!

Rhizome caespitose, with short internodes. Stems 82-145 cm, very stout, trigonous, smooth, green to yellowish-green, but densely dark purplish-red spotted or tinted towards the base. Leaves 16-65 cm × 11-14 mm, plicate, revolute, rigid, slightly scabrid on the edges and apical parts; sheaths dark purplish; ligule 2.5-7.5 mm, obtuse; anteligule edge flat. Inflorescence 25-58 cm, lowest internode 5-20 cm and the second one 3-12.5 cm. Lowest bract 13-28 cm × 4-9 mm, shorter than the inflorescence (sometimes longer); sheath 5-9.5 cm long, the inner side purplish-red. Spikes 5-21, subhomomorphic to subheteromorphic, 0-3 male spikes at the top and 5-20 androgynous lateral spikes, with the male part increasingly longer along the stem; terminal spike 1-8 cm × 4-10 mm, ± terete, peduncle up to 2 cm; lateral spikes, 1-6.5 cm × 5-11 mm, dense-flowered, widely terete, some of them arising in groups of three, the rest singly or in pairs, sometimes with a few short branches at the base of the largest spikes, peduncle up to 8 cm. Male glumes 5.5-7 × 1.4-2 mm, oblong-lanceolate to oblanceolate, dark brown to reddish-brown with straw or green coloured midrib, mucronate or aristate, mucro or acumen up to 1 mm, rarely obtuse. Female glumes 4-5.5 × 1.4-1.8 mm, oblong-lanceolate, reddish-brown to purplish, with straw or green coloured midrib, mucro or acumen up to 1 mm, rarely obtuse. Utricles 4.2-5.5 × 1.2-1.7 mm, brown with reddish-brown or purplish-red speckles, ellipsoid to obovoid-trigonous, straight, plurinerved, tapered to a beak, sometimes purplish coloured in the whole of the upper half; beak 1-1.7 mm, truncate or bidentate, with ventral sinus deeper than dorsal one, the latter up to 0.2 mm depth, smooth or with a few short, scattered, prickles. Achenes 2.7-3 × 0.9-1.3 mm, ellipsoid-trigonous. $2n = ?$

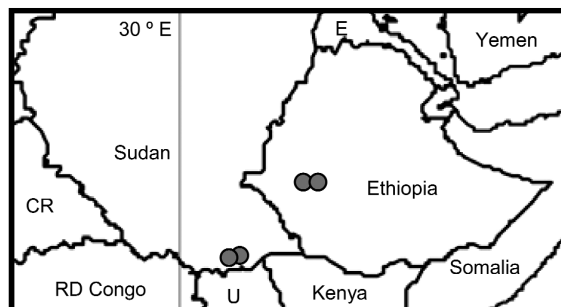


Fig. 9. Distribution of *Carex mannii* subsp. *thomasii*: U, Uganda; CR, Central African Republic; E, Eritrea.

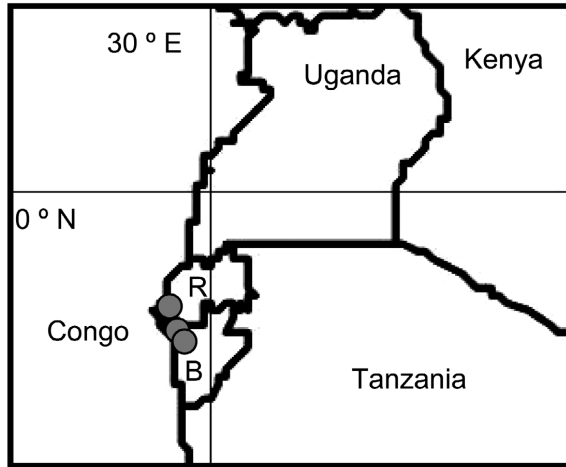


Fig. 10. Distribution of *Carex mildbraediana*: **R**, Rwanda; **B**, Burundi.

Jan.-Dec. Wet grasslands and peat bogs; 1800-2100 m; Burundi (Ryarusera and Bugarama) and Rwanda (Rukarara).

Comments: We have not seen type material of *Carex mildbraediana* var. *alpicola* Kük., (Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem, 9: 314. 1925. Type: "Mt. Aberdare: Alpine Region an einer feuchten Stelle", R.E. Fries & T.C.E. Fries 2671) and are, therefore, unable to confirm whether it is different to typical *C. mildbraediana*.

The putative isotype material of *Carex mildbraediana* J. Mildbraed 966 (K363486 photo!) comprises just a few utricles.

Carex ramosipes has usually been treated as a synonym of *C. mildbraediana* (a species showing bidentate or truncate utricles). The studied materials (type materials) of *C. ramosipes* show bifid utricles as well as all materials of *C. greenwayi*. Nevertheless, we advise against treating *C. ramosipes* as a synonym of *C. greenwayi* since the observed specimens show some deviant features from the typical *C. greenwayi* morphos from Tanzania. More data are needed to elucidate if *C. ramosipes* might be considered an independent taxa or a simple deviant form of *C. mildbraediana*.

The possible isotype material of *Carex ramosipes* [H. Humbert 7939, K363481 photo!] is only made up of a few utricles.

Selected specimens

BURUNDI. Bugarama, crossing, on road to Ryaruser, 2080 m, 28-4-1982, M. Reekmans, 11054 (MO 3255498, BR, WAG 225339).

RWANDA. Rukarara, Rugege Wald, Quellbach im Moor, 1800 m, 8-1907, J. Mildbraed, 966 (B 100166187).

8. *Carex spec. nov.*

Rhizome creeping, with \pm long internodes. Stems 50-90 cm, \pm stout, trigonous, smooth, green to yellowish-green, dark purplish-red spotted. Leaves 15-35 cm \times 5-11 mm, plicate, with revolute margins, very rigid and coriaceous, slightly scabrid on apical parts; sheaths brown, reddish-brown to purplish-red; ligule 3-6 mm, sub-acute; anteligule edge concave. Inflorescence 28-49 cm, the lowest internode 8.5-21 cm and the second 6.5-12.5 cm. Lowest bract 13.5-40 cm \times 5-8 mm, shorter than the inflorescence, with revolute margins; sheath 5-7.5 cm long, the inner side dark purplish-red. Spikes 7-13, heteromorphic to subheteromorphic, 1-3 male spikes, 0-2 androgynous spikes and 3-11 female spikes; terminal spike 2.5-8.5 cm \times 3-12 mm, terete, sessile or with a peduncle up to 1.2 cm; females spikes, 4.5-12 cm \times 7-12 mm, dense-flowered, terete, arising always singly, peduncle up to 5.9 cm. Male glumes 5-7 \times 0.9-1.6 mm, oblong-elliptic to oblong-obovate, dark purplish-red with a narrow and straw coloured midrib, mucronate, mucro up to 1 mm. Female glumes (3.5)4-6(8) \times 1-2.2 mm, oblong-elliptic, dark purplish-red, with a narrow and green or straw coloured midrib, acuminate, acumen up to 1.2 mm. Utricles 3.5-5 \times 1.1-1.6 mm, elliptic to elliptic-obovoid, straight or slightly curved, plurinerved, gradually or abruptly narrowed into a beak, brown to reddish-brown with purplish-red darker speckles; beak 0.8-1.5 mm, bifid, with \pm similar dorsal and ventral sinus, 0.2-0.5 mm depth, smooth or \pm aculeolate. Achenes 2.3-2.5 \times 1-1.2 mm, oblong-elliptic to oblong-obovoid. $2n = ?$

Nov.-Dec. Streams, peat bogs and other damp places; 2700-2800 m; Tanzania (Kitulo Plateau).

