

Research Article

GENUS *KOBRESIA* WILLD. (CYPERACEAE) IN INDIA

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ABSTRACT

Taxonomic revision of the genus *Kobresia* Willd. (Cyperaceae), in India, is presented in this paper. Two new species viz., *Kobresia vibhae* Jana, R.C.Srivast & Manas Bhaumik sp. nova., and *Kobresia paramjiti* Jana, H.J. Noltie, R.C. Srivast & Ambarish Mukherjee sp. nova., are described and 3 new records for India are reported here. Ornamentation of nut surface under SEM (Plates I, II) has been found to be an effective tool in solving taxonomic complexes.

Keywords: *Kobresia*, Cyperaceae, India

INTRODUCTION

Genus *Kobresia* Willd.(Cyperaceae) withc. 65 species, is distributed in Northern hemisphere, especially in the higher altitudes of Himalayas; few are in Europe and America (Mabberley, 2008). In Asia, it is mainly distributed in India, China, Nepal, Bhutan, Malaysia and Pakistan. Thirty two species and 5 varieties were enlisted from India by Karthikeyan *et al.* (1989).

MATERIALS AND METHODS

Extensive field surveys in Himalayan regions of India were conducted by both the authors. The collected specimens were processed as per standard herbarium methodology and the specimens are deposited in CAL. Scrutiny of the relevant literature (Clarke, 1894; Rajbhandari & Ohba, 1991; Govaerts *et al.*, 2007); study of the herbarium specimens deposited in K, E, LIV by the second author and the studies on herbarium specimens deposited in CAL, BSHC, DD, BSD, ASSAM, BSHC, ARUN herbaria were done by the first author under the supervision of the second author. SEM photographs were taken by using the standard methodology.

RESULTS

Present study revealed the occurrence of 42 species of *Kobresia* in India. Brief taxonomic account of these is presented below:

Kobresia Willd., Sp. Pl. 4: 205.1805; Hook.f., Fl. Brit. India 6: 694. 1894; Kük. in A. Engler, Das Pflanzenr. 38. IV. 20, 38: 33.1909 (as *Cobresia*). *Elyna* Schrader, Fl. Germ. 1: 155. 1806. *Cobresia* Persoon, Synops. Pl. 2: 534.1807. *Hemicarex* Benth. in J. Linn.Soc. 18: 367.1881& in Benth. & Hook.f., Gen. Plant. 3: 1072. 1883.

Type: *Kobresia scirpina* Willd.

Perennial herbs. Rhizomes densely tufted or partly loose and elongated or short. Culms stiff and erect, sometimes slender and curved or bent, triquetrous or terete and striate, smooth or scabrid. Leaves shorter or longer than culms, usually arranged basally,sometimes sub-basal, sheaths and ligules membranous; lamina linear flat or filiform, convolute or involute, surfaces smooth, margins scabrid or glabrous. Basal outer sheaths testaceous, herbaceous or membranous, lamina-bearing or laminaless. Inflorescences simple with a single spike or branched with many congested or loosely arranged spikes. Spikes unisexual or androgynous with female spikelets in the proximal and male spikelets in the distal end. In the many-spiked inflorescence the lower spikes androgynous in each branch of the inflorescence and terminal male or in some case (*K. rcsrivastavae*) lower branch female and upper branch male. Spikelets unisexual or

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bisexual. Bisexual spikelets with one female flower at proximal end and one to four or five male flowers in the distal end. Glumes of the lowest spikes ovate or oblong, aristate or not, sheathing at base or not, shorter than inflorescence, or sometimes leafy and longer than inflorescence. Glumes of the female spikelets ovate, elliptic, oblong or lanceolate, membranous, 1 – 3-nerved, aristate or not. Prophylls elliptic, linear, lanceolate, ovate or rarely obovoid or membranous, surface smooth or rarely hairy, 2-nerved or nerves indistinct, 2-keeled or sometimes keels obscure, keels scabrid or smooth; open on one side, some times open only in apex, sometimes open from apex to middle, sometimes open from apex to base. Sterile racheola in the female spikelets present, prominent or reduced, absent in bisexual spikelets. Glumes of the male flowers of various shapes (like linear, lanceolate, oblong) membranous, smooth, 1-nerved. Male flowers with 3 stamens, filaments free, slender, longer than glumes. Ovary bi- or tri-carpellate with a solitary basal ovule. Styles 3-fid, or rarely 2-fid (*K. macrantha*). Stigmas 3 or 2. Nuts trigonous or flattened (*K. macrantha*), beaked or not; beak curved (*K. seticulmis*) or straight, sessile, or sometimes distinctly stipitate (*K. fissiglumis*, *K. macrantha*). Seeds trigonous.

Alpine herbs; c.66 species, distributed in Northern hemisphere, especially in the higher altitudes of Himalayas ; few in Europe and America. In Asia, it is mainly distributed in India, China, Bhutan, Malaysia, Nepal, Pakistan and Afghanistan; 42 species recorded by present authors in India.

Key to the Species

- | | | |
|-----|---|----------------------------------|
| 1a. | Stigmas-2; nuts flattened | 24. <i>K. macrantha</i> |
| 1b. | Stigmas-3; nuts trigonous..... | 2 |
| 2a. | Inflorescence simple, consisting of a single unbranched spike..... | 3 |
| 2b. | Inflorescence compound, consisting of branched spikes..... | 28 |
| 3a. | Spikes unisexual..... | 4 |
| 3b. | Spikes bisexual..... | 9 |
| 4a. | Prophylls broadly ovate, open only at apex..... | 42. <i>K. vidua</i> |
| 4b. | Prophylls linear, elliptic or oblong, open from apex to middle or apex to base..... | 5 |
| 5a. | Prophyll elliptic-oblong, not embracing nut..... | 12. <i>K. fissiglumis</i> |
| 5b. | Prophyll linear to oblong, embracing nut..... | 6 |
| 6a. | Leaves exceeding the culm..... | 40. <i>K. vaginosa</i> |
| 6b. | Leaves equaling or shorter than culm..... | 7 |
| 7a. | Male and female spikes borne on separate plants..... | 11. <i>K. esenbeckii</i> |
| 7b. | Male and female spike borne on same plants.. | 8 |

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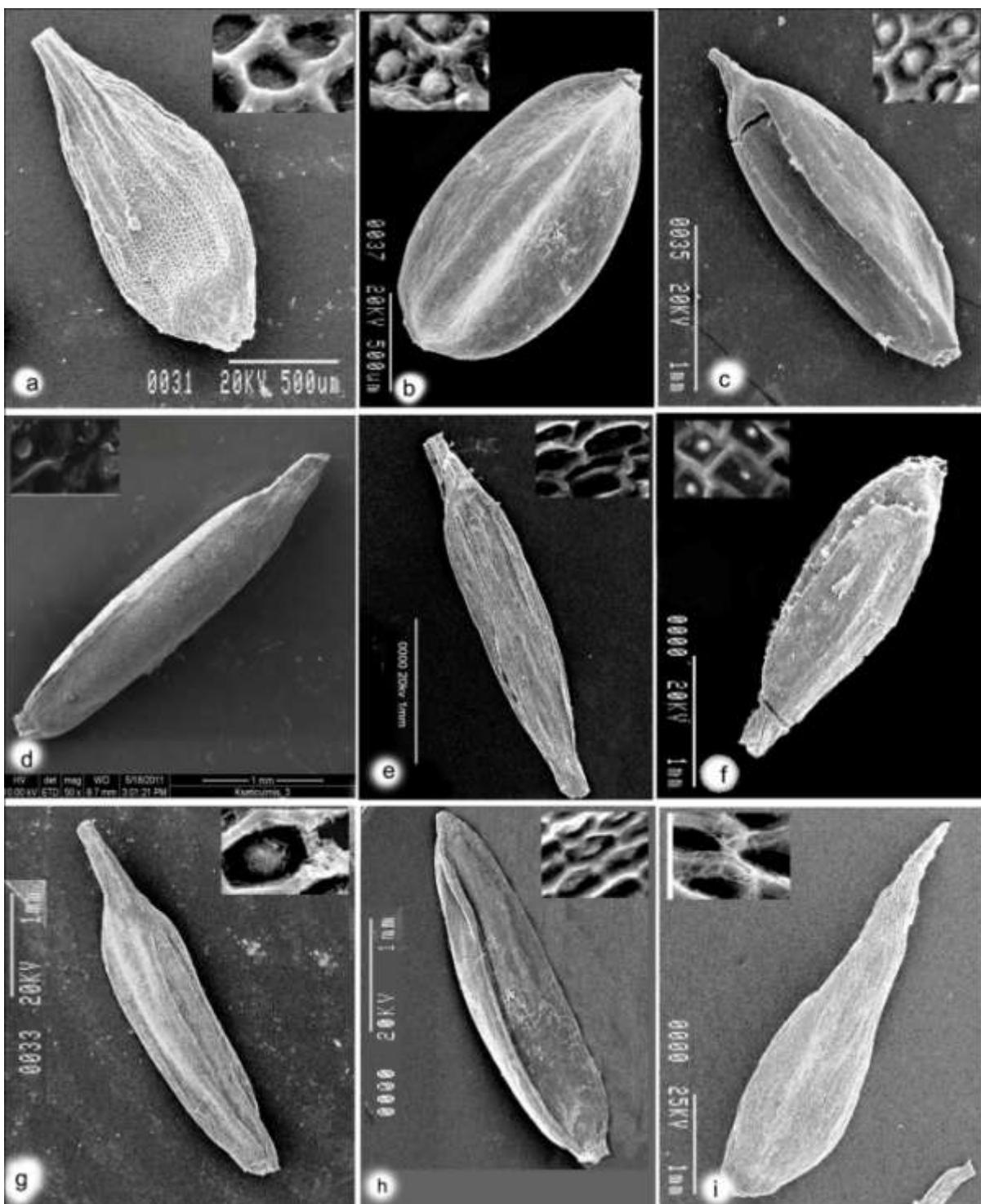


Plate I: Fig. a-i: Nuts & nuts surface (inset) as seen under SEM; a. *Kobresia curvata* (Boott) C.B. Clarke (*J.D.Hookers.n.*, CAL); b. *Kobresia fragilis* C.B. Clarke (*Soulie 731*, CAL); c. *Kobresia clarkeana* (Kük.) Kük (*G.King's native collector s.n.*, CAL); d. *Kobresia seticulmis* Boeckeler (*B. Jana 53182* CAL); e. *Kobresia hookeri* Boeckeler (*P.K.Hajra 73946* BSD); f. *Kobresia fissiglumis* C.B. Clarke (*C.M. Arora 49698*, BSD); g. *Kobresia paramjiti* Jana& al. (*G.P. Sinha & D.G. Long & al. 18266*, BSHC); h. *Kobresia vibhae* Jana, M. Bhaumik & R.C. Srivast. (*M. Bhaumik 27142*, ARUN); i. *Kobresia gammiei* C.B. Clarke (*G.A. Gammie s.n.*, CAL).

