TAXONOMIC ANALYSIS OF THE GENUS *FIMBRISTYLIS* VAHL (CYPERACEAE) IN SOUTH INDIA

Thesis submitted to the
University of Calicut for the award of the
Degree of Doctor of Philosophy in Botany

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CERTIFICATE

This is to certify that the thesis titled **"Taxonomic Analysis of the Genus *Fimbristylis* Vahl (Cyperaceae) in South India"** submitted to the University of Calicut by **Mr. Anoop K. P.** in partial fulfilment for the award of the degree of Doctor of Philosophy in Botany is the bonafide record of research work done under my guidance and supervision. No part of this work has been presented elsewhere for any degree or diploma previously.

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Date:

Dr. R. Prakashkumar

DECLARATION

I hereby declare that the thesis entitled "**Taxonomic analysis of the genus *Fimbristylis* Vahl (Cyperaceae) in South India**", submitted by me in partial fulfilment for the award of degree of Doctor of Philosophy of the University of Calicut, incorporates the results of the original work done by me in the Malabar Botanical Garden and Institute for Plant Sciences, Post Box No.1, Kozhikode-673014, Kerala. No part of the work has formed the basis for the award of any other degree or diploma previously.

Calicut **Anoop K. P.**

Date:

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1

INTRODUCTION

The world is now in an age of alarming environmental crisis caused mainly due to extensive destruction of the habitat consequent to injudicious anthropogenic activities. This has only now been realized and all our effort for environmental conservation are going on one side but unfortunately there is continuous and irrational exploitation of nature making the environment in hostile for life. As many keen observers can pursue, it is not only the earth, water and air but also the biodiversity that is going to hold the key for sustaining the quality of life on this earth. We do not even know for sure, how many species of organisms are in existence in the world. It is worthwhile to undertake explorations especially in the tropical part of the world, which harbors 40 – 50 % of total number of species. Which is basic requirement not only for academic and aesthetic pursues but also for improving human life on this globe.

India is the third richest country in the world with respect of biodiversity, and the tropical Peninsular India is particularly rich in this respect. But we have not paid serious attention to document this diversity especially in the post-colonial period. The information now available on this matter is outdated and far short of the actual situation present. Even among the few taxonomists who are actively engaged in floristic studies, sedges have never been under serious consideration. Except for the classical work of C. B. Clarke (1893, 1894) and Fischer (1934) there was no serious effort to study about of sedges of Peninsular India.

1.1. Importance of sedges

Cyperaceae or the sedge family are the third largest monocotyledonous family, consisting of about 109 genera and about 5,500 species of ubiquitous occurrence, closely allied to grasses, but of much less economic importance. They are mainly distributed in wet or moist lands. Often they are weeds of cultivation and in that way they are of negative economic importance. But some members of the family have been known to be of great usefulness to man since ancient times. The papyrus used by ancient Egyptians as writing paper hails from this family. The tubers of some species (*Cyperus rotundus* L., *Kyllinga nemoralis* Dandy ex Hutch. & Dalziel, *Kyllinga odorata* Vahl, *Kyllinga bulbosa* P. Beauv.) are used in indigenous medicine, while the split stem of some species (*Cyperus malaccensis* Lam., *Cyperus corymbosus* Rottb., *Cyperus pangorei* Rottb.) are used in mat and basket making. Sedges are produced in terrestrial ecosystem and provide food and habitat for many birds and animals.

1.2. Toxic aspects

The juice of *Cyperus longus* L. has been regarded as being very poisonous in South Africa and South Rhodesia (Zimbabae) and is said to burn the skin when applied to it. *Carex brunnea* Thunb. is another grass like herb found in the North Western Himalayas also in Manipur, Assam and Nilgiris has shown the presence of hydrocyanic acid when examined in fresh condition. Young leaves when eaten by cattle have been reported to have caused poisoning (Chopra *et al.* 1965)

1.3. Cyperaceae systematic position and affinities

The systematic position of the family Cyperaceae, and its origin and affinities are still unresolved. Several hypotheses have been proposed in this regard. There are two opposite view points. On one hand, earlier ystematic considered that the families Cyperaceae and Gramineae are closely related. On the other side, many botanist do not agree with this alliance.

Lindley (1853) placed Cyperaceae and Gramineae under the order Glumales in the class Endogenes which also included Devauxiaceae (Centrolepidaceae), Restionaceae and Eriocaulaceae. Bentham (1883) placed Cyperaceae along with

Flagellariaceae and Palmae. Tieghem (1891) divided the Monocotyledons into four orders. The order Graminidees included the families Graminees, Cyperacees, Centrolepidees, etc. Engler (1887) included the Cyperacees and Gramineae under the order Glumiflorae and the Juncaceae under Liliflorae. Subsequently, Engler and Prantl (1889), Warming (1904), Losty (1911) and Engler and Diels (1936) followed the same relative positions for these families.

Warming (1912) placed Juncaceae, Cyperaceae and Gramieae under Glumales. Bessy (1915) placed Cyperaceae and Poaceae under Graminales and Juncaceae under Liliales. Rendle (1953) grouped the Cyperaceae and the Gramineae under the order Glumiflorae but unable to assign the order a definite phylogenetic position to the order. He concluded that the Juncaceae form an apparently natural group. However their relation with Liliaceae is so close that it is difficult to draw a line between the two families.

According to Cronquist (1968) the order Cyperales consists of two familes, the Gramineae (Poaceae) and Cyperaceae. The two families are alike and differ from most other monocots in having the stomata in straight lines or rows of one or two, all oriented in the same direction. Like the Juncales and Restionales, the Cyperales have stomata with two supporting cells and have vessels in all vegetative organs. The pollen in Cyperales and Juncales is uniformly trinucleate as in that of single species of Restionaceae that has been studied palynologically.

Most genera in both families have perfect flower. The perfect flowers of the Cyperaceae have sometimes been interpreted as pseudanthia, but Cronquist (1968) does not agree with such an interpretation. According to him "there is no need or reasonable possibility to treat the perfect flower of *Scirpus* L. for example as anything but a flower. If the pseudanthial interpretation were accepted, Cyperaceae would hang on an evolutionary sky-hook, without evident relatives unless one were to accept also the even more difficult interpretation that the individual grass flower is a pseudanthium" (Cronquist, 1968). He also believed that it is more useful to group Gramineae and Cyperaceae in a single order Cypearles. The two families have too much in common to be derived from each other. They are lines diverging at an angle from a common source. The Cyperales are to be distinguished from the

Juncales on the one hand and the Restionales on the other. All three of these orders take their origin from the Commelinales and all that is really required to confirm Commelinales be ancestral to the other three orders. Thorne (1968, 1976) divided the Monocotyledons into five superorders. Juncaceae, Cyperaceae and Poaceae come under the superorder Commeliniflorae under the order Commelinales.

Hegnauer (1963) finds that the admittedly scanty chemical data are fully compatible with a relationship among Juncaceae, Cyperaceae, Gramineae and Restionaceae. Furthermore, although the Cyperaceae differs from the Gramineae in several respects, the chemical similarities between them are more suggestive of phyletic unity than a convergence. In recent years many authors have segregated Cyperaceae and Gramineae into different orders and even superorders. This view has been conditioned partly by the pseudanthial interpretation of the Cyperaceous flowers and partly by the seemingly incompatible relationships of the two families, the Cyperaceae to the Juncales and Gramineae to the Restionales. However, many cyperologists recognized considerable differences between Cyperaceae and Poaceae.

Many investigators have questioned the classical Cyperaceae – Gramineae alliances and instead have proposed a relationship of Cyperaceae with the family Juncaeae. Wettstein (1901) placed Cyperaceae and Poaceae in separate 'Reichen'. Hallier (1903, 1905a, 1905b, 1912) included Gramineae under Enantioblastae and Cyperaceae under Cyperales. Fischer (1934) placed Cyperaceae and Juncaceae in the order Cyperales. But, Hutchinson (1934) created the order Juncales for the family Juncaceae and treated it as the progenitor of the Cyperales and Graminales. Wettstein (1935) believed the Cyperaceae to be an offshoot of the Liliflorae although the transition was obscure. He retained the Juncaceae in Liliflorae and treated the order Cyperales as monotype with the only family Cyperaceae.

Willis (1973) associated the family Cyperaceae with the Juncaceae. He considered the Cyperaceae as being reduced from the Juncaceae. According to Thorne (1963) these two families are derived from the Xyridales. Among others who have suggested a Cyperaceae – Juncaceae relationship are Hakansson (1954, 1958), Love and Raymond (1957), Maheshwari (1958) and others.

Takhtajan (1959, 1969) placed Juncaceae and Cyperaceae under the subclass Commelinidae in the superorder Juncaceae. Juncaceae comes under Juncales and Cyperaceae under Cyperales. Poaceae comes under Poales in the superoder Commelinanae. Thus Poaceae and Cyperaceae come under the same subclass but different superorders. Takhtajan (1980) assumed that the Graminales (Poales) were derived from the Commelinales while the Cyperales derived from the Juncales. He placed Juncales and Cyperales under the superorder Juncanae and Poales under Commelinanae. According to his view the Cyperales are derived from the most primitives Juncaceae.

Stennins (1974) segregated these three families into different orders, Poales, Juncales and Cyperales under the superorder Commelinidae, and has been followed by Dahlgren (1975). Ehrendorfer (1978) considered that the subclass Lilidae include superorders Juncanae and Commelinanae. Juncanae include Juncales and Cyperales, Commelinanae include Poales.

Phylogenetically Cyperaceae are allied closely to the Gramineae. Hutchinson (1934) separated the families into two separate orders (Cyperales and Graminales). He considered the latter to be more highly advanced and treated both as having been derived from Liliaceous ancestors via the Juncaceae complex. The studies by Snell (1936) and Blaser (1940) indicated that the Gramineae are not close allies of Cyperaceae. Blaser (1940) pointed out that: (1) the superficial grass like habit has no phylogenetic significance and has appeared also in other unrelated families, (2) the spikelets of the Cyperaceae are not at all homologous with those of the grasses, since in the former they vary widely in organization within the family, whereas in the latter they are reasonably constant, (3) the basic placental condition of the Cyperaceae has been derived from an ancestral free-central type, whereas in the Gramineae it has been derived from a parietal type, (4) the florets of the Gramineae (excluding bracts) are borne terminally, whereas in the Cyeraceae they are always axillary in position. From these it is clear that the two families are not so closely related as some indicated them to be, but there remains the "possible derivation of the Cyperaceae from small flowered, few seeded, hypogynous Liliales with axile placentation, the transition having occurred through loss of septa and

placental axis and may have occurred through some line not recognizable" (Blaser, 1940)

It is generally agreed that the grasses and sedges are very advanced group, whose seemingly simple inflorescence and floral structure represent drastic reduction from unknown ancestral types. It is also generally conceded that they have been evolved from primitive Liliaceous ancestral stocks, stocks of unknown identities or contemporary relationships although phylogenesists have presented many hypotheses on this subject (Bessy, Arber and Hutchinson considered these to be Juncaceous in character). Formerly it is believed that two groups (grasses and sedges) are not as closely related. Furthermore the spikelet once thought to be a feature common to both is now not believed to be homologous and does not indicate a bond of phyletic relationship.

1.4. Classification of the Family

This family has been classified based on the morphology of the spikelets.

Engler and Diels (1936) divided the family into three subfamilies, seven tribes and about 72 genera. Hutchinson (1926, 1934) recognized 7 tribes represented by 83 genera. Bentham (1877) divided the family into two series, Monoclines (Scirpeae, Hypolytreae, Rhynchosporeae) and Diclines (Sclerieae, Cryptangieae and Cariceae). Bentham and Hooker (1883) divided the family into 6 tribes, viz. Scirpeae, Hypolytreae, Rhynchosporeae, Cryptangieae, Scleriae and Cariceae.

Clarke (1893) divided the family into Cypereae, Hypolytreae, Sclerieae and Cariceae. Cypereae was divided into three tribes, viz. Eucypereae, Scirpeae and Rhynchoporeae. Hypolytreae, Sclericeae and Cariceae were not divided.

Kern's (1974) classification was mainly based on the ideas of Holttum (1948) but has undergone some deviations. Kern divided the family into two subfamilies: Cyperoideae (bisexual flowers present) and Caricoideae (all flowers unisexual). Subfamily Cyperoideae was divided into three tribes: (1) Hypolytreae (outer two hypogynous scales folded, transverse and sharply keeled, ciliate or spinulose on the keel, free or sometimes connate on the adaxial side) represented by the genus *Hypolytrum*; (2) Cyperaceae (hypogynous scales when present, otherwise

or perianth consisting of bristles, spikelets as a rule several to many flowered, only one or two lower glumes empty) represented by the genera *Abilgaardia* Poir., *Bulbostylis* Steven, *Cyperus* L., *Eleocharis* R. Br., *Fimbristylis* Vahl, *Fuirena* Rottb., *Indocourtoisia* Bennet & Raizada, *Kyllinga* Rottb., *Lipocarpha* R. Br., *Mariscus* Scop., *Pycerus* Reichb., *Queenslandiella* Domin, *Remirea* Aubl., *Rikliella* J. Raynal *and Schoenoplectus* (Rchb.) Palla *and* Rhynchosporeae (hypogynous scales when present, otherwise or perianth consisting of bristles, spikelets as a rule glumes empty) represented by the genus *Rhynchospora* C. B. Clarke. Subfamily Caricoideae was divided into two tribes: (1) Sclerieae (all flowers strictly unisexual, female flowers not enclosed by a sac-like organ, a modified prophyll) represented by the genera *Diplacrum* R. Br. and *Scleria* P. J. Bergius and (2) Cariceae (all flowers strictly unisexual, female flowers enclosed by a scale-like modified prophyll) represented by the *Carex* L.

Dahlgren, Clifford and Yeo (1985) recognized five subfamilies, viz., subfamily Scirpoideae, Rhynchosporoideae, Mapanioideae, Sclerioideae and Caricoideae.

Tucker (1987) recognized two subfamilies, both having distribution worldwide, the Cyperoideae (Scirpoideae Pax, flowers perfect) and the Caricoideae Pax (flowers imperfect). The subfamily Cyperoideae is divided into four tribes, Scirpus, Scirpeae Dumort. (including Fimbristylideae Raynal; spikelets with 1 or 2 sterile basal scales, numerous fertile scales spirally arranged, perianth bristles generally present, embryos well differentiated), the Schoeneae Dumort. (Rhynchosporeae Fenzil; spikelets with several sterile basal scales, fertile scale 1 or 2, perianth bristles generally present, embryos slightly differentiated) and the Hypolytreae Fenzl (Mapanieae Koyama). The subfamily Caricoideae is divided into two tribes, the Scleriae Fenzl (achene naked, borne on a hardened disk) and the Cariceae Dumort. (achenes enclosed in a perigynium).

The genus *Fimbristylis* Vahl is the fourth largest genus within the Cyperaceae, having 306 species including several homogenous subunits (Bruhl & Wilson 2007). Distributed worldwide, especially in the tropics and subtropics. A few species are found in the warmer parts of the temperate region also. About 300

species have been reported from all over the world, of which majority are distributed in tropical Asia. 92 species of *Fimbristylis* have been reported from India (Prasad & Singh, 1997).

1.5. *Fimbristylis* complex – concepts of genera and generic delimitation.

The *Fimbristylis-Abildgaardia-bulbostylis* complex in the tribe *Scirpeae* is comprised of around 300 species, primarily of warm temperate, tropical and subtropical regions around the world (Kral, 1971). However, generic delimitations within this complex is still unresolved issue, nor it seems to be resolvable in the future, for a need of monographic work on a world-wide scale.

Gordon-Gray (1971) has given us a brief historical perspective of this matter. There are two opposite view points on generic delimitation in this group. On the one hand Koyama (1961) and his school consider *Fimbristylis* Vahl to be a broad genus to include *Abildgaardia* Vahl and *Bulbostylis* Steven in it because it "comprises a gradient of adaptive form at one extreme, the tropical, more or less water loving, morphologically diverse representatives, closest no doubt, to the immediately ancestral generic stocks at the other, the more temperate "dry-land" morphologically more uniform species derives, it would seem, in response to the stresses of more demanding environment between a zone of intermediates linking the extremes". On the other side, we have many others who define genera on narrow lines and recognize *Bulbostylis* Steven and *Abildgaardia* Vahl as segregate genera. The scenario is now more confusing with some cyperologists making various realignments in this complex (Lye, 1971, 1973).

The genera *Fimbristylis* Vahl and *Abildgaardia* Vahl were established by Vahl (1805) to accommodate sedges with spirally imbricated glumes each subtending a bisexual floret, with a biconvex or trigonous achene carrying a basally expanded, usually fimbriate margined, 2 – 3 branched style in the former and those with sub-distichous basal glumes and a trigonous, persistent style base in the latter.

Later authors, however, established a number of genera bearing close relationship to the taxa of Vahl among them were, *Isolepis* Brown (1810), characterized in part by solitary spikelets, *Trichelostylis* Lestiboudois (1819) with spirally imbricate glumes, trigonous achenes and 3-branched styles and

Pogonostylis Bertolini (1833) with long, pendent hairs from the style base overhanging the achenes.

Kunth (1837) recognized 3 sections in *Isolepis* R. Br. of which sect. *Bulbostylis* formed a link between sect. *Isolepis* and sect. *Fimbristylis* and suggested the former could well be treated as a distinct genus. This was later on validated by Clarke (1893) and is now conserved against *Stenophyllus* Rafinesque (in Neogenyt. 4. 1825), and *Bulbostylis* Steven (in Mem. Soc. Nat. Mos. V. 1814) which is an earlier homonym for some species now include in *Eleocharis.* However, the entry of *Bulbostylis* Kunth among the nomina generica conservanda in the Code has to be amended as *Bulbostylis* Kunth ex Clarke as Hooper (1968) has rightly pointed out (Gordon-Gray, 1971).

Bulbostylis Kunth has been widely recognized as a distinct genus since Clarke (1893), and includes mostly annuals with slender stem, very narrow leaves only from the base, generally finely hairy sheaths, 3 - 1 stamens (usually 2), anthers without crests and with small, bulbiform stylar base persistent on the achenes as a button. Ecologically, *Fimbristylis* Vahl and *Bulbostylis* Kunth have different requirements. Whole species of the former generally thrives in humid climates and high hydroperiod soil, most of the later are found on sandy substrate that are, as a rule, drier than on which *Fimbristylis* Vahl succeeds (Kral, 1971). Support for recognition of *Bulbostylis* Kunth as a separate genus has also come from other quarters. Veken's (1965) studies on embryo types in this complex have revealed that *Bulbostylis* Kunth and *Abildgaardia* Vahl have an embryo type different from that of *Fimbristylis* Vahl, even though Lye (1971) has challenged this. Guaglianone (1970) has demonstrated that the inflorescence of *Bulbostylis* Kunth is characterised by intraprophyllar buds while they are lacking in *Fimbristylis* Vahl, and that it can be a good diagnostic character for distinguishing them. Svenson (1957) and Goetghebeur and Coudijzer (1984) have emphasized the shape of epidermal cells on the achenes for generic delimitation: cells horizontally elongated and in vertical bands in *Fimbristylis* Vahl and cells vertically elongated and in horizontal bands in *Bulbostylis* Kunth. However, Kern (1974) is not in agreement with this sort of generic delimitation.

It is generally agreed that *Bulbostylis* Kunth is very close to *Fimbristylis* Vahl. In the classical sense, the only one character, that separates these two genera is the duration of the style base, they are more or less thick and deciduous in *Fimbristylis* Vahl and persistent in *Bulbostylis* Kunth. Other they have the same type of inflorescence (*Bulbostylis* Kunth has more frequently a congested inflorescence), fruits and vegetative characters, (except that species of *Bulbostylis* Kunth with open inflorescence do not have such broad leaves as are common in similar species of *Fimbristylis* Vahl (Lye, 1971). Cytologically they are similar and have the same base number (Koyama, 1961; Kral, 1971). Both these taxa (also *Abildgaardia* Vahl) possess an unusual type of microsporogenesis where the entire process takes place inside the wall of the microspore mother cell, (without cytokines is taking place) which ultimately forms the covering of the single pollen produce in the process (Tanaka, 1939, 1941; Kral, 1971)

However, it has been shown that the persistent stylar base is not such an infallible character for generic delimitation in this complex because there are intermediates (Gordon-Gray, 1971). Lye (1971) during the studies on African sedges, found that *Fimbristylis hispidula* (Vahl) Kunth had a *Bulbostylis* type embryo (Veken, 1965) and exhibited great variation in hairiness, in the size, shape and surface patterns of achenes and more important is the persistence of stylar base. Some had persistent stylar bases while others lacked it. So Lye (1971) suggested that this is no more useful character for generic delimitation and recommended their union, but later on retraced from this standpoint (Lye, 1973).

Vahl (1806) described the genus *Abildgaardia* to include species of *Fimbristylis* Vahl like habit, but with opposite glumes and flattened spikelets (Lye, 1973). He included two species in the genus: *Abildgaardia monostachya* Vahl now *Abildgaardia ovata* (N.L. Burm.) Kral and *Abildgaardia tristachya* vahl (now *Abildgaardia triflora* (L.) Abeywickr). But this genus has been recognized only by a few cyperologists, while most others unite them with *Fimbristylis* Vahl (Clarke, 1902; Hooper & Napper, 1972). However, embryological investigations by Van der Veken (1965) have shown that it is more close to *Bulbostylis* Kunth than to *Fimbristylis* Vahl. The only character that separates *Abildgaardia* Vahl and

Bulbostylis Kunth seems to be that at least the lower glumes are arranged distichously in *Abildgaardia* Vahl while all are spiral in *Bulbostylis* Kunth. Other characters like deciduous or persistent stylar base were found to be of no taxonomic value, because both conditions are represented in each genus (Lye, 1971; Kral, 1971; Gordon-Gray, 1971). Intraprophyllar buds which are lacking in *Fimbristylis* Vahl and present in *Bulbostylis* Kunth are also present in some species of *Abildgaardia* Vahl (Guaglianone, 1970). Consequently the generic alignment in this complex has advocated the inclusion of *Bulbostylis* Kunth in *Fimbristylis* Vahl has now resurrected *Abildgaardia* Vahl, mainly based on embryo types, as a distinct genus and has included *Bulbostylis* Kunth in it (Lye, 1973). But this has yet to find acceptance among cyperologists.

In short, the present scenario as to the generic delimitations and circumscription in the *Fimbristylis* – *Abildgaardia* - *Bulbostylis* complex is quite confusing. It appears that the differences separating the genera are few (Kral, 1971). Generally the borad view of Koyama (1961) while indicative of the overall relationship of the species, is too coarse a classification to delimit finer, yet well marked phenetic similarities among them. If, at the other extreme generic limits are drawn to emphasise the smallest phonetic groups recognizable, then the genera will be many and mostly after too uniform and narrow for recognition of section or series within them (Gordon-Gray, 1971).

Nevertheless, Koyama's (1961) perspective of the genus comprises a gradient of adaptive forms. Most of the cyperologists (lumpers as well as splitters) accept that they comprise distinct biological units either as sections under *Fimbristylis* Vahl or as a distinct genera.

In the absence of world wide monographic treatment of the taxa involved, the only path available to us is that of expediency (Kral, 1971). In the light of this, we prefer to treat the three as distinct genera, for the purpose of this treatise as has been done by Kral (1971), Gordon-Gray (1971) and Tucker (1987), and will leave the question of generic circumscription and delimitation for future monographers. The three genera can be keyed out as follows (key after Gordon-Gray, 1971).

1. Tropical, water-loving mostly perennial with spiral, imbricate glumes, almost glabrous with 3 - 2 angled achenes, expanded deciduous style base and a *Fimbristylis* type embryo……...***Fimbristylis*** vahl

2. Intermediate, water-loving to dry land, perennials with spikelets flattened basally only or throughout, glumes glabrous or pubescent, achenes 3-angled, and a *Bulbostylis* like embryo ……..……..……. ***Abildgaardia*** Vahl

3. Fine leaves, dry land perennials or annuals with spirally imbricated, finely pubescent glumes, 3 - 2 angled achenes, persistent style base and a *Bulbostylis* like embryo……..……..***Bulbostylis*** Kunth

1.6. Morphology of *Fimbristylis*

Underground part:

Members of the genus are usually annuals or perennial herbs. Annuals have fibrous root system and perennials have short or long creeping rhizomes. Annual or perennial habit is often used to distinguish the members of genus at different taxonomic levels in combination with other characters.

Stems:

Stems are usually tufted and erect or obliquely erect. It can be capillary or slender to stout, few centimeters to one meter long, without nodes, more or less angular or subterete, striate or sulcate rarely ancipitous as in *Fimbristylis complanata* (Retz.) Link. Usually smooth, at times scabrid especially on the edges. Some of these stem characters are helpful to identify the genus at species level.

Leaves:

Leaves are usually in a basal cluster, but a time or a few or almost all cauline and in some species leaves are reduced to bladeless sheaths. Leaves are linear, sessile, herbaceous, shorter to much longer than stem, flat, involute. In *Fimbristylis*

lottoralis Gaudich. leaves are laterally flattened and equitant. Leaf sheath vary from few millimeters to several centimeters, membranous or herbaceous, usually closed, loosely or tightly enclosing the stem and colour varies from reddish, purplish, to greenish. Mouth of the sheath is concave, truncate or convex. Ligules absent or sometimes present represented by a fringe of hairs. Leaf characters especially its presence or absence, length, basal or cauline arrangement, presence or absence of ligule, etc. are used to distinguish many species of the genus.

Inflorescence:

Inflorescence in this family is constituted by the arrangement of spikelets. Inflorescence is always terminal and in some species reduced to single spikelet. Otherwise inflorescence is normally anthelate or capitate. Anthelate or umbellate inflorescence can be simple, compound, decompound or supra decompound. Sometimes spikelets are arranged in short to long spikes or in clusters. Inflorescences are usually subtended by foliaceous or glumaceous invalucral bracts. Number of the bracts varies from one to several. Normally the lowest bract is the longest and gradually becoming shorter upward. As inflorescence diversification play a pivotal role in understanding the relationship between different taxa.

Spikelets:

Spikelets is vary in their size, shape and colour and are found either solitary or in inflorescence. Each spikelet is generally subtended by a prophyll and below that a bract. It consists of a rachilla bearing glumes and flowers. In most species of *Fimbristylis* Vahl have tightly and spirally arranged glumes. Flowers are bisexual.

Glumes:

Glumes exhibit important taxonomic characters because of variation in their arrangement, number, size, shape, colour, nervation, apex, etc. Glumes are arranged spirally or distichously, but in some species of *Fimbristylis* Vahl the lower glumes of the spikelets are distichous and the upper ones spiral. Shape of the glumes can be linear, lanceolate, oblong, ovate, obovate or spathulate, the apex can be acute, obtuse, mucronate, etc. The size varies with in the range of a few millimeters and the colour varies from stramineous to different shades of red and brown. It can be

striate and often keeled with a faint to prominent midnerve. Presence or deciduous nature of the rachilla and presence or absence of wings on the rachilla is also important taxonomic characters.

Flowers:

Flowers are minute and inconspicuous in the genus *Fimbristylis* Vahl. But there are many useful floral characters such as number of stamens vary from 1-3, size of anthers, number (2-3) and length of stigma, hairs of the style, thickness of style etc.

Fruits:

Fruits are one seeds, indehiscent and usually known as nuts or achenes. Nuts are sessile or subsessiles or sometimes stipitate. It can be lenticular or trigonous and the shape varies as oblong, obovoid, ovoid or globose; apex can be obtuse, acute, apiculate. Difference in the size of the nut is often useful to differentiate the species within the genus. Surface of the nut varies according to the species. It can be smooth or with different kinds of ornamentation as trabeculate, verruculose or with some glandular outgrowth.

1.7. Distribution in India and ecology

Fimbristylis Vahl is the 4th largest genus within the Cyperaceae, consisting of about 306 species including many homogenous subunits (world Checklist of Monocot, 2006; Bruhl & Wilson, 2007) distributed throughout the world, but particularly abundant in the subartic and temperate regions of north and southern hemispheres. In India, genus is represented by 92 species (Karthikeyan *et al.*, 1989) of which 37 are endemic. Peninsular India has maximum number of endemics (Prasad and Singh, 1997)

Members of this genus are usually found in every formation and in any biotype except epiphytic and a substantial part of the herbaceous plants cover in grass lands and savanna. They are also found in eutrophic swamps, wet rice fields, swinging bogs and lake shores. Some species are found along muddy sea shores or in the mangroves (eg. *Fimbristylis argentia* (Rottb.) Vahl and *Fimbristylis polytrichoides* (Retz.) R. Br.). Some are found in sandy beaches (eg. *Fimbristylis*

cymosa R. Br.). Some members are salt tolerant and occur in salt marshes along the coast brackish and backwaters (eg. *Fimbristylis ferruginea* (L.) Vahl). Many species serve as indicators of swamp and marsh sedges like *F. acuminata* Vahl , *F. aestivalis* (Retz.) Vahl, *F. aphylla* Steud., *F.complanata* (Retz.) Link, *F. ferruginea* (L.) Vahl, *F. umbellaris* (Lam.) Vahl , *F. quinquangularis* (Vahl) Kunth, *F. tetragona* R. Br., etc. Some species found in mountain swamps, marshes and streams fringes (eg. *Fimbristylis salbundia* (Nees) Kunth, *Fimbristylis pierotii* Miq.). Majority of the species are distributed in low land.

Indian species extending to south and south-east Asian countries. Many species found in India have worldwide distribution, *F. dichotoma* (L.) Vahl, *F. complanata* (Retz.) Link, *F. ferruginea* (L.) Vahl and *F. cymosa* R. Br. are a few examples. But several species and a few infra-specific taxa shown an interesting range of distribution, being restricted to India and the neighboring countries of South Asia also extending to the southeast Asian region. *F. umbellaris* var. *vicaryi* (Clarke) Karthik, probably extends from North India to Pakistan, along the river Chenab. Similarly *F. intonsa* Blake, *F. merguensis* Clarke and *F. aestivalis* var. *trichopoda* Kern are found only in India and Malaysia. *F. multinerva* Govind. extends from the northeast to Myanmar. *F. disticha* Boeck. And *F. fimbristyloides* (F. V. Muell) Druce, found in Andaman and Nicobar Islands and northeast India respectively, are also found in Myanmar, Thailand and China. *F. obtusata* (Clarke) Ridl. reported from eastern India extends to Myanmar, Thailand and Malaysia. Similarly *F. sleumeri* Kern found in Thailand and Myanmar is also found in northeast India. *F. pierotii* Miq. occurring in east and northeast India is found in Malaysia, Korea and Japan also. In India, *F. rigidula* Nees is distributed in the Himalayas, east and northeast India and also found in Nepal, Southern China, Malaysia, Thailand and the Philippines. In India *F. stolonifera* Clarke is restricted to central, east and northeast and Andaman and Nicobar Island is also. *F.umbellaris* (Lam.) Vahl found in north, east, northeast and Andaman and Nicobar Island is also found in Nepal, Sri Lanka, Indo-China and Japan. *F. griffithii* Boeck. Reported from northeast India and Andaman and Nicobar Island is also found in Myanmar, Thailand, Malaysia and Indo-china. *F. eragrostis* (Nees & May. Ex Nees) Hance

extends from India to Sri Lanka, southern China, Malaesia and Indo-China. *F. merrilli* Kern reported recently from western peninsular India by Mistry and Almeida (1887) is found in China, Thailand, Queensland and Malaysia (Prasad and Singh, 1997).

Vegetative propagation in the genus by underground stem (rhizome) is common in rhizomatous species grown in sandy beaches. Seeds of some species are dispersed by aquatic birds like ducks. Pasture animals and man also play a role in the dispersal of sedges.

1.8. Objectives of the study

- To explore the wetland situations of Southern states of the country for collecting specimens of the genus *Fimbristylis* Vahl for its taxonomic evaluation.
- To study the herbarium specimens of the genus deposited in the major herbaria in South India for developing data-base for the diversity of the genus.
- To identify the specimens collected using dissection microscope and available literature.
- To find out the distribution of species in South India and to note intraspecific variations, if any.
- To find out the present status of the taxa and to suggest conservation measures wherever necessary.

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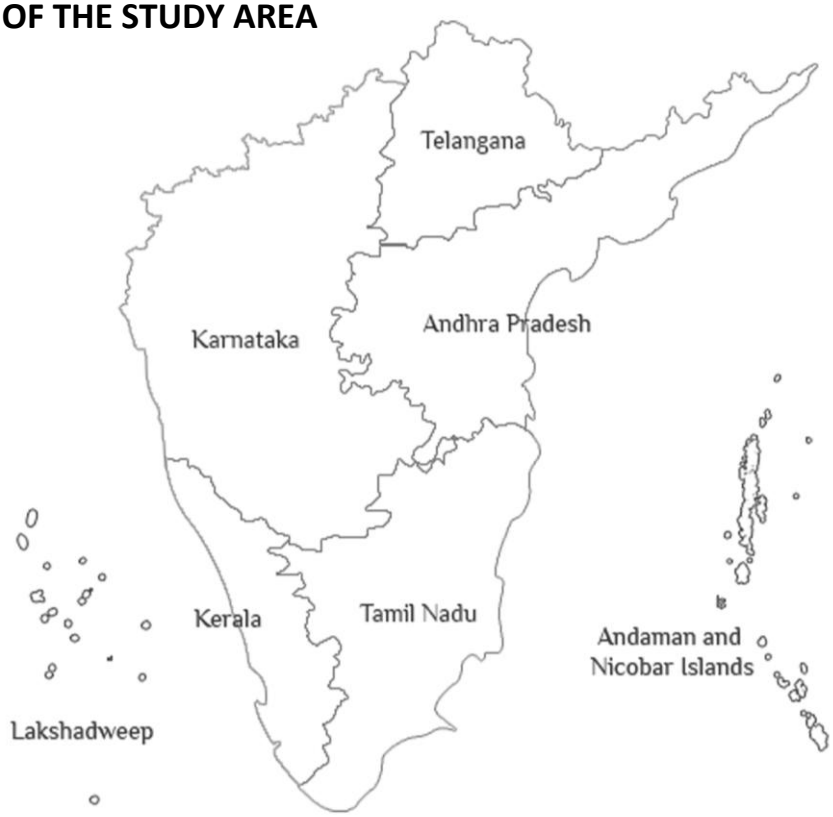
2

AREA OF STUDY

The area of present study is South India, which consists of the States of Kerala, Karnataka, Tamil Nadu, Andhra Pradesh and Telangana stretching north south between N 8^0 and 18^0 latitudes and east west between E 74^0 and 85^0 longitude. The total area is 4,67,186 km^2. It is bounded on the north by the states of Goa, Madhya Paradesh Maharashtra, and Orissa and on the east by the Bay of Bengal, on the south by Indian Ocean and of west by Arabian Sea.

