

A comparative taxonomic study of four closely resembling taxa in the genus *Fimbristylis* (Cyperaceae) in India

V.P. Prasad*

Central National Herbarium, Botanical Survey of India, P.O. Botanic Garden, Howrah – 711 103, India.

*Email: prasad_parur@yahoo.com

Abstract

A comparative study of four morphologically similar taxa namely *Fimbristylis aestivalis* (Retz.) Vahl, *F. squarrosa* Vahl var. *squarrosa*, *F. squarrosa* var. *esquarrosa* Makino and *F. griffithii* Boeckeler has been undertaken and the findings are discussed in detail. Some of the diagnostic features, such as hairiness of the leaves, straight or recurved mucro of the glumes, presence or absence of cilia on the style and presence or absence of long pendent hairs at the style-base can be used for differentiating these taxa unambiguously. *Fimbristylis griffithii* is reported for the first time from Arunachal Pradesh and West Bengal.

Keywords: *Fimbristylis*, Identification, India, New report, Similarity, Taxonomy.

Introduction

Fimbristylis is the fourth largest genus of the family Cyperaceae, comprising 316 species (Govaerts *et al.*, 2018) distributed worldwide in tropical and temperate regions. The genus is characterized by the style articulated with the ovary, but deciduous with its dilated base. Karthikeyan *et al.* (1989) enumerated 91 species of *Fimbristylis* from India and Prasad & Singh (2002) reported c. 115 species. Further species were added by subsequent workers (Wadoodkhan & Lakshminarasimhan, 2008; Murugesan *et al.*, 2010; Kumar *et al.*, 2013; Sunil *et al.*, 2016 and Viji *et al.*, 2016) and hence, the present number is estimated to be 121 species in the country. Prasad and Singh (1997) discussed in detail about the distribution and endemism of the genus in India.

While working on specimens of *Fimbristylis* collected from different regions of India it was observed that some morphologically similar taxa were often wrongly identified. During the present study, four such closely related taxa have been carefully studied and the circumscription of each taxon is deciphered unambiguously. All four taxa look similar and share certain common characters such as the annual life-form with tufted culms, eligulate leaves, compound to decompound inflorescence, solitary spikelets, spirally arranged glumes, distigmatic flowers, stamens and the biconvex, obovate achenes.

Materials and Methods

The four closely related taxa selected for the study were *Fimbristylis aestivalis*, *F. squarrosa* var. *squarrosa*, *F. squarrosa* var. *esquarrosa* and *F. griffithii*. Herbarium specimens of these taxa housed at CAL and in herbaria of different regional centres of Botanical Survey of India were studied in detail. For all the four taxa, a brief nomenclature citation and description along with flowering and fruiting season, habitat, distribution at global level and within the country and details of representative specimens from each state are provided.

Taxonomy

Fimbristylis aestivalis (Retz.) Vahl, Enum. Pl. 2: 288. 1805. *Scirpus aestivalis* Retz., Observ. Bot. 4: 12. 1786. **Fig. 1a-c.**

Annuals with slender tufted culms, 4–15 cm high. Leaves slender to filiform, shorter than to as long as the culm, densely hairy. Inflorescence a decompound corymb of few to numerous spikelets. Spikelets solitary, angular, ovoid or oblong-lanceolate, 2–5 × 1–1.5 mm, acute at apex. Glumes ovate, 1.2–1.5 × c. 0.7 mm, acute at apex, mucronate, keeled. Stamen 1; anther oblong, 0.3–0.5 mm long. Style 0.5–0.7 mm long, ciliate towards the top. Achene biconvex, obovate to elliptic, 0.5–0.8 × 0.2–0.3 mm, brownish, often shining.

Flowering & Fruiting: Throughout the year.

Habitat: Common in moist areas, near ponds, ditches and streams; common weed of paddy fields.

Distribution: Tropical and subtropical Asia to Australia. Throughout in India.