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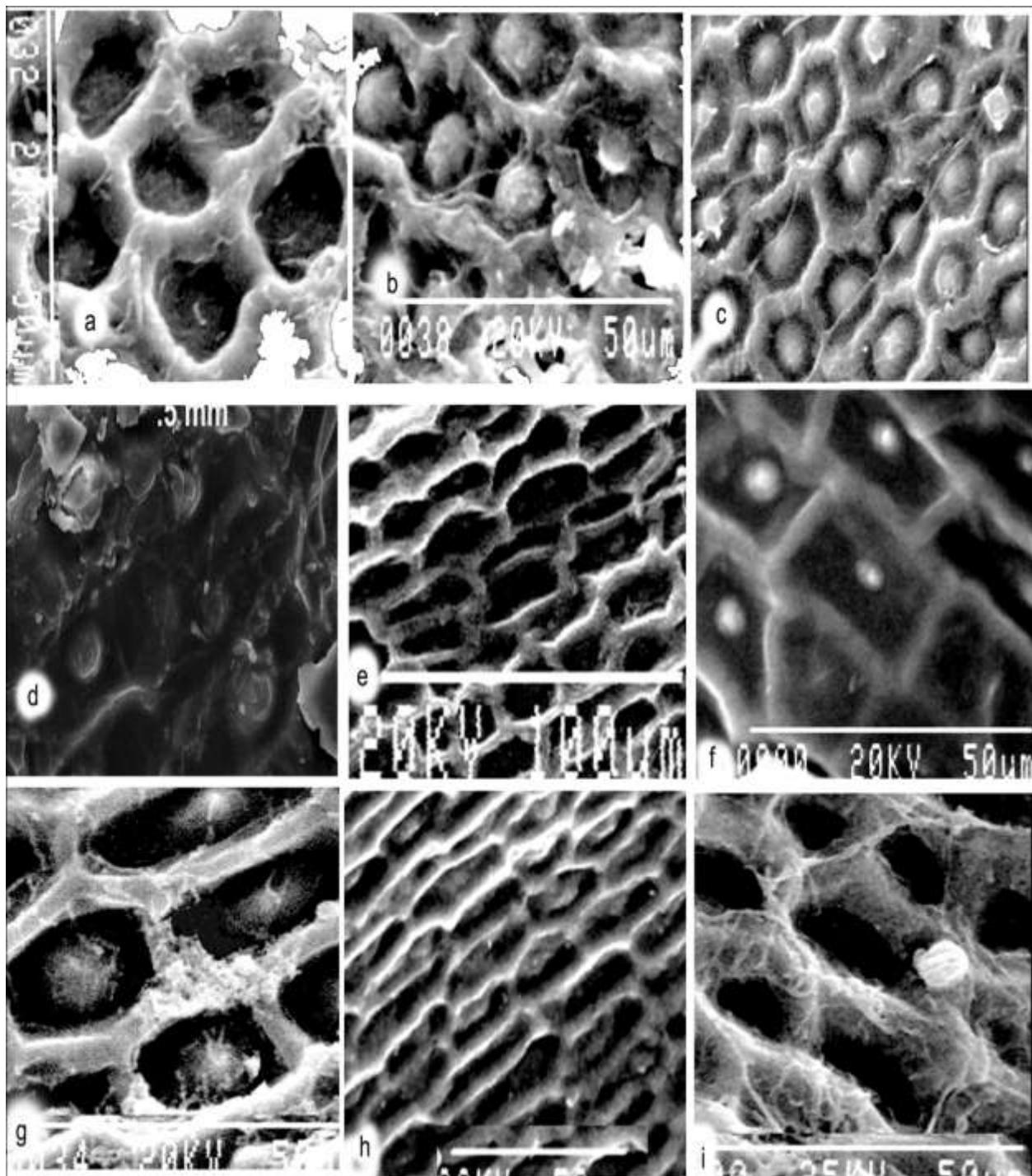


Plate II: Fig. a-i: Nut surface as seen under SEM: a. *Kobresia curvata* (Boott) C.B. Clarke (J.D.Hooker s.n., CAL); b. *Kobresia fragilis* C.B. Clarke (Soulie 731, CAL); c. *Kobresia clarkeana* (Kük.) Kük (G.King's native collector s.n., CAL); d. *Kobresia seticulmis* Boeckeler (B. Jana 53182 CAL); e. *Kobresia hookeri* Boeckeler (P.K.Hajra 73946 BSD); f. *Kobresia fissiglumis* C.B. Clarke(C.M. Arora 49698, BSD); g. *Kobresia paramjiti* Jana, R.C. Srivast. & A. Mukherjee (G.P. Sinha & D.G. Long & al. 18266, BSHC); h. *Kobresia vibhae* Jana & al.(M. Bhaumik 27142, ARUN); i. *Kobresia gammie* C.B. Clarke (G.A. Gammie s.n. CAL).

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- 8a. Culm thick; mid vein of the female spikelets 3-nerved..... **31. K. prainii**
8b. Culm slender; mid vein of the female spikelets 1-nerved **20. K. kanaii**
9a. Spikelets all unisexual..... 10
9b. Spikelets bisexual at base..... 18
10a. Prophylls curved at upper portion; inflorescence pyramid shaped..... **3.K. caricina**
10b. Prophylls straight; inflorescence not pyramid shaped..... 11
11a. Leaves more or less flat, exceeding or equaling the culm..... 12
11b. Leaves more or less filiform, shorter than the culm..... 15
12a. Prophylls lanceolate, apex truncate, beak of the nut inserted 13
12b. Prophylls linear-oblong, apex rounded, beak of the nut exserted..... 14
13a. Prophylls small covered only ovary, surface smooth..... **18.K. hookeri**
13b. Prophylls large covering whole gynoecium, surface ciliate..... **27.K. nepalensis** var. **elachista**
14a. Beak of the nut curved..... **36.K. seticulmis**
14b. Beak of the nut straight..... **26. K. nepalensis**
15a. Dwarf, turf-forming plants; culms commonly up to 5 cm long; prophylls c.2.5 mm long..... 16
15b. Erect, tufted plants; culms usually over 7 cm long; prophylls over 3 mm long..... 17
16a. Prophylls utriculate, culms thick..... **30. K. pygmaea**
16b. Prophylls oblong, culms slender..... **1. K. angusta**
17a. Culms slender; prophylls open from apex to the middle..... **16.K. gandakiensis**
17b. Culms thick; prophylls open from the apex to base..... **5. K. cercostachys**
18a. Leaves flat, midrib distinct abaxially..... 19
18b. Leaves filiform, midrib not distinct abaxially..... 24
19a. Spikes large, linear, lanceolate to oblong..... 20
19b. Spikes comparatively small, ovate..... **28.K. nitens**
20a. Prophylls linear to oblong, open from base..... 21
20b. Prophylls utriculiform, open near apex..... 23
21a. Lamina flat,c. 5 mm..... **29.K. paramjiti**
21b. Lamina flat,c. 2 mm..... 22
22a. Culms slender; prophylls speckled purplish at lower portion..... **13.K. filicina**
22b. Culms thick; prophylls yellowish brown..... **10. K. duthiei**
23a. Vertical striation present on the body of prophyll, male spikelets many, compactly arranged throughout the spike..... **2.K. brandisii**
23b. Vertical striation absent on the body of the prophyll, male spikelet few, less compactly arranged throughout the spike..... **19.K. humilis**
24a. Spikes robust, basal sheaths conspicuous, orange-brown; male spikelets more than 5 per prophyll **34.K. schoenoides**
24b. Spikes more slender, basal sheath often dark brown; male spikelets less than 5 per prophyll 25
25a. Culm stout (to 1.5 mm in diam.), erect, exceeding leaves; spikes very short in relation to the length of culm **38.K. tibetica**
25b. Culm more slender (to 1 mm in diam.), not or slightly exceeding the leaves; spikes more

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elongate	26
26a. Sheaths usually dark chocolate brown; glumes wide, blunt, with broad hyaline margins 3.K. capillifolia
26b. Sheaths paler; glumes narrower, not or narrowly hyaline margined.....	27
27a. Spikes club shaped, culms shorter, male spikelets usually 2 within the prophyll..... 35. K. squamiformis
27b. Spikes linear, culms longer, male spikelet usually 1 within the prophyll.....	5. K. myosuroides
28a. Branches of spikes unisexual; male and female spikelets born on separate spikes of same or separate Inflorescence	29
28b. Branches of spikes bisexual; male and female spikelets born on same spikes of same Inflorescence.....	30
29a. Male and female spikes borne on same inflorescence.....	33.K. rcsrivastavae
29b. Male and female spikes borne on different inflorescences.....	9. K. curvirostris
30a. Spikelets bisexual.....	31
30b. Spikelets all unisexual.....	32
31a. Culms very stout, acutely triquetrous; inflorescence branches very dense, club shaped.....	20.K. kansuensis
31b. Culms slender, not obviously triquetrous; inflorescence branches slightly spreading..... 32.K. royleana
32a. Culms curved..... 8. K. curvata
32b. Culms straight.....	33
33a. Prophylls speckled purplish.....	34
33b. Prophylls yellowish or yellowish-brown.....	35
34a. Racheola speckled purplish; nerves yellowish.....	5. K. clarkeana
34b. Racheola yellowish; nerves green	14. K. fragilis
35a. Leaves usually over 5mm wide; prophylls over 8mm long; racheola shorter than the nuts 7. K. curticeps
35b. Leaves less than 5mm wide; prophylls up to 7mm long; racheola subequaling or exceeding nuts 36
36a. Nuts elliptic..... 23. K. loliacea
36b. Nuts linear.....	37
37a. Inflorescence branches equal in length; surface of the prophyll glabrous.....	22.K. laxa
37b. Inflorescence branches unequal in length, lower branches longer than the upper; surface of the prophyll ciliate.....	38
38a. Racheola shorter than the nuts; culms slender.....	39
38b. Racheola almost exceeding the nuts; culms stout.....	40
39a. Prophylls lancolate, open from the middle, more than 4 mm long.....	17.K. harae
39b. Prophylls utriculiform, open only at apex, less than 4 mm long.....	37.K. sikkimensis
40a. Surface of the prophyll scabrid.....	41
40b. Surface of the prophyll glabrous.....	15.K. gammie
41a. Arista of the lower glume leafy, not exceeding the inflorescence.....	39.K. uncinoides

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41b. Arista of the lower glume leafy, exceeding the inflorescence.....**41.K. vibhae**

Kobresia angusta C.B.Clarke in Hook.f., Fl. Brit. India 6: 695.1894; Kük. in A. Engler, Das Pflanzenr. 38. IV.20:48.1909.Type : Sundukphoo, 12000ft, 5th June, 1884, *C.B. Clarke s.n.* (Syntype - K, barcode no.- K000794693!)

Fl.&Fr.: June – July.

Distrib.: INDIA: West Bengal [Darjeeling district (Sandakphu)], Sikkim [North Sikkim district (Thangu)]; 11000ft – 12000ft

Habitat: Dry, open, grassy mountaintop.

Etymology: The specific epithet ‘*angusta*’ (means narrow formed) refers to its narrow habit.

Voucher Specimens: INDIA: West Bengal: Sundukphoo, 12000ft, 5th June, 1884, *C.B. Clarke s.n.* (K, image, barcode no. K000794693); Sandakphu, 11800ft, 10.06. 1894, G. A. Gammie 16 (CAL!). Sikkim Himalaya:1884, *Dr. King's collectors.n.*(CAL!).

2. Kobresia brandisii C.B. Clarke ex Jana & R.C.Srivast. in *J. Japanese Botany* 89:205-208.2014.

Holotype: Chejarie (Herb. D. Brandis, presented 1880), 6000ft, *D. Brandis* 1456 (DD!); Chejarie (Herb. D. Brandis, presented 1880), 6000ft, *D. Brandis* 1456 (Isotype-DD!)

Allied to *Kobresia duthiei* C.B. Clarke but differs in having long and more slender culms, unisexual spikelets and compactly arranged male spikelets. Also allied to *K. laxa*, but lamina less flattened; culms more slender and male spikelets compactly arranged through the spike.

Perennial herbs. Culms slender, 23 – 34.5 × 0.1 – 0.15 cm (excluding inflorescence), more than twice longer than the leaves, striate, obtusely trigonous. Leaves basal, 7 – 16 × 0.1 – 0.15 cm; lamina linear, filiform. Basal sheath dark brown, fibrillose, retaining dried lamina. Spikes linear-lanceolate, 2.5 – 4 × 3 – 0.4 cm, yellowish, consist of two types of spikelets i.e, male and female. Female spikelets few, spirally arranged; male spikelets many, compactly arranged throughout the spike. Lower glumes aristate c. 2.5mm long (excluding arista), arista ca 1.5 mm long. Female spikelets oblong, c. 3.5 × 1.5mm, dark brown. Glumes of the female spikelets ovate-oblong, c.3 × 1.5 mm, slightly aristate, dark brown, midrib yellowish. Prophylls utriculiform, c.3.5 × 1.5mm, with vertical striation in the body, open from the apex. Gynoecium, c. 3.5 × 1mm; stigma bifid; ovary c. 1.5 mm long. Glumes of the male spikelets linear-blond, c. 2.5 × 1mm, light brown, margin hyaline; stamens-3.

