

An updated checklist of genus *Carex* Linnaeus (Cyperaceae) in the Indian Himalayan State of Jammu & Kashmir

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Abstract

The genus *Carex* Linnaeus (Cyperaceae) in the Indian Himalayan state of Jammu and Kashmir has been little investigated taxonomically. As a result of this, the overall species richness of *Carex* in this Himalayan region has been numerically variable and taxonomically confusing as regards the identification and nomenclature of several species of *Carex*. To fill this knowledge gap, the present study provides an updated checklist of *Carex* in this region. The paper records 40 species of *Carex* based on the field collections over the last one decade, and perusal of the herbarium specimens and taxonomic literature of last half a century. Each recorded species of *Carex* has been provided with its updated nomenclature, habit, diagnostic characters, local distribution, altitudinal range and flowering period in the state.

Key words: *Carex*, biodiversity, taxonomy, checklist, Kashmir Himalaya

INTRODUCTION

Carex Linnaeus, commonly known as carices, is the largest genus (*ca.* 2,000 species) of Cyperaceae and one of the largest genera amongst the angiosperms. The genus is cosmopolitan in distribution, with higher species richness in temperate regions of the Northern Hemisphere. It has 533 species in the North America (Mackenzie 1935), 200 species in Europe, 382 species in Russia (Ball 1990). Generally, the species richness decreases while moving from northern to southern latitudes, with 110 species in South America, while only 25 species are found in the Africa (Ball 1990).

In the Indian subcontinent, 168 species of *Carex* have been reported from the North-west and Central Himalayas, where as 78 species occur in the Eastern Himalaya; the species richness declines further towards the southern India where only 50 species have been recorded (Karthikiyan *et al* 1989). In Jammu and Kashmir state, located in the lap of Indian Himalayas, *Carex* constitutes one of the speciose and widely distributed genera, occurring from the sub-tropical Jammu, through the temperate Kashmir valley, to the cold-arid Ladakh region. From this state, over the last one century, a number of workers while carrying out general floristic studies have reported the occurrence of carices (Hooker 1894; Stewart 1972; Rao & Verma 1982; Dhar & Kachroo 1983; Kaul 1986; Singh & Kachroo 1994; Kukkonen 1998; Aswal & Mahrotra 1999; Murti 2001). However, the number of *Carex* species reported by these workers in the region varies considerably (i.e. ranges from 15 – 35 species). Hooker (1894) reported 23 species of *Carex* from this region; Stewart (1972) recorded 50 species from the region, including the areas presently under the control of Pakistan and China. Kukkonen (1998) monographed Cyperaceae of Pakistan and Kashmir in the '*Flora of Pakistan*', and reported 26 species of *Carex*. Given this confusing situation, the present paper provides a checklist of *Carex* in this Himalayan state with an updated nomenclature along with basionym and/or synonyms, local distribution in the three provinces (i.e. Jammu, Kashmir and Ladakh), altitudinal range, and flowering phenology of each *Carex* species. Three species have been reported for the first time from the study area,

Carex brownii (Haq *et al* 2011) and *Carex leporina* (Haq *et al* 2012) are reported new to India where as *Carex hokarsarensis* new to science (Haq *et al* 2010).