Based on physiography South India can be subdivided in to two distinct floristic areas *viz*., Malabar and the Deccan. Malabar area is a strip of land lying west of Western Ghats parallel to the coast of Arabian Sea. This area includes coastal plains and hill ranges of the Western Ghats passing through the states of Karnataka, Kerala, Maharashtra and Gujarat. Western Ghats is a chain of mountain ranges stretching North-South along the western peninsular India for about 1600 kms. The Western Ghats is more or less continuous except at Palakkad gap, which separates the Nilgiri ranges from Anamalai. The average altitude of Western Ghats is 1,550 m and Anamudi, the highest peak in the south of Himalayas with a height of 2,695 m is located in the Idukki district of central Kerala. Some of the important centers of diversity in Western Ghats are Agasthyamala, Anamalai hills, Courttalum, Kalakkad-Mundanthurai, Kothayar, Kudremukh, Nilgiri Biosphere Reserve, Periyar Tiger Reserve, etc.

MAP OF THE STUDY AREA



Deccan plateau lies east to the Western Ghats which extends up to the Aravallies, the Malva, the Vindhyas, and the Satpura and Chotanagpur hills in the north and narrows right down towards Kannyakumari. Western and eastern sides are bordered by Western Ghats and Eastern Ghats. The northern part of the plateau slopes westwards while the southern part slopes towards the southeast. The annual rainfall is less in this region and the climatic condition is dry and the flora is represented by drought resistant species and thorny shrubs. The eastern sides of the plateau running parallel to the Coromandel coasts consist of fertile coastal plains. These plains are mainly formed from the deltas of Cauvery in Tamil Nadu, Godavari and Krishna in Andhra Pradesh and a number of small rivulets and streams.

Northern Western Ghats (Northern West Coast), Southern Western Ghats (West Coast), Eastern Ghats (Coromandel Coast), and Deccan are the four major phytogeographic divisions of peninsular India. It provides a wide variety of habitat, lateritic hills and valleys, swamps, marshy low lands,

sandy seacoasts, fresh water rivers, ponds and backwaters on the sea front and harbors diverse type of vegetations.

2.1. Rainfall

South India is nourished by both south-west monsoon (June – September) and north-east monsoon (October – December). Kerala and coastal Karnataka receive heavy rainfall from the south-west monsoon while north-east monsoon is more active in Andhra Pradesh and Tamil Nadu. The west coast region receives maximum rainfall during the monsoon season (± 2,200 mm annually). Tamil Nadu and Andhra Pradesh receive 1,500 – 2,000 mm rainfall annually. The climate of the southern parts of Andhra Pradesh is dry and getting only an annual rainfall of less than 500 mm.

2.2. Climate

Chowdhury and Sarwade (1982) divided homo-climatic regions of India into 5 categories viz., arid region, semi-arid region, sub-humid region, humid regime and super-humid regime. Among them, South India falls under four homo-climatic types. The coastal districts of Andhra Pradesh, interior Karnataka and some districts in Tamil Nadu comes under semi-arid climate. Northern coastal Andhra Pradesh, southern districts of Karnataka and northern Tamil Nadu experiences dry, sub-humid climate while coastal Karnataka and northern Kerala have moist, sub-humid type of climate. The humid regime predominates in southern districts of Kerala and at higher elevations around Coonoor and Ooty (Tamil Nadu). However, super-humid climate regimes occupies only at Kodaikanal in Tamil Nadu.

2.3. Rivers

South India is endowed with a lot of large and small rivers of which majority are originating from the Western Ghats and pour in to Arabian Sea and Bay of Bengal. The major rivers are Cauvery, Godavari and Krishna. Bharatapuzha, Nethravathy, Pampa and Periyar are some of the minor rivers that originate from Western Ghats and pour in to Arabian Sea (Meher Homji, 2001).

2.4. Forests

There are six major forest types in South India, viz. Tropical thorn forests, Tropical dry deciduous forests, Tropical moist deciduous forests, Tropical dry evergreen forests, Tropical semi-evergreen forests and tropical wet evergreen forests (Subramanyam & Nayar, 1974). The tropical wet evergreen forests is further subdivided in to the west coast tropical evergreen forests and the southern hilltop tropical evergreen forests. Tropical dry and moist deciduous forests dominates most of the geographical area of Peninsular India. The high altitude mountains gets the full benefit of both the monsoons, and it is in these wet humid parts of the Ghats that the evergreen and shola forests develop.

2.5. Soil

The major types of soils met with South India are red soil, black soil and lateritic soil. Red soil mainly occurs in Andhra Pradesh and Karnataka while black soil is distributed in Tamil Nadu, parts of Karnataka and Andhra Pradesh. The black cotton soil dominates in the peninsular region is derived from Deccan trap. The eastern part of Peninsular India was chiefly occupied by red soils. Lateritic soil occurs mostly on the Hills of Peninsular India, which is rich in Aluminium and Iron. Lateritic soils are generally reddish or yellowish-red and turn black on exposure to sun. Laterites are well developed on hilltops and are characterized by rich humus content.

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3

REVIEW OF LITERATURE

The genus *Fimbristylis* Vahl of the family Cyperaceae was founded Vahl in 1806 by segregating the species from the genus *Scirpus* L. which have spiral glumes and flat ciliate, deciduous style with dilated base (Prasad & Singh, 1997). Robert Brown (1810) noted the deciduous style articulated with the nut as the characteristic of the genus *Fimbristylis* Vahl and he included many tristigmatic species in this genus which were treated under *Scirpus* L. till then. *Trichelostylis* T. Lestib. is another genus founded by Lestiboudois (1819) based on tristigmatic nature, but later it has become synonymized under *Fimbristylis* Vahl. At global level detailed and critical floristic details on sedges are provided by Beetle (1943,), Kuekenthal (1949), Koyama (1958, 1985), Kern (1974), Kral (1971), Wilson (1981), Thomas (1984, 1992, 1994, 1998), Schuyler (1971), Muasya *et al*. (1998), Thomas & Alves (2008) etc.

Clarke's (1893 -1894) pioneer contribution in J. D. Hooker's flora of British India is the main source of information of Indian Cyperaceae which described 58 species of *Fimbritylis* Vahl.

Fyson (1915) reported 17 species of *Fimbristylis* Vahl from Nilgiris and Palani hill tops. Fischer (1934) made a crucial study on the sedges of presidency of Madras including the states of Andhra Pradesh, Karnataka, Tamil Nadu and parts of Kerala

and Orissa and described 32 species of *Fimbristylis* Vahl. Kern (1974) enumerate the Cyperaceae of Malesia and studied 78 species of *Fimbristylis* Vahl. Govindarajalu, one of the well known cyperologists of India (1973, 1974, 1975, 1990, 1994, 1996 & 1998) described a few new species from the state of Tamil Nadu. Koyama (1974) studied the genus *Fimbristylis* Vahl in Ceylon and reported 32 species.

Govindarajalu (1981) described a new section and a new species of *Fimbristylis* Vahl and studied the vegetative and anatomical data. Mathew (1981, 1983) has studied the flora of Tamil Nadu Carnatic and reported 20 species of *Fimbristylis* Vahl. Ramachandra and Nair (1988) explored the flora of Cannanore and reported 8 species of *Fimbristylis* Vahl. Manilal (1988) studied the flowering plants flora of Silent Valley and reported 3 species of *Fimbristylis* Vahl.

Henry *et al.* (1989) studied the flora of Tamil Nadu, made a critical study on Cyperaceae of Tamil Nadu and listed 185 species under 12 genera and explained 42 species of *Fimbristylis* Vahl. Karthikeyan *et al.* (1989) presented a review of Indian monocotyledons and sedges, which cover 514 species under 37 genera. Vajravelu (1990) studied the flora of Palghat district and enumerated 7 species of *Fimbristylis* Vahl. Rejani (1991) conducted a detailed study on the taxonomy of Cyperaceae of Kerala and reported 4 species of *Fimbristylis* Vahl. Ravi and Anilkumar (1993) described two new species of *Fimbristylis* Vahl, viz. *F. angamoozhiensis* Ravi & Anilkumar and *F. pseudonarayani* Ravi & Anilkumar from Kerala.

Mohanan and Henry (1994) studied the Flora of Thiruvananthapuram and reported 10 species of *Fimbristylis* Vahl. Cook (1996) enumerated 173 species of sedges under 37 genera, of which 43 are *Fimbristylis* spp. Govindarajalu (1996) reported two new species of *Fimbristylis* Vahl, viz. *F. brevicula* Govind. and *F. stigmatotecta* Govind. from Kerala. Prasad and Singh (1996) studied the endemics of the genus *Fimbristylis* Vahl in India and identified 37 endemics from the country. Pullaiah and Hanumanthappa (1997) studied the sedges of Andhra Pradesh and reported 23 species of *Fimbristylis* Vahl. Sivarajan and Mathew (1997) studied the flora of Nilambur and collected 7 species of *Fimbristylis* Vahl.

Prasad and Singh (1999) described two new species of *Fimbristylis* Vahl namely, *F. ambavanensis* Prasad & Singh *and F. simpsonii* Prasad & Singh from Western Peninsular India. Mathew (1999) Explored flora of the Palni Hills of South India and reported 17 species of *Fimbristylis* Vahl. Prasad and Singh (2000) reported 54 species of sedges as additions to the sedge flora of India. Sunitha and Rao (2001) made an addition to the flora of Andhra Pradesh, i.e. *Fimbristylis littoralis* Gaudich. Prasad and Singh (2002) studied the sedges of Karnataka and recorded 163 species including 39 species of *Fimbristylis* Vahl. Sasidharan (2004) reported 54 species of *Fimbristylis* Vahl from Kerala. Anilkumar *et al.* (2005) studied the flora of Pathanmthitta, Western Ghats Kerala and reported 12 species of *Fimbristylis* Vahl. Wadoodkhan *et al.* (2006) described 4 new taxa such as *F. sanjappae* W. Khan *et al.*, *F. merrilli* subsp. *sofiyae* W. Khan *et al.*, *F.dichotoma* subsp. *dichotoma* var. *poladpurensis* W. Khan *et al.* and *F. zatei* W. Khan *et al.*, from different part of the Western Ghats.

Wadoodkhan and Lakshminarasimhan (2008) reported a new species *Fimbristylis naikii* W. Khan & Lakshmin. from Andhra Pradesh. Sunil and Sivadasan (2009) studied the flora of Alappuzha district of Kerala and reported 18 species of *Fimbristylis* Vahl. Shaikh & Solanke (2009) reported two new varieties of *Fimbristylis ligulata* Govind. from Western Ghats. Murugesan *et al.* (2010) described two new species of *Fimbristylis* Vahl such as *F. matthewii* Murugesan *et al.* and *F. velliangiriensis* Murugesan *et al.* from Velliangiri hills in the Nilghiri Biosphere Reserve located in the Western Ghats area of Tamil Nadu. Wadoodkhan *et al.* (2011) explained a new section and a new species *Fimbristylis poklii* W. Khan *et al.* from Maharashtra.

Veeranjaneyulu and Rao (2011) reported *Fimbristylis aestivalis* var. *major* Trimen ex T. Koyama and *Fimbristylis dichotoma* ssp. *glauca* (Vahl) T. Koyama as an addition to the flora of Andhra Pardesh. Wadoodkhan *et al.* (2011) reported three new species and one forma belong to the genus, *F. bhuskutii* W. Khan *et al.* and *F. nairii* W. Khan *et al.* and *F. nairii* forma *chaukulensis* Shaikh R. I. from Maharashtra.

Veeranjaneyulu *et al.* (2013) reported *Fimbristylis salbundia* (Nees) Kunth as a new distribution record for Andhra Pradesh. Wadoodkhan (2015) conducted a detailed study on the Cyperaceae of Western Ghats, West Coast and Maharashtra. Sunil *et al.* (2015) reported a new species *Fimbristylis pokkudaniana* Sunil *et al.* from the laterite hillocks of Kannur District, Kerala. It is closely resembles *Fimbristylis bispicula* Govind. Ansari *et al.* (2016) studied the aquatic and wetland plants of Kerala. Viji and Preetha (2017) reported an African sedge species *Fimbristylis scabrida* Schumach. first time from the Western Ghats of India and form a new distributional record for the Asian continent. Rijuraj *et al.* (2017) described two little known species of *Fimbristylis* from lateritic plains of Kerala. Anoop *et al.* (2017) reported *F. schultzii* from Agashtyamala biosphere reserve which was a new distribution record for India.

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4

MATERIALS AND METHODS

4.1. Specimen collection

Extensive field explorations were conducted throughout wetlands of south Indian states such Kerala, Thamil Nadu, Karnataka and Andhra Pradesh as for the collection of *Fimbristylis* Vahl members and the fertile specimens were collected from south India including coastal, midland and highlands, all types of forest and non-forest areas in flowering seasons. Both Inflorescence and vegetative parts of the members were collected. Took Photographs of the plant using digital camera. Noted the filed observations such as habit, habitat, height of the plant, nature of leaves, colour and shape of the spikelets etc. in the field book.

4.2. Herbarium Preparation

Plant materials with vegetative and reproductive part were dried and pressed in herbarium press. The dried specimens were mounted on standard herbarium sheets (28 x 42 cm) and labeled the specimens using standard herbarium labels (14.5 × 11 cm), with the information such as scientific name, family, altitude, date of collection, field notes and name of collector. The specimens were deposited in herbarium of Malabar Botanical Garden and Institute for Plant Sciences (MBGH).

4.3. Descriptions and photoplates

The collected specimens have been studied in the laboratory using Magnus MSZ-TR microscope. Floral characters of the genus are microscopic and prepared a detailed taxonomic description of the each species. Microscopic photographs of dissected plant materials were taken using Olympus Camera attached with Magnus MSZ-TR microscope. Photoplates of each species were prepared including the photographs of Habit, Inflorescence, Spikelets, Stamens, Pistil and Nuts.

4.4. Identification, Nomenclature and Citations

Identifications of each species were done with the help of relevant literature including regional floras, revisions, etc. Specimens housed at Central National Herbarium, Kolkata (CAL), Botanical Survey of India, Southern regional Centre, Coimbatore (MH), Calicut University Herbarium, Malappuram (CALI), Kerala Forest Research Institute Herbarium, Peechi (KFRI), Jawaharlal Nehru Tropical Botanical Garden and Research Institute herbarium, Trivandrum (TBGT), Sivaji University Herbarium, Kohlapur (SUK) were studied. Type sheet information was also retrieved from JSTOR. The plant names were corrected by consultation of authentic websites like IPNI (http://www.ipni.org), The Plant list (http://www.theplantlist.org), Tropicos (http://www.tropicos.org), etc. For nomenclature clarifications ICN (Shenzhen Code) (Turland, N. J. *et al.*, 2018) was used.

4.5. Conservation status

Conservation status of each species has given based on IUCN Red List Categories and Criteria Version 2018-1 and IUCN standards and Petitions Subcommittee (2013).

4.6. *Ex-situ* conservation of rare species of *Fimbristylis* Vahl from South India

All the species of *Fimbristylis* Vahl could be collected from the field were planted in the aquatic plant conservatory (Aquagene) of Malabar Botanical Garden and Institute for plant sciences (MBGIPS) and 26 species are

successfully established. Habitat variation is the main threat for the conservation.

4.7. Presentation of Data

The systematic part begins with the genera characters, which is followed by key to the species, present name of the species, citation, type, synonym, detailed taxonomic characters, flowering and fruiting, distribution, habitat and relevant notes. The species are presented in alphabetic sequence. All specimens studied were cited under specimens examined. The details of specimens examined are given in the following sequence: state, district, and collection locality, date of collection, collector/collectors name and collection number, and acronym of the depository.

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5

RESULTS

5.1. Systematic treatment

Fimbristylis Vahl

Enum. 2: 285 nom. cons. Clarke in Hook. f. Fl. Brit. India 6: 630. 1893; Kern in Steenis Fl. Malesiana 1. 7(3): 540. 1974; Koyama in dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 268. 1985. *Iria* (L. C. Rich.) Hedgwing f. Gen. Pl. 360. 1806. *Abildgaardia* Vahl En. Pl. 2: 296. 1806. *Echinotytrum* Desv. J. Bot. 1: 20. 1808. *Trichelostylis* P. Beauv. In Lestb. Ess. Fam. Cypr. 40. 1819. *Pogonstylis* Bert. Fl. Ital. 1: 312. 1833. *Microspora* Boeck. Fl. 43: 113. 1860. *Actinoschoenus* Benth. Benth. & Hook. Gen. Pl. 3: 1058. 1883.

Type species: *Fimbristylis dichotoma* (L.) vahl

Annual or perennial with short or woody rhizomes. Culms long, thick, tufted, slender to stout, more or less angular, compressed especially bellow the inflorescence. Leaves linear, flat, basal, glabrous or more or less pubescent, ligule a dense fringe of short hairs or membranous projection or absent. Leaf sheaths glabrous to puberulus. Inflorescence terminal, in some cases pseudolateral, simple to decompounds corymbs of solitary or few to many spikelets. Involucral bracts much shorter to longer than inflorescence, leafy or scale like. Spikelets densely

many flowered, ovoid to ellipsoid, acute at apex, rachilla persistent, winged or broadly winged by the persistent basal part of the glumes. Glumes spiral, ovate or ovate-oblong, arranged imbricated or distichously or rarely subdistichously, pubescent or glabrous, sides nerveless with narrow hyaline margins, obtuse, acute, subacute, apiculate or mucronate at apex. Flowers all bisexual, hypogynous scales absent. Stamens 1 -3; anthers linear, oblong, ovate or apiculate. Styles trigonous or flattened, style base slightly dilated and articulated at base, ciliate or nonciliate at margin. Stigma 2 or 3 fids. Nut biconvex, trigonous or triquetrous, lenticular, obovoid, oblong to linear, smooth or verruculose, shortly stipitate, trabeculate, white to stramineous, epidermal cells transversely elliptic to oblong, linear, trabeculate with longitudinal ribs.

5.2. Key to species

1a. Stigma 2; Nut biconvex..... 2
1b. Stigma 3; Nut trigonous or triquetrous.....17

2a. Inflorescence with single terminal spikelet; sometimes 2 or 3…….....3
2b. Inflorescence with few to many spikelets..... 7

3a. Plants leafless or leaves highly reduced, eligulate,..... 4
3b. Plants leafy, leaves ligulate 5

4a. Nut cylindrically oblong with almost parallel sides; gynophore up to 0.5 mm long, glumes embracing the nuts; style base almost as wide as the nuts.....**40. *F. teragona***
4b. Nut obovoid, elliptic or suborbicular with wavy ridges; gynophores min 0.2 – 3 mm long; glumes not embracing the nut; style base much narrower than the nut ....**1. *F. acuminata***

5a. Glumes with distinct 4 -7 side nerves; nut 1.5 – 2.1 x 0.8 – 1.2 mm, reticulate or subtrabeculate epidermal cells; stamens 3..... .....**35. *F. schoenoides***
5b. Glumes without side nerves; nut 0.5 – 0.9 x 0.4 – 0.7 mm, granulated or strongly trabeculate from transversely oblong epidermal cells..... 6

6a. Nut granulated or smoothly reticulate with 24 – 30, fine vertical striations, densely verruculose; Glumes oblong – lanceolate, subflat, much longer than broad; style filiform, hairy; stems and leaf not capillary.....**28. *F. polytrichoides***
6b. Nut trabeculate with 7 – 14 vertical ridges on each face, tuberculate or etubercuate; glumes ovate or ovate oblong; stems and leaves capillary..... .....**45. *F. ligulata***

7a. Leaves eligulate .....,,,,,,,,,.....8
7b. Leaves ligulate.....,,,,,,,,,.....12

8a. Annual herbs; leaves 0.5 – 1 mm wide, up to 15 cm long; stamen 1...,,,,,,,..... 9
8b. Perennials herbs; leaves 2.5 – 4 mm wide, up to 30 cm long; stamens 2 or 3.....,,,,,,,..... 11

9a. Spikelets all sessile, clustered in to single globoase head at the end of stem; glumes apiculate; culms, leaves or sheath glabrous .....,,,,,,,,,,,,,,,,,,,,,,.....**6. *F. argentea***
9b. Spikelets all solitary in anthelate inflorescence; glumes mucronate or recurved awns; culms, leaves or sheath more or less hairy 10
10 a. Leaves densely pubescent; Style ciliate towards top.....**2. *F. aestivalis***
10b. Leaves glabrous; style glabrous.....**15. *F. dispacea***

11a. Spikelets all or partially sessile, clustered, intermixed with some solitary one; nut sparsely verruculose.....**12. *F. cymosa* var. *spathacea***
11b. Spikelets stalked, solitary; nuts not verruculose.....**17. *F. eligulata***

12a. Glumes wholly or partly densely tomentoseon the back; nut smooth or finely reticulate.....13
12b. Glumes glabrous, rarely minutely ciliolate on apex margin; nut trabeculate or reticulate..... 14

13a. Glumes wholly or partly pubescent on the back, 1.5 – 2.8 mm long; gynophores of nut 0.1 mm; style sparsely fimbriate.....**32. *F. pubesquama***
13b. Glumes tomentose in upper half on the back, 3.5 – 4 mm long; gynophores of nut 0.2 – 0.4 mm long; style densely fimbriate throughout…….....**20. *F. ferruginea***

14a. Spikelet solitary.....15
14b.Spikelets at least partly sessile, clustered intermixed with solitary ones.....**35. *F. sanjappae***

15a. Nuts trabeculate,.....16
15b. Nuts veruculose.....**3. *F. alboviridis***

16a. Nuts smoothly trabeculate, 0.4 – 0.6 mm long with 4 – 6 vertical ridges; Style very narrow; stamen 1.....**8. *F. bisumbellata***
16b. Nuts coarsely tuberculate 0.8 – 1.1 mm long with 7 – 9 vertical ridges; style flat; stamens 2.....**13. *F. dichotoma***

17a. Inflorescence of single spikelet, sometimes with 2 or 3…….....18
17b. Inflorescence of few to many spikelets.....24

18a. Plants leafy; glumes not embracing the nut; nuts obovoid, ellipsoid or suborbicular; style deciduous.....19
18b. Plants leafless; glumes embracing the nuts; nut subcylindrically oblong, trabeculate; style persistent.....**41. *F. tetragona***

19a. Leaves eligulate; stamens 3.....20
19b. Leaves ligulate; stamens 2 or 3.....23

20a. Glumes atleast lower ones distichous; spikelets flattened or subcompressed, starmineous or tinged with brown.....21
20b. Glumes spiral; spikelets terete, chestnut brownish..... ***F. pierotii***

21a. Perennials; Culms 10 – 80 cm long; glumes 3 – 6 mm long, mucronate; nut very large, Pyreform, 2.5 – 1.4 mm long; Style hairy.....22
21b. Annuals; culms 8 – 15 cm long; glumes 1.8 – 2 mm long, muticous, nut very small, obovoid, 0.4 – o.5 mm long; style glabrous.....**45. *F. zatei***

22a. Plants up to 30 cm tall; stem and leaves filiform; spikelets 0.8 – 1.5 cm long; glumes 3 – 6 x 2 – 4 mm; style trigonous, 2 mm long.....**26. *F. ovata***
22b. Plants up to 80 cm long; stem and leaves 1 – 3 mm wide; spikelets 1.5 – 3 cm long; glumes 6 – 8 mm long; style flat, 4 – 6 mm long.....**42. *F. triflora***

23a. Inflorescence with 2 – 4 spikelets; spikelets solitary with 6 mm long rays; stamens 3.....**38. *F. simpsonii***
23b. Inflorescence with 1 – 3 spikelets; spikelets paired without rays; stamens 2.....**7. *F. bispicula***

24a. Spikelets sessile, all clustered or partly clustered intermixed with some solitary ones.....25
24b. Spikelets all solitary, none clustered.....32

25a. Leaves eligulate; plants perennials.....26
25b. Leaves ligulate; plants annuals.....31

26a. Spikelets all clustered, no solitary ones added.....27
26b. Spikelets not all clustered, some solitary ones added.....30

27a. Spikelets clustered in single capitates head at the end of stem, rays absent…….....28
27b. Spikelets clustered at the end of rays, rays and raylets present.....29

28a. Cauline leaves reduced to blade less sheaths; spikelets linear – lanceolate; nuts with one flat face.....**22. *F. lawiana***
28b. Cauline leaves well developed; spikelets oblong – ovoid; nut without flat face.....**37. *F. schultzii***

29a. Leaves 1 -2 mm wide; glumes glandular; nut triquetrous; Involucral bracts longer than inflorescence.....**27. *F. paupercula***
29b. Leaves 3 mm wide; Glumes nit glandular; nut trigonous; Invalucral bracts shorter than inflorescence.....**19. *F. falcata***

30a. Inflorescence with 3 – 10 spikelets; Spikelets 2 mm broad, mostly clustered, few solitary; glumes 3 – 4 mm long; style densely hairy at top; nut smooth, not verruculose.....**43. *F. uliginosa***
30b. Inflorescence with more than 10 spikelets; spikelets 2 – 4 mm broad, mostly solitary, few clustered; glumes up to 5 mm long; style glabrous or sparsely hairy; nut verruculose.....**18. *F. eragrostis***

31a. Lower glumes distichous, upper one spiral; nut not verruculose, tricostulate; style glabrous.....**30. *F. pseudomicrocarya***
31b. Glumes all spiral; nut verruculose, not costulate; style pubescent.....**44. *F.woodrowii***

32a. Glumes densely gland dotted, mostly in upper half…….....33
32b. Glumes not gland dotted.....34

33a. Glumes distichous; linear to lanceolate; style 3 – 3.5 mm long, style base distinctly bristly.....**9. *F. cinnamometorum***
33b. Glumes spiral, ovate; style 4 – 6 mm long, style base not bristly.....**21. *F. fusca***

34a. Glumes at least the lower ones distichous.....35
34b. Glumes all spiral.....36

35a. Fruiting glumes 3.5 x 2.5 mm, loosely imbricate, muticous, nut depressed at apex with raised shoulders without rib o angles.....**25. *F. narayanii***

35b. Fruiting glumes 3 x 2 mm, closely imbricate, mucronate; nut obtuse to subtruncate at apex, with ribbed on angles.....**31. *F. pseudonarayanii***

36a. Culms strongly compressed, ancipitus or 2 sided …….....37
36b. Culms not compressed, terete or angular, sometime compressed trigonous.....41

37a. Leaves eligulate up to 8 mm wide; involucral bracts 10 – 25 cm long; Inflorescence up to 25 cm long.....38
37b. Leaves ligulate, 1- 4 mm wide; involucral bracts 1- 5 cm long; Inflorescence 1 -7 cm long.....39

38a. Spikelets 4 -13 mm long; densely many flowered, nut sparsely verruculose throughout; Leaves distichous, shorter to as long as culm.....**16**. ***F. dura***

38b. Spikelets up to 5 mm long, up to 10 flowered, nuts sparsely verruculose near apex; Leaves tristichous, much overtopping culm.....**4. *F. angamoozhiensis***

39a. Perennials; culms 3 -4 mm wide, scabrid in lower greater part; spikelets ovate lanceolate; glumes 2.5 – 3 x 2 mm; style 1 – 2.3 mm long.....40
39b. Annuals; culms 1 -1.7 mm wide, scabrid bellow the inflorescence; spikelets ovoid; glumes 1 x 1 mm; style 0.5 mm long.....**24. *F. microcarya***

40a. Leaf sheath rounded on the back; leaves 1 – 2 mm wide; culms 1 1.5 mm thick; glumes muticous; style 1.7 – 2.3 mm long; nut not verruculose....**11. *F. consanguinea***
40b. Leaf sheath laterally compressed, acute on the back; leaves 3 -5 mm wide; culms 3 – 4 mm wide; glumes mucronate; style 1 - 1.3 mm long; nut verruculose…….....**10. *F. complanata***

41a. Leaves if present eligulate.....42
41b. Leaves ligulate.....**14. *F. dimorphonucifera***

42a. Cauline leaves reduced to bladeless sheaths; leaves on sterile shoot present or absent.....43
42b. Cauline leaves well developed.....**40. *F. tenera***

43a. Plants leafy from sterile culm; stem not arranged as above, glumes 1- 1.5 x 1 mm, stamen 1 or 2.....44
43b. Plants leafless; sterile leafy cuml absent; culms closely arranged along the horizontal rhizome; glumes 2 – 3 mm long stamen 3.....**34. *F. salbundia***

44a. Annuals; spikelets angular, 1- 1.5 mm broad; ferrugineous or yellowish brown; glumes strongly keeled, mucronate, acute; stamen 1; style 0.5 mm long.....**33. *F. quinquangularis***
44b. Perennilas; spikelets terete, 1.5 – 2 mm broad, brownish to dark brownish; glumes scarcely keeled, muticous, obtuse; stamens 1 – 2; style 1 mm long.....**5. *F. aphylla***

1. *Fimbristylis acuminata* Vahl, Enum. Pl. 2:285.1806; Clarke in Hook f. Fl. Brit. India 6:631.1893; Fischer in Gamble Fl. Pres. Madra (1931) 3:1649.1994; Kern in Steenis Fl. Malesiana 1(3).7:588.1974; Hooper in Saldanha & Nicolson, Fl. Hassan 675.1976; Rao & Razi, Fl. Mysore 562.1981; Rao & Verma, Cyp. NE India 29.1982; Sharma *et al.* Fl. Karnataka 308.1984; Koyama in Dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 319.1985; L' Narasimhn in Sharma *et al.* Fl. Maharashtra (Monocot) 2:304.1996; Cook, CDK. Aq. & wetl. Pl. India: 135.1996; Karthik. *Et al.* Fl. Indic. En. Monocot. 50.1989; Keshava Murthy & Yoganarasimhan. Fl. Coorg 506.1990; Prasad & Singh Sedg. Karnataka (Fam. Cyper.): 155.2002; W.Khan, Cyperaceae W. Ghats, W. Coast & Maharshtra 164. 2015. **(Plate -1)**
Type: Malaca, *Koenig.*

Fimbristylis acuminata var. *pumila* Nees, Hooker's J. Bot. Kew Gard. Misc. 6: 29. 1854**.**

Fimbristylis acuminata var. *minor* Nees ex Boeckeler, Linnaea 37: 4. 1871.

Erect herbs with inconspicuous rhizome and fibrous roots. Culms 3-30 cm long, ca 1 mm thick densely tufted, slender, angled, glabrous. Leaves reduced to sheath, 1-1.4 cm long. Inflorescence a solitary, terminal spikelets. Involucral bracts glume like, triangular – ovate, ca 3 x 2mm, keeled; keel slightly curved towards inside. Spikelets ovoid to lanceolate, acute- acuminate at apex, 6-10 x 2-4 mm, few to many flowered, greenish white to pale brown. Glumes spiral, broadly ovate, keeled, slightly mucronate at apex, 3-4.5 x 2-3 mm, usually brown spotted towards the middle portion, hyaline margined, lowest 1 or 2 empty. Stamens 2, anthers linear-oblong, 1-1.25mm long, minutely aciculate. Style 3 mm long, minutely ciliate towards apex, stigma 2; 1mm long, narrowed towards apex. Nut biconvex, obovate, rounded toards apex, ca 1.7 x 1.5 mm, with 5-8 transeverse ridges, whitish to cream coloured, gynophores inconspicuous.

Flowering and Fruiting: September - October

Distribution: South and South East Asia (Sri Lanka, China, Malaysia), tropical Australia. **India:** throughout. **Kerala**: Calicut, Malappuram. **Karnataka**: Dakshina kannana, Shimoga.

Habitat: Open wet muddy area, marshes, swamps, rice fields and river banks.

Specimen examined: **Kerala**: Calicut, Kuttiyadi, 26.06.1965, *Naithani 24642* (MH); Ramanatukara, 21.1.1970, *V.V. Sivarajan 671* (CALI); Wayanad, Muthanga, 23.07.2013, *Anoop K. P. 9529* (MBGH). **Karnataka:** Dakshina Kannada**,** Sampagi, 15.11.1900, *Barber 2401* (MH); Shimoga, Jog falls, 08.03.1985, *Madhusoodanan 41432* (CALI).

2**. *Fimbristylis aestivalis*** (Retz.) Vahl, Enum, Pl. 2: 88. 1806; Clarke in Hook. f. Fl. Brit. India 6: 637. 1893; T. Cooke, Fl. Pres. Bombay 881. 1908; Kern in Steenis Fl. Malesiana 1.7 (3): 584. 1974; Koyama in Dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 313. 1985; Karthik *et al.* Fl. indic. En. Monocot. 50. 1989; L' Narasimhn in Sharma *et al.* Fl. Maharashtra (Monocot) 2: 304. 1996; Cook, CDK. Aq. & Wetl. Pl. India: 135. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cyper.): 156. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 165. 2015. **(Plate -2)**
Type: Sri Lanka, *Koenig.*

Fimbristylis aestivalis var. *glaberrima* Boeckeler, Linnaea 37: 11. 1871.

Fimbristylis aestivalis f. *glabra* Kük., Bot. Jahrb. Syst. 59: 49. 1924.

Fimbristylis aestivalis f. *latifolia* T. Koyama, J. Jap. Bot. 30: 129. 1955.

Fimbristylis aestivalis subsp. *major* Trimen ex T.Koyama, Bot. Mag. (Tokyo) 87: 325. 1974.

Fimbristylis aestivalis var. *squarrosa* (Vahl) T.Koyama, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 8: 116. 1961.

Herbs with fibrous roots, 4 - 15 cm height. Culms slender, densely tufted, angular, 1- 11 cm long, 0.2-0.7 mm thick. Leaves setaceous to filiform, shorter than to as long as the stem, up to 1 mm wide, flat or canaliculated, densely pubescent, eligulate. Inflorescence a decompound corymb of few to numerous spikelets. Involucral bracts few, lowest 2-3 leafy, shorter or more often overtopping the inflorescence, with stout bristles at base, primary rays short up to 1.5 cm glabrous.

Spikelets solitary, ovoid or oblong lanceolate, angular, acute at apex, 2-5 x 1-1.5 mm, greenish-brown, many flowered. Glumes spiral, membranous, ovate, acute at apex, 1.2 – 1.5 x 0.7mm, keeled, extending to sharp mucro of ca 0.3 - 0.5 mm long. Stamen 1, anther oblong, 0.3 - 0.5 mm long. Style flat 0.5 - 0.8mm long, ciliate towards the top, dilated base; stigma 2, 0.3 - 0.4 mm long. Nut biconvex, obovate to elliptic, 0.5 – 0.8 x 0.2 – 0.3 mm brownish, often shining, usually with prominent margins.