Fl. & Fr.: July – October (?).

Habitat.: N.W.Himalaya;c. 1800m.

Distrib.: INDIA: Uttarakhand (Chejarei)

Etymology: C.B.Clarke named the species *Kobresia brandisii* to the honour of Dr. D. Brandis, German Botanist and collector of this specimen.

3. Kobresia capillifolia (Decne.) C.B. Clarke in J.Linn.Soc.Bot.20:378.1884 & in Hook.f.,Fl. Brit. India 6:697.1894; R.C.Srivast. in Hajra & Verma, Fl. Sikkim 1:222.1996;. *Elyna capillifolia* Decne. In Jacquem.,Voy.4(Bot.) :173,t.174.1840. Type: Ad nevies, supra 4000m. a kanum, ad soungnum, 11. 15. 1898, *Jacquemont s.n.* (Lectotype-P, barcode no.-P00077182!). *Kobresia capilliformis* N.A.Ivanova, Bot.Zhurn.S.S.S.R. 24:486.1939.

*Fl. & Fr.:*July – August.

Distrib.: INDIA: Sikkim [North Sikkim district (Chholhamoo, Gurudongmar, Giagong Plain)], Himachal Pradesh [Lahul & Spiti (Losar), Jammu & Kashmir [Ladakh (Lakong, Namikela, Tso-kar Lake, Tsomoriri Lake)], Uttarakhand [Nanda Devi National Park (Dharansi), Tihiri-Gurhwal (Phulaldree in Nula Valley)]; BHUTAN, PAKISTAN.

Habitat: Dry, open, grassy mountain-top; meadow in *Abies* forest; 3480 – 4800m.

Etymology: Specific epithet ‘*capillifolia*’ refers to the minute hairs on the margin of lamina.

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Voucher Specimens: INDIA: Himachal Pradesh: Lahul, 14.8.1938, N.L. Bor 112 (CAL Jammu & Kashmir: Ladakh, Namikela, 3720 – 3950 m, 21. 07. 1976, B.M. Wadhwa 58858 (BSD). Uttarakhand: Tihiri-Gurhwal, Phulaldree in Nula Valley, 11 – 12000 ft, 20th June 59, J.F. Duthie 66 (DD).

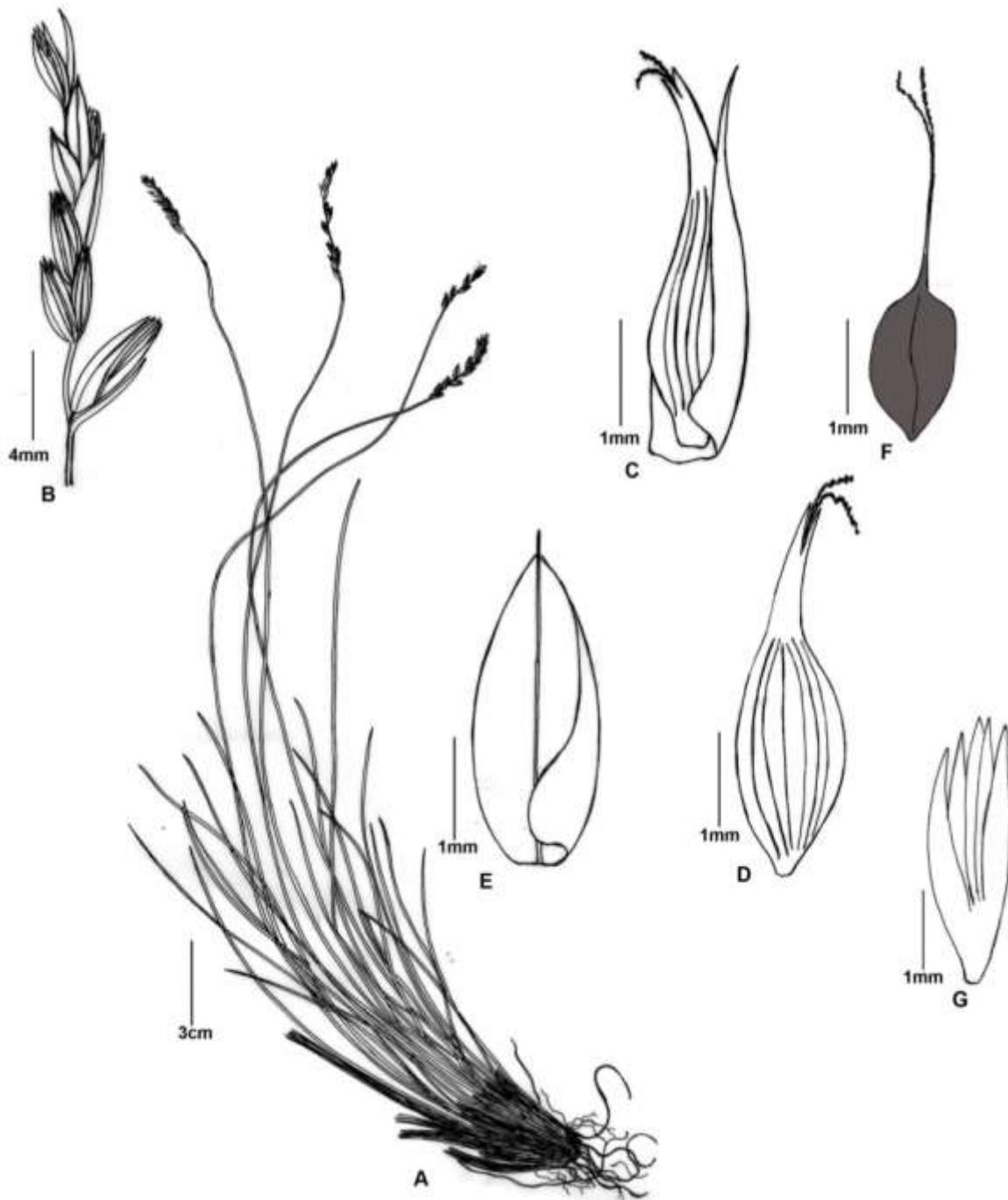


Plate III: Figures A-G: *Kobresia brandisii* C.B.Clarke ex Jana & R.C. Srivast.; A: Habit; B: Spike; C: Female spikelet; D: Prophylly with gynoecium; E: Female glume; F: Gynoecium; G: Compactly associated male spikelets

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4. Kobresia caricina Willd., Sp. Pl. 4: 206. 180. *Carex simpliciuscula* Wahlenb. in vet._ Akad. NyaHandl. Stockholm 24: 141. 1803. *Kobresiasimpliciuscula* (Wahlenb.) Mackenzie in Bull. Torr. Bot. Cl. 349: 1923.

Type: Hab. in Westmorlandia Angliae, Turners.n. (Holotype-S).

Fl. & Fr.: June – July.

Distrib.: INDIA: Jammu & Kashmir (Kagnag Range)

Habitat: On dry stony slopes at an altitude of 12 – 13000ft.

Voucher Specimens : INDIA: Jammu & Kashmir: Kagnag Range, 12 – 13000ft, May 1892, J.F. Duthie 11041 (CAL).

Notes: *Kobresia caricina* Willd. is unique in having pyramidal shaped spikes and slightly curved prophylls.

5. Kobresia cercostachys (Franch.) C.B. Clarke in J. Linn. Soc. 36: 267. 1903 p.p. *Carex cercostachys* Franch. in Bull. Soc. Philom. Paris 8 (7): 27. 1895 & in Nouv. Arch. Mus. Paris 3(8): 191. 1896. Type: YUNNAN: Yengtzhay, 3500 m., 7th August, 1888, Delavay 3403 (iso-syntype K!, E!). *Kobresia stiebritziana* Hand.-Mazz., Anzeiger der Akademie der Wissenschaften in Wien. Mathematisch-naturwissenschaftliche Klasse. Wien 57: 54. 1920. Type: Prov. North- Western Yunnan, at the side western mount Pipeun, 4400 – 4650 m., Handel-Mazzetti 4734 (Isotype- E, image, barcode no.- E00271735!). *Kobresia nepalensis* var. *stiebritziana* (Hand.-Mazz.) R.C.Srivast., Novon 8: 203. 1998.

Fl. & Fr.: July – October.

Distrib.: INDIA: Sikkim [North Sikkim district (Yumshondong, above Yumthang Sebu-La), East Sikkim district (Kupup)]; CHINA, NEPAL.

Habitat: Grassy slopes among shrubs on rocks, alpine meadows; 3600 – 5000m.

Etymology: The specific epithet ‘cercostachys’ refers to its horn like spikes.

Voucher Specimens :INDIA: North Sikkim district, East side of Lasha- Chu, bellow Sebu-La, 4440m., 21. 07.1996, G.P. Sinha & D.G. Long & al. 18227 (BSHC).

6. Kobresia clarkeana (Kük.) Kük. in A. Engler, Das Pflanzenr. 38. IV. 20: 48. 1909; R.C.Srivast. in Hajra & Verma, Fl. Sikkim 1: 222.1996. *Schoenoxiphium clarkeanum* Kük. in Bull. Herb Boiss. 2(4):49.1904. Type: Sikkim Himalaya, Cho-le-la, 1874, Dr. King's native Collector. s.n. (Lectotype CAL!, Isolectotype: K!).

Fl. & Fr.: June – July.

Distrib.: INDIA : Sikkim [North Sikkim district (Cho-le-la), West Sikkim district]; BHUTAN.

Habitat: Dry rocky slopes on damp shady place.

Etymology: George Küenthal named this species in the honour of C.B. Clarke.

Voucher Specimens :INDIA: Sikkim, Cho-le-la, 1874, Dr. King's native Collector s.n.; Chumbi & Phari, July 1879, Dungboo s.n. (CAL, accession no. 513651 p.p.!, 513652!, 513655!); West Sikkim district, Hille R.F., 11. 05. 1995, P.Singh & S.K. Rai 17033 (BSHC).

Notes: During present study 3 syntypes were found in CAL and one syntype in K herbaria. Authors have chosen Lectotype of CAL specimen and reinstated *K. clarkeana* as a distinct species.

7. Kobresia curticeps (C.B. Clarke) Kük. in A. Engler, Das Pflanzenr. 38.IV. 20:47.1909; R.C.Srivast. in Hajra & Verma, Fl. Sikkim 1:223.1996. *Carex curticeps* C.B. Clarke in Hook.f., Fl. Brit. India 6:729.1894. Type: Sikkim Himalaya, Singalelah, 10 – 12000ft, 25th October, 1875, C.B. Clarke 25644 (Lectotype K, barcode no. K000794670!).

Fl. & Fr.: June – October.

Distrib.: INDIA: Arunachal Pradesh [Kameng district].Sikkim [East Sikkim district (Kyanglasha, Changu, Nathu-la), West Sikkim district (Dzongri, Gnatong, Chakung Chu,)].West Bengal [Darjeeling district (Sandakphu, Singalellah)]; BHUTAN, CHINA.

Habitat: Open stony or sandy slopes in damp conifer forest; 2740 – 4100m.

Voucher Specimens: INDIA: Sikkim, Chakung Chu, 12000ft, 16.07.10, W.W. Smith 3501(CAL).

Notes: *K. curticeps* (C.B.Clarke) Kük. apparently looks like *K. laxa* Nees, but differs in having loosely paniculate inflorescence, large and lower aristate glume sometime exceeding the inflorescence. During

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the course of study authors identified 2 syntypes in K herbarium and choose one of them (barcode no. K000794670) as Lectotype.

