



Carex ledongensis (Cyperaceae), a new sedge from Hainan Isl. Of South China

HU-BIAO YANG^{1,2} & GUO-DAO LIU^{1,3*}

¹ Tropical Crops Genetic Resources Institute, Chinese Academy of Tropical Agricultural Sciences, Danzhou, Hainan 571737, China.

² yanghubiao@163.com; <https://orcid.org/0000-0002-7380-8874>

³ liuguodao2008@163.com; <https://orcid.org/0000-0003-4189-9959>

Abstract

A new species of *Carex* sect. *Mitratae*, *C. ledongensis*, is described and illustrated from Hainan, South China. The new species is similar to *C. pseudotristachya* but differs from the latter in its leaves much longer than culms, inflorescence with 3 spikes, terminal spike with 1.5 cm long peduncle, lateral spikes bisexual, perigynia fusiform, 6–8 mm long, and nutlets brownish black, 5–6 mm long.

Keywords: *Carex*, *Carex* sect. *Mitratae*, new species, taxonomy

Introduction

Carex Linnaeus (1753: 972), with about 2000 species, is one of the largest genera of vascular plants. It is distributed almost worldwide in various habitats (Ohwi 1936, Nelmes 1951, Ball & Reznicek 2003, Dai *et al.* 2000, Frodin 2004, Global *Carex* Group 2016). The recent revision of the genus from China revealed and recorded 527 species in fifty-seven sections (Dai *et al.* 2010). In recent decades, 28 new species and 2 subspecies have been reported: *Carex tianmushanica*, *C. pseudotristachya*, *C. densipilosa*, *C. austrozhejiangensis*, *C. chaofangii* (Jin *et al.* 2004); *C. arisanensis* subsp. *ruianensis* (Song *et al.* 2008); *C. yunyiana* (Jin 2009); *C. datongensis* (Su 2009a); *C. incisa* subsp. *longissima* (Su 2009a); *C. kuniuensis* (Su 2009a); *C. langyaensis* (Su 2009a); *C. kobresiiiformis* (Su 2009b); *C. qingliangensis* (Weng *et al.* 2009); *C. yandangshanica* (Jin *et al.* 2010); *C. dapanshanica* (Zhao *et al.* 2011); *C. zhejiangensis* (Jin *et al.* 2011); *C. tenuirostrata* (Jin *et al.* 2012a); *C. paracheniana* (Jin *et al.* 2012b); *C. longipetiolata* (Wang *et al.* 2012); *C. trongii* (Yu *et al.* 2012); *C. longicolla* (Deng 2014); *C. diaoluoshanica* (Yang *et al.* 2014); *C. huangshanica* (Chen & Jin 2015); *C. procumbens* (Yang *et al.* 2015a), *C. jianfengensis* (Yang *et al.* 2015b); *C. concava* (Yang *et al.* 2016); *C. chungii* (Jin 2017), *C. xueyingiana* (Yang 2017); *C. honglinii*, *C. subglabra* (Lu & Jin 2018).

Carex sect. *Mitratae* (Kükenthal 1909) is easily distinguished from other sections by its achenes, trigonous in cross-section, ovoid, rhombic-ovoid or obovoid in outline, and usually with an annulate-discoid appendix at apex (Kükenthal 1909, Dai & al. 2010). It contains 29 species in China and ca. 60 species in Japan (Dai *et al.* 2010; Hoshino & Masaki 2011; Zhao *et al.* 2011; Jin 2017). Recent studies show that it is not a natural group and that some of its species may be better classified in other sections (Jiménez-Mejías *et al.* 2016).

Hainan Island is located at the southern part of China, at the northern edge of tropical Asia. During botanical explorations in Hainan Island, seven new *Carex* taxa have been discovered and described (Yang *et al.* 2014, 2015a, 2015b, 2016; Wang 2012; Deng 2014; Yang *et al.* 2017). Recently, during an investigation of the flora of Jianfeng Ling Nature Reserve, Ledong Xian in 2019, a novel species of *Carex* was collected. Here we describe it as a new species from sect. *Mitratae* (Fig.1). Morphologically, the new species has affinities with *C. pseudotristachya* X. F. Jin & C. Z. Zheng (Jin *et al.* 2004).

