

GENUS ELEOCHARIAS R.BR. (CYPERACEAE) IN UTTAR PRADESH, INDIA

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Abstract

The paper provides a detailed taxonomic account of 8 species of the genus *Eleocharis* R.Br. in Uttar Pradesh. Key to the species is also provided.. Uses are also given wherever known.

The state of Uttar Pradesh (after recent reorganisation) is situated between 77⁰-3' & 84⁰-39' N and 23⁰-52' & 30⁰-25' E. The area falls under Gangetic Plain and covers forested area of Tarai & Bhabhar tract, cultivated areas of Purvanchal, Rohilkhand Duabs, Bundelkhand etc. But the flora of the region is not yet worked out. Present study deals with the floristic diversity of the genus *Eleocharis* in the state. The study is based on the field observations, scrutiny of literature (Uniyal *et al* 1997, Duthie 1929, Hooker 1893-94, Singh & Srivastava 2002) and herbarium specimens housed in CAL, LWG, DD, BSA, BSIP, MU (Herbarium at Merrut University) GU, (Herbarium at Gorakhpur University) DUTHIE (Allahabad University) herbaria. The genus is of economic importance too. In addition to its use in fodder, the tubers of *Eleocharis dulcis* which is commonly known as '*Chinese water Chestnut*' are edible and rich in starch (Comparable to starch content to sweet potato and cassava). Tubers of this species are cooked and served in salad and soups. This is also used in making mats.

ELEOCHARIS R. Br.

Prodr., Fl. Nov. Holl. : 224. 1810 ('*Elaeocharis*', '*Eleocharis*' et '*Heleocharis*', *sphalm.*).

Type : *E. capitata* R. Br.

Annuals or perennials. Rhizomes, when present short or long creeping. Stems terete or angular, sometimes spongy, septate, all fertile or with some sterile ones appearing like leaves. Leaves reduced to a solitary or few basal sheaths; sheaths membranaceous, tubular, truncate or cuspidate, sometimes shortly laminate. Inflorescence reduced to a solitary terminal spikelet, rarely a few additional branchlets terminated by smaller spikelets; bracts absent; spikelets terete, or angular (rarely compressed), few-many-flowered; rhachilla persistent; glumes membranaceous or coriaceous, spiral, or the lower sometimes subdistichous, caducous; lower 1-3 usually

empty, sometimes nut-bearing, more persistent, usually longer than the other glumes but shorter than the spikelets. Flowers bisexual, upper few tabescent; perianth of (4-)5-7, (-8-10), retrorsely scabrid bristles (sometimes absent); stamens 1-3, anterior; anthers linear, oblong-lanceolate or ovate, crested or multicous; styles about as long as the nut, usually glabrous, dilated at the base with a constriction above the nut; base persistent; stigmas 2-3 (rarely 4). Nuts obovoid, orbicular or pyriform, lenticular or trigonal, crowned by the persistent style base, smooth, reticulate, trabeculate or cancellate, usually black.

A genus of *ca* 200 species cosmopolitan; 14 species in India; 8 in Uttar Pradesh (present study).

Sprague (Kew Bull. 1928 : 352, 1928) pointed out that *Eleocharis* R. Br. (Prodr. 1: 224, 1810) is the correct generic name for this taxon, even though *Heleocharis* Lestib. (Ess. *Cyperac.* 41. 1819) is more appropriate than *Eleocharis*.