8. Kobresia curvata (Boott) C.B. Clarke in Kew Bull. Addit. Ser. 8: 68. 1908; R.C.Srivast. in Hajra & Verma, Fl. Sikkim 1: 223.1996. *Carex curvata* Boott, Illustr. 1:2, t.5. 1858. Type: Sikkim, 12 – 14000ft, *J.D.Hookers.n.* (Lectotype- K !, bottom right hand specimen. Isolectotype- CAL!).

Fl. & Fr.: July – August.

Distrib.: INDIA: Sikkim [East Sikkim district (Changu, Kupup, Nathu-La, Kyangos-La, Katao), North Sikkim district (Lachung, Tsomgo, Thangu, Lachen)], West Bengal (Darjeeling district).

Habitat: Open moist grassy damp soil; 3600 – 4400m.

Etymology: The specific epithet name ‘*curvata*’ refers its curved culms.

Voucher Specimens: INDIA: West Bengal, Darjeeling district, A.B.Chowdhury 53(CAL); Sikkim: North Sikkim district, Kala Pahar, Katio, 28. 07.1989, N.R.Mondal 10133 (BSHC); North Sikkim district, Thangu, 17. 08.1989, R.C.Srivastava 12289 (BSHC); North Sikkim district, Thangu, 17.08.1989, R.C.Srivastava 10206 (BSHC); North Sikkim district, Lachen, 2550m., 07. 06.1999, D.Maiy 21327 (BSHC).

Notes: Noltie (1993) mentioned that the inflorescence branch of type specimens of *K. curvata* C.B. Clarke and *K. fragilis* C.B. Clarke are similar (without mentioning any micro-morphological characters), and mentioned that except the curvature of the culm of *K. curvata*, it looks like the type of *K. fragilis* and the curvature of the stem may be due to the grazing and trampling’ and that’s why he put *K. curvata* C.B. Clarke as a synonym of *K. fragilis* C.B. Clarke. Srivastava (1996) treated *Kobresia curvata* as a distinct species in ‘Flora of Sikkim’. Present study revealed that though the external appearance of these taxa shows some resemblance, but morphologically *K. curvata* is a distinct species having curved culm, long exserted and ovate-oblong yellowish prophyll without any purplish spot.

9. Kobresia curvirostris (C.B. Clarke) C.B. Clarke in Hook.f., Fl. Brit. India 6: 699. 1894. *Hemicarex curvirostris* C.B. Clarke in J. Linn. Soc. 20: 384.1883.

Type: Sikkim, *J.D. Hooker s.n.* (Syntype -K!barcode no.- K000794672).

Fl. & Fr.: July – September.

Habitat.: Wet rocky slopes and wet mossy cliffs; 3290 – 3960m.

Distrib.: INDIA: Sikkim [North Sikkim district (Thangu)], Uttarakhand [Tehri Garhwal (Kumaon); BHUTAN].

Etymology: The specific epithet ‘*curvirostris*’ (means curved beak) refers to the curved beak of the nut.

Voucher Specimens: INDIA: Sikkim, J.D. Hookers.n. (K!barcode no.- K000794672). Uttarakhand, Kumaon, 3000m., 07.01.1972, C.M.Arora 49707 (BSD).

Notes: Extremely Rare

10. Kobresia duthiei C.B. Clarke in Hook.f., Fl. Brit. India 6: 697. 1894; R.C.Srivast. in Hajra & Verma, Fl. Sikkim 1:23.1996 Type: Kumaun, Palang Gadh, Byans, 11 – 12,000ft, 20. July. 1886, J.F.Duthie 6093 (Lectotype CAL! barcode no.- CAL0000001899).

Fl. & Fr.: August – September.

Habitat: Bare mossy peat; wet, open flushes; exposed, dry, rocky ridges; grassy slopes; 3920 – 4600m.

Distrib.: INDIA: Himachal Pradesh (Lahul & Spiti district), Sikkim [East Sikkim district (Nathu-La, Jelep La), West Sikkim district (Bikbari, Dzongri to Perk Chu, Thangshing to Lam Pokhri, Jemathang to Goecha La), North Sikkim district (Yumsondong)], Uttarakhand [Tehri- Gurhwal district (Kumaon, Lebung Glacier, Palang Gadh, Dumphang, Sahastra Tal, Rishingang Valley, Kailu Vinayak, Bajmora) Nanda Devi Biosphere Reserve (Bhojgara to Ramani); BHUTAN, NEPAL, PAKISTAN].

Etymology: C.B. Clarke named this species in the honour of Sir John Firminger Duthie, a British botanist and explorer.

Voucher Specimens: INDIA: Himachal Pradesh; Lahul& Spiti district, 12000 ft, 26.05.1941, N.L.Bor 12638 (DD); Uttarakhand: Kumaun, near the Lebung glacier, 14 –15,000 ft, 03. 08. 1886, J.F.Duthie 6094(syntype K!, barcode no.- K000794660, Image).

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Notes: *K. duthiei* C.B. Clarke resembles to *K. bellardii* (All.) Degl. ex Loisl, (= *K. myosuroides* (Vill.) Fiori) but leaves are flat in former and filiform in later. It is widely distributed in Eastern, Western and Central Himalaya. Generally plants have long slender culm and much shorter leaves, but some dwarf forms were also observed during the field survey in North Sikkim district where leaves are much flatter and longer than the culm. During the course of study, syntypes deposited in CAL, K, DD herbaria were examined and Lectotype was chosen from CAL specimen.

11. *Kobresiae senbeckii* (Kunth) Noltie in Edinb. J. Bot. 50: 43. 1993. *Carex esenbeckii* Kunth, Enum. Pl. 2:522. 1837, non Boott 1845. *K. trinervis* (Nees) Boeckeler in Linnaea 39:4. 1875 in nota; C.B. Clarke in Hook.f., Fl. Brit. India 6: 695. 1894 & in J. Linn. Soc. 36 : 269. 1903. *Carex trinervis* Nees in Wight, Contrib. Bot. India 120. 1834, non Degland. *Kobresia foliosa* C.B. Clarke in Hook.f., Fl. Brit. India 6: 696. 1894.

Type: Nepal, Royle 138 p.p (Isotype LIV!).

Fl. & Fr.: May – October.

Habitat: Wet rocks and cliff-ledges; grazed slopes; lakes shore; 3500 – 4270m.

Distrib.: **INDIA: Himachal Pradesh** [Lahul & Spiti district (Rhotang Pass), Sikkim [North Sikkim district (Lachen, Lachung, Namdee, Sherabthang), East Sikkim district (Changu, Lhonak, Tsomgo, Tukula, Nathu-La)], West Bengal [Darjeeling district (Sandakphu, Phalut Top, Singalelah, Tonglu Top)]

BHUTAN, CHINA, NEPAL.

Etymology: The specific epithet ‘esenbeckii’ was provided by Kunth in the honour of Nees von Esenbeck, a German naturephilosopher, physician and botanist.

Voucher Specimens: **INDIA: Himachal Pradesh:** Rhotang pass, 3800m., H.J. Chowdhery & party 75977 (BSD); **Sikkim**, Josar, Chakung Chu, 14000ft, 26.10.1910, Ribu & Rhomoo 4494 (CAL).

Notes: Nees (1834) described *Carex trinervis* Nees being ignorant of the publication of *Carex trinervis* Degland (1807). Thus *Carex trinervis* Nees is an illegitimate homonym of *C. trinervis* Degland. Kunth (1837) provided a new name *Carex esenbeckii* for *C. trinervis* Nees based on same type. Boeckeler (1875) published a new name *Kobresia trinervis* Boeckeler, it's a illegitimate name because Boeckeler does not use earliest available legitimate name i.e, *Carex esenbeckii* Kunth rather he use illegitimate *Carex trinervis* to made a new combination. Noltie (1991) correctly made a new combination *Kobresia esenbeckii* (Kunth) Noltie and put *C. esenbeckii* as a basionym. Type specimen deposited in LIV herbarium, is the male plant of *K. esenbeckii*. Field study and herbarium consultation revealed that it is dioecious plant rather than the *K. hookeri* Boeckeler and *K. seticulmis* Boeckeler, is monoecious plant and leaves of *K. esenbeckii* are more flat than the other two.

12. *Kobresia fissiglumis* C.B. Clarke in Hook.f., Fl. Brit. India 6:696.1894. *Kobresia esenbeckii* var. *fissiglumis* (C.B. Clarke) Noltie, Edinburgh J. Bot. 50:43.1993.

Type: Western Nepal, Nampa Gadh, 12 – 13,000 ft, 25. 07. 1886, J.F. Duthie 6092 (Lectotype, DD).

Fl. & Fr.: July – August.

Habitat: On rocks and cliff-ledges; 4250 – 4300m.

Distrib.: **INDIA: Sikkim, Uttarakhand** [Kumaon district (Pailang Gadh)]; **BHUTAN, CHINA, NEPAL.**

Etymology: Specific epithet ‘fissiglumis’ (means the splitted glume) is derived from its splitted male glume.

Voucher Specimens: **INDIA: Uttarakhand:** Kumaon, Pailang Gadh, Byans, 11 – 12000ft, 21.07.1886. J.F. Duthie 6092 (CAL); Kumaon, Pailang Gadh, Byans, 11 – 12000ft, 21.07.1886. J.F. Duthie 6092 (DD!).

Notes: *Kobresia fissiglumis* C.B. Clarke is a dioecious plant. Noltie (1993) merged it into the variety of *K. esenbeckii*, but he again treated it as a distinct species (Noltie, 2010). Present studies revealed that it is morphologically very different; culm of *K. fissiglumis* is much longer and prophyll is very short, open from the base; style is exerted from the prophyll. Hence, treated here as a distinct species.

13. *Kobreisa filicina* (C.B. Clarke) C.B. Clarke in Hook.f., Fl. Brit. India 6:696.1894. *Hemicarex filicina* C.B. Clarke in J. Linn. Soc. 20: 384. 1884. Type: Himal. Bor. Occ, Simla, T. Thomson s.n. (syntype K!, barcode no.-K000794696). *Kobresia filicina* var. *subfilicinoides* P.C.Li in Acta. Phytotax. Sin. 37

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(2):155.1999.Type: China, Yunnan: Zhenkang, in jugo nicis, in partis repetribus declivibus, 3rd August, 1939, T.T.Yü 17145 (Holotype-PE).

Fl. & Fr.: August.

Habitat: Open rocky grass fields; 2700 – 3000m.

Distrib.: **INDIA: Himachal Pradesh** (Shimla), **Uttarakhand** (Kumaon).

Etymology: Species name ‘filicina’ refers to its fern like inflorescence.

Voucher Specimens: INDIA: Himachal Pradesh: Simla, *T.Thomsons.n.* (syntype-K, barcode no.- K000794696); Uttarakhand: Kumaun, Ralau valley, 9 – 10,000 ft, 21. 08. 1884, *J.F.Duthie* 3463 (syntype K!, barcode no.-K000794695); Kumaun, Ralau valley, 9 – 10,000ft, 21. 08. 1884 *J.F.Duthie* 3463 (syntype DD!).

Notes: *Kobresia filicina*(C.B.Clarke) C.B. Clarke seems to quite rare; only one specimen could be seen in DD herbarium. Culm is very much slender with filiform leaves and spikes consists of loosely arranged spikelets.

14. *Kobresia fragilis* C.B. Clarke in J. Linn. Soc. 36: 267. 1903. Type: Tibet Orientali, Tongolo, Kiala, *J.A. Soulle* 731 (Holotype-K, Isotype- CAL!, acc.no.- 512696). *Schoenoxiphium caricinum* Kük. in Bull. Herb. Boiss. 4(2) : 49. 1904.

Fl. & Fr.: July – September.

Distrib.: **INDIA : Sikkim** [East Sikkim district (Tsomgo, Changu-Lake, Karponang, Kyanglasha, Nathu-La, Mon Lapcha,) West Sikkim district (Jamlinghang to Bikbari, Dzongri), North Sikkim district (Thangu, Lachen, Yumthang); **BHUTAN, NEPAL, CHINA**.