Specimens examined: INDIA, **Arunachal Pradesh**, Bompū–Sissini, Kameng F.D., N.E.F.A., 28.03.1958, *G. Panigrahi* 6224 (ASSAM); Ziro, Lower Subansiri F.D., N.E.F.A., 29.09.1959, *G. Panigrahi* 19787 (ASSAM); Bejari, Dibang Valley, 26.03.1999, *M. Bhaumik & M.K. Pathak* 2186 (ASSAM); Ziro, Subansiri F.D., N.E.F.A., 03.06.1961, *G.V.S. Rao* 24705 (ASSAM). **Assam**, Golaghat district, Dhansiri Mukh, 300 ft, 02.02.1944, *N.L. Bor* 18374 (DD); Jorhat, 29.03.1962, *J.G. Srivastava* 79952 (LWG); Lakhimpur district, Laluk, Islampur, N. Lakhimpur, 19.05.1966, *D.M. Verma* 46513 (CAL); Nagaon district, Sunnary village, Silghat, 19.02.1957, *G. Panigrahi* 5409 (CAL); Sonitpur district, on the way back to Chardwar, 20.02.1957, *G. Panigrahi* 5780 (CAL); Naharani R.F., Sonai-Rupai Sanctuary, 07.04.1976, *P.K. Hajra* 55033 (ASSAM); Tinsukia district, Laluk, Eslampur, N. Lakhimpur, 19.05.1966, *D.M. Verma* 46513 (ASSAM); Brahmaputra, near Tezpur, 27.03.1885, *C.B. Clarke* 37658D (CAL). **Bihar**, Santara, Santhal Parganas, September 1904, *C.H. Swindor s.n.* (CAL). **Chhattisgarh**, Bastar district, way to Jayathgiri, 12.02.1961, *N.P. Balakrishnan* 12082 (CAL); Kanker district, Rowghat Block A, 04.02.2006, *B.K. Shukla* 64081 (BSA); Dhamtari, Dokal, Raipur, 27.5.1972, *D.M. Verma* 17306 (BSA); Raigarh district, Sarangarh, 03.02.1974, *N.C. Rathakrishnan*, 19677 (BSA); Korba district, Kathgora, 17.04.1965, *C.M. Arora* 6030 (BSA); Badgaon, Abujmarh, Baster, 24.05.1983, *G.P. Roy* 34010 (BSA); Raipur district, Bagbahora–Pithora, 12.06.1972, *D.M. Verma* 17692 (BSA); Bilaspur district, Khoota ghat, 07.08.1973, *S.K. Murthy* 19522 (BSA); Raipur district, Gariaband–Rajim, 08.06.1972, *D.M. Verma* 17612 (BSA); Raigarh district, Sarangarh, 29.03.1976, *N.C. Rathakrishnan* 24336 (BSA); Raipur district, Rudri, Dhamtari, 26.05.1972, *D.M. Verma* 17235 (BSA); Bastar, Chhote Dongar, Abujmarh, 24.05.1983, *G.P. Roy* 34010 (BSA); Loothapara forest, Balaghat, 30.05.1977, *V.J. Nair* 22786 (BSA). **Goa**, Fields of Palim, March 1965, *J. Pallithanam* G. 102 (BSI); Satre River Bridge between Codel–Amboch, 24.03.1964, *K.C. Kanodia* 96467 (CAL); North Goa, Pernem, Arambol, 19.05.1968, *M.R. Almeida* 630 (BLAT); Corgao, Petechawada, 27.04.2008, *R.T. Patil* 3016 (BSI); Dhargal, 22.04.2007, *R.T. Patil* 192557 (BSI);

Candola, Ponda, 16.02.2007, *R.T. Patil* 192550 (BSI); Marcela–Tonca, 16.02.2007, *R.T. Patil* 192543 (BSI); Sattari, Nanorem river side, 24.03.1964, *K.C. Kanodia* 96492 (BSI); Valpoi, 02.05.1963, *K.C. Kanodia* 88354 (BSI); Valpoi, near the broken bridge between Codel–Ambacho Gol on Satrem river, 24.03.1964, *K.C. Kanodia* 96467 (BSI & CAL); South Goa, Canacona, Butpal forest, 24.04.1963, *K.C. Kanodia* 88240 (BSI). **Karnataka**, Belgaum district, Chappoli nallah, Jambotti R.F., 15.12.1994, *V.P. Prasad* 172882 (BSI); Chikmagalur district, Balihole–Magundi, 09.03.1979, *Ramesh & Prakash* 6568 (JCB); Dakshina Kannada district, Malpe, 09.03.1963, *R.K. Arora* 3032 (CAL); Dakshina Kannada district, Kannadekatte, 06.05.1975, *Bhat* 179 (MGH); Dakshina Kannada district, Padergudda, Malpe, 18.12.1976, *Bhat* 438 (MGH); Hassan district, Aglati, November 1908, *A. Meebold* 9994 (CAL); Hassan district, Bisle, 14.03.1985, *Saldanha* 13075 (JCB); Kodagu district, Katakare, 18.12.1980, *Bhat* 728 (MGH); Mandya district, Sreerangapatana, 26.1.1984, *Dinesh* 779 (MGH); Mysore district, Gathenahalla (Devagiribetta), Biligirirangan hill ranges, 17.04.1962, *Rao* 80033 (BSI); Mysore district, Biligirirangan hill ranges, 27.04.1962, *A.S. Rao* 80380 (CAL); Mysore district, Tondaikerekan, base of Malkibetta, Biligirirangan hill ranges, 27.04.1962, *Rao* 80380 (BSI); Shimoga district, Agumbe–Someswar Road, Addaiguda, 20.05.1960, *R.S. Raghavan* 62741A (BSI); Shimoga district, Agumbe, 18.05.1960, *R.S. Raghavan* 62619 (BSI); Uttara Kannada district, Dandeli, August 11 (without year), *Talbot* 2270 (BSI); Uttara Kannada district, Vincholi, 04.04.1965, *Talbot* 943 (BSI); Uttara Kannada district, Sidhapur, 05.05.1956, *G.S. Puri* 1982 (CAL); Uttara Kannada district, Yesle forest, 02.05.1956, *Mahajan* 1694 (BSI). **Kerala**, Ernakulam district, Paravoor, 14.01.1989, *Rejani* 30689 (CALI); Idukki district, Meenmutti, 18.02.1982, *V.S. Raju* 71255 (CAL, MH); Idukki district, Valara Waterfalls, 19.03.1982, *R. Rajan* 73078 (MH); Kannur district, Parappa, 24.1.1979, *V.J. Nair* 59849 (MH); Kannur district, Kannur, 18.03.1980, *V.S. Ramachandran* 66807 (CAL); Kollam district, Kodumon, 02.04.1978, *C.N. Mohanan* 54952 (CAL, MH); Kottayam district, Nalukodi, 16.04.1984, *V.T. Antony* 385 (MH); Kozhikode district, Feroke, 04.11.1977, *A.R. Raju* 22770 (CALI); Kozhikode district, Chedaleth, 10.05.1965, *J.L. Ellis* 24040 (CAL, MH); Palakkad district, Malampuzha dam site, 5.5.1958, *G.S. Puri* 36421 (BSI); Palakkad district, Nilumbur, 30.04.1958, *s.coll.* JAV 35995 (BSI); Palakkad district, Kakupadi to Mukkali, 17.04.1978, *N.C. Nair* 56875 (CAL); Palakkad district, Walayar R.F., 17.04.1978, *E. Vajravelu* 19048 (MH); Thiruvananthapuram district, Neyyar,