Key to the species

- 1a. Stems somewhat stout, 2-10 mm thick. Spikelets as thick as the stems, subcylindric; glumes coriaceous, 4-8 mm long ...2
- 1b. Stems slender, 0.2-1.5 mm thick. Spikelets markedly thicker than the stems, ovoid oblong; glumes membranous, 1-4.5 mm long ...3
- 2a. Stems terete, transversely septate. Nuts smooth ... *E. dulcis*
- 2b. Stems terete or angled, not septate. Nuts trabeculate or cancellate
...*E. acutangula*
- 3a. Stems capillary ...*E. acicularis*
- 3b. Stems otherwise ...4
- 4a. Nuts lenticular ...5
- 4b. Nuts trigonal ...7
- 5a. Spikelets less than 5 mm long (less than 2 mm wide; glumes upto 1 mm long; bristles white, shorter than nut. Nuts *ca* 0.65 mm long; style-base like a minute button, *ca* 0.05 mm long) ...*E. atropurpurea*
- 5b. Spikelets 3-20 mm long ...6
- 6a. Perianth bristles 4. Nuts 1.2-1.7 mm long; style base oblong-conic, 1.5 mm long
...*E. palustris*
- 6b. Perianth bristles 6-7. Nuts 0.7-1.2 mm long; style base ovoid, *ca* 0.3 mm long...*E. congesta*
- 7a. Spikelets 3-3.5 mm wide; glumes 1.75-2 mm long. Bristles 6-8, slightly longer than nut, brown. Nuts upto 0.9 mm long ...*E. geniculata*
- 7b. Spikelets, glumes, bristles otherwise. Style base broadly triangular. Nuts brownish or straw coloured ...*E. ovata*

Eleocharis acicularis, (L.) Roem. & Schult., Syst. Veg. 2 : 154. 1817; C.B. Clarke in Hook. *f.*, Fl. Brit. India 6 : 628. 1893. *Scirpus acicularis* L., Sp. Pl. 71. 1753.

Herbs. Stems 5-10 cm high, capillary. Rhizomes filiform. Spikelets, slender, few-flowered, *ca* 5.2 mm, with 4-6 (rarely 8-10) nuts; glumes in the few flowered spikelets subremote, lower 2-3 distichous, upper distinctly spiral bristles 3-4 white, feebly retrorse scabrid, variable in length, occasionally absent. Nuts oblong-lanceolate, straw coloured, as long as $\frac{1}{2}$ - $\frac{2}{3}$ the glume, polyhedral, subterete, with 12-15 longitudinal ribs; styles 3-fid; style-base small narrow bulbiform.

Fl. & Fr. : Aug.-Nov.

Habitat : in wetlands.

Distribution : Europe, N. & E. Asia, America.

Distrib in U.P. : Basti (*cf.* Saini, 1990).

Eleocharis acutangula (Roxb.) Schult. in R. & S. Mant. 2: 91, 1924. *Scirpus acutangulus* Roxb., Fl. Ind. 1: 216. 1820. *Scirpus fistulosus* Poir., Ency. 6 : 749, 1804 non Forsk. 1775. *Eleocharis fistulosa* Schult. in R. & S. Mant. 2: 87. 1824; Clarke in Hook. f., Fl. Brit. India 6: 626. 1893 & in Ill. Cyp. t. 35, f. 1-4, 1909; S.T. Blake in Journ. Arn. Arb. 28 : 226, 1947; Singh & Murty in Journ. Bom. Nat. Hist. Soc. 63(2) : 462, 1966; Singh & Dixit in Ind. For. 98(2) : 124, 1972.

Rush-like caespitose herbs, 30-90 cm high. Rhizomes stoloniferous. Stems tough, terete, glabrous, triquetrous at the top. Spikelets terminating the stem, embraced at the base by a short rounded bract, cylindric, acute, dusky green, 2-4 cm high, as broad as stem. Glumes laxly imbricate, much striated, sub-erect, obovate, subacute. Bristles 6, slightly longer than the nut, brown. Nuts ovoid, faintly striate, 1.5-2 by 1.25-1.5 mm, pale or dark brown, tipped with persistent style bases.

Fl. & Fr. : Oct.-Dec.

Distrib. : Nepal, Assam to Myanmar and Sri Lanka, Malesia, Tropics generally.

Distrib. in Uttar Pradesh : Agra, Allahabad, Basti, Deoria, Jaunpur (*cf.* Singh & Dixit, 1969), Kheri, Meerut, Sultanpur.

Representative specimens : **Agra** : Salempur, AKS, 853 (RBSC); **Kheri** : *s.l.*, Inayat, 22882 (CAL!). **Allahabad** : Malaka, B.K. Verma & R.P. Dube, 440 (DUTHIE). **Basti** : Khalilabad, D.C. Saini, 11350 (BSIP!). **Meerut** : Amhera, Murty & Singh, 2495 (MU). **Sultanpur** : Kui Tal, Om Prakash, 10673 (GU).

