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Dracoscirpoides (Cyperaceae) — A new genus from Southern Africa, its taxonomy and floral ontogeny

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Abstract

A new genus, *Dracoscirpoides* Muasya, is described and illustrated. This genus accommodates two southern African species, *Scirpus falsus* and *S. ficinioides*, until now included in the holarctic *Scirpus* (Scirpeae) due to the presence of perianth parts. Recent molecular phylogenetic studies have established that these species form a clade closer to *Scirpoides* and *Hellmuthia* within the *Isolepis*/*Ficinia* clade (Cypereae). We present floral developmental data focussing on the origin of the perianth parts (bristles) in these species, and discuss the utility of this character in generic delimitation. Cypereae are diagnosed by the presence of a *Cyperus*-type embryo and by the absence of perianth parts, except in the genera *Dracoscirpoides* and *Hellmuthia*. We describe a third species in the genus, *Dracoscirpoides surculosa*, diagnosed by its surculose underground stem and more northerly distribution.

Keywords: Cyperaceae; Cypereae; *Dracoscirpoides*; Perianth parts; Southern Africa; Taxonomy

1. Introduction

Linnaeus (1753, 1754) described *Scirpus* to encompass cyperaceous species with terete spikelets, spirally arranged glumes, and bisexual flowers with or without perianth parts. Over time, *Scirpus* was either recognized as one large genus (e.g. Boeckeler, 1870; Clarke, 1908), or divided into more than 50 small genera (e.g. Goetghebeur, 1998). *Scirpus sensu* Linnaeus (1753) was heterogeneous and the 24 species he recognized have subsequently been placed in 12 genera (*Bolboschoenus*, *Bulbostylis*, *Cyperus*, *Eleocharis*, *Fimbristylis*, *Isolepis*, *Schoenoplectiella*, *Schoenoplectus*, *Scirpoides*, *Scirpus*, *Scleria* and *Trichophorum*). Currently, *Scirpus sensu stricto* includes perennials with few to many-noded culms, (0-)3–6 perianth parts (usually called perianth bristles), and the presence of a *Fimbristylis*-type of embryo (e.g. Van der Veken, 1965; Raynal, 1977; Wilson, 1981, 1989; Haines and Lye, 1983; Bruhl, 1995; Goetghebeur, 1998).

A number of aberrant species described in *Scirpus* have been retained in the genus due to a lack of clear diagnostic characters placing them elsewhere. Among these are two species from the Drakensberg Mountain area of southern Africa, *Scirpus falsus* C.B. Clarke and *S. ficinioides* Kunth (hereafter referred to as Drakensberg *Scirpus*). These two species have perianth bristles similar to those in *Scirpus* but differ in gross morphology and in biogeography. The Drakensberg *Scirpus* are endemic to southern Africa, and have scapose stems with basal leaves and capitate inflorescences. In contrast, *Scirpus sensu stricto* is predominantly holoarctic with some occurrence in other temperate areas outside Africa. It has noded, leafy stems and anthelate inflorescences (Gordon-Gray, 1995; Goetghebeur, 1998).

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Angiosperm genera are traditionally circumscribed by an intuitive interpretation of predominantly morphological data, predating molecular phylogenetic studies, with the result that unrelated species are often grouped together due to morphological convergence. In Cyperaceae, a large family with extreme reductions of morphological features at both inflorescence and floral levels, genera are circumscribed on a limited number of characters. Recent molecular phylogenetic studies (Besnard et al., 2009; Muasya et al., 2009a, b) have demonstrated that the two Drakensberg *Scirpus* species form a clade closely related to *Scirpoides* and *Hellmuthia* in the tribe Cypereae (*Ficinia* clade *sensu* Muasya et al., 2009a; Fig. 1) and are well-separated from *Scirpus sens. str.* and other taxa in tribe Scirpeae. These two species do not, however, fit into any of the accepted genera without disrupting current generic concepts in the Cyperaceae. We therefore consider it to be the best solution to describe a new genus that includes these species. We revise the taxonomy, including describing a third species, and provide an identification key to the species. In addition, we present floral ontogenetic data focussing on the origin of the perianth parts.

2. Materials and methods

The morphology and ecology of the species were studied in the field. Additional comparative morphological studies were undertaken on our own collections and on herbarium specimens (BOL, GENT, GRA, K, NBG, NH, NU, PRE; acronyms follow Index Herbariorum, http://sciweb.nybg.org/science2/IndexHerbariorum.asp). Gross morphological characters were investigated using a dissecting microscope with a measuring eyepiece. Characters studied included culm length, leaf sheath length, leaf blade length and width, involucral bract number and length, spikelet length and width, glume length, glume mucro length, and nutlet length and width. This morphology was compared with features in other genera of the *Ficinia*-clade.

Inflorescences for SEM study were collected in the field (*Muasya & Stirton 3748* (BOL)) and fixed in 70% ethanol. Spikelets and floral buds were dissected in 70% ethanol, washed twice with 70% ethanol for five min and then placed in a mixture (1/1) of 70% ethanol and DMM (dimethoxymethane) for five min. Subsequently, the material was transferred to 100% DMM for 20 min, before it was CO_2 critical point dried using a CPD 030 critical point dryer (BAL-TEC AG, Balzers, Liechtenstein). The dried samples were mounted on aluminum stubs using Leit-C and coated with gold with a SPI-ModuleTM Sputter Coater (SPI Supplies, West-Chester, PA, USA). Scanning electron microscope (SEM) images were obtained on a Jeol JSM-6360 (Jeol, Tokyo) at the Laboratory of Plant Systematics (K.U. Leuven Belgium). Embryos were obtained from mature seeds, bleached and observed following the protocol of Van der Veken (1965).

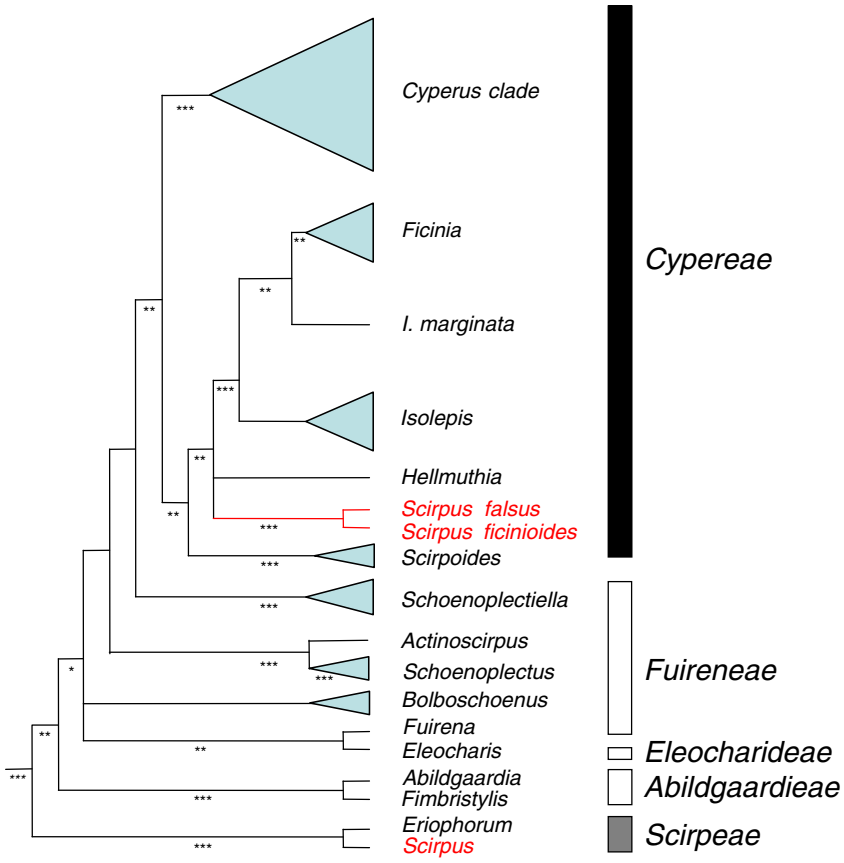

Fig. 1. Phylogenetic position of *Scirpus falsus* and *S. ficinioides*. Cladogram modified from Muasya et al. (2009a) and tribal classification following Muasya et al. (2009b). Bootstrap support values are shown below branches (*for 50–74%, ** for 75–89% and *** for 90–100%) and triangle sizes are proportional to taxa number.