Results and taxonomic treatment

Carex ledongensis H.B. Yang & G.D. Liu *sp. nov.* (Figures 2–3).

Diagnosis:—The new species resembles superficially *C. pseudotristachya*, but differs from it by its leaves 4–5 times longer than culms (vs. equaling or slightly exceeding culms), spikes 3 (vs. 2–4), terminal spike with 1.5 cm long peduncle (vs. sessile), lateral spikes

androgynous (vs. pistillate), perigynia fusiform (vs. ovate-fusiform), 6–8 mm long (vs. 4.5–5 mm long), and sessile (vs. stipitate), and nutlets brownish black (vs. yellowish), 5–6 mm long (vs. ca. 3 mm long) (Fig. 2–3). See also Table 1 for more details in the comparison and additional characters.

Type:—CHINA. Hainan: Ledong County, Jianfeng Ling Nature Reserve, 1357 m, N 108°52'23", E 18°43'1", 25 April 2019, *Yang Hubiao* 201904254614 (holotype, IBSC; isotypes, ATCH).

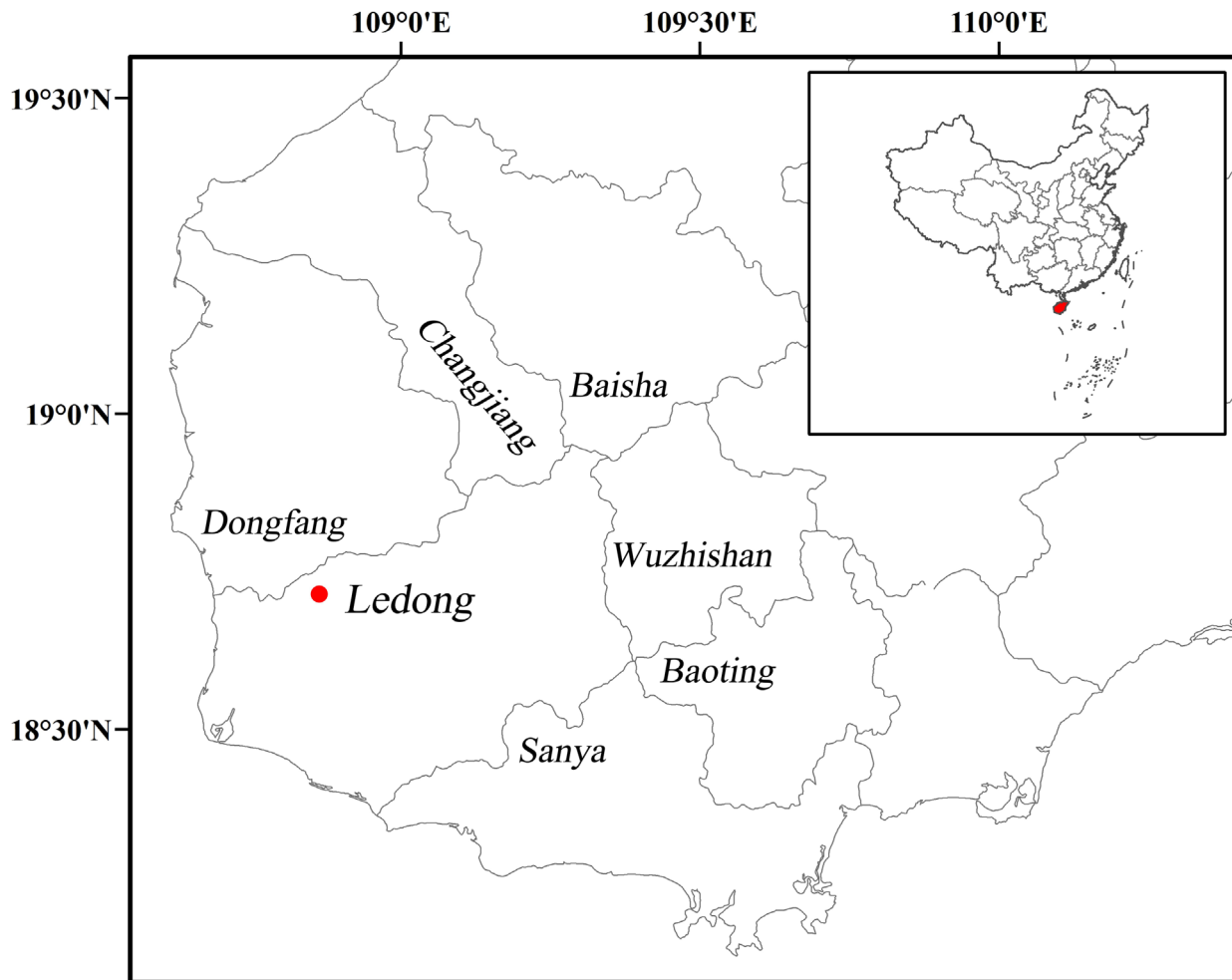


FIGURE 1. Distribution of *Carex ledongensis* in Hainan, China.

Rhizome short. Culms 10–20(–25) cm tall, trigonous, smooth. Basal sheaths dark brown, splitting into fibers. Leaves basal, much longer than culms; blades green, 50–100 long, 0.5–1 cm wide, glabrous on both surfaces, margins scabrid. Bracts sheathing, lowermost one leaf-like, to 30 cm long or more, longer than the inflorescence, upper 1 or 2 shortly leaf-like or bristle-like; sheaths ca. 5 mm long. Inflorescence racemose, with 3 spikes, upper 2 contiguous, lowermost 1 distant; terminal spike staminate, linear-cylindric, ca. 