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Ficinia gracilis complex (Cypereae, Cyperaceae) revisited– Species delineations and description of a new species from South Africa

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ABSTRACT

The name *Ficinia gracilis* has been misapplied to multiple taxa occurring from the Cape Peninsula through the Drakensberg into Afromontane habitats in eastern Africa. This broad circumscription encompasses at least five species (*F. filiformis*, *F.rigida*, *F.gracilis*, *F.cinnamomea* and an additional unnamed taxon). These taxa have been suggested (e.g. Gordon-Gray 2008) to be inseparable on gross morphology, and recent floras apply the broad concept of *F.gracilis*. This study re-examines species delineation, using ecology, gross morphology, and studies of nutlet morphology based on scanning electron microscopy, recognizing three groups of species, namely, *F.gracilis* (including *F.undosa;* sticky leaf sheaths, rugose nutlets, in grasslands), *F.cinnamomea* (together with the unnamed taxon; non sticky leaf sheaths, minutely papillose nutlets, in grasslands) and *F.filiformis*(together with *F.rigida;* sticky leaf sheaths, rugose nutlets, in fynbos). *Ficinia eligulata* Gordon-Gray ex Muasya is named and described, diagnosed by filiform culms and leaves, non sticky leaf sheaths and with leaves lacking a ligule, and minutely papillose nutlets.

1. Introduction

Gordon-Gray (2008) presented a taxonomic overview on the *Ficinia gracilis* complex. This complex consists five species, namely, *F.filiformis* (Lam.) Schrad., *F.rigida* Levyns, *F.gracilis* Schrad., *F.cinnamomea* C.B. Clarke and an additional unnamed taxon. *Ficinia gracilis* is widespread, occurring from the Cape Floristic Region into KwaZulu-Natal Drakensberg, but the name has also been misapplied for a taxon extending into Tanzania and Kenya(Clarke, 1897–98; Pfeiffer, 1921; Haines and Lye, 1983; Gordon-Gray 1995; Archer, 2003; Hoenselaar et al., 2010). Typical *F.gracilis* is characterized by a tufted habit with culm bases frequently bearing a short rhizome, flattened leaf blades, a capitate inflorescence, and a nutlet whose surface has transverse wrinkles (rugose) and bearing a distinct gynophore. *Ficinia filiformis*, occurring in the Cape Peninsula and surrounding areas, is similar to *F.gracilis* (nutlets rugose) but has filiform leaves and stems and its nutlets lack a gynophore. Levyns (1950) added another taxon to the complex by separating *F.rigida* from *F.filiformis* based on the presence of a gynophore on nutlets of plants with *F.filiformis* morphology.

Within the Afromontane grassland, *F.cinnamomea* was distinguished (Clarke 1894, 1897–98) by its compact inflorescence with fewer spikelets (5–10 vs 6–20 in *F.gracilis*). Gordon-Gray (1995) maintained *F.cinnamomea* as separate from *F.gracilis* based on its more projected glume tip, but noted that 'there were discrepancies inthe nutlets and gynophores that required further study in order tomake synonymy certain'. Observations on nutlet morphology (Gordon-Gray 1995) reveal differences in nutlet surface ornamentation and gynophore shape between *F.gracilis* and *F.cinnamomea*. In addition, an unnamed species occurring in the Afromontane grassland (*Ficinia* sp. A (Gordon-Gray 1995); later tentatively named *F.eligulata* ined.(Gordon-Gray 2008)) was included in the initial concept of *F.cinnamomea*(Clarke 1897–98).

This study evaluates species boundaries among the taxa in the *Ficinia gracilis* complex and whether *Ficinia* sp. A (sensu Gordon-Gray 1995) is distinguishable from *F.cinnamomea*.

2. Material and methods

Comparative morphological and ecological data were based on specimens in the herbaria (BOL, BR, EA, GENT, K, NBG, NU, PRE; acronyms following Thiers 2018) and supplemented with field observations. Measurements of gross morphology were made using a ruler and a digital caliper, and aided by a dissecting microscope. Effort was made to consult historical specimens, especially those cited by Clarke (1897–98) and Gordon-Gray (1995), vital in delimitation of entities as separate taxa.

Mature nutlets were observed under the dissection microscope for ornamentation. Mature nutlets, selected from at least three specimens

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representative of the morphological and geographical range of each taxon, were further studied using the scanning electron microscope (SEM). These were mounted on an aluminum stub using Leit-C adhesive and coated with gold with a SPI-ModuleTM Sputter Coater (SPI Supplies, West-Chester, PA, USA). Surface ornamentation images were obtained with a JEOLJSM-6360 (JEOL Ltd., Tokyo) at the Laboratory of Plant Systematics (K.U. Leuven).