3. Results

The Drakensberg *Scirpus* are perennial herbs, bearing short rhizomes or stolons. Their culms have a single, large internode (peduncle), 300–1300 mm tall. Leaves are well developed, lack a ligule and leaf blades are canaliculate with scabrid margins. Flowers are bisexual, have bristle-like perianth parts, aggregated into a terete spikelet. Spikelets are borne in a capitate head but occasionally some stalked heads occur (Table 1; Figs. 2, 5, 6).

3.1. Floral ontogeny in S. falsus

The spikelet develops in the axil of a bract (Fig. 3A). In a developing spikelet, the prophyll becomes larger than the spikelet, which is nested within in with a torsion (Fig. 4F). The proximal glumes grow out and envelope the rest of the spikelet (Fig. 4F). Mature glumes have a spiny mucro (Fig. 4F). All glumes, with exception of the first glume or prophyll, subtend a flower (Fig. 3A, B). At the distal part of a developing spikelet, the glumes are distichously arranged, whereas at the proximal side they are arranged spirally (Fig. 3B). The rachilla is indeterminate, with new glumes originating successively immediately below the rachilla apex. The flower primordium in the axil of a glume expands laterally (Fig. 3C), forming first two lateral stamen primordia and immediately after their appearance, a third stamen primordium originates abaxially (Fig. 3D). The development of the abaxial stamen primordium remains delayed compared to the two lateral ones. Simultaneously, the lateral outer perianth parts develop (Fig. 3D), while the abaxial outer and two abaxial inner perianth parts are originating (Fig. 3D, E). Meanwhile, the floral apex forms a bulge (Fig. 3D, E), which subsequently differentiates into an annular ovary primordium surrounding a central ovule primordium (Fig. 3F). The ovary wall grows up from this annular primordium, and on its top first two adaxial stigma primordia appear (Fig. 3F), followed by a third abaxial one (Fig. 3G). At this stage, the inner adaxial perianth part primordium is visible (Fig. 3G). The ovary wall grows up, gradually enveloping the ovule (Fig. 3G–I). Meanwhile, the other floral parts also develop; the perianth parts grow out and first the adaxial-lateral stamen primordia start differentiating into filament and anther (Fig. 4A), followed by the abaxial one (Fig. 4D). Sometimes, the adaxial perianth part primordium gives rise to two adaxial perianth members (Fig. 4B). At this stage, the stamens grow rapidly, protruding beyond the gynoecium (Fig. 4C–E). An apiculus is formed on the top of the anthers (Fig. 4E). The stigma branches also grow out, becoming papillose (Fig. 4E), while the perianth parts develop into smooth ribbon-like structures (Fig. 4D, E), which at maturity have barbs facing upwards (antrorse).

4. Discussion

S. ficinioides and *S. falsus* are fairly common species that have been known to science for over 100 years. They were considered to be anomalous in *Scirpus* due to their *Ficinia*-like gross morphology and occurrence in Africa (e.g. Gordon-Gray, 1995; Table 1) but could not be unambiguously placed based on morphological data alone. Their placement within Cypereae, based on DNA phylogenetic data (Muasya et al., 2009a; Fig. 1), is supported by embryological studies, which confirm that the species have a *Cyperus*-type embryo (Fig. 2F). In Cypereae, perianth parts are observed in *Hellmuthia membranacea* (Thunb.) R.W. Haines & Lye (Vrijdaghs et al., 2006) and have been reported in a single collection of *Ficinia ixioides* Nees (Schönland, 1922).

We consider the presence of perianth parts to be ancestral among the Cyperoideae and they have been lost independently in multiple lineages such as Abildgaardieae and core Cypereae. However, perianth part presence and morphology, even within a genus (e.g. in *Fuirena*; Vrijdaghs et al., 2004), is potentially labile and consequently best used in combination with other characters. In *S. falsus*, the adaxial perianth primordium can split to develop into more than one perianth part (Fig. 4B). A similar phenomenon occurs in *Dulichium*, where up to ten bristles are formed from the usual three inner and three outer perianth part primordia (Vrijdaghs et al., 2005a).

Spikelet and floral ontogeny in *S. falsus* follows the cyperoid pattern described by Vrijdaghs et al. (2009, 2010). Based on our results, we cannot tell whether the observed distal distichous glume arrangement appears only at a later stage of the spikelet development or whether the spiral arrangement in the proximal part of the spikelet is the result of a torsion. The typical floral developmental sequence – flower primordium, lateral stamen primordia, abaxial stamen primordium, outer perianth parts, inner perianth parts, differentiation of the floral apex into annular ovary wall primordium surrounding a central ovule primordium – is

Table 1
Comparison of *Scirpus* and genera in *Ficinia* clade.

	Drakensberg *Scirpus*	*Scirpus* L.	*Scirpoides* Ség.	*Hellmuthia* Steud.	*Isolepis* R.Br.	*Ficinia* Schrad.
Life form	Perennial	Perennial	Perennial	Perennial	Perennial and annual	Perennial
Internode	Single	Several	Single	Single	Mostly single	Mostly single
Inflorescence type	Capitate	Anthelate	Capitate, anthelate	Capitate	Capitate	Capitate, spike
Glume arrangement	Spiral	Spiral	Spiral	Spiral	Spiral, few distichous	Spiral, few distichous
Perianth type in fertile flowers	6 (7) bristles	(0) 3–6 bristles	Absent	3 scales in lower flowers	Absent	Absent (single case recorded)
Embryo type	*Cyperus*	*Fimbristylis*	*Cyperus*	*Cyperus*	*Cyperus and Ficinia*	*Ficinia*
Number of species	3	64	4	1	75	75
Distribution	Southern Africa	Holarctic, Andes	Southern Africa, Europe	Southern Africa (Cape)	Southern and Tropical Africa, Americas, Australasia, Europe	Southern and Tropical Africa, Australia, New Zealand, circumpolar