3 cm long, ca. 1 mm wide, base with 1.5 cm long peduncle; lateral spikes androgynous, 1–1.5 cm long, the upper part with ca. 5 staminate flowers, lower part with ca. 5 pistillate flowers, upper peduncles short and enclosed in bract sheath, lowest one ca. 4 cm long, exserted. Staminate glumes green, ovate-lanceolate, glabrous, ca. 5 mm, membranous, margin connate from base to middle, with a green 1-veined costa excurrent into a 1 mm long awn; pistillate glumes green, sparsely pubescent, ovate, ca. 4 mm, membranous, with 1 green midrib, margins hyaline, and apex obtuse. Perigynia green, deciduous after ripening, longer than pistillate glumes, erect, fusiform, trigonous, 6–8 mm, membranous, puberulent, many veined, base attenuate and sessile, apex attenuate into a beak, orifice minutely 2-toothed. Nutlets tightly enveloped, ovate, trigonous, 5–6 mm long, brownish black, base shortly stipitate, apex discoid-annulate; style base conically thickened. Stigmas 3.

Distribution and Habitat:—*Carex ledongensis* was collected in the Jianfengling Nature Reserve on Hainan Island. It grows under the tropical monsoon rainforest, at altitudes of 1357 m. Associates include *Pentaphragma eurypoides* Gardn. et Champ., *Ternstroemia gymnanthera* (Wight et Arn.) Beddome, *Photinia glabra* (Thunb.) Maxim., *Polyspora axillaris* (Roxburgh ex Ker Gawler) Sweet, *Rhodomyrtus tomentosa* (Ait.) Hassk., *Manglietia hainanensis* Dandy, *Oligostachyum nuspiculum* (McClure) Wang et Ye.

