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CAREX DRUKYULENSIS (CYPERACEAE), A 'NEW' SPECIES FROM THE HIMALAYAS (BHUTAN)

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On the basis of previously published molecular data, and morphological observations, *Carex nigra* subsp. *drukyulensis* from the eastern Himalayas (Bhutan) is raised to specific rank as *Carex drukyulensis*.

Keywords. Bhutan, *Carex* sect. *Phacocystis*, taxonomy.

Introduction

Carex nigra subsp. *drukyulensis* Noltie (Cyperaceae) was described on the basis of three herbarium sheets from Bhutan (Noltie, 1993; see imaged material at RBGE, continuously updated). Its morphological features pointed to *Carex* sect. *Phacocystis* Dumort., and the characters of its moderate size (stems up to 30 cm), reddish brown basal sheaths, narrow leaves (1.6–2.6 mm), possession of a male terminal spike, and conspicuously veined utricles suggested a close resemblance to *Carex nigra* (L.) Reichard (see Chater, 1980; Egorova, 1999; Ball & Reznicek, 2002; Luceño & Jiménez-Mejías, 2008). At the time, this morphological affinity justified its description as a subspecies of *Carex nigra*, despite a great disjunction with the other known populations of that species (Noltie, 1993; Jiménez-Mejías *et al.*, 2012).

However, the inclusion of a sample of one of the paratype specimens (*Grierson & Long* 119) in a recent molecular study (Global *Carex* Group, 2016) showed that this taxon was not closely related to *Carex nigra* but was recovered in a well-supported clade with two species from northern Asia: the mainly Siberian *Carex eleusinoides* Turcz. ex Kunth (also present in northern China and western North America) and the Korean *Carex humbertiana* Ohwi (Ohwi, 1933). This led us to compare *Carex nigra* subsp. *drukyulensis* with these and other similar taxa in order to ascertain if it merited raising to specific rank.

Materials and Methods

The type specimens of *Carex nigra* subsp. *drukyulensis* housed at E (Noltie, 1993) were studied. These plants were compared with the four taxa with which we considered it to have the closest morphological and phylogenetic affinities:

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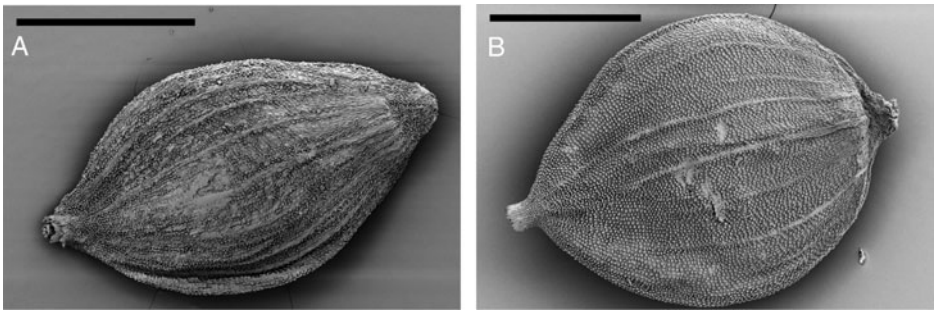

FIG. 1. Scanning electron microscope photographs of utricles of A, *Carex nigra* subsp. *drukyulensis* (from Holotype, *Grierson & Long* 1764); and B, *C. nigra* subsp. *nigra* (Scotland, Isle of Eigg; *P.H. Davis* 695 GB 1955). Scale bar, 1 mm.

- typical *Carex nigra* from the western Palaearctic
- *Carex eleusinoides* and *C. humbertiana*, the species found to be closely related to *C. nigra* subsp. *drukyulensis* in the Global *Carex* Group (2016) phylogeny
- *Carex minxianica* Y.C.Yang, a recently described endemic from southern Gansu, to which the Bhutanese specimens key out in the *Flora of China* (Dai *et al.*, 2010).

Representative material of *Carex eleusinoides* and *C. nigra* (housed at NY and E, respectively) was studied, as was the type material of *C. humbertiana* at NY. Additional variation reported in reference treatments for these taxa was also considered (Ohwi, 1933; Chater, 1980; Egorova, 1999; Ball & Reznicek, 2002; Luceño & Jiménez-Mejías, 2008; Dai *et al.*, 2010; Jiménez-Mejías *et al.*, 2015). Attempts to obtain a loan, or images, of the type material of *Carex minxianica* failed, so comparisons were limited to the descriptions provided in its protologue (Yang, 1984) and in the *Flora of China* (Dai *et al.*, 2010).