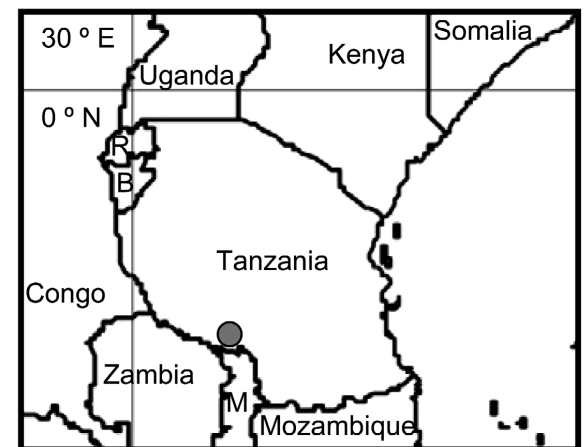


Fig. 11. Distribution of *Carex spec. nov.*: **R**, Rwanda; **B**, Burundi; **M**, Malawi.

Selected specimens

TANZANIA. Kyimbila, North of Lake Nyasa, 1915, *A. Stolz*, 2284 (UPS, BR, PRE, C, HUH 246049, H 1559427). Kitulo Plateau, just left of Igoma-Kitulo road, 1 Km beyond Kikondo, 2750 m, 31-12-1969, *RW*, 530 (K). Kitulo Project, along Maken-galima River, 25-11-1967, *J. Prins-Lambert*, 317 (WAG 112511, WAG 112512).

9. *Carex petitiana* A. Rich., Tent. Fl. Abyss. 2: 513. 1850.

Inc. loc.: “*Crescit in montosis provinciae Ouodgerate (Ant. Petit)*” [Ethiopia].

Lectotype (designated by Haines & Lye, 1983): *Petit s.n.* (P 466086, photo!).

= *Carex longipedunculata* K. Schum. in Engl., Pflanzenw. Ost-Afrikas, C: 130. 1895.

Ind. loc.: “(Nordseite des Kl. [Kilimanjaro] ...)”. “*Sumpfige Senke bei der Höhle Nobolu*, 3200 m”.

Lectotype (designated in Gehrke, 2011): Volkens 2015 (B); isotype: K363582 photo! K 363591 photo!

= *Carex longipedunculata* subsp. *cuprea* Kük. in Notizbl. Bot. Gart. Berlin-Dahlem 9: 315-316. 1925.

Ind. loc.: “West-Kenia, Forest Station in Sumpf, 2300 m”.

Lectotype (designated in Gehrke, 2011): *R.E. Fries & T.C.E. Fries 734* (UPS); isotype: BR 8638984! K; paratypes: *R.E. Fries & T.C.E. Fries 405* (UPS!, K 363585 photo!), *R.E. Fries & T.C.E. Fries 659* (S 05-9680 photo!, UPS!), *R.E. Fries & T.C.E. Fries 943* (UPS!), *R.E. Fries & T.C.E. Fries 2763* (UPS!). *Carex cuprea* (Kük.) Nelmes in Bull. Misc. Inform. Kew 1938: 247. 1938.

= *Carex preussii* K. Schum. in Bot. Jahrb. Syst. 24: 340. 1897.

Ind. Loc.: “Mt. Cameroon, near Mann’s spring, 2600 m”.

Lectotype (designated in Gehrke, 2011): *Preuss 727* (B).

= *Carex preussii* var. *camerunensis* Nelmes in Bull. Misc. Inform. Kew 1938: 247. 1938.

Ind. loc.: “British Cameroons, Cameroons Mountain, 2130-3000 m”.

Lectotype (designated in Gehrke, 2011; precised here): *Mann 2099* (K); isotypes: HUH 246054! K 363492 photo!, K 3634923 photo!, K 363494 photo!

= *Carex aethiopica* var. *stolonifera* Boeck, Linnaea 41: 286. 1877.

Ind. loc.: “*Abyssinia, Gaffat (alt. 8000 ped.)*”.

Lectotype (designated in Gehrke, 2011): *Schimper 1298* (K); isotypes: EA, K 363462 photo, M 105734

photo! US 945614!, Z + ZT. *Carex simensis* var. *stolonifera* (Boeck.) Kük. in Engl. (ed.), Pflanzenr. IV, 20(38): 654. 1909.

Rhizome caespitose, with short, or very exceptionally long, internodes. Stems (27.5)40-133 cm, ± stout, trigonous, smooth, green to yellowish-green. Leaves (12)15-60 cm × (4)4.8-10 mm, keeled to plicate, rigid, slightly scabrid on the edges and apical parts; sheaths brown to reddish-brown; ligule 1.5-10.5 mm, obtuse or acute; anteligule edge concave to convex. Inflorescence (7)11-43 cm, lowest internode (3)5-18.5 cm and second one (0.2)2-12 cm. Lowest bract 5.5-35 cm × 2-7.5 mm, shorter or longer than the inflorescence; sheath 1.8-7(8) cm long, the inner side brown, reddish-brown or purplish. Spikes 3-9, subhomomorphic to subheteromorphic (rarely heteromorphic), generally all spikes gynecandrous, with the male part increasingly longer as going upwards in the stem, sometimes lowest spikes entirely female (more rarely 1 male terminal and the rest female); terminal spike 3.2-6.5 cm × (5)7-12 mm, clavate (rarely terete), sessile or with a peduncle up to 3.3 cm; lateral spikes (1)2-6 cm × 7-12 mm, dense-flowered, clavate to widely terete or ellipsoid, solitary or in pairs, exceptionally with a few short branches at the base of the largest spikes, peduncle up to 7.5(12.5) cm. Male glumes (4.5)5.4-7.5(9) × (1)1.1-2.2(2.4) mm, oblong-elliptic to oblong-obovate, dark brown to dark reddish-brown with straw or green coloured midrib, mucronate or acuminate, mucro or acumen up to 1.5 mm, rarely obtuse. Female glumes 3.4-6(7) × (1.1)1.3-2.6 mm, widely oblong-elliptic, dark brown, reddish-brown or purplish-red, with wide and green or straw coloured midrib, mucro or acumen up to 1(1.5) mm, rarely, obtuse. Utricles (3.7)4-6(6.5) × 1.2-2.2(2.5) mm, ellipsoid-trigonous, straight, tetra-nerved to plurinerved, tapered to beak, greyish-green with reddish or purplish speckles; beak 1.1-1.6(1.8) mm, deeply bifid, with ± similar dorsal and ventral sinus, 0.4-0.6 mm depth, aculeolate (very rarely smooth). Achenes 2.5-3(3.2) × 1.1-1.6(1.9) mm, trigonous, oblong-elliptic to oblong-obovoid. $2n = 70$.