Habitat: Moist slopes on alpine forest at an altitude of; 3500 – 4000m.

Voucher Specimen: **Sikkim**, North Sikkim district, Changu Lake, 3640 m, 08. 07. 1996, *G.P.Sinha & D.G.Long & al.* 17737 (BSHC).

Notes: *K. curvata* (Boott) C.B. Clarkediffers from the *K. fragilis* C.B. Clarke in having curved culm and inflorescence, racheola exserted from the prophyll. External appearance of the taxa is like the *K. curvata*, but microscopic study proved its clear distinction as a separate taxon. C.B. Clarke in the protologue mentioned the “ Szechuen: Tonglo in Kiala, *Soulle* 731 (Herb Kew)”, that means holotype is deposited in K. One specimen bearing same collection number is deposited in CAL, it is the Isotype. Critical studies of this specimen in comparision to the Isolectotype of *K. curvata* in CAL revealed that it is a distinct taxon.

15. *Kobresia gammie* C.B. Clarke in Kew Bull. Addit. Ser. 8. 68. 1908;; R.C.Srivast. in Hajra & Verma, Fl. Sikkim 1: 224. 1996. Type: Sikkim Himalaya, 1892, *G.A.Gammie s.n.* (Isotype- CAL!, barcode no.- CAL0000001896). *K.williamsii* T. Koyama in Bot. Mag. Tokyo 86:279, t.3.1977. Type: Nepal, above seng talola, 13000ft, 26.06.1954, Stainton, Sykes & Williams 3255 (Holotype-BM, image, barcode no. 000058173BM!).

Fl. & Fr.:July – August.

Distrib.: **INDIA: Sikkim** [West Sikkim district (Dzongri to Gamothang, Jamlinghang, Bikbari, Kalijhar), North Sikkim district(Mon Lapcha, Thangsing to Lam Pokhri)]; **BHUTAN, CHINA**.

Habitat.: Damp humus-rich slope in *Abies* forest; damp grassy water lock rocky soil; 3660 – 4420m.

Etymology: The species name in the honour of George Alexander Gammie, a plant explorer

Voucher Specimens: INDIA: Sikkim,1892, *G.A.Gammie s.n.* (CAL); Dzongri, 14000 ft, 12. 08. 1913, *G.H.Cave* 962 (CAL); West Sikkim, Kalijhar, Chewabhanjwang, 19.06.2003, *S.K.Rai & S.Pradhan* 25052 (BSHC).

Notes: *Kobresia gammie* was described by C.B. Clarke (1908) from Gammie’s specimen collected from Sikkim. It is also reported from China. Koyama (1977) published a new taxon *K. williamsii* T. Koyama, but it is heterotypic synonym of former. Inflorescence is similar to *K. laxa* Nees alsobut female glumes, prophylls and gynoecium are larger then the *K.laxa*.

16. *Kobresia gandakiensis* Rajbh. & H.Ohba, Bull. Univ. Mus. Univ. Tokyo 34: 132. 1991;Jana & Srivastava in Nelumbo 54: 273. 2012.

Holotype:Nepal, Kabre, Kali Gandaki Valley, 6500ft, June 13,1954, *Stainton, Sykes & Williams* no. 5744 (TI!).

Research Article

Fl. & Fr.: July

Distrib.: **INDIA** : Himachal Pradesh [Lahul & Spiti (Koksar)], **Sikkim** [East Sikkim district (Kupup)]; **NEPAL**

Etymology: This species is named after the type locality viz., Kali Gandaki Valley of Nepal from which it was first record.

Voucher Specimen: **INDIA:** **Sikkim**, East Sikkim, Kupup, Singu Lake, 4050m., 17. 09.1998, G.P.Sinha & D.G.Long 20453 (BSHC!).

Notes: New Record from India.

17. Kobresia harae Rajbh. & H.Ohba, J.Jap.Bot. 62: 193.1987 & in Himalayan Plant 2: 140.1991; Jana & al. in JoTT 4 (6): 2644 – 2666. Type:Nepal, Janakpur Zone, Ramechhap District, Serdingma-Dubikharka, 3400–3720m, 7th July 1985, Ohba & al. 8570278 (Holotype TI!).

Fl. & Fr.: July

Distrib.: **INDIA:** **Sikkim** [North Sikkim district (Yumthang)]; **Himachal Pradesh;** **NEPAL.**

Etymology: The species is named on the honour of Hiroshi Hara, a Japanese Botanist.

Voucher Specimens: INDIA: Sikkim: North Sikkim district, Yumthang, 3520m., 13.07.1996, G.P.Sinha & D.G.Long 17821 (BSHC!); **Himachal Pradesh**, Koksar, 3100m., Sept. 1984, Bipin Balodi & Surendra Singh 75703 (BSD).

Notes: It is allied to *K. laxa* Nees but lamina is not flattened, inflorescence is much linear and shorter (much broader in *K. laxa*). Rachella of *K. harae* is much shorter than the *K. laxa*.

18. Kobresia hookeri Boeckeler in Linnaea 39: 4.1874; C.B. Clarke in Hook.f., Fl. Brit. India 6:695.1894; Chowdhury & Wadhwa, Flora of Himachal Pradesh 3: 752. 1984. *Hemicarex hookeri* C.B. Clarke in J. Linn. Soc. 20: 383.1883. Type: Sikkim, 12000ft, J.D. Hooker s.n. (Iso-lectotype CAL, lectotype K!, barcode no.- K000794690).

Fl. & Fr.: July – August.

Distrib.: **INDIA:** **Uttarakhand** [Tehri-Garhwal, Nanda Devi National Park (Bhojgara to Ramani)], Sikkim [North Sikkim district (Lachen)].

Habitat: on hill slopes; 3000 – 3500m.

Etymology: The species is named in the honour of Sir J.D.Hooker, a British botanist and explorer.

Voucher Specimens: **INDIA:** **Uttarakhand:** Kumaon, Khalpatal, 3000m., 13. 08.1972, C.M.Arora 49935(CAL). **Sikkim**, 12000ft, J.D. Hooker s.n. (Iso-lectotype CAL).

Notes: Noltie (1991) commented that the holotype of *K. hookeri* Boeckeler in Berlin herbaria (B) is destroyed and he choose Lectotype of the name based on J.D.Hooker's specimens collected from Sikkim (Sikkim, Lachen, 12000ft, 20. 06. 1849 J.D. Hooker housed in K (barcode no. K000794690). According to him proposed Lectotype of *K. hookeri* showing a gradation of states from almost all male spikes to predominantly female. He merged *Kobresia hookeri* Boeckeler under the the *K. esenbeckii* (Kunth) Noltie. Microscopic examination of Iso-lectotype of the *K. hookeri* (housed in CAL) revealed that spike is androgynous, lower spikelets are female and terminal one male; prophylls open from apex to middle.

In *K. esenbeckii* plant is dioecious i.e, male and female spikes are born on separate plants and quite distinct from *K. hookeri*. It treated here as as a distinct taxon is *K. hookeri* Boeckeler.

19. Kobresia humilis (C.A. Mey. ex Trautv.) Serg. in V.L.Komarov, Fl. URSS 3:111.1935. *Elyna humilis* C.A.Mey apud Trautv. in Acta Horti Petrop. 1:21.1871. *Kobresia persica* Kük. & Bornm. in Oest. Bot. Z. 47:133, t.2.1897. Type: Sougonii, September 1870., Skrenek s.n. (Ex Hebario Horti Petropolitani) (Syntype K, barcode no. K000794698).

Fl.&Fr.: Aug. – September.

Distrib.: **INDIA:** **Himachal Pradesh** [Lahul & Spiti (Bar lacha La, Koksar)], **Sikkim** [North Sikkim district (Lachung, Singhba Rhododendron Sanctuary, Yumthang)]; **CHINA.**

Habitat: Growing in water logged muddy soil in associated with member of rushes like *Juncus* and grasses; 3500-4800m.

Voucher Specimen: Himachal Pradesh: Lahul, Baralacha La, 4800m., 24.08.1970, U.C.Bhattacharyya 40828 (BSD).

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20. Kobresia kanaii Rajbh. & H.Ohba, Bull. Univ. Mus.Univ. Tokyo 34: 135.1991. Type:Nepal: Janakpur Zone, Ramechhap Distr., Around Jata Pokhari, 4400 m., July 17, 1985, H.Ohba, T. Kikuchi, M. Wakabayashi, M.Suzuki, N. Kurosaki, K.R. Rajbhandari & S.K. Wu60410, (Holotype TI!)

Fl. & Fr.: June – Aug.

Distrib.: INDIA: Sikkim[East Sikkim district (Kupup)]; NEPAL

Etymology: This species is named in the honour of H. Kanai.

Voucher Specimen: INDIA: Sikkim: East Sikkim district, Kupup, 4115 m., N 27° 18. 908' E 088° 50. 158', 28th July,2012, Bikash Jana53167 (CAL).

Notes: Known so far from Nepal only. **New Record for India.**

21. Kobresia kansuensis Kük., Acta Horti Gothob. 5:38. 1930; Type: CHINA, China boreali occidentalis, Kansu Province, T'ao River basin', Swampy meadow of mountains, West of Adjuan, 3500m., October, 1925, J.F. Rock 13714 (Isotype- A!, E!). *Kobresia pseuduncinoides* Noltie, Edinburgh J. Bot. 50: 47. 1993 & Fl. Bhutan3: 337. 1994. Type: Bhutan, Upper Kulong Chu district, Singbe, Me La, 12500ft, 11. 06.1949, Ludlow, Sherriff & Hicks 20725 (Holotype-BM!).

Fl. & Fr.: June – July.

Distrib.: INDIA: Sikkim [North Sikkim district (Thila)]; BHUTAN, CHINA, NEPAL.

Etymology: The species is named after its type locality 'Kansu' province of China.

Voucher Specimen: INDIA: Sikkim: North Sikkim district, Thila, 4000 m., 13. 07. 2000, D. Maity 23093 (BSHC).

22. Kobresia laxa Nees in Wight, Contr. Bot. Ind. 119. 1834; C.B. Clarke in Hook.f, Fl. Brit. India 6: 698. 1894. Type: N.W. India, *H. Royle s.n.*(syntype K! barcode no.- K000794674). *Hemicarex laxa* (Nees) Benth. J.Linn.Soc. Bot. 18:367.1881.*Elyna laxa* (Nees) Kunth, Enum. Pl. 2:534.1837.*K. pseudolaxa*C.B. Clarke in J. Linn. Soc. 20: 381.1883;

Fl. & Fr.: June – July.

Habitat: Rocky slopes; 3353 – 3658m.

Distrib.: INDIA: Himachal Pradesh (Lahul & Spiti), Jammu & Kashmir, Sikkim[North Sikkim district (Lachen)], Uttarakhand (Tehri Gurhwal,Chamoli District, Kumaun), West Bengal (Darjeeling); BHUTAN, CHINA, NEPAL, PAKISTAN

Etymology: The specific epithet laxa is derived from its lax inflorescence or loosely arranged spike.

Voucher Specimens: INDIA: **Himachal Pradesh:** Lahul, 10500ft, 03. 07.1938, N.L.Bor 12298 (CAL); **Jammu & Kashmir:** Sind Valley 7 – 8000ft, 25. 06. 1892, J.F.Duthie 11479 (CAL). **Uttarakhand:** Chamoli Dist., Hemkund, 14.9.1982, N. Juyal 59190 (BSD). **Sikkim**, North Sikkim district, Glacial valley above Yakche, 3100m., 15. 07. 1996, G.P.Sinha & D.G.long & al. 17876 (BSHC). **West Bengal:** Darjeeling, Sandakphu,11917ft, 27.06.1960, A.B.Chowdhury 3 (CAL).

Notes: *Kobresia laxa* Nees occurs throughout Himalaya. It's unique identifying feature is its lax inflorescence and sub-basal leaves with longer racheola.