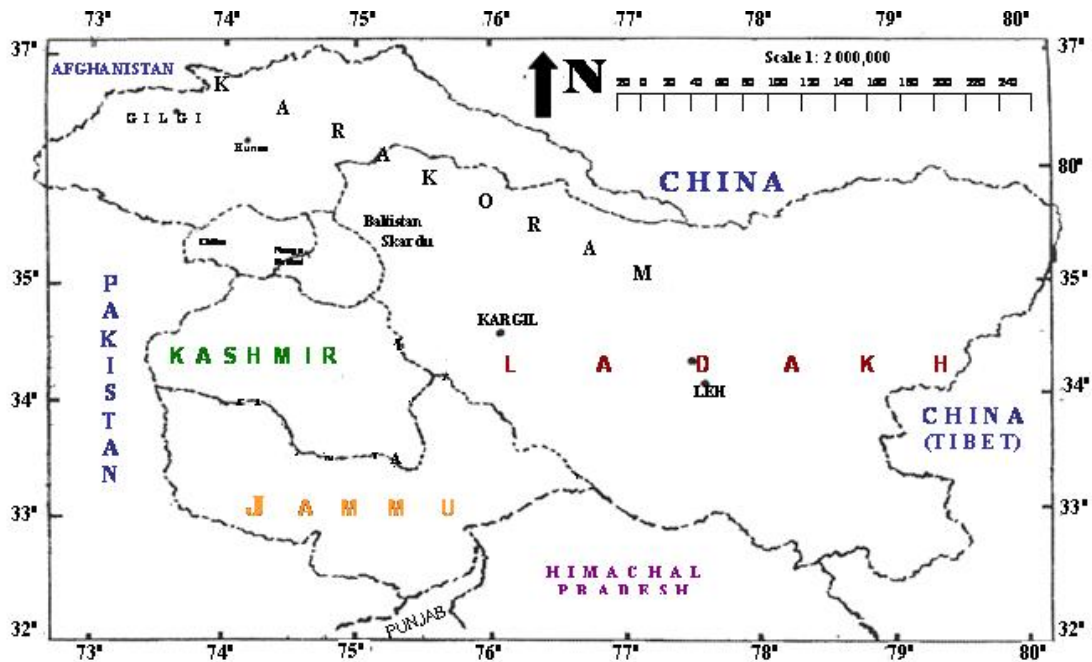


Figure 1. Location map of Jammu and Kashmir State, showing three provinces of Jammu, Kashmir, Ladakh.

Study Area

The Jammu & Kashmir state, being located in the northwestern extremity of India, represents a mosaic of biogeographic zones, such as Western Himalaya, Northwestern Himalaya and Trans-Himalaya (Figure 1). The state, with an area of about 2, 22, 236 km², contributes the largest percentage area (41.65 %) of Indian Himalayan Region (Nandy *et al* 2006). As a result of the prevalence of wide range of physiographic and bioclimatic conditions, the state supports a rich and diverse flora, including carices. The Jammu province has subtropical and temperate climates and the vegetation consists of broad-leaved deciduous forests at lower elevations and coniferous forests at higher elevations. The climate of Kashmir valley is temperate-like and the vegetation consists of coniferous forests and alpine meadows. In the cold-arid desert of Ladakh, the scarce vegetation is primarily steppe-like grasslands with infrequent stunted scrubs. While the annual precipitation in Jammu is about 1700 mm, mainly due to the Indian summer monsoon, that of Kashmir valley is 1050 mm, mostly as winter snow. Because the high mountain ranges of Greater Himalaya prevent rain clouds reaching the interior valleys, Ladakh receives just about 100 mm annual precipitation. Geologically, the region is young and has been formed by the upfolding of the Himalaya. (De Terra 1934).

MATERIALS AND METHODS

The present work is based on the species of *Carex* collected from this Himalayan state. The study area was surveyed at regular intervals from February (onset of flowering) to September (end of flowering and fruiting) each year over the last one decade for the collection of carices.

The plant specimens were collected in the vegetative, early flowering, late flowering and in the fruiting stages. Standard herbarium methods were used in the collection, pressing, drying, mounting and preserving of the collected plant specimens (Jain & Rao 1977). The processed plant specimens were identified using the relevant taxonomic literature and previous herbarium specimens deposited in Kashmir University Herbarium (KASH). The illustrations of *Carex* species from different floras were also frequently consulted. In addition, several monographs, manuals, research papers, periodicals and relevant books were consulted for identification, description and distribution of the species (Hooker 1894; Clarke 1894; Mackenzie 1935; Babu 1977; Dhar & Kachroo 1983; Kukkonen 1998; Egorova 1999). All the herbarium specimens have been deposited in the KASH. Recent nomenclature changes were incorporated by using the specialized online taxonomic web resources.

RESULTS AND DISCUSSION

At the present stage of investigation, the genus *Carex* is represented by 40 species in the study area. Each species has been provided with presently valid scientific name, author citation, basionym and synonyms (if any), habit and diagnostic features, local distribution, altitudinal range and flowering period. Currently valid scientific names have been bold-faced, and synonyms italicized. A taxonomic checklist of all the *Carex* species documented is given below.

Carex acutiformis J.F. Ehrhart, Beitr. Naturk. 4: 43. 1789; C.B. Clarke in Hooker f., Fl. Brit. Ind. 6: 740. 1894. *C. paludosa* Good

Perennial stoloniferous herb, spikes dark-brown, perigynia ellipsoid, shortly stipitate, papillose upwards with shallow notched beak.

Distribution: Kashmir (Srinagar, Kashmir University campus, Hazratbal, Nigeen, Khanyar, Hokarsar, Ganderbal); 1600 – 2200 m; April – June.

Exsiccatae: Kashmir: Srinagar, along Nigeen Lake 24.04.2006, *Ehtisham, Dar & Wafai* 250 (KASH); Khanyar 23.03.1997, *G.H. Dar* 10009 (KASH).

Carex brownii Tuckermen, Enum. Meth. Carec. 21. 1843; E.U. Haq *et al*, Pleione 5(2): 325. 2011. *C. nipposinica* Ohwi.

Perennial rhizomatous herb, rhizome short, roots long clustered at the base of culms, culms sharply trigonous, smooth, differentiated into nodes and internodes.

Distribution: Kashmir (Bandipora, Srinagar, Dachigam National Park); 1600 – 1700 m; April – June.