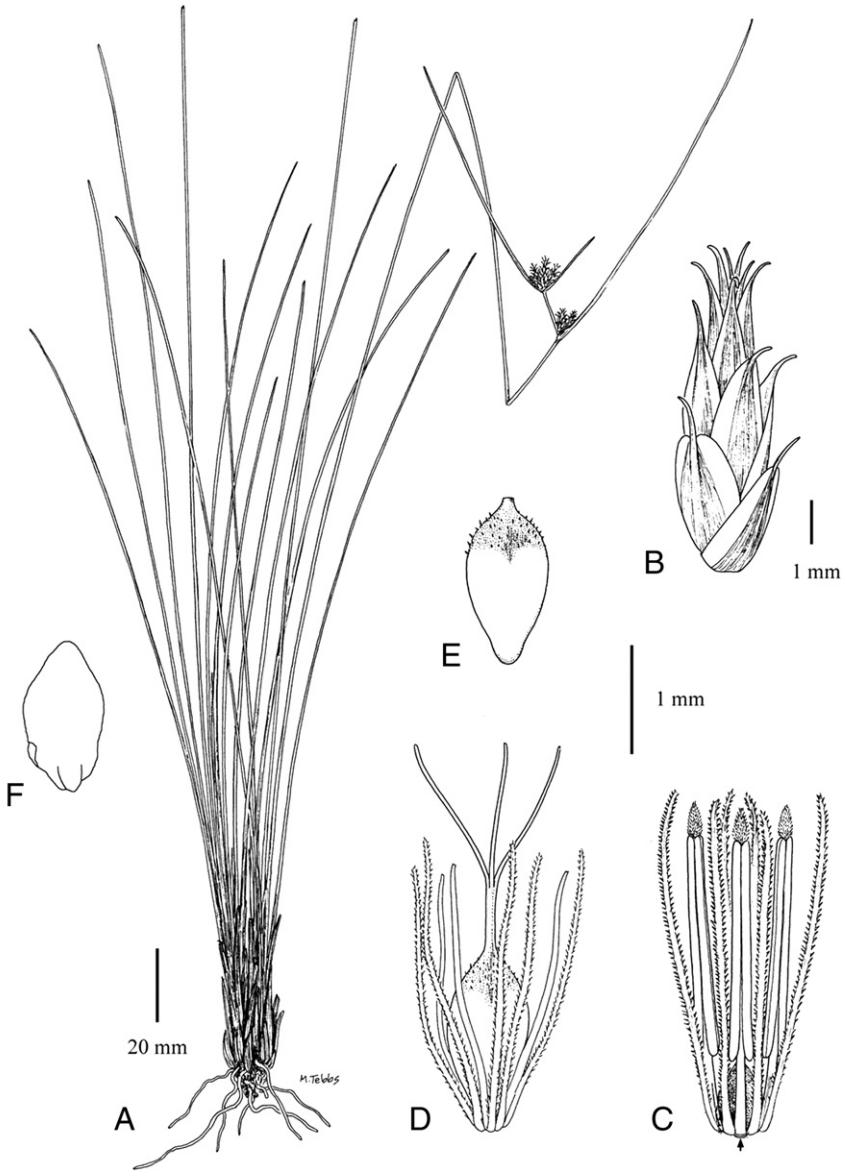

Fig. 2. *Dracoscirpoides falsa*. (A) Habit; (B) spikelet; (C) young flower, with outer bristle removed (marked with arrow); (D) mature flower; (E) nutlet; (F) embryo. (A–E) drawn from *Killick 1344* by M. Tebbs, (F) drawn from *Muasya & Stirton 3748* by M. Reynders.

initially more compressed than observed in other Cyperoideae such as *S. sylvaticus* L. (Vrijdaghs et al., 2005a), which gives the impression that perianth parts and stamen primordia originate simultaneously. Nevertheless, the floral ontogenetic sequence in *S. falsus* can be considered to be in accordance with the general cyperoid floral ontogenetic model and similar to the one in *Ficinia*, *Isolepis*, *Hellmuthia* and *Scirpoides* (Vrijdaghs et al., 2005a, b, 2006).

Based on the presence of a *Cyperus*-type embryo and molecular phylogenetic data, we place *S. falsus* and *S. ficinioides* in tribe Cypereae thus adding a second lineage with perianth parts to the tribe. Cypereae were previously circumscribed to include taxa with a *Cyperus*-type embryo lacking perianth parts (Goetghebeur, 1998), or more narrowly to include only taxa with a distichous glume arrangement (Bruhl, 1995). However, taxa with a spiral glume arrangement and with/without perianth parts were added in the course of time. Another aberrant *Scirpus* species found in Southern Africa, *S. varius* Boeck. ex C.B. Clarke, which has a *Cyperus*-type embryo (Van der Veken, 1965: 310, Fig. 35, P) and flowers lacking perianth parts, has been moved into *Scirpoides* (Browning and Gordon Gray, 2011).

The Drakensberg *Scirpus* are morphologically most similar to *Scirpoides* (Table 1), sharing vegetative (perennial life form, scapose culms) and reproductive features (spiral glume arrangement, absence of gynophore) but differ in having perianth parts. *Hellmuthia* is also similar to these two lineages, differing in presence of scale-like perianth parts. Molecular data (Muasya et al., 2009a, b) supports the Drakensberg *Scirpus* to be a single lineage closer to *Hellmuthia* (Fig. 1). To maintain nomenclatural stability, we opt to erect a separate genus for the Drakensberg *Scirpus* lineage. This decision is consistent with previous authors, who have recognized genera in Cyperaceae

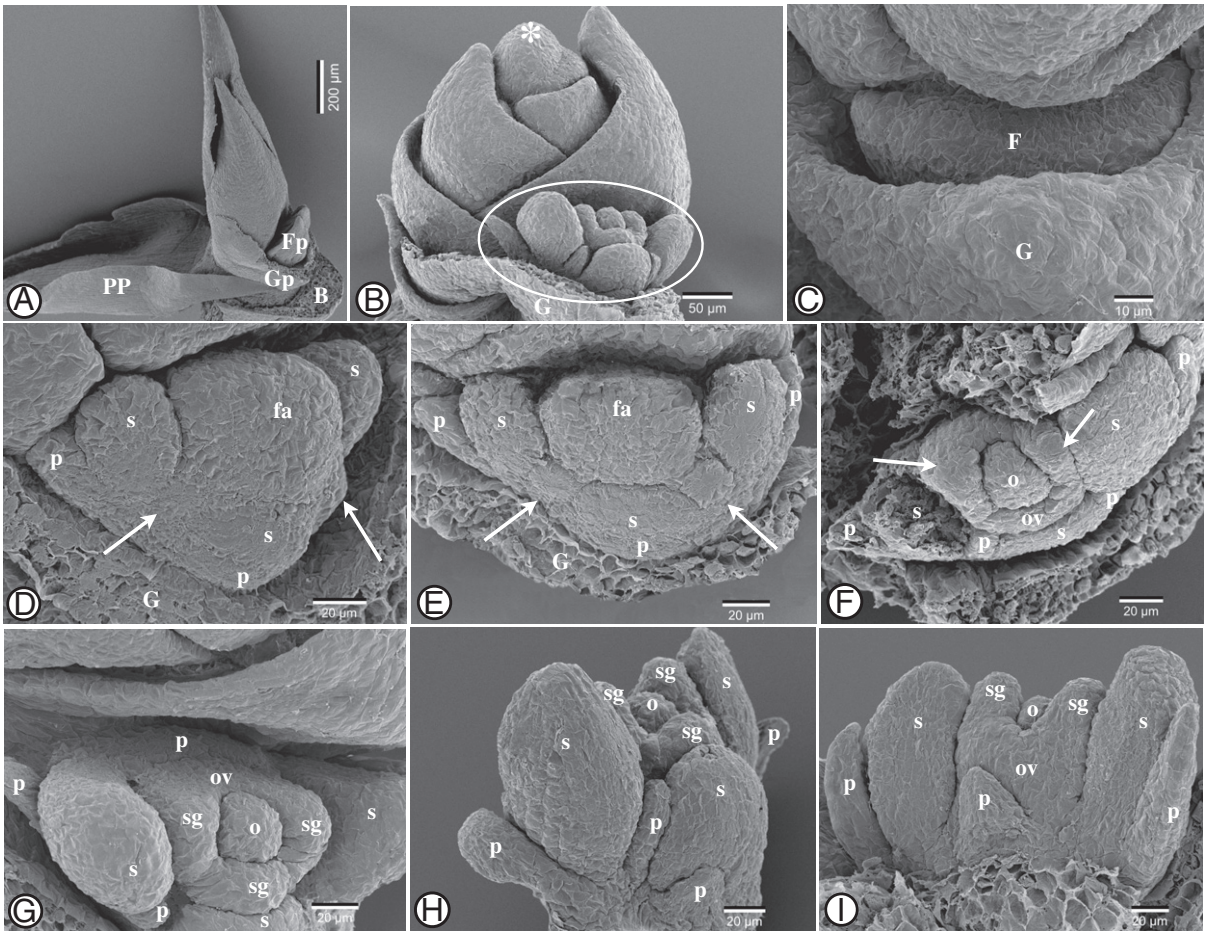

Fig. 3. SEM images of early spikelet and floral ontogenetic stages in *Dracoscirpoides falsa*. (A) Lateral view of a developing spikelet with the subtending bract and proximal glume removed, and the prophyll opened; (B) lateral view of the distal part of a developing spikelet, with an indeterminate rachilla apex, distal distichously organized glumes, and proximal glumes arranged spirally, of which one removed, exposing a developing flower (encircled); (C) detail of a young glume with a laterally expanding flower primordium in its axil; (D) apical-abaxial view of a flower at early developmental stage, the abaxial inner perianth parts start originating (arrowed); (E) apical view of an early flower, with all perianth member primordia present. The two abaxial inner ones are arrowed, the adaxial inner one is encircled; (F) apical view of an early flower with the floral apex differentiated into an annular ovary primordium with on its top two lateral-adaxial stigma primordia (arrowed); (G) apical-adaxial view of an early flower with developing ovary wall with on its top three stigma primordial; (H) abaxial-lateral view of a developing flower; (I) adaxial view of a developing flower. Abbreviations: B, bract; F, flower primordium; fa, floral apex; Fp, proximal flower; G, glume; Gp, proximal glume; o, ovule primordium; ov, ovary wall (primordium); p, perianth part primordium; PP, prophyll; sg, stigma primordium; *, rachilla apex.

based on a single morphological character or combination of morphological and molecular data.

