

# Notes on *Carex* (Cyperaceae) from China (IX): three new species of section *Mitratae* s.l.

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## Abstract

*Carex* sect. *Mitratae* s.l. was established by Kükenthal in 1909 and can be distinguished from the closely related sections in having nutlets frequently discoid-annulate at the apex and a persistent style base. Based on field surveys and specimen examination, three new species of sect. *Mitratae* are described and illustrated here. *Carex fatsuaniana* was collected from Yunnan and differs from *C. truncatigluma* in having the utricles nearly glabrous, the nutlets with a ca. 0.5 mm long beak at the apex, the staminate spikes cylindrical, 5–7.5 cm long, 4–5 mm wide, and the pistillate glumes acuminate at the apex. *Carex damingshanica* was collected from Guangxi and differs from *C. breviscapa* and *C. rhynchachaenium* in having 3 or 4 spikes, the lateral spikes cylindrical, the pistillate glumes, utricles and nutlets all shorter than in the other two species. *Carex radicalispicula* was collected from Sichuan and differs from *C. truncatirostris* in having the staminate spikes clavate, 1.5–2 mm wide, the pistillate glumes pale yellow-white, 3–3.2 mm long, acuminate or short-awned at the apex, and the nutlets with 3 angles shallowly constricted at the middle.

## Keywords

*Carex* sect. *Mitratae*, China, new species, sect. *Lageniformes*

## Introduction

*Carex* L. (Cyperaceae), a morphological diverse genus with about 2,000 species, is one of the largest genera of angiosperms and is distributed on all continents except Antarctica (Reznicek 1990; Govaerts et al. 2021; Pender et al. 2021). The main

characters of this genus that distinguish it from the other genera in the Cyperaceae are flowers unisexual, the female ones contained within a prophyllar structure called a perigynium, which is referred to as a utricle when its margins are fused and closed (Dai et al. 2010; Jiménez-Mejías et al. 2016). Following an increasing number of samples and molecular markers, the systematic framework of *Carex* has become more robust, six strongly supported distinct main lineages were detected, viz. the *Siderostictae*, *Schoenoxiphium*, *Unispicate*, *Uncinia*, *Vignea* and core *Carex* clades (Villaverde et al. 2020; Roalson et al. 2021). A large number of new species of the core *Carex* clade were described during, or soon after, the preparation of the “Flora of China” (Dai et al. 2010; Lu and Jin 2022; Lu et al. 2022).

*Carex* sect. *Mitratae* Kük. s.l. (Kükenthal 1909), containing 80+ species, was traditionally divided into three sections: *Cryptostachyae* Franch., *Lageniformes* (Ohwi) Nelmes and *Mitratae* s.s. These are mainly distributed from E and SE Asia to Australia and New Zealand, with a few species reaching Europe, as well as into western and northern Asia (Akiyama 1955; Dai et al. 2010; Roalson et al. 2021). Recent phylogenetic studies revealed the sect. *Mitratae* s.l. is a polyphyletic group, and five clades which were named as Sect. *Cryptostachyae*, *Tristachya* Clade, *Truncatigluma* Clade, *Mitrata* Clade and *Conica* Clade in the core *Carex* clade are recognized (Roalson et al. 2021).

The group, sect. *Mitratae* s.l., is easily recognized on some morphological characters such as nutlet shape and utricle shape, as well as growth habits. During the field surveys and specimen examination of *Carex*, and during preparation of a taxonomic monograph of sect. *Mitratae* s.l., three new species were discovered, which are described below.