Flowering and Fruiting: November - June

Distribution: South to East Asia (Sri Lanka, China, Indo-China, Thailand, Malesia, Japan, Amurland), tropical Australia. **India**: Almost throughout. **Kerala**: Thiruvananthapuram, Kannur, Thrissur, Kozhikode, Malappuram, Paravoor.

Habitat: Along streams and ponds, open damp places, swampy areas, near ditches. It found as common weed in paddy fields.

Specimen examined: **Kerala:** Thiruvanathapuram, Nayyar, 26.05.1979. *M. Mohanan 63285* (MH); Kannur, Kuthuoarambu, 23.01.1979, *V.S. Ramachandran 59182* (MH); Trichur, Peechi forest, *K.M. Sebastine 27183* (MH); Kozhikode ,Feroke, 19.02.1984, *Madhu & Rajani 26591* (CALI); Kozhikode, C.U. Campus, 10.10.1981, *Susha K. 196* (CALI); Kozhikode, Feroke, 04.11.1977, *Raju A. R. 27570* (CALI); Kollam, Paravoor, 14.1.1989, *Rajani 39691*(CALI); Alappuzha, Ambalapuzha, 21.12.2012, *Anoop K. P. 9509* (MBGH).

3. *Fimbristylis alboviridis* Clarke in Hook f. Fl. Brit. India 6: 638. 1893; Kern in Steenis Fl. Malesiana 1(7)3: 580. 1974; Manilal & Sivarajana Fl. Calicut 326. 1982; Karthik. *et al.* Fl. Indic. En. Monocot. 50. 1989; Cook, CDK. Aq. & wetl. Pl. India: 136. 1996; L'narasimhn in Sharma *et al* Fl. Maharashtra (Monocot) 2: 305. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cyper.): 157. 2002. W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 167. 2015. **(Plate -3)**

Cyperus alboviridis C.B. Clarke ex Scott-Elliot., J. Linn. Soc., Bot. 29: 62. 1891.

Fimbristylis diphylla var. *tuberculata* Cherm., Arch. Bot. Bull. Mens. 4(7): 31. 1931.

Fimbristylis pluristriata var. *tuberculata* (Cherm.) Berhaut, Bull. Soc. Bot. France 101: 376. 1955.

Fimbristylis podocarpa var. *tuberculata* (Cherm.) Berhaut, Fl. Senegal ed. 2: 371. 1967.

Slender herbs with fibrous root. Culms angular, slender, 20 - 50 cm long and 1 - 1.5 mm thick, tufted, compressed, glabrous smooth. Leaves linear, flat, 1 - 2 mm wide, half as long as the stem, often slightly falcate, obtuse to rather acute at apex, glaborus, scabrid on the margins in the upper part, ligules as a fringe of short hairs. Inflorescence simple to subcompound, loose, rays 4 - 6 cm long, with few to several spikelets. Involucral bracts 3 – 4, the lowest foliaceous shorter than or much overtopping the inflorescence. Spikelets solitary, terete, ovoid to oblong, acute at apex, 5 - 7 x ca 2.5 mm, many flowered, stramineous or greenish-white, with short peduncles, rachila narrowly winged. Glumes spiral, broadly ovate, obtuse, glabrous, 2.2 - 2.5 x 1.5 mm, muticous or scarcely apiculate at apex, brownish with hyaline basal part and margins. Stamen 1, anther oblong, ca 0.5 mm long. Style slender, flat, slightly dilated at the base, ciliate in the upper part, 1mm long; stigma 2 fid, shorter than style. Nut biconvex obovate, 0.8 - 1 x 0.5 - 0.7 mm, longer than broad, shortly stipitate, scaly - verruculose, obtusely reticulate on each face, epidermal cells transversely elliptic or oblong, 10 - 16 vertical rows on each face.

Flowering and Fruiting: September – November.

Distribution: South and South-East Asia (India to Malesia). **India**: Western Peninsula, Central and North-East India, Andaman & Nicobar Island, Karnataka. **Kerala**: Kannur, Kasarkode. **Karnataka**: Hassan, Shimoga and Agumbe

Habitat: Growing at the edges of pools but also in moist and shady places, in dry grassland and along roadsides.

Specimens examined: **Kerala**: Kannanore, Kanoth reserve forest, 19.04.1980, *V.S. Ramachandran 66903* (MH); Kannur, Payyanur, 16.01.2013, *Anoop K. P. 9519* (MBGH); Wayanad, Kalpetta, 19.07.1975, *V.V. Sivarajan 39688* (MH).

4. *Fimbristylis angamoozhiensis* Ravi & Anilkumar in Rheedea 3(2): 108. 1993. Mohanan & Sivadasan Fl. Agasthyamala 779. 2002. W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 169. 2015. (**Plate – 4**)

Type: Kerala, Pathanamthitta, Angamoozhi, 05.05.1992, *Anilkumar 1799* (MH! holotype)

Perennial rhizomatous herbs. Rhizome short, thick, woody. Culms up to 50 cm long, triquetrous towards the base and more or less flattened towards the apex, glabrous. Leaves linear, flat, up to 70 cm long, 8 mm wide, many, basal, spiral, coriaceous, tapering to an cute apex, pale brown, eligulate; leaf sheath membranous and hyaline opposite to the blade, glabrous. Inflorescence a compound umbel, up to 25 cm wide. Involucral bracts several, outer 3 or 4 leaf like, exceeding the inflorescence, gradually tapering to an cute apex. Spikelets many, upto 5 x 1 mm, solitary on slender, 5-8 mm long peduncles, sessile at forkings, ovate-lanceoate, acute at both ends, , upto 10 flowered, rachilla winged, brownish-black, persistent. Glumes spiral, triangular-ovate, boat shaped, keeled, keel 3 nerved, sparsely scaberulous on the back towards the mucronate apex, margin hyaline, brownish yellow, glabrous, veinless. Stamens 3, anthers linear, upto 1mm long. Style less than 1mm long, sparsely ciliolate towards the apex. Stigma 3 fid, longer than style. Nut oblanceolate to ellipsoid, trigonous, 1 x o.5 mm, cuneate at base shortly tipitate, subacute at apex, trabeculate, transversely hexagonal cells in 3 to 6 vertical rows on each face, sparsely verruculose, mostly towards the upper half, pale white.

Flowering and Fruiting: November – December

Distribution: Endemic to south India.

Habitat: Growing in open wet areas near forest streams.

Specimen examined: **Kerala:** Pathanamthitta, Angamoozhi, 05.05.1991, *Anilkumar 1799* (MH); Thiruvanathapuram, Agasthyamala, 12.03.2013, *Anoop K. P. 5980* (MBGH).

5. *Fimbristylis aphylla* Steud. Syn. Pl. Glum. 2: 114. 1855. Kern in Blumea 8. 117. 1955. et in Steenis Fl. Malesiana 1.7(3): 552. 1974. Koyama Contr. Inst. Bat. Univ. Montreal 70: 47. 1957; Karthik. *et al.,* Fl. Indic. En. Monocot. 50. 1989; Cook, CDK. Aq. & wetl. Pl. India 136. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cypr.) 158: 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 170. 2015. **(Plate - 5)**

Fimbristylis globulosa var. *aphylla* (Steud.) Miq., Fl. Ned. Ind. 3: 322. 1856.

Fimbristylis quadrangularis var. *crassa* C. B. Clarke, Fl. Brit. India 6: 644. 1893 F

Fimbristylis vanderystii De Wild., Pl. Bequaert. 4: 205. 1927.

Fimbristylis testui Cherm., Arch. Bot. Bull. Mens. 4 (7): 33. 1931**.**

Fimbristylis quinquangularis var. *testui* (Cherm.) Robyns & Tournay, Fl. Spermatophyt. Parc Nat. Albert 3: 262. 1955.

Fimbristylis aphylla var. *gracilis* Tang & F. T. Wang, in Fl. Reipubl. Popul. Sin. 11: 227. 1961.

Perennial herbs with short rhizome. Culms 60 cm, 1.5 – 3 mm wide, gradually narrowed to apex, tufted, smooth, glabrous, prominently 4-5 angled. Leaves of sterile shoot well developed, up to 30 cm long, 2 – 3 mm wide, flat, with prominent mid vein on the lower surface. Leaves of culms reduced to bladeless sheaths, sheath loose, tubular, herbaceous, up to 20 cm long, brown. Inflorescence compound to decompound, loose with many spikelets, 5 – 8 cm long, 4 – 10 cm wide. Involucral bracts 2 – 3, lanceolate, up to 2 cm long, not overtopping the inflorescence. Spikelets solitary, terete, ovoid to elliptic, 2.5 – 3.5 x 1.5 – 2 mm, densely many flowered, rachilla winged. Glumes spiral, membranous, broadly ovate, obtuse at apex, 2 – 2.5 x 1.6 mm, hyaline margined. Stamens 1 or 2,

filaments flat, anthers linear – oblong, 0.8 mm long, acute at apex. Style trigonous, 1 mm long, slightly thickened towards base, ciliate towards apex. Stigma 3 fid, ciliate. Nut trigonous, obovoid, shortly umbonulate, shortly stipitate, whitish, 0.7 x 0.5 mm, densely verruculose, transversely linear epidermal cells in 4 – 6 vertical rows on each face.

Flowering and fruiting: September to November

Distribution: South and South East Asia, tropical and South Africa. **India**: South, North and North-West India. **Kerala**: Wayanad. **Tamil Nadu**: Tiruvannamalai, Dharmapuri. **Karnataka**: Hassan, Mysore, Chikmangalur, Kodagu.

Habitat: Water loged areas, marshy areas and near paddy fields

Specimens examined: Kerala: Wayanad, 03.09.1985, *Balakrishnan 40426* (CALI); Wayanad, Tholpetty, 31.05.1984, *R.T. Balakrishnan 40268* (CALI); Wayanad, Tholpetty, 29.05.1984, *Rejani 39943* (CALI); Wayanad, Muthanga, 23.07.2013, *Anoop K. P.* (MBGH).

6. *Fimbristylis argentea* (Rottb.) Vahl, Ennum. 2: 294. 2809; Clarke in Hook f. Fl. Brit India 6: 640. 1893; Fischer in Gamble Fl. Pres. Madras (1931) 3: 1652. 1994; Kern in Steenis Fl. Malesiana 1.7 (3): 586. 1974; Koyama in Dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 314. 1985; Karthik *et al* Fl. Indic. En. Monocots. 51. 1989; Cook, CDK. Aq. & wetl. Pl. India: 137. 1996; Prasad & Singh Sedg. Karnataka (fam. Cyper.): 160. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 171. 2015. **(Plate – 6)**

Type: India, *Koenig.*

Scirpus argenteus Rottb., Descr. Icon. Rar. Pl. 51. 1773.

Scirpus nanus Poir., Encycl. 6: 759. 1805.

Aplostemon triquetrum Raf., J. Phys. Chim. Hist. Nat. Arts 89: 105. 1819.

Fimbristylis monandra (Rottb.) F. Muell., Fragm. 1: 195. 1859.

Iria monandra (Rottb.) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Iria muelleriana Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Perrenial herbs with short rhizome. Culms 3-20 cm long, 0.5-1mm wide, Compressed- trigonous, glabrous. Leaes narrowly linear, usually shorter than culm or often over topping the inflorescence, 0.5 - 1mm wide, flat or canaliculated, rather abruptly acuminate, sheaths broarder than the leaf blades. Inflorescence capitates, 1-2 cm across, semiglobose to globose, involucral bracts 2 - 4, lower 2 - 3 much longer than inflorescence. Spikelets sessile, oblong-ovoid, slightly angular, acute at apex, 4 - 6 x 1.5 - 2 mm, densely many flowered, rachilla narrowly winged. Glumes spiral, membraneous, ovate, obtuse, minutely apiculate at apex, 1.5 x 1 mm, slightly keeled, 3 nerved, with prominent midrib. Stamen 1, anther oblong, 0.5 mm long. Style flat, dilated at base, minutely ciliolate in the upper part, 0.7 mm long. Stigma 2 fid, shorter than style. Nut biconvex, with scute edge, broadly abovate, apiculate, smooth or sparsely verruculose.

Flowering and Fruiting: September – November

Distribution: Sri Lanka, Malesia, Peninsular Thailand. **India**: Western peninsula, Central and Eastern India. **Kerala**: Kannur, Kasargod, Malappuram, Nilambur, Kollam. **Karnataka:** Hassan, Mysore, Kodagu, Tumkur, Bagnalore. **Tamil Nadu**: Ramanathapuram, Thanjuavur, Kanchipuram, Madurai, Coimbatore.

Habitat: Growing in swampy places, at the drying edges of open water, in dried out rice fields, wet sandy ground, waste places, clefts of rocks and along sea shores.

Specimens examined: **Kerala**: Kollam, Oachira, 17.02.1980, *C. N. Mohanan 65061* (MH); Kozhikode, Feroke, 19.02.1984, *Rajani 26594* (MH). **Tamil Nadu**: Madurai, Nupuraganda, 11.06.1957, *K. Subramanyam 3389* (MH); Madurai, Kumbukere, 15.06.1961, *K. M. sebastine 12599* (MH); Coimbatore, Nellimalai reserve forest, 28.08.1962, *K. Ramamurthy 14863* (MH); Ramanathapuram, Thelisathanallur, 23.05.1988. *V. Balasubramanian 1772* (MH); Kanyakumari, Kuzhithurai, 02.08.1977, *A. N. Henry 49548* (MH). Kanchipuram, 24.02.2015, *Anoop K. P. 11123* (MBGH); Kanchipuram, 25.02.2015, *Anoop K. P. 11125* (MBGH).

7. *Fimbristylis bispicula* Govind. In. Rheedea 6(2): 59. F. 1. 60. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cypr.) 161. 2002. W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 172. 2015. **(Plate – 7)**

Type: India, Karnataka, Shimoga, Agumbe, Nishanigudda, *Govindarajalu 8800A* (CAL)

Annaul herbs with fibrous roots. Culms 3 – 7 cm long, 0.5 mm wide, solitary, rarely tufted, stiff, tetragonous, smooth, leafy at base. Leaves shorter than stem, flat, stiff, erect, subacute or obtuse at apex, 0.5 – 1 mm wide, ligule a fringe of hairs, glabrous, leaf sheath brown. Inflorescence simple, usually with a pair of spikelets, 5 – 7 mm long. Involucral bracts 2, distichously paired, glumiform. Spikelets paired, ovoid – lanceolate, angular, aculte at apex, dark brown, 3 – 4 x 1 – 1.2 mm, 8 -10 flowered, rachilla winged. Glumes spiral, membranous, broadly ovate, acute and muticous at apex, 2 x 1.2 – 1.3 mm, keeled, keel 3 nerved, sides nerveless, dark brown, translucent towards margins. Stamens 2, anthers short, ovate, 0.2 – 0.3 mm long. Style triquetrous, narrow pyramidal base, 1mm long, glabrous. Stigma 3 fid, slightly shorter than style. Nut trigonous, broadly obovoid or subgloboid, obtuse at apex, 1 x 0.5 – 0.6 mm, brownish, somewhat verruculose, epidermal cells transversely elongate – hexagonal in 4 - 6regular rows on each face.

Flowering and fruiting: October to November.

Distribution: Endemic to Karnataka and Maharashtra

Habitat: Distributed in wet open grasslands.

Specimens examined: **Kerala**: Kannur District, Madayipara , 10.11.2017, *Anoop K. P*., 11148 (MBGH). **Karnataka:** Shimoga, Agumbe, Nishanigudda, *Govindarajalu 8870* (MH).

Note: This report is an addition to the flora of Kerala. Earlier this species was reported only from Karnataka

8. *Fimbristylis bisumbellata* (Forssk.) Bub. Dodec. 30. 1850. Fischer in Kew Bul. 149. 1935 et in Gamble Fl. Pres. Madras (1931) 3: 1650. 1994; in corrig. P. 1898. Kern in Steenis Fl. Malesiana 1.7 (3): 579. 1974; Manilal & Sivarajan, Fl. Calicut. 326. 1882; Koyama in Dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 312. 1985; L'narasimhn in Sharma *et al.* Fl. Maharshtra (Monocots) 2: 306. 1996; Karthik. *et al.* Fl. Indic. En. Monocot. 51. 1989; Prasad & Singh Sedg. Karnataka (Fam. Cyper.): 162. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 180. **(Plate – 8, 8A)**

Type: Egypt.

Scirpus bisumbellatus Forssk. Fl. Aeg. Arab. 1: 15. 1775.

Fimbristylis dichotoma var. *villosa* Vahl. Enum. Pl. Obs. 2: 287. 1805.

Iria bisumbellata (Forssk.) Kuntze. Revis. Gen. Pl. 2: 752. 1891

Fimbristylis liukiuensis Tuyama. J. Jap. Bot. 11: 250. 1935.

Fimbristylis bisumbellata var. *elata* Täckh. Publ. Cairo Univ. Herb. 5: 41. 1972 publ. 1974.

Fimbristylis dichotoma subsp. *bisumbellata* (Forssk.) Luceño. Anales Jard. Bot. Madrid 57: 176. 1999.

Erect annual herbs with fibrous root. Culm slender, densely tufted, angular, glabrous, 10 - 25 cm long, 1 - 1.5 mm wide. Leaves, linear, sheath membranous, stramineous or ferrugineous, blades shorter to somewhat longer than stem, 1 - 2 mm wide. Inflorescence compound or decompund, loose with many spikelets, 1 - 6 cm across. Involucral bracts 2 - 4, longest one overtopping the inflorescence, 1 - 9 cm long. Spikelets solitary, ovoid, ellipsoid or oblong, angular, acute at apex, 3 - 8 mm x 1 - 1.5 mm. Glumes spiral, ovate, 1 - 1.3 x 1 mm wide, membranous, glabrous, acute, mucronulate, sharply keeled with 3 nerves, brownish, sides nerveless and hyaline margins. Stamen 1, anther oblong, 0.5 mm long. Style slender, flat with dilated base, ciliate in the upper half. Stigma 2 fid, shorter than style. Nut biconvex, obovoid, 0.6 x 0.3 mm, epidermal cells transversely oblong, 5 - 9 vertical rows on each face.

Flowering and fruiting: November – July.

Distribution: Widely distributed in tropics, extending to Mediterrannian region of Europe. **India**: Throughout. **Kerala:** Kozhikode, Payyoli, Kannur, Idukki, Thiruvananthapuram, Kasargod, Palakkad, Kollam. **Karnataka:** Mysore, Shimoga, Hassan, Mandya, Kolar, Bangalore, Kodagu. **Tamil Nadu:** Thirunelveli, Kanchipuram, Thanjavur, Coimbatore. **Andhra Pradesh:** Krishna, Hyderabad, Nalconda, East Godavari, Visakapatnam.

Habitat: Growing along streams and rivers, on sandy river beds, edges of pools, along road sides, common in rice fields.

Specimens examined: **Kerala**: Thiruvananthapuram, Kovalam, 08.04.1984, *Rajani 42426* (MH). **Tamil Nadu:** Thiruchirappally, Musiri, 20.02.2015, *Anoop K. P. 11115* (MBGH). **Karnataka**: Shimoga, Jog falls, 08.03.85, *Madhu 41437* (CALI). **Andhra Pradesh:** Krishna, Kolleru lake, 24.01.1958, *K. Subramanyam 5098* (MH); Hyderabad, Paranapull, 27.06.1958, *K. M. Sebasyine 5996* (MH); Medak, Narnapur, 24.04.1959, *K. M. Sebasine 7970* (MH); Nalconda, Krishna river bank, 16.12.1959, *K. M. Sebastine 9807* (MH); Visakapatnam, Punyagiri Village, 08.05.1964, *G. V. Subba Rao19410* (MH); East Godavari, Rampachodavaram, 17.05.1966, *G. V. Subba Rao 27245* (MH); Krishna, Guraja, 09.03.1985, *P. Venkanna 5543* (MH); Visakapatnam, Madugula, 09.04.1997. *G. V. Subba Rao 47267* (MH).

9. ***Fimbristylis cinnamometorum*** (Vahl) Kunth En. Pl. 2: 229. 1837. Kern in Steenis Fl. Malesiana 1.7 (3): 565. 1974; Koyama in Dassan. & Fosb. Rev. Handb Fl. Leylon 5: 278. 1985; Manilal, in Fl. Silent Valley, 342. 1988; Mohan. & Henr. Fl. Thiruvananthapuram 514. 1994; L'narasimhn in Sharma *et al.,* Fl. Maharashtra (Monocots) 2: 306. 1996; Cook, CDK. Aq. & wetl. Pl. India: 138. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cypr.): 165. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 176. 2015. **(Plate – 9)**

Type: Sri Lanka "habit in cinnamometis Zeylonae", *Koenig.*

Fimbristylis cyperoides R. Br., Prodr. Fl. Nov. Holl. 229. 1810.

Isolepis cinnamometorum (Vahl) Roem. & Schult., Syst. Veg. 2: 119. 1817.

Trichelostylis cinnamometorum (Vahl) Nees, Linnaea 9: 290. 1834.

Abildgaardia cinnamometorum (Vahl) Thwaites, Enum. Pl. Zeyl. 347. 1864

Fimbristylis biflora Boeckeler, Linnaea 38: 393. 1874.

Fimbristylis kamphoeveneri Boeckeler, Bot. Jahrb. Syst. 5: 505. 1884.

Iria biflora (Boeckeler) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Iria cinnamometorum (Vahl) Kuntze, Revis. Gen. Pl. 2: 753. 1891**.**

Perennial with creeping, woody rhizome. Culms 25 – 50 cm long, 0.5 mm thick, solitary, slender, compressed – angular, smooth, 3 sided. Leaves half as long as stem, erect, setaceous, rigid, 0.3 – 0.5 mm wide, ligule absent. Inflorescence compound or decompound, loose, with many to numerous spikeletes, 3 -6 cm long. Involucral bracts 1 -2, erect, much shorter than to slightly longer than inflorescence, lowest up to 4 cm long. Spikelets solitary, oblong or linear – oblong, strongly compressed, acute at apex, 4 – 5 x 1 mm, few flowered, rachilla winged. Glumes distichous, membranous, erect, ovate – lanceolate, acute, muticous or apiculate at apex, sharply keeled, 2.7 – 4 x 1.5 – 2 mm, dendely reddish gland dotted sides. Stamens 2, anther linear, 1.5 – 2 mm long. Style slender, 3 – 3.5 mm long, pyramidally thickened at base, glabrous, short hairs at base. Stigma 3 fid, much shorter than style. Nut triigonous with some what convex sides, obovoid or oblong – obovoid, shortly stipitate, umbonulate, 0.8 – 0.9 x 0.4 – 0.7 mm, verruculose, transversely lineolate on the faces by the linear – oblong epidermal cells.

Flowering and fruiting: October to November

Distribution: South and South-East to tropical Australia. **India**: Western Peninsula, central and North - East India. **Kerala**: Thiruvananthapuram, Kollam. **Karnataka**: Dakshina Kannada, Hassan, Uttara Kannada. **Andhra Pradesh**: Chittoor.

Habitat: In swamps and marshy areas of dry deciduous forest, wet places of at low altitude.

Specimens examined: **Kerala**: Thiruvananthapuram, Ponmudi estate, 13.09.1977, *N. C. Nair 51017* (MH); Palakkad, Silent Valley, 01.11.2013, *Anoop K. P. 9577* (MBGH); Kollam, Plachery, 25.02.1979, *C. N. Mohanan 61209* (MH). **Andhra Pradesh**: Chittoor, Seethalam river bed, Thandipandal, *M. Chandrabose 45098* (MH).

10. *Fimbristylis complanata* (Retz.) Link, Hort. Bot. Berol. 1: 292. 1827; Clarke in Hook f. Fl. Brit. India 6: 646. 1893; T. Cooke, Fl. Pres. Bombay 3: 400 (1908) 1958 (repr.ed.); Fischer in Gamble Fl. Pres. Madras (1931) 3: 1654. (repr.ed) 1994; Kern in Steenis Fl. Malesiana 1.7(30): 548. 1974; L'narasimhn in Sharma *et al.*, Fl. Maharashtra 2: 306. 1996; Cook, CDK. Aq. & wetl. Pl. India: 136. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cypr.) 167. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 180. 2015. **(Plate –10)**

Type: India

Scirpus complanatus Retz., Observ. Bot. 5: 14. 1788.

Fimbristylis conferta A. Rich., Hist. Fis. Cuba, Bot. 11: 291. 1850.

Fimbristylis amblyphylla Steud., Syn. Pl. Glumac. 2: 116. 1855.

Fimbristylis cylindrostachya Steud., Syn. Pl. Glumac. 2: 119. 1855.

Fimbristylis kielmaieri Steud., Syn. Pl. Glumac. 2: 113. 1855.

Fimbristylis boeckeleri Steud., Syn. Pl. Glumac. 2: 113. 1855.

Fimbristylis rudgeana (Nees) Steud., Syn. Pl. Glumac. 2: 115. 1855.

Fimbristylis obscura Fernald, Proc. Amer. Acad. Arts 36: 492. 1901.

Fimbristylis complanata var. *macrocarya* Domin, Biblioth. Bot. 85: 463. 1915.

Fimbristylis autumnalis var. *complanata* (Retz.) Kük., Bot. Jahrb. Syst. 59: 50. 1924.

Fimbristylis autumnalis f. *hemisphaerica* Kük., Bot. Jahrb. Syst. 59: 6. 1924.

Fimbristylis bequaertii De Wild., Pl. Bequaert. 4: 200. 1927

Perennial with short rhizome. Culms 30 – 80 cm long, 1 – 4 thick, strongly 4 angled towards base, flattened and ancipitous towards upper part. Leaves 1 – 35 cm long, 3 – 5 mm wide, glabrous, abruptly acuminate, ligule a dense fringe of short hairs. Leaf sheaths flattened, keeled on the back, the lowest one bladeless. Inflorescence compound or decompound, 4 – 10 cm long and 2.5 – 6 cm wide, with many to numerous spikelets. Involucral bracts 3 – 4, shorter than inflorescence, acuminate at apex, densely scabrous on margins. Spikelets solitary, lanceolate or ovoid – lanceolate, angled, acute at apex, 4 – 6 x 1.5 – 2 mm, few flowered. Glumes spiral, membranous, ovate or oblong – ovate, acute, mucronate, keeled, 2 – 2.8 x 1.6 – 2 mm, hyaline margined. Stamens 3, filaments flat and hyaline, anther linear oblong apiculate, 2.3 mm long. Style triquetrous, pyramidally thickened at base, glabrous. Stigma 3 fid, as long as style, scabrous. Nut trigonous, broadly obovoid, shortly stipitate and minutely umbonulate, creamy – white, 0.8 – 1 x 0.4 – 0.5 mm, verruculose, epidermal cells very minute.

Flowering and fruiting: Throughout the year

Distribution: Pantropical. Common in South – East Asia. **India**: Throughout. **Kerala**: Kasrgod, Kannur. **Tamil Nadu**: Tirunelveli. **Karnataka**: Mysore, Bellary, Chikmangalur, Hassan, Bangalore, Kodagu, Mandya. **Andra Pradesh**: Hydrabad, Vishakapattanam, Karimnagar, Anantapur, Adilbad

Habitat: common in moist soil, muddy river banks, swampy grass fields, rice fields and on their margins.

Specimens examined: **Kerala**: Munnar, 03.03.1984, *Madhu 12037* (MH). **Tamil Nadu**: Coimbatore, Gobichettipalayam, 28.11.1931, *S.R. Raja 6225* (MH); Coimbatore, Aliyar Submerged area, 24.11.1962, *K. M. Sebastine 15342* (MH); Nilgiri, Moyar reserve forest, 17.08.1970, *B. D. Sharma 35561* (MH); Dharmapuri, Thoppur nursery, 15.07.1978, *E. Vajravelu 57802* (MH); Madurai, Shankaralinyapuram, 23.02.1986, *K. Ravikumar 3217* (MH); Ramanathapuram, Paramakudi, 23.12.1989, *V. Balasubramaniam 2287* (MH). **Karnataka**: Mysore, Srirangapatnam, 11.03.1964, *K. M. Sebastine 18730* (MH); Agumbe, 24.09.2013,

Anoop K. P. 9539 (MBGH). **Andhra Pradesh**: Kistua, Gunavaran, 13.08.1907, *C. A. Barber 8190* (MH); Vizagapatanam, Gajapatinanagaram, 12.10.1930, *V. Narayanaswami 4586* (MH); Hyderabad, Katasintha, 28.06.1958, *K. M. Sebastine 6017* (MH); Hyderabad, Near Hussain Sagar dam, 28.04.1959, *K. M. Sebastine 8037* (MH); Cuddapali, Balapalle, 21.07.1962. *J. L. Ellis 14301* (MH); Karimnagar, Kodimial, 18.07.1964, *G. V. Subarao 20110* (MH); Anantapur, Paikati cherunu, 08.03.1983, *N. Yesoda 1217* (MH); Adilbad, Ontimamidi vagu stream, 27.03.1988, *N. Rama Rao & T. Ravishankar 86545* (MH)

11. *Fimbristylis consanguinea* Kunth En. Pl. 2: 228. 1837; Kern in Steenis Fl. Malesiana 1.7(3): 549. 1974; Mohan & Henr. In Fl. Thiruvananthapuram, 514. 1994; Cook, CDK. Aq. & wetl. Pl. India 139. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cypr.) 169. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 180. 2015. **(Plate –11)**

Type: S. Africa, Cape of Good Hope, *drege s. n.* Isotype (L)

Fimbristylis connectens Thwaites, Enum. Pl. Zeyl. 349. 1864.

Iria consanguinea (Kunth) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Fimbristylis complanata var. *kraussiana* C. B. Clarke, Fl. Brit. India 6: 646. 1893.

Fimbristylis kraussiana Hochst. ex Hook.f., Handb. Fl. Ceylon 5: 63. 1900.

Fimbristylis horsfieldii C. B. Clarke, Bull. Misc. Inform. Kew, Addit. Ser. 8: 25. 1908.

Perennial herbs with short rhizome. Culms 7 – 15 cm long, 0.5 – 0.8 mm thick, tufted, 3 – 4 angled, slightly compressed. Leaves shorter than stem, 1 - 1.5 mm wide, flat, linear, abruptly acuminate at apex, glabrous, ligule a fringe of short hairs, lowest leaves usually reduced to sheaths, sheath cylindrical, orifice ciliate, up to 2.3 cm long. Inflorescence simple to compound, with 3 – few spikelets, 1 – 2 x 0.5 – 2 cm. Involucral bracts 3, shorter than inflorescence, lowest 6 – 8 mm long. Spikeletes solitary, ovoid or oblong – ovoid, acute or subacute at apex, 3 – 4 x 1.2 mm, faintly angled, few flowered, rachilla winged. Glumes spiral, membranous,

ovate, cute – muconate at apex, 1.6 – 2 x 1 – 1.3 mm, keeled, hyaline towards margin. Stames 3, anthers linear – oblong, apiculate at apex, 0.7 mm long. Style trigonous, 2.2 mm long, pyramidally thicked towards base, glabrous. Stigma 3 fid, slightly shorter than style. Nut trigonous, broadly obovoid, umbonulate, shortly stipitate, 0.8 x 0.5 – 0.6 mm, smooth or sparsely tuberculed faces, epidermal cells not clear on the smooth faces, transversely oblong in many vertical rows.

Flowering and fruiting: September - December

Distribution: Sri Lanka, China, Malesia, South Africa and Madagascar. **India**: Southern peninsula. **Kerala**: Thiruvananthapuram. **Tamil Nadu**: Thirunelvely**. Karnataka:** Shimoga, Hassan.

Habitat: Swampy areas and wet grasslands.

Specimens examined: **Kerala**: Thiruvananthapuram, Bonacaud, 18.05.1979, *M. Mohanan 61833* (MH); Bonacaud, 01.11.2013, *Anoop K. P. 9578* (MBGH); Palakkad, Aruvampara Reserve Forest, 10.10.1979, *N. C. Nair 64476* (MH). **Tamil Nadu**: Thirunelvely, Agasthyamala peak, 26.05.1963, *A. N. Henry 16318* (MH).

12. *Fimbristylis cymosa* var. *spathacea* (Roth) Koyama in Micronesica 1: 83. 1964 et in Dassan. & Fosb. Rev. Handb. Fl. Celon 5: 301. 1995; *F. spathacea* Roth Nov. Sp. Pl. 24. 1821; Clarke in Hook. f. Fl. Brit. India. 6: 640. 1893; Cook, CDK. Aq. & wetl. Pl. India: 136. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cypr.): 171. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 180. 2015. **(Plate –12)**

Fimbristylis spathacea Roth, Nov. Pl. Sp. 24. 1821.

Fimbristylis wightiana Nees, Contr. Bot. India 99. 1834.

Fimbristylis kankaoensis Hayata, Icon. Pl. Formosan. 6: 111. 1916.

Fimbristylis cymosa subsp. *spathacea* (Roth) T. Koyama, Micronesica 1: 83. 1964

Perennial with short and thick rhizome, Culms 10 - 60 cm long, 1 - 2.5mm thick, rigid, densely tufted, compressed, trigonous to subterete, smooth. Leaves

densely tufted, 5 - 20 cm long, 1 - 3 mm wide, much shorter than stem, coriaceous, canaliculated, abruptly acuminate, eligulate. Inflorescence compound or decompounds, loose to very dense, several to many spikelets. Involucral bracts 2 - 3, shorter than inflorescence, erect, dilated at base. Spikelets solitary, ovoid, oblong-ovoid, angular, densely many flowered 3 - 6 x 2 mm, rachilla broadly winged. Glumes spiral, membranous, ovate – obtuse, slightly keeled, 3 nerved, 1.5 x 1.2 mm, light brown, hyaline margin especially in upper half. Stamens 2, anther linear, 0.6 mm long, not bristly at top. Style linear, base narrowly dilated, glabrous. Stigma 2 or 3, as long as or longer than style. Nut biconvex, obovoid, 0.7 - 0.8 x 0.5 mm, brown to black, sparsely verruculose.

Flowering and Fruiting: September – December

Distribution: Tropical and subtropical region of the world. **India**: Western Peninsular India, East India, Andaman & Nicobar Island. **Kerala:** Thiruvananthapuram, Malappuram, Kozhikode. **Tamil Nadu**: Kanchipurm, Thiruchirappally.

Habitat: Usually seen in sandy areas near sea shores, river beds and marshy low lands.