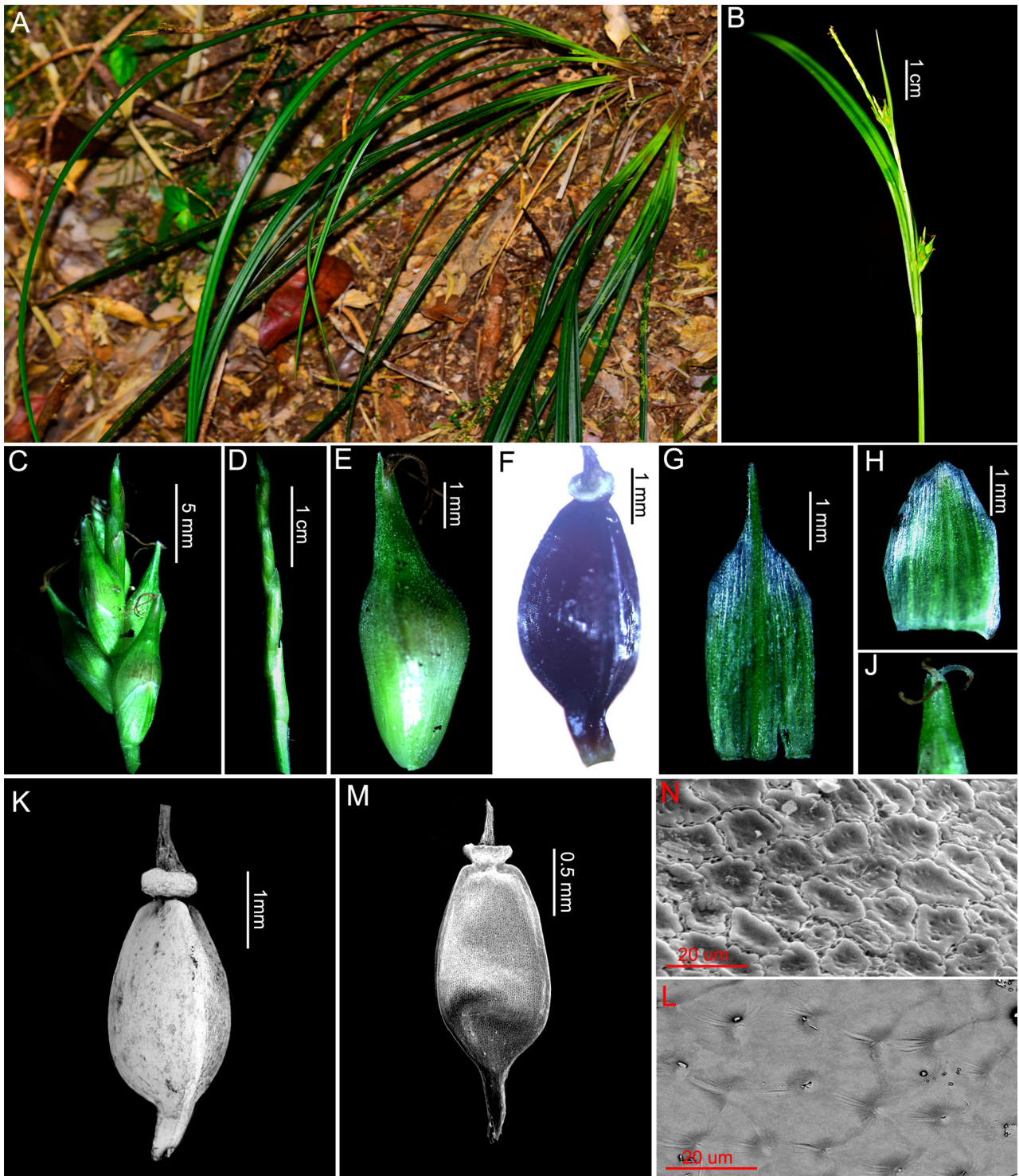


FIGURE 2. *Carex ledongensis*, A. Habit, B. Inflorescence, C. Lateral bisexual spike, D. Terminal staminate spike, E. Perigynia, F. Nutlet, G. Staminate glume, H. Pistillate glume, J. Stigma, K. Nutlet(SEM), L. Surface sculpturing of Nutlet(SEM); *C. pseudotristachya*, M. Nutlet(SEM), N. Surface sculpturing of Nutlet(SEM).

Phenology:—Flowers have been observed from March. The plant bears ripe fruits in May.

Etymology:—The epithet “*ledongensis*” refers to from the type locality, Ledong county in Hainan island. Accordingly the plant is called “乐东薹草” in Chinese.

Conservation status:—The population of *Carex ledongensis* covers an area of about 30 000 m². But the individual density of population is not high, with about 25 caespitose individuals per 100 m². This population needs to be monitored for its conservation.