## Taxonomic treatment

### 1. *Carex fatsuaniiana* X.F.Jin, Y.F.Lu & Z.C.Lu, sp. nov.

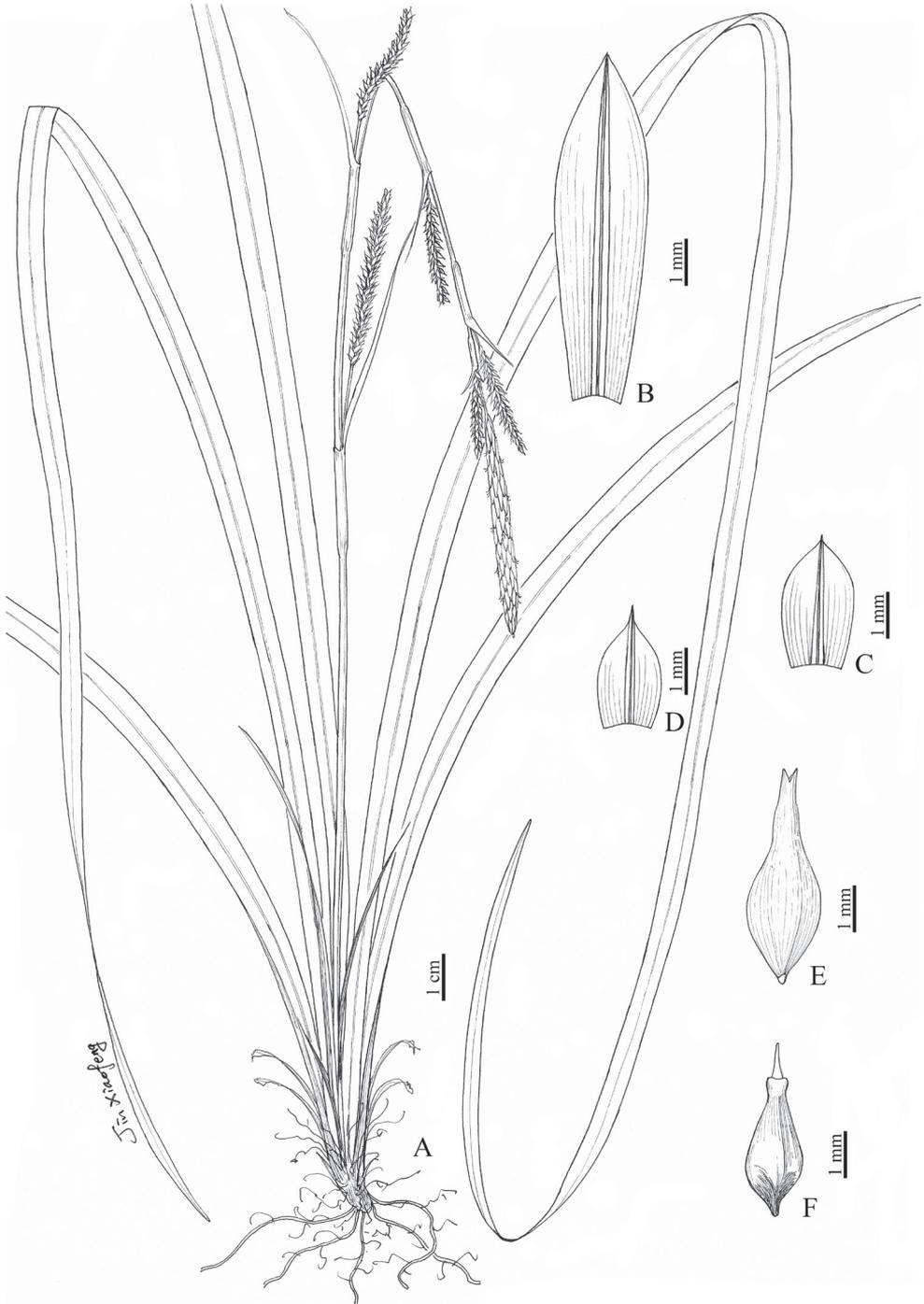
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Fig. 1A–G

**Diagnostic description.** This new species is similar to *Carex truncatigluma* C.B. Clarke, but differs in having utricles nearly glabrous, nutlets with a ca. 0.5 mm long beak at apex, staminate spikes cylindrical, 5–7.5 cm long, 4–5 mm wide, and pistillate glumes acuminate at apex.