Notes : This species can be readily distinguished in the field from other species of the genus found in the Upper Gangetic Plain by its sharply triquetrous stem at the top.

After Troupin (Troupin, Fl. Psm. Parc. Nat. Garamba 108, 1956) had pointed out that the correct name of this species is *E. acutangula*, not *E. fistulosa*, Koyama (Koyama, Journ. Fac. Sci. Un. Tokyo III, 8: 98, 1961) accepted again the latter combination in ascribing it to Link, Jahrb. Gewacksh 3 : 78, 1820. However, as already pointed out by Kern (1974) the combination was not definitely made there (“*Scirpus fistulosus* ist ebenfalls eine *Eleocharis*”).

Eleocharis atropurpurea (Retz.) K.B. Presl, Rel. Haenk. 1: 196. 1828 *exclud specim.*; C.B. Clarke in Hook. *f.*, Fl. Brit. India 6: 627. 1893. *Scirpus atropurpureus* Retz., Obs. Bot. 5 : 14. 1788.

Slender, annual, caespitose herbs; with many barren, leaf-like stems at base, shorter than normal stems with inflorescences. Leaves absent; sheaths membranous; appressed, purplish or brownish. Spikelets terminal, oblong ovoid or sub-cylindric, wider than stems, many-flowered; bristles 5-6, shorter than or as long as nuts, retrorsely scabrous; gumes black or chestnut brown, 1-1.5 mm long, broadly elliptic or oblong, obtuse or rounded at tip, folded, membranous, 3-veined, keel green, imbricate; stamens 1-2, anthers linear-oblong, not crested; ovaries 1-celled; styles stigmatic. Nuts smooth, black obovoid.

Fl. & Fr. : Apr.-Dec.

Habitat : in muddy places near streams, dried up ditches, cultivated fields etc. Common.

Chr. No. : $2n = 10, 20, 21$.

Distribution: Pantropical; also in Europe and U.S.A.

Distribution in Uttar Pradesh : Agra, Aligarh, Allahabad, Azamgarh, Bahraich, Banda, Bulandshahar, Ghazipur, Gorakhpur, Jaunpur, Kheri, Lucknow, Mahrajganj, Meerut, Mirzapur, Moradabad, Saharanpur, Sitapur, Sultanpur.

Representative Specimens : **Agra** : Jagner, AKS, 942 (RBSCH). **Aligarh** : Nanau, A.K. Singh, 5018 (MU). **Allahabad** : Garwa, B.K. Mishra, 85 (DUTHIE!); Garwa, R.P. Dubey, 4026 (DUTHIE!). **Azamgarh** : Bhimber, S.N. Srivastava, 14340 (GU); Martinganj, V. Chandra, 4556 (GU). **Bahraich** : *s.l.*, M.A. Rau, 8117 (CAL!); Rupaidiha, O.P. Mishra, 6632A (BSA). **Banda** : Narainey, B.K. Sinha, 5782 (DUTHIE). **Bulandshahar** : Lakhaoti College, L.K. Sharma, 1492 (MU). **Ghazipur** : Nandganj, S.D. Singh, 12678 (GU). **Gorakhpur** : Deibhar, A.K. Srivastava, 7229 (GU); Ramgarh Tal, T.N. Srivastava, 532 (GU). **Jalaun** : Kalpi, Hiralal, 4032 (LWG!). **Jaunpur** : (*cf.* S.K. Singh & Dixit, 1969). **Lucknow** : Kukrail forest, Umashankar, 12937 (LWG!); Kursi Road, Gogo forest, Chunnoo, 3511 (LWG!); Banthra farm, S.P. Lancaster, 35092 (LWG!). **Meerut** : Meerut City, R.S. Saxena, 319 (MU). **Moradabad** : *s.l.*, Paliwal & Singh, 453 (Herb Hindu College Moradabad). **Saharanpur** : Chandak, A.K. Goel, 206 (MU). **Sitapur** : Ponara Tal, S.L. Kapoor *et al.*, 64912 (LWG!). **Sultanpur** : Kadipur, Om Prakash, 10198 (GU).