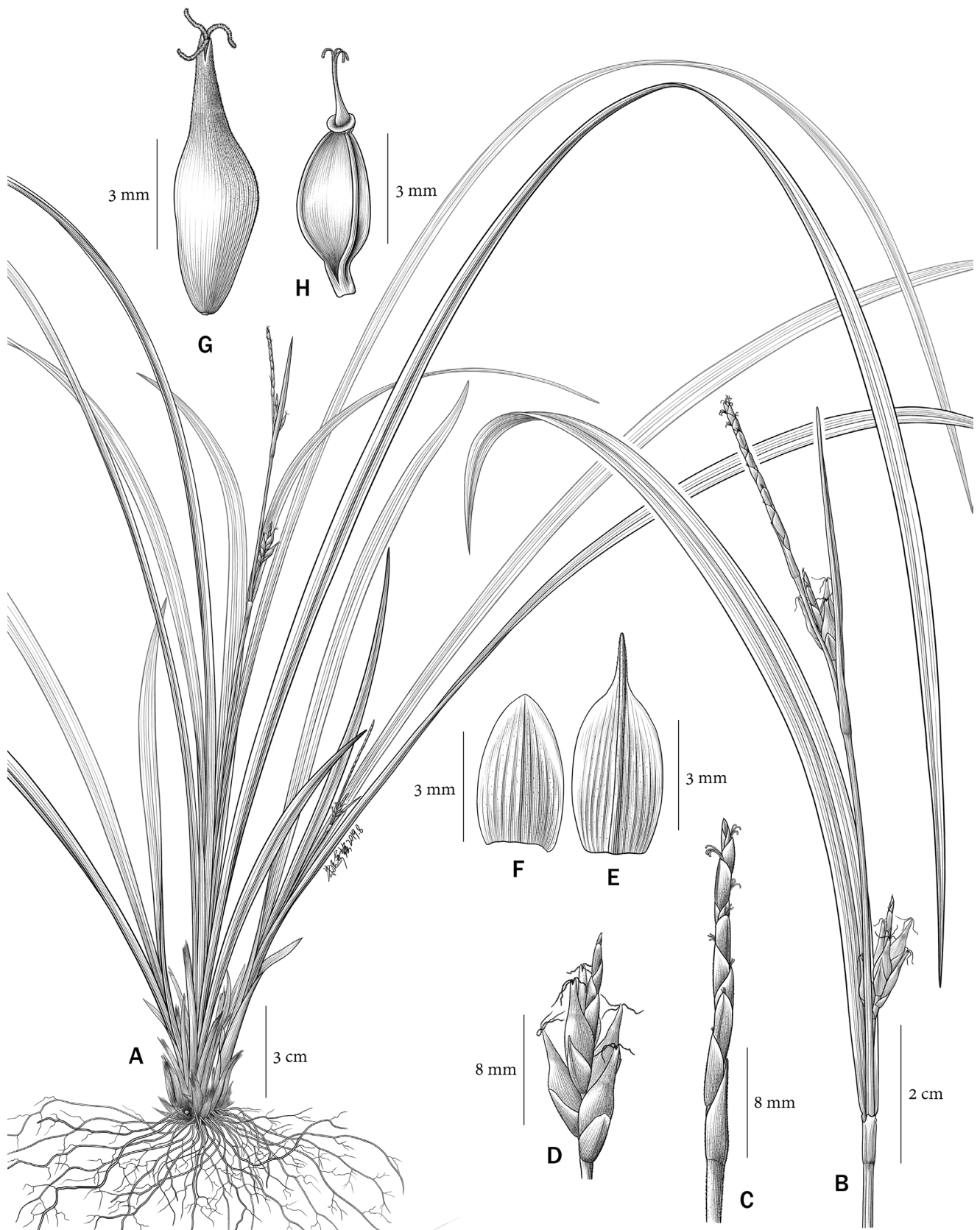


FIGURE 3. *Carex ledongensis*, **A.** Habit, **B.** Inflorescence, **C.** Terminal staminate spike, **D.** Lateral bisexual spike, **E.** Staminate glume, **F.** Pistillate glume, **G.** Perigynia, **H.** Nutlet. Drawn by Yu-xi Zhu.

TABLE 1. Morphological comparison between *Carex ledongensis* and *Carex pseudotristachya*.