**Type.** CHINA. Yunnan: Foo-ning [Funing County], Ban-loun [Banlun Township], under dense-thickets, alt. 700 m, 10 Apr 1940, C. W. Wang 88293 (holotype: PE!; isotypes: IBK00181423!, PE!).

**Description.** Perennial herbs. Rhizomes woody, obliquely ascending. Culms lateral, 45–60 cm tall, trigonous, smooth, base with short leaves and brown fibrous sheaths. Leaves longer than culms, blades flat, leathery, 4.5–9 mm wide, scabrous on upper surfaces and margins. Bracts leaf-like or shortly leaf-like, base with



**Figure 1.** *Carex fatsuaniana* sp. nov. **A** habit **B** staminate glume **C, D** pistillate glume **E** utricle **F** nutlet. (Drawn by Xiao-Feng Jin; based on the holotype: *C. W. Wang* 88293 in PE).

1–2.5 cm long sheath. Spikes 6; terminal spike staminate, cylindrical, 5–7.5 cm long, 4–5 mm wide, base with 8–20 mm long peduncles; lateral spikes pistillate, cylindrical, 2.5–4.5 cm long, 3–3.5 mm wide, densely flowered, with peduncles exerted from or enclosed in sheaths. Staminate glumes elliptic-lanceolate or oblanceolate, pale brown, 7–7.5 mm long, apex acuminate, with 3-veined yellow-brown costa. Pistillate glumes ovate-elliptic or obovate, pale yellow, 2.5–3 mm long, apex acuminate and mucronate, or acute, with 3-veined yellow-brown costa. Utricles yellow-green, narrowly ellipsoid-ovoid, obtusely trigonous, 4–4.5 mm long, longer than pistillate glumes, membranous, obliquely patent, distinctly thinly veined, nearly glabrous, base gradually cuneate, short-stipitate, apex gradually contracted into a ca. 1 mm long beak, orifice 2-lobed with short teeth. Nutlets tightly enveloped, brown, ovoid, trigonous, 2.5–3 mm long, with 3 sides slightly concave below, base short-stipitate, apex contracted into a ca. 0.5 mm long cylindrical beak; style base slightly thickened; stigmas 3.

**Etymology.** The specific epithet '*fatsuaniana*' is in honour of Prof. Fa-Tsuan Wang (Fa-Zuan Wang, 1899–1985), the taxonomic founder of Chinese monocots.

**Phenology.** Flowering and fruiting occur in early April.

**Conservation status.** Data Deficient (DD). Only four sheets (*C. W. Wang 88293*) of the new species were collected by Chi-Wu Wang in 1940 from the type locality. Adequate information is lacking on its distribution and population status to make a direct or indirect assessment of the risk of extinction (IUCN 2019).

**Notes.** *Carex fatsuaniana* has nutlets contracted distally into a ca. 0.5 mm long cylindrical beak at the apex, which morphologically belongs to sect. *Lageniformes* and is similar to *C. truncatigluma* (Dai et al. 2010). In sect. *Lageniformes*, the species has terminal staminate spikes thinly linear-clavate, whereas those of the new species are cylindrical, 5–7.5 cm long, 4–5 mm wide. The characters distinguishing the new species from *C. truncatigluma* are shown in Table 1.

Based on the phylogenetic scaffold for the *Carex* classification (Roalson et al. 2021), the sampled species in sect. *Lageniformes* were arranged in two clades: *Carex breviscapa* and *C. longicolla* in Tristachya clade, and *Carex truncatigluma* in Truncatigluma clade, but *C. densipilosa* was placed in the uncertain group. The new species, *Carex fatsuaniana*, is mostly closed to *C. truncatigluma* in morphology, so it's temporarily placed in the Truncatigluma clade.

