



Carex procumbens (*Carex* sect. *Rhomboidales*, Cyperaceae), a new species from Hainan, China

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Abstract

Carex procumbens, a new species of *Carex* sect. *Rhomboidales* from Hainan, China, is described and illustrated. The new species is similar to *C. longipetiolata* but differs in culms soft and usually prostrate on the ground, having narrower leaves with the leaf base gradually narrowed, with 2–3 spikes, terminal spike 8–12 mm long, lateral spikes 5–15 mm long and loosely flowered, staminate glumes ovate with green middle vein and apex rounded, pistillate glumes ovate-lanceolate ca. 6 mm and middle vein excurrent into a short awn for ca. 2 mm, perigynia fusiform and glabrous, nutlet brown to dark brown and ovate-rhomboid, nutlet ca. 7 mm long and with a short curved beak.

Key words: *Carex*, *Carex* sect. *Rhomboidales*, new species, taxonomy

Introduction

The genus *Carex* L. was established by Carl Linnaeus in the first edition of *Species Plantarum* (1753: 972). It is one of the largest genera of vascular plants, comprising about 2 000 species distributed almost worldwide in distribution in variety of different habitats (Ohwi 1936, Nelmes 1951, Dai *et al.* 2000, Ball & Reznicek 2003). In China, *Carex* is represented by 536 species in three subgenera and 69 sections. Nine of these species have been named since the recent publication of the treatment for *Carex* in the Flora of China in 2010 (David 2004, Jin *et al.* 2004, Shimizu 2008, Jin & Zheng 2010, Jin *et al.* 2011, 2012a, 2012b, Yu *et al.* 2012, Wang *et al.* 2012).

The genus *Carex* is clearly distinguished from all other Cyperaceae genera by having consistently unisexual flowers and a perigynium, the latter a sac-like structure of prophyllar origin that surrounds the naked gynoeceum (Blaser 1944). The variations in the structure of the perigynium are used as the key features in *Carex*. This is largely due to the subtle differences in its shape, size, texture and nervation, which have been used as primary characters for the delimitation of many species in *Carex* (Nelmes 1951). *Carex* has been divided into subgenera in a number of ways based on stigma number, inflorescence structure and the distribution of staminate and pistillate flowers within the spikes. The most influential was Georg Kükenthal's (1909) classification which recognised four subgenera: *Carex* subg. *Vigneastra* (Tuck.) Kük. [= *Indocarex* (Baill.) Kük.], *C.* subg. *Carex*, *C.* subg. *Vigneae* (P. Beauv. ex Lestib. f.) Perterm., and *Psyllophora* (Degl.) Peterm. [= *Primocarex* Kük. in Engl.]. This classification continues to be widely followed by most authors (Koyama 1962, Reznicek 1990, Dai *et al.* 2000, Waterway & Starr 2007, Waterway *et al.* 2009).

Carex sect. *Rhomboidales* Kükenthal (1909: 662) belongs to *C.* subgen. *Carex* and is characterized by long-sheathing bracts with short blades, trigonous, rhombic to ovoid perigynia with columniform bidentate beaks at the apex, and obovoid or ovoid, trigonous nutlets that are constricted in the middle part and mitrate or hastate at the apex (Kükenthal 1909, Ohwi 1936). The section consists of 50 species (40 species, 6 subspecies and 4 species varieties) mainly distributed in eastern Asia, with 36 species, 3 subspecies and 2 varieties being native to China (Dai *et al.* 2000, 2010, Oda *et al.* 2003, Jin *et al.* 2004, Shimizu 2008, Su 2009a, 2009b, Jin & Zheng 2010, Wang *et al.* 2012, Jin *et al.*, 2012a, 2012b, Jin & Zheng 2013). Hainan is a large island (35,400 km²) located in the southern part of China where it

1b. Lateral spikes pistillate.