26.05.1979, M. Mohanan 63285 (CAL, MH); Kottur R.F., 03.04.1973, J. Joseph 44000 (MH); Thrissur district, Peechi forest, 18.05.1966, K.M. Sebastine 27183 (MH); Olakara rice fields, 26.11.2015, V.P. Prasad 70717 (CAL); Wayanad district, Vythiri, 13.01.2007, Viji A.R. 61018 (TBGRI). **Madhya Pradesh**, Jabalpur district, Marlli rocks, Bheraghat, 16.01.1961, J.K. Maheshwari 4552 (CAL); Bilaspur district, Korba, 17.04.1965, G. Panigrahi and C.M. Arora 8675 (CAL); Mala Tank, Damoh, 14.02.1979, B.K. Shukla 29779 (BSA); Pondi, Sanjay National Park, 30.04.2002, Ranu Ganguli 55519 (BSA); Sarroli, Balaghat, 29.12.1976, V.J. Nair 25654 (BSA); Hoshanbad district, Madai, Pachmarhi Biosphere Reserve, 02.05.2001, B.K. Sinha 47271 (BSA). **Maharashtra**, Kolaba district, Rohu, 23.06.1957, S.K. Jain 18802 (CAL); Mumbai district, Marve Rd., Malad, 24.12.1955, Shah 6622A (BLAT); Borivali National Park, 12.12.1955, R.R. Fernandez R.1725A (BLAT); Pune district, Lonavala, 24.09.1961, V.D. Vartak 24139 (AHMA); Khandala, 08.04.1956, R.R. Fernandez R.2302 (BLAT); near Valvan dam, Lonavala, 18.08.1964, B.V. Reddi 98633 (BSI); Lohagad, 05.05.1956, S.K. Jain 844 (BSI); Khandala, 02.01.1963, V.D. Vartak 23101 (AHMA); Bhimashankar, 31.03.1957, G.S. Puri 12643 (CAL); Ratnagiri district, Gavata, 18.02.1966, M.Y. Ansari 108393 (BSI); ½ km west of Alceri, 15.02.1966, B.G. Kulkarni 107782 (BSI); Ratnagiri, 10.12.1960, V.D. Vartak, 17811 (AHMA); Satara district, on way to Chiniman's fall, 07.05.1961, R.S. Rao 71654 (BSI); before Lingmala falls, 07.05.1961, R.S. Rao 71621 (BSI); Mahabaleswar, 04.04.1956, G.S. Puri 193 (CAL); Mahabaleswar, 29.12.1957, Y.A. Merchant 523 (BLAT); Sindhudurg district, Amboli, 19.05.1968, M.R. Almeida 630 (BLAT); Bombay, 01.02.1961, V.D. Vartak 17946 (AHMA). **Manipur**, s. loc., s.d., D. Deb 1604 (CAL). **Meghalaya**, Kopili river bed, K. & J. Hills, 06.04.1972, N.C. Deori 50269 (ASSAM); Khasia, s.d., s. coll. s.n. (CAL). **Nagaland**, Naga Hills, s.d., F. Kingdon Ward 11325 (CAL). **Odisha**, Kendujhar district, Palaspal, 30.06.1957, G. Panigrahi 8466 (ASSAM); Jajpur, Sukinda, 22.06.1957, G. Panigrahi 8261 (ASSAM); Vani-Vihar, Bhuwaneswar, 20.11.1970, S.S. Rath 34 (AHMA); Bolangir district, Deogaon, 27.06.1957, G. Panigrahi 8381 (CAL); Barqud, 15.02.1961, G. Panigrahi 23859 (CAL); Mahendragiri, Sabakota village, 14.03.1959, G. Saran & Party 58678, 58720 (LWG); Puri, 05.03.1959, G. Saran & Party 58188 (LWG); Khordha district, Balugaon, 04.03.1959, G. Saran & Party 56779 (LWG); Sambalpur district, Bamsa, Badrama range, 24.03.1964, S.L. Kapoor & Party 71384 (LWG). **Sikkim**, s.loc., 04.02.1867, T. Anderson s.n. (CAL); s.loc., 10.10.1868, S. Kurz s.n. (CAL); Lingla, 20.4.1908, Rhomos 233 (CAL); s.loc., s.d., N.C. Majumdar & R.M. Dutta 346 (CAL); Sikkim East district, Ranipool, 2500 ft, 23.08.1980, P.K. Hajra 610 (BSHC). **Tamil Nadu**, Coimbatore district, Amaravathy Dam, 18.05.2012, Viji A.R. 73461 (MH); Madurai district, near Forebay Dam, 15.10.1959, K. Subramanyam 9378 (CAL); Near Kumili, 22.06.1959, K. Subramanyam 8140 (MH); Nilgiris district, Pykara, June 1883, J.S. Gamble 11840 (CAL); Gudalur, June 1886, s. coll. s.n. (MH); Devala, 07.01.2007, Viji A.R. 61165 (TBGRI); Pudukkottai district, Narthamalai, 15.03.1986, C. Arulappan 740 (MH); Thanjavur district, Thajavur, 28.05.1978, V.J. Nair 57171 (CAL); Tirunelveli district, Manimuthar Dam, 28.06.1957, K.M. Sebastine 3703 (CAL). **Tripura**, M.B.B. College premises, Agartala, 02.04.1956, D.B. Deb 402 (CAL, DD); College lake, M.B.B. Collage, Agartala, 02.01.1957, D.B. Deb 571 (CAL); Charilam, 04.03.1960, D.B. Deb 2521 (CAL). **Uttar Pradesh**, Pilibhit district, Pilibhit, 26.05.1898, Inaqaat 22875 (CAL); Bahraich district, Sohelwa, 12.07.1954, s.coll. 12421 (LWG); Banaras (Varanasi) district, Latipshah dam, 05.01.1957, Kaul & Party 47671 (LWG). **West Bengal**, Bankura district, Bishnupur, 21.02.1965, M.N. Sanyal 564 (CAL); Barddhaman district, Idilpur, Burdwan, 04.05.1960, A.K. Dutta 115 (CAL); Hoogly district, Jarakeswan, 27.04.1964, M.K. Ghosh 862 (CAL); Howrah district, Burgachia, 25.05.1963, S.S.R. Bennet 309 (CAL); Jalpaiguri district, Alipurwar, Jalpaiguri, 23.04.1959, C.R. Das 79 (CAL); Kalimpong-Samsing and surrounding forests, 675 m., 29.04.1981 B. Krishna 1524 (BSHC); Malda district, Saluka bill area, 28.04.1966, R.M. Dutta 250 (CAL); Midnapur district, Kankrajohore forests, 19.05.1963, G. Sengupta 477 (CAL); Purulia district, Manbhum, s.d., J. Campbell s.n. (CAL); West Dinajpur district, Balurghat, 07.04.1984, R.N. Banerjee & party 16222 (CAL).