Character	<i>C. ledongensis</i>	<i>C. pseudotristachya</i>
Clums	10–20(–25) cm.	15–20 cm.
Leaves	4–5 times longer than culms; blades 50–100 cm long, 0.5–1 cm wide.	Equaling or slightly exceeding culms; blades 3–5 mm wide.
Bracts	Longer than subtending spikes; sheaths ca. 5 mm long, sparsely hispid.	Shorter or longer than subtending spikes; sheath 5–10 mm, glabrous.
Inflorescence	Spikes 3, upper two contiguous, lower one distant.	Spikes 2–4, upper one separated.
Spikes	Terminal spike staminate ca. 3 cm × 1 mm, with 1.5 cm long peduncle; lateral spikes androgynous, 1–2 cm long.	Terminal spike staminate 1–2.5 cm × ca. 1 mm, subsessile; lateral spikes pistillate, 1–2.5 cm × ca. 3 mm, sparsely flowered.
Glumes	Pistillate glumes green, sparsely pubescent, ovate, ca. 4 mm, apex obtuse.	Pistillate glumes pale brown, glabrous, broadly ovate, ca. 1.5 mm, apex acute.
Perigynia	Fusiform, 6–8 mm long, puberulent, base attenuate and sessile.	Ovate-fusiform, 4.5–5 mm long, puberulent, base attenuate and stipitate.
Nutlets	Brownish black, 5–6 mm long; epidermal cells irregular, with margins somewhat lobed.	Yellowish, ca. 3 mm, apex; epidermal cells irregularly 4-5-gonal.

Key to the species of *Carex* sect. *Mitratae* species occurring in Hainan.

- 1a. Nutlets contracted on angles..... *C. tungfangensis*
 1b. Nutlets not contracted on angles.....2
 2a. Lateral spikes androgynous; nutlets 5–6 mm long..... *C. ledongensis*
 2b. Lateral spikes unisexual; nutlets size less than 3 mm long.....3
 3a. Terminal spike oblong; perigynia nearly equaling glume, obovate; nutlets ca. 1.8 mm long..... *C. breviculmis*
 3b. Terminal spike linear-cylindric; perigynia longer than glume, ovate-fusiform; nutlets 2–2.5 mm long..... *C. tristachya*

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References

- Ball, P.W. & Reznicek, A.A. (2003) *Carex*. In: Ball, P.W., Reznicek, A.A. & Murray, D.F. (Eds.) *Flora of North America: North of Mexico* (vol 23). Oxford University Press, pp. 254–640.
 Blaser, H.W. (1944) Studies in the morphology of the Cyperaceae. I. Morphology of flowers. II. The prophyll. *American Journal of Botany* 31: 53–64.
<https://doi.org/10.1002/j.1537-2197.1944.tb08001.x>
 Dai, L.K., Liang, S.Y., Li, P.C. & Tang, Y.C. (2000) *Carex* (Cyperaceae-Carioideae). In: Dai, L.K. & Liang, S.Y. (Eds.) *Flora Reipublicae Popularis Sinicae* 12. Science Press, Beijing. pp. 56–528.