Jan.-Dec. Open (sometimes shady) and wet places: swamps, wet meadows, streams and bogs; 1800-3600 m; Cameroon, D.R. Congo, Ethiopia, Kenya, Malawi, Nigeria, Tanzania, Uganda and Zimbabwe.

Comments: *Carex preussii* K. Schum. was described from Cameroon and accepted by some authors, such as Hooper & Napper (1972) and Gehrke (2011). Nevertheless, we have not found any difference between materials from western tropical Africa and the remaining typical *C. petitiana* materials from eastern tropical Africa.

The putative isotype material of *Carex longipedunculata* subsp. *cuprea* Kük. “*West-Aberdare: An der Grenze zwischen Bergwald und Bambusregion*”, R.E. Fries & T.C.E. Fries 2763 (K 363586 photo!) consists of just a few utricles.

KEY TO THE SUBSPECIES OF *CAREX PETITIANA*

1. Spikes all solitary in the nodes; female glumes brown to reddish-brown **9a. *C. petitiانا* subsp. *petitiانا***
1. At least some spikes arising in pairs; female glumes reddish-brown to purplish-red ... **9b. *C. petitiانا* subsp. *attenuata***

9a. *Carex petitiانا* subsp. *petitiانا*

Stems (27.5)40-95(120) cm, ± stout. Leaves (12)15-35(42) cm × (4)4.8-8(9) mm. Inflorescence (7)11-33(37) cm, lowest internode (3)5-15 cm and second one (0.2)2-7.3(9.5) cm. Lowest bract 5.5-23 cm × 2-4(7.5) mm; sheath (1.8)2.5-7(8) cm long, the inner side brown to reddish-brown. Spikes 3-8, all solitary. Female glumes (3.5)4-6(7) × 1.6-2.6 mm, dark brown to reddish-brown. $2n = 70$.

Jan.-Feb. Open (sometimes shady) and wet places: swamps, wet meadows, streams and bogs; 2000-3600 m; Cameroon, D.R. Congo, Ethiopia, Kenya, Nigeria, Tanzania and Uganda.

Selected specimens

CAMEROON. Northwest, near Verkovi Village, lower slopes of Mt. Oku, 2600 m, 4-1986, D.W. Thomas & H.L. Mcleod, 6045 (MO 3442595). Bambouto Mountains, ca. 5 Km NW. of the village Biété, 2300 m, 9-5-1964, W.J.J.O. de Wilde & B.E.E. de Wilde-Duyffes, 2541 (MO 2171215, B 100240029). Southern Cameroons, Bamenda, 2000 m, 17-2-1958, F.N. Hepper & J.R. Charter, 2042 (K, WAG 112529). Bafut-Ngemba Forest Reserve, 2150 m, 20-2-1958, F.N. Hepper, 2085A (K). Southern Cameroons, Bamenda, 2150 m, 20-2-1958, F.N. Hepper, 2085 (K). Mezam, Bambili Lakes, 2230 m, 16-5-1970, P.J. Bauer, 68 (K). Following from ridge above Bamenda and Bafutngem F.R., 2320 m, 8-7-1962, M. Brunt, 777 (K). Bambouto Mountains, c. 5 Km NW of the village of Biété, 2300 m, 9-5-1964, G.J.H. Amschoff, 1965 (U227743). Est, Kumbo, Mt. Okou, 2700 m, 1-2-1970, C.N.A.D., 1814 (WAG 112528). Kamerunberg, Gras region, 2500 m, 8-5-1938, Domke, 308 (B 100240033). Buea, Manns-Quelle, Abhang, 4-2-1891, Preufs (B 100240031). Bamenda, Mt. Mba, Kokeka, 2130 m, 21-3-1935, D.E. Coombe, 229 (B 100240032).

CONGO. Parc National Albert (Virunga National Park), Shakeru, 2700 m, 1-1938, J. Lebrun, 9332 (BR, NY, BM 898009, B 100240039). Parc Natinal Albert (Virunga National Park), Versant E du Ninagongo, cratere du Shakeru, 2100 m, 11-1937, J. Lebrun, 8780 (BR, US 2091181). Kivi Nord, Talsohle von Ngunzu, 18 Km SW Sake, 2300 m, 12-8-1954, H.U. Stauffer, 69 (WAG 225343).

ETHIOPIA. About 5 Km NE of Addis Abeba, 2400 m, 26-4-1965, W.J.J.O. de Wilde & B.E.E. de Wilde-Duyffes, 6431 (WAG 112498, WAG 112499, WAG 112500). Arussi, Chilalo Awraja, Gobe Livestock farm, c. 10 Km N of Koffale, 2700 m, 12-10-1971, M. Thulin, 1466 (UPS). About 10 Km SE of Hagere Selam, SE of Wondo, 3000 m, 13-3-1966, W.J.J.O. de Wilde & B.E.E. de Wilde-

Duyffes, 10307 (WAG 112493). Schimper, 1298 (US 945614, BM 898016).