Eleocharis congesta D. Don, Prodr. Fl. Nepal 41, 1825; Clarke in Hook. *f.*, Fl. Brit. India. 6: 630, 1893; Singh & Dixit in Bull. Bot. Soc. Beng. 23(2) : 201, 1969 and Ind. For 98(2) : 124; 1972; *Eleocharis pellucida* Presl., Rel. Haenk. 1: 196, 1828; Svens. Rhodora 41 : 101, 1939; Koyama Contr. Inst. Bot. Un. Montreal n. 70 : 37, 1957; *Eleocharis afflata* Steud. (in Zoll. Syst. Verz. 1: 62, 1854 *nom. nud.*) Syn. 2: 76, 1855; Clarke in Hook. *f.*, Fl. Brit. India 6 : 627, 1893; *Eleocharis subvivipara* Boeck. in

Linnaea 36 : 424. 1870; Clarke in Fl. Brit. India 6 : 629, 1893; Ill. Cyp. t. 37, f. 13-16, 1909.

Tufted annuals or perennials, up to 40 cm. Stems more or less angular-ribbed, but not actually quadrangular; sheaths appressed, often purplish at base, mucicous or with a minute mucro at the oblique or very oblique mouths. Spikelets ovoid or lanceolate, acutish, terete, densely several to many flowered, 3-9 by 1.5-3 mm, often proliferous at the base, pale, ferruginous, often tinged with red; glumes oblong-ovate to lanceolate, 1.5-2 mm; bristles 6, slender, retrorsely scabrous, slightly to distinctly longer than the nut, at first whitish, finally ferruginous. Stamens 2-(-3). Styles 3-fid. Nuts trigonous, obovoid, smooth, yellowish green to olivaceous, *ca* 1 mm long. Style base shortly pyramidal, triangular, as long as or slightly longer than wide, 1/3-1/2 as broad as nut.

Fl. & Fr. : Sept.-Dec.

Habitat : in paddy fields and muddy soil. Frequent.

Distribution : From India to China and Japan.

Distribution in Uttar Pradesh : Azamgarh, Ghazipur, Gorakhpur, Jaunpur, Saharanpur, Sultanpur.

Representative Specimens : **Azamgarh** : Devgaon, V. Chandrea, 4573 (GU). **Ghazipur** : Gahmar, S.D. Singh, 12481 (GU). **Gorakhpur** : Madhulia forest, A.K. Srivastava, 7028 (GU); Maheswara, T.N. Srivastava, 1435 (GU). **Jaunpur** : *cf.* S.K. Singh, 13 (GU). **Saharanpur** : Balawali, A.K. Goel, 204 (MU). **Sultanpur** : Lambhuwa, Om Prakash, 10627 (GU).

Eleocharis dulcis (Burm. f.) Henschel, Vita Rumph. 186. 1833; Svens. Rhodora 31 : 159. 1929; Kern, Reinwardtia 6 : 36. 1961. *Andropogon dulce* Burm. f., Fl. Ind. 219. 1768. *Scirpus plantagineus* Retz., Obs. Bot. 5 : 14. 1789. – *Eleocharis plantagineus* (Retz.) Roem. & Schult., Syst. Veg. 2 : 150. 1817; Fl. Brit. India 6 : 625. 1893; Duthie in Fl. Upper Gangetic Plains. 3 : 348. 1929.

Perennial stoloniferous, upto 1.5 m high. Herbs. Stems transversely septate tufted, terete, longitudinally striated glaucous green. Transversely septate. Leaf sheaths usually reddish, 5-20 cm long. Spikelets terete, 15-16 x 3-6 mm straw-coloured. Glumes stramineous, with red dots, ovate-oblong, obtuse, scarious-margined 5-8 mm long coriaceous, several nerved. Bristles 7, yellowish threadlike retrorsely scabrid as long as the nut. Stigmas usually 3, sometimes 2. Nuts pale yellowish brown, tipped with a persistent style-base, ovoid, biconvex, 1.5-2.7 mm long, truncate top, smooth; Style base pyramidal, about half as long as and about 2/3 as broad as nut.