23. Kobresia loliacea F.T.Wang & Tang ex P.C. Li in Acta Bot. Yunnan. 12: 13 – 14.1909. Holotype: CHINA, Yunnan, Yuanbao, Daling, 3200 m, 20. 07. 1983, *Qinghai-Xizang* 12065 (PE!)

Fl. & Fr.: July – September.

Distrib.: INDIA: Arunachal Pradesh (Upper Siang dist.); CHINA

Voucher Specimens : INDIA: Arunachal Pradesh: Upper Siang dist., Kanebang to Pao Camp, 3000m., 09.09.2009, Manas Bhaumik13287 (CAL).

Notes: **New Records for India.**

24. Kobresia macrantha Boeckeler, Cyper. Nov. 1: 39. 1888; C.B. Clarke in Hook.f., Fl. Brit. India 6: 699. 1894. p.p.; Karthikeyan & al. Fl. Indicae. Enumerat. Monocot. 58. 1989; Murti, Flora of Cold Desert of Western Himalaya 1: 225. 2001. *Kobresia nudicarpa* (Y.C.Yang) S.R. Zhang, Acta Phytotax. Sin. 33: 160. 1978. Type: Tibet, Liagtsung to panamik, 24thJuly 1856, Schlaginweit s.n. (BM!, barcode no.- BM000058375).

Fl. & Fr.: June – August.

Research Article

Distrib.: INDIA : Jammu & Kashmir [Ladakh (Khardungla)], Himachal Pradesh [Lahul & Spiti (Koksar)]; NEPAL, PAKISTAN, TIBET.

Habitat: Growing copiously in sandy soil.

Etymology: Specific epithet ‘*macrantha*’ refers to its large anthers that are exserted from the male glume.

Voucher Specimens : INDIA: Jammu & Kashmir: Ladakh, Khardungla, 16th August, P.K.Hajra 74120 (BSD); Himachal Pradesh: Lahul & Spiti, Koksar, 3958 m. N 32°24' 45.6'', E 077°14' 24.2'', 19. 07. 2013, *Bikash Jana* 53176 (CAL).

Notes: Plants are very short with leaves equaling or rarely shorter than the culm. Its bifid stigma is a unique character.

25. *Kobresia myosuroides* (Vill.) Fiori in A.Fiori & al., Fl. Italia 1: 125. 1896. *Kobresia bellardii* (All.) Degl. ex Loisel, Fl.Gall. 2:626.1807. *Carex bellardii* All., Fl.Pedem.2:264,t.92,f.2.1785. *Kobresia filiformis* Dewey in Amer. J. Sci. 1.29:253,t.z, f. 85. 1836. *Elyna spicata* Schrad., Fl. germ. 1:155.1806; Kunth, Enum. Pl. 2:533. 1837; Reichb., Icon. 8: 2., t. xcii, f. 520.1846; Boiss., Fl. Orient. 5: 394. 1896 p.p. *E. bellardii* K. Koch in Linnaea 21: 616. 1848; *E. filiformis* Steud., Synops. Cyper. 245. 1855. *Carex myosuroides* Vill., Hist. pl. Dauph. 2: 194, t. 6. 1787. non Lowe. *Carex hermaphrodita* J.F. Gmel., Syst. 2: 139. 1791, non Jacq. *Carex affinis* R.Br. in Richards., App. Narr. Frankl. Voy. 763. 1823.

Fl. & Fr.: May–September.

Distrib.: Western & Central Himalaya: INDIA: Uttarakhand (Kumaon); CHINA.

Habitat: On rocky slopes; moist grass fields.

Voucher Specimens : INDIA: Jammu & Kashmir: Ladakh, Tsokar Lake, 24. 07. 2013, 4432m, N33°13'46.4'', E 078°21' 18.9'', *Bikash Jana* 53182 (CAL); Uttarakhand: Kumaon, Martholibugyal, 4200 – 5600m., 15th June 1958, Dr. T.A.Rao 6844 (BSD).

26. *Kobresia nepalensis* (Nees) KüK. in A. Engler, Das Pflanzenr. 38.IV.20:40.1909; C.B. Clarke in Hook.f., Fl. Brit. India 6:712.1894.p.p.; R.C.Srivast. in Hajra & Verma, Fl. Sikkim 1:224 – 225.1996; Type: Nepal, Royle 147 pp and 309 (Syntype, K!). *Uncinia nepalensis* Nees in Wight, Contrib. Bot. Ind. 129. 1834. *Carex linearis* Boott, Illustr.1:51,t.136. 1858; Boeckeler in Linnaea 39:36. 1875; C.B. Clarke in Hook.f., Fl.Brit. India 6:712.1894. *Hemicarex linearis* Benth., J. Linn. Soc., Bot.18:367.1881.

Fl. & Fr.: June – October.

Distrib.: INDIA: Himachal Pradesh [Lahul & Spiti (Rhotang pass, Koksar)], Sikkim [North Sikkim district (Lachen, Chakung Chu), East Sikkim district (Nathu La)], Uttarakhand [Kumaon (Tejum-haya, Jamunotri), Chamoli district (NandaDevi Biosphere Reserve), Tehri- Garhwal (Kailu-Vinayak)]; BHUTAN, CHINA, NEPAL, PAKISTAN.

Habitat: Dry grassy slopes; exposed rocky and stony ridges; moraines; on mossy rocks and damp cliff-ledges; 3800-4200m.

Etymology: The species is named after its type locality in Nepal.

Voucher Specimens : INDIA: Himachal Pradesh: Chanchal Pass, 3750 m, 23rd July 1965, N.C.Nair 36138(BSD); Sikkim, Chakung Chu, 14000ft, 01. 08. 1910, W.W.Smith 4009 (CAL); Uttarakhand: Kumaon, Tejum-haya, 4200m., 10. 08.1972, C.M.Arora 49825(CAL).

27. *Kobresia nepalensis* var. *elachista* (C.B. Clarke) Kük. in A.Engler, Das Pflanzenr., 38. IV. 20: 40. 1909. Type: West Nepal, J.F.Duthie 6091 (Syntype DD!). *Carex linearis* var. *elachista* C.B. Clarke in Hook. F., Fl. Brit. India 6:713. 1894.

Fl. & Fr.: June – July.

Distrib.: INDIA: Sikkim [East Sikkim district (Changu)]; BHUTAN, CHINA, NEPAL.

Voucher Specimens: INDIA: Sikkim, Changu, 12000ft, June 1910, W.W.Smith 3247 (CAL).

Notes: It differs from *K. nepalensis* (Nee) Kük.var. *nepalensis* in having its dwarf formation, female glumes having a groove at lower portion, prophylls linear- oblong shaped and shorter racheola..

28. *Kobresia nitens* C.B. Clarke in J. Linn. Soc. Bot. 20: 379, t. 30, f. 7. 1883 & in Hook.f., Fl. Brit. India 6: 697. 1894. Type: Kashmir, Buyans, 14500ft, 1st August, 1876, C.B. Clarke 29840 (Syntype K! barcode no. K000794652); Kashmir, Buzil, 12000ft, 28th July, 1876, C.B. Clarke 29697 (Syntype K! barcode no. K000794653).

Research Article

Fl. & Fr.:July – Aug.

Distrib.: **INDIA : Jammu & Kashmir**: [Ladakh (TsokarLake)], HimachalPradesh [Lahul & Spiti (Kailang, Losar)], **Uttarakhand**: [Tehri Gurhwal (Dudu glacier, Phuladree valley), Kumaon (Sebung Pass)]; **CHINA, NEPAL, PAKISTAN**.

Etymology: The specific epithet ‘*nitens*’ refers to its dark and shiny inflorescence.

Voucher Specimens: INDIA : **Himachal Pradesh**: Lahul, Kailing- Ka-Jot, 06. 07.1938, N.L.Bor 69(CAL); **Uttarakhand**: Kumaun, Sebung Pass, *J.F.Duthie* 3462(CAL); Tihri- Gurhwal, Dudu glacier moraine below Srikanta, 14 –15000ft, 10th August1930, *J.F.Duthie* 372(CAL); **Jammu & Kashmir**: Gilgit, Niltar Valley,10 – 11000ft, 04. 08.1892, *J.F.Duthie* (CAL, acc no. 512613).

Notes: *K. nitens* is very common in Western and Central Himalaya but rare in Eastern Himalaya.

29. Kobresia paramjitii Jana, H.J.Noltie,R.C. Srivast & Ambarish Mukherjee *sp. nova*.

Holotype: India:Sikkim, North Sikkim district, North slopes above Sebu-La, 4750 m, 23. 07. 1996, G.P.Sinha & D.G.Long & al. 18266 (Holotype-BSHC).

Allied to *Kobresia cuneata* Kük. but differs in having more compact basal sheath, acutely trigonous culm, more flattened leaves lamina, much longer and lanceolate spike, smaller glume with broadly hyaline margin.

Perennial herbs. Rhizome thick, *c.3.5 × 2 cm*, woody. Culms erect, *c.19.5 × 0.25 cm*(excluding inflorescence), acutely trigonous, striate. Leaves basal, *26.5 – 30.5 × 0.4 – 0.5 cm*, exceeding the culm; lamina flat, midrib not distinct abaxially, margin slightly serrate. Basal sheath prominent, dark brown, fibrillose, not retaining dried lamina. Inflorescence single dense spike, lanceolate, *c.7.2 × 0.6 cm*, dark brown. Spikes consist of 3 types of spikelets, lower bisexual, lateral female and terminal male spikelets. Glumes of the lower spikelets aristate, *c.15 × 4.5 mm*, margin brownish in colour, midvein greenish yellow. Glumes of the female and bisexual spikelets ovate-oblong, *4 – 4.5 × 2 mm*, margin broadly hyaline, dark brown in colour, apex obtuse, not aristate, margin smooth. Prophyll of female spikelets oblong, *c.6 × 1– 1.5 mm*, yellowish in lower part, brown above, apex truncate, hyaline, 2-keeled, keel minutely scabrid, margin open from apex to base. Prophyll of bisexual spikelets, *c.8 × 1.5 mm*, consist single gynoecium with 3 – 4 male spikelets. Gynoecium *c.8 mm*, ovary *4 × 0.75 – 1mm*; style *c.1.5 mm*; stigma 3-fid. Male spikelets elliptic- oblong, *c.7.5 × 0.5 mm*, margin hyaline, brown in colour; stamens 3. Nuts oblong, *3.5 – 4 × 1 mm*, trigonous, yellowish, shortly beaked. Nut surface under SEM shows net like rectangular reticulation; septum continuous; ridges prominent; projection spheroid single in each cell, not protruding the ridges; central cavity deep.

Fl. & Fr.:July.

Distrib.:INDIA (Sikkim).

Habitat: It grows in grazed grasslands on hill slopes; *c.4750 m*.

Etymology:The species is named to honour Dr. Paramjit Singh, Director BSI, Kolkata.

30.Kobresia pygmaea (C.B. Clarke)C.B. Clarke in Hook.f., Fl.Brit. India 6: 696.1894; R.C.Srivast. in Verma & Hajra, Fl. Sikkim 1:225.1996. *Hemicarex pygmaea* C.B. Clarke in J. Linn. Soc. Bot. 20: 383.1883. Type: Sikkim, 14000 – 17,000 ped, (7. *Elyna*) *J.D.Hooker s.n.* (Lectotype: CAL!, barcode no. CAL0000001900). *Kobresia pygmaea* var. *filiculmis* Kük., Acta Horti Gothob. 5: 37. 1930. Type: Sze-chuan bor.-occid: Tsipula in parto alpino 4300m., 02.08.1922, 4146 (Holotype- PE!).

Fl. & Fr.:May – September.

Distrib.: **INDIA: Sikkim** [North Sikkim district (Zero point, Kareng- Cholhamu Lake, Tebhla Pass, Sebu-La); **BHUTAN, CHINA, NEPAL**.

Habitat: Exposed grassy ridge; on top of walls and rocks; bare turf by paths; *c.4880m*.