KENYA. Narok, K. 6, Enesambulia Valley N.E., 2700 m, 29-6-1969, P.J. Greenway & Kanuri, 13666 (MO 1991712). Mau Range, c. 10 Km N of Timboroa, 2700 m, 2-6-1948, O. Hedberg, 1089 (UPS, K). Mt. Kenya occid., prope Forest Station, 2300 m, 27-1-1921, R.E. Fries & T.C.E. Fries, 405 (UPS). Mt. Aberdare occid., 3-4-1922, R.E. Fries & T.C.E. Fries, 2763 (UPS). Mt. Kenya occid., 2300 m, 1-1-1922, R.E. Fries & T.C.E. Fries, 659 (UPS). Mt. Kenya occid., Coles Farm, 2000 m, 16-1-1922, R.E. Fries & T.C.E. Fries, 943 (UPS). Narok, Mbalagai (Masai), Doboti about 9 miles from Cobb's Gate near the Mau Forest Reserve on the track to Nairagie Ngare, 2900 m, 22-5-1961, Clover & al., 1486 (BR, K). Navaisha, South Kinangop, 2750 m, 3-6-1961, Polbill, 429 (BR, K, NY). Thomson's Falls to Nakuru, 20 miles from Th. Falls, 2750 m, 14-8-1952, A.V. Bogdan, 3525 (K). Near Njoro, 2380 m, 9-8-1962, A. Bogdan, 552 (K). NE of Kijabe, Aberdare Forest Reserve, 2500 m, 16-10-1949, A. Bogdan, 2655 (K). 5 miles NW of Timboroa, 2750 m, 17-5-1959, A. Bogdan, 4826 (K). Mdoto Mts., Siruan, 2440 m, 1-1-1959, J.G.B. Neubould, 3373 (K). Trans-Nzoia, Suam Sawmills road, 2200 m, 21-5-1969, D.M. Napper & Tweedie, 2133 (K, WAG 112510, WAG 112509). Rift Valley, Nakuru, eastern Mau Forest Reserve, camp 10, Songei, 2650 m, 1-9-1949, R.A. Maas Geesteranus, 6015 (WAG 112526). Vicinity of Lake Naivasha, British East Africa, 1950 m, 17-7 to 15-8-1909, E.A. Mearns, 899 (US 630929, BM 898014). Bamboo zone, western slopes of Mount Kenya, along the trail from West Kenya Forest Station to summit, British East Africa, 3000 m, 28-9 to 7-10-1909, E.A. Mearns, 2359 (US 632331). Mt. Kenya National Park, Naro Moru route, 2270 m, 28-7-2007, M.L. Buide & al., 123UPO-K (UPOS 3212). Mt. Elgon National Park, 2788 m, 23-7-2007, M.L. Buide & al., 56UPO-K (UPOS 3278). Mt. Elgon National Park, Kambi Mtamayua, 3450 m, 22-7-2007, M.L. Buide & al., 24UPO-K (UPOS 3270). Aberdares National Park, Mutubio West Gate, 3212 m, 27-7-2007, M.L. Buide & al., 100UPO-K (UPOS 3296). Mt. Elgon National Park, 2768 m, 23-7-2007, M.L. Buide & al., 53UPO-K (UPOS3276). Mt. Elgon National Park, Kambi Mtamayua, 3450 m, 22-7-2007, M.L. Buide & al., 24UPO-Kbis (UPOS 3270bis). Mt. Elgon National Park, Kambi Mtamayua, 3561 m, 22-7-2007, M.L. Buide & al., 29UPO-K (UPOS 3271). Mt. Elgon National Park, Kambi Mtamayua, 3561 m, 22-7-2007, M.L. Buide & al., 30UPO-K (UPOS 3272).

NIGERIA. NE State Nigeria, Sardauna, Gangirwal, 2290 m, 24-11-1974, J. Chapman, 3576 (OXF 142981).

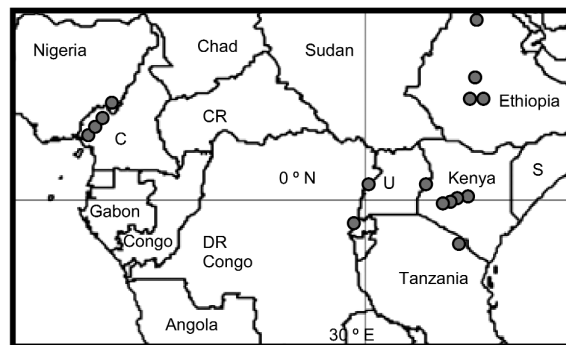


Fig. 12. Distribution of *Carex petitiانا* subsp. *petitiانا*: CR, Central African Republic; U, Uganda; C, Cameroon; S, Somalia.

UGANDA. Kigezi, 13-2-1945, *Greenway & Kanuri*, 7121 (BR). Virunga Mountains, Mgainga-Sabinio, 2440 m, 21-11-1934, *G. Taylor*, 1897 (BM 898026). Ruwenzori, 2440 m, 1893-94, *G.F. Scott Elliot*, 7578 (BM 898017).

9b. *Carex petitiiana* subsp. *attenuata* (Kük.) Luceño & M. Escudero, **comb. nov.**

≡ *Carex longipedunculata* var. *attenuata* Kük. in Bot. Not. (Lund) 1934: 82. 1934, basyonimus.

Ind. loc.: “*Inyanga: prope pagum Inyanga ad rivulum kubera, c. 1800 m.s.m.*” [Malawi].

Lectotype (designated here): *T.C.E. Fries & al. 3094* (LD 60956!); isotype: *T.C.E. Fries & al. 3094* (S photo!).

Stems 50-133 cm, very stout. Leaves 20-60 cm × 8-10 mm. Inflorescence 21-43 cm, lowest internode 7-18.5 cm and second one 4.5-12 cm. Lowest bract 16-35 cm × 3-7 mm, shorter than the inflorescence; sheath 1.8-5 cm long, the inner side reddish-brown to purplish. Spikes 5-9, arising in pairs in at least one node, the rest singly. Female glumes 3.4-5.5 × (1.1)1.3-1.9(2) mm, dark reddish-brown to purplish-red. $2n = 70$.

Jan.-Dec. Wet and open places: swamps, wet meadows and bogs; 1800-2300 m; Malawi (Nyika) and Zimbabwe (Inyanga).

Comments: All specimens studied from Zimbabwe are well differentiated from those of the typical subspecies, but some individuals from Malawi display some intermediate features between the subspecies.

Selected specimens

MALAWI. Northern, Nyika Plateau, 2300 m, 15-12-1975, *E.*

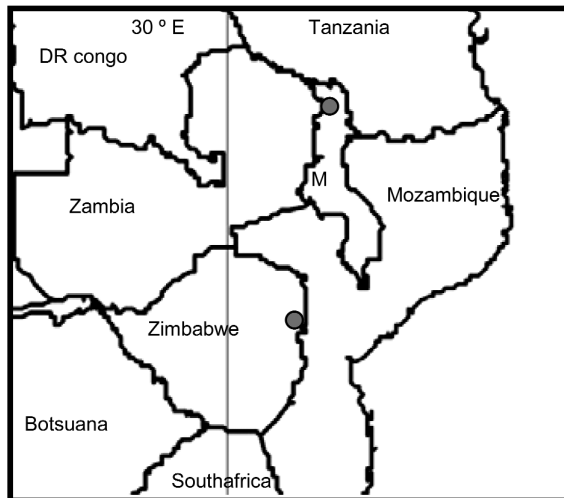


Fig. 13. Distribution of *Carex petitiiana* subsp. *attenuata*: **M**, Malawi.

Phillips, 530 (MO 2829617). Northern, Nyika Plateau, 2300 m, 7-11-1975, *E. Phillips*, 145 (MO 2449940). Nyasaland, Nyika Plateau, Lake Kaulime, 4-1-1959, *E.A. Robinson*, 3028 (M 124768, M 124769). Northern, Nyika Plateau, 2290 m, 6-11-1975, *E. Phillips*, 118 (WAG 112780, WAG 112779). Northern, Nyika Plateau, 2290 m, 22-11-1975, *E. Phillips*, 396 (WAG 112782, WAG 112781). Mare Dam in Nyika National Park, 2000 m, 1-1-1991, *S. Laegaard*, 16024 (US 3261097, B 100014065).