Fl. & Fr. : Sept.-Dec.

Habitat : in swampy areas and as a weed in paddy fields. Common.

Distribution : Tropics of the old world. (India : Saharanpur and Assam to Sri Lanka and Malay Paninsula).

Distribution in Uttar Pradesh : Aligarh, Allahabad, Azamgarh, Bulandshahar, Deoria, Faizabad, Fatehpur, Lucknow, Meerut, Bahraich, Bulandshahar, Ghazipur, Gorakhpur, Sultanpur, Sitapur, Saharanpur.

Representative specimens : **Aligarh** : Sankra, A.K. Singh, 1275 (MU). **Allahabad** : Sirsa, R.P. Dube, 544 (DUTHIE); Mau Aima, B.K. Mishra, 559 (DUTHIE). **Azamgarh** : Satona Tal, S.N. Srivastava, 14322 (GU); Bilariyaganj, V. Chandra, 4696 (GU). **Bahraich** : Motipur, Sri Ram, 46407 (DD!). **Bulandshahar** : Anup Shahar Road, L.K. Sharma, 531 (MU). **Fatehpur** : Kishanpur, S.K. Dixit, 10 (DUTHIE). **Ghazipur** : Gogna Tal, S.D. Singh, 12483 (GU). **Gorakhpur** : Along Turra Nala, A.K. Srivastava, 7023 (GU); Domingarh, T.N. Srivastava, 1081 (GU). **Jaunpur** : (cf. S.K. Singh & Dixit, 1969). **Meerut** : Meerut City, R.S. Saxena, 324 (MU). **Sultanpur** : Karahwa Tal, Om Prakash, 10691 (GU).

Uses: The genus is of economic importance too. In addition to its use in fodder, the tubers of *Eleocharis dulcis* which is commonly known as 'Chinese water Chestnut' are edible and rich in starch (Comparable to starch content to sweet potato and cassava). Tubers of this species are cooked and served in salad and soups. This is also used in making mats.

Eleocharis geniculata (L.) R. & S., Syst. Veg. 2 : 150. 1817. Mishra & Verma, Fl. Allahabad. 394. 1992. *Scirpus geniculatus* L., Sp. Pl. 48. 1753. *Eleocharis capitata* R. Br., Prodr. 225. 1810; C.B. Clarke, Hook. f., Fl. Brit. India. 6 : 627. 1894; Singh & Dixit, Ind. For. 98 : 124. 1972.

Herbs. Culms tufted, up to 40 cm high, sheath appressed, purple at base, oblique or acute at mouth. Spikelets globose, ovoid, 3-5 x 3-3.5 mm, rounded at apex, much broader than stem. Lower glumes bractiform, slightly shorter. Female glumes ovate, obtuse, concave, not keeled. Stamens 2-3. Styles bifid. Nuts obovoid, biconvex, shining, dark brown or blackish less than half length of glumes. style-base small narrow, 3-angular, depressed, conical.

Fl. & Fr. : Sept.-Dec. (Jan.)

Habitat : in paddy fields, along ponds.

Distribution in U.P. : Allahabad, Bahraich, Basti, Bulandshahar, Deoria, Sitapur.

Representative specimens : **Allahabad**, Garwa, B.K. Misra, 528 (DUTHIE); Handia, B.K. Misra, 591 (DUTHIE), Tans river side, Kaul et al., 47303 (LWG!). **Sultanpur**, Mohammadabad, Om Prakash, 10378 (GU). **Bahraich** : s.l., C.L. Malhotra, 26712 (CAL!); Orla, O.P. Singh, 6555 (BSA). **Bulandshahar** : Lakhaoti, Kanpur road, L.K. Sharma, 3056 (MU).

Eleocharis ovata, R. Br., Prodr. 224 (in note) 1810. C.B. Clarke in Hook. f., Fl. Brit. India 6 : 628. 1893. *Scirpus ovatus* Roth Catal. i. 5. *Eleogenus ovatus* Nees in Linnaea, 9. 294.