**Table 1.** Morphological characters distinguishing *Carex fatsuaniana* from *C. truncatigluma*.

Characters	<i>C. fatsuaniana</i>	<i>C. truncatigluma</i>
1. Staminate spike	Cylindrical, 5–7.5 cm long, 4–5 mm wide	Thinly linear-clavate, 1–2 cm long, 1–2 mm wide
2. Staminate glume	Elliptic-lanceolate or oblanceolate, 7–7.5 mm long, acuminate at apex	Oblong-ovate or ovate, 3–3.5 mm long, obtuse at apex
3. Pistillate glume	Ovate-elliptic or obovate, acuminate and mucronate, or acute at apex	Broadly obovate, obtuse, truncate or emarginate at apex, sometimes short-awned or mucronate.
4. Utricle	Nearly glabrous	Pubescent
5. Nutlet	Beak ca. 0.5 mm long, cylindrical	Beak 0.5–1.5 mm long, thick-cylindrical

**2. *Carex damingshanica* Z.C.Lu & X.F.Jin, sp. nov.**

urn:lsid:ipni.org:names:77318324-1

Figs 2A–G, 3A–H

**Diagnostic description.** This new species is similar to *Carex breviscapa* C.B. Clarke and *C. rhynchachaenium* C.B. Clarke in having spikes in a short racemose and culms much shorter than leaves, but differs from these two relatives in having spikes 3 or 4, lateral spikes cylindrical, shorter, 4–11 mm long, pistillate glumes (1–1.2 mm long), utricles (2.5–3 mm long) and nutlets (1.5–1.9 mm long) all shorter than in related species.

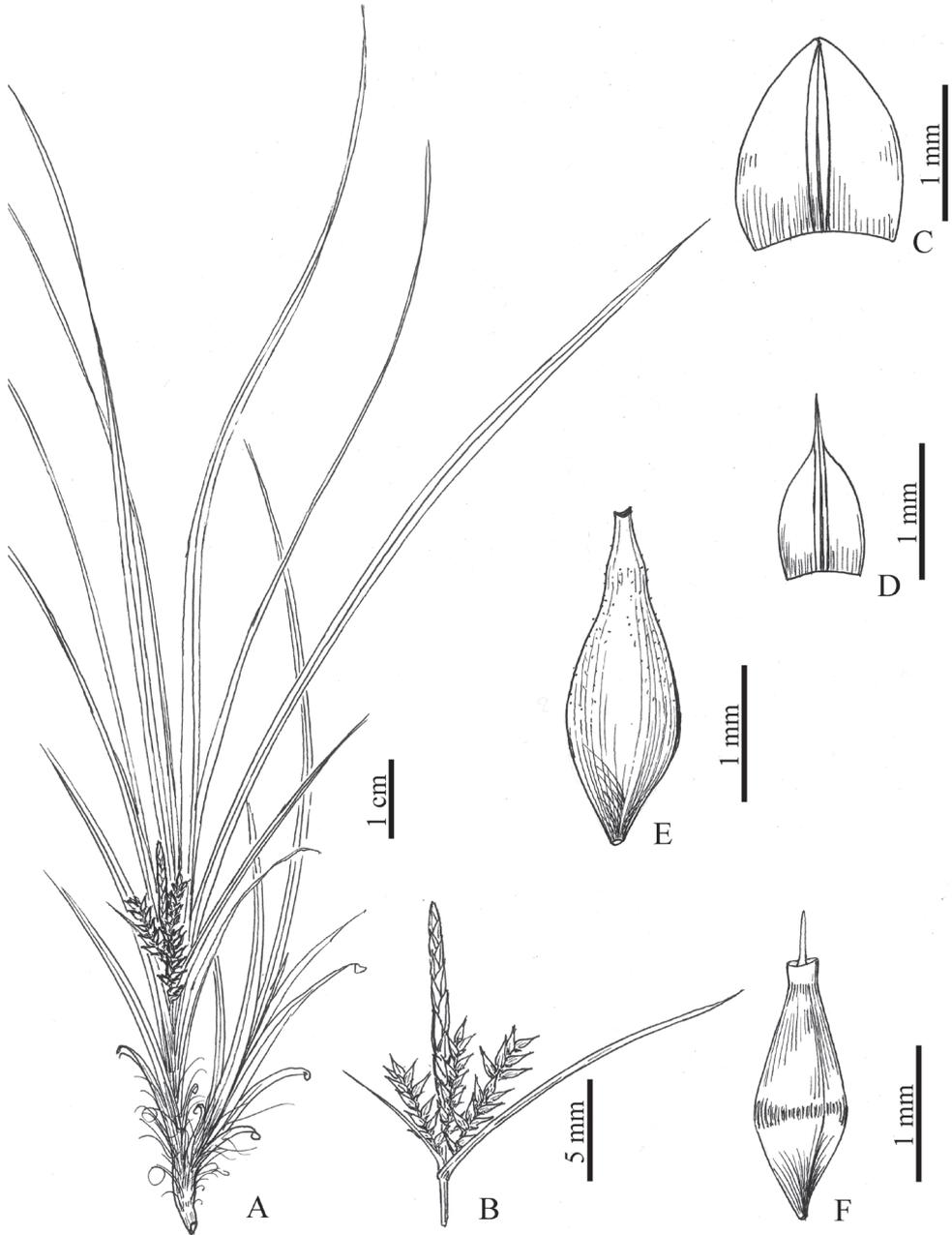
**Type.** CHINA. Guangxi: Nanning City, Shanglin County, Dafeng Town, Shuiyuan Village, Damingshan, 23°24'53.29"N, 108°31'45.16"E, under broad-leaved forest, alt. 423 m, 26 May 2020, *P. Yang et al.* 450125200526074LY (holotype: ZM!; isotypes: IBK00445399!, IBK00445400!, ZJFC!, ZM!).