5. Taxonomic treatment

5.1. Dracoscirpoides

Dracoscirpoides Muasya, gen. nov. Genus novum, *Scirpoides* affine, embryonis forma Cyperi, inflorescentia pseudolateralisque, sed ab eo setis hypogynis conspicue differt. Type species: *Dracoscirpoides falsa* (C.B. Clarke) Muasya.

Tufted perennials with short rhizome, surculose or stolon. *Culms* up to 1300 mm tall, scapose with up to 3 leaves borne at basal nodes. *Leaves*: sheath 15–105 mm long, closed with ciliate rim, concolorous with lamina, with fibrous remains from previous seasons; blade shorter than or as long as culm, canaliculate, margins scabrid. *Inflorescence* capitate but occasionally with one additional stalked head, appearing pseudolateral, not proliferating (not pseudoviviparous); bracts 2–4, leaf-like with scabrid margins. *Spikelets* 4–25, 3.0–8.0 mm × 2.5–4.0 mm. *Glumes* appearing semi-distichous at base to spirally arranged, 2.7–5.5 mm long, wine-red to dark brown, with mucro 0.2–1.0 mm long. *Perianth* bristles 6(7), scabrid with antrorse or retrorse barbs, occasionally elongating to form fluffy cotton-like mass. *Stamens* 3, anthers basifixed, 1.5–3.1 mm long, connective conical and scabrid. *Style* trifid. *Nutlets* 1.3–3.5 mm × 0.8–1.3 mm, trigonous, brown to dark brown, surface reticulate, scabrid or smooth towards apex. *Embryo* of the *Cyperus*-type (elliptical, root cap lateral, coleoptile basal, germ split parallel with first leaf) (Figs. 2, 5, 6).

5.2. Etymology

The name *Dracoscirpoides* includes the locality *Draco–* (Latin for dragon, referring to the Dragon Mountains in Afrikaans) and the taxonomic affinity *–scirpoides* (like *Scirpus*).

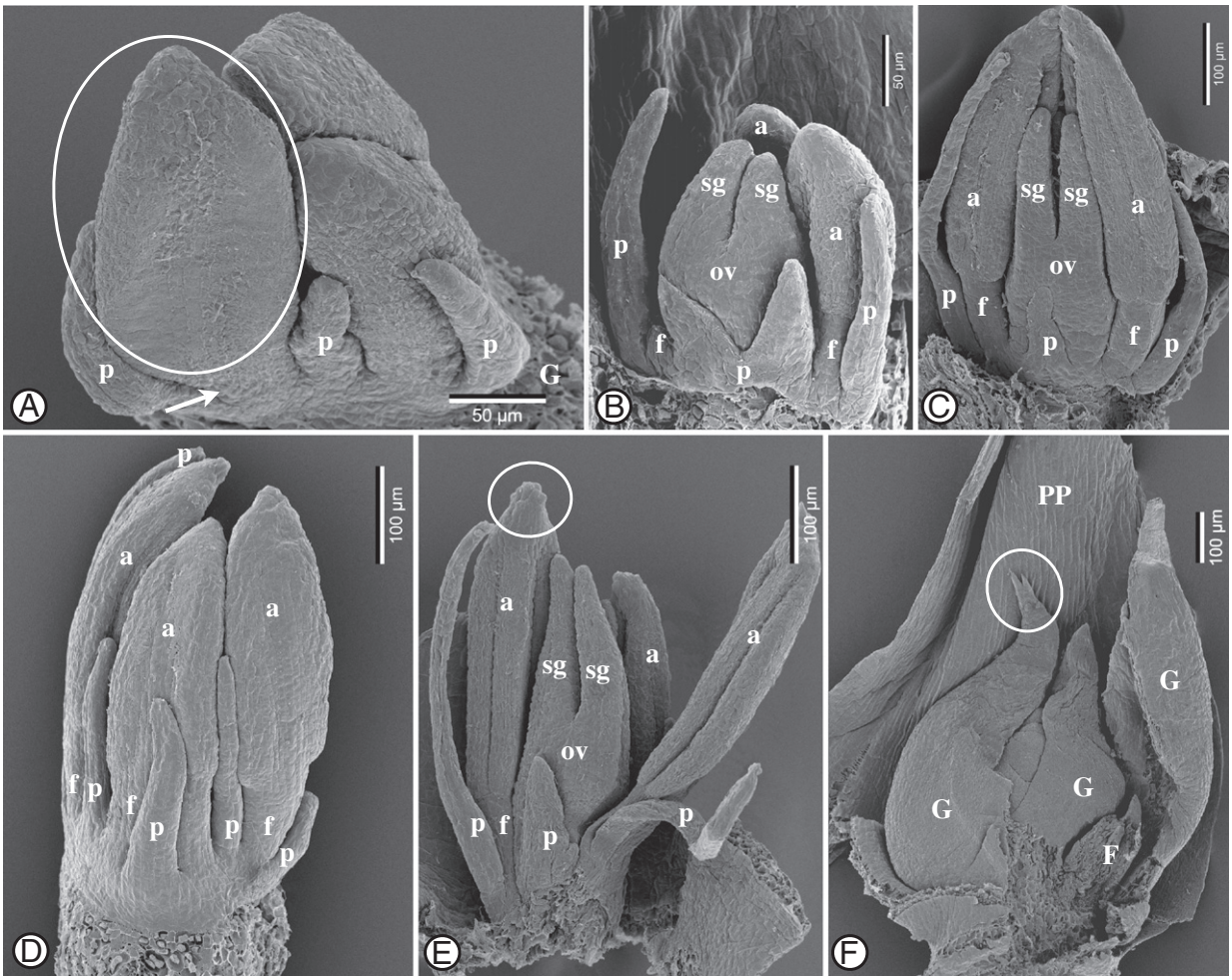

Fig. 4. SEM images of floral ontogenetic stages in *Dracoscirpoides falsa*. (A) Lateral-abaxial view of a developing flower with a stamen primordium differentiating into filament (arrowed) and anther (encircled); (B) adaxial view of a developing flower with left stamen removed. The adaxial perianth member is split into two; (C) adaxial view of a developing flower, with a single adaxial perianth member. The stamens protrude the gynoecium; (D) abaxial view of a flower at the same stage as in "C". The perianth members grow at different rates; (E) adaxial view of a developing flower. On the top of the anthers, an apiculus is formed (encircled); (F) semi-mature spikelet, seen from the side of its (removed) subtending bract. The proximal glumes envelop the whole spikelet and have spiny mucros (encircled). Abbreviations: a, anther; f, filament; F, flower; G, glume; ov, ovary wall; p, perianth part; PP, prophyll; sg, stigma.