Exsiccatae: Bandipora, Papchan paddy-fields, especially along sides of water channels, 07.06.2005 *Ehtisham, Dar & Wafai* 701 – 702 (KASH).

Carex canescens Linnaeus, Sp. Pl. 1: 974. 1753; R.R. Stewart, Annt Cat. Vas. Pls. Pak. & Kash.: 83. 1972.

Perennial rhizomatous herb, sometimes tufted, stems sharply trigonous, green, papillose, leaves shorter than the stem.

Distribution: Kashmir (Gulmarg, Pahalgam); 2800 – 3700 m; April – July.

Exsiccatae: Gulmarg, on way to Apherwat, 06.07.2005, *Ehtisham, Dar & Wafai* 3305 (KASH).

Carex cardiolepis Nees, Contr. Bot. Ind. 127. 1834; C.B. Clarke in Hooker f., Fl. Brit. Ind. 6: 744. 1894.

Perennial rhizomatous herb, tufted, rhizome robust, ascending, covered by brown scars of leaf bases, male and female glumes truncate with barbed arista, perigynia obovoid, hispid, grey-green to brownish.

Distribution: Jammu (Poonch), Kashmir (Pahalgam, Srinagar, Dachigam National Park, Sonamarg, Sarbal, Shajnar), Ladakh (Zoji La); 2300 – 2900 m; April – August.

Exsiccatae: Pahalgam, Sallar, on mountain-slopes along the road, 11-5-2006, *Ehtisham, Dar & Wafai* 254 (KASH).

Carex cruenta Nees, Contr. Bot. India. 128. 1834; R.R. Stewart, Annt Cat. Vas. Pls. Pak. & Kash. :83. 1972.

Perennial herb, terminal spikes gynecandrous, lower spikes pistillate and drooping, bracts equaling inflorescence.

Distribution: Kashmir (Gulmarg, Sonamarg, Khillanmarg, Lidder valley), Ladakh (Nubra); 2500 – 4000 m; July – August.

Exsiccatae: Gulmarg, Agharwat, *Pollunin* 16/198 (E); Sonamarg, *Stewart* 9774 (K).

Carex diandra Schrank, Acta Acad. Mogunt. 49. 1782; R.R. Stewart, Bull. Bot. Surv. Ind. 9: 75.1967. *C. diandra* var. *major* Kuk.; *C. teretiuscula* Good; *C. thomsonii* Boott

Perennial herb, tightly tufted, rhizome short, stem trigonous, smooth, scabrous along edges, especially towards apex, leaves shorter than stem

Distribution: Kashmir (Ganderbal, Hokarsar, Nilnag); 1600 - 2150 m; April – June.

Exsiccatae: Ganderbal, Rakhe Kujar, *Ehtisham, Dar & Wafai* 703 (KASH); Hokarsar wetland, *Ehtisham, Dar & Wafai* 1071 (KASH).

Carex diluta M. Bieberstein, Fl. Taur.- Cauc. 2: 388. 1808; C.B. Clarke in Hooker f., Fl. Brit. Ind. 6: 737. 1894. *C. aitchisoni* Boeckeler

Perennial herb, caespitose, stem obtusely trigonous, smooth, perigynium with a bidentate ostiole, nut with a prominent style base.

Distribution: Kashmir (Chandanwari, Noorkah, Qazinag, Tanghdar, Karnah), Ladakh (Drass); 1500 – 3500 m; April – August.

Exsiccatae: Uri: Chandanwari, Noorkah along moist to wet slopes, 29.04.2006 *Ehtisham, Dar & Wafai* 1260 (KASH).

Carex dimorpholepis Steudel, Syn. Pl. Glumac. 2: 214. 1855; C.B. Clarke in Hooker f., Fl. Brit. India 6: 707. 1894. *C. cernua* Boott; *C. prealonga* Wadhwa *et* Chowdhery

Perennial herb, rhizome short and woody, leaves clustered, spikes drooping, terminal spikes gynecandrous, male and female glumes truncate with barbed arista.

Distribution: Kashmir (Bandipora, Srinagar, Dachigam National Park, Chattergul, Tangmarg); 1550 – 2400 m; May – July.

Exsiccatae: Kashmir: Bandipora, Watpora along water channels, 06.06. 2005 *Ehtisham, Dar & Wafai* 301 (KASH).

Carex divulsa Stokes, Bot. Arr. Brit. Pl. ed. 2. 2: 1035. 1787; R.R. Stewart, Annt. Cat. Vas. Pls. W. Pak. & Kashmir : 80. 1972. *C. persica* Nelm

Perennial herb, caespitose, spikes androgynous, bracts glume-like, narrow, sheath-less, perigynia narrowly winged with wrinkled suberous base.

Distribution: Kashmir (Gulmarg, Tangdhar, Bandipora, Srinagar, Dachigam National Park, Yusmarg); 1500 – 2100 m; May – August.