ZIMBABWE. Inyanga, Mare Dam, Inyanga National Park, 6-1-1972, *G.E. Gibbs Russell*, 1208 (MO 2653179). Rhodesia austr., Inyanga, ad pedes montis Inyangani, 2000 m, 6-7-1930, *T.C.E. Fries & al.*, 3504 (UPS). Rhodesia austr., Inyanga, ad pedes montis Inyangani, 2000 m, 6-7-1930, *T.C.E. Fries & al.*, 3504 (BR, BM 896204, B 100240030, LD 600955, LD 600956).

10. *Carex simensis* Hochst. ex A. Rich. In Tent. Fl. Abyss. 2: 514. 1850.

Ind. loc.: “*Crescit in pratis humidis montis Bouhait, ad fines et supra fines arborum et fruticum, in provinciali Semiène, manse Junio* (Schimper)” [Ethiopia].

Lectotype (designated in Haines and Lye; precised here): *Schimper 1180* (P 466087 photo!); isotypes: P 466088 photo!, P 466089 photo!, MO 3255498!, MO 2128070!, L 625307!, L 625305!, US 945543!, M 105740 photo!, STU 347 photo!, STU 348 photo!, BR 8249845 photo!, WAG 3721 photo!

= *Carex simensis* var. *lanuriensis* De Wild., Pl. Bequaert. 4: 247. 1927.

Ind. loc.: “*Ruwenzori, vallée du Lanuri 4000 et 4300 m. et aux environs de 3000 m. d'altitude*”.

Lectotype (designated in Gehrke, 2011): *Bequaert 4520* (BR 8644619 photo!); isotypes: OXF!, PRE, K 363488 photo!, BR 8644626 photo!, S; paratypes: *Bequaert 4680* (BR 864461!), BR!, K 363487 photo!, PRE 0594525-0 photo!

= *Carex karisimbiensis* Cherm. in Bull. Soc. Bot. France 82: 344. 1935.

Ind. loc.: “*volcan Karisimbi (NE. du lac Kivu), 3400-3900* [Congo]”.

Lectotype (designated in Gehrke, 2011; precised here): *H. Humbert 8557* (P 466090 photo!); isotypes: P 466091 photo!, P 466092 photo!, B 100166188 photo!, BR 8644596 photo!, BR 8644602 photo!

= *Carex simensis* var. *longistipitata* Kük. in Notizbl. Bot. Gart. Berlin-Dahlem 9: 316. 1925.

Ind. loc.: “*West-Kenia: Obere Bambusregion im sumpfe, 2800 m*”.

Lectotype (designated in Gehrke, 2011): *R.E. Fries & T.C.E. Fries 1300* (UPS); isotypes: BR 6265427 photo!, H 1559429!, S 05-9686 photo!; paratype: *R.E. Fries & T.C.E. Fries 1300a* (UPS).

= *Carex simensis* var. *memorum* Chiov. in Ann. Bot. (Rome) 10(3): 407. 1912.

Holotype: G. Negri (FT 669 photo!).

Rhizome caespitose, with short internodes. Stems (13)22-79 cm, ± stout, trigonous, smooth, green to yellowish-green. Leaves 6.5-31 cm × 3-12 mm, keeled to plicate, very rigid, ± coriaceous, slightly scabrid on apical parts; basal sheaths dark purplish to blackish, coriaceous; ligule 3-23 mm, acute; anteligule edge concave to convex. Inflorescence 4-43.5 cm, lowest internode 0.5-15.5(23) cm and second one 0.5-8(12) cm. Lowest bract 6.5-20 cm × 2-5 mm, shorter than the inflorescence; sheath (0.5)1-7.5 cm long, the inner side deep purple to blackish. Spikes 5-12, heteromorphic, 0-2 male spikes at the top (sometimes the terminal one gynecandrous) and 3-11 female lateral spikes; terminal spike (1)2.5-4.8(7) cm × 2-7(10) mm, terete, sessile or with a peduncle up to 2.5 cm; female spikes, 1.5-6.5(8) cm × 5-10 mm, subdense-flowered, terete to narrowly ellipsoid, arising singly or in pairs, sessile or with a peduncle up to 8(10) cm. Male glumes (4)5-8(9) × (1.2)1.4-2.2(2.8) mm, oblong-elliptic to oblong-obovate, blackish with very wide and pale midrib, emarginate-mucronate to mucronate, mucro up to 1 mm, rarely obtuse. Female glumes (3)4-6(6.5) × (1.2)1.4-2.1(2.5) mm, oblong-elliptic, deep purple to blackish, with very wide and pale midrib, acuminate or aristate, acumen or arista up to 1.6 mm. Utricles (3.5)4.5-6.5(7.2) × (1.1)1.2-1.6(2) mm, narrowly ellipsoid-trigonous, straight, plurinerved, tapered to beak, greyish-brown to green; beak (0.7)1-1.6(2) mm, bifid, with ± similar dorsal and ventral sinus 0.2-0.6 mm depth, smooth. Achenes (2.2)2.3-2.9(3.2) × (0.9)1-1.2(1.3) mm, trigonous, oblong-ellipsoid. $2n = ?$

Jan.-Dec. Open (sometimes shady) and wet places: wet meadows, streams and swamps; 2800-4100 m; D.R. Congo, Ethiopia, Kenya and Uganda.

Comments: Some populations, mainly from Ethiopia but also from Kenya, are formed by individuals that are significantly smaller in all their parts.

The names *C. simensis* var. *lanuriensis* and *C. kari-simbiensis* were created to accommodate plants exhibiting some atypical characters but, in our opinion, all such forms should be included within the variability of *C. simensis*.

Selected specimens

CONGO. Kivu, Parc des Virunga, Karisimbi, plateau de Rukumi, 3500 m, 22-1-1972, *P. van der Keken*, 9125 (MO 3763955). Kivu, Parc des Virunga, Karisimbi, plateau de Rukumi, 3500 m, 22-1-1972, *P. van der Keken*, 9126 (MO 3763955). Parc National des Virungas, between Mikeno & the Karisimbi volcanoes, 3200 m, 23-

1-1972, *G. Troupin*, 14301 (MO 2421974). Bale, Square 84D, between Shashamane and Goba, 3200 m, 28-5-1972, *J. Ash*, 1696 (K).