Specimens examined: **Kerala:** Thiruvananthapuram, Kovalam, 16.11.1979, *M. Mohanan 65102* (CALI); Kozhikode, Kadalundi, 21.03.1984, *Rejani 37824* (CALI); Malappuram, Parappanangadi, 05.03.1985, *Rajani 39783* (CALI); Kozhikode, Payyanur, 22.07.2014, *Anoop K. P. 9597* (MBGH). **Tamil Nadu:** Thanjvore, Muthupet, 19.09.1965, *K. Ramamurthy 25856* (MH); Puthukottai, Poovarankudi, 24.02.1985, *C. Arulappan 375* (MH); Ramanathapuram, Krusadi Island, 30.12.1987, *V. Balasubramanian 1468* (MH); South Arcot, Gori, 19.03.1987, *N. Parthasarathy & K. Ravikumar 85410* (MH); Thiruchirappally, Kollidam, 20.02.2015, *Anoop K. P. 11114* (MBGH); Kanchipuram, Netteri, 24.02.2015, *Anoop K. P. 11122* (MBGH).

13. ***Fimbristylis dichotoma*** (L.) Vahl, Ennum. 2: 287. 1806; Kern in Steenis Fl. Malesiana 1(7) 3: 575. 1974; Koyama in Contr. De Inst. Bot. Univ. Montreal 70:

39. 1957. et in Dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 307. 1985; Cook, CDK. Aq. & wetl. Pl. India: 141. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cypr.): 172. 2002; L'narasimhn in Sharma *et al* Fl. Maharshtra (Monocot) 2: 307. 1996; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 180. 2015. **(Plate –13)**

Scirpus dichotumus L. Sp. Pl. 50. 1753.

Fimbristylis diphylla (Retz.) Vahl l. c. 289 Clarke in Hook. f. Fl. Brit. India. 6: 637. 1893. excl. var *Pluristriata* Clarke l.c. *F. diphylla* var. *annua* non R. & S.
Scirpus diphyllus Retz. Obs. 5: 15. 1789.
Fimbristylis longispica Clarke l. 639. 1893.

Annual or perennial with woody rhizomes. Culms 10 - 65 cm long, 1 - 2 mm thick, tufted, slender to stout, angular, compressed especially bellow the inflorescence. Leaves linear, flat, basal, 3 - 40 cm long, 1.5 - 3mm wide, glabrous or more or less pubescent, ligule a dense fringe of short hairs. Leaf sheaths 0.5 -18 cm long, glabrous to puberulus. Inflorescence simple to decompounds corymbs of few to many spikelets. Involucral bracts 2 - 5, much shorter to longer than inflorescence, 0.5 - 18 cm long. Spikelets densely many flowered, ovoid to ellipsoid, acute at apex, 4 - 7 x 2 - 4 mm, ferruginous or pale brown, rachilla broadly winged. Glumes spiral, ovate or ovate-oblong, 2 - 3.5 x 1.5 - 2.2 mm, keeled, glabrous, sides nerveess with narrow hyaline margins, obtuse at apex, muticous or apiculate. Stamens 1 - 3; anthers linear, 0.8 - 1 mm long, apiculate. Style flat, 1 - 1.8 mm long, slightly dilated at base, ciliate at margin. Stigma 2 fid, tapering towards apex, 0.5 - 1.5 mm long. Nut biconvex, obovoid or suborbicular, 1 - 1.2 x 0.8 - 1 mm, shortly stipitate, verruculose, trabeculate, white to stramineous, epidermal cells transversely elliptic to oblong.

Flowering and Fruiting: April to November.

Habitat: Rice fields, river banks and wet grasslands

Distribution: A widely distributed species, throughout the warmer part of the world. **India**: Throughout. **Kerala**: Kottayam, Kumarakam, Alappuzha, Thriuvanathapuram, Kannur, Kozhikode, Wayanad, **Tamil Nadu**: Coimbatore,

Madurai. Karnataka**:** Bangalore, Belgaum, Dakshina Kannada, Udupi, Hassan, Shimoga, Mandya, Mysore. **Andhra Pradesh**: Kurnool, Vishakapattanam, East Godavari

Habitat: Moist sandy areas, open waste places, edges of rice fields and in moist ditches along road sides.

Specimens examined: **Kerala**: Malappuram, C.U. campus, 15.02.1971, *V.V. Sivarajan 991* (MH); Kannur, Tellichery, 12.05.1987, *Rajani 12061* (MH); *Kottayam*, Kumarakam, 22.03.2014, *Anoop K. P. 9590* (MBGH). **Andhra Pradesh:** Kurnool, Moodavaguluvanka, 08.12.1963, *J. L. Ellis 18006* (MH); Vishakapatnam, Galikonda, 15.05.1964. *G. V. Subba Rao 19608* (MH); Kurnool, 14.08.1972. *J. L. Ellis 42251* (MH); East Godavari, 25.09.1980, *G.V. Subba Rao 68551* (MH); East Godavari, Maredumilli, 22.12.1993, *M. Mohanan 100830* (MH); East Godavari, 23.02.1994, *M. Mohanan 101352* (MH). **Tamil Nadu:** Coimbatore, Sholayar, 27.07.1963. *K. Ramamurthy 16699* (MH); Nilgiri, Mudumalai reserve forest, 18.11.1958, *K. M. Sebastine 7387* (MH).

14. ***Fimbristylis dimorphonucifera*** Govind. J. Rheedea 7(2): 122. F. 4. 121. 1997; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 190. 2015. **(Plate –14)**
Type: India, Karnataka, S. Kanara, Kannadekkatta, *Govindarajalu 8860 G* – (CAL! Holotype)

Annaul herbs with fibrous roots. Culms 8 – 12 cm long, 1 mm thick, glabrous, usually up to 3 noded and bearing tubular sheaths. Leaves 1.5 – 3.5 cm long, 1.5 – 2.5 mm wide, leaves of sterile shoots shorter than stem, ligule a dense fringe of hairs. Inflorescence simple, sometimes 1 – 2 rays added, loose, with 4 – 10 spikelets. Spikelets solitary, angular, ellipsoid or elliptic – ovoid, acute, 4.5 – 5 x 1.5 – 2 mm, 10 – 20 flowered, rachilla winged. Glumes spiral, ovate, broadly rounded at apex, 1.5 – 2.2 x 0.75 mm, with 3 nerved keel, sides translucent. Stamens 3, anthers linear – oblong, 1.2 – 1.3 mm long. Style triquetrous, with narrow pyramidal base, up to 1.2 mm long. Stigma 3 fid, 0.7 – 0.8 mm long. Nut

dimorphic, densely tubercled, 1 - 2 basal nuts larger, obscurely trigonous, assymetric, sessile, minutely umbonulate or non umbonulate, 0.75 – 1 x 0.75 – 1 mm, black, with obscure epidermal cells. Other nuts small triquetrous, symmetric, narrowly obovoid, shortly stipitate, non umbonulate, 0.75 x 0.5 mm, stramineous, with narrowly linear transversely elongated epidermal cells.

Flowering and fruiting: November

Distribution: Endemic to Karnataka (Dakshina Kannada) and Kerala (Kasargod)

Habitat: Marshy soil and wet habitats.

Specimens examined: **Kerala:** Kasargod, uppala, 16.01.2013, *Anoop K. P. 9518* (MBGH). **Tamil Nadu:** Tanjavur, Thruvarur, *V. J. Nair 75177* (MH); Neduvakottai, 21.02.2015, *Anoop K. P. 11117* (MBGH).

Note: This species was reported as endemic to Karnataka (Pradas & Singh 1996). So it is a new distribution report of this species from kerala.

15. *Fimbristylis dispacea* (Rottb.) Clarke in Hook. f. Fl. Brit. India 6: 635. 1893; Fischer in Gamble Fl. Pres. Madras (1931) 3:1650. (repr.ed) 1994; Kern in Steenis Fl. Malesiana 1.7 (3): 590. 1974; Koyama in dassan. & Fosb. Rev. handb. Fl. Ceylon 5: 321. 1985; Karthik. *et al.,* Fl. Indic. En. Monocots. 52. 1989; L'narasimhn in Sharma *et al.,* Fl. Makarshtra (Monocots) 2: 309. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cypr.) 175. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 190. 2015. **(Plate –15)**
Type: India, *Koenig.*

Scirpus dipsaceus Rottb., Descr. Icon. Rar. Pl. 56. 1773.

Echinolytrum dipsaceum (Rottb.) Desf., J. Bot. (Desvaux) 1: 20. 1808.

Isolepis dipsacea (Rottb.) Roem. & Schult., Syst. Veg. 2: 119. 1817.

Scirpus minimus Roxb., Fl. Ind. 1: 219. 1820.

Annual herbs with fibrous roots. Culms 2 - 15 cm long, 0.5 mm thick, higly tufted, very slender, trigonous, smooth, glabrous. Leaves 0.5 – 3cmlong, 0.3 – 0.5

mm wide, filiform, tapering towards apex, sheaths very small, lowest scale like, brownish, eligulate. Inflorescence simple umbel of few spikelets. Involucral bracts 3 – 5, filiform, usually at leat 2 or 3 longer than the inflorescence. Spikelets solitary, subglobose, oblong or ovoid, terete, obtuse at apex, 2 – 6 x 2 – 4 mm, densely many flowered, rachilla winged. Glumes spiral, spreading, lanceolate narrowed towards apex, 1.5 - 2 x 0.3 – 0.5 mm, keeled, thinly membranous towards margin, keel protruding beyond the apex forming a recuved awn. Stamen 1, anthers oblong – lanceolate, apiculate at apex, 0.3 mm long. Style 0.6 – 0.8 mm long, slender, slightly dilated at base, glabrous. Stigma 2 fid, as long as style. Nut subterete, linear – oblong, obtuse at apex, slightly curved, brownish, 0.5 – 0.9 x 0.3 mm, with few caducous, clavage appendages on both the margins, epidermal cells minute, transversely oblong.

Flowering and fruiting: April to May

Distribution: South and East Asia, tropical Africa. **India**: Western Peninsular India, Central India, Northern India, East and North-East India. **Tamil Nadu**: Thanjavur. **Karnataka**: Dakshina Kannada, Hassan, Mysore. **Andra Pradesh**: Naspur

Habitat: Occasional in Muddy areas of lake sides, river banks, wet rice fields, open marshy areas and wet sandy areas at low altitude.

Specimens examined: **Tamil Nadu**: Tanjavur, Thiruvarur, 28.05.1978, *V. J. Nair 57177* (MH); Puthukottai, Narthamali, 03.08.1984, *C. Arulappan 124* (MH); Coimbatore, Marudha road, 08.05.1957, *3041* (MH); Kanchipuram, 24.02.2015, *Anoop K. P.* (MBGH). **Andhra Pradesh**: Medak, Narsapur, 24.04.1959, *K. M. Sebastine 7974* (MH).

16. *Fimbristylis dura* (Zoll. & Moritz.) Merr. Philipp. J. Sci. 1. 53. 1916; Kernin Steenis Fl. Malesiana1.7(3): 554. 1974; Koyama in dassan. & fosb. Rev. handb. Fl. Ceylon 5: 287. 1984; Mohan & Sivadan Fl. Agasthyalama 780. 2003. W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 192. 2015.

Isolepis dura Zoll. and Moritzi, Syst. Verz. 97. 1846.

Fimbristylis asperrima Boeckeler, Linnaea 37: 40. 1871.

Trichelostylis asperrima Nees ex Boeckeler, Linnaea 37: 41. 1871.

Perennial herbs with short rhizome. Culms 40 -100 cm tall, 1.5 – 3 mm thick bellow, trigonous or compressed – trigonous, smooth or scabrulous on angles bellow the inflorescence, glabrous. Leaves shorter than culms, 3 – 6 mm wide, sheath 2 – 15 cm long, rounded on the back. Inflorescence decompound, with numerous spikelets. Involucral bracts 3 – 5, leaf like, the lowest much surpassing the inflorescence, 10 – 25 cm long. Spikelets solitary, linear, some what angular, brown or chestnut – brown, 6 – 11 x 1.3 – 1.5 mm, acute at apex, many flowred. Glumes ovate, oblong deeply boat shaped, 1.8 – 2 x 1.5 mm, acute, brown or reddish brown, with hyaline magins, keel 3 nerved, mucrnate. Stamen 3. Stigma 3 fid. Nut trigonus, broadly ellipsoid or obovoid, 0.7 x 0.5 mm, dendely verruculose, indistinctly reticulate by transversely oblong epidermal cells on each face.

Flowering and fruiting: October to December

Distribution: Endemic to Maharashtra and Kerala (Agasthyamala)

Habitat: Along the margins of water courses

Specimens examined: Thiruvananthapuram, Agsthyamala, 12. 12. 2013, *Anoop K. P. 9579* (MBGH).

17. *Fimbristylis eligulata* Govind. In Proc. Indian Acad. Sci. 76B. 184. 1972; Karthik. *et al.*, Fl. Indic. En. Monocots 52. 1989. W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 192. 2015. **(Plate –17)**

Perennial herbs with short rhizome. Culms 5 – 30 cm long, 1 – 1.4 mm thick. Leaves shorter than culm, 1 – 2.5 mm wide, glabrous or hairy, sometimes curved, sheaths glabrous with ferruginous margins. Inflorescence simple to compound with 10 – 20 spikelets. Involucral bracts setiform, much shorter than inflorescence, 5 - 15 mm long. Spikelets solitary, ovoid, 5 – 6 x 2 – 3 mm, many flowered, dark to chestnut brown finally become pale, rachilla wingless. Glumes ovate, subaute, 2 –

2.2 x 1.3 – 1.5 mm, with 5 nerved keel, muticous, sides nerveless or invisible 1 – 2 nerved, broadly hyaline margined. Stamens 3, anther linear, muticous, 0.7 – 0.8 mm long. Style very slender, 0.7 – 0.9 mm long, distinctly pyramidally dilated at base, hairy in upper half. Stigma 2 fid. Nut biconvex, trabeculate, obovoid, 0.5 – 0.7 x 0.4 – 0.5 mm, with 5 - 7 vertical ridges, transversely oblong minute epidermal cells.

Flowering and fruiting: September to November

Distribution: Endemic to Tamil Nadu and Andhra Pradesh

Habitat: Along the shores, sandy banks of the back water river, wet grass lands.

Specimens Examined: **Andhra Pradesh**: Nellore, Pulicat Lake, 22.10.2005, *Solanke S. N. 146* (SUK).

18. *Fimbristylis eragrostis* (Nees & Mey. Ex Nees) Hance in J. Linn. Soc. Bot. 13: 132. 1872; Kern in Steenis Fl. Malesiana 1.7 (3): 567. 1974; Mohan. & Henr. In Fl. Thiruvananthapuram 515. 1994; Mohan. & Sivad. In Fl. Agasthyamala 781. 2002; Prasad & Singh Sedg. Karnataka (Fam. Cypr.): 177. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 193. 2015. **(Plate –18)**

Type: China, *Meyen.*

Abildgaardia eragrostis Nees, Contr. Bot. India 95. 1834

Fimbristylis subtetrastachya Boeckeler, Linnaea 37: 50. 1871.

Iria eragrostis (Nees) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Iria subtetrastachya (Boeckeler) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Fimbristylis lepidota E. G. Camus, Notul. Syst. (Paris) 1: 247. 1910.

Fimbristylis tortispica Turrill, Bull. Misc. Inform. Kew 1911: 348. 1911.

Fimbristylis schlechteri Kük., Bot. Jahrb. Syst. 59: 50. 1924.

Perennial herbs with woody rhizome, rhizome often clothed with old decayed leaf sheaths. Culms 6 – 36 cm long, solitary, 4 angled, sulcate, slightly

compressed and often ancipitous below the inflorescence, smooth or scabrid at top. Leaves 2 – 10 cm long, 1.5 – 3 mm wide, flat, stiff, subfalcate, linear, obtuseand apiculate at apex, eligulate. Leaf sheath dilated towards base, striate, 1.5 – 5 cm long. Inflorescence compound to decompound, 1.5 – 4 x 1 – 5 cm, with few to many spikelets. Involucral bracts 2 – 4, very short, erect, lowest 4 – 6 mm long. Spikelets solitary compressed or subterete, ovate, oblong – ovate or lanceolate, acute at apex, 5 – 8 x 2 – 3 mm, pale to dark brown, few flowered, rachilla winged. Glumes distichous or subspiral, broadly ovate, obtuse – acute and mucronulate at apex, keeled, 3.2 – 3.8 x 2.5 – 2.8 mm, glabrous. Stamens 3, anther linear, prominently apiculate, 1.3 – 2 mm long. Style triquetrous, pyramidally thickened towards base, 2.2 – 2.5 mm long, glabrous or sparsely ciliate at top. Stigma 3 fid, as long as style. Nut trigonous, obovoid, umbonulate, greyish, 1 x 0.8 mm, shortly stipitate, verruculose, isodiametric minute epidermal cells in 12 – 13 vertical rows.

Flowering and fruiting: May to October

Distribution: Sri Lanka, South China, Formosa, Malesia and tropical Australia. **India**: Peninsular India, North-East India, Andaman and Nicobar Island. **Kerala**: Thiruvananthapuram. **Karnataka**: Dakshina Kannada, Hassan, Kodagu, Shimoga. **Andhra Pradesh**: East Godavari, Chittoor.

Specimens examined: **Kerala**: Thiruvananthapuram, Kurisumalai, 07.03.1979, *M. Mohanan 59467* (MH); Wayanad, Chandanathode, 24.06.1965, *J. L. Ellis 25116* (MH); Wayanada, Mananthavadi, 20.01.2013, *Anoop K. P. 9514* (MBGH). **Andhra Pradesh**: East Godavari, Valamuru, 23.02.1994, *M. Mohanan 101351* A (MH); Chittoor, Gosala, 30.09.1974, *G. V. Subba Rao 45890* (MH).

19. *Fimbristylis falcata* (Vahl) Kunth En. Pl. 2: 239. 1837. Kern in Steenis Fl. Malesiana 1.7(3): 557. 1974; Koyama in Dassan. & Fosb. Rev. handb. Fl. Ceylon 5: 289. 1985; L'narasimhn in Sharma *et al.*, Fl. Maharshtra 2: 309. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cyper.): 179. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 194. 2015. **(Plate –19)**

Type: India, *Koenig.*

Scirpus falcatus Vahl, Enum. Pl. Obs. 2: 275. 1805.

Isolepis falcata (Vahl) Roem. & Schult., Syst. Veg. 2: 118. 1817.

Fimbristylis brevifolia J. Presl & C. Presl, Reliq. Haenk. 1: 192. 1828.

Fimbristylis brachyphylla J. Presl & C. Presl, Reliq. Haenk. 1: 351. 1830.

Fimbristylis torta (Nees) Kunth, Enum. Pl. 2: 241. 1837.

Fimbristylis latifolia (Nees) Kunth, Enum. Pl. 2: 239. 1837

Fimbristylis chaetorrhiza (Nees) Kunth, Enum. Pl. 2: 240. 1837.

Fimbristylis junciformis (Nees) Kunth, Enum. Pl. 2: 239. 1837

Fimbristylis haenkei D. Dietr., Syn. Pl. 2: 161. 1840

Fimbristylis crassipes Boeckeler, Flora 41: 602. 1858.

Fimbristylis junciformis var. *conostachya* C. B. Clarke, J. Bot. (Morot) 3: 197. 1889.

Iria falcata (Vahl) Kuntze, Revis. Gen. Pl. 753. 1891.

Fimbristylis falcata var. *latifolia* (Nees) H. B. Naithani & M. B. Raizada, Indian Forester 103: 414. 1977.

Perennial herbs with woody rhizome. Rhizome 0.5 – 1 cm thick, creeping, clothed or ciliate towards apex. with remains of old leaf sheaths and with rather stout fibrous roots. Culms more or less tufted, compressed, angular, sulcate, 0.75 – 1.5 mm thick, smooth. Leaves 2 – 15 cm long, 1 – 3 mm wide, mostly basal, much shorter than stem, often acabrous on the margins, eligulate. Inflorescence compound or subcompound, open, with few to many spikelets, 1 – 5 cm x 1 – 3 cm, Involucral bracts 3 – 4, much shorter than inflorescence, acute at apex, lowest up to 1.8 cm long. Spikelets usually in clusters, often in pairs or 3 – 5, some solitary ones intermixed, ovoid, acute, 3.5 – 6 x 1.5 mm, few to many flowered, rachilla winged. Glumes spiral broadly ovate, acute, minutely apiculate at apex, keeled, 2 – 3 x 2 – 3 mm, scarious to hyaline towards margins, lowest glumes often long mucronate.

Stamens 3, filaments flat, hyaline, anthers linear to oblong, connective distinctly produced with white bristles at tip. Style triquetrous, 2 mm long, pyramidally thickened at base, glabrous. Stigma 3 fid, slightly shorter than to as long as style. Nut trigonous, obovoid, shortly stipitate, umbonulate, whitish, 1 x 0.7 mm, smooth or slightly verruculose, epidermal cells transversely linear to oblong.

Flowering and fruiting: September to November

Distribution: Sri Lanka, Pakisthan, Nepal, Thailand, Indo-China, Malesia. **India**: Throughout. **Kerala**: Wayanad, Kozhikode. **Karnataka**: Chikmangalore, Bellary, Bangalore, Hassan, Mysore, Shimoga. **Andhra Pradesh**: Srikakulam, Visakapatanam, Adilabad.

Habitat: Occasional in open grass lands, wet rocky localities, slopes of hills, moist humus soil, sandy areas on hills.

Specimens examined: **Tamil Nadu**: Coimbatore, Marudamalai, 24.06.1930, *V. Narayanaswami 3139* (MH); Thanjavur, Athanoor, 22.02.2015, *Anoop K. P. 11119* (MBGH). **Andra Pradesh**: Srikakulam, Korada Reserve Forest, 12.05.1979, *G. V. Subba Rao 62390* (MH); Visakapatanam, Punyagini Hill, 06.08.1973, *G. V. Subba Rao 44227* (MH); Adilabad, Boggularaavi, 01.07.1987, *T. Ravishankar 85245* (MH)

20. *Fimbristylis ferruginea* (L.) Vahl, Enum. 2: 291. 1806; Clarke in Hook. f. Fl. Brit. Inidia 6: 638. 1893; Cook Fl. Pres. Bombay 2: 881. 1908; Manilal & Sivarajan in Fl. Calicut, 324. 1982; Fischer in Gamble Fl. Pres. Madras (1931) 3: 1651 (repr. ed.) 1994; Kern in Steenis Fl. Malesiana 1.7(3): 572. 1974; Mohan. & Henr. Fl. Thiruvananthapuram, 515. 1994. L'narasimhn in Sharma *et al.*, Fl. Maharashtra (Monocot) 2: 309. 1996; Cook, CDK. Aq. & wetl. Pl. India: 142. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cyper.): 181. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 197. 2015. **(Plate –20)**

Type: Jamaica

Fimbristylis ferruginea var. *sieberiana* (Kunth) Boeckeler, Linnaea 37: 17. 1871.

Fimbristylis ferruginea var. *foliate* Benth., Fl. Austral. 7: 312. 1878

Fimbristylis ferruginea var. *boiviniana* C. B. Clarke, Consp. Fl. Afr. 5: 606 .1895.

Fimbristylis ferruginea f. *decomposita* Domin, Biblioth. Bot. 85: 459. 1915.

Fimbristylis ferruginea var. *compacta* Kük., Repert. Spec. Nov. Regni Veg. 23: 196. 1926.

Fimbristylis ferruginea var. *anpinensis* (Hayata) H.Y.Liu, in Fl. Taiwan ed. 2, 5: 269. 2000.

Perennnial herbs with short, creeping, woody rhizome. Culms 20 – 100 cm long, 1 – 3mm wide, tufted, striate, compressed, smooth. Leaves much shorter than stem, 3 – 10 cm long, 0.5 – 1.5 mm wide, ligule a dense of fringe short hairs; lower leaf sheath bladeless, coriaceous, shining brown, upper one ferrugineous, ciliolate at the mouth. Inflorescence simple to subcompound, contracted with 5 – 25 spikelets. Involucral bracts 2 – 3, foliaceous, shorter than inflorescence. Spikelets solitary, ovoid to oblong, teret, acute, 4 – 10 x 3 – 4 mm, sometimes 2 – 3 sessile spikelets, rachilla narrowly winged. Glumes spiral, ovate to oblong, 3 – 4.5 x 2.5 – 3 mm, scarcely keeled, apiculate with one nerved keel, almost twice longer than broad, ciliolate at the upper margin, cilioate at the upper edge. Stamens 3, anthers linear 1 – 1.5 mm long, brownish. Style flat, dilated at the base, densely ciliolate towards upper half. Stigma 2 fid, shorter than style. Nut biconvex, obovate to oblong, 0.8 – 1.1 x 0.7 – 1 mm, bulged at the centre, surface smooth, shortly stipitate, epidermal cells isodiametric.

Flowering and Fruiting: Throughout the year

Distribution: Pantropical. **India:** Andaman & Nicobar, Andra Pradesh, Delhi, Gujarath, Kerala, Karnataka, Lakshadweep, Maharashtra, Punjab, Madhya Pradesh, Rajasthan, Tamil Nadu, Uttar Pradesh & West Bengal (Cook 1996, Verma 2001, Lakshminarasimhan 1996). **Kerala**: Kollam, Kannur, Ernakulam, Kozhikode, Alappuzha. **Tamil Nadu:** Coimbatore, Ramanathapuram, Thanjavur, Kanchipuram, Thirichirappalli. **Karnataka**: Bangalore, Belgaum, Hassan, Mysore, Shimoga.

Habitat: Grows in wet and marshy places, especially with sandy or clayish soil, shallow water and in brackish water near the sea and also grows in river and lake sides. (Cook 1996).

Specimens examined: **Kerala:** Kollam, Paravur, 23.05.1978, *C. N. Mohan 55762* (MH); *Cannanore*, Kumbla, 25.01.1929, *V. J. Nair 59900* (MH); Ernakulam, Vypin, 03.10.1984, *Rejani 38091* (CALI); Kannur, Pazhayangadi, 22.07.2014, *Anoop K. P. 9598* (MBGH); **Tamil Nadu:** South Arcot, Ammapettai, 25-08-1930, *V. Narayanaswami 4158* (MH); Coimbatore, Gobichettipalayam, 28.11.1931, *S. R. Raju 6228* (MH); Tanjavur, Muthupett, 20.05.1978, *V. J. Nair 56548* (MH); Ramanathapuram, Krusadi Island, 29.09.1987, *V. Balasubramanian 1391* (MH); Kanchipuram, Thirupulivanam, 24.02.2015, *Anoop K. P. 11121* (MBGH). **Karnataka:** Mysore, Vrindavan garden, 21.07.2015, *Anoop K. P. 11132* (MBGH).

21. *Fimbristylis fusca* (Nees) Clarke in Hook f. Fl. Brit. India 6. 649. 1893; Kern in Steenis Fl. Malesiana 1.7 (3): 567. 1974; Koyama in dassan. & Fosb. Rev. Handb. Fl. Ceylon 5. 276. 1985; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 199. 2015. **(Plate –21)**

Abildgaardia fusca Nees, Contr. Bot. India 95. 1834.

Fimbristylis fusca (Nees) Benth., Gen. Pl. 3: 1048. 1883.

Fimbristylis cyperoides (J. Presl & C. Presl) F. Muell., Fragm. 9: 11. 1875

Iria fusca (Nees) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Fimbristylis fusca var. *cantoniensis* C. Branch Roy. Asiat. Soc. 59: 223. 1911.

Fimbristylis stenochlaena Kük., Mitth. B. Clarke, J. Linn. Soc., Bot. 36: 237. 1903.

Fimbristylis subfusca E. G. Camus, Notul. Syst. (Paris) 1: 248. 1910.

Fimbristylis rigidifolia Ridl., J. Straits Thüring. Bot. Vereins n. f., 50: 11. 1943.

Perennial herbs with short, woody rhizome clothed with the remains of dead leaf sheaths. Culms 20 – 50 cm long, 0.4 – 0.6 mm wide, trigonous, smooth, glabrous, often scabrid to pilose just bellow the inflorescence. Leaves much shorter

than culm, 2 – 4 mm wide, rather stiff, flat, abruptly pointed, glabrous or pubescent especially beneath, scabrid at top, eligulate. Inflorescence compound to decompound, loose with several to numerous spikelets, up to 10 cm long. Involucral bracts 3 – 5, very short, glabrous or pilose, dilated at base, up to 7 cm long. Spikelets solitary, lanceolate, strongly compressed, acute, 5 – 10 x 2 – 2.5 mm, 3 – 10 flowered, rachilla broadly winged. Glumes spiral, ovate, sharp keeled, 1 nerved, glabrous, whitish hyaline margin, 4 – 6 x 2 – 2.5 mm. Stamens 3; anther linear, 1.5 – 2 mm long. Style very slender, 4 – 6 mm long, triquetrous, pyramidally thickened at base, glabrous. Stigma 3, much shorter than style. Nut trigonous with convex sides, obovoid, cuneate at base, shortly stipitate, umbonulate, whitish to brown, 1 x 0.5 mm, densely verruculose, isodiametric epidermal cells.

Flowering and fruiting: September to November

Distribution: Nepal, India, Thailand and Indo-China to South China and Japan. **India**: Andhra Pradesh (Khammam district)

Habitat: In open rather dry to wet grasslands.

Specimen examined: **Andhra Pradesh**: Khammam, Bhadrachalam, *Solanke S. N. 681* (SUK)

22. *Fimbristylis lawiana* (Boeck.) Kern in reinwardia 4: 96. 1956; L'narasimhn in Sharma *et al.,* Fl. Maharashtra (Monocots) 311. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cypr.) 183. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 206. 2015. **(Plate –22)**

Scirpus lawianus Boeckeler, Linnaea 36: 497. 1870.

Fimbristylis digitata Boeckeler, Flora 61: 35. 1878.

Trichelostylis digitata Dalzell ex Boeckeler, Flora 61: 35. 1878.

Trichelostylis lawiana (Boeckeler) M. R. Almeida, Fl. Maharashtra 5B: 396. 2009.

Perennial herbs with bulbous rhizome and fibrous roots. Rhizomes clothed with remains of decayed leaf sheaths and fibrous roots. Culms slender, 0.3 – 1 mm

thick, angular-sulcate, usually triangular to quadrangular towards apex. Leaves 2 – 13 cm long, 0.5 – 0.7 mm wide, shorter than culm, flat, abruptly acuminate at apex, usually scabrid towards apex, eligulate. Cauline leaves reduced into bladeless sheaths, sheath 0.5 – 2.5 cm long. Inflorescence a head with 3 – 5 sessile spikelets, 5 – 10 x 5 – 11 mm. Involucral bracts 3, glume like, much smaller than spikelets. Spikelets oblong to lanceolate or ovate to lanceolate, acute, whitish to straw coloured, 4 – 9 x 2 – 3, subterete or obscurely angled, many flowered. Glumes spiral, broadly ovate or oblong to ovate, acute, faintly to prominently apiculate at apex or rarely obtuse, 2.2 – 2.5 x 1 – 1.5 mm, hyaline towards margin. Stamens 3, filaments flat, anthers linear to oblong, 1 mm long. Style triquetrous, 1.5 – 2 mm long, thickened towards base. Stigma 3 fid, shorter than style, up to 1 mm long. Nut trigonous to plano convex, obovoid, obtuse at apex, 0.8 – 1 x 0.6 – 0.7 mm, minutely stipitate, not umbanulate, smooth, glabrous, epidermal cells transversely elongate in 8 vertical rows.

Flowering and fruiting: June to August

Distribution: Endemic to peninsular India. **Karnataka**: Bijapur, Uttara Kannada

Habitat: Common in open grasslands, rice fields and among grasses on hill slopes

Specimen examined: Tamil Nadu: Thanjavur, Thiruvarur, *V. J. Nair 57149* (MH)

23. ***Fimbristylis ligulata*** Govind. In Proc. Indian Acad. Sci. 76. B. 187. F. 3. 188. 1972; Karthik. *et al.,* Fl. Indic. En. Monocots: 53. 1989; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 213. 2015.

Annual herbs, Culms 20 – 25 cm long, 0.3 – 0.4 mm, trigonous, smooth. Leaves 10 – 15 cm long, 0.3 – 0.5 mm, sheath dark brown, hirsultely hairy. Inflorescence simple consisting of 1 – 3 spikelets, 2 x 3 cm. Invalucral bracts leaf like, overtopping the inflorescence, 2.5 – 10 cm long. Spikelets ovoid – elliptic, obtuse – subacute, many flowered, solitary, ferrugineous brown, 3 – 4 x 2.3 – 2.5 mm. Glumes ovate, subacute, loose, inflated by the nut with faintly nerveless sides, 1.4 – 1.5 x 0.9 – 1.1 mm, rachilla minutely winged. Stammen 1 or 2; anther apiculate, 0.3

– 0.4 mm long. Style flat, dilated at base, glabrous, 0.7 – 0.9 mm long. Nut obcordate, biconvex, smooth, umbanulate, stipitate, 0.8 – 0.9 x 0.6 – 0.7 mm, epidermal cells transversely elongated.

Flowering and fruiting: August to December

Habitat: Semi-wet marshes, wet open grasslands.

Distribution: **Karnataka:** North Kanara

Specimen examined: **Karnataka**: North Kanara, Shiggan, *D. P. Chavan 5223* (SUK).

24. *Fimbristylis microcarya* F. V. Muell. Fragm 1: 200. 1859; Kern in Steenis Fl. Malesiana 1.7(3): 550. 1974; Karthik. *et al.,* Fl. Ind. En. (Monocots): 53. 1989; L' narasimhn in Sharma *et al.,* Fl. Maharashtra (Monocots): 315. 1996; Cook, CDK. Aq. & wetl. Pl. India: 144. 1996; Prasad & Singh Sedg. Karnataka (Fam. Cypr.): 191. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 213. 2015. **(Plate –24)**

Fimbristylis thonningiana Boeckeler, Linnaea 38: 395. 1874

Fimbristylis complanata var. *microcarya* (F. Muell.) C. B. Clarke, Fl. Brit. India 6: 646. 1893.

Fimbristylis autumnalis var. *microcarya* (F. Muell.) Kük., Bot. Jahrb. Syst. 69: 258. 1938.

Fimbristylis taiwanica Ohwi, J. Jap. Bot. 14: 574. 1938.

Fimbristylis quinquangularis f. *abludens* Backer, Bekn. Fl. Java em. ed. 10 (246): 26. 1949.

Fimbristylis autumnalis subsp. *taiwanica* (Ohwi) T. Koyama, in Fl. Taiwan 5: 230. 1978.