Exsiccatae: Gulmarg, near Gandola, 07.02.2006, *Ehtisham, Dar & Wafai* 450 (KASH); 487 (KASH).

Carex duthiei C.B. Clarke, Fl. Brit. India. 6: 731. 1894. *C. nigerrima* Nelm; *C. atrata* Linnaeus var. *pullata* (Boott) Kukenthal

Perennial herb, caespitose, stem sharply trigonous, smooth, leaves shorter than stem.

Distribution: Kashmir (Tragbal Pass, Khillanmarg); 2800 – 5000 m; July – August.

Exsiccatae: Tragbal Pass, *Stewart* 4920 (RAW); Khillanmarg, *Stewart* 8595a (K)

Carex fedia Nees *ex* Wight, Contr. Bot. India. 129. 1834; R.R. Stewart, Bull. Bot. Surv. Ind. 9: 76. 1967. *C. wallichiana* Presc.

Perennial herb, tufted with long subterranean stolons, male spikes light to dark-brown, perigynium pubescent, ovoid, hairs more dense towards beak, obscurely-nerved.

Distribution: Kashmir (Srinagar, Nigeen lake, Dachigam National Park, Zainakot, Hokarsar, Ganderbal, Ananthnag, Bandipora, Wular lake); 1500 – 2400 m; March – June.

Exsiccatae: Kashmir, Bemina along paddy fields, 02.06.2005, *Ehtisham, Dar & Wafai* 059 (KASH).

Carex filicina Nees in Wight, Contr. Bot. India. 123. 1834; R.R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash. :83. 1972. *C. meiogyna* Nees; *C. caricinus* (D. Don) Ghildyal & U.C. Bhattacharyya
Perennial herb, tufted, inflorescence axis sharply angular, grooved, conspicuously scabrous, perigynia prominently nerved.

Distribution: Jammu (Poonch), Ladakh (Chang La); 2000 – 4700 m; August – September.

Exsiccatae: Poonch, Chatter, *Khan* (RAW); Changla Gali, *Stewart* 7692 (RAW).

Carex foliosa D. Don, Trans. Lin. Soc. London. 14,2: 327. 1824; R.R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash.: 83. 1972. *C. muricata* var. *foliosa* (D. Don) C.B. Clarke; *C. muricata* var. *indica* Boott

Perennial herb, caespitose, rhizome knotty with short internodes, covered with grey-brown, fibrous scales.

Distribution: Jammu (Patnitop, Poonch, Aliabad); 1500 – 2500 m; April – July.

Exsiccatae: Patnitop, along road from Srinagar to Jammu, *Kukkonen* 77024 (H).

Carex griersonii Noltie, Edinb. J. Bot. 50: 195. 1993. *Kukkonen* in Rechinger f., Fl. Iran 173: 200. 1998.

Perennial herb, loosely caespitose, lowest bract mostly sterile, acute to mucronate, perigynia trigonous, ellipsoid to ovoid, densely hispid, beak ostiole truncate.

Distribution: Kashmir (Gulmarg); 2400 – 3350 m; May – July.

Exsiccatae: Gulmarg near Gandolla project, 07.02.2006 *Ehtisham, Dar & Wafai* 2450 (KASH).

Carex haematostoma Nees in Wight, Contr. Bot. India. 125. 1834; C.B. Clarke in Hooker f., Fl. Brit. Ind. 6: 77. 1894. *C. alexeenkoana* Litwinow

Perennial rhizomatous herb, caespitose, culms terete, nut with persistent, barbed style.

Distribution: Jammu (Poonch), Kashmir (Prang, Kangan, Budmarg, Baltal, Lidder valley, Apharwat, Harnag, Najwan), Ladakh (Nubra); 2100 – 5000 m; July – August.

Exsiccatae: Prang, 15.07.1983, *G. H. Dar* 6558 (KASH).

Carex hokarsarensis E.U. Haq & Dar, Rheedeia 20: 29 – 31. 2010.

Perennial herb, loosely caespitose in small clumps, leaves clustered at basal part of the stem, spikes sessile, densely overlapping and frequently branched.

Distribution: Kashmir (Srinagar, Zainakoot); 1600m; March-June.

Exsiccatae: Srinagar, Zainakoot, *Ehtisham, Dar & Wafai* 3421 – 3423 (KASH). *Note:* New species from the study area.

Carex infuscata Nees in Wight, Contr. Bot. India. 125. 1834; R.R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash.: 78. 1972. *C. alpina* ssp. *infuscata* (Nees) Kukenthal; *C. trispiculata* Boeckeler; *C. atrofurfur* Koyama

Perennial herb, caespitose, spikes closely placed together, terminal frequently gynecandrous, lower spikes entirely pistillate.