RESULTS AND DISCUSSION

Morphological limits between species of *Carex* sect. *Phacocystis* are small, which has led to the frequent treatment of certain species as subspecies, or varieties, of other taxa. Some recent molecular work has, however, revealed that such treatments, based solely on morphology, have been unfounded, resulting in the raising of some of these infraspecific taxa to specific rank (e.g. Dragon & Barrington, 2009; Jiménez-Mejías *et al.*, 2011).

As noted above, the striking similarity between *Carex nigra* subsp. *drukyulensis* and more typical forms of *C. nigra*, especially regarding utricle morphology, explain the initial description of the taxon as a subspecies of the latter. The utricles of *Carex nigra* subsp. *drukyulensis* are elliptical to elliptical-obovate (Fig. 1A), whereas in *C. nigra* they range from ovate (Fig. 1B) to elliptical-obovate (Chater, 1980; Egorova, 1999; Ball & Reznicek, 2002; Luceño & Jiménez-Mejías, 2008; Jiménez-Mejías *et al.*, 2015). Utricles of both species share papillose ornamentation and conspicuous nerves.

Among the subtle differences between the two taxa, the most prominent are the glumes, which equal the utricles in *Carex nigra* subsp. *drukyulensis*, whereas in *C. nigra* they are typically shorter (Chater, 1980; Egorova, 1999; Ball & Reznicek, 2002; Luceño & Jiménez-Mejías, 2008).

The two taxa found to be related to *Carex nigra* subsp. *drukyulensis*, *C. eleusinoides* and *C. humbertiana*, display clear-cut differential characters with it. The terminal spike of *Carex eleusinoides* is gynaecandrous rather than male-only (Egorova, 1999; Ball & Reznicek, 2002). *Carex humbertiana* is larger in overall size (stems 30–50 cm), with wider leaves (3–4 mm) and ovate utricles (Ohwi, 1933).

Apart from the taxa included in the Global *Carex* Group (2016) phylogeny, *Carex nigra* subsp. *drukyulensis* does not seem to be a good match for any other species described from Bhutan or neighbouring areas. From descriptions of *Carex minxianica* (Yang, 1984; Dai *et al.*, 2010), *C. nigra* subsp. *drukyulensis* can be distinguished by its shorter stems (23–33 cm versus 40–60 cm in *C. minxianica*), basal sheaths (reddish brown, not fibrillose versus dark purple, disintegrating into fibres), female glumes (with narrow hyaline margins versus without hyaline margins) and utricle nerves (conspicuously versus faintly nerved).

The differential characters between *Carex nigra* subsp. *drukyulensis* and the taxa cited above are summarised in Table 1.

Conclusion and Taxonomic Treatment

The combination of the previous molecular results (Global *Carex* Group, 2016) and our comparison with related taxa support the recognition of *Carex nigra* subsp. *drukyulensis* as a distinct species.

Carex drukyulensis (Noltie) Jim.Mejías & Noltie, **comb. et stat. nov.**

Carex nigra subsp. *drukyulensis* Noltie, Edinburgh J. Bot. 50: 189 (1993) [basionym] – Holotype: Bhutan, Bumthang district, Byakar, 2750 m, 9 vi 1979, *Grierson & Long* 1764 (E!; image at RBGE, continuously updated).

The following morphological and ecological summary is based largely on Noltie (1993). No new specimens of this species have become available since this publication, so the measurements and main characteristics remain essentially the same. Given the small number of populations on which our observations are based, greater morphological and ecological variation might be expected in nature.

Herb, rhizomatous, stems apparently tufted. Basal sheaths few, short, acute, reddish brown, not fibrillose. Flowering stems 23–33 cm, trigonous, scabrid on angles. Leaves basal, shorter than to equalling flowering stems, 1.6–2.6 mm wide, epistomatic. Bracts leaf-like, not sheathing, with inconspicuously or minute dark auricles at their insertion, lowermost one longer than its spike but shorter to almost equalling the entire inflorescence. Inflorescence racemose, with usually 4 spikes, lateral ones pistillate or shortly androgynous, the terminal one staminate, all erect. Staminate

TABLE 1. Comparison of the main differential characters between *Carex nigra* subsp. *drukyulensis* and the species considered in this study

Character	*Carex nigra* subsp. *drukyulensis*	*Carex eleusinoides*	*Carex humbertiana*	*Carex minxianica*	*Carex nigra*
Stem length (cm)	23–33	15–40	30–50	40–60	5–110
Basal sheaths	Reddish brown, not fibrillose	Reddish to purple-brown, disintegrating into fibres	Brown to reddish brown, not fibrillose	Dark purple, disintegrating into fibres	Brown to reddish brown, not fibrillose
Leaf width (mm)	1.6–2.6	2.5–4	3–4	c.2	2–10
Terminal spike	Male	Gynaecandrous	Male	Male	Male
Female glumes	Equalling the utricles, dark purple with narrow hyaline margins	Equalling the utricles, dark purple to black, with or without narrow hyaline margins or without margin	Equalling or longer than the utricles, dark purple, with narrow hyaline margins	Equalling or longer than the utricles, dark brown, without hyaline margins	Shorter than the utricles, dark purple to black, with or without narrow hyaline margins
Utricles	2–2.4 mm, elliptical to elliptical-obovate, minutely papillose, nerved on faces	2–3 mm, elliptical to elliptical-obovate, minutely papillose, nerveless or faintly nerved on faces	3 mm, ovate, minutely papillose, nerved on faces	2–2.5 mm, elliptic, faintly nerved (probably minutely papillose)	2–3.7 mm, ovate to elliptical-obovate, minutely papillose, nerved on faces, rarely faintly nerved