5.3. Key to the species

1. Plants forming dense tufts, with short rhizome; stems 80–320 × 0.5–0.9 mm, wiry and indistinguishable from leaves; perianth bristles densely antrorsely barbed; growing on mountain slopes with well drained soils.....*D. falsa*

1*. Plants in lax tufts, with stolon or surculose; stems 30–1300 × 1.0–2.6 mm, coarse and distinguishable from leaves; perianth bristles sparsely retrorsely or antrorsely barbed; growing along streams and wetlands.....2

2. Plants distinctly stoloniferous; perianth bristles sparsely retrorsely barbed; growing in southern Drakensberg..... .....*D. ficinioides*

*2**. Plants distinctly surculose; perianth bristles sparsely antrorsely barbed; growing in northern Drakensberg..... .....*D. surculosa*

5.4. D. falsa (C.B. Clarke) Muasya, comb. nov.

S. falsus C.B. Clarke in W.T. Thiselton-Dyer (eds), Fl. cap. 7: 230 (1898). Lectotype, designated here: South Africa, Mont Aux Sources (2828DB), Jan. 1844, *Flanagan 2010* (K, lecto.!; BOL!, PRE!, iso.). [Syntype: South Africa, Mont Aux Sources (2828DB), Jan. 1844, *Flanagan 2011* (BOL!, K!, PRE!)].

Slender, tufted perennial with short rhizome. *Culms* 80–320 × 0.5–0.9 mm, wiry, terete at base but becoming triangular towards inflorescence, scabrid along angles. *Leaves*: sheath 15–55 mm long, usually dark brown and old sheaths persistent, rarely papery and pale, rim smooth; blade 90–350 × 0.6–1.0 mm, filiform, scabrid along the margins. *Inflorescence* pseudolateral, congested into one or rarely two heads of 2–12 mm wide; bracts 2–4, usually the base has the same dark color as the glumes with a hyaline margin, main bract erect, 20–117 × 0.4–0.7 mm, other

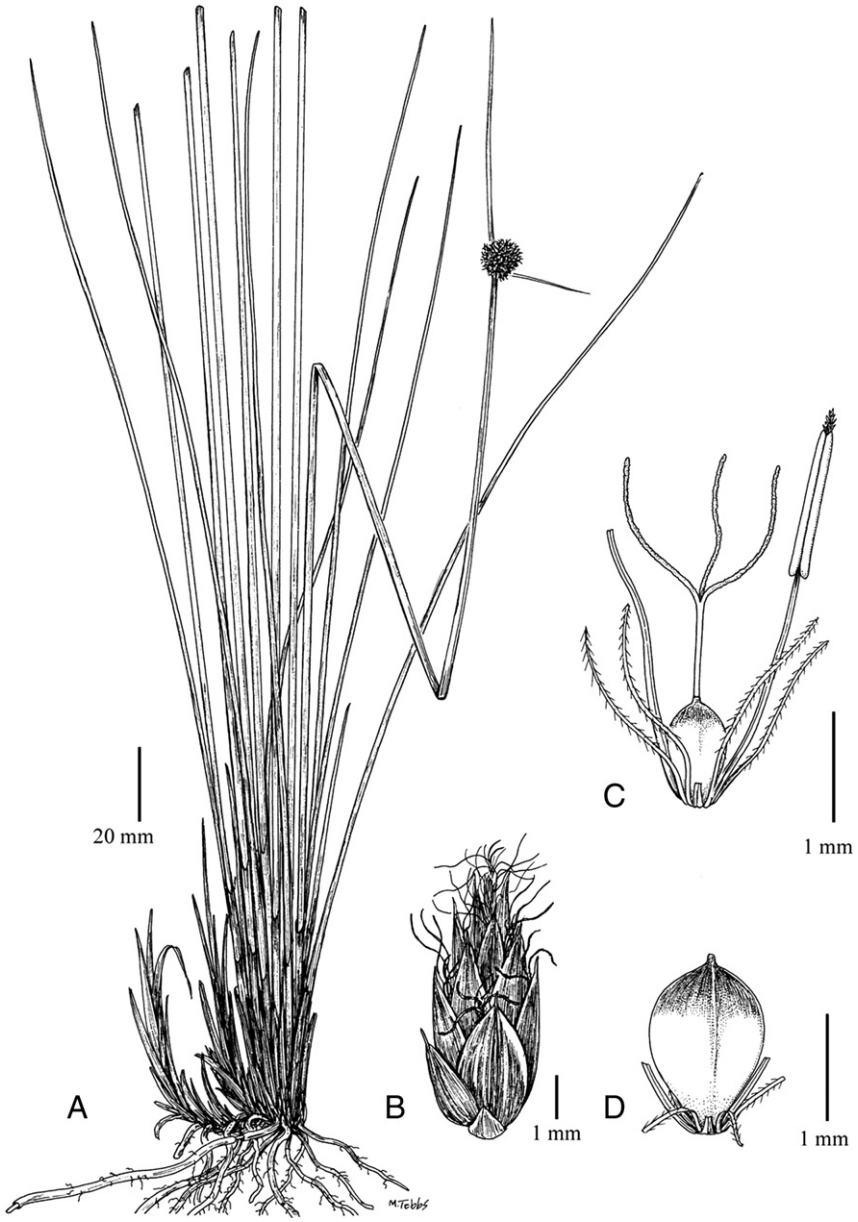

Fig. 5. *Dracoscirpoides ficinioides*. (A) Habit; (B) spikelet; (C) flower; (D) nutlet.
All drawn from *Hilliard & Burtt 17467* by M. Tebbs.

bracts erect to spreading. *Spikelets* 4–14, 5.0–8.0 × 2.0–4.0 mm, pale brown to black; glumes 3.5–5.5 mm long, elliptic to lanceolate, pale brown to black with many pale nerves, margins usually hyaline, midrib often scabrid in the lower part, excurrent as a usually dark colored, smooth mucro of 0.3–1.0 mm long. *Perianth bristles* 6(7), densely antrorsely scabrid. *Anthers* 1.9–3.1 mm long. *Nutlets* 2.2–3.5 × 1.0–1.3 mm, triangular, elliptic, surface smooth or scabrid towards apex (Fig. 2).

5.4.1. Additional selected specimens of D. falsa examined

5.4.1.1. Lesotho. 2927 (Maseru): Molimo Nthuse Hotel (−BC), 6 Nov. 1975, *Schmitz 6313* (PRE); God-Help-Me-Pass, between Bushmen's Pass and Blue Mountain Pass (−BD), 15 Nov. 1983, *De Kruif 1155* (PRE).

2928 (Marakabei): Marakabeis District, Bokong Vlei, (−AB), 7 Dec. 1991, *Browning 421* (GENT, NU); between Oxbow and Mokhotlong (−BB), 15 Jan. 1973, *Werger 1646* (PRE); Mantsonyane, 5.9 km from Mantsonyane on road to Maseru, Che Che Pass (−CA), 8 Mar. 1990, *Smook 7306* (PRE); Qacha's Nek District, Matebeng Pass, S of road at neck of Pass (−DD), 18 Feb. 1990, *Braun 1007* (PRE).

2929 (Underberg): Mokhotlong District, Temrock Peak (−AC), Jan. 1953, *Liebenberg 5720* (PRE); Thabana Ntlenyana (−AD), 20 Jan. 1955, *Jacot-Guillarmod 2361* (PRE).