**Description.** Perennial herbs. Rhizomes short, woody, stiff. Culms central, loosely turfed, 2.5–11 cm tall, trigonous, base with brown fibrous sheaths. Leaves much longer than culms, blades 1.5–3.5 mm wide, flat, leathery, scabrous on upper part and margins. Lowermost bract leaf-like, longer than inflorescence, base with 1–2 mm long sheath or sheathless, others setaceous, shorter than inflorescence, sheathless. Spikes 3 or 4, aggregated; terminal spike staminate, narrowly linear-cylindrical, 6–20 mm long, 1–1.5 mm wide, base with 1–3 mm long peduncles; lateral spikes pistillate, cylindrical, 4–13 mm long, 2.5–3 mm wide, loosely 9–14-flowered, with peduncles slightly exerted from sheaths. Staminate glumes broadly ovate, pale yellow-brown, ca. 1.5 mm long, apex obtuse, with 3-veined yellow costa. Pistillate glumes ovate, pale yellow, 1–1.2 mm long, apex acuminate, with 3-veined yellow costa. Utricles yellow-green, narrowly fusiform, obtusely trigonous, 2.5–3 mm long, longer than pistillate glumes, membranous, obliquely patent, distinctly thinly veined, sparsely pubescent, base gradually cuneate, short-stipitate, apex gradually contracted into a ca. 0.5 mm long beak, orifice 2-lobed with minute teeth. Nutlets tightly enveloped, brown, narrowly ovoid, trigonous, 1.5–1.9 mm long, with 3 sides slightly concave above and below, base with a ca. 0.2 mm long stipe, apex contracted into a 0.2–0.4 mm long cylindrical beak, truncate and shallowly concave at top; style base slightly thickened; stigmas 3.