- Dai, L.K., Liang, S.Y., Zhang, S.R., Tang, Y.C., Koyama, T. & Tucker, G.C. (2010) *Carex* Linnaeus. In: Wu, Z.Y., Raven, P.H. & Hong, D.Y. (Eds.) *Flora of China* 23. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis. pp. 285–461.
- Deng, Y.F. (2014) *Carex longicolla* (Cyperaceae), a new sedge from China. *Phytotaxa* 178 (3): 181–188.
<https://doi.org/10.11646/phytotaxa.178.3.3>
- Frodin, D.G. (2004) History and concepts of big plant genera. *Taxon* 3: 753–776.
<https://doi.org/10.2307/4135449>
- Hoshino, T. & Masaki, T. (2011) *Illustration Sedges of Japan*. Tokyo, Heibosha Ltd., 523 pp.
- Jiménez-Mejías, P., Hahn, M., Lueders, K., Starr, J.R., Brown, B.H., Chouinard, B.N., Chung, K.-S., Escudero, M., Ford, B.A., Ford, K.A., Gebauer, S., Gehrke, B., Hoffman, M.H., Jin, X.-F., Jung, J., Kim, S., Luceño, M., Maguilla, E., Martín-Bravo, S., Míguez, M., Molina, A., Naczi, R.F.C., Pender, J.E., Reznicek, A.A., Villaverde, T., Waterway, M.J., Wilson, K.L., Yang, J.-C., Zhang, S., Hipp, A.L. & Roalson, E.H. (2016) Megaphylogenetic Specimen-Level Approaches to the *Carex* (Cyperaceae) Phylogeny Using ITS, ETS, and matK Sequences: Implications for Classification. *Systematic Botany* 41 (3): 500–518.
<https://doi.org/10.1600/036364416X692497>
- Jin, X.F., Zheng, C.Z. & Ding, B.Y. (2004) New taxa of *Carex* (Cyperaceae) from Zhejiang, China. *Acta Phytotaxonomica Sinica* 42: 541–550.
- Jin, X.F. (2009) *Carex yunyiana* sp. nov. (Cyperaceae) from zhejiang, China. *Nordic Journal of Botany* 27 (4): 344–347.
<https://doi.org/10.1111/j.1756-1051.2009.00452.x>
- Jin, X.F. & Zheng, C.Z. (2010) *Carex yandangshanica* sp. nov. (Cyperaceae; C. sect. *Rhomboidales*) from Zhejiang, China. *Nordic Journal of Botany* 28: 709–712.
<https://doi.org/10.1111/j.1756-1051.2010.00817.x>
- Jin, X.F., Zhao, Y.J., Zheng, C.Z. & Zhang, H.W. (2011) *Carex zhejiangensis* sp. nov. (Cyperaceae) from Zhejiang, eastern China. *Nordic Journal of Botany* 29: 63–70.
<https://doi.org/10.1111/j.1756-1051.2010.00977.x>
- Jin, S.H., Zhao, Y.J., Shen, T.T., Wu, D.F. & Jin, X.F. (2012a) *Carex tenuirostrata* (Cyperaceae), a new species of section *Confertiflorae* from Zhejiang, China. *Brittonia* 64: 325–329.
<https://doi.org/10.1007/s12228-012-9236-2>
- Jin, X.F., Simpson, D.A., Zheng, C.Z., Sun, L. & Zhang, H.W. (2012b) *Carex paracheniana* (*Carex* sect. *Rhomboidales*, Cyperaceae), a new species from Guangxi and Guizhou, China. *Systematic Botany* 37: 929–937.
<https://doi.org/10.1600/036364412X656617>
- Jin, X.F. & Zheng, C.Z. (2013) Taxonomy of *Carex* sect. *Rhomboidales* (Cyperaceae). Science Press, Beijing. 237 pp.
- Jin, X.F. & Chen, W.J. (2015) *Carex huangshanica* (sect. *Rhomboidales*, Cyperaceae), a new species from anhui, eastern China. *Phytotaxa* 233 (3): 281–287.
<https://doi.org/10.11646/phytotaxa.233.3.5>
- Jin, X.F. (2017) Taxonomic revision of *Carex chungii* (Cyperaceae; sect. *Mitratiae*) and allied species. *Phytotaxa* 317 (1): 029–041.
<https://doi.org/10.11646/phytotaxa.317.1.3>
- Koyama, T. (1962) Classification of the family Cyperaceae (2). *Journal of the Faculty of Science, University of Tokyo, Section III. Botany* 8: 149–278.
- Kükenthal, G. (1909) Cyperaceae Caricoideae. In: Engler, A. (Ed.) *Das Pflanzenreich IV*. 20. Engelmann, Leipzig. 824 pp.
- Liu, G.D. & Bai, C.J. (2010) *Cyperaceae of Hainan*. Science Press, Beijing. 426 pp.
- Lu, Y.F. & Jin, X.F. (2018) Notes on *Carex* (Cyperaceae) from China (V): new species, combination and subspecies from Zhejiang. *Phytotaxa* 372 (3): 203–211.
<https://doi.org/10.11646/phytotaxa.372.3.3>
- Nelmes, E. (1951) The genus *Carex* in Malaysia. *Reinwardtia* 1: 221–450.
- Oda, J., Tanaka, A., Naiki, A. & Nagamasu, H. (2003) *Carex jubozanensis* (Cyperaceae), a new species from Japan. *Acta Phytotaxonomica et Geobotanica* 54: 127–135.
- Ohwi, J. (1936) Cyperaceae Japonicae I. A synopsis of the Caricoideae of Japan, including the Kuriles, Saghalin, Korea and Formosa. *Memoirs of the College of Science, Kyoto Imperial University (ser.B)* 11: 229–530.
- Reznicek, A.A. (1990) Evolution in sedges (*Carex*, Cyperaceae). *Canadian Journal of Botany* 68: 1409–1432.
<https://doi.org/10.1139/b90-180>
- Shimizu, T. (2008) *Carex kagoshimensis*, a new species of *Carex* (sect. *Rhomboidales*) from Japan. *Acta Phytotaxonomica et Geobotanica* 59: 67–72.
- Song, C., Wang, H. & Jin, X.F. (2008) A new subspecies of *Carex arisanensis* (Cyperaceae) from zhejiang, China. *Annales Botanici Fennici* 45 (2): 156–158.
<https://doi.org/10.5735/085.045.0212>