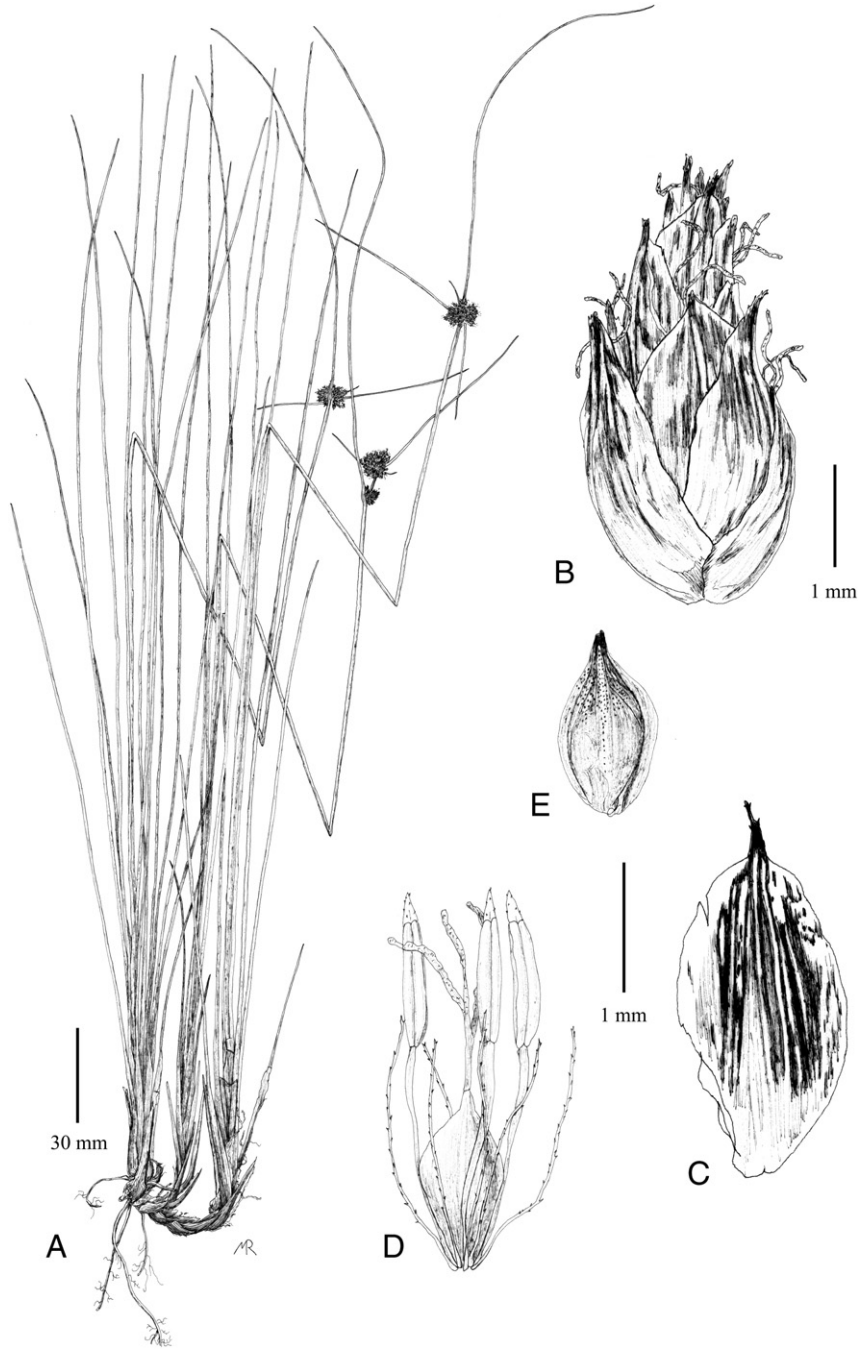

Fig. 6. *Dracoscirpoides surculosa*. (A) Habit; (B) spikelet; (C) glume; d, flower (abaxial view); e, fruit (abaxial view). All drawn from *Browning* 647 (GENT) by M. Reynders.

5.4.1.2. South Africa. Free State. — 2729 (Volksrust): Drie Kop Farm, 42 km SE of Vrede, Aasvoëlkop, (−CB), 5 Feb. 1987, *Smook 6440* (PRE); Witkoppenberge, Farm Eben (−CD), 3 May 1992, *Eckhardt 317* (NU).

2828 (Bethlehem): Bethlehem District, Golden Gate Highland National Park, (−BC), Jan. 1966, *Liebenberg, 7530* (PRE); Kestell, Korfshoek(−BD), 3 Nov. 1983, *Blom 276* (PRE); Butha Butha District, Pone Valley, Mothae Mts. (−CD), 7 Jan. 1958, *Coetzee 804* (PRE); Sentinel Peak, plateau behind Sentinel Peak near chain ladder (−DB), Mar. 1975, *Arnold 852* (NU); Mont Aux Sources (−DD), 17 Mar. 1955, *Edwards 599* (NU, PRE).

KwaZulu-Natal. — 2730 (Vryheid): Wakkerstroom District, Oshoek Farm, (−AD), 6 Feb. 1985, *Reid 1017* (PRE, GENT).

2829 (Harrismith): Harrismith District, Platberg, (−AC), 4 Feb. 1975, *Venter 7079* (PRE!); Scheepershoek, S of Sterkfontein, Dumbe Guest Cottages (−CA), 9 Nov. 2009, *Muasya & Stirton 4935* (BOL, NBG, K); Cathedral Peak Forest Reserve, top of Mike's Pass (−CC), Mar. 1973, *Arnold 876* (PRE); Bergville District, Cathedral Peak Forest Research Station,

Catchment 2 (−CC), 25 Jan. 1951, *Killick 1344* (NU, PRE); Estcourt District, Bushman Pass (−DD), 22 Jan. 1940, *West 1661* (PRE).

2929 (Underberg): Estcourt District, Giants Castle Game Reserve, (−AB), 15 Dec. 1957, *Edwards 2272* (NU); Lions River District, Ross, Umgeni Poort (−BD), 3 Nov. 1964, *Moll 1358* (NU); Underberg District, Garden Castle NR, Pillan Cave valley (−CA), 5 Nov. 1977, *Hilliard & Burtt 10433* (NU); Underberg District, 5–7 miles NNW of Castle View Farm, Headwaters of Mlahlangubo River (−CB), 24 Nov. 1980, *Hilliard & Burtt 13609* (GENT, NU); Underberg District, vicinity of Tarn Cave, above Bushman's Nek (−CC), 20 Jan. 1984, *Hilliard & Burtt 17418* (NU, PRE); Lions River District, Inhluzane (−DB), 15 Oct. 1964, *Moll 1276* (PRE).

Eastern Cape: — 3027 (Lady Grey): Barkly East District, Near New England, Faskally Farm (−DA), 9 Nov. 1995, *Victor 1558* (PRE); Ben Mcdhui (−DB), 11 Mar. 1904, *Galpin 6874* (BOL).

3028 (Matatiele): Lake Letsie, (−AC), 11 Dec. 1977, *Killick 4389* (PRE); Barkly East District, Mavisbank Farm, Neck NE of Mavisbank farmhouse (−CA), 8 Dec. 1999, *Archer & Archer 2340* (PRE); Transkei, Naudesnek, Tinahead (−CA), 6 Nov. 1987, *Strever 421* (PRE).

3029 (Kokstad): Nsikeni, (−AB), 31 Oct. 1993, *Abbott 6153* (NH, NU); Griqualand East (−CB), 4 Apr. 1918, *Mogg PRE18746* (GRA, PRE).

3224 (Graaff-Reinet): Sneeuberg, Farm Upper Waterkloof 362, Eastern end of the Nardousberg ridge, (−BB), 4 Feb. 2008, *Clark &Crause 58* (GRA); Asante Sana PG Reserve, Farm adjoining Nooitgedacht & Waterkloof 353 (−BD), 4 Feb. 2008, *Clark & Crause 14* (GRA).

3226 (Fort Beaufort): Adelaide District, Great Winterberg (−AD), 21 Jan. 2009, *Clark, Pienaar & Daniels 232* (BOL, GRA); Katberg, top of Katberg, (−BC), Nov. 1928, *Hutchinson 1616* (BOL, PRE); Amatole Mts, Gaika's Kop (−DB), Nov. 1928, *Hilliard & Burtt* 18815 (NU); Robertson Falls (−DC), 26 Nov. 1994, *Sonnenberg 335* (GRA, NU).

5.5. *Dracoscirpoides ficinioides (Kunth) Muasya, comb. nov.*

Scirpus ficinioides Kunth, Enum. Pl. 2: 172 (1837). Lectotype, designated here: South Africa, Eastern Cape, Katberg (3226DA), 13 Nov 1832, *Drège 3937* (P (P00462605), lecto.!; P! (P00462606), P! (P00462607), PRE!, iso.). [Paratype: Katberg, date unknown, *Drège 3938* (P)].