Annual herbs with fibrous roots, non rhizomatous. Culms, 5 – 30 cm long and 1 – 1.5mm wide, slender, tufted, compressed, ribbed, smooth, glabrous. Leaves

linear, flat, 1 – 2mm wide, shorter than stem, ligule a dense fringe of short hairs. Inflorescence compound, 3 – 5 cm long, dense with numerous spikelets. Involucral bracts 2 – 4, erect, foliaceous, shorter than to as long as inflorescence. Spikelets solitary, small, ovoid to oblong, lanceolate, angular, ferrugineous, 2 – 4 x 1 mm, rachilla winged. Glumes spiral, ovate, acute, mucronulate, membranous, acutely keeled, 3 nerved, brownish, glabrous, 1 – 1.75 x 1 mm, basal two glumes empty, shorter than the fertile one. Stamens 3, anther oblong, 0.3 – 4.4 mm. Style linear, triquetrous, pyramidally thickened at base, glabrous, 0.8 mm long. Stigma 3 fid, shorter than style. Nut obovoid, trigonous to triquetrous, 0.5 – 0.6 x 0.3 – 0.4 mm, whitish, 4 – 6 vertical rows on each face, smooth or minutely verruculose.

Flowering and fruiting: August to December

Distribution: Widely distributed in North Australia, Queensland and Eastern Asia. **India**: Peninsular India and Himalaya. **Kerala:** Wayanad**. Karnataka:** Belgaum, Hassan.

Habitat: Common in open lands near the river, margins of lakes, and open grass lands.

Specimens examined: **Kerala:** Kozhikode, Malabar Wildlife Sanctuary Kakkayam, 12.09.2014, *Anoop K. P. 11104* (MH); Kozhikode, Poloor, 13.07.2015, *Anoop K. P. 11126* (MH); Trissur, Vilangan Kunnu, 16.08.2015, *Anoop K. P. & Sojan Jose 11128* (MH). **Andhra Pradesh:** Mangrool tank, 24.10.2004, *Solonke Sudhir N. 121* (SUK)

25. *Fimbristylis narayanii* Fischer in Gamble Fl. Pres. Madrs (1931) 3: 1658 (repr.ed) 1994; Manilal in Fl. Silent Valley, 348. 1988; Karthik. *et al.*, Fl. Indic. En. (Monocots) 53. 1989; Mohan & Sivad. Fl. Agasthyamala 782. 2002; Parasad & Singh, sedg. Karnataka (Fam. Cypr.) 195. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 220. 2015. **(Plate –25, 25 A, 25 B)**

Type: Kerala, Travancore, 07.11.1928, *Fischer 1357* (**Lectotype**: K000974041 – **Fig. 25 B**, designated here; **Isolectotype**: MH00002569).

Annual herbs. Culms densely tufted, slender, 0.3 – 0.5 mm thick, 4 angled. Leaves 3 – 9 cm long, 1 – 1.5 mm wide, shorter than stem, linear, abruptly acuminate at apex, eligulate, sheath striate, up to 1.5 cm long. Inflorescence simple, 3 – 4 loosely arranged spikelets, 1 – 2 x 1 – 2.5 cm. Involucral bracts 2 – 3, very short, inconpsicous, longest 4 – 8 mm long, scabrous on the margins towards apex. Spikelets solitary, oblong to lanceolate, acute at apex, flat, 6 x 2 mm, 10 – 12 flowered, rachilla winged. Glumes distichous, ovate to lancolate or oblong-lanceolate, 2.5 x 1.5 mm, mucronate, keeled, scarious towards margin. Stamens 3, anther linear to oblong, 0.5 mm long. Style trigonus, pyramidally thickened towards base, glabrous. Stigma 3 fid, much shorter than style. Nut trigonous, obovoid, umbanulate at apex, shortly stipitate, whitish, 0.9 x 0.5 mm, epidermal cells isodiametric, in 7 – 10 verical rows.

Flowering and fruiting: June

Distribution: South India and North West Himalaya. **Kerala**: Kozhikode, Kottayam, Idukki, Thiruvananthapuram. **Karnataka**: Dakshina Kannada.

Habitat: Moist rocky slopes

Specimes examined: **Kerala**: Thiruvananthapuram, Kottur Reserve Forest, 27.09.1973, *J. Joseph 44433* (CALI); Thiruvananthapuram, Upper sanitorium Ponmudi, 17.09.1977, *N. C. Nair 49894* (CALI); Kollam, Rani Reserve Forest, 17.05.1980, *C. N. Mohanan 68380* (MH)

Notes: C. E. C. Fischer described *F. narayanii* based on the collection of V. Narayanaswami (*V. Narayanaswami 1357*) from Travancore without precise locality. After extensive survey we located 2 sheets of *F. narayanii* collected by V. Narayanaswami and both sheets contain inscription by Fischer, one each at K and MH, but no specific herbarium sheet was designated as holotype. Among them the specimen housed at K (K000974041) agree exactly with the protalogue which is selected here as the lectotype of the taxon.

26. *Fimbristylis ovata* (Burm.f.) Kern in: Blumea 15(10): 126. 1967. Et in Steenis Fl. Malesiana 1.7(3): 565. 1974; Koyama in Dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 273. 1985; Karthik. *et al.,* Fl. Indic. En. (Monocots): 54. 1989; L'narasimhn in Sharma *et al.,* Fl. Maharashtra (Mnoncots) 2: 316. 1996; Cook, CDK. Aq. & wetl. Pl. India: 145. 1996; Prasad & Singh, sedge. Karnataka (Fam. Cyper.): 195. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 221. 2015. **(Plate –26, 26 A)**

Type: Java

Cyperus monostachyos L., Mant. Pl. 2: 180. 1771.

Abildgaardia monostachya (L.) Vahl, Enum. Pl. Obs. 2: 296. 1805.

Scirpus schoenoides Roxb., Fl. Ind. 1: 221. 1820.

Fimbristylis monostachya (L.) Hassk., Pl. Jav. Rar. 61. 1848.

Fimbristylis compressa Fern.-Vill., Fl. Filip., ed. 3 4(13A): 307. 1880.

Iria monostachya (L.) Kuntze, Revis. Gen. Pl. 2: 752. 1891.

Scirpus monostachyus (L.) Kuntze, Gen. Pl. 3(2): 337. 1898.

Abildgaardia ovata (Burm.f.) Kral, Sida 4: 72. 1971.

Perennial herbs with short rhizome. Culm 5 – 40 cm long, 0.5 – 1 mm wide, densely tufted, compressed. Leaves linear, shorter than stem, 0.5 – 1 mm wide, incurved margins, subacute, leaf sheath glabrous. Inflorescence usually a terminal spikelet, rarely 1 or 2 additional lateral spikelets found. Spkelets ovate or ovate to lanceolate, strongly compressed, green or yellowish 8 – 15 x 4 – 6 mm, rachilla winged. Involucral bracts 2, glabrous, 4 mm long, awned, the awn not overtopping the inflorescence. Glumes distichous, broadly ovate, acute, mucronate, gland dotted, with prominent 3 nerved keel and nerveless sides, lower glumes empty. Stamens 3, anther linear, 1.5 – 2 mm long. Style flat, 3 mm long, hairy throughout, pyramidally thickened at the base. Stigma 3 fid, shorter than style. Nut obtusely trigonous, pyriform, 2 – 3 x 1 – 1.12 mm, coarsely tuberculate epidermal cells minute, isodiametric.

Flowering and Fruiting: September to December

Distribution: Pantropical plant. **India**: Throughout the warmer parts. **Kerala**: Thiruvananthapuram, Kollam, Kottayam. **Tamil Nadu**: Kanchipuram, Madurai. **Karnataka:** Kodagu, Hassan, Shimoga, Tumkur, Bangalore, Mandya. **Andhra Pradesh**: Vishakapattanam, Chittoor, East Godavari , Krishna

Habitat: A common wide spread species found in sunny or partly shaded grasslands, shady places along roadsides, on rocks of beach sides, buds of cultivated fields and edges of pools and streams.

Specimens examined: **Andhra Pradesh:** Vishakapattanam, Gantikota, 07.08.1973, *G. V. Subbarao 44246* (MH); Chittoor, Kambakam hills, 24.09.1974, *M. Chandrabose 45074* (MH); East Godavari, Addathigala, 25.09.1980, *G. V. Subbarao 68557* (MH); Anantapur, S. K. University campus, 13.06.1982, *T. pullaian & N. Yesoda 157* (MH); Krishna, S. N. Gollapalem, 22.09.1985, *P. Venkanna 5357* (MH); Krishna, Kondapalli, 04.08.1985, *P. Venkanna 5631* (MH); **Tamil Nadu:** Kanchipuram, karikili, 27.01.1976, *A.N. Henry 47083* (MH); Madurai, Karungalakudi, 08.10.1985, *R. Ravikumar 2580* (MH); Thiruchirappalli, Thiruvayur, 20.02.2015, *Anoop K. P. 11113* (MBGH).

27. *Fimbristylis paupercula* Boeck. Linnaea, 38: 396. 1874. Clarke in Hook. f. Fl. Brit. India 6: 647. 1893; Fischer in Gamble Fl. Pres. Madras (1931) 3: 1656. (repr. ed.) 1994; Karthik. *et al*., Fl. Indic. En. (Monocots): 54. 1989; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 224. 2015. **(Plate -27)**

Annuals with short rhizome. Culms up to 40 cm long, slender, angular, minutely scabrous to pilose. Leaves as long as to half the length of culm, narrow. Inflorescence subcompound, rays 4 – 5 numbers, 2 – 2.5 cm long. Involucral bracts 3, lower ones longer than inflorescence, apex often puberulous. Spikelets 2 – 7, brown, 0.6 – 0.7 mm long, ellipsoid. Glumes ovate, minutey mucronate, keel slightly excurrent as a mucro, glandular upward, sometimes puberulous. Style

ciliate, 1 mm long. Stigma 3 fid. Nut triquetrous, apex obtuse, 0.7 – 0.8, epidermal cells shortly transversely elliptic, 16 vertical series on each face.

Flowering and fruiting: August to December

Habitat: River banks, moist grass lands and wet cultivated land

Distribution: **Tamil nadu:** Planai hills, Nilgiri

Specimens examined: Tamil Nadu, Nilgiri, 31.05.1978, *V. J. Nair 57200* (MH)

28. *Fimbristylis pierotii* Miq. Ann. Mus. Ludg. Bat. 2 (1865) 145; Boeck. Linnaea 37 (1871) 32; Clarke Fl. Br. Ind. 6 (1893) 642; Ohwi, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 65; Kern, Blumea 8 (1955) 112; Koyama, J. Fac. Sc. Un. Tokyo III, 8 (1961) 106. **(Plate –28, 28 A)**

Iria pierotii O.K. Rev. Gen. Pl. 2 (1891) 753.

F. pinetorum Merr. Philip. J. Sc. 9 (1914) Bot. 266; En. Philip. 1 (1923) 125.

Perennial with creeping woody rhizome covered with lanceolate scales. Culms 20 – 60 cm long and 0.5 – 1 mm wide, slender, solitary, compressed, striate, scabrid at the tip. Leaves eligulate, shorter than stem, 1 – 3 mm wide, rigid, flat or inrolled, scabrid margined, acute or abruptly acuminate, lower leaves bladeless. Inflorescence simple or subcompound, loose with 5 – 9 spikelets, 1.5 – 4 cm long. Involucral bracts 2, more than half the length of inflorescence, 1 – 1.5 cm long. Spikelets solitary, ovoid to lanceolate, angular, acute, loosely flowered, 4.5 – 8 mm long and 1 – 1.5 mm wide, rachilla broadly winged. Glumes spirally arranged, ovate, acute to obtuse, muticous, 3 nerved, gland dotted in the upper half 2 – 2.5 mm long and 1 mm wide. Stamens 3, anthers linear, 0.5 – 0.6 mm long. Style triquetrous, pyramidally thickened at the base, glabrous, 2 mm long. Stigma 3, shorter than style. Nut trigonous, obovate, verruculose, whitish or straw coloured, 0.5 – 1mm long, epidermal cell isodiametric.

Flowering and fruiting: August to November

Distribution: Japan, Korea, India. **India**: North West Himalaya, Simla, Kumaon. **Kerala:** Thiruvananthapuram, Agathyamala. It is a new distribution record for Kerala. **Tamil Nadu**: Coimbatore.

Habitat: In open moist grasslands in hilly area.

Specimen Examined: **Kerala**: Thiruvananthapuram District, Agasthyamala Bioreserve, 12.09.2013, *Anoop K. P.*, 9582 (MBGH). **Tamil Nadu**: Coimbatore, Near Lampton peak, 23. 06. 1964, *J. L. Ellis & C. P. Sreemadhakaran 20010* (MH)

Note: This report is a new distribution record for Kerala.

29. *Fimbristylis polytrichoides* (Retz.) R. Br. Prodr. 226. 1810; Clarke in Hook. f. Fl. Brit. India 6: 632. 1893; Cook T. F. Pres. Bombay 2: 879. 1908; Kern in: Steenis Fl. Malesiana 1.7 (3): 586. 1974; excl. descript. Karthik. *et al.*, Fl. Indic. En (Monocots): 54. 1989; Koyama in Dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 318. 1985; Karthik. e*t al.,* Fl. Indic. En. Monocots: 54. 1989; Fischer in Gamble Fl. Pres. Madras (1931) 3: 1649 (repr.ed) 1994; Cook, CDK. Aq. & wetl. Pl. India: 145. 1996; Simpson & Koyama in Santis. & Larsen (eds.) Fl. Thailand, 6(4): 336. 1998; Prasad & Singh, segd. Karnataka (fam. Cypr.): 199. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 226. 2015. **(Plate –29, 29 A)**

Type: Sri Lanka, *Koenig.*

Scirpus polytrichoides Retz., Observ. Bot. 4: 11. 1786.

Aplostemon polytrichoides (Retz.) Raf., J. Phys. Chim. Hist. Nat. Arts 89: 105. 1819.

Abildgaardia javanica Steud., Syn. Pl. Glumac. 2: 72. 1854.

Fimbristylis subbulbosa Boeckeler, Flora 41: 598. 1858.

Iria polytrichoides (Retz.) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Fimbristylis takaoensis Hayata, Icon. Pl. Formosan. 6: 112. 1916.

Fimbristylis polytrichoides var. *takaoensis* (Hayata) T. Koyama, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 8: 110 1961.

Perennial herbs with fibrous roots. Culms 40 – 45 cm long, 0.5 – 1 mm wide, setaceous, smooth, grooved, lower portion covered with leaf sheath. Leaves much smaller than stem, 2 – 15 cm long, 0.5 – 0.7 mm wide, setaceous, ligules a row of short hairs, sheaths 0.5 – 5.5 cm long. Inflorescence with a single terminal spikelet, 1 or 2 lateral spikelets added. Involucral bracts 1 or 2, glabrous, not overtopping the inflorescence, 2 mm long. Spikelets solitary, erect, ovoid to ellipsoid or oblong, acute at apex, 3 – 15 x 2 – 3 mm, densely many flowered, pale brown, rachilla narrowly winged. Glumes spiral, membranous, broadly hyaline margined, oblong – ovate, green mid nerve, 2.5 – 3 x 1 – 1.25 mm, minutely mucronate at apex. Stamens 3**,** anther linear; 0.7 mm long. Style flat, slender, slightly dilated at the base, sparsely ciliate at top, 1 mm long, style base narrowly pyramidally dilated. Stigma 2 fid, 1 mm long, as long as style or slightly smaller than style. Nut biconvex, oblong to obovate, rounded smooth, 1.5 x 1 mm, greyish black, verruculose, transversely eliptic to oblong epidermal cells.

Flowering and fruiting: August to December

Distribution: Tropical Asia, Africa and Australia. **India:** Western Peninsula, Central and Eastern India. **Kerala:** Kannur, Sulthanbathery, Kasargod, Kollam. **Tamil Nadu:** Thiruchirappalli. **Karnataka:** Dakshina Kannada, Uttara Kannada.

Habitat: Found in Marshes, wet hollows, ditches on saline mud or sandy soil near to the coast.

Specimens examined: **Kerala:** Kannur, Muzhuppilangade, *Anoop K. P. 9517* (MBGH). **Tamil Nadu:** Thiruchirappalli, Kollidam, *Anoop K. P. 11112* (MBGH).

30. *Fimbristylis pseudomicrocarya* Govind. In Proc. Indian Acad. Sci. 100: 77. F. 1. 78. 1990; Prasad & Singh, Sedg. Karnataka (Fam. Cypr.) 201. 2002. Type: India, Karnataka, Dakshina Kannada (South Kanara), Bachapu, *Govindarajalu 13141* (CAL! Holotype)

Annual herbs with fibrous roots. Culms 5 – 7 cm long, 0.5 mm thick, 4 – 5 angled, rigid, erect, glabrous, ribbed, sulcate. Leaves 2 - 4 cm long, 0.3 – 0.6 mm wide, filiform, acute at apex, smooth margins, ligule a fringe of hairs, basal sheath bladeless, uppermost sheaths with blades. Inflorescnce simple, contracted, with 3 – 10 spikelets, 6 – 10 cm long. Involucral bracts somewhat leafy, shorter than to as long as the inflorescence, stiff, erect, ovate to lanceolate, 4 – 10 mm long, smooth margins. Spikelets usually paired or in threes, sessile, erect, linear to oblong, obtuse or subacute at apex, angular, 3 – 4 x 0.8 – 1, brown, many flowered, rachilla winged. Glumes distichous in lower half, spiral in upper half, scaroius margins, muco erect or recurved. Stamen 1, anther linear – oblong, obtuse at both ends, 0.2 – 0.3 mm long. Style triquetrous, 0.4 – 0.5 mm long, slightly pyramidal at base, glabrous. Stigma 3 fid, glabrous. Nut trigonous, obovoid, umbanulate, minutely stipitate, 0.5 – 0.6 x 0.3 – 0.4 mm, usually crystaline, smooth, epidermal cells distinct in the upper half, transversely elongated hexagonal, in 4 – 5 regular rows on each face.

Flowering and fruiting: December

Distribution: Endemic to South Western Peninsular India (Karnataka and Kerala)

Habitat: Common in grasslands.

Specimens examined: Idukki, Eravikulam, 05.12.1987, *P. Bhargavan 87345* (CALI). Kozhikode, Malabar Wildlife Sanctuary, 12.09.2014, *Anoop K. P. 11106* (MBGH)

31. *Fimbristylis pseudonarayanii* Ravi & Anilkumar, J. Rheedea 3(2): 110. 1993; Mohanan & Sivadasan, Fl. Agsthyamala 728. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 228. 2015. **(Plate –31)**

Type: India, Kerala, Kollam, thenmalai, *Ravi 2254* (MH! Holotype).

Annual herbs with fibrous roots. Culms 6 – 17 cm long, slender, tufted, glabrous, quadrangular. Leaves numerous, blades 3.5 – 7 cm long , 1 mm wide, basal, lowest 1 or 2 sheath like, acuminate with reduced blades, others foliaceous. ligules absent;

leaf sheath membranous, glabrous mouth truncate, up to 2 cm long,. Inflorescence a simple umbel with 3 spikelets, rays 1 – 2. Spikelets compressed, elliptic to lanceolate, 1 x 2 mm wide, rachilla winged. Glumes distichous, up to 13, keeled, keel sharply angled, exceeding the glumes, margin hyaline. Stamens 2, anther linear, 0.7 mm long, sagitate at base. Style glabrous, 2 mm long, base pyramidally thickened at base. Stigma 3 fid, 0.5 mm long. Nut trigonous, obovoid to obconical, white to pale brown, 0.8 x 0.4 mm, upper half verruculose, transversely elongate epidermal cells in 5 well defined vertical rows.

Flowering and Fruiting: September to December.

Distribution: **India**: Endemic to Kerala. **Kerala:** Kollam, Idukki, Thiruvananthapuram.

Habitat: Moist places in hilly areas.

Specimens examined: **Kerala:** Kollam, Thenmalai, 16.10.1987, *Ravi & Anilkumar 2254* (MH00001478, type); Idukki, Wagamon, 15.10.2013, *Anoop K. P. 11126* (MBGH).

32. *Fimbristylis pubisquama* Kern, Blumes 8: 131. 1955; Koyama in dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 304. 1985; Karthik. *et al.*, Fl. Indic. En. (Monocots) 54. 1989; L'narasimhn in Sharma *et al*., Fl. Maharashtra (Monocots) 2: 317. 1996; Cook, CDK. Aq. & wetl. Pl. India: 145. 1996; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 229. 2015. **(Plate –32)**

Fimbristylis compressa Boeckeler, Linnaea 38: 387 1874.

Iria compressa Kuntze, Revis. Gen. Pl. 2: 753 1891.

Annual herbs with golden yellow fibrous roots . Culms 8 – 50 cm long, 0.5 – 1.2 mm, trigonous, glabrous. Leaves shorter than culm, 0.7 – 1.5 mm wide, contracted at subacute apex. Leaf sheath 10 cm long, ciliate with soft hairs on margins. Inflorescence compound to decompound, 2 – 7 x 1 – 6 cm, 25 – 30 spikelets. Involucral bracts 1 – 3, leaf like, base dilated. Spikelets ovoid to ellipsoid, subacute at apex, rusty brown, 4.5 – 7 x 1.5 – 3 mm, densely many

flowered. Glumes spiral, ovate to broadly ovate, rusty brown, 1.5 – 2.7 x 0.8 – 1.4 mm, wholly pubescent with short hairs, ciliate on margins, weekly keeled with a slender midvein. Stamens 2, anthers oblong, 0.4 – 0.6 mm long. Style pubescent at base, 0.7 – 1.2 mm long, dilated base. Nut obovate, biconvexed, yellow to brown, 0.8 – 1 x 0.5 – 0.8 mm, rounded at apex, epidermal cells hexagonal.

Flowering and fruiting: September to November

DistributionHabitat: In open grasslands, along margins of water course, coastal sandy soil.

Specimen sexamined: **Kerala:** Kannur, Payyanur, 14.09.1985, *Govindankutty 42439* (CALI)

33. *Fimbristylis quinquangularis* (Vahl) Kunth en. Pl. 2: 229. 1837; Clarke in Hook. f. Fl. Brit. India 6: 644: 1893; Fischer in Gamble Fl. Pres. Madras (1931) 3: 1653. (repr.ed.) 1994; Koyama. dassan. & Fosb. Rev. handb. Fl. Ceylon 5: 295. 1985; Karthik. *et al.*, Indic. En. (Monocots): 54. 1989; Cook, CDK. Aq. & wetl. Pl. India: 144. 1996; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 230. 2015. **(Plate –33, 33 A)**

Fimbristylis miliacea (L.) Vahl, Enum. Pl. Obs. 2: 267. 1805.

Scirpus quinquangularis Vahl, Enum. Pl. Obs. 2: 279. 1805.

Fimbristylis benghalensis (Pers.) Roem. & Schult., Syst. Veg. 2: 94. 1817.

Fimbristylis angularis Link, Enum. Hort. Berol. Alt. 1: 289. 1821.

Trichelostylis miliacea (L.) Nees, Contr. Bot. India 103. 1834

Iria quinquangularis (Vahl) Kuntze, Revis. Gen. Pl. 2: 752. 1891.

Fimbristylis quinquangularis var. *bistaminifera* Tang & F.T.Wang, Fl. Reipubl. Popul. Sin. 11: 227. 1961.

Fimbristylis quinquangularis var. *elata* Tang & F.T.Wang, Fl. Reipubl. Popul. Sin. 11: 227. 1961.

Annual herbs with fibrous roots. Culms 30 - 40 cm long, 1 - 1.5 mm wide, densely tufted, smooth, angular, base covered with tubular bladeless sheath. Leaves linear, 10 – 30 cm long, 1.5 – 2.5 mm wide, shorter than to as long as stem, dorsiventraly flattened, some leaves are bladeless. Inflorescence compound or decompound loosely flowered with many to numerous spikelets, 4 – 10 cm long. Involucral bracts 3 – 5, setaceous, shorter than inflorescence. Spikelets solitary, ovoid, densely flowered, 1.5 – 5 x 1 – 1.5 mm wide, sub acute at apex, rachilla narrowly winged. Glumes spiral, ovate, apiculate, 3 nerved, keel, mucronate, 1 – 1.5 x 0.8 – 1 mm, yellow or brown, brown streak on both sides of the keel and hyaline margin. Stamen 1, anther oblong, 0.3 mm long. Style trigonous, pyramidally thickened at base, glabrous. Stigma 3 fid, as long as or longer than style. Nut trignous, obovate, 0.5 – 0.6 x 0.3 – 0.4 mm, stramineous, transversely oblong to linear epidermal cells, 4 – 6 vertical rows of cells on each face, surface verruculose.

Flowering and fruiting: August to December

Distribution: Pantropical species, widely distributed in America, Africa and Asia. **India**: Throughout. **Kerala**: Kozhikode, Malappuram, Palakkad, Thrissur, Thiruvananthapuram, Kollam. **Tamil Nadu**: Madurai, Ramanathapuram, Nagapattaam. **Karnataka**: Mysore, Shimoga, Agumbe, Tumkur, Bangalore. **Andhra Pradesh**: Karimnagar, East Godavari, West Godavari.

Specimens examined: **Kerala**: Kozhikode, Mayanad, 15.01.1970, *V. V. Sivarajan 9* (CALI); Kozhikode, Vadakara, 24.09.1985, *Balakrishnan 42435* (CALI); Alapuzha, Muhamma, 22.03.2014, *Anoop K. P. 9587* (MBGH). **Tamil Nadu**: Nagapattanam, Puduthorai, 11.02.1931, *V. Narayanaswami 5212* (MH); Ramanathapuram, Thirupathur, 29.11.1977, *N. C. Nair 5212* (MH); Madurai, Meghamalai, 27.08.1985, *K. Ravikumar 2428* (MH). Thiruchichirappalli, Thiruvayur, 20.02.2015, *Anoop K. P. 11112* (MBGH), Thanjavur, Cholapuram, 21.02.2015, *Anoop K. P. 11116* (MBGH). Thanjavur, Athanoor, 22.02.2015, *Anoop K. P. 11120*,. **Karnataka**: Shimoga, Jog Falls, 07.03.1985, *Madhu 41439* (CALI). **Andhra Pradesh**: West Godavari, Narsapur, 25.09.1958, *K. M. Sebastine 6720*

(MH); East Godavari, maredumilli, 23.08.1995, *M. Mohanan 105097* (MH); Karimnagar, Aklaspur, 10.11.1987, *M. R. Rajendra Prasad 649* (MH); Chittoor, Karvetnagar, 24.20.2004, *Solonke Sudhir N. 121* (SUK).

34. *Fimbristylis salbundia* (Nees) Kunth En. Pl. 2: 230. 1937; Clarke in Hook. f. Fl. Brit. India 6: 646. 1893; Kern in Reinwardtia 6: 40. 1961 et in Steenis Fl. Malesiana 1.7(3): 553. 1974; Koyama. dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 298. 1985; Karthik. *et al.*, Fl. Indic. En. (Monocots): 54. 1989; Cook, CDK. Aq. & wetl. Pl. India 146. 1996; Simpson & Koyama. Satis. & Larsen Fl. Thailand 6(4): 309. 1998; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 232. 2015. **(Plate –34, 34 A)**

Trichelostylis pentaptera Nees, Contr. Bot. India 105. 1834.

Trichelostylis salbundia Nees, Contr. Bot. India 105. 1834

Fimbristylis pentaptera (Nees) Kunth, Enum. Pl. 2: 229. 1837.

Iria pentaptera (Nees) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Fimbristylis paludosa Merr., Philipp. J. Sci., C 9: 265. 1914.

Fimbristylis haspaniformis T. Koyama, Contr. Inst. Bot. Univ. Montréal 70: 45. 1957.

Fimbristylis salbundia subsp. *pentaptera* (Nees) T. Koyama, Bot. Mag. (Tokyo) 87: 317. 1974.

Perennial herbs with short creeping rhizomes, covered with ovate-lanceolate scales. Culm 30 – 70 cm long, 1 – 3 mm thick, 4 – 5 angled, deeply grooved. Leaves 10 – 40 cm long, 2 – 2.5 mm wide, with prominent midrib, margins incurved, eligulate, leaves of the culm reduced into bladeless sheaths. Inflorescence compound or decompound, loose or rather dense, with 8 – 12 spikelets, 3 – 4 cm diameter. Involucral bracts 2, 0.8 – 1 cm long, lanceolate, pointed towards apex. Spikelets solitary, elliptic or ovoid, straw coloured, 8 – 15 flowered, 3 – 6 x 2 mm wide, rachilla winged. Glumes spiral, membranous, ovate to obtuse, keeled, 3 – 5

nerved, glabrous, lower glumes less than half long as spikelets. Stamens 2, anthers linear, sagitate, 1 – 1.2 mm long. Style triangular, pyramidally thickened at base. Stigma 3 fid, as long as style. Nut trigonous, broadly obovate, whitish to brownish, smooth or sparsely verruculose, transversely elliptic or oblong epidermal cells in 7 – 9 vertical rows on each face.

Flowering and Fruiting: October to December

Distribution: South and South East Asia. **India**: Peninsular India.

Habitat: Growing in wet open places, marshes, swamps and grasslands, usually found in high altitudes

Specimens examined: **Kerala**: Thiruvananthapuram, Ponmudi, 02.09.1984, *Rejani 38043* (CALI); Wayanad, Chembra peak, 28.11.2018, *Anoop K. P. 11145* (MBGH).

35. *Fimbristylis sanjappae* W. Khan Chavan & Solanke. J. Eco. Tax. Bot. 30(3): 717. 2006; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 234. 2015. **(Plate –35)**

Type: Maharashtra, Sindhudurg, Amboli ghats, 19.10.1995, *W. Khan 4410* (MH00001487!)

Perennial herbs with short rhizome. Culms slender, 1 mm wide, compressed, grooved. Leaves shorter than stem, falcate, 4 – 19 long, 2 – 1.5 mm wide, ligules as fringe of hairs, sheath stramineous. Inflorescence simple to subcompound, 1.5 – 3 x 1 – 1.5 cm. Involucral bracts 4 – 5, 2 foliaceous, others setaceous, the lowest one as long as inflorescence. Spikelts solitary, ovoid, subacute, 4 – 5 x 1.5 – 2 mm, grouped together on rays, rachilla winged. Glumes spiral, obovate to oblong, shortly mucronulate, 3 – 4 nerved keel, brownish along nerves, stramineous with pale brown in upper half. Stamen 1 or 2, anther linear, 0.5 – 0.75 mm long. Style flat, narrowly dilated at base, ciliolate in the upper part, 1.5 mm long. Stigma 2 fid, shorter than style. Nut biconvex, obovate, acutely edged, 0.75 – 0.8 x 0.5 mm, shortly stipitate, transversely oblong cells between 5 – 6 vertical ridges.

Flowering and fruiting: October to December

Distribution: Confined to Peninsular India. **Kerala:** Kozhikode, Kannur, Kasargod. **Tamil Nadu:** Kumbam. **Karnataka:** Udupi, Agumbe, Chikmangalur, Shimoga.

Habitat: Common in wet grass lands, hill slopes and around agriculture land.

Specimens examined: **Kerala:** Kozhikode, Pokkunnu, 18.08.2015, *Anoop K. P. 11131*(MBGH); Kasargod, Chillarikkal, 15.10.2004, *M. A. Wadoodkhan 5443* (SUK). **Tamil Nadu:** Kumbam, 18.10.2004, *Solanke S. N.787* (SUK).

36. *Fimbristylis schoenoides* (Retz.) Vahl. Enum. Pl. 2; 286. 1806; Clarke in Hook. f. Fl. Brit. India 6: 634. 1893; Cooke T. Fl. Pres. Bombay 2: 880. 1908; Kern in Steenis Fl. Malesiana 1.7(3): 573. 1974; Koyama in Dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 315. 1985; Fischer in Gamble Fl. Pres. Madras (1931) 3: 1650. (repr. ed) 1994; Cook, CDK. Aq. & wetl. Pl. india: 147. 1996; L'narasimhn in Sharma *et al.,* Fl. Maharashtra 2: 317. 1996; Prasad & Singh, sedg. Karnataka (Fam. Cypr.): 202. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 236. 2015. **(Plate –36, 36 A)**

Type: India, *Koenig.*

Scirpus schoenoides Retz., Observ. Bot. 5: 14. 1788.

Isolepis bispicata (J. Koenig ex Roxb.) Schult., Mant. 2: 61. 1824.

Fimbristylis bispicata (J. Koenig ex Roxb.) Nees & Meyen, Contr. Bot. India 97. 1834.

Fimbristylis inconstans Steud., Syn. Pl. Glumac. 2: 107. 1855.

Fimbristylis schoenoides var. ciliata Ridl., J. Linn. Soc., Bot. 20: 335. 1883.

Fimbristylis kunthiana Ridl., Trans. Linn. Soc. London, Bot. 2: 151. 1884.

Iria schoenodes (Retz.) Kuntze, Revis. Gen. Pl. 2: 752. 1891.

Fimbristylis longifolia S. T. Blake, Pap. Dept. Biol. Univ. Queensland 1 (13): 9. 1940.

Annual or perennials with short rhizome. Culm 5 – 50 cm long, 0.5 – 1 mm thick, tufted, compressed, smooth, glabrous. Leaves as long as or shorter than stem, 0.5 – 1 mm thick, involute margins, abruptly acuminate, ligules as a fringe of hairs. Leaf sheath glabrous, ferruginous, up to 15 cm long. Inflorescence consist of single terminal spikelet, often proliferates into 1 – 2 peduncled spikelets. Involucral bracts 2 – 3, glume like, ovate or triangular, apiculate 1.5 – 2 mm long, the lowest often leafy up to 4 mm. Spikelet ovoid, many flowered, 5 – 10 x 3 – 5 mm, rachilla narrowly winged. Glumes spiral, membranous, broadly ovate, apiculate or muticous, usually broader than long, 2.5 – 3 mm long, scarcely keeled, many nerved. Stamens 3, anthers oblong, 0.75 mm long. Style flat, dilated at base, ciliate in the upper half, 1 – 1.5 mm long. Stigma 2, shorter than style. Nut biconvex, obovate, whitish or brownish, 1.5 – 1.75 x 1 mm, smooth, isodiametric epidermal cells.

Flowering and fruiting: August to January

Distribution: Sri Lanka, China, Malesia, Thailand, Formosa, Tropical Australia and India. **India:** Throughout. **Kerala:** Kannur, Kasargod, Wayanad, Thiruvananthapuram, Kollam. **Tamil Nadu**: Thanjavur. **Karnataka:** Shimoga, Kodagu, Hassan, Mysore, Bangalore.