Stems somewhat slender. Roots fibrous. Spikelets small, dense; bristles exceeding the nut retrorsely scabrous brown. Nuts straw coloured or brownish smooth; styles 2-fid base broad triangular.

Fl. & Fr. : Sept.-Dec.

Habitat : in wetlands.

Distribution : Tropics and temperate regions.

Distribution in Uttar Pradesh : Basti, Deoria.

Notes : Very much resembles *Eleocharis capitata*, except in the colour of the nut and the shape of the style-base.

Eleocharis palustris (L.) R. Br., Prodr.: 224. 1810; Roem. & Schult., Syst. Veg. 2 : 151. 1817; C.B. Clarke in Hook. f., Fl. Brit. India 6 : 628. 1893; Koyama in Hara *et al.*, Enum. 1 : 109. 1978. *Scirpus palustris* L., Sp. Pl. : 70. 1753.

Perennial, tufted herbs. Rhizomes black, creeping. Stems terete. Leaves absent; sheaths membranous, often red below. Spikelet solitary, terminal, ellipsoid or cylindrical, wider than stems, dense-flowered, yellow or brownish; bristle 5-6, as long as or slightly longer than nuts, retrorsely scabrous; glumes membranous, ovate-lanceolate, muticous, keel, green, margins hyaline or coloured, obtuse, 4-5 mm long, lower 2-3 empty; stamens 3, sometimes 2, anthers apiculate; ovaries 1-celled. Nuts obovoid rounded and with very broad style-base, nearly half as long as nuts.

Fl. & Fr. : Dec.-July.

Habitat : in the muddy habitats. Common.

Chrom. No. : $2n = 10, 14, 16, 17, 18, 36, 37, 38, 40, 42, 44, 46-49, 50 \text{ \& } 51$.

Distribution : Cosmopolitan, chiefly in temperate regions of Northern hemisphere.

Distribution in Uttar Pradesh : Aligarh, Allahabad, Azamgarh, Bahraich, Banda, Bijnor, Bulandshahar, Deoria, Ghazipur, Gorakhpur, Jalaun, Kheri, Lucknow, Mahoba, Meerut, Mirzapur, Moradabad, Saharanpur, Sitapur, Sultanpur.

Representative Specimens : **Aligarh** : Charra, A.K. Singh, 1221 (MU). **Allahabad** : Siyad Sarai, B.K. Mishra, 786 (DUTHE!). **Azamgarh** : Koylsa, S.N. Srivastava, 14337 (GU). **Bahraich** : Bankatwa, Hiralal, 440 (LWG!); *s.l.*, G. Panigrahi, 2886 (CAL!); Jirampurwa, O.P. Mishra, 7760 (BSA). **Bulandshahar** : Jatvi, Anupshahar, L.K. Sharma, 1425 (MU). **Ghazipur** : Bogna Tal, S.D. Singh, 12679 (GU). **Gorakhpur** : Sri Ram, 46408 (DD!); Ramgarh Tal, A.K. Srivastava, 7112 (GU); Rajghat, T.N. Srivastava, 544 (GU). **Jalaun** : Nadigaon, G. Shukla, 634 (DUTHIE). **Jaunpur** : (*c.f.* S.K. Singh & Dixit 1969). **Kheri** : South Kheri, Sri Ram, 46409 (DD!). **Lucknow** : Pusabag, U. Shankar & Chunnoo, (LWG-44312); Kukrail, J.G. Srivastava, 46948 (LWG!); *s.l.*, J.C. Srivastava, 9586 (BSIP!); Tanda, U.C. Bhatta, 13231 (BSD). **Meerut** : Hastinapur, R.S. Saxena, 1938 (MU). **Moradabad** : *s.l.*, Paliwal & Singh (Hindu Colege Herb.). **Saharanpur** : Manglore, A.K. Goel, 2148 (MU). **Sitapur** : Gomtisi side lake R.P. Singh,

19940 (LWG!). **Sultanpur** : Kadu Nal forest, *Om Prakash*, 10724 (GU).

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