Scirpus kunthii Boeck., Linnaea 36: 508 (1870). Syntypes: *Drège 3837, 3938.*

Tufted perennial with long stolons; cataphylls stramineous to dark brown, ± 20 mm long. *Culms* 470–1130 × 0.7–3.2 mm, coarse, terete at base but becoming triangular towards inflorescence, scabrid along angles. *Leaves*: sheath up to 60–136 mm long, brown and membranaceous, old sheaths persistent, rim ciliate; blade 230–415 × 0.6–1.5 mm. *Inflorescence* pseudolateral, congested into one or rarely two heads of 5–11 mm wide; bracts 2–(3), main bract 60–130 × 0.3–1.0 mm, erect, other bracts spreading. *Spikelets* 14–40, 2.4–5.0 × 1.0–2.5 mm, dark brown to black; glumes 2.2–3.3 mm long, elliptic, dark brown to black with many pale nerves, midrib excurrent in a dark and smooth mucro of 0.1–0.5 mm long. *Perianth bristles* 6, sparsely and retrorsely scabrid. *Anthers* 1.5–2.2 mm long, connective conical and scabrid. *Nutlets* 1.4–2.2 × 0.8–1.1 mm, broadly elliptical to obovate, surface smooth (Fig. 5).

5.5.1. *Additional specimens of D. ficinioides examined*

5.5.1.1. Lesotho. 2828 (Bethlehem): Leribe, LHDA Phase 1A (−AB), 13 Jan. 1996, *Phillipson, Mokumu, Judd & Hobson 4740* (GRA); Leribe (−CC), 1919, *Dieterlen 594B* (PRE); Butha Buthe District, Oxbow Camp (−DC), Jan. 1960, *Jacot-Guillarmod 4143* (PRE); Oxbow Lodge, 3 km N. of lodge on road to Moteng Pass (−DC), 8 Dec. 1977, *Killick 4349* (PRE).

2927 (Maseru): Roma District (−BC), 27 Mar. 1960, *Ruch 1675* (PRE); Mountain road, Bushmans Pass (−BD), 2 Dec. 1978, *Schmitz 8465* (PRE).

2928 (Marakabei): Lehaha-La-Sekhonyane (−AD), 30 Dec. 1946, *Jacot-Guillarmod 204* (GRA, PRE); Likalaneng Province: Senqunyane River, Near Ha Marakabei (−CA), 24 Nov. 1997, *Boucher 6211* (PRE); Thaba-Tseka Province: Malibamatso River near Paray (−CB), 25 Nov. 1997, *Boucher 6233* (PRE); Semonkong (−CC), 28 Nov. 1976, *Forbes 685* (PRE).

5.5.1.2. South Africa. Free State. — 2827 (Senekal): Excelsior District, Korannaberg (−CC), 15 Nov. 1988, *Zietsman 510* (PRE).

2828 (Bethlehem): Bethlehem District, Golden Gate Highland National Park, W Entrance of Goat Camp (−BC), 16 Jan. 1966, *Liebenberg 7491* (PRE); Bestersvlei (−BD), 1894, *Flanagan 1874* (PRE); Golden Gate Highland National Park, Kalieskraal (−DA), 6 Apr. 1994, *Bezuidenhout 751* (PRE).

2927 (Maseru): Ladybrand District, Leliehoek (−AB), 18 Oct. 1988, *Zietsman 350* (PRE).

KwaZulu-Natal. — 2829 (Harrismith): Bergville District, Cathedral Peak Forestry Research Station, Catchment 8 (−CC), 6 Nov. 1950, *Killick 1096* (NU, PRE).

2929 (Underberg): Mamalapi (−AA), 29 Dec. 1948, *Jacot-Guillarmod 773* (PRE); Drakensberg summit, Cleft Peak area (−AA), 1 Dec. 1953, *Killick & Marais 2185* (NU, PRE); Mpendhle District, Loteni Valley area, Ngondwini valley (−BC), 24 Dec. 1982, *Hilliard & Burtt* 16095 (GENT, NU, PRE); Umzimkulu Valley (−CA), Nov. 1979, *Small 16* (PRE); Underberg District, Cobham Forest Reserve, Upper Polela cave area (−CB), 16 Feb. 1979, *Hilliard & Burtt 12593* (GENT, NU, PRE); Sani Pass summit, Sani River (−CB), 14 Jan. 1977, *Killick 4117* (PRE); Sehlathebe National Park (−CC), 17 Mar. 1990, *Browning 321* (NU, PRE); Drakensberg Garden Hotel, near entry of Forestry Reserve, close to Mlambonja River (−CC), 8 Feb. 1982, *Goetghebeur 4529* (GENT, PRE); Drakensberg Garden Hotel, near entry of Garden Castle Reserve (−CC), 9/11/2009, *Muasya & Stirton 4919* (BOL, K, PRE).

2930 (Pietermaritzburg): Pietermaritzburg District, Table Mt, top of mountain (−DA), 11 Sep. 1948, *Killick 198* (NU, PRE).

Eastern Cape. — 3027 (Lady Grey): Lady Grey District, Zastron, Aasvoelberg, above Zastron campsite (−AC), 27 Mar. 1980, *Reid 166* (PRE); Barkly East District, Pitlochrie, Three Drifts stream (−DC), 10 Dec. 1981, *Hilliard & Burtt 14711* (GENT, NU, PRE).

3028 (Matatiele): Barkly East District, Sar Bachan Farm (Mavis Bank Farm), Valley of Kloppershoek Stream, N. of farmhouse (−CA), 7 Dec. 1999, *Archer & Archer 2252* (PRE); Barkly East District, Naudesnek road (−CC), 12 Dec. 1999, *Archer 2387* (PRE).

3029 (Kokstad): Mount Currie District, 2.3 miles S of Cedarville, Umzimvubu River (−AC), 16 Feb. 1962, *Acocks 21993* (PRE).

3127 (Lady Frere): Barkly East District, Saalboom Nek (−AB), 15 Jan. 1959, *Acocks 20177* (BOL, PRE).

3226 (Fort Beaufort): Adelaide District, Farm Finella Falls 1 (−AD), 25 Jan 2009, *Clark, Pienaar & Daniels 514* (BOL, GRA).

3227 (Stuttarheim): Hogsback (−CA), 24 Nov. 1994, *Sonnenberg 312* (NU, PRE).

5.6. *Dracoscirpoides surculosa Muasya, Reynders & Goetgh. sp nov.*

A D. ficinioides differt basi surculosa (versus basim stoloniferam) atque perianthio antrorse barbellato (versus perianthium retrorse barbellatum). Type: Mpumalanga Province, Pilgrim's Rest Dsictrict, Graskop (2430DD), 17 Nov. 1993, Browning 647 (NU! holo.; GENT!, PRE!, iso.).

Tufted perennial with surculose base; cataphylls dark brown with pale nerves, 6–10 mm long. *Culms* 340–750 × 1.6–3.0 mm, coarse, terete at base but becoming triangular towards inflorescence, scabrid along angles. *Leaves*: sheath pale, membranaceous, up to 40–90 mm long, rim ciliate; blade 200–550 × 1.0–1.5 mm, stiff and wiry, sabrid on the margins. *Inflorescence* pseudolateral, congested into one or rarely two heads of 7–18 mm wide; bracts 2–4, main bract erect, 80–125 × 0.6–1.5 mm, other bracts spreading. *Spikelets* 12–50, 3.0–5.0 × 1.6–3.0 mm, brown; glumes 2.6–3.2 mm long, elliptic, dark chestnut brown, with many pale nerves, midrib excurrent as a slightly scabrid mucro 0.2–0.5 mm long. *Perianth bristles* 6, sparsely and antrorsely scabrid. *Anthers* 1.5–2.3 mm long. *Nutlets* 1.3–1.7 × 0.8–0.9 mm, triangular, elliptic, pale brown, surface smooth (Fig. 6).