Habitat: Common in grass lands, open areas in forest, rice fields and edges of tanks and canals.

Specimens examined: **Kerala:** Thiruvananthapuram, Kottur Reserve Forest, 03.04.1973, *J. Joseph 44005* (MH); Kasargod, Payyanur, 25.09.1982, *R. Ansari 73982* (MH); Kottayam, Kangazha, 27.09.1984, *V. J. Antony 818* (MH); Kannur, Madayipara, 22.07.2012, *Anoop K. P. 9599* (MBGH). **Tamil Nadu:** Thanjavur, Thiruvayar, 21.02.2015, *Anoop K. P. 11118* (MBGH).

37. *Fibristylis schultzii* Boeck. Linnaea 38 (1874): 391; Benth. Fl. Austr. 7 (1878) 320; S. T. Blake, Proc. R. Soc. Queensl. 58 (1947): 45; Kern, Blumea 8 (1955): 116. **(Plate –37 & 37 A)**

Fimbristylis platystachys Boeckeler, Linnaea 38: 390. 1874.

Fimbristylis platystachys var. *schultzii* (Boeckeler) Domin, Biblioth. Bot. 85: 464. 1915**.**

Fimbristylis stellata S. T. Blake, Proc. Roy. Soc. Queensland 58: 46. 1947.

Iria platystachya (Boeckeler) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Annual slender herbs with fibrous roots. Culms 16 **–** 26 cm long, densely tufted, pubescent, ribbed, lower portion covered with leaf sheath. Leaves linear, filiform, 2 **–** 18 cm long, convoluted at margin, acute to shortly acuminate at apex, leaf sheath and lamina not distinguished by ligules. Inflorescence an umbel with closely packed 3 **–** 6 spikelets, 5 **–** 10 mm across, rachilla winged. Involucral bracts 3, one large (8 **–** 9 mm) and two smaller (4 **–**5mm), base broad suddenly pointed at apex, prominently 5 **–** 6 nerved. Spikelets 3 **–** 6, sessile, oblong to ovoid, dark brown, 3.5 **–** 7.5 mm, 10 **–** 14 flowered, lower glumes sterile. Glumes spiral, membranous, 1.5 x 3.5 mm, golden brown, ovate keeled with one prominent midrib, glabrous or denticulate or ciliolate at upper edge. Stamens 3, filaments linear (3 mm long), anther linear, 1.5 mm long and sagitate with acute apex. Style trigonous, pyramidally thickened at base, glabrous, 2 **–** 2.5 mm long. Stigma 3 fid, about as long as style. Nut obovoid, trigonous, 1 x 1 mm, dark brown, surface verucculose with transversely elongate cells.

Flowering and fruiting: August to December

Distribution: Australia, Malesia, India (new distribution Record for India). India: Thiruvananthapuram, Agsthyamala.

Specimens examined: India, Kerala, Thiruvananthapuram District, Agasthyamala Biosphere Reserve, 12. 09. 2013, *Anoop K. P.*, 9583 (MBGH).

Note: This species has been reported as a new distribution record for India (Anoop *et.al*., 2015)

38. *Fimbristylis simpsonii* Parasad & Singh, J. Bombay Nat. Hist. Soc. 96 (3): 456. F. 2. 1999; Prasad & Singh, Sedg. Karnataka (Fam. Cypr.): 207. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 239. 2015. **(Plate –38)**

Type: India, Karnataka, Shimoga, Kanagalgudda, *Sundara Raghava 90025* (CAL! Holotype)

Annual herbs with fibrous roots. Culm 10 – 15 cm long, slender, tufted, trigonous below inflorescence. Leaves shorter than culm, 8 cm long, 1.2 mm wide. Leaf sheaths up to 1.5 cm long. Inflorescence simple, 1 – 4 spikelets, 5 – 10 x 6 – 15 mm. Involucral bracts much shorter than inflorescence. Spikelets solitary, ovoid to oblong lanceolate, acute at apex, 3 – 4 x 1 – 1.5 mm, brown rachilla winged. Glumes spiral, ovate, acute, 2 x 1 – 1.5 mm, mucronate at apex, strongly keeled, hyaline towards margin, brown. Stamens 3, anther linear to oblong, obtuse to acute at apex, 0.6 mm long, filaments up to 2 mm long. Style triquetrous, dilated towards base, 1.5 mm long, glabrous. Stigma 3 fid, shorter than style. Nut trigonous, obovoid to oblong, 0.5 – 0.8 x 0.5 - 0.7 mm, surface verruculose, 4 – 6 vertical rows of transversely oblong cells on each phase.

Flowering and fruiting: August to October

Distribution: Endemic to Karnataka (Shimoga Distrct) and Kerala (Kasrgod, Kannur)

Habitat: Growing in rocky slopes near river beds.

Specimens examined: **Kerala**: Kasargod, Bevinja, 15.10.2004, *D. P. Chavan 5453* (SUK); Kannur, Payyanur, 22.07.2014, *Anoop K. P 9596* (MBGH), Kannur, Madayipara, 22.07.2014, *Anoop K. P. 9600* (MBGH).

39. ***Fimbristylis subdura*** Ohwi, Blumea 8 (1955) 101, f. 5; Kern in Back. & Bakh. F. Fl. Java 3 (1968) 463. **(Plate –39)**

Perennial with short woody rhizome. Culms 40 – 50 cm long, 1 – 1.5 mm wide, densely tufted, angular, slightly compressed towards top, striate, smooth, base covered with 1 – 2 tubular, bladeless or very short bladed shetahs. Cauline laves shorter than stem, 2.5 – 4 mm wide, flat, gradually narrowed towards abruptly acuminate apex, ligules absent. Inflorescence compound or decompound, loose with numerous spikelets, up to 10 cm long. Involucral bracts 4 – 5, setaceous, erect

or slightly curved, shorter than inflorescence. Spikelets solitary, lanceolate, 3 - 6 x 1 – 1.4 mm, terete, acute, many flowered, rachilla broadly winged. Glumes spiral, broadly ovate, obtuse, apiculate or mucronulate, 2 x 1.6 mm, slightly keeled, with 3 nerved keel, nerveless sides, hyaline margin. Stamens 3; anther oblong to linear, 0.7 mm. Style triquetrous, slightly thickened at base, glabrous or sparsely ciliate at the top, 1.5 mm long. Stigma 3, shorter than style. Nut trigonous, broadly ellipsoid or slightly obovoid, broadly stipitate, greyish white, densely verruculose epidermal cell transversely elliptic.

Flowering and fruiting: October to December

Habitat: Moist forest areas

Distribution: Malesia. India, Kerala: Bonacord

Specimen examined: **Kerala:** Thiruvananthapuram, Agasthyamala, 27.08.2013, *Anoop K. P. 9536* (MBGH)

Note: This species was earlier reported form Malesia so this report is a new distribution record for India.

40. *Fimbristylis tenera* Roem & Schult. Mant. Syst. 2: 57. 1824; Clarke in Hook. f. Fl. Brit. India 6: 642. 1893; Koyama in Dassan & Fosb. Rev. Handb. Fl. Ceylon 5: 293. 1985; Fischer in Gamble Fl. Pres. Madras (1931) 3: 1656 (repr.ed.) 1994. L'narasimhn in Sharma *et al.*, Fl. Maharshtra (Monocots) 2: 319. 1996; Prasad & Singh, Sedg. Karnataka (Fam. Cypr.): 210. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 244. 2015**.** (Plate – 40)

Scirpus tenellus Roxb., Fl. Ind. 1: 224. 1820.

Fimbristylis glabra Hochst. ex Steud., Syn. Pl. Glumac. 2: 111. 1855.

Fimbristylis muricatula Steud., Syn. Pl. Glumac. 2: 113. 1855.

Fimbristylis oxylepis Steud., Syn. Pl. Glumac. 2: 110. 1855.

Iria tenera (Schult.) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Fimbristylis tenera var. *oxylepis* (Steud.) C. B. Clarke, Fl. Brit. India 6: 642. 1893.

Annual herbs with fibrous roots. Culms 4 – 22 cm long, 0.2 – 0.5 mm thick, tufted, trigonous, smooth. Leaves much shorter than culm, 1.5 - 2 mm wide, eligulate, sheath glabrous, rather thick, leaves on the flowering stem sometimes reduced to an appendage. Inflorescence simple or subcompound, with few to many spikelets, 1 – 3 x 0.8 – 2 cm. Involucral bracts 2 – 3, much shorter than inflorescence. Spikelets solitary, ovate – lanceolate, acute at apex, faintly angled, brownish, 4 – 6 x 1.5 – 2 mm, many flowered, rachilla winged. Glumes spiral, broadly triangular to ovate, acute to mucronate at apex, keeled, 2.5 x 2 mm, minutely puberulous towards apex. Stamens 1, anther linear to oblong, acute at apex, up to 0.7 mm long. Style slender, dilated at base, 1.2 mm long. Stigma 3 fid, 0.5 mm long, minutely scabrous. Nut trigonous, obovoid, obtuse, angular, marble-white 1 – 1.2 x 1 mm, verruculose, transveresley hexagonal epidermal cells.

Flowering and fruiting: July to November

Distribution: Sri Lanka and Tropical Africa. **India**: Western Peninsula, Central and North India. **Kerala**: Kozhikode, Malappuram. **Karnataka**: Bangalore, Bellary, Hassan, Mysore. **Andhra Pradesh**: Cuddapah, Anatapur.

Habitat: Among grasses in sandy soil, along road sides.

Specimens examined: **Kerala**: Kozhikode, C. U. campus, 05.08.1978, *Raju A. R. 27583* (CALI); Malappuram, Parappanangadi, 17.01.2013, *Anoop K. P. 9522* (MBGH). **Tamil Nadu**: Madurai, Maharajamettu Mottai, Meghamalai, 27. 08. 1985, *K. Ravikumar 2428* (MH). **Karnataka**: Bellary Rock, July 1886, *J. S. Gambel 17763* (MH). **Andhra Pradesh**: Cuddapah, Guvalcheruvu, 22.08.1958, *K. Subramanyan 6388* (MH); Anatapur, Tadptri – Chintakunta, 09.10.1981, *T. Pullaiah 457* (MH).

41. *Fimbristylis tetragona* R. Br. Prodr. 226. 1810; Clarke in Hook f. Fl. Brit. India 6: 631. 1893; Cooke T. Fl. Pres. Bombay 2: 879. 1908; Koyama in dassan. & Fosb. Rev. Handb. Fl. Pres. Madras (1931) 3: 1649. (repr. ed.) 1994; L'narasimhn in Sharma *et al.*, Fl. Maharashtra (Monocots) 2: 319. 1996; Karthik. *et al.*, Fl. Indic.

En. Monocots: 55. 1989; Prasad & Singh, Sedg. Karnataka (Fam. Cypr.): 211. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 245. 2015. **(Plate – 41)**

Fimbristylis abjiciens Steud., Syn. Pl. Glumac. 2: 107. 1855.

Fimbristylis arnottii Thwaites, Pl. Zeyl. 348. 1864.

Fimbristylis cylindrocarpa Kunth, Enum. Pl. 2: 222. 1837.

Fimbristylis oxyrhachis Miq., Fl. Ned. Ind., Eerste Bijv. 601. 1861.

Fimbristylis xyrioides Arn. ex Thwaites, Enum. Pl. Zeyl. 348. 1864.

Iria tetragona (R.Br.) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Scirpus tetragonus (R.Br.) Poir., Encycl. Suppl. 5: 98. 1817.

Perennial with short rhizome. Culms 15 – 40 cm long, 0.8 – 1 mm thick, densely tufted, smooth, erect, quadrangular. Leaves much shorter than culm, glabrous, acute, involute margin, eligulate, those on sterile shoots reduced. Leaf sheath glbrous, membranous. Inflorescence single spikelet. Spikelet ovoid to spherical, 5 – 8 x 4 – 6 mm, densely many flowered, rachilla narrowly winged. Glumes spiral, obovate to oblong, membranous, 3.5 – 4 x 1.2 – 1.5 mm, obtuse or acute-obtuse at apex, scarious, 3 nerved smooth keels, sides nerveless or faintly nerved, lower few empty. Stamens 1 – 3, anther linear to oblong, 1mm long. Style 1.5 mm long, slightly dilated and dark brown at base, minutely ciliate. Stigma 3 fid, 0.5 mm long. Nut biconvex, cylindrically ellipsoid to oblong, light yellow, 2 x 0.5 mm, with persistent style and staminal filament.

Flowering and fruiting: August to February

Distribution: Sri Lanka, Nepal, South China, Malesia, Thailand, Indo-China, tropical North Australia. **India**: Throughout. **Kerala**: Malappuram, Kozhikode. **Karnataka**: Bangalore, Belgaum, Hassan, Kodagu, Mysore, Shimoga. **Andhra Pardesh**: Mirzapur

Habitat: In open wet places, swampy grasslands, wet rice fields, near streams, marshes and swamps, muddy base of rocky river beds, along with shot grass in wet soil.

Specimens examined: **Kerala**: Malappuram, C.U. Campus, 29.08.1970, *V. V. Sivarajan 405* (CALI); Malappuram, Nilambur, 03.08.1984, *Rejani 39968* (CALI). **Karnataka**: Shimoga, Jog Falls, 08.03.1985, *Rejani 41430* (CALI); Agumbe, 24.09.2013, *Anoop K. P. 9539* (MBGH). **Andra Pradesh**: Mirzapur, 04. 12. 2004, *Solanke Sudhir 176* (SUK).

42. *Fimbristylis triflora* (L.) Schum. Ex Engler Abh. Preuss. Wiss. 14. 1894; Koyama in Dassan. & Fosb. Rev. Handb. Fl. Ceylon 5: 271. 1985; Britto & Mathew, Fl. Tamil Nadu Carn. Furth. Ill. 4: 676. 1988; Cook, CDK, Aq. & wetl. Pl. India 149. 1996; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 248. 2015. **(Plate –42)**

Cyperus triflorus L., Mant. Pl. 2: 180. 1771.

Abildgaardia tristachya Vahl, Enum. Pl. Obs. 2: 297. 1805.

Abildgaardia triflora (L.) Lye, edges & Rushes E. Afr. 400. 1983.

Fimbristylis tristachya (Vahl) Thwaites, Enum. Pl. Zeyl. 434. 1864.

Iria triflora (L.) Kuntze, Revis. Gen. Pl. 2: 753. 1891.

Perennial with short rhizome. Culms upto 70 cm long, 1 – 3 mm thick, terete, cylindrical, smooth and glabrous, thickened at base. Leaves shorter than half long as culm, acuminate, scabrid on the margin in the upper part, 0.5 – 1 mm wide, leaves on some culms reduced to sheaths, sheath brownish, 5 – 6 cm long. Inflorescence simple, loose with 3 – 7 spikelets. Involucral bracts 1 – 2, much shorter than inflorescence. Spikelets solitary, ovate or ovate to lanceolate, terete, acute, densely many flowered, 10 – 25 x 4 – 6 mm, straminous to brown coloured. Glumes spiral, broadly ovate, mucronate, keeled, many nerved, ferrugineous, 4 – 6 x 3 – 4. Stamens 3, anther linear, 1.5 mm long. Style flat, broad, slightly dilated at base, densely ciliate, 4 mm long. Stigma 2 fid, shorter than style. Nut biconvex,

obovate, distinctly stipitate, smooth, stramineous, 1 – 1.5 x 1 mm, isodiametric epidermal.

Flowering and fruiting: Throughout the year.

Distribution: Tropical Australia, Malaesia, India, Philippines. **India**: Confined to South India. **Kerala**: Kottayam, Alapuzha. **Tamil Nadu**: Thiruchirappalli, Puthukottai. **Andhra Pradesh**: Anantapur.

Specimens examined: **Kerala**: Kottayam, Kumarakam, 22.03.2014, *Anoop K. P. 9585* (MBGH). **Tamil Nadu**: Rameswaram, Krusadai, 30.01.1945, *D. Daniel & S. R. Raju 88191* (MH); Puthukottai, Kottaipattinam, 31.01.1978, *K. Ramamurthy 53701* (MH); Puthukottai, Vadakkamma pattinam, 30.08.1985, *C. Arulappan 465* (MH); Thanjavur, Kodaikkarai reserve forest, 15.11.1987, *S. Ragupathy 532* (MH). **Andhra Pradesh**: Anantapur, Samathagram, 03.07.1981, *N. Yesoda 199* (MH). Prakasham, Magampalli, 03.11.06, *Solanke Sudhir N. 924* (MH).

43. *Fimbristylis uliginosa* Steud. Syn. Pl. Glum. 109. 1855; Clarke in Hook f. Fl. Brit. India 6: 648. 1893; Fischer in Gamble Fl. Pres. Madras (1931) 3: 1657. (repr.ed) 1994; Britto & Mathew K. M. Fl. Tamil Nadu Car. 3: 1762. 1983. et Furth. Illust. 4: 677. Pl. 677. 1988; Mohan & Sivad. Fl. Agasthyamala: 783. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 250. 2015. **(Plate – 43, 43 A)**

Perennial herbs with woody rhizome. Culms 6 – 18 cm long, tufted, angular, galbrous, basal region covered with leaf sheath. Leaves linear, 3.5 – 8 cm long, 0.5 – 1 mm wide, acute to shortly acuminate at apex, ligule as a fringe of hairs. Inflorescence a loose umbel, simple to subcompound. Involucral bracts 2, 4 – 5 mm long, glaborus, broad at base, shortly spinulose at apex, prominently 1 nerved. Spikelets 2 – 3, pedunculate, blackish brown, 3 – 4 x 1 – 1.5 mm, 7 – 9 flowered. Glumes spiral, reddish brown, 2 x 1 mm, 3 nerved, scarious at margin, rachilla winged. Stamens 3, filaments linear; anther sagitate, cordate at base, 0.5 mm long. Style trigonous, 1 – 1.2 mm long, fimbriate near the top, glabrous bellow,

pyramidally thickened at base. Stigma 3 fid, shorter than style. Nut trigonous, obovoid, 0.7 – 1.2 x 0.5 – 0.8 mm, smooth, brownish or yellow, thickened at angles, rounded at apex.

Flowering and fruiting: June to December

Distribution: Confined to South India. **Kerala**: Idukki, Thiruvananthapuram. **Tamil Nadu**: Ooty, Coimbatore, Thirunelveli. **Andhra Pradesh**: Ananthpur, Chittoor

Habitat: Grows near the streams and moist open areas of hill stations.

Specimens examined: **Kerala**: Thiruvananthapuram, Agasthyamala peak, 12.12.2013, *Anoop K. P. 9581* (MBGH); **Tamil Nadu**: Thirunelveli, Agasthyamala peak, 26.08.1953, *A. N. Henry 17330* (MH); Coimbatore, Kadamparai, 21.07.1978, *M. Chadrabose 57221* (MH); Thirunelveli, Kannikotty reserve forest, 23.02.1990, *Gopalan 91684* (MH); Ooty, 28.05.2014. *Anoop K. P. 9595* (MBGH).

44. *Fimbristylis woodrowii* Clarke. Bull. Misc. inf. 227. 1898. J. Linn. Soc. Bot. 34: 68. 1998; Cooke T. Fl. Pres. Bombay 2: 884. 1908; L'narasimhn in Sharma *et al.*, Fl. Maharshtra 2: 323. 1996; Cook CDK. Aq. & wetl. Pl. India: 151. 1996; Prasad & Singh, Sedg. Karnataka (Fam. Cypr.): 216. 2002; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 253. 2015. **(Plate –44)**

Annual herbs with fibrous roots. Culms 8 – 20 cm long, 0.5 mm thick, tufted, slender, 5 angled below, compressed bellow the inflorescence. Leaves up to 2 – 12 cm long, shorter than stem, flat, 0.5 – 1.5 mm wide, abruptly acuminate at apex, ligule a fringe of minute hairs. Leaf sheath striate 0.5 – 2.5 cm long. Inflorescence simple or compound umbel, spikelets few to many. Involucral bracts 1 – 3, smaller than to overtopping the inflorescence, up to 2.5 cm long. Spikelets paired or in clusters of 3, of which one sessile and other two short peduncled, ovoid to lanceolate, acute at apex, angled, 2 – 6 x 1 – 2 mm, rachilla winged. Glumes spiral, membraneous, broadly triangular to ovate, acute and mucronate at apex, 1.2 – 1.8 x 1 – 1.3 mm, hyaline towards margin, keeled, keels 3 nerved. Stamen 1, anther oblong, 0.3 – 0.5 mm long, minutely apiculate at apex. Style triquetrous,

pyramidally thickened at base. Stigma 3 fid, shorter than to as long as style. Nut trigonous, abovoid, umbonulate, stipitate, 0.7 – 0.9 x 0.4 – 0.8 mm, cream to white, smooth or verruculose, epidermal cells transversely linear to oblong.

Flowering and fruiting: August to December

Distribution: Endemic to Western Peninsular India. **Kerala**: Malappuram, Nilambur, Palakkad. **Karnataka**: Shimoga, Hassan, Akumbe.

Habitat: Among grasses in open area, river beds, rocky crevices, cultivated fields and roadsides.

Specimens examined: **Kerala**: Palakkad, Walayar, 28.07.1939, *S. R. Raju & Ratnavel 18641* (MH); Palakkad, Malampuzha, 14.07.1963, *J. S. Joseph 171561* (MH); Kozhikode, Calicut University Campus, 08.05.1978, *Razia M. I. 29911* (CALI).

45. *Fimbristylis zatei* W. Khan & Chavan D. P. J. Eco. Taxon. Bot. 30(3): 121. 2006; W. Khan, Cyperaceae W. Ghats, W. Coast & Maharashtra 254. 2015. **(Plate –45)**

Type: Kasargod, Bevingia, 15.10.2004, *W. Khan & D.P. Chavan 5451* (MH 00001490!)

Annual herbs with fibrous roots. Culm 8 – 15 cm, 4 angled, grooved, filiform, tufted. Leaves setaceous, shorter than half long as culm, glabrous. Inflorescence simple with 2 – 3 or single spikelets. Involucral bracts 1 – 2 glumiform or setiform, 2 – 6 mm long. Spikelet solitary, ellipsoid to lanceolate acute, strongly compressed, whitish to pale brownish, 3 – 10 x 1 – 1.2 mm, 15 – 22 flowered, rachilla winged. Glumes distichous, ovate, acute, muticous or minutely apiculate, 1.8 – 2 x 1 – 1.2 mm, uninerved keel, nerveless sides. Stamens 3, anther ellipsoid to oblong, 0.3 – 0.4 mm long. Style filiform, glabrous, 1.8 – 2 mm long, abruptly pyramidally dilated at base. Stigma 3 fid, shorter than style. Nut trigonous, obovoid to oblong, 0.4 – 0.5 x 0.2 – 0.3 mm, sparsely verruculose, truncate, trabeculate with 3 – 4 vertical rows of transversely oblong epidermal cells.

Flowering and fruiting: October to November

Distribution: Confined to South India. **Kerala**: Kasargod, Kozhikode

Habitat: Grows in marshes along road sides.

Specimens examined: Kasargod, Bevingia, 15.10.2004, *W. Khan & D. P. Chavan 5451* (MH 00001490); Kozhikode, Kakkadampoyil, 10.10.2016, *Anoop K. P.11142* (MBGH).

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6

DISCUSSION

The present study deals with the Taxonomic investigation of the Genus *Fimbristylis* Vahl of South India. The major objective of this study is to find out the species diversity of the genus *Fimbristylis* Vahl in South India. In this regard conducted extensive filed explorations throughout South Indian states and consulted major herbaria of South India for developing a database for the distribution of the genus. The collected specimens were studied in laboratory and prepared detailed taxonomic notes of each species. Each species is critically studied based on the Type specimens housed at major national and international Herbaria. The Taxonomic study contains nomenclatural history, systematic treatment, morphology, Flowering and fruiting, habitat, distribution of the species; Herbarium specimens of all collected taxa from different localities of South India were prepared. The plant names were corrected by consultation of authentic websites like IPNI (http://www.ipni.org), The Plant list (http://www.theplantlist.org), Tropicos (http://www.tropicos.org), etc. For nomenclature clarifications ICN (Shenzhen Code) (Turland, N. J. *et al.*, 2018) was used.

During the present study 45 species could be recognized from South India. The species are distributed in South Indian States Such as Kerala, Tamil Nadu, Karnataka and Andhra Pradesh. Majority of the species were distributed

across all states. Species like *F. aestivalis* (Retz.) Vahl, *F. angamoozhiensis* Ravi & Anilkumar, *F. pierotii* Miq., *F. pseudonarayanii* Ravi & Anilkumar, *F. zatei* W. Khan & Chavan D.P., *F. salbundia* (Nees) Kunth and *F. schultzii* Boeck. were confined to Kerala, *F. fusca* (Nees) Clarke is distributed only in Andhra Pradesh and *F. lawiana* (Boeck.) Kern and *F. simpsonii* Parasad & Singh were reported form Karnataka.

6.2. Habitat and ecology:

Most of the species prefer wet localities, wet rice fields, margin of lake, river bank, etc and mainly distributed in low land and plains. Only a few species were recorded form high altitude regions like *Fimbristylis schultzii* Boeck., *Fimbristylis pierotii* Miq., *Fimbristylis angamoozhiensis* Ravi & Anilkumar, *Fimbristylis dura* (Zoll. & Moritz.) Merr, *Fimbristylis falcata* (Vahl) Kunth, *Fimbristylis pseudonarayanii* Ravi & Anilkumar. *F. microcarya* F. V. Muell and *F. aestivalis* (Retz.) Vahl *are* found both in High altitude ranges and also in low land area, they exhibit variations in their size of leaves and culm based on altitude variation.

6.3. Significance of *Fimbristylis* Vahl

Members of the genus are not directly beneficial to human but have significant role in ecosystem. They are one of the major primary producers in ecosystem and provide food for many grazing animals (Table 2) and also prevent soil erosion by making a mat on the soil surface.

Table 2. *Fimbristylis* spp. used as cattle feed

Sl. no	Name of Species
1	*Fimbristylis acuminata* Vahl
2	*Fimbristylis aestivalis* (Retz.) Vahl
3	*Fimbristylis alboviridis* Clarke
4	*Fimbristylis argentea* (Rpttb.) Vahl
5	*Fimbristylis cymosa* var. *spathacea* (Roth) Koyama
6	*Fimbristylis dichotoma* (L.) Vahl
7	*Fimbristylis eragrostis* (Nees & Mey. Ex Nees) Hance
8	*Fimbristylis microcarya* F. V. Muell
9	*Fimbristylis ovata* (Burm.f.) Kern
10	*Fimbristylis polytrichoides* (Retz.) R. Br.
11	*Fimbristylis quinquangularis* (Vahl) Kunth
12	*Fimbristylis sanjappae* W. Khan, Chavan & Solanke
13	*Fimbristylis schoenoides* (Retz.) VAhl.
14	*Fimbristylis woodrowii* Clarke

6.4. Comparative morphology of *Fimbristylis* Vahl

Habit:

Members of the genus are either annual or perennial with or without rhizome. Perinnial species are rhizomatous such as *F. acuminata* Vahl, *F.*

dichotoma (L.) Vahl, *F. angamoozhiensis* Ravi & Anilkumar, *F. aphylla* Steud., *F. argentea* (Rottb.) Vahl, *F. cinnamometorum* (Vahl) Kunth, *F. complanata* (Retz.) Link, *F. consanguinea* Kunth, *F. eligulata* Govind., *etc*.. Annuals with fibrous root system is noticed in the following member like *F.aestivalis* (Retz.) Vahl, *F. bispicula* Govind., *F. bisumbellata* (Forssk.) Bub., *F. dimorphonucifera* Govind., *F. dispacea* (Rottb.) Clarke, *F. microcarya* F. V. Muell, *F. polytrichoides* (Retz.) R. Br., *F. pesedonarayanii, F. peseudomicrocarya,* etc. The smallest species that has been collected from South India are *F. microcarya* F. V. Muell and *F. pseudomicrocarya* Govind. The tallest species is *F. ferruginea* (L.) Vahl it may grow up to a height of 100 cm.

Culms:

Shape of the culms have variation in different species, it is compressed in *F. cymosa* var. *spathacea* (Roth) Koyama, *F. consanguinea* Kunth, *F. ferruginea* (L.) Vahl, *F. pierotii* Miq., etc.. While *F. dichotoma* (L.) Vahl, *F. dispacea* (Rottb.) Clarke, *F. eragrostis* (Nees & Mey. Ex Nees) Hance, *F. lawiana* (Boeck.) Kern, *F. paupercula* Boeck. it is angular. In some species the cum is rounded but compressed towards the inflorescence as in *F. dura* (Zoll. & Moritz.) Merr. and *F. fusca* (Nees) Clarke. Length of the culm show great variations ranges from 4 cm to 90 cm.

Leaves:

Leaves characters like length, shape, width and presence or absence of ligule are important characters for the species identification. In some species leaves are reduced into sheath as in *F. acuminata* Vahl and while in other leaves well developed with sheath and lamina. Length of lamina is also variable; it ranges from 5 cm to 45 cm. In certain species like *F. aestivalis* (Retz.) Vahl, *F. cinnamometorum* (Vahl) Kunth, *F. dimorphonucifera* Govind., *F. ligulata* Govind., *F. polytrichoides* (Retz.) R. Br., *F. pseudomicrocarya* Govind., *F. schultzii* Boeck., *F. zatei* W. Khan & Chavan D.P. , etc. the lamina is filiform. Ligule is represented by a fringe of small hairs in between the leaf sheath and lamina as in *F. alboviridis* Clarke, *F. bispicula* Govind., *F. complanata* (Retz.) Link, *F. consanguinea* Kunth, *F. dichotoma* (L.) Vahl and *F. fusca* (Nees) Clarke. While in *F. dispacea* (Rottb.)

Clarke, *F. aestivalis* (Retz.) Vahl, *F. angamoozhiensis* Ravi & Anilkumar, *F. cinnamometorum* (Vahl) Kunth, *F. dispacea* (Rottb.) Clarke, *F. eligulata* Govind., *F. eragrostis* (Nees & Mey. Ex Nees) Hance, *F. ferruginea* (L.) Vahl, *F. lawiana* (Boeck.) Kern, *F. schultzii* Boeck. it is absent (eligulate).

Inflorescence:

Inflorescence terminal and decompound to compound corymbs of solitary or few to many spikelets. Inflorescence is reduced into solitary one or two spikelet as in *F. acuminate* Vahl, *F. ovata* (Burm.f.) Kern, *F. polytrichoides* (Retz.) R. Br. and *F. schoenoides* (Retz.) Vahl.. While in other species it is simple to decompound umbels. In certain species like *F. angamoozhiensis* Ravi & Anilkumar, *F. argentea* (Rottb.) Vahl, *F. bispicula* Govind., *F. dimorphonucifera* Govind., *F. ferruginea* (L.) Vahl, *F. lawiana* (Boeck.) Kern, *F. scultzii* and *F. woodrowii* Clarke spikelets are sessile and arranged as clusters, while in others it is solitary with distinct rays.

Spikelets:

Spikelets densely many flowered, ovoid to ellipsoid, acute at apex, rachilla persistent, winged or broadly winged by the persistent basal part of the glumes. In majority of the species, glumes are spirally arranged and in some members like *F. cinnamometorum* (Vahl) Kunth, *F. narayanii* Fischer, *F. ovata* (Burm.f.) Kern, *F. pseudonarayanii* Ravi & Anilkumar and *F. zatei* W. Khan & Chavan D.P.have distichous arrangements. Number of stamen is variable, 1 – 3; in a few species have variable number of stamens like *F. aphylla* Steud. it is 1 – 2 and in *F. dichotoma* (L.) Vahl, it is 1 – 3. Styles is trigonous in certain species such and *F. aphylla* Steud., *F. consanguinea* Kunth, *F. schultzii* Boeck. and *F. uliginosa* Steud. and while in others it is flattened, style base slightly dilated and articulated at base. In most species the style is ciliated towards top as in *F. acuminata* Vahl, *F. aestivalis* (Retz.) Vahl, *F. alboviridis* Clarke, *F. angamoozhiensis* Ravi & Anilkumar, *F. argentea* (Rottb.) Vahl, *F. bisumbellata* (Forssk.) Bub., *etc.*. In *Fimbristylis narayanii* Fischer the whole style is densely ciliate and in *F. pubisquama* Kern ciliate only at style base. The stigma is bifid or trifid; it is trifid in majority of the species such as *F. amgamoozhiensis*, *F. aphylla* Steud., *F. bispicula* Govind., *F. cinnamometorum* (Vahl) Kunth, *F. complanata* (Retz.) Link, *F. consanguinea*

Kunth, *F. dura* (Zoll. & Moritz.) Merr., *F. eragrostis* (Nees & Mey. Ex Nees) Hance, *F. fusca* (Nees) Clarke, *F. polytrichoides* (Retz.) R. Br., *F. sanjappae* Chavan & Solanke, etc. and is bifid in species like *F. angamoozhiensis* Ravi & Anilkumar, *F. aphylla* Steud., *F. bispicula* Govind., *F. cinnamometorum* (Vahl) Kunth, *F. complanata* (Retz.) Link, *F. dura* (Zoll. & Moritz.) Merr., *F. eragrostis* (Nees & Mey. Ex Nees) Hance, *F. fusca* (Nees) clarke, etc.

Nut:

Nature of nut is an important identifying character of the members of this genus. Nut is biconvex or trigonous in outline. It is biconvex in members like *F. agentea* (Rottb.) Vahl, *F. bisumbellata* (Forssk.) Bub., *F. cymosa* var. *spathacea* (Roth) Koyama, *F. dichotoma* (L.) Vahl, *F. sanjappae* Chavan & Solanke, *F. schoenoides* (Retz.) Vahl., *F. tetragona* R. Br. Prodr. etc., It is trigonous in species *F. angamoohziensis* Ravi & Anilkumar, *F. aphylla* Steud., *F. bispicula* Govind., *F. complanata* (Retz.) Link, *F. eragrostis* (Nees & Mey. Ex Nees) Hance, *F. lawiana* (Boeck.) Kern, *F. schultzii* Boeck., etc. Shape of the nut varies as obovoid, ovoid, or oblong to linear. Surface of the nut varies according to the species, it is verruculose in most species, such as *F. alboviridis* Clarke, *F. angamoozhiensis* Ravi & Anilkumar, *F. aphylla* Steud., *F. bispicula* Govind., *F. cinnamometorum* (Vahl) Kunth, *F. complanata* (Retz.) Link, *F. dichotoma* (L.) Vahl, etc. whereas it smooth as in *F. acuminata* Vahl, *F. consanguinea* Kunth, *F. lawiana* (Boeck.) Kern. In *Fimbristylis dispacea* (Rottb.) Clarke cleavage appendages are present on the surface. In species like *F. bisumbellata* (Forssk.) Bub., *F. eligulata* Govind. and *F. sanjappae* Chavan & Solanke nut surface ornamented with vertical ridges. While in *F. acuminata* Vahl nut surface have transverse ridges.