Distribution: Jammu (Pir Panjal Range, Kishtwar), Kashmir (Gulmarg, Liddar Valley, Sonamarg, Pulwama, Kongwatan, Gurais, Checkwali), Ladakh (Kargil, Drass, Zaskar, Parkachik, Thrungs); 1700 – 4000 m; May – August.

Exsiccatae: Gulmarg, moist meadows, 06.07.2005, *Ehtisham, Dar & Wafai* 953, 966 (KASH).

Carex karoii (Freyn) Freyn, Oesterr. Bot. Z. 46: 132. 1896; R. R. Stewart, Bull. Bot. Surv. Ind. 9: 78. 1967. *C. capillaris* ssp. *karoii* Freyn, Oest. Bot. Zeitschr. 11: 303. 1890. *C. delicata* C.B. Clarke

Perennial herb, tufted, bracts shorter than or equaling their spikes, sheathed, spikes slightly drooping.

Distribution: Kashmir (Sonamarg, Thajwas); 2800 – 3500 m; June – July.

Exsiccatae: Sonamarg, Thajwas, 11.07.2005, *Z.S. Khan & A.A. Khuroo* 1950 (KASH).

Carex kashmirensis C.B. Clarke in Hook. Fl. Brit. India. 6:743. 1894; R.R. Stewart, Bull. Bot. Surv. Ind. 9: 78. 1967.

Perennial stoloniferous herb, tufted, rhizome covered with dark-brown scales, stem obtusely trigonous, perigynium bi-convex, nerved, reddish-brown, white-papillose.

Distribution: Jammu (Pir Panjal, Kishtwar), Kashmir (Gulmarg, Sonamarg, Thajwas, Lidder valley, Najwan, Gurais); 2600 – 4500 m; July – August.

Exsiccatae: Gulmarg, 15.07.2006 *Ehtisham, Dar & Wafai* 1190 (KASH).

Carex lateralis Kuentner, Pflanzenr. IV. 20, 38: 639. 1909; R.R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash.: 83. 1972.

Perennial herb, caespitose, leaves of lateral shoots longer than stem, sheaths dark grey-brown, disintegrating into fibers.

Distribution: Jammu (Poonch); 1600 – 2000 m; April – June.

Exsiccatae: Poonch, Nakial near Kotli, *Stewart* 25803 (RAW).

Carex leporina Linnaeus, Sp. Pl. 973. 1753. *C. nipposinica* Ohwi., *Carex ovalis* P. Good; *C. argyroglochin* Hornemann

Perennial rhizomatous herb, culms densely tufted, spikelets obovate, orbicular to ellipsoid, light brown.

Distribution: Kashmir (Gulmarg, Dachigam National Park); 1800 – 2700 m; May – July.

Exsiccatae: Kashmir: Gulmarg, 02.07.2006, *Ehtisham, Dar & Wafai* 964 (KASH). *Note:* New record for India from the study area.

Carex melanantha C.A. Meyer, Fl. Alt. 4: 216. 1833; C.B. Clarke in Hooker f., Fl. Brit. Ind. 6: 79. 1894.

Perennial rhizomatous herb, spikes dark-brown to reddish-brown, densely overlapping, lowest spike occasionally remote.

Distribution: Kashmir (Sonamarg, Lidder valley), Ladakh (Zoji La, Drass, Kargil, Rangdum, Parkachey, Zanaskar, Thusgam, Changla Pass, Nubra); 3000 – 5100 m; June – August.

Exsiccatae: Kargil: Rangdum on hill slopes, 28.05.2007, *Ehtisham, Dar & Wafai* 3001 (KASH).

Carex microglochin Wahlenb., Kungl. Svenska Vetenskapsakad. Handl. N. S. 24 : 140. 1803; R.R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash.: 81. 1972.

Perennial stoloniferous herb; stem erect, smooth and terete, leaves half the stem length, inflorescence with single androgynous spike, bract absent

Distribution: Ladakh (Drass); 3000 – 4000 m; June – August.

Exsiccatae: Ladakh, Thomson S. N. (K); Dras, Karpuchu valley, Duthie 11973 (BM, K).

Carex nivalis Boott, Trans. Linn. Soc. London, Bot. 20: 136. 1851; C.B. Clarke in Hooker f., Fl. Brit. Ind. 6: 732.1894. *C. cinnamomea* Boott; *C. griffithii* Boott; *C. gilesii* Nelmes; *C. luteo-brunnea* Nelmes; *C. lepus-aestatis* T. Koyama

Perennial herb, female spikes long-pedunculate, the lower remote, drooping, reddish-brown to black.

Distribution: Kashmir (Sonamarg, Gulmarg, Sind valley, Lidder valley, Thajwas), Ladakh (Zojila, Changla Pass, Zanaskar); 2700 – 5000 m; June – August.

Exsiccatae: Kashmir: Sonamarg, Thajwas, 11.07.2005, *Z.S. Khan & A.A. Khuroo* 1241 (KASH).