- Su, S.W. (2009a) Additional notes on the genus *Carex* Linn. from Anhui, China. *Journal of Anhui Agricultural University* 36: 557–563.
- Su, S.W. (2009b) *Carex kobresiformis*, a particular species of *Carex* from China. *Journal of Anhui University* 33 (6): 83–86.
- Wang, Q.L., Yang, H.B., Deng, Y.F., Wang, Z.N. & Liu, G.D. (2012) *Carex longipetiolata* (Cyperaceae), a new sedge from Hainan, China. *Phytotaxa* 75: 65–69.
<https://doi.org/10.11646/phytotaxa.75.1.6>
- Weng, D.M., Zhang, H.W., Xu, S.F. & Jin, X.F. (2009) *Carex qingliangensis* sp. nov. (Cyperaceae) from zhejiang, eastern china. *Nordic Journal of Botany* 27 (1): 7–10.
<https://doi.org/10.1111/j.1756-1051.2009.00394.x>
- Yang, H.J., Xu, H., Deng, Y.F. & Li, Y.D. (2017) *Carex xueyingiana* (Cyperaceae), a new species from Hainan Island, China. *Phytotaxa* 308 (2): 239–248.
<https://doi.org/10.11646/phytotaxa.308.2.5>
- Yang, H.B., Wang, Q.L., Bai, C.J., Li, X.X. & Liu, G.D. (2014) *Carex diaoluoshanica* (*Carex* sect. *Lageniformes*, Cyperaceae), a New Species from Hainan, China. *PLoS ONE* 9 (6): e97658.
<https://doi.org/10.1371/journal.pone.0097658>
- Yang, H.B., Li, X.X., Chang, J.B., Wang, W.Q., Wang, Q.L., Yu, D.G., Dong, R.S. & Liu, G.D. (2015a) *Carex procumbens* (*Carex* sect. *Rhomboidales*, Cyperaceae), a new species from Hainan, China. *Phytotaxa* 201 (3): 207–213.
<https://doi.org/10.11646/phytotaxa.201.3.4>
- Yang, H.B., Li, X.X., Wang, W.Q., Bai, C.J. & Liu, G.D. (2015b) *Carex jianfengensis* (*Carex* sect. *Rhomboidales*, Cyperaceae), a new species from Hainan, China. *PLoS ONE* 10 (9): e0136373.
<https://doi.org/10.1371/journal.pone.0136373>
- Yang, H.B., Li, X.X., Bai, C.J., Wang, W.Q. & Liu, G.D. (2016) *Carex concava* (*Carex* sect. *Rhomboidales*, Cyperaceae), a new species from Hainan, China. *Phytotaxa* 283: 155–162.
<https://doi.org/10.11646/phytotaxa.283.2.4>
- Yu, L.Y., Huang, Y.F., Xu, W.B. & Deng, Y.F. (2012) *Carex trongii* K. K. Nguyen, a newly recorded species of Cyperaceae from China. *Journal of Tropical and Subtropical Botany* 20: 403–406.
- Zhao, Y.J., Shen, T.T., Zheng, Y., Chen, Z.L. & Jin, X.F. (2011) *Carex dapanshanica* sp. nov. (*C.* sect. *Mitratae*, Cyperaceae) from Zhejiang, China. *Nordic Journal of Botany* 29: 670–673.
<https://doi.org/10.1111/j.1756-1051.2011.01132.x>