2. *Fimbristylis squarrosa* Vahl, Enum. Pl. 2: 289. 1805. var. *squarrosa*. Fig. 1d-f.

Annuals with slender, tufted culms, 5–16 cm high. Leaves shorter than culm, very narrow, often sparsely hairy towards base and the sheath. Inflorescence compound or decompound, 2–4 cm long. Spikelets solitary, 4–8 × c. 3 mm (including mucro of the glumes), acute at apex, prominently squarrose. Glumes ovate or oblong-ovate, 2–2.2 × 1 mm (including the 0.8–1 mm long excurved mucro), acute at apex, keeled. Stamen 1; anther oblong, 0.25–0.3 mm long. Style sparsely ciliate towards the top; with a whorl of long, pendent hairs from the base covering upper part of the achene. Achene biconvex, obovate, 0.7–0.8 × c. 0.5 mm, shortly stipitate.

Flowering & Fruiting: Almost throughout the year.

Habitat: Found in wet sandy soil along shores of lakes and edges of paddy fields.

Distribution: Widely distributed in tropical and subtropical Old World. INDIA: Assam, Bihar (Singh *et al.*, 2001), Chhattisgarh (Subramanyam & Henry, 1966), Gujarat, Himachal Pradesh (Chowdhery & Wadhwa, 1984), Jharkhand (Sarma & Sarkar, 2002), Jammu and Kashmir, Madhya Pradesh, Manipur, Meghalaya, Odisha, Rajasthan, Tripura, Uttarakhand, Uttar Pradesh and West Bengal.