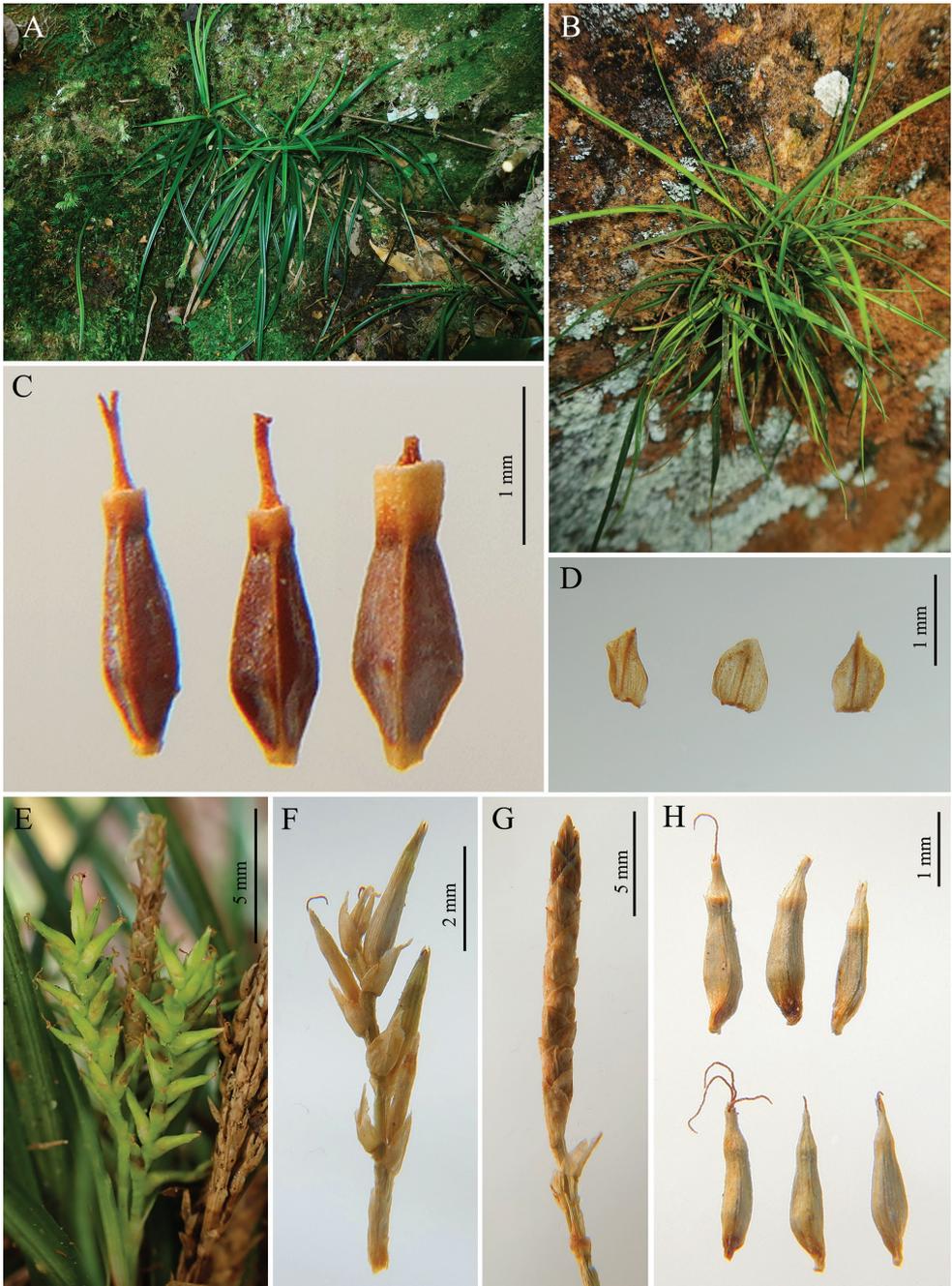
**Etymology.** The specific epithet '*damingshanica*' refers to the type locality of this new species.

**Phenology.** Flowering and fruiting occur from late March to late May.

**Additional specimens examined.** CHINA. Guangxi: Nanning City, Shanglin County, Xiyan Town, Jiangu Village, Damingshan, from Zuitun to Sanbao, 23°30'50.83"N, 108°28'22.42"E, under broad-leaved forest, alt. 473 m, 31 May 2020, *Y. L. Su et al.* 450125200531038LY (IBK00445401!, IBK00445402!, ZJFC!, ZM!); Nanning City, Shanglin County, Dalan River, Damingshan, alt. 460 m, 16 Oct 2011, *L. Wu & J. C. Yang* D3254 (IBK00218552!); Nanning City, Shanglin County, Liangjiang Town, Chaoyang River, Damingshan, alt. 1030 m, 23 May 2011, *L. Wu* D2120 (IBK00218553!).