Carex nubigena D. Don, Trans. Linn. Soc. London. 14: 326. 1824; C.B. Clarke, in Hooker f., Fl. Brit. Ind. 6: 702. 1894.

Perennial herb, tufted, leaves as long as or overtopping the stem; upper bracts inconspicuous, lower green, filiform equaling or overtopping the inflorescence.

Distribution: Jammu (Patnitop, Poonch, Bhaderwah), Kashmir (Gulmarg, Pahalgam, Ladder valley, Chattergul, Uri); 1500 – 3500 m; June – August.

Exsiccatae: Gulmarg, on slopes to Agharwat, 25.08.2006, *Ehtisham, Dar & Wafai* 1090-1093(KASH).

Carex orbicularis Boott, Trans. Linn. Soc. London, Bot. 20: 134. 1851; R.R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash.: 81. 1972. *Carex rigida* P. Good; *C. erostrata* Boott ex C.B. Clarke; *C. vulgaris sensu* C.B. Clarke; *C. satakeana* T. Koyama; *C. pakistanica* T. Koyama.

Perennial rhizomatous herb, bracts shorter than individual spikes, perigynium green to almost black, glossy, papillose, shortly stipitate, abruptly reduced to a beak.

Distribution: Kashmir (Gulmarg, Sonamarg), Ladakh (Drass, Kargil, Parkachey, Rangdum, Zanskar, Thusgam, Nubra valley); 2400 – 4300 m; March – July.

Exsiccatae: Kashmir: Gulmarg, 08.04.2006, *Ehtisham, Dar & Wafai* 092, 101 (KASH).

Carex pamirica (O. Fedtschenko) O. & B. Fedtschenko ex B. Fedtschenko, J. Bot. St.-Petersb. 1, 6: 191. 1907; R.R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash.: 81. 1972. *C. vesicaria* L. var. *pamirica* O. Fedtschenko; *C. obscuriceps* Kuk. var. *pamirica* (O. Fedtschenko) Kukenthal; *C. dichroa* (Frey) V. Kreczetowicz ssp. *pamirensis* (C.B. Clarke ex B. Fedtschenko) Egorova. Perennial herbs, tufted, perigynia inflated, membranous, nerved and glossy, not papillose.

Distribution: Kashmir (Gulmarg), Ladakh (Zojila, Drass, Kargil, Parkachy, Rangdum, Zanskar, Padam); 2600 – 4000 m; June – September.

Exsiccatae: Kashmir, Gulmarg, in marshy areas, 07.03.2006, *Ehtisham, Dar & Wafai* 201 (KASH).

Carex plectobasis V.I. Kreczetowicz, Not. Syst. Leningr. 9: 192. 1946; R.R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash.: 82. 1972. *C. hirtella* Drejer, *C. tenuis* Nees

Perennial herb, tufted, perigynia ovoid, plano-convex with conspicuous dorsal nerves.

Distribution: Jammu (Poonch, Kishtwar), Kashmir (Sonamarg, Baltal, Tragbal, Prang), Ladakh (Drass, Zanskar, Tog); 2600 – 4500 m; July – August.

Exsiccatae: Sonamarg, Baltal on sandy slopes, 02.09.1982, *G.H. Dar* 3837 (KASH).

Carex pseudobicolor Boeckeler, Biotr. Cyper. 1: 44. 1888; R.R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash.: 83. 1972. *C. erostrata* (Boott) C.B. Clarke; *C. alpina* Swartz ssp. *infuscata* (Nees) Kukenthal var. *erostrata* (Boott) Kukenthal; *C. infuscata* Nees var. *erostrata* (Boott) T. Koyama

Perennial herb, leaf-blades with slightly revolute margins, spikes overlapping, dark to reddish-brown, terminal spikes gynecandrous, perigynia obscurely nerved, papillose, ostiole rounded.

Distribution: Kashmir (Sonamarg, Thajwas, Budmarg), Ladakh (Kargil, Rangdum, Parkachy); 2700 – 5000 m. May – August.

Exsiccatae: Sonamarg, Thajwas, Z.S. Khan & A.A. Khuroo 1242 (KASH).

Carex pseudocyperus Linnaeus, Sp. Pl. 978. 1753; C.B. Clarke in Hooker f., Fl. Brit. India 6: 740. 1894.

Perennial herb, loosely tufted, bracts much overtopping the inflorescence, perigynia spreading, erect, later reflexed, strongly nerved with two rigidly toothed beak

Distribution: Jammu (Pir Panjal), Kashmir (Uri, Limber, Hokarsar, Dal Lake, Nil Nag); 1500 – 2400 m; May – July.

Exsiccatae: Kashmir: Uri, Limber along Khar-Kol, 15.06.2004, *Ehtisham, Dar & Wafai* 350 (KASH).