ETHIOPIA. Montis Simensis Bachit ad fines et supra fines, 23-6-1838, *Schimper*, 1180 (MO 3255498, MO 2128070, M 124766, L 625307, L 625305, US 945543, O). Mt. Boruluccu, along road to Ticcio, about 30 Km SE of Asella, 4000 m, 4-7-1965, *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyffes*, 9119 (MO 2265995, WAG 112492). Bale, 10-15 Km SE of Goba on road towards Masslo, 3400 m, 16-5-1980, *M. Thulin & al.*, 3716 (UPS, K). Arussi, Kaka, E slope, 3750 m, 7-1980, *O. Hedberg & M. Tadesse*, 7047 (UPS). Arussi, Chillalo Awraja, Galama Mts. (c. 30 Km ESE of Aselle), about 3 Km E of Boraluco, 3750 m, 6-9-1967, *O. Hedberg*, 4181 (UPS, K). Arussi, Kaka, E slope, 3750 m, 7-1980, *O. Hedberg & M. Tadesse*, 7068 (UPS). Shewa, c. 25 Km from Debra Brhan to Akober (Gorebela) near microwave, 3600 m, 4-6-1982, *S. Edwards & Class*, 502/82 (UPS). Arussi, Chillalo Awraja, Galama Mts. (c. 30 Km ESE of Aselle), about 3 Km E of Boraluco, 3750 m, 8-9-1967, *O. Hedberg*, 4224 (UPS). Bale, Bale Mountains National Park, on the crest S of Garba Goracha cap site, 4100 m, 2-11-1973, *O. Hedberg*, 5659 (UPS). Gojjam, Mts. Choké, vicinity of the upper Ghiedeb valley, 12-8-1957, *I.M. Evans & C.L.A. Leakey*, 482 (K). Bale, Dinshu, about 157 Km E of Shashamane, along road to Goba, 3300 m, 24-7-1970, *J.J.F.E. De Wilde*, 6787 (K). Guma, 10-9-1863, *Schimper*, 1289 (M124765, US945608, E219439). About 25 Km of Asella, W-slope of Mt. Boruluccu, 3800 m, 11-9-1965, *W.J.J.O. de Wilde & B.E.E. de Wilde-Duyffes*, 8124 (WAG 112494, WAG 112495). Harar, Gara Mullata Mt, 3290 m, 10-6-1962, *W. Burger*, 1902 (US 2480955). In Monte Simenensis Bachit, 22-2-1852, *Schimper*, 1988 (GOET, WU 676).

KENYA. Nyanza, Trans-Nzoia, Mount Elgon, 3400 m, 24-2-1935, *G. Taylor*, 3677 (MO 1611134). Mt. Kenya, K2, Cheramgani Hills, Chepkotet, 3240 m, 13-8-1968, *M. Thulin & A. Tigids*, 243 (UPS). Aberdare Range, Kinangop, northern slope, Alpine belt, 3750 m, 13-7-1948, *O. Hedberg*, 1546 (UPS). Mt. Kenya, NW slopes, in the uppermost part of the Hagenia-Hypericum zone, 3400 m, 18-8-1948, *O. Hedberg*, 1936 (UPS). Mt. Elgon, in the crater (alpine region), near "Maji ya moto", 3600 m, 21-5-1948, *O. Hedberg*, 1017 (UPS). Nanyuki, Mt. Kenya, W slope, National Park Road (Naro Moru Track), 3600 m, 10-1-1971, *O. Hedberg*, 4828 (UPS). Fort Hall, Mt. Aberdare, S slope above S Kinangop,

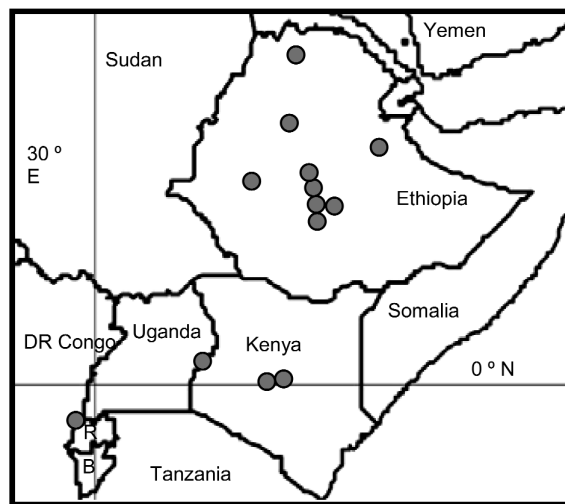


Fig. 14. Distribution of *Carex simensis*: R, Rwanda; B, Burundi.

along the path towards “The Elephant”, 3500 m, 20-9-1967, *O. Hedberg*, 4330 (UPS). Western, Mt. Elgon, on the ridge W of Suam River, 3560 m, 24-9-1966, *S.W. Bie*, 66266 (UPS). Bamboo zone, western slopes of Mount Kenya, along the trail from West Kenya Forest Station to summit, British East Africa, 3000 m, 28-9 to 7-10-1909, *E.A. Mearns*, 1677 (NY, US 631628). Bamboo zone, western slopes of Mount Kenya, along the trail from West Kenya Forest Station to summit, British East Africa, 3000 m, 28-9 to 7-10-1909, *E.A. Mearns*, 1706 (NY, BM 898007, HUH 246050). Mt. Elgon, Kimothon Route, 3640 m, 15-3-1983, *H. Rehder* (M 124778). Bamboo zone, western slopes of Mount Kenya, along the trail from West Kenya Forest Station to summit, British East Africa, 3000 m, 28-9 to 7-10-1909, *E.A. Mearns*, 1742 (BM 898008, HUH 246051). Obere Bambusregion im Sumpfe, 2800 m, 30-1-1922, *R.E. Fries & T.C.E. Fries*, 1300 (H 1559429). Aberdares National Park, Mutubio West Gate, 3212 m, 27-7-2007, *M.L. Buide & al.*, 101UPO-K (UPOS 3297). Mt. Kenya National Park, Naro Moru route, 3588 m, 28-7-2007, *M.L. Buide & al.*, 116UPO-K (UPOS 3307).

UGANDA. Mt. Elgon, at the Sebei path W of Swam river, 3530 m, 22-5-1948, *O. Hedberg*, 1043 (UPS).

11. *Carex uluguruensis* Luceño & M. Escudero, spec. nov.

A simili Carex mildbraediana Kük. *foliis angustioribus atque spicis lateralibus solitariis aut binis – nec ternis – differt.*

Ind. loc.: “Tanzania, Morogoro, Uluguru Mountains”.

Holotype: *H.J. Schlieben* 3516 (WAG 112513!); isotypes: B 100240022!, PRE!

Rhizome caespitose, with short internodes. Stems 50-90 cm, ± stout, trigonous, smooth, green to yellowish-green. Leaves 13-26 cm × 7-9 mm, keeled to plicate, very rigid and coriaceous, with revolute margins, slightly scabrid on the edges and apical parts; sheaths reddish-brown to purplish-red; ligule 4-6.5 mm,

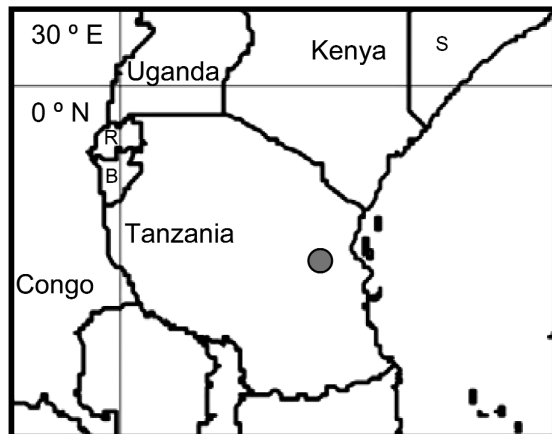


Fig. 15. Distribution of *Carex uluguruensis*: B, Burundi; R, Rwanda; S, Somalia.