Specimens examined: **Assam**, Dibrugarh district, Dibrugarh, 04.04.1885, C.B. Clarke 37721A (CAL); Lakhimpur district, near N.E.F.A. IB., North Lakhimpur, 12.05.1966, D.M. Verma 41738 (ASSAM); Jorhat district, Jorhat, 31.03.1963, J.G. Srivastava 81447, 81450, 81451 (LWG). **Gujarat**, Banaskantha district, Sipu dam, 03.06.2002, S.L. Meena 17849 (BSJO, Image). **Jammu and Kashmir**, Verinag, northern hills, 08.07.1962, D. Dev & Party 73991 (LWG); Kulgam kund, 20.09.1962, Aminshah & Aslam 82819 (LWG); *s. loc.*, October 1953, Kaul & party, *s.n.* (LWG). **Madhya Pradesh**, Shivpur district, Shivpur National Park, March 1986, A.N. Singh 35850, 35928, 41723 (BSA). **Manipur**, Hills N.W., Imphal, 16.04.1962, J.G. Srivastava 81607, 81610, 81612, 81614 (LWG). **Meghalaya**, Norgkhlaw, K & J Hills, 15.06.1958, G. Panigrahi 16205 (CAL). **Odisha**, Lion's Rump, 22.02.1961, G. Panigrahi 23979 (ASSAM); Bargud (Bargarh?), 15.02.1961, G. Panigrahi 23859 (ASSAM). **Rajasthan**, Aboo, 1868, *s. coll.*, *s.n.* (CAL). **Tripura**, *s.loc.*, *s.d.*, D.B. Deb *s.n.* (CAL). **Uttarakhand**, Nainital district, Bhimtal, 20.08.1923, H.G. Champion 44922 (DD). **Uttar Pradesh**, Moradabad district, Moradabad, March 1844, T. Thomson *s.n.* (CAL); Mirzapur district, Dhandharaud Dam, 19.07.1965, O.P. Misra 9813 (BSA); Deoha River bed, 14.05.1970, C.L. Malhotra 40214 (BSD); Saharanpur district, Mohand, 08.09.1968, O.P. Misra 37901 (BSD). **West Bengal**, Howrah district, banks of river Ganges, near Shibpur, *s.d.*, S. Kurz 5162 (CAL); Jalpaiguri district, Jaldapara National Park, Sisamara, 23.09.2012, K. Karthikeyan 58996 (CAL); Jaldapara National Park, Dayamara, 11.12.2014, K. Karthikeyan 65061 (CAL); West Dinajpur district, Raigunj, 12.04.1984, R.N. Banerjee 17441 (CAL).

Note: According to Karthikeyan *et al.* (1989), the typical variety is distributed almost throughout the country. However, during the present study it was found that it is restricted to northern, northeastern, eastern, central and northwestern states. No specimens were found from the southern

states and there are no authentic reports as well. In the southern states, the species is represented by the variety *esquarrosa*. Wadoodkhan (2015) reported *F. squarrosa* from Maharashtra and Tamil Nadu without specifying the variety. Since he included the report of *F. squarrosa* var. *esquarrosa* from Karnataka (Prasad & Singh, 2002) in the nomenclatural citations, it is assumed that the specimens studied by him are of var. *esquarrosa*.

3. *Fimbristylis squarrosa* var. *esquarrosa* Makino, Bot. Mag. (Tokyo) 17: 47. 1903. *F. velata* R. Br., Prodr. Fl. Nov. Holland.: 227. 1810. *F. aestivalis* var. *esquarrosa* (Makino) Koyama, J. Fac. Sci. Univ. Tokyo III. 8: 116. 1962. *F. dichotoma* var. *villosa* C.E.C. Fisch. in Gamble, Fl. Madras: 1658. 1931, non Vahl, 1805. *F. bisumbellata* var. *hirtistyla* C.E.C. Fisch., Bull. Misc. Inform. Kew 1935: 150. 1935. **Fig. 1g-i.**

Glumes 1.8–2 mm long (including the mucro). Stamen 1; anther linear-oblong, *c.* 0.5 mm long; filament up to 2 mm long. Style prominently long-ciliate, with a whorl of long, pendent hairs from the base covering upper part of the achene; stigmas 2, shorter than style. Achene *c.* 0.7 mm long.

Flowering & Fruiting: March–June; December.

Distribution: China, Russian Far East, Korea, Indochina, Thailand, Japan, Malesia, Australia, New Zealand, Fiji. INDIA: Southern and eastern India (Karnataka, West Bengal).

Specimens examined: **Southern India** (state?), *s. loc.*, *s.d.*, *s. coll.*, *s.n.* (CAL). **Karnataka**, Hassan district, Hebbasale, 24.12.1970, Saldanha 16450 (JCB); Uttara Kannada district, along Kargatti river, 29.05.1978, Ahmed 1159 (JCB). **West Bengal**, Birbhum district, Ballavpur WLS, Bolpur, 11.03.2008, A.K. Sinha 43358A (CAL); Howrah district: Kulgachia, 22.05.1963, S.S.R. Bennet 295 (CAL); Hoogly district: Tarakeshwar, 27.04.1963, M.K. Ghosh 862 (CAL); South 24 Parganas district, Kakdweep, 05.06.1965, A.K. Mukherjee E4365 (CAL).

Notes: This variety is very similar to *F. aestivalis* in appearance, rather than the typical *F. squarrosa*. Spikelets are not prominently squarrose, because the mucro at glume apex is not recurved, hence, the spikelets also look like those of *F. aestivalis*. In typical *F. squarrosa*, the spikelets are prominently squarrose, because of the longer and excurved mucro.