Carex pseudofetida Kukenthal, Bot. Tidsskr. 28: 226. 1908. ssp. *afghanica* I. Kukkonen, Ann. Bot. Fenn. 21: 384, 1984. R. R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash. : 81. 1972. *C. enervis* C.A. Meyer

Perennial rhizomatous herb, bracts short glumacious, all spikes gynecandrous, female glumes obtuse to acute, margins completely scarious.

Distribution: Kashmir (Sonamarg, Tangmarg, Thajwas), Ladakh (Zanskar, Rangdum); 2700 – 4700 m; June – September.

Exsiccatae: Sonamarg, moist meadows near Thajwas Wildlife Sanctuary, 11.06. 2006 *Ehtisham, Dar & Wafai* 3491 (KASH).

Carex psychrophila Nees in Wight, Contr. Bot. India. 127. 1834; C.B. Clarke, in Hooker f., Fl. Brit. Ind. 6: 732. 1894.

Perennial rhizomatous herb, stem sharply trigonous, edges scabrous, sides concave, ligule arch much higher than wide.

Distribution: Jammu (Pir Panjal Range, Poonch), Kashmir (Srinagar, Dachigam National Park, Gulmarg, Khillanmarg, Sonamarg, Pahalgam, Liddar valley, Tangdhar, Uri), Ladakh (Chang La); 1500 – 3300 m; May – August.

Exsiccatae: Kashmir: Gulmarg, on way to Apharwat, 2400 – 2800 m, 27.05.2007, *Ehtisham, Dar & Wafai* 2013 (KASH).

Carex remota Linnaeus, Fl. Angl. (Linnaeus) 24. 1754, - vide Stearn in Ray Soc. Publ. 148 (Facsim. J. Ray. Syn. Method. Strip. Brit. e C. Linn. Fl. Angelica): 65. 1973; Singh & Kachroo, Forest Fl. Srinagar :219. 1976; *C. remota* Linnaeus var. *rochebrunni* C.B. Clarke

Perennial herb, loosely tufted, bracts leaf-like, sheath-less, the lowest longer than inflorescence, spikes gynecandrous.

Distribution: Kashmir (Srinagar, Gulmarg, Chattergul, Bandipora, Uri, Beehama, Keran, Pahalgam); 1500 – 3000 m; June – August.

Exsiccatae: Gulmarg, along road side in open areas, 12.07.2006, *Ehtisham, Dar & Wafai* 3313 (KASH); 220 (KASH).

Carex royleana Nees in Wight, Contr. Bot. India. 127. 1834; R.R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash.: 81. 1972. *C. breviculmis* R. Brown ssp. *royleana* (Nees) Kuk.

Perennial herb, tufted, leaves half the stem length, male and female glumes with long barbed arista, style base surrounded by collar.

Distribution: Jammu (Poonch, Trankhal), Kashmir (Noorkah, Chandanwari, Pahalgam, Aru); 1500 – 3000 m; April – June.

Exsiccatae: Uri: Noorkah, Chandanwari, 20.05.2006, *Ehtisham, Dar & Wafai* 401, 402 (KASH).

Carex sanguinea Boott, Trans. Linn. Soc. London. 20:137. 1851; C.B. Clarke, in Hooker f., Fl. Brit. India 6: 740. 1894.

Perennial stoloniferous herb, internodes short with dark, overlapping and strongly nerved scales.

Distribution: Jammu (Poonch), Kashmir (Jhelum valley road); 1300 – 2500 m; April – June.

Exsiccatae: Poonch, Nakial, *Stewart* 25741 (RAW).

Carex schlagintweitiana Boeckeler, Beitr. Kenntniss Cyperac. 1: 48. 1888; R.R. Stewart, Annt. Cat. Vas. Pls. Pak. & Kash. : 81. 1972. *C. setigera* D. Don var. *schlagintweitiana* (Boeckeler) Kuk.; *C. setigera* var. *humilis* Nees

Perennial herb, caespitose, bracts narrow, longer than stem and sheathed, leaf sheath later disintegrating into fibrous net.

Distribution: Jammu (Patnitop), Kashmir (Gulmarg, Sonamarg, Yusmarg, Tangdhar), Ladakh (Changla Gali); 1800 – 3000 m; April – July.

Exsiccatae: Gulmarg, near Gandolla project, 06.05.2007, *Ehtisham, Dar & Wafai* 1110 (KASH).

Carex serotina Merat, Nouv. Fl. Env. Paris, ed. 2. 2: 54. 1821; Murti, Fl. Cold Deserts W Himalaya 1: 607. 2001. *C. flava* C.B. Clarke

Perennial herb, caespitose, culms obtuse to terete, smooth, grooved, glabrous, bracts much overtopping the inflorescence, frequently reflexed.