6.5. **New distribution records**

The present study described 4 new species distribution records for the study area. *Fimbristylis bispicula* Govind. is endemic to Karnataka, during the exploration this species is reported from Madayipara of Kannur district of Kerala and it is a new distribution record for Kerala. *F. pierotti* Miq. was earlier reported form Tamil Nadu, during the present study it is collected form Agasthyamala biosphere reserve of Kerala, India and it form a new distribution record for Kerala.

F. schultzii Boeck. was earlier reported form Malaysia and Australia, in this study the species was collected form Agasthyamala biospheresrve of Kerala, India; hence it is a new distribution record for India. *F. subdura* Ohwi was earlier reported form Malesia, during the study the species is collected form Kannur district of Kerala, India, so it is a new distribution record for India.

6.6. Endemism:

37 species of *Fimbristylis* Vahl are endemic to India (Prasad & Singh 1996). Distribution data reviled that out of the 45 species collected, 15 are endemic to the study area **(Table 3)**

Table 3. *Fimbristylis* spp. endemic to the study area

Species	Distribution
Fimbristylis angamoozhiensis Ravi & Anilkumar	KL
Fimbristylis bispicula Govind.	KL, KA, AP
Fimbristylis complanata (Retz.) Link	KL, TN, KA, AP
Fimbristylis dimorphonucifera Govind	KL, TN, KA
Fimbristylis eligulata Govind	TN, AP
Fimbristylis lawiana (Boeck.) Kern	KA
Fimbristylis narayanii Fischer	KL, KA
Fimbristylis pseudonarayanii Ravi & Anilkumar	KA
Fimbristylis paupercula Boeck.	TN
Fimbristylis pierotii Miq.	KL
Fimbristylis pubisquama Kern	KL
Fibristylis schultzii Boeck.	KL
Fimbristylis subdura Ohwi	TN
Fimbristylis uliginosa Steud.	KL, TN, AP
Fimbristylis woodrowii Clarke	KL,KA

6.7. Germplasm collection and *ex-situ* conservation

An attempt has been made to conserve the *Fimbristylis* Vahl species in the Aquatic plant conservatory (Aquagene) of Malabar Botanical Garden and Institute for Plant Sciences (MBGIPS), Kozhikode. All the live specimens

collected from various localities were planted in conservatory and 26 species are successfully established. Survival of the species from high altitude localities is very low.

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Summary of the work

During the present study 45 species of *Fimbristylis* Vahl were recognised from South India with updated nomenclature, detailed taxonomic descriptions, colour photographs, Illustrations, details of flowering and fruiting, habitat and distribution. A taxonomic key is provided for easy identification of the species. Conducted extensive field exploration trips throughout South Indian states such as Kerala, Tamil Nadu, Karnataka and Andhra Pradesh for the collection of live specimens and consulted major herbaria of South India. The collected specimens were identified based on authentic literature and type specimens. All the collected specimens preserved and mounted on herbarium sheets and deposited at MBGH. Out of the 45 species recognised, 15 species are endemic to the study area. In the present study 5 species were reported as new to the study area, viz., *F. dimorphonucifera, F. bispicula, F. pierotii, F. schultzii* and *F. subdura. F. narayani* Fischer is typified.

Live specimens of all the collected specimens were brought to Malabar Botanical Garden and Institute for Plant Sciences to establish a live germplasm and planted in aquatic plant conservatory (Aquagene). Perennial members are successfully established while the *ex-situ* conservation of annuals found to be difficult. Altitude variation is an issue faced in the *ex-situ* conservation, high altitude species were not survive in our conservatory for a long period of time.

None of the members of the genus are known to be directly beneficial to human and hence they are commonly treated as weeds, but have significant role in ecosystem as one of the major producers in ecosystem. They provide food for many grazing animals and birds. They also prevent soil erosion by growing as a mat on the soil surface. Many of the species are under threat due to habitat destruction. More scientific efforts are needed for the conservation of threatened species of this genus which are usually treated as 'useless weeds'.

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Index to species described

ANOOP K. P. “ TAXONOMIC ANALYSIS OF THE GENUS FIMBRISTYLIS VAHL (CYPERACEAE) IN SOUTH INDIA”. THESIS. KSCSTE-MALABAR BOTANICAL GARDEN AND INSTITUTE FOR PLANT SCIENCES, UNIVERSITY OF CALICUT, 2018.

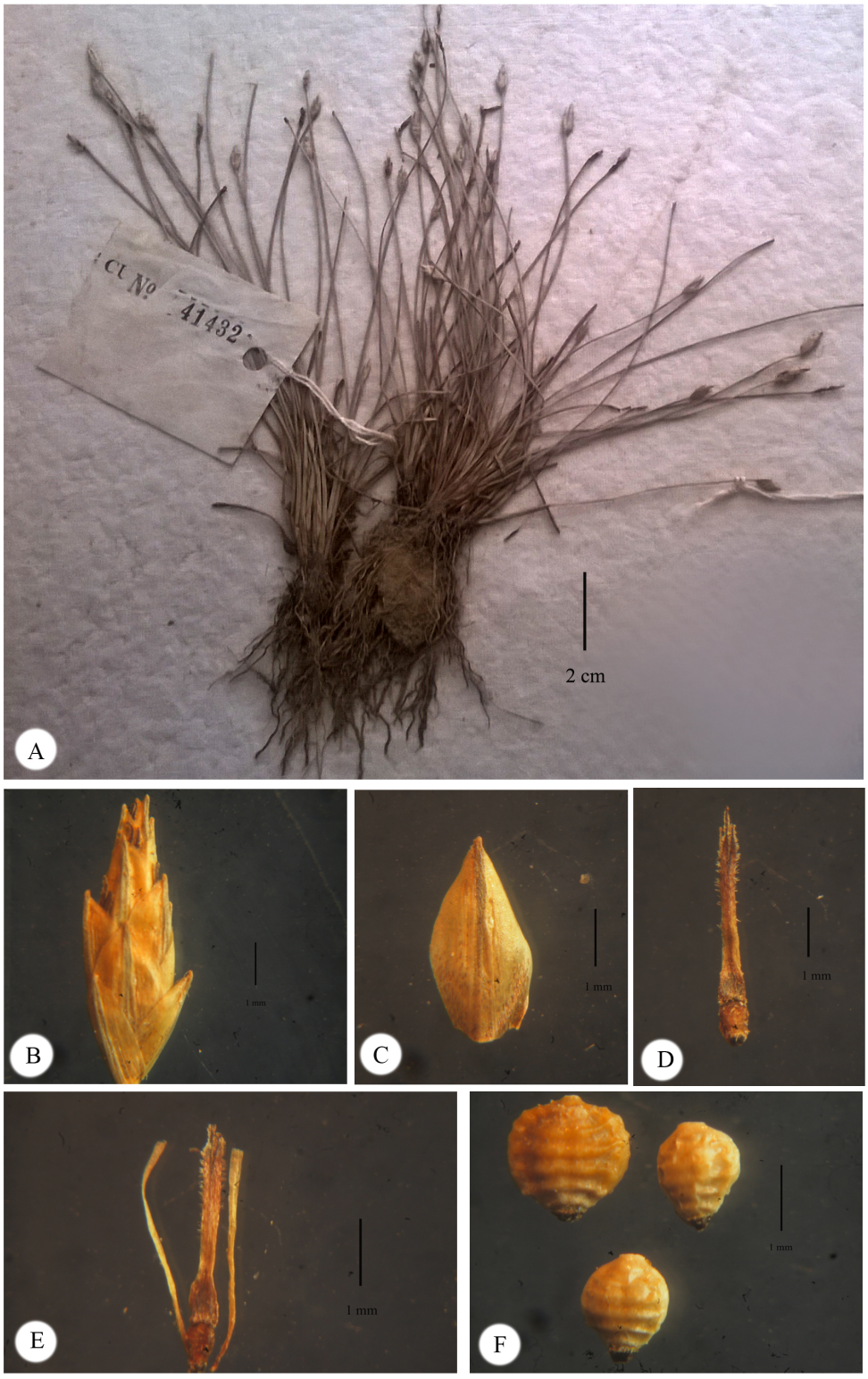

Plate 1. ***Fimbristylis acuminata*** Vahl, A - Habit, B - Spikelet, C - Glume, D & E - Gynoecium, F - Nuts

Plate: 11. ***Fimbristylis consanguinea*** Kunth

Plate: 21. Fimbristylis fusca (Nees) Clarke

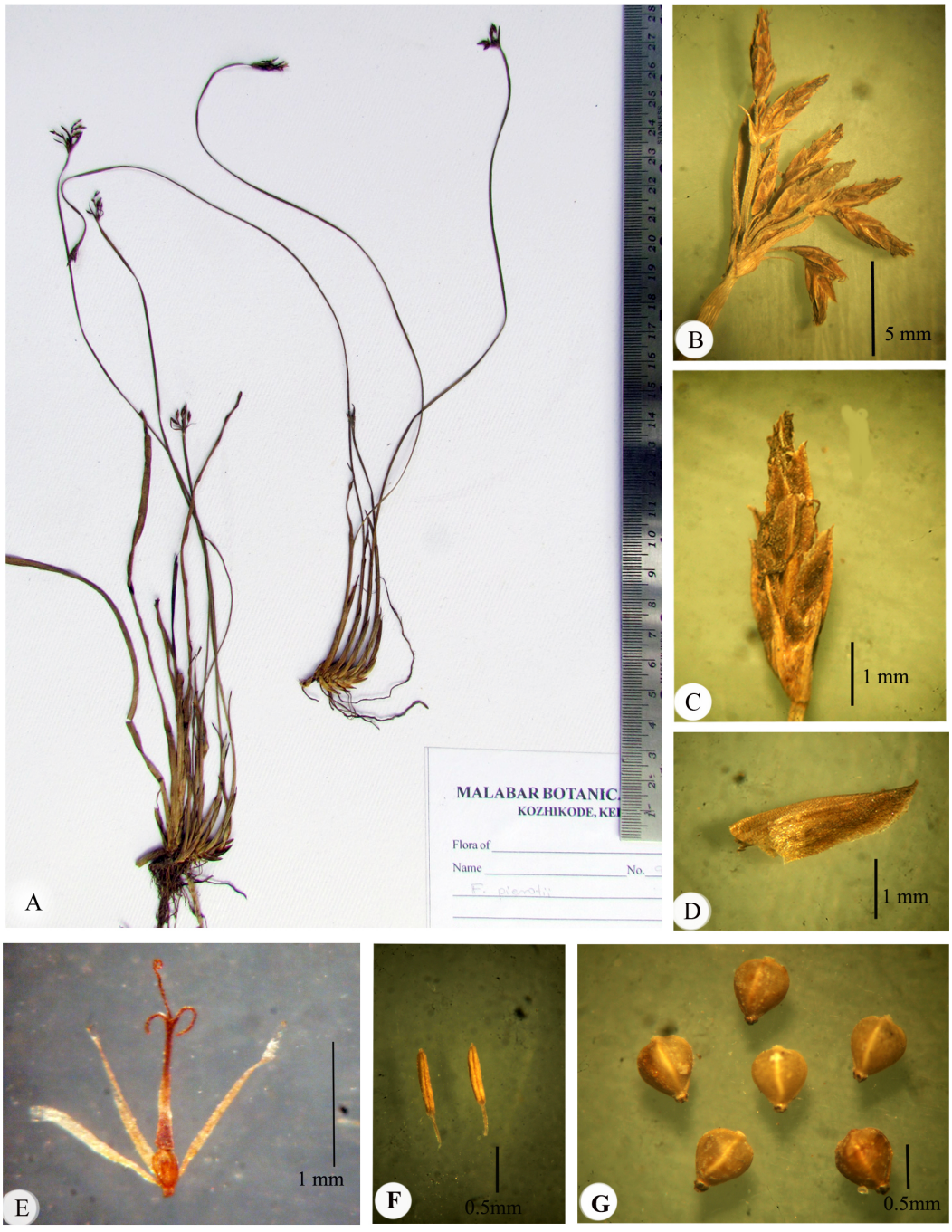

Plate: 28. ***Fimbristylis pierotii*** Miq.; A: Habit, B:Inflorescence, C: Spikelet, D: Glume, E: Pistil, F: Stamens, G: Nuts

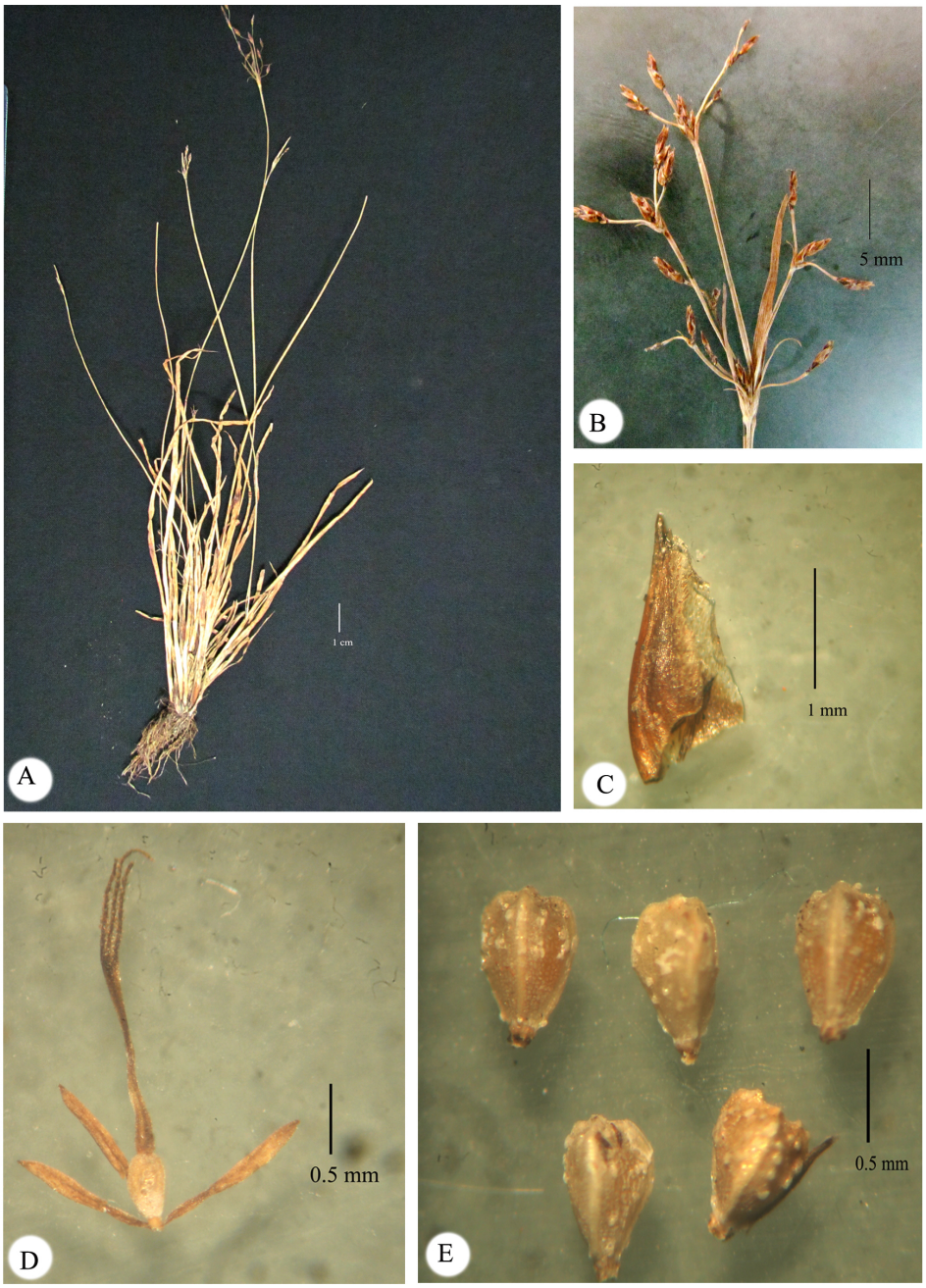

Plate: 24. ***Fimbristylis microcarya*** F. V. Muell.; A - Habit, B - Inflorescence, C - Glume, D - Pistil with stamens, E - Nuts

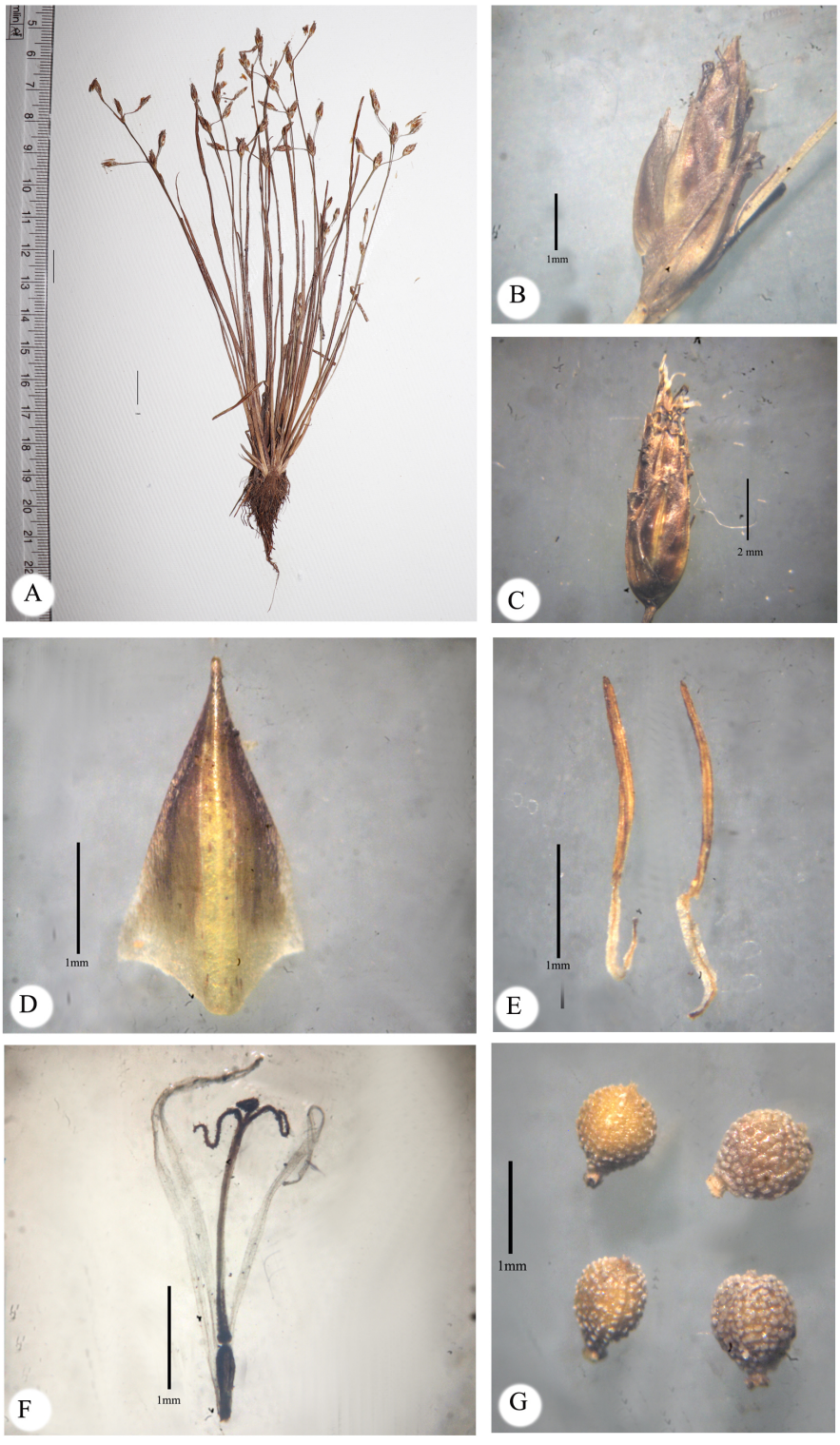

Plate: 7. ***Fimbristylis bispicula*** Govind.; A - Habit, B & C - Spikelets, D - Glumes, E - Stamens, F - Pistil, G - Nuts

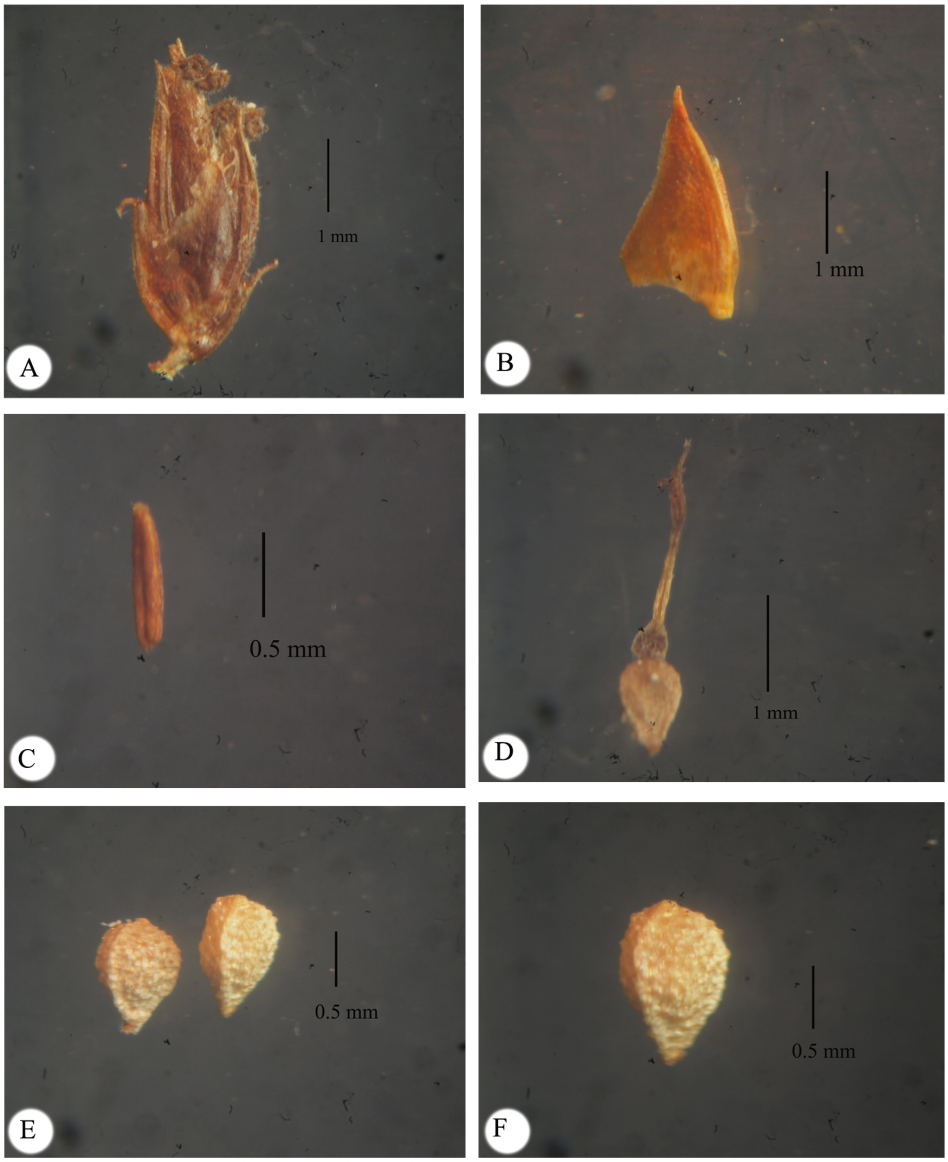

Plate: 22. ***Fimbristylis lawiana*** (Boeck.) Kern; A - Spikelet, B - Glume, C - Anthers, D - Pistil, E & F - Nuts

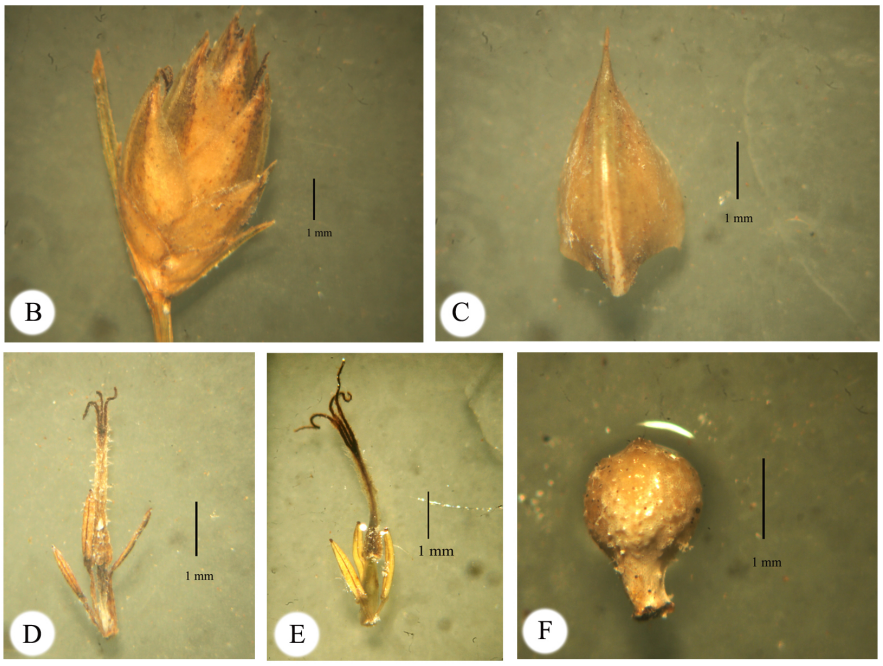

Plate: 26. ***Fimbristylis ovata*** (Burm.f.) Kern; A - Habit, B - Spikelet, C - Glume, D & E - Pistil with Stamens, F - Nut

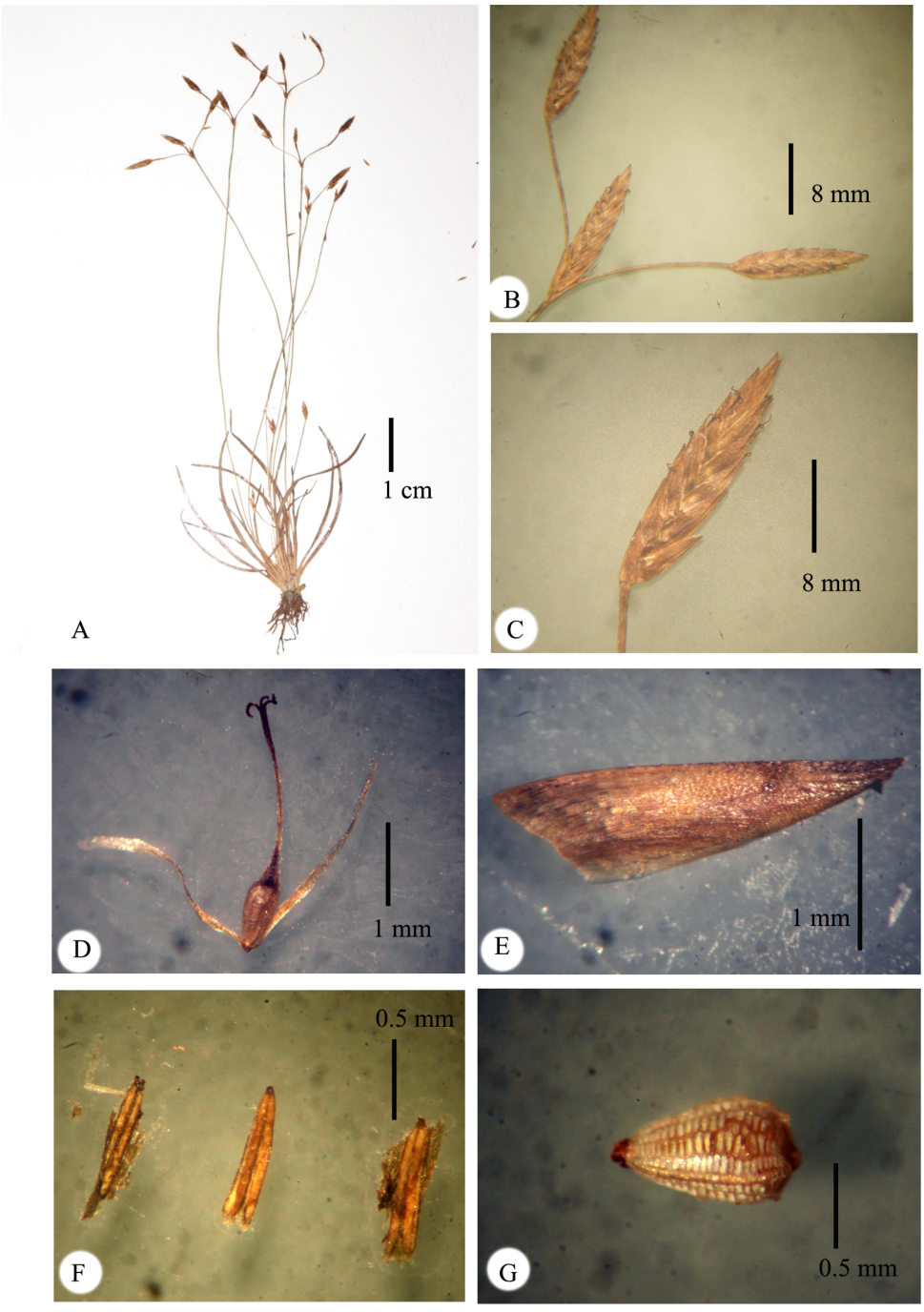

Plate: 31. ***Fimbristylis pseudonarayanii*** Ravi & Anilkumar; A - Habit, B - Inflorescence, C - Spikelet, D - Pistil, E - Glume, F - Anthers, G - Nut

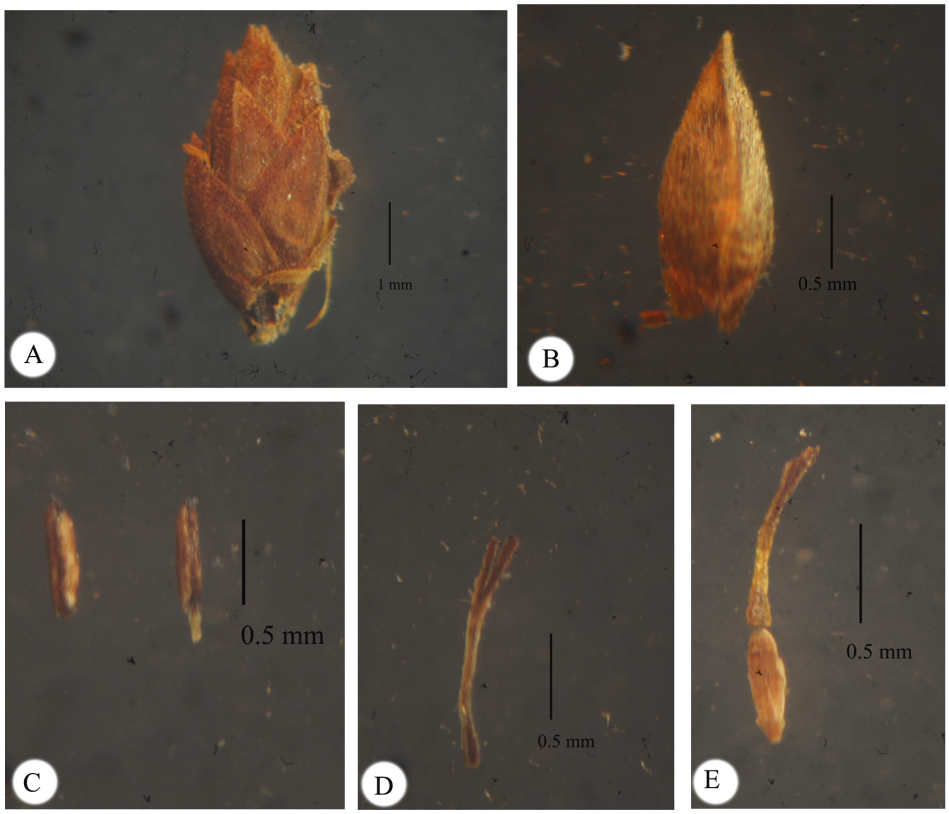

Plate: 32. ***Fimbristylis pubisquama*** Kern; A - Spikelet, B - Glume, C - Stamens, D - Style with stigma, E - Pistil