**Figure 2.** *Carex damingshanica* sp. nov. **A** habit **B** upper part of inflorescence **C** staminate glume **D** pistillate glume **E** utricule **F** nutlet. (Drawn by Xiao-Feng Jin; based on the holotype: *P. Yang et al.* 450125200526074LY in ZM).



**Figure 3.** *Carex damingshanica* sp. nov. **A, B** habit **C** nutlets **D** pistillate glume **E** inflorescence **F** pistillate spike **G** staminate spike **H** utricle. (**C, D, F-H** from type material).

**Conservation status.** Least Concern (LC). The new species is known from four localities in Damingshan National Nature Reserve of Guangxi. These populations are in protected areas where they are not really threatened but need attention at ordinary times (IUCN 2019).

**Notes.** *Carex damingshanica* belongs to sect. *Lageniformes* in having terminal spikes staminate and nutlets apex contracted into a prominent long cylindrical beak (Dai et al. 2010). It is similar to *C. breviscapa* and *C. rhynchachaenium*, but differs from these two species in the characters of spikes, pistillate glumes, utricles and nutlets. The morphological differences of *C. damingshanica*, *C. breviscapa* and *C. rhynchachaenium* are shown in Table 2.

As above-mentioned, *Carex breviscapa* was placed in Tristachya clade, therefore its closed species, *C. damingshanica*, is temporarily placed in the Tristachya clade.

**Table 2.** Morphological characters distinguishing *Carex damingshanica* from *C. breviscapa* and *C. rhynchachaenium*.

Characters	<i>C. damingshanica</i>	<i>C. breviscapa</i>	<i>C. rhynchachaenium</i>
1. Spikes	3 or 4, aggregated	Many, 3–5 at each node	3–6
2. Lateral spikes	Pistillate, cylindrical, 4–13 mm long	Pistillate or mostly with male part at apex, narrowly cylindrical, 3–4.5 cm long	Pistillate, shortly cylindrical, 1–2 cm long
3. Pistillate glume	Ovate, 1–1.2 mm long, apex acuminate	Ovate-oblong, 2.5–3 mm long, apex rounded	Oblong-elliptic, apex truncate-rounded, occasionally mucronate
4. Utricle	Narrowly fusiform, obtusely trigonous, 2.5–3 mm long	Rhombic-fusiform, trigonous, 3.5–5 mm long	Lageniform with weak constriction at middle, 5–6.5 mm long
5. Nutlet	Narrowly ovoid, 1.5–1.9 mm long	Rhombic-ovoid, 2.5–3 mm long	Rhombic-ovoid, ca. 4 mm long

### 3. *Carex radicalispicula* Tang & F.T.Wang ex Y.F.Lu & X.F.Jin, sp. nov.

urn:lsid:ipni.org:names:77318325-1

Fig. 4A–G

**Diagnostic description.** This new species is similar to *Carex truncatirostris* S.W.Su et S.M.Xu, but differs in having staminate spikes clavate, 1.5–2 mm wide, pistillate glumes pale yellow-white, 3–3.2 mm long, acuminate or short-awned at apex, nutlets with 3 angles shallowly constricted at middle.

**Type.** CHINA. Sichuan: Kangding County, Erdaoqiao, on roadside, alt. 2650 m, 26 May 1940, *K. L. Chü* 6963 (holotype: PE!; isotypes: IBSC0654521!, PE!).