Etymology:Specific epithet ‘*pygmaea*’ refers to its dwarf size.

Voucher Specimens . INDIA : **Sikkim**: Gangtok, 5600ft, 19. 05. 1947, Dr. K. Biswas 7038 (CAL); North Sikkim district, Zero point, 4868m, N27° 55' 48." E088° 44' 12.7'', 26. 07.2011 Bikash Jana 53152 (CAL).

Notes: Syntypes identified in CAL, K and P herbaria; choosen Lectotype from them by present authors.

Research Article

31. Kobresia prainii Kük. in Bull. Herb. Boiss. 2 (4): 50. 1904 & A. Engler, Das Pflanzenr. 38. IV. 20: 40. 1909; R.C.Srivast. in Hajra & Verma, Fl. Sikkim 1: 225. 1996. *Kobresia utriculata* C.B. Clarke in Kew Bull. Addit. ser. 8: 67. 1908.

Type: Osthimalaya, Bhutan, Ky-oo-la, Dungboo 224 (CAL)

Fl. & Fr.: May – Sept.

Distrib.: INDIA: Sikkim [North Sikkim district (Yumthang, Thangu, Zero), East Sikkim district (Nathu-La, Muguthang); BHUTAN.

Habitat: On dry mountain slopes; grassfield and rocks.

Voucher Specimens: INDIA: Sikkim, North Sikkim district, between Thangu and Lashar, 4250 m, 18. 07. 1996, G.P. Sinha & D.G. Long & al. 17688 (BSHC).

Notes: Unisexual spike, wide, tri-nerved midrib in female glumes are important characters.

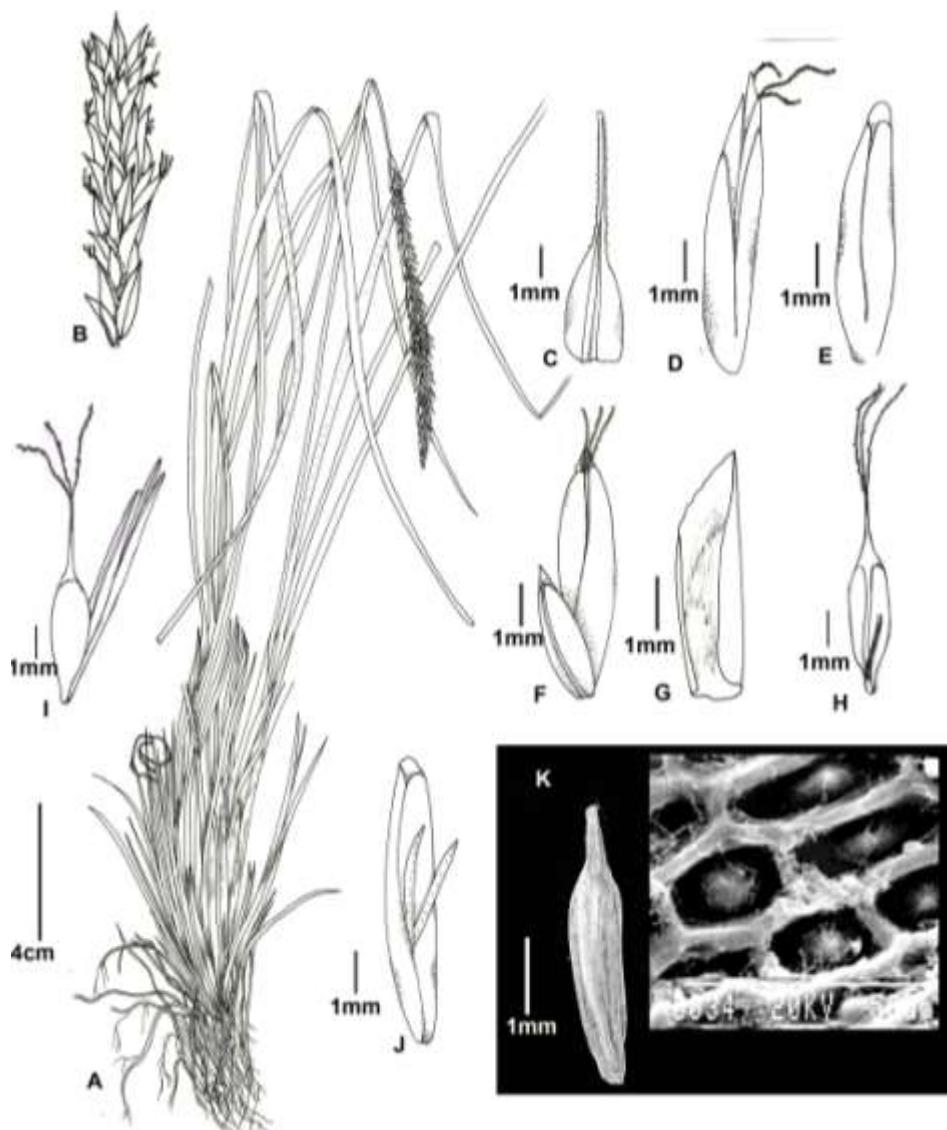


Plate IV: Figures A-J: *Kobresia paramjiti* Jana & R.C.Srivast. et al.; A: Habit; B: Part of the spike; C: Lower glume; D: Prophyll of bisexual flower; E: Prophyll of female flower; F: Female spikelet; G: Female glume; H: Gynoecium with racheola; I: Gynoecium with male; spikelet (Bisexual flower); J: Male spikelets; K: nut & nut surface under SEM

Research Article

32. Kobresia royleana (Nees) Boeckeler in Linnaea 39: 8. 1875; C.B. Clarke in Hook.f., Fl. Brit. India 6: 698. 1894. *Trilepis royleana* Nees in Edinb. New Phil. J. 17: 267. 1834. & in Wight, Contrib. Bot. Ind. 119. 1834.

Type : Nepal, *Royle s.n.* *K. stenocarpa* C.B. Clarke in J. Linn. Soc. 20: 380.1883; Meinh. in Acta Horti Petropol. 18: 278. 1900.

Fl. & Fr.: May – Sept.

Distrib.: **INDIA** : Jammu & Kashmir [Ladakh (Tsokar-Lake, Tsomoriri-Lake)], Himachal Pradesh [Lahul & Spiti (Rohtang Pass, Koksar)], Uttarakhand [Chamoli district(Nandadevi Biosphere Resrve), Tehri-Gurhwal, Kumaun (Jammunotri)]; **AFGHANISTAN, CHINA, NEPAL**.

Habitat: Grassy sandy soil with association of grasses like *Festuca*; 4000 – 4500 m.

Etymology: Specific epithet is in the honour of John Forbes Royle, a British botanist and physician.

Voucher Specimens **INDIA: Himachal Pradesh**: Lahul & Spiti, Kunlung, beside the river, 15000ft, 21. 07. 1841, N.L. Bor 15428 (CAL). **Jammu & Kashmir**: Ladakh, Pang Rupshy, 4600 m., 2nd September 1970, U.C. Bhattacharyya 40974 (CAL); **Uttarakhand**: Kumaun, Wet ground of Kuth Yangti valey, 14 – 15000ft, 01. 08. 1886, J.F. Duthie 6069 (CAL).

33. Kobresia rcsrivastavae Jana in Indian J. Fund. Applied Life. Sci...2 (2): 256 – 260.2012.

Holotype: India, Uttarakhand, Nanda Devi National Park, Sarsaupathar, 05. 07. 1982, P.K. Hajra 73962 (BSD!).

Fl. & Fr.: July.

Distrib.: INDIA (Uttarakhand).

Habitat: Hill slopes in Western Himalaya.

Etymology: This species is named in honour of Dr. R.C.Srivastava in view of his vast contributions on Flora of Eastern Himalayan region of India.

Notes: Allied to *K. woodii* but differs in having bisexual inflorescence, branched spike and oblong prophylls, also allied to the *K. cercostachys* but differs in having straw coloured upper leaf sheaths, leaves exceeding the culm, more or less flat leaves and yellowish prophylls.

34. Kobresia schoenoides (C.A. Mey.) Steud. Synop. Cyper. 246. 1855.;R.C.Srivast. in Hajra & Verma, Fl. Sikkim 1: 226. 1996. *Elyna schoenoides* C.A. Mey in Ledeb. Fl. alt. 4: 235. 1833; Kathikeyan & al., Fl. Ind. Enumerat. Monocot. 58. 1989.Type: Fl. Caucas. Legit C.A. Meyer 1829. 1830 no. 176 (Isotype-P!, barcode no.-P00079306).

Fl. & Fr.: May — Sept.

Habitat.: Shady rocks; open grazed slopes; moist sedge moorland; edges of sandy pasture; 3800 – 4500 m.

Distrib.: **INDIA: Sikkim** [North Sikkim district (Chholhamu, Yumthang), East Sikkim district (Nathu La, Kupup), West Sikkim district (Samding, Tungu, Chakung Chu, Chumegata, Lhonak, Jelep La, Kopup, Dickchu, Jemthang), Himachal Pradesh [Lahul & Spiti (Koksar)]; Jammu & Kashmir [Ladakh (Mahi, Tsomoriri-Lake)]; BHUTAN, CHINA, NEPAL.

Voucher Specimens: INDIA: **Himachal Pradesh**: Lahul, Sissu, 10500ft, 06. 07. 1938. N.L.Bor 12379 (CAL); **Jammu & Kashmir**: Sonsalnala, Lidden Valley, 13 – 14000ft, 31. 07. 1893 J.F. Duthie 1338199 (CAL); **Sikkim**: Dikchu, 13000ft, 23. 07. 1910, W.W. Smith 3753 (CAL); **Uttarakhand**. Tehri- Garhwal, Dudu glacier moraine,14000-15000ft, J.F.Duthie 370 (CAL)

Notes: Most distinguishable characters is its large size, tuft forming habit and prominent basal sheath.

35. Kobresia squamiformis Y.C.Yang, Acta Biol. Plateau Sin. 2: 9. 1984.Type: China, Gansu, Xiahe, 3300 – 3600 m, 14 Aug. 1980, H.T. Zhaos.n. (LZU).

Fl. & Fr.: July – October.

Distrib.: INDIA: Sikkim [North Sikkim district (Cholhamo Lake)]; CHINA

Etymology: Specific epithet refers to its scaly prophylls.

Voucher Specimens: **INDIA: Sikkim**, North Sikkim district, Cholhamo Lake, Mohon Kumar Ganguly 36439 (BSHC!).

Research Article

36. Kobresia seticulmis Boeckeler in Linnaea 39: 3. 1875; C.B. Clarke in Hook.f. Fl. Brit. India 6: 696. 1894.

Type: Sikkim, *J.D.Hooker s.n.* (lectotype K!, barcode no. K000794689, Iso-lectotype CAL!).
Fl. & Fr.: July – Aug.

Distrib.: INDIA: Himachal Pradesh (Lahul & Spiti), Uttarakhand [Tihri Garhwal (Bajmora, Dumdar Valley), Sikkim [East Sikkim district (Kupup), North Sikkim district (Thangu, Shivmandir)]; CHINA, BHUTAN, NEPAL.

Habitat: Rocky slopes; damp grass field; 3000 – 4000 m.

Voucher Specimens: Uttarakhand: Tehri- Garhwal, Bajmora, 3800 m., 17th June 1959, M.A. Rau 10294 (CAL). Sikkim, East Sikkim, Kupup, 4115 m, N 27° 18. 908' E 088° 50. 158', 28. 07.2012, Bikash Jana 53178; North Sikkim district, Babamandir, 4019 m, N 27° 20.064' E 088° 50.512', 28. 07.2012, Bikash Jana 53182.

Notes: It can be distinguished from its allied species viz., *K. hookeri* and *K. esenbeckii* in having longer linear leaves and long curved beak that emerges from the prophyll.