4. *Fimbristylis griffithii* Boeckeler, Flora 43: 241. 1860. *F. aestivalis* sensu C.B. Clarke in Hook.f., Fl. Brit. India 6: 637. 1893, *p.p. non* (Retz.) Vahl, 1805. **Fig. 1j-l.**

Annuals with fibrous roots (rarely short-lived perennial with short rhizome), glabrous, (2–)7–33 cm high. Culms tufted, slender, compressed, 3–5-angled. Leaves shorter than to as long as the culm, not hairy, at times falcate and scabrid on the margins. Inflorescence compound to decomposed, 1.5–10 × 1.5–14 cm. Spikelets few to many, solitary, angular, ovoid or oblong-ovoid, 4–6 × c. 1.5 mm. Glumes ovate, 1.3–1.8 × c. 0.7 mm (including the 0.1–0.3 mm long mucro), acute at apex; keel prominent, green; sides hyaline. Stamens 1 or 2; anthers linear-oblong, 0.3–0.4 mm long; style 0.7–1 mm long, glabrous; stigmas 2, shorter than style. Achene biconvex, obovate, 0.5–0.7 × 0.3–0.4 mm, yellowish brown, shining.

Flowering & Fruiting: February–June; September–November.

Habitat: Rice fields, river banks and stream sides.

Distribution: Malesia, Myanmar, New Guinea, Thailand and Vietnam. INDIA: Andaman and Nicobar Islands, Arunachal Pradesh (reported here for the first time), Assam, West Bengal (reported here for the first time),

Specimens examined: **Andaman and Nicobar Islands**, South Andamans, Putatang stream, 02.02.1904, C. Gilbert Rogers 65 (CAL); Nicobar Islands, Dogmar River bank, 09.04.1966, K. Thothathri 11612 (CAL); Gallathia river side, 24.03.1966, K. Thothathri 11493 (CAL). **Arunachal Pradesh**, Bombu to Sissini, Kameng F.D., 28.03.1958, G. Panigrahi 6224 (CAL); Ziro, 03.06.1961, G.V. Subba Rao 24705 (CAL). **Assam**, Jalap–Lakhimpur, 23.03.1894, G.A. Gammie 177 (CAL). **West Bengal**, Hoogly district, Balagar, 11.09.1968, Subir Sen 751 (CAL); Jaldaka River, Duars plains, 23.02.1911, Ribu & Rhomoo 4979 (CAL).

Discussion

Among the four taxa, *F. griffithii* is easily mistaken for the similar looking *F. aestivalis* because of the close resemblance in their habit as well as the reproductive structures. It is worth mentioning that Clarke (1893) did not treat *F. griffithii* as a distinct species, but as a synonym of *F. aestivalis*. However, *F. griffithii* can be differentiated by the glabrous nature of the plant and the glabrous style. In *F. aestivalis*, plants are usually smaller and hairy, with the style ciliate at least towards the top. Similarly, *F. squarrosa* var. *esquarrosa* is closer to *F. aestivalis* in appearance rather than typical *F. squarrosa*. Such similarity in appearance often leads to wrong identification of species. For instance, while checking the identity of the specimens identified as *F. aestivalis* at CAL, some of the specimens from Andaman and Nicobar Islands, Arunachal Pradesh, Assam and West Bengal were found to be wrongly identified as *F. aestivalis*, in fact they are either *F. griffithii* or *F. squarrosa* var. *esquarrosa*. All the specimens from the Andaman and Nicobar Islands, identified as *F. aestivalis*, are of *F. griffithii*. The same observation was made during a recent visit to PBL. Hence, presence of *F. aestivalis* in Andaman and Nicobar Islands needs to be confirmed. However, it is a common species distributed almost throughout the mainland India, whereas *F. griffithii* is hitherto known only from Andaman and Nicobar Islands and Assam. There are collections of this species at CAL, from Arunachal Pradesh and northern West Bengal, which were wrongly identified as *F. aestivalis*. Therefore, *F. griffithii* is reported here for the first time from these two states.

Fimbristylis squarrosa var. *esquarrosa* is another taxon often confused with *F. aestivalis* because of their close resemblance. Unlike the typical *F. squarrosa*,

Table 1. The important diagnostic characters of *Fimbristylis aestivalis*, *F. squarrosa* var. *squarrosa*, *F. squarrosa* var. *esquarrosa* and *F. griffithii*

	<i>Fimbristylis aestivalis</i>	<i>F. squarrosa</i> var. <i>squarrosa</i>	<i>F. squarrosa</i> var. <i>esquarrosa</i>	<i>F. griffithii</i>
Leaves	Densely hairy on sheaths and lamina	Often sparsely hairy towards base and on sheaths	Somewhat hairy on sheaths	Glabrous
Spikelets	Not squarrose	Prominently squarrose	Not squarrose	Not squarrose
Style	Ciliate at least towards the top; without pendent hairs at base.	Sparsely ciliate towards the top, with pendent hairs at base covering upper part of the achene	Densely ciliate, with pendent hairs at base covering upper part of the achene	Glabrous, without pendent hairs at base