Distribution: Jammu (Pir Panjal), Kashmir (Sonamarg, Nilnag, Gulmarg, Gabral, Prang, Kujar, Noorkah, Sind valley, Gurais), Ladakh (Kargil, Drass); 1450 – 3350 m; May – August.

Exsiccatae: Kargil, Drass, on wet mountain slopes, 29.05.2007, *Ehtisham, Dar & Wafai* 1230 (KASH).

Carex setosa Boott, I11. Gen. *Carex*. 3: 108. pl. 327 – 329. 1862; C.B. Clarke, in Hooker f., Fl. Brit. Ind. 6: 745. 1894.

Perennial herb, stem obtusely trigonous, female spikes fusiform or club-shaped, lax, male glumes pale-yellow, lanceolate to oblong, obtuse.

Distribution: Jammu (Poonch, Bantara Gali), Kashmir (Sonamarg, Baltal, Thajwas, Lidder valley); 2700 – 4800 m; June – July.

Exsiccatae: Kashmir, Sonamarg, Thajwas, 11.07.2005, Z.S. Khan & A.A. Khuroo 1050 (KASH).

Carex songorica Karelin & Kir., Bull. Soc. Imp. Nat. Mosc. 15, 3: 525. May 1842; C.B. Clarke, in Hooker f., Fl. Brit. Ind. 6: 739. 1894. *C. songarica* Schrank; *C. heterostachya* auct. non Bunge, Kuk; *C. elbursensis* Gilli

Perennial stoloniferous herb, caespitose, male spikes close terminally and female spikes remote and sessile to sub-sessile.

Distribution: Kashmir (Srinagar, Dachigam National Park, Gurais), Ladakh (Drass); 1600 – 3600 m; April – July.

Exsiccatae: Srinagar, Dachigam National Park, along road sides, 13.05.2005 Ehtisham, Dar & Wafai 3323 (KASH).

Carex stenophylla Wahlenberg, Kongl. Vetensk. Acad. Nya Handl. 24: 142. 1803; C.B. Clarke in Hooker f., Fl. Brit. Ind. 6: 700. 1894.

var. *stenophylla*

Spikes 3 - 8; utricles veined, with stipe up to 0.3 mm.

Distribution: Ladakh (Zanskar, Nubra); 3000-4000m; June-August.

Exsiccatae: Kashmir: Thajwas Wildlife Sanctuary, Ehtisham, Dar & Wafai 837 (KASH); Budgam, Branwar, Ehtisham, Dar & Wafai 963 (KASH).

var. *longipedicellata* (Boeckeler) Kukenth, in Eng. Pflanzenr. Heft. 38: 121. 1909. *C. longipedicellata* Boeckeler, Cyp. Nov. 1: 41. 1888.

Spikes 3; utricles veinless, long stipitate.

Distribution: Kashmir (Sonamarg, Budgam, Branwar), Ladakh (Nubra, Rupshu, Kargil, Drass, Thrungs, Sangrah, Zanskar, Padam); 1700 – 4000 m; March – July.

Exsiccatae: Drass, along mountain slopes 06.05.2007, Ehtisham, Dar & Wafai 1234 (KASH); Nubra, M. Y. Malla 5768 (KASH).

DISCUSSION AND CONCLUSION

The present study documents 40 species of *Carex* in the Jammu and Kashmir state of India. Of these species, *Carex pseudofortida* and *C. stenophylla* are represented by infra-specific taxa in the study area: the former by *C. pseudofortida* ssp. *afghanica* and the latter by two varieties *Carex stenophylla* var. *stenophylla* and *C. stenophylla* var. *longipedicellata*. The highest number of *Carex* species (35) has been recorded from Kashmir region, followed by Ladakh and Jammu regions with 14 and 12 species, respectively. The proportion of species is quite different in three climatic zones, with 87 % of the total species in the temperate Kashmir region, 35 % in the cold-arid Ladakh, and 30 % in the sub-tropical Jammu region. This decrease in the number of species of *Carex* from the Kashmir valley towards the other two regions (more to the sub-tropical Jammu) is interesting and amply demonstrates that the temperate Kashmir region from low lying areas of 1500 m altitude to sub-alpine and alpine regions up to 3200 m altitude, provides the most favorable conditions and variety of habitats for suitable growth of *Carex*. In the Ladakh region, carices dominate the moist shady habitats best prevalent from Kargil to Zanskar between an altitudinal gradient of 2700 – 4000 m, where as the dry arid areas of Ladakh show scanty representation of *Carex*. Flowering in the genus mostly initiates in the month of April and extends up to July. In few cases, as in *C. fedia*, *C. hokarsarsensis*, *C. orbicularis* and *C. stenophylla*, flowering starts much earlier in the month of March and extends rarely up to September. This work highlights the taxonomy of all the known species in all the three climatic regions of the Kashmir Himalaya (sub-tropical Jammu, temperate Kashmir, and the cold arid Ladakh).

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