spike 2.2–4.2 cm × 3–4 mm, cylindrical to narrowly oblanceolate, on a peduncle 1–3.5 cm. Pistillate spikes 1–5.5 cm × 2.5–4 mm, narrowly cylindric to oblong, overlapping, sessile or on peduncles up to 1 cm, lowermost sometimes sub-basal and then on a long peduncle up to 12 cm. Staminate glumes c.3.5–4 × 0.9–1 mm, rounded at apex, purplish brown, with a light-coloured midrib and sometimes very narrowly hyaline margins towards the apex. Pistillate glumes 1.9–2.6 × 1–1.2 mm, narrowly oblong-lanceolate, apex rounded, dark purplish brown, midrib greenish, margins very narrowly hyaline. Stigmas 2. Utricles 2–2.4 × 1–1.2 mm, elliptic to elliptic-obovate, narrowly biconvex, greyish green, minutely papillose, with 5–9 nerves per face, ± attenuated at the apex into an inconspicuous c.0.1- to 0.2-mm beak, slightly contracted proximally into a stipitate base c.0.5 mm long. Achenes biconvex.

Paratypes (as indicated in Noltie, 1993). Bhutan, Bumthang district, Chunkar, 9500 ft, 12 vi 1949, *Ludlow, Sherriff & Hicks* 20100 (BM!); 6 km N of Thimphu Dzong, 2450 m, 9 vi 1975, *Grierson & Long* 119 (E!).

Ecology. Wet and moist meadows, between c.2450 and 2900 m.

Etymology. The specific epithet refers to the Bhutanese name of Bhutan, which is *Druk yul*.

Key to Bhutanese species of Carex *sect.* Phacocystis

The following artificial identification key is abstracted largely from Noltie's (1994) generic key to *Carex*. It allows the distinguishing of the Bhutanese species of *Carex* sect. *Phacocystis* from all the other members of the genus in this area.

1a. Stigmas 3 ——— Other species of *Carex*
1b. Stigmas 2 ——— 2

2a. Spikes all androgynous or gynaecandrous, all sessile or subsessile Other species of *Carex*
2b. Terminal spike usually male, lateral spikes female or androgynous, spikes sessile or conspicuously pedunculate ——— 3

3a. Female dark purplish brown or pale brownish, with midrib long-excurrent into a conspicuously scabrid awn, if glumes not awned and tip acute then the colour is pale brown ——— sect. *Praelongae*
3b. Female glumes blackish-purple to dark purplish-brown, rounded to acute, not awned, sometimes tipped by a minute non-scabrid mucro — 4. sect. *Phacocystis*

4a. Utricles widely elliptic to suborbicular, dark-coloured on at least its upper third when ripe, rounded at the apex and abruptly constricted into a 0.1- to 0.2-mm beak; mature pistillate spikes with utricles erect or patent ——— *C. orbicularis*

4b. Utricles narrowly elliptic, elliptic-obovate or lanceolate, not dark-coloured above or only at the beak, attenuated or constricted at the apex into a 0.1- to 1-mm beak, or utricles almost beakless; mature pistillate spikes with utricles erect ——— 5

5a. Utricles elliptic to elliptic-obovate, attenuated at the apex into a minute inconspicuous 0.1- to 0.2-mm beak; terminal staminate spike conspicuously overtopping the lateral ones, giving to the inflorescence an elongated appearance at the top ——— *C. drukyulensis*

5b. Utricles elliptic to lanceolate, attenuated or more or less contracted at the apex into a conspicuous cylindrical 0.3- to 1-mm beak; terminal staminate spike long overlapping with the lateral ones, giving to the inflorescence a corymbose appearance at the top ——— 6

6a. Utricles up to 2.1–2.9 mm long, abruptly contracted at the apex into a beak 0.3–0.6 mm long, conspicuously bifid at the apex; glumes dark purplish brown *C. notha*

6b. Utricles (3–)3.5–4.6 mm long, attenuated at the apex into a beak up to 1 mm long and truncate at the apex; glumes black ——— *C. fucata*

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