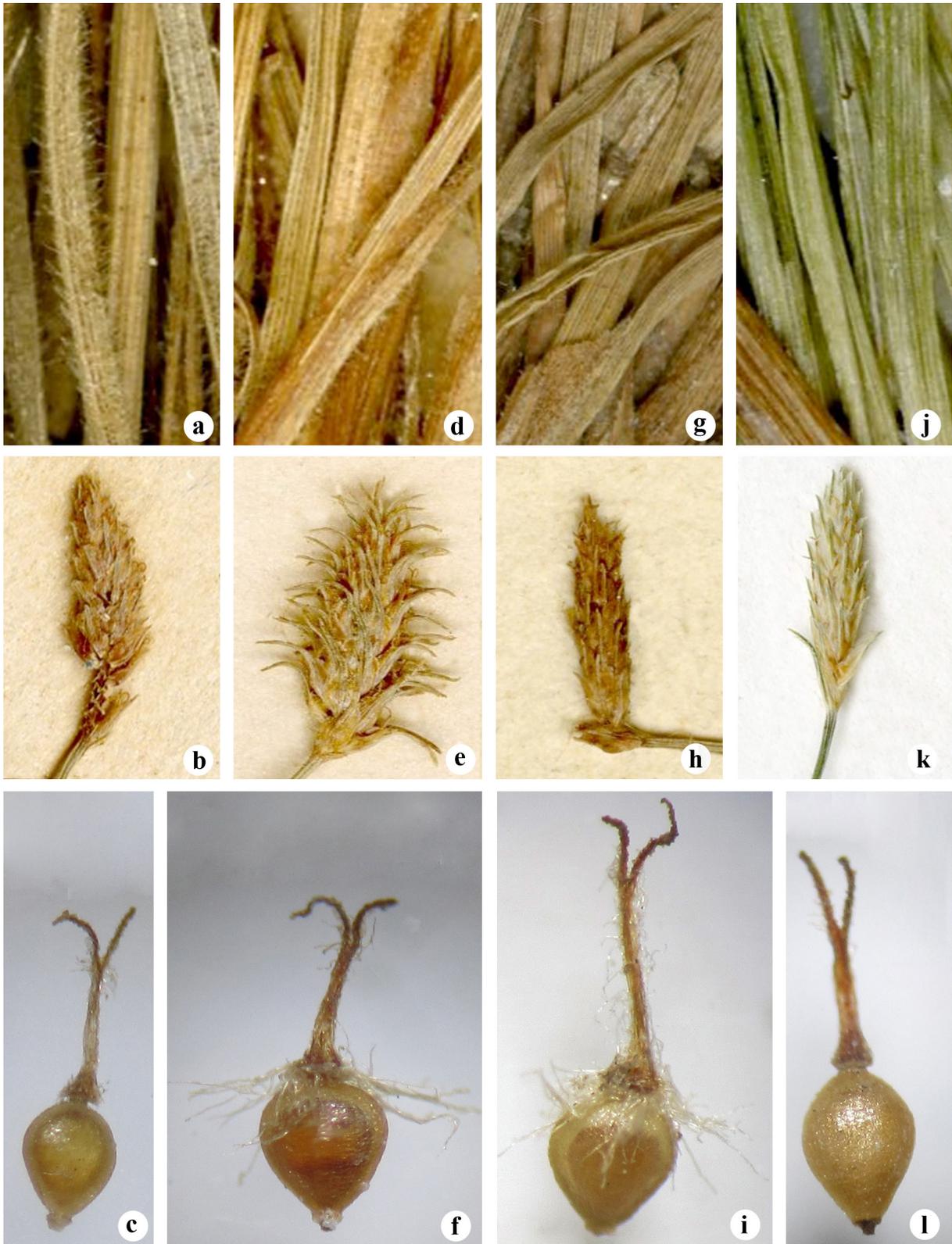


Fig. 1. a–c. *Fimbristylis aestivalis*: a. Leaves (with dense hairs); b. Spikelet; c. Achene (with style ciliate towards the top); d–f. *F. squarrosa* var. *squarrosa*: d. Leaves (sparsely hairy towards the base and sheaths); e. Spikelet (showing the squarrose nature); f. Achene (with style sparsely ciliate towards the top and pendent hairs at base); g–i. *F. squarrosa* var. *esquarrosa*: g. Leaves (without hairs on the lamina); h. Spikelet; i. Achene (with style densely ciliate and pendent hairs at base); j–l. *F. griffithii*: j. Leaves (glabrous); k. Spikelet; l. Achene (with glabrous style).

muco of the glumes is not excurved in these taxa, but straight. Interestingly, it is rather easy to differentiate the typical variety of *F. squarrosa* from var. *esquarrosa* by the squarrose nature of its spikelets. The prominently excurved muco of the glumes gives a squarrose appearance to its spikelets. At CAL, all the specimens of *F. squarrosa* var. *esquarrosa* from the state of West Bengal were found wrongly identified as *F. aestivalis*. These can be differentiated only by observing the style and achene under microscope. The trichomes are either absent or inconspicuous on the style-base of *F. aestivalis*, but prominently long and pendent, covering up to $\frac{3}{4}$ ths of the achene in *F. squarrosa* var. *esquarrosa*.