3a. Leaves 10–15 mm wide; culms erect; perigynia ovate-lanceolate, 7–8 mm long, sparsely pubescent; nutlets ca. 5.5 mm long, base not stipitate, apex with a long erect beak.....3. *C. longipetiolata*

3b. Leaves ca. 5 mm wide; culms prostrate on the ground; perigynia fusiform, 7–10 mm long, glabrous; nutlets ca. 7 mm long, base with shortly stipitate, apex with a short curved beak4. *C. procumbens*

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References

- 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.
<http://dx.doi.org/10.2307/2437667>
- 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.
- 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.
- Frodin, D G. (2004) History and concepts of big plant genera. *Taxon* 3: 753–776.
<http://dx.doi.org/10.2307/4135449>
- Deng, Y.F. (2007) *Carex*. In: Wu, T.L. (Ed.) *Flora of Guangdong* 8. Guangdong Provincial Publishing Group, Guangdong Science and Technology Press, Guangzhou, pp. 363–395.
- Jin, X.F. & Zheng, C.Z. (2013) Taxonomy of *Carex* sect. *Rhomboidales* (Cyperaceae) Science Press, Beijing, 237 pp.
- 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.
<http://dx.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.
<http://dx.doi.org/10.1600/036364412X656617>
- Jin, X.F., Zhao, Y.J., Zheng, C.Z. & Zhang, H.W. (2011) *Carex zhejiangensis* sp. nov. (Cyperaceae) from Zhejiang, eastern China. *Nordic Journal Botany* 29: 63–70.
<http://dx.doi.org/10.1111/j.1756-1051.2010.00977.x>
- Jin, X.F. & Zheng, C.Z. (2010) *Carex yandangshanica* sp. nov. (Cyperaceae; *C.* sect. *Rhomboidales*) from Zhejiang, China. *Nordic Journal Botany* 28: 709–712.
<http://dx.doi.org/10.1111/j.1756-1051.2010.00817.x>
- Jin, X.F., Zheng, C.Z. & Ding, B.Y. (2004) New taxa of *Carex* (Cyperaceae) from Zhejiang, China. *Acta Phytotaxonomica Sinica* 42: 541–550.
- 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*. Engelmann, Leipzig, 824 pp.
- Li, S., Sun, W., Li, F., Lin, P., Zheng, Y. & Nie, L. (2005) Study on the characteristics and the cause of sandy desertified land in the west of Hainan Island. *Acta Geographica Sinica* 61: 433–442.
- Liao, W.B., Jin, J.H., Wang, B. (2001) On island biogeography of Hainan Island's flora-Endemism and edge effect characteristics. *Advances in Plant Science* 4: 57–76.
- Liu, G.D. & Bai, C.J. (2012) *Cyperaceae of Hainan*. Science Press, Beijing, 426 pp.
- Nelmes, E. (1951) The genus *Carex* in Malaysia. *Reinwardtia* 1: 221–450.

- Oda, J., Tanaka, A., Naiki, A. & Nagamasu, H. (2003) *Carex juboanensis* (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) Botany* 11: 229–530.
- Reznicek, A.A. (1990) Evolution in sedges (*Carex*, Cyperaceae). *Canadian Journal of Botany* 68: 1409–1432.
<http://dx.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.
- Su, S.W. (2009a) *Carex kobresiformis*, a particular species of *Carex* from China. *Journal of Anhui University (Natural Science Edition)* 33(6): 83–86.
- Su, S.W. (2009b) Additional notes on the genus *Carex* Linn. from Anhui, China. *Journal of Anhui Agricultural University* 36: 557–563.
- 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.
<http://dx.doi.org/10.11646/phytotaxa.75.1.6>
- Waterway, M.J., Hoshino, T., Masaki, T. (2009) Phylogeny, Species Richness, and Ecological Specialization in Cyperaceae Tribe Cariceae. *The Botanical Review* 75: 138–159.
<http://dx.doi.org/10.1007/s12229-008-9024-6>
- Waterway, M.J. & Starr, J.R. (2007) Phylogenetic relationships in tribe Cariceae (Cyperaceae) based on nested analyses of four molecular data sets. *Aliso* 23: 165–192.
<http://dx.doi.org/10.1007/s12229-008-9024-6>
- 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.
- 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.
<http://dx.doi.org/10.1371/journal.pone.0097658>