acute; anteligule edge concave. Inflorescence 8.5-20.5 cm, lowest internode 4.5-11.5 cm and second one 2-3.5 cm. Lowest bract 8.5-13.5 cm × 3-6 mm, shorter or longer than the inflorescence; sheath 4-5 cm long, the inner side purplish-red. Spikes 5-8, heteromorphic, 1 male (sometimes gynecandrous) terminal spike and 4-7 female lateral spikes; terminal spike 2.2-3.5 cm × 3.5-4.5(11) mm, terete, sessile or with a peduncle up to 1 cm; lateral spikes, 1-5 cm × 9-10 mm, dense-flowered, terete, arising singly or in pairs, peduncle up to 4.5 cm. Male glumes 5.5-8 × 1.2-2.2 mm, oblong-elliptic, dark purplish-red with very wide and straw coloured midrib, acuminate, acumen up to 1.5 mm. Female glumes 4-7.2 × 1.2-1.8 mm, oblong-elliptic, dark purplish-red, with a wide and straw coloured midrib and an acumen up to 2 mm. Utricles 4.3-5 × 1-1.5 mm, ellipsoid-trigonous, straight, plurinerved, although the veins are not very prominent, tapered to beak, brown to reddish-brown; beak 1-1.6 mm, smooth truncated or bidentated, with ventral sinus deeper than the dorsal one, the latter up to 0.2 mm depth. Achenes 2-2.4 × 0.9-1.1 mm, trigonous, oblong-ellipsoid to oblong-obovoid. $2n = ?$

Feb. Marshy grassland; 2400 m; Tanzania (Uluguru mountains).

Comments: Although only a single collection was studied, we consider that these specimens merit status as a new species due to: (1) their morphological differences to the other species of this group, and (2) their geographical isolation (the only other species of this group found in the Uluguru mountains is *C. vallis-rosetto* which is clearly different to *C. uluguruensis*).

Selected specimens

TANZANIA: Tangañjika, Morogoro, Uluguru, Lukwangule Plateau, Savannenhügel, 2400 m, 20-2-1933; *H.J. Schlieben*, 3516 (PRE, L 625309, WAG 112513, B 100240022).

12. *Carex vallis-rosetto* K. Schum. in Engl. (ed.), Pflanzenw. Ost-Afrikas, C: 130. 1895.

Ind. loc.: “(Usb., Rosettothal ...)” “An Bachbetten im Gürtelwalde; auch über demselben in Erika-Beständen bis 2800 m”.

Lectotype (designated in Gehrke, 2011): *Holst* 3823 (B 100166181!); isotype: K 363446 photo!

= *Carex cyrtosaccus* C.B. Clarke in Thiselton-Dyer (ed.), Fl. Trop. Afr. 8: 524. 1902.

Ind. loc.: “Nyasaland, Mt. Milanji”.

Lectotype (designated here): *A. White s.n.* (K 363565 photo!); isotype: BR 898011!; paratypes: *A. White s.n.* (K 363563 photo!), “Nyasaland, Mt. Zom-

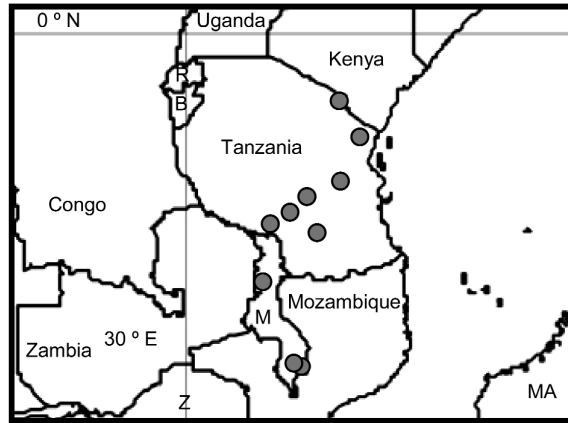


Fig. 16. Distribution of *Carex vallis-rosetto*: M, Malawi; MA, Madagascar; Z, Zimbabwe.

ba, 4000-6000 ft." *A. White s.n.* (K 363564 photo!).

Rhizome caespitose, with short internodes. Culms (46)70-190(215) cm, very stout, trigonous, smooth, green to yellowish-green, but densely dark purplish-red spotted or tinted towards the base. Leaves 25-76 cm \times 7.5-13.5 mm, plicate, with revolute margins, slightly scabrid on margins and apical parts; sheaths dark purplish-red; ligule up to 6 mm, acute or obtuse; anteligule edge flat to convex. Inflorescence 14-76(98) cm, lowest internode 5-25(31) cm and second one 2.5-17.5(25) cm. Lowest bract 21-40 cm \times 3-7.5(10) mm, longer or shorter than the inflorescence; sheath 3-10.5(15.5) cm long, the inner side purplish-red. Spikes 7-22, homomorphic to heteromorphic, 0-6 male spikes at the top and up to 17 female or androgynous spikes; male spikes 1-6.5(11.5) cm \times (2)3-7(8) mm, terete, sessile or with a peduncle up to 3.3 cm; lateral spikes, (1)2-9(12) cm \times 7-11 mm, dense-flowered, terete, mostly arising in pairs or groups of three, the rest single, frequently with some short branches at the base of the largest spikes, sessile or with a peduncle up to 6 cm. Male glumes (3.5)4.5-6.5 \times 1-2 mm, oblong-lanceolate to oblong-obovate, dark reddish-brown to purplish-red with straw or green coloured midrib, mucronate, mucro up to 1.3 mm, or obtuse. Female glumes (3)3.5-5.7 \times 1-2 mm, oblong-lanceolate, dark reddish-brown to purplish-red with straw or green coloured midrib, mucronate or acuminate, mucro or acumen up to 1.5 mm, rarely obtuse. Utricles 4-5.5 \times 1.2-1.8 mm, ellipsoid to obovoid, clearly curved, tetra-nerved (sometimes plurinerved), gradually or abruptly narrowed into a beak, greyish-green with purplish-red speckles, sometimes entirely purplish in the upper half, trigonous; beak 1-1.8 mm, bifid, with ventral sinus deeper

than dorsal one, the latter 0.2-0.5 mm depth, smooth or with some scattered pricklets. Achenes 2.5-3.1 \times 0.9-1.2 mm, trigonous, oblong-ellipsoid to oblong-obovoid. $2n = ?$

Jul.-Mar. Wet places: streams and bogs; 1750-2500 m; Tanzania and Malawi.

Selected specimens

MALAWI. Southern, Mt. Mulanje, Litcheny Plateau, near C.C.A.P. Hut, 1990 m, 28-11-1986, J.D. Chapman & E.G. Chapman, 8276 (MO 3255780, PRE). Williams falls Zomba Plateau, 21-10-1986, A.J. Salubeni, 4768 (MO 3917787, PRE). N Nkhata Bay, ENE Chikangawa, 1780 m, 13-10-1978, E. Phillips, 4081 (WAG 112783). 1962, P.J. Tyrer, 746 (BM 898023). Mt. Milanji, 1891, *White s.n.* (BM 898011).