3. Results and discussion

3.1. Species delineation

The morphology of the *F.gracilis* complex is summarized in Table 1. Two groups can be distinguished based on the leaf sheath morphology, whether sticky (*F.gracilis*, *F.filiformis* and *F.rigida*) or non sticky (*F. cinnamomea* and *F.eligulata*). Additionally, these two groupings differ in nutlet surface ornamentation (Fig. 1), a feature which can be seen using a hand lens, appearing rugose among the sticky sheathed taxa but smooth to minutely papillose (under higher magnification) for the taxa bearing non sticky leaf sheaths. Three distinct species are here recognized among the sticky sheathed taxa, namely, *F.gracilis* (including *F. undosa* B.L.Burtt), *F.filiformis* and *F.rigida*. *Ficinia gracilis* is predominantly an Afromontane grassland taxon described based on a material from the Uitenhage area in the Eastern Cape Province, whose leaf blades are open and broader (0.5–0.8 mm), and has glumes that are obtuse and lack a mucro. Both *F.filiformis* and *F.rigida* occur in the fynbos biome, have filiform leaves and glumes that are ovate and mucronate. The utility of presence (or absence) of the gynophore as a robust character to separate *F.rigida* from *F.filiformis* has been queried (e.g. Gordon-Gray 2008), considering that this character is polymorphic in *F.gracilis* (where *F.undosa* was recognized for the entity lacking gynophore; Burtt 1986). I opt to retain *F.rigida* as distinct pending a comprehensive study on the group, as there appear to be ecological differences (occurrence in fynbos versus renosterveld vegetation) among the taxa.

Ficinia cinnamomea can be further distinguished from *F.gracilis* based on: (i) number of spikelets (5–10 vs 6–20); (ii) glume shape (acute, keel excurrent versus glumes ovate, obtuse, or obtuse with a hardly excurrent mucro, or subacute); and (iii) nutlets surface ornamentation (smooth versus lineolate). Misapplication of the name *F.gracilis*, to include specimens here recognized under *F.cinnamomea*, dates back to Clarke (1897–98). Clarke's broad circumscription of *F.gracilis* encompassed specimens that fall within his *F.cinnamomea*, including material from tropical East Africa(Kilimanjaro). More recent authors (e.g. Haines and Lye 1983; Hoenselaar et al., 2010) have adopted this erroneous concept of *F.gracilis*, with exception of Gordon-Gray (1995) who distinguished the taxa and provide an identification key suitable to separate the species.

Furthermore, among specimens cited by Clarke (1897–98) under *F. cinnamomea*, *Buchanan 71* (K)is unique in being filiform and having leaf sheaths that lack a ligule. Similar specimens have been accumulated over the years, predominantly from the Drakensberg, and classified as a distinct taxon (*Ficinia* sp. A, Gordon-Gray 1995; *F.eligulata* ined, Gordon-Gray 2008). This taxon grows as a dense tuft in wet montane grassland, resprouting after fires and the filiform stems have a green-yellow color. Its leaf sheaths are non sticky and lack a ligule (Gordon-Gray 1995, Fig.30 A1, A2), and nutlets are smooth to minutely papillose. This taxon is named and described below.

3.2. Key to the species

1. Leaf sheaths sticky; inflorescence with >10 spikelets; nutlet rugose.....3
   Leaf sheaths not-sticky; inflorescence with <10 spikelets; nutlet smooth to papillose 2
2. Leaf sheath lacking a ligule, leaf blade 0.3–0.6 mm ..... *F. eligulata*
   Leaf sheath terminating in a ligule, leaf blade 0.7–1.2 mm ..... *F. cinnamomea*
3. Shortly rhizomatous to caespitose; leaf blade 0.5–0.8 mm; glume apex obtuse, not mucronate ..... *F. gracilis*
   Caespitose; leaf blade 0.3–0.4 mm; glume apex acute, mucronate *4*
4. Nutlet lacking gynophore ..... *F. filiformis*
   Nutlet bearing a distinct gynophore ..... *F. rigida*

3.3. Ficinia eligulata Gordon-Gray ex Muasya sp. nov. Type: South Africa: KwaZulu-Natal, 2929 (Underberg): Lions River District, Ross, Umgeni Poort Farm (BD), grassland, 1675 m, 21 December 1964, Moll 1445 (holotype: NU, barcode NU0038012; isotypes: NBG,K (2 sheets), PRE).

Perennial, tufted with no distinct rhizome. *Culm*170–590 mm tall, 0.4–1.1 mm thick, but c. 2.2 mm thick across the rim of the leaf sheath, glabrous. *Leaf sheath*30–55 mm long, glabrous, not papery, wine-red, non sticky. *Ligule* absent, sheath mouth sloping inward and downward to leaf attachment. *Leaf blade*120–260 mm long, 0.3–0.6 mm thick, margins scabrid, canaliculate to terete. *Involucral bract*2–3, primary culm-like, 20–85 × 0.3–0.6 mm, glabrous. *Inflorescence* occasionally pseudoviviparous, globose, 5.1–9.5 mm diameter, each with 4–9 spikelets. *Spikelets* 4.8–6.0 × 2.0–2.9 mm, terete, darkbrown. *Glumes* 3.0–3.6 mm long, acute with a mucro 0.2–0.5 mm long; margins entire. *Style* trifid. *Stamens* 3, anthers crested, 1.8–2.3 mm long. *Nutlets* 1.5–2.0 × 0.9–1.1 mm, dark brown with a whitish-gray overlay, smooth under low magnification to minutely papillose; hypogynous disk to 0.5 mm long, cupular, 3-lobed(Fig. 2).