**Description.** Perennial herbs. Rhizomes short, woody. Culms central, loosely turfed, 8–30 cm tall, slender, trigonous, smooth, base with grey-brown sheaths. Leaves shorter than or rarely equal to culms, blades 1.5–2 mm wide, flat, leathery, scabrous on margins. Lowermost bract leaf-like, others setaceous, base with 4–6 mm long sheath. Spikes 3 or 4; terminal spike staminate, clavate, (5–)9–12 mm long, 1.5–2 mm wide; lateral spikes pistillate, with the lowermost arising from the base of

culms, shortly cylindrical or cylindrical, 7–15 mm long, 3.5–4 mm wide, 4–12-flowered, with the lowermost peduncle slightly exerted from the sheath. Staminate glumes elliptic-lanceolate, yellow-brown, 4.5–5.5 mm long, apex obtuse, with 1-veined yellow costa. Pistillate glumes broadly ovate, pale yellow-white, 3–3.2 mm long, apex acuminate or with a ca. 0.5 mm long scabrous awn, with 3-veined green costa. Utricles yellow-green, rhombic-ovoid, obtusely trigonous, ca. 3.8 mm long, ca. 1.3 mm wide, longer than pistillate glumes, membranous, obliquely patent, distinctly thinly veined, sparsely pubescent, base gradually cuneate, short-stipitate, apex gradually contracted into a 0.8–1 mm long beak, orifice 2-lobed with short teeth. Nutlets tightly enveloped, pale yellow, rhombic-ovoid, trigonous, ca. 2.5 mm long, with 3 angles shallowly constricted at middle, lateral sides slightly concave above and below, base shortly curved-stipitate, apex abruptly contracted into a discoid-annulate style-base; style base thickened; stigmas 3.

**Etymology.** The specific epithet '*radicalispicula*' refers to the lowermost spike arising from the base of culm.

**Phenology.** Flowering and fruiting occur in late May.

**Conservation status.** Least Concern (LC). The new species was collected by Kuei-Ling Chü (*K. L. Chü 6963*) from the type locality, including two sheets deposited in PE and one in IBSC. The authors carried out a field trip to the type locality in 2019, but failed to locate and collect any similar specimens. The type locality has been disturbed and the quality of the habitat appears to be continuously declining now (IUCN 2019).

**Notes.** With rhombic-ovoid nutlets abruptly contracted into a discoid-annulate style-base at the apex, 3 angles constricted at the middle, and the lowermost spike arising from a culm base, *Carex radicalispicula* is similar to *C. truncatirostris*. A taxonomic revision of *C. chungii* Z.P.Wang and the allied species has been conducted (Jin 2017), and these very closely related species can be distinguished from each another using the following key.

- 1a Lowermost spikes exerted from the basal sheaths of culms; lowermost bract sheaths < 6 mm long..... **2a**
- 2a Terminal staminate spikes 1.5–2 mm wide; nutlets shallowly constricted at middle angles; pistillate glumes pale yellow-white, 3–3.2 mm long, acuminate or short-awned at apex ..... *Carex radicalispicula*
- 2b Terminal staminate spikes 0.6–1 mm wide; nutlets constricted at middle angles; pistillate glumes pale brown or yellow-brown, 2–2.5 mm long, emarginate or obtuse at apex ..... *Carex truncatirostris*
- 1b Lowermost spikes exerted from the middle sheaths of culms; lowermost bract sheaths > 1 cm long..... **3a**
- 3a Terminal spikes 1–3 cm long; pistillate glumes long-awned at apex; staminate glumes short-awned or mucronate at apex ..... *Carex chungii*
- 3b Terminal spikes 3.5–6 cm long; pistillate glumes mucronate at apex; staminate glumes acute at apex..... *Carex nanpingensis*



**Figure 4.** *Carex radicalispicula* sp. nov. **A** habit **B** lowermost spike **C** staminate glume **D, E** pistillate glume **F** utricle **G** nutlet. (Drawn by Xiao-Feng Jin; based on the holotype: *K. L. Chü* 6963 in PE).

The new species is closed to *Carex truncatirostris*, and the species have nutlets apex abruptly contracted into a discoid-annulate style-base which were divided into two clades in the recent phylogenetic scaffold for the *Carex* classification (Roalson et al. 2021). The species in the Mitrata Clade have shorter lateral spikes and smaller plants, and the new species is temporarily placed in the Mitrata clade.

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