TANZANIA. Same, Kilimanjaro, T3, south Pare Mountains, Chome Forest Reserve (Shengena Forest), 1900 m, 18-11-1999, J. Elia, 130 (MO 5337368, PRE). Iringa, Mufinidi, Luisenda, 1830 m, 24-8-1984, D.W. Thomas, 3577 (MO 3298505, K). Morogoro, Uluguru Mountains, Luwkwangulu Plateau, 2400 m, 19-9-1970, M. Thulin & B. Mboro, 1060 (UPS). Tanganyika, Morogoro, Uluguru Mts., Lukuangule plateau, above Chenzema Mission, 2500 m, 13-3-1953, R.B. Drummond & J.H. Hemsley, 1511 (BR, NY). Tanganyika, Tanga, Lushoto, Mkuzi Forest Reserve, 18-10-1962, S.R. Semsei, 3527 (PRE). Tanganyika, Southern, Luwira-Kitega Forest, 25-10-1962, S.R. Semsei, 2550 (PRE). Tanganyika, T.T., Southern Highlands, Kigogo, Mufinidi, 1800 m, 7-1959, J. Procter, 1284 (PRE, K). Tanganyika, Rungwe, Ngozi, Poroto Mts., 2100 m., 17-10-1956, H.M. Richards, 6573 (K). Mbeya, Poroto Mts., Ngozi, 1950 m, 17-10-1956, H.M. Richards, 6577 (K). Usambara, Rosetto-Thal an Bächen, 9-1882, Holst (B 100166182). Usambara, 9-1892, Holst, 3823 (B 100266181).

Acknowledgements

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- 75UPO-K (5), 76UPO-K (6a), 79UPO-K (6a), 83UPO-K (4a), 92UPO-K (6b), 100UPO-K (9a), 101UPO-K (10), 103UPO-K (6b), 104UPO-K (4a), 105UPO-K (6b), 116UPO-K (10), 123UPO-K (9a), 132UPO-K (6b)
- Burger, W. 1902 (10)
- Cadet, T. 451 (1)
- Carvahlo, 3677 (6a)
- Chapin, J.P. sn (4b)
- Chapman, J.D. sn (12), 3575 (9a)
- Charmichael, W. 1549 (5)
- Clover, 1486 (9a)
- C.N.A.D., 1814 (9a)
- Coombe, D.E. 229 (9a)
- Croat, T.B. 28307 (6a)
- D'Alleizette, C.H. (2)
- D'Arcy, W.G. 7574 (4b), 7789 (6), 8280 (6a), 8317 (4b), 8520 (4b)
- Davidse, G. 7031 (4a, 6a)
- Drummond, R.B. 1511 (12)
- Domke, 308 (9a)
- Dummer, R.A. 3459 (6a), 3465 (4a)
- Edwards, S. 502/82 (10)
- Eggeling, W.J. 1070 (6a)
- Elia, J. 130 (12)
- Endlich, R. 626 (4a, 5)
- Evans, I.M. 482 (10)
- Fries, R.E. 405 (9a), 493 (4a), 659 (9a), 676 (5), 943 (9a), 1158 (5), 1228 (6b), 1300 (10), 1462 (4a), 2210(4a), 2533 (6a), 2552 (6b), 2553 (6b), 2703 (6b), 2763 (9a)
- Friis, I 853 (6c), 1640 (6c), 3504 (9b), 7150 (6c)
- Geilinger, 4374 (5)
- Gereau, R.E. 1667 (4a)
- Germain, 3723 (4b), 3724 (4b)
- Greenway, P.J. sn (4a), 7121 (9a), 13666 (9a)
- Gibbs Russell, G.E. 1208 (9b)
- Haines, R.W. 274 (4b), 4315 (6a)
- Hedberg, O. 193 (4a), 397(4a), 854 (3), 1017 (10), 1043 (10), 1089 (9a), 1546 (10), 1600 (6b), 1633 (6a), 1936 (10), 2179 (4a), 2420 (4a), 4181 (10), 4224 (10), 4330 (10), 4555 (3), 4828 (10), 5659 (10), 7047 (10), 7068 (10)
- Hepper, F.N. 2042 (9a), 2085 (9a), 2085A (9a), 4962 (6b)
- Hienthmay, 10162 (2)
- Holst, sn (12), 3823 (12)
- Hooker, sn (2)
- Howard, W.J. 32 (6c)
- Humbert, H. 7999 (6a)
- Jackson, J.K. 1550 (4a)
- Johnston, H.B. 1408 (6c)
- Johnston, H.H. sn (2)
- JMG, 93937 (5), 9464 (4a),
- Katende, 3004 (4b)
- Keken, P. van der 9125 (10), 9126 (4b, 10)
- Laegaard, S. 16024 (9b)
- Lebrun, J. 7450 (4b), 8747 (6a), 8780 (4b, 9a), 9332 (9a)
- Liebenberg, L.C. 1708 (6a)
- Linder, D.H. 2076 (6a), 2252 (4b), 2364 (4b)
- Lisowski, S. 10936 (4a), 10956 (6a)
- Luceño, M. 127ML08 (2), 1ML09 (1), 2ML09 (2), 13ML09 (2), 14ML09 (2), 21ML09 (2)
- Louis, J. 5404 (4b)
- Lye, K.A. 5271 (6a), 5287 (6a), 5300 (6a), 1259 (4a)
- Maas Geesteranus, R.A. 5475 (4a), 5882 (6b), 5966(4a), 6015 (6b, 9a)
- Marien, W. 678 (6b)

Appendix 1

List of numbered *exsiccatae*

The numbers in parenthesis refer to those given in the numerical list of taxa.

- Amshoff, G.J.H. 1965 (9a)
- Ash, J. 1696 (10)
- Bamps, P. 3064 (4b)
- Balfour, I.B. sn (1)
- Barclay, C. 1334 (1)
- Bauer, P.J. 68 (9a)
- Bequaert, 4680 (6)
- Bie, S.W. 66246 (5), 66266 (10)
- Bogdan, A.V. 552 (9a), 2655 (9a), 3525 (9a), 4826 (9a)
- Boivin, sn (2), 23bis (1), 996 (2)
- Bory, 1003 (1)
- Brunt, M. 777 (9a)
- Buide, M.L. 24UPO-K (9a), 24UPO-Kbis (9a), 29UPO-K (9a), 30UPO-K (9a), 31UPO-K (3), 53UPO-K (9a), 56UPO-K (9a),

- Mearns, E.A. 899 (9a), 1674 (4a), 1677 (10), 1706 (10), 1736 (4a), 1742 (10), 1765 (4a, 6a), 2359 (9a)
 Milbraed, J. 966 (7), 1338 (6a), 1578 (4b)
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