As indicated earlier, all the above-mentioned taxa share important common characters, such as eligulate leaves, anhelate inflorescence with well-developed rays, size and shape of the angled spikelets, spirally arranged ovate glumes, distigmatic flowers and dorsiventrally compressed, obovate, smooth achenes. Because of their close resemblance, *F. aestivalis*, *F. squarrosa* var. *esquarrosa* and *F. griffithii* can be differentiated only by observing the specimens with a hand lens or under a microscope. But the typical *F. squarrosa* can easily be distinguished by the squarrose spikelets. The important differentiating characters of the four taxa are given in Table 1 and in Figure 1.

Acknowledgements

The author is grateful to the Director, Botanical Survey of India, and the Head of Office, CAL, Howrah, for the facilities at CAL. Grateful thanks are due to the Heads of Office/Department of AHMA, ARUN, ASSAM, BLAT, BSA, BSD, BSHC, BSI, DD, JCB, LWG, MH and Manasa Gangotri Herbarium, Mysore University, for the permission to work in their respective herbarium. Thanks are due to Dr. Ramesh Kumar, Scientist 'C', BSJO, for sending an image of the specimen of *Fimbristylis squarrosa* var. *squarrosa* collected from Gujarat and Dr. Narayanan Nair, Principal Scientist, National Botanical Research Institute, Lucknow, for arranging the image of a specimen of *F. aestivalis* from Odisha. Dr. W. Arisdason, Scientist, Botanical Survey of India, Kolkata, has kindly gone through the manuscript and improved its quality. Dr. Animesh Maji, SPF, CAL, helped in procuring literature. Thankful acknowledgements are also due to Mr. Anand Kumar, Botanical Assistant and Mr. Dinesh Sah, Artist, Botanical Survey of India, Kolkata, for scanning the specimens and for preparing the plate, respectively.

Literature Cited

- Chowdhery, H.J. & B.M. Wadhwa 1984.** *Flora of Himachal Pradesh – Analysis 3*. Botanical Survey of India, Howrah. p. 751.
- Clarke, C.B. 1893.** Cyperaceae. In: Hooker, J.D. (ed.), *The Flora of British India*. Vol. 6. L. Reeve & Co., London. p. 637.
- Govaerts, R., Koopman, J., Simpson, D.A., Goetghebeur, P., Wilson, K., Egorova, T. & J.J. Bruhl 2018.** *World Checklist of Selected Plant Families*. Facilitated by the Royal Botanic Gardens, Kew. Published on the Internet; <http://apps.kew.org/wcsp/> (accessed 29.09.2018).
- Karthikeyan, S., Jain, S.K., Nayar, M.P. & M. Sanjappa 1989.** *Florae Indicae Enumeratio: Monocotyledonae*. Botanical Survey of India, Kolkata. pp. 50–56.
- Kumar, A., Halder, S., Ranjan, V. & P. Venu 2013.** *Fimbristylis clarkei*, a new species of Cyperaceae from India. *Kew Bull.* **68(4)**: 669–672.
- Murugesan, M., Balasubramaniam, V. & N. Nagarajan 2010.** Description of two new species of the genus *Fimbristylis* Vahl (Cyperaceae) from Vellingiri hills, Nilgiri Biosphere Reserve, India. *J. Threat. Taxa* **2(13)**: 1379–1381.
- Prasad, V.P. & N.P. Singh 1997.** Notes on the distribution and endemism of Indian *Fimbristylis*. *J. Bombay Nat. Hist. Soc.* **94**: 22–26.
- Prasad, V.P. & N.P. Singh 2002.** *Sedges of Karnataka (India)*. Scientific Publishers, Jodhpur. p. 151.
- Sarma, T.K. & A.K. Sarkar 2002.** In: Singh, N.P. & P.S.N. Rao (eds.), *Flora of Palamau District, Jharkhand*. Botanical Survey of India, Kolkata. p. 652.
- Singh, N.P., Mudgal, V., Khanna, K.K., Srivastava, S.C., Sahoo, A.K., Bandhopadhyay, S. Aziz, N., Das, M., Bhattacharya, R.P. & P.K. Hajra 2001.** *Flora of Bihar – Analysis*. Botanical Survey of India, Kolkata. p. 574.
- Subramanyam, K. & A.N. Henry 1966.** Vascular plants of Bastar, Madhya Pradesh. *Bull. Bot. Surv. India* **8**: 207–215.
- Sunil, C.N., Ratheesh Narayanan, M.K., Sivadasan, M., Naveenkumar, V.V., Ahmed Alfarhan, H., Abdul Jaleel, V. & M.H. Sameh 2016.** A new species of *Fimbristylis*

(Cyperaceae) from India. *Bot. Lett.* DOI: 10.1080/23818107.2016.1244776

Viji, A.R., Pandurangan, A.G. & S. Deepu 2016.

Fimbristylis tuckeri (Cyperaceae), a new species from the Western Ghats, India. *Kew Bull.* DOI: 10.1007/s12225-016-9652-7.

Wadoodkhan, M.A. 2015. *Cyperaceae of Western Ghats, West Coast and Maharashtra.* Datsons, Nagpur. p. 241.

Wadoodkhan, M.A. & P. Lakshminarasimhan 2008. Two new species of Cyperaceae from peninsular India. *J. Bot. Res. Inst. Texas* **2(1)**: 379–384.

Received: 26.10.2018

Revised and Accepted: 22.12.2018