37. Kobresia sikkimensis Kük. in A. Engler, Pflanzenr. 38. IV.20: 47. 1909; C.B. Clarke in Kew. Bull. Addit. ser 8: 145. 1908; R.C.Srivast. in Hajra & Verma, Fl. Sikkim 1: 226. 1996.

Type: Osthimalaya, Sikkim, *Dr.King's native collector s.n.*

Fl. & Fr.: May – July.

Distrib.: INDIA: Sikkim [North Sikkim district (Shingba Rhododendron sanctuary)]; BHUTAN, CHINA.

Habitat : Open grassy slopes; damp soil; c. 3800 m.

Etymology: The specific epithet ‘*sikkimensis*’ refers to its Type locality (Sikkim).

Voucher Specimen: INDIA: Sikkim, North Sikkim district, Singhba Rhododendron Sanctuary, 4039m., N.27° 51'14.7'' E088 41'46.5'', 27. 07. 2011, Bikash Jana 53129 (CAL).

38. Kobresia tibetica Maxim. in Bull. Acad. Petersb. 29: 219. 1883.

Type: China Occidentalis’, Prov. Kansu, Tangut, *N.M. Przewalskis.n.* (Syntype E!barcode no.-E00271744, CAL!, acc. no- 512719).

Fl. & Fr.: May – Aug.

Distrib.: INDIA: [Jammu & Kashmir (Ladakh)]; CHINA.

Etymology: The specific epithet ‘*tibetica*’ refers to its Type locality (Tibet).

Voucher Specimens : INDIA: Jammu& Kashmir, Ladakh, Tsokar Lake, 4432m., N 33° 13' 46.4'', E 078° 21' 18.9'', 26. 07. 2013 Bikash Jana 53185 (CAL).

Notes: *K. tibetica* is very rare species in India. During the survey of Tsokar Lake in Ladakh district of Jammu & Kashmir, few population were recorded.

39. Kobresia uncinoides (Boott) C.B. Clarke in Hook.f., Fl. Brit. India 6: 698. 1893. *Carex uncinoides* Boott, Illustr. 1: 8, t. 23. 1858.

Type: Sikkim, 11 – 14000ft, *J.D.Hooker s.n.* (Lectotype- CAL, barcode no.-CAL0000001901).

Fl. & Fr.: June – October.

Distrib.: INDIA: Sikkim [West Sikkim district (Dzongri, Yakla, Megu, Sherabthang, Chakung Chu, etc), East Sikkim district (Changu,, NathuLa, Kupup), North Sikkim district (Lachung, Lachen, Cholhamo lake); BHUTAN, BURMA, CHINA, NEPAL.

Habitat: Alpine pastures; damp fallows on hillside in open or among shrubs; 3000 – 4000 m.

Voucher Specimen : INDIA: Sikkim: Yumthang, Lachung, 12000ft, 24. 08. 1842, G.A.Gammie 999 (CAL).

40. Kobresia vaginosa C.B. Clarke in Hook.f., Fl. Brit. India 6: 695. 1894. Type : Sikkim, Lachen Valley, Momay, 16,000 ft, Sept. 1849, *J.D.Hooker s.n.* (syntype K! barcode no.-K000794654).

Fl. & Fr.: July – Sept.

Distrib.: INDIA: Sikkim [West Sikkim district (Bikbari, Momay)], Jammu & Kashmir (Liddan Valley), Himachal Pradesh [Lahul & Spiti (Rhotang Pass)]; CHINA, NEPAL, BHUTAN.

Habitat: Dry slopes; open grassland; alt. 3900 – 4877m.

Research Article

Etymology: Specific epithet is due to its large, compact basal sheath.

Voucher Specimens : INDIA: **Jammu & Kashmir**, Sonsal nala, Liddan Valley, 13 – 14000ft, 31. 07. 1893, J.F.Duthie 13364 (CAL). **Himachal Pradesh**, Lahul & Spiti, Rhotang Pass, 3956m. N 32° 23' 2.1", E 077°14' 46.2", 19.07.2013, Bikash Jana 53182 (CAL).

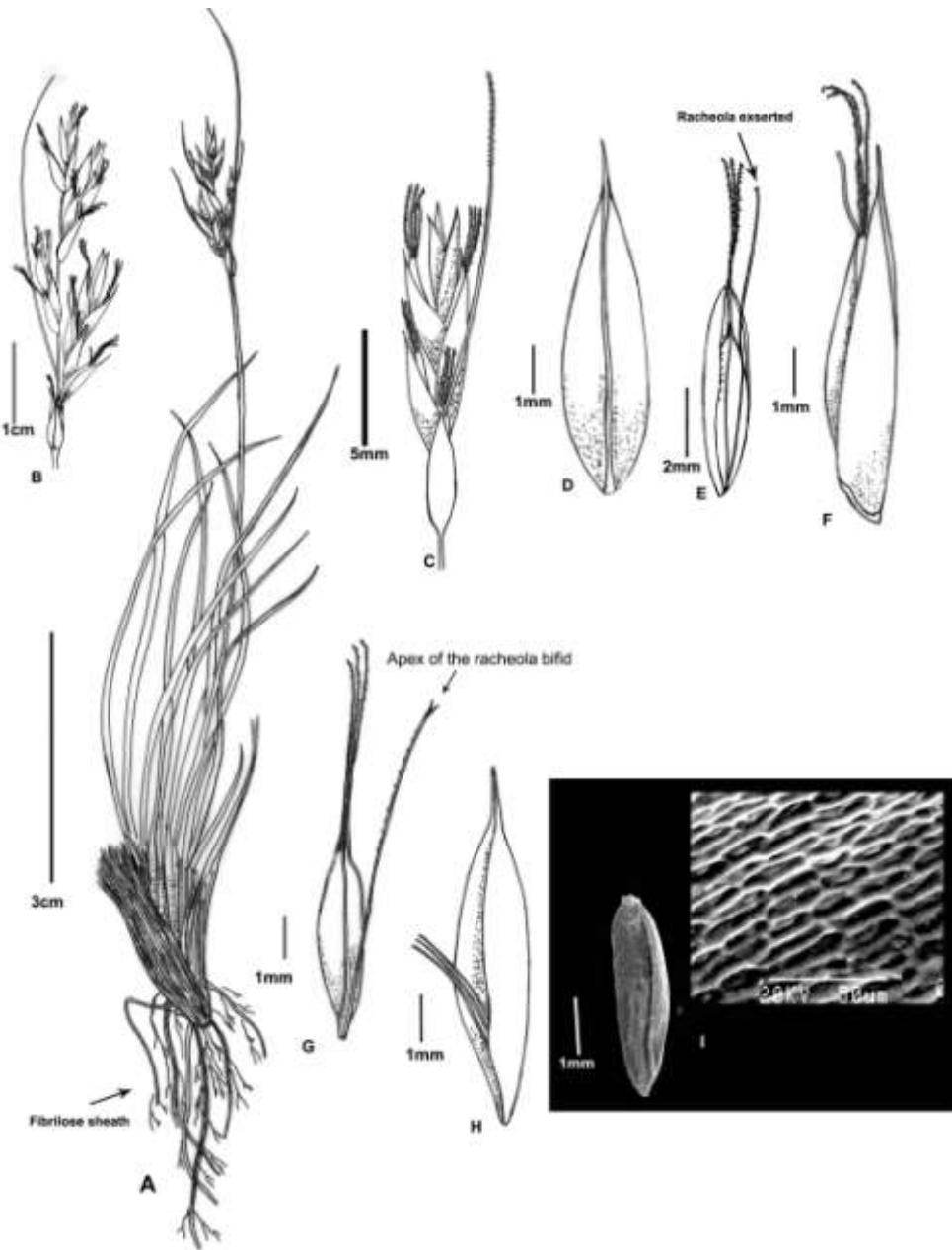


Plate V: Figures A-I: *Kobresia vibhae* Jana, M. Bhaumik & R.C.Srivast. sp. nova; A: Habit; B: Panicle spike; C: Part of the spike; D: Female glume; E: Prophyl with gynoecium; F: Female spikelet; G: Gynoecium; H: Male spikelets; I: nut & nut surface under SEM

41. *Kobresia vibhae* Jana, R.C.Srivast & Manas Bhaumik sp. nova.

Holotype: INDIA: Arunachal Pradesh; Upper Siang, Mabo Mountain top, (N 28° 22.555', E 94° 98.534'), 3615m, 28.08.2011, M. Bhaumik 27142 (Holotype- ARUN!).

Research Article

Allied to *K. kobresioidea* but differs in having shorter and glabrous culms; leaves about half length of the culm; disintegrated basal sheaths to form persistent fibres; much shorter inflorescence; arista of the lower glume exceeding the inflorescence; 3-5 female spikelet on each spike; racheola exserted from prophyll. Perennial herbs. Rhizome slightly elongated, c. 1.7×0.9 cm. Culms slender, c. 18×0.1 cm (excluding inflorescence), slightly curved at middle, triquetrous, scabrid, green, base covered with grayish green lamina bearing outer sheaths. Basal sheath prominent, deeply disintegrated into persistent fibres, grayish in colour. Leaves basal, $7.5 - 17.1 \times 0.15 - 0.2$ cm; lamina linear, flat, green, margin slightly scabrid. Basal sheath membranous, splitted deeply to form fibrillose hair. Inflorescence oblong, c. 5.1×0.5 cm (excluding arista of lower glume), paniculate, with 4 – 5 loosely arranged spikes, axis smooth. Glumes of the lowest spike aristate; arista 8×0.1 cm, scabrid, usually longer than the inflorescence. Spikes oblong, $1.2 - 1.7 \times 0.4 - 0.5$ cm (excluding arista), consisting of 5 – 8 unisexual spikelets, lower 3 – 5 female and upper 2 – 3 male spikelet. Glumes of the female spikelets ovate- oblong, aristate, c. 7×2 mm (excluding arista, arista c. $1 - 1.5$ mm long), glabrous, margin hyaline, 1-nerved. Prophylls linear- lanceolate, $6 \times 0.75 - 1$ mm, 2-keeled; keels scabrid, margins open from the apex to base. Racheola flattened, c. 7.5 mm, often slightly bifid at the apex, margin scabrid, exceeding the prophyll. Male glumes oblong to lanceolate, c. 6.5×2 mm, apex rounded, smooth hyaline margin, golden yellowish in colour; stamens 3; filaments c. 4 mm. Gynoecium, c. 9 mm; Ovary, c. 4 mm ; styles c. 2 mm and stigma, c. 3 mm, tri- ridged structure found at the joining of style and ovary. Nuts oblong, c. $3 \times 0.75 - 1$ mm, trigonous. SEM image of the nuts showing net like rectangular ornamentation; ridges of the wall prominent; septum discontinuous; projection not present in each cell, irregular in shaped.

Fl. & Fr.: July – Aug.

Distrib.: **INDIA: Arunachal Pradesh** (Upper Siang).

42. Kobresia vidua (Boott ex C.B. Clarke) Kük. in Engler, Pflanzenr. 38. IV. 20: 40. 1909; R.C.Srivast. in Verma & Hajra, Fl. Sikkim 1:227.1996. *Carex vidua* Boott ex C.B. Clarke in Hook.f., Fl.Brit.India 6:713. 1894. Type: Sikkim, Lachen, alt. 13000ft, J.D. Hookers.n. (K, image barcode K000794662!).

Fl. & Fr.: May – Sept.

Distrib.: **INDIA : Sikkim** (Lachen, above Thangsing to Lam Pokhri); **BHUTAN, TIBET.**

Habitat: Dry soil on plains; on rocks; dry grassy, rocky or sandy slopes; 3350 – 4530 m.

Notes: *Kobresia vidua* is dioecious plant and is very rare in distribution. Only a single imperfect female specimen of *K. vidua* in CAL could be located during present study.

DISCUSSION

Present studies have revealed that to solve the taxonomic complexes in these alpine herbs (*Kobresia* species), studies on the ornamentation of the nut surface under SEM is quite useful which is evinced by the results presented above.

ACKNOWLEDGEMENTS

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