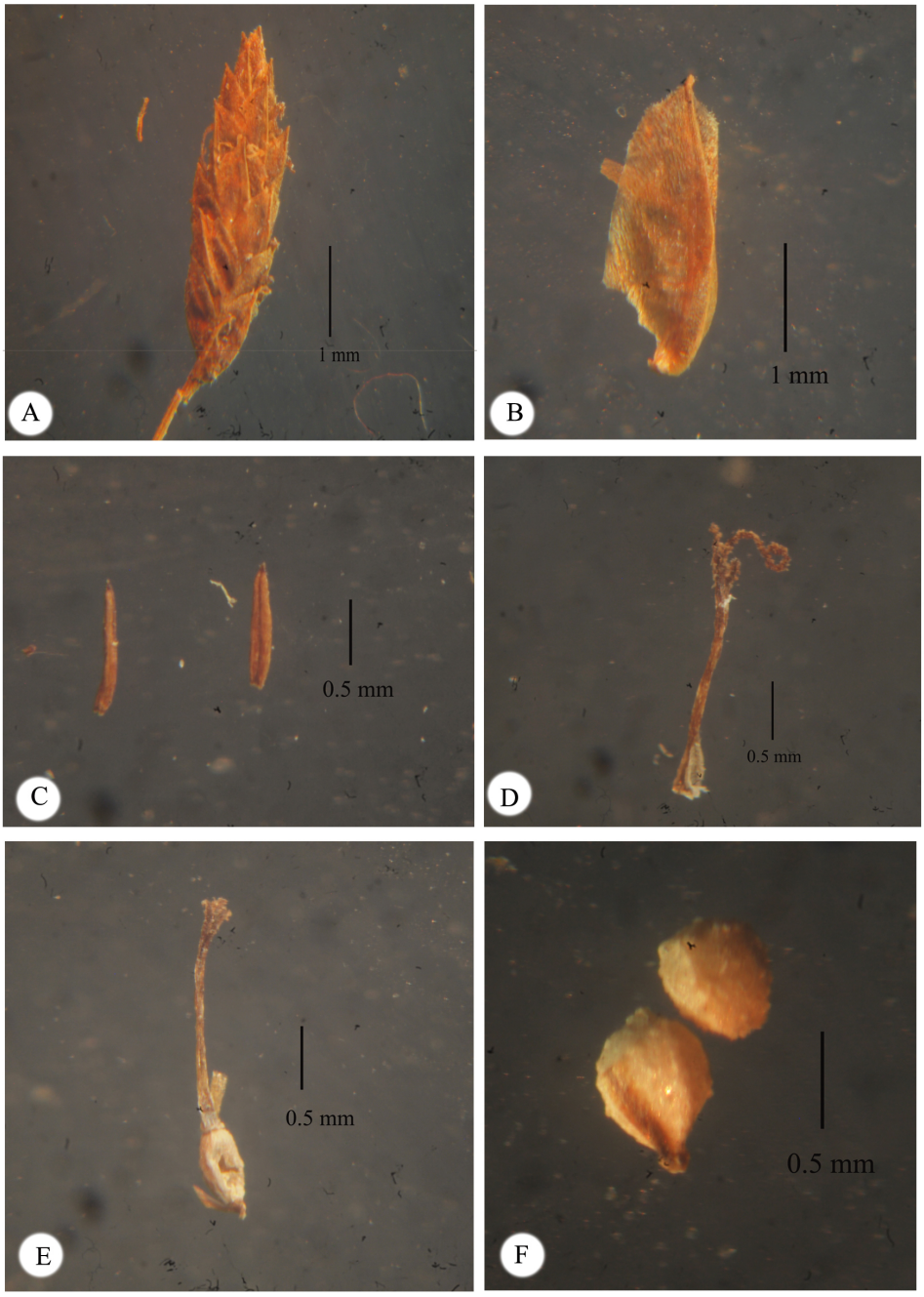

Plate: 39. ***Fimbristylis subdura*** Ohwi; A - Spikelet, B - Glume, C - Anther, D - Style with Stigma, E - Pistil, D - Nuts

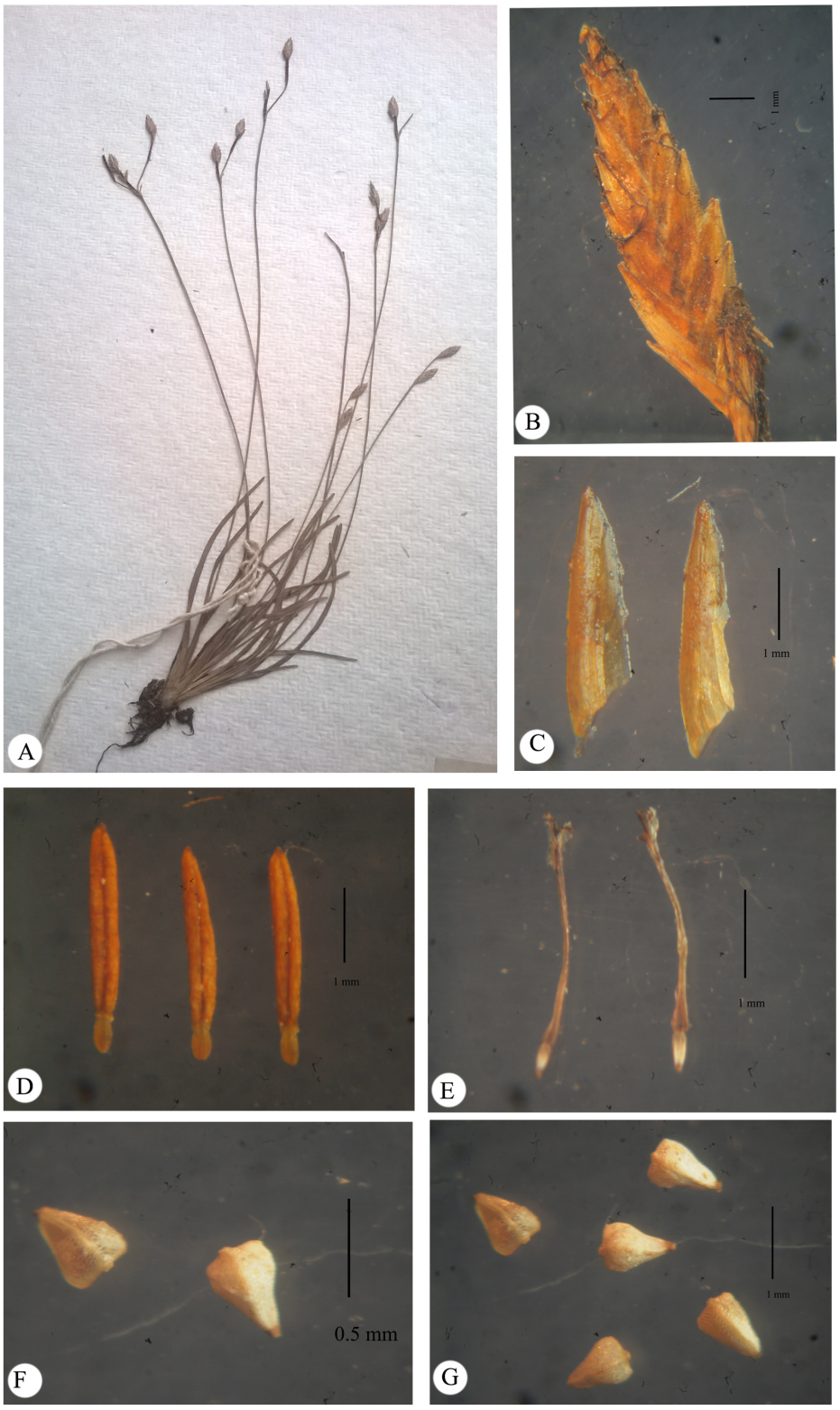

Plate: 25. ***Fimbristylis narayanii*** Fischer; A - Habit, B - Spikelet, C - Glumes, D - Anthers, E - Pistils, F & G - Nuts.

Plate: 29. ***Fimbristylis polytrichoides*** (Retz.) R. Br. ; A - Habit, B - Inflorescence, C - Spikelet, D - Glumes, E - Anthers, F - Pistil, G - Nut

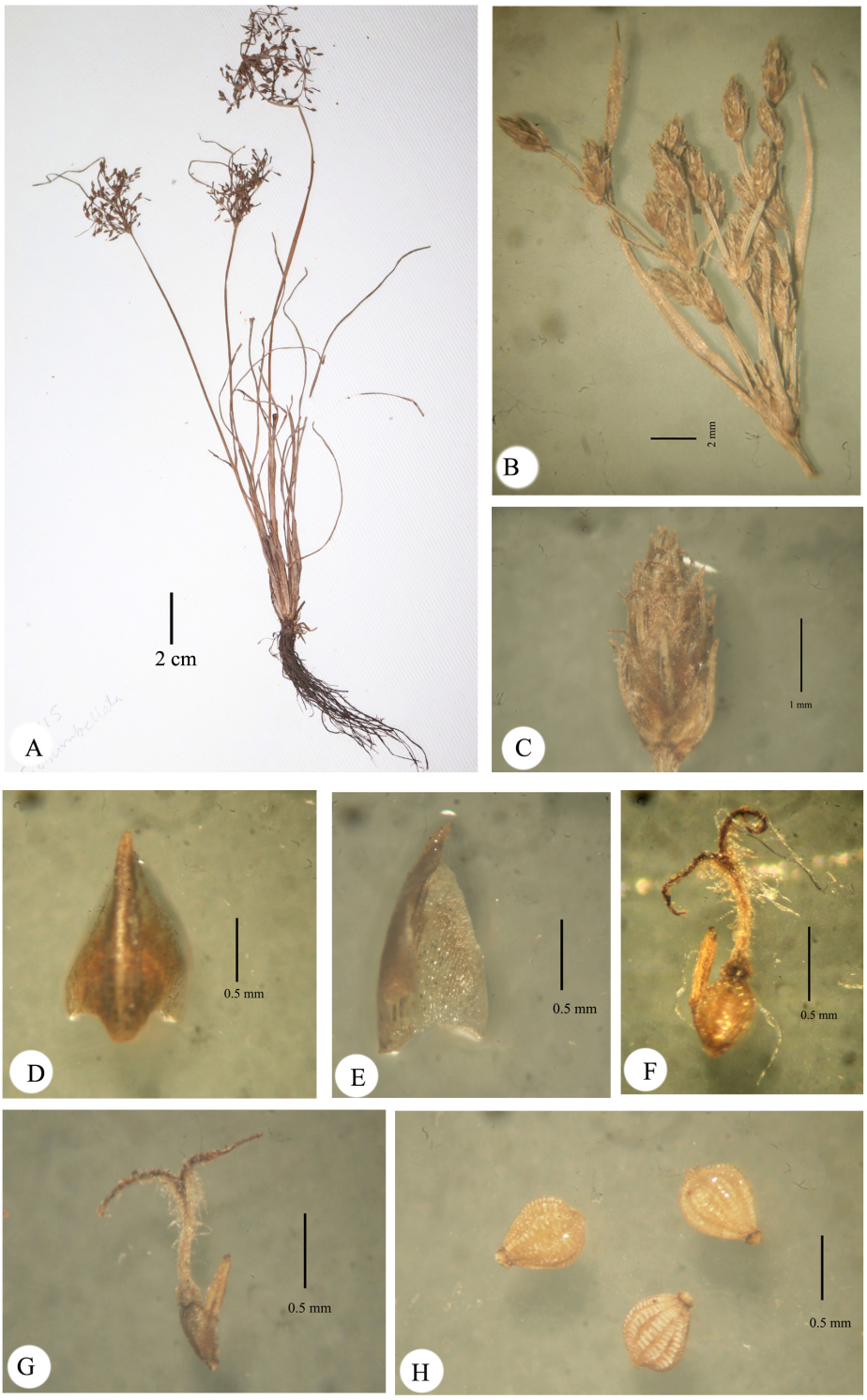

Plate: 8. ***Fimbristylis bisumbellata*** (Forssk.) Bub.; A - Habit, B - Inflorescence, C - Spikelets, D & E - Glumes, F & G - Pistil with Stamen, H - Nuts

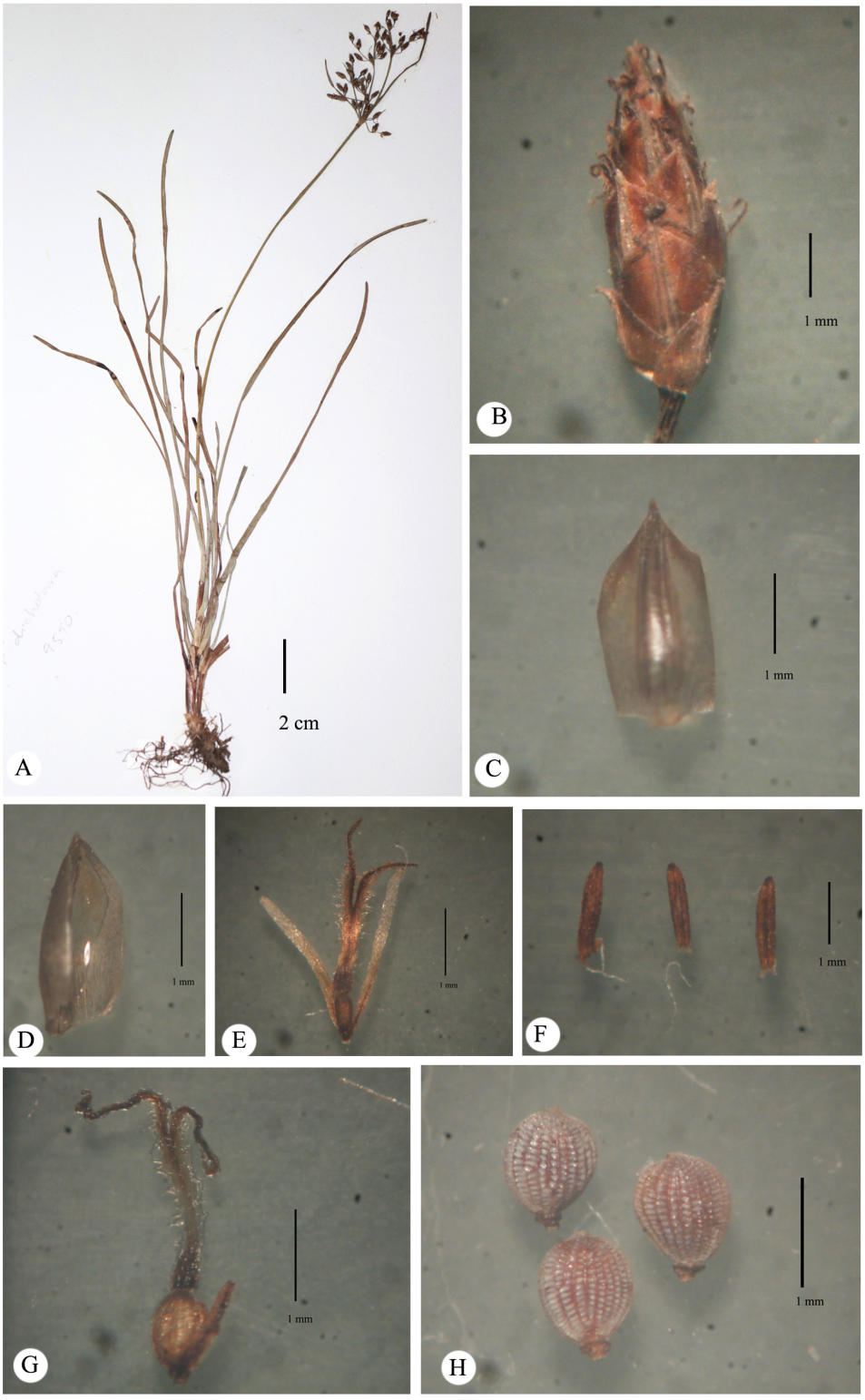

Plate: 13. ***Fimbristylis dichotoma*** (L.) Vahl. A - Habit, B - Spikelet, C & D - Glumes, E - Pistil, F - Anthers, G - Pistil with Stamen, H - Nuts

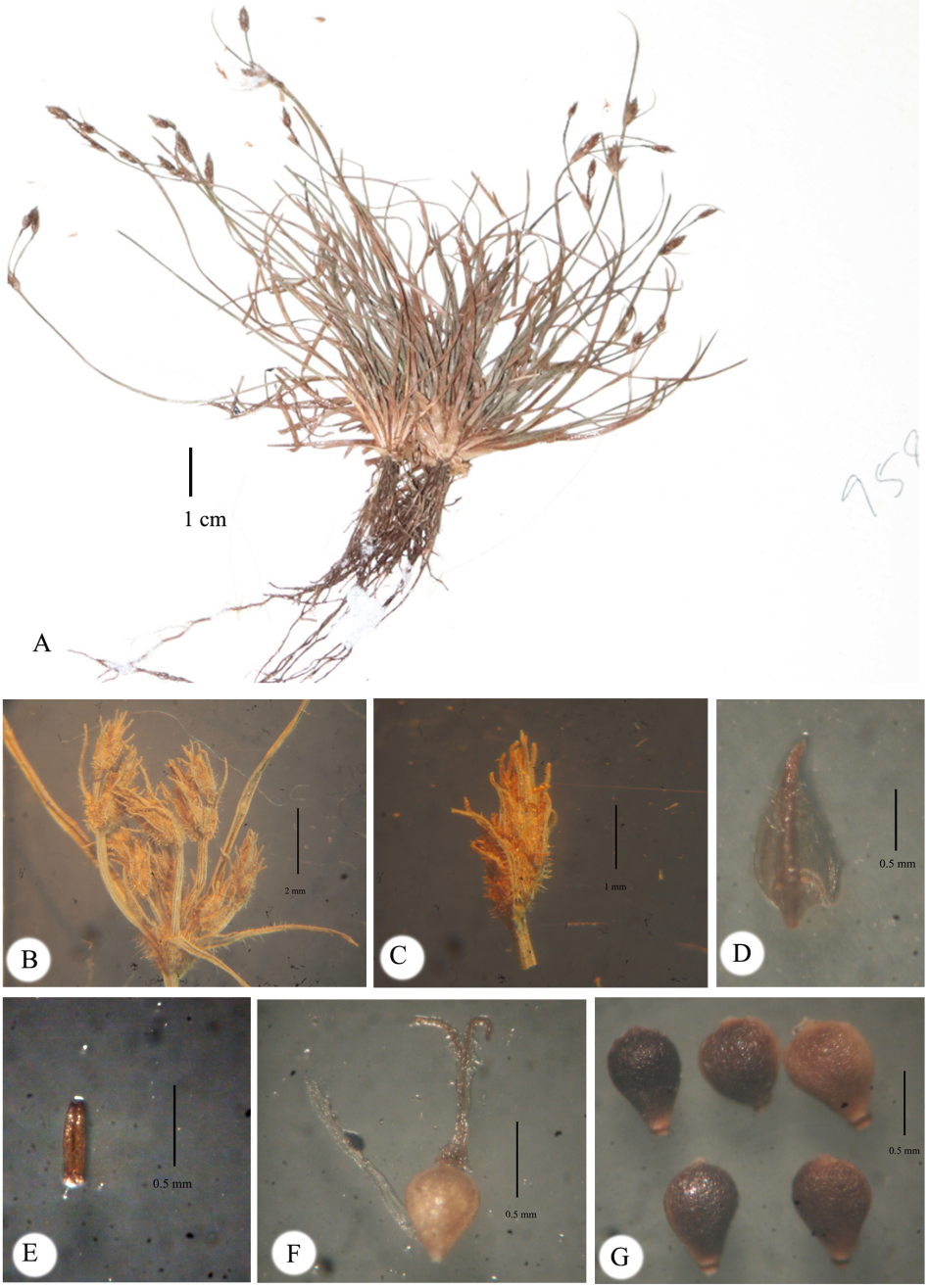

Plate: 2. ***Fimbristylis aestivalis*** (Retz.) Vahl; A - Habit, B - Inflorescence, C - Spikelet, D - Glume, E - Anther, F - Pistil, G - Nuts

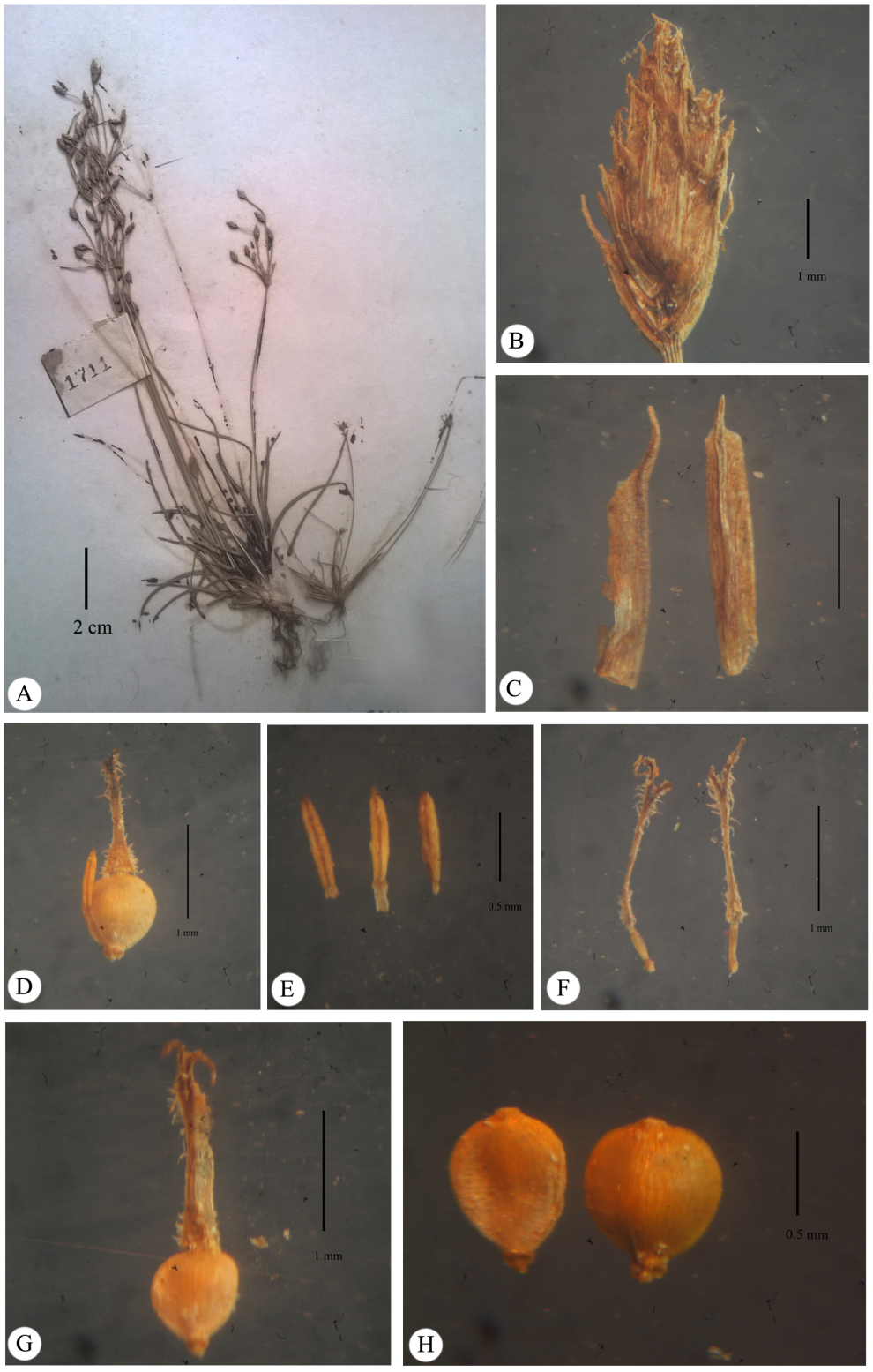

Plate: 3. ***Fimbristylis alboviridis*** Clarke; A - Habit, B - Spikelet, C - Glumes, D - Pistil with stamen, E - Anthers, F - Pistil, G - Nut with style, H - Nut

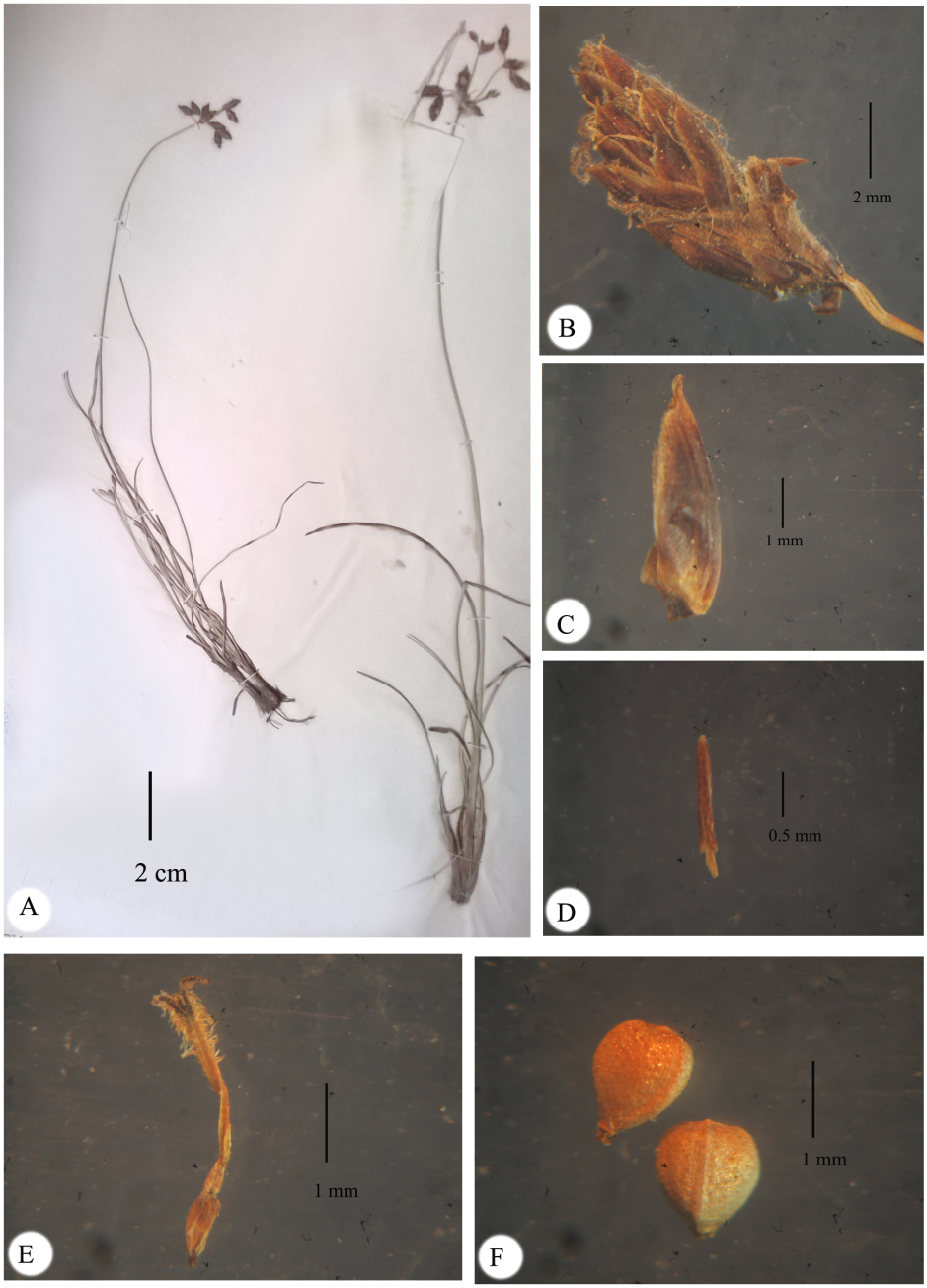

Plate:27. ***Fimbristylis paupercula*** Boeck.; A - Habit, B - Spikelet, C - Glume, D - Anther, E - Pistil, F - Nuts.

Plate: 9. ***Fimbristylis cinnamometorum*** (Vahl) Kunth; A - Habit, B - Spikelet, D & C - Glumes, E - Pistil with Satmens, F - Nuts.

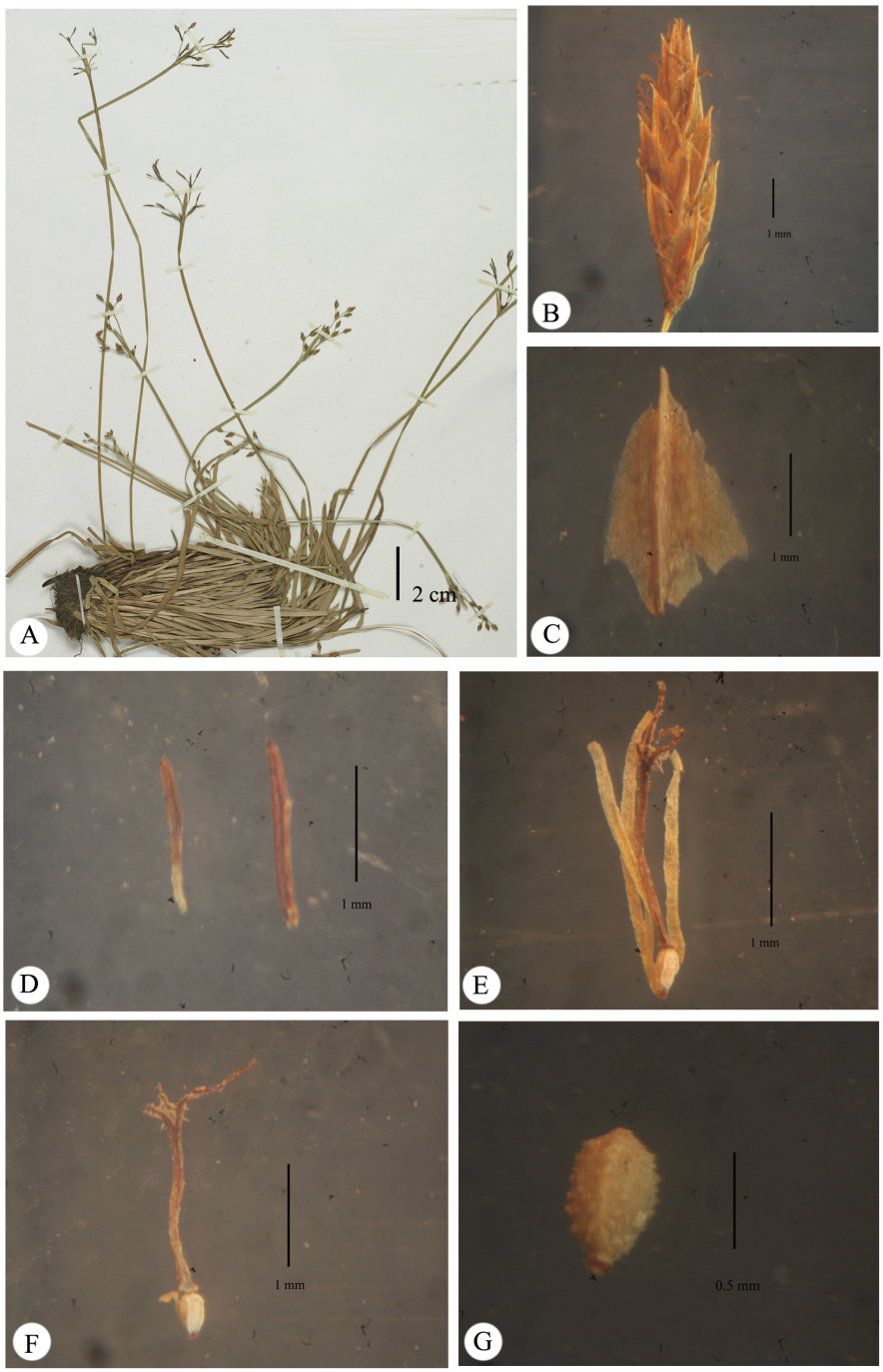

Plate: 10. ***Fimbristylis complanata*** (Retz.) Link; A - Habit, B - Spikelet, C - Glume, D - Anthers, E - Pistil with filaments, F - Pistil, G - Nut.

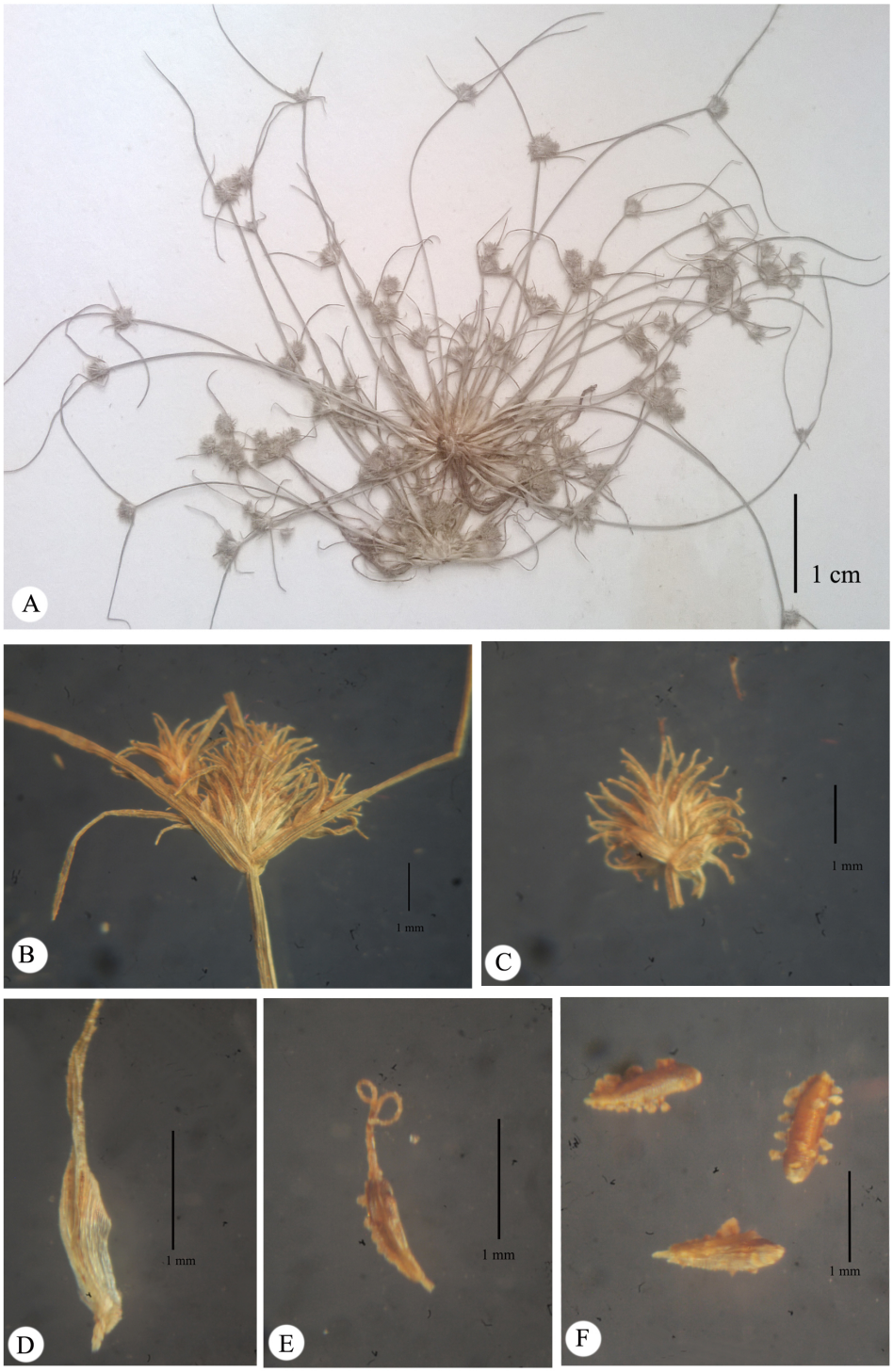

Plate: 15. ***Fimbristylis dispacea*** (Rottb.) Clarke; A - Habit, B - Inflorescence, C - Spikelet, D - Glume, E - Pistil, F - Nuts

Plate: 18. ***Fimbristylis eragrostis*** (Nees & Mey. Ex Nees) Hance; A - Habit, B - Spikelet, C & D - Glumes, E - Pistil with filaments, F & G - Nuts