5.6.1. Additional specimens of *D. surculosa* examined

5.6.1.1. South Africa. Limpopo. — 2427 (Thambazimbi): Waterberg District; Bergkrans, Bergfontein 277 KQ Farm (−BC), 28 Nov. 1984, *Jacobsen 3504* (PRE).

Mpumalanga. — 2430 (Pilgrim's Rest): Pilgrim's Rest District, Morgenzon Natuurreservaat. (−DC), 18 Nov. 1979, *Kluge 2093*; Graskop (−DD), 17 Nov. 1993, *Browning 655* (NU); Fairyland (−DD), 15 Oct. 1991, *Crouch 465* (NU); Near stream on road to Gods Window (−DD), 21 Nov. 1993, *Browning 673* (GENT, NU); c. 3 km SE. of Graskop on Kowyn's Pass, on S. side of road (−DD), 17 Feb. 1992, *Reid 1773* (PRE).

2530 (Lydenburg): Belfast District, Dullstroom, Verlorenvalei Farm 95 JT (−AC), 29 Nov. 1980, *Drews 213* (PRE); Steenkampsberg Natuurreservaat; Verloren Vallei 95 JT. (−AC), 18 Dec. 1985, *Bloem 194* (PRE); Lydenburg District, Ceylon Forest Reserve; Hartebeesvlakte (−BA), 21 Jan. 1987, *Deall 2577* (PRE); Lisabon State Forest (−BA), 9 Jan. 1985, *Reid 829* (PRE); Mac Mac Natuurreservaat, Bo-Op Eskarpement (−BB), 25 Oct. 1979, *Kluge 1981* (PRE).

Gauteng. — 2627 (Potchefstroom): Witwatersrand District, Witpoortjie Kloof (−BB), 18 Nov. 1923, *Moss 8360* (PRE).

Free State. — 2827 (Senekal). Senekal District, Paul Roux (−BD), 12 Nov. 1946, *Acocks 13179* (PRE).

KwaZulu-Natal. — 2830 (Dundee): Qudeni, Mountain View, Manzimnyama River (−DB), 11 Mar. 1993, *Browning 532* (NU).

2929 (Underberg): Impendle District, Tillietudlem Farm (−DB), 0 Jan. 1949, *Huntley 467* (NU, PRE).

2930 (Pietermaritzburg): Pietermaritzburg District; Table Mt. (−DA), 11 Sep. 1948, *Killick 198* (NU, PRE).

3030 (Port Shepstone): Port Shepstone District, Umtamvuna Nature Reserve (−CC), 10 Jan. 2008, *Muasya & Stirton in Abbott 8841.14* (BOL).

5.6.1.2. Swaziland. 2631 (Mbabane): Mbabane District, Forbes Reef Road (−AA), 9 Dec. 1959, *Compton 29549* (PRE); Malalotsa Dam (−AA), 17 Mar. 1979, *Haines 7044* (PRE).

5.7. Distribution and ecology

Dracoscirpoides occurs in Lesotho, South Africa and Swaziland (Fig. 7). *D. falsa* is commonly found in mountain grassland and rocky slopes at altitudes of 1200–3200 m, in Lesotho and South Africa (Eastern Cape, KwaZulu-Natal and Free State). *D. ficinioides* overlaps in distribution, along mountain streams and other wet habitats at altitudes of 350–3000 m, in Lesotho, and South Africa (Eastern Cape, KwaZulu-Natal, and Free State). At several localities these two species were observed growing in close proximity but partitioned on wetness regime of the soil. *D. surculosa* is predominantly allopatric and occurs in wet habitats similar to *D. ficinioides*. All three species are wind-pollinated while the nutlets are shed with perianth still attached and may be dispersed by both wind and water.

5.8. Diagnostic characters

Dracoscirpoides species have the appearance of a *Ficinia*, having scapose culms with terete spikelets forming capitate heads, as noted by Clarke (1898). On one of the isolectotypes of *D. falsa* (*Flanagan 2010*, BOL), Clarke (1898, page 230) commented that 'this plant has the habit entirely of *Ficinia*, but it has 6 strong hypogynous setae. *Ficinia* is a part of *Isolepis*; no traces of setae are known in it. Everything that cannot be forced

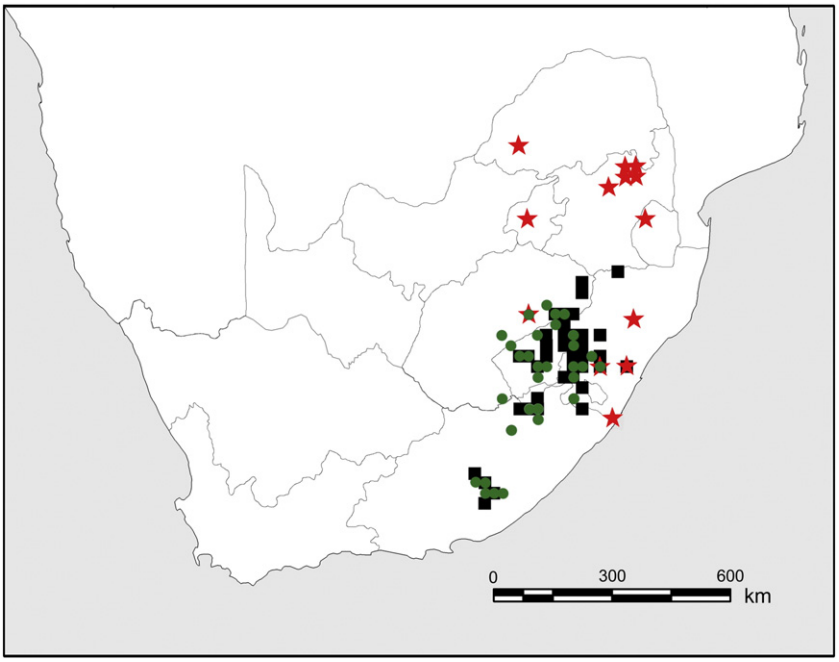

Fig. 7. Distribution of *D. falsa* (square), *D. ficinioides* (circle) and *D. surculosa* (star) in Southern Africa.

into *Ficinia*, *Fimbristylis*, *Bulbostylis* etc. has to be called *Scirpus*'. Later workers (e.g. Gordon Gray, 1994) retained these species in *Scirpus* pending studies to 'incontrovertibly determine' their position.

Within its distribution range, *Dracoscirpoides* grows with other taxa belonging to the *Ficinia* clade (*Ficinia*, *Isolepis* and *Scirpoides*). It is the only scapose member of tribe Cypereae with bisexual flowers bearing perianth bristles. The Drakensberg species, *Scirpoides burkei* (C.B. Clarke) Goetgh., Muasya & D.A. Simpson is diagnosed by its larger size (plants to 1 m tall) and anthelate inflorescences, while *Ficinia* species have a gynophore. Several co-occurring *Isolepis* (e.g. *I. costata* A. Rich. and *I. pellocolea* B.L. Burtt) have similar growth habit and height but differ in their highly reduced (less than 5 mm) leaf blades and pseudoviviparous (proliferating) inflorescences.

The three species of *Dracoscirpoides* differ in a number of characters. *D. falsa* is diagnosed by the tufted habit with no visible rhizome, and plants have a wiry appearance with culms and leaves indistinguishable. The inflorescence is capitate and the perianth bristles are densely antrorsely barbed. *D. ficinioides* is obviously stoloniferous, and plants have a distinct culm which is distinguishable from the leaves. The inflorescence is pseudolateral, and the perianth bristles are sparsely retrorsely barbed. *D. surculosa* specimens have the general morphology of *D. ficinioides* (culm distinct from leaves, pseudolateral inflorescence) but have a distinct surculose stem base (versus stolon) and perianth bristles with scattered antrorse barbs (verses retrorsely barbed in *D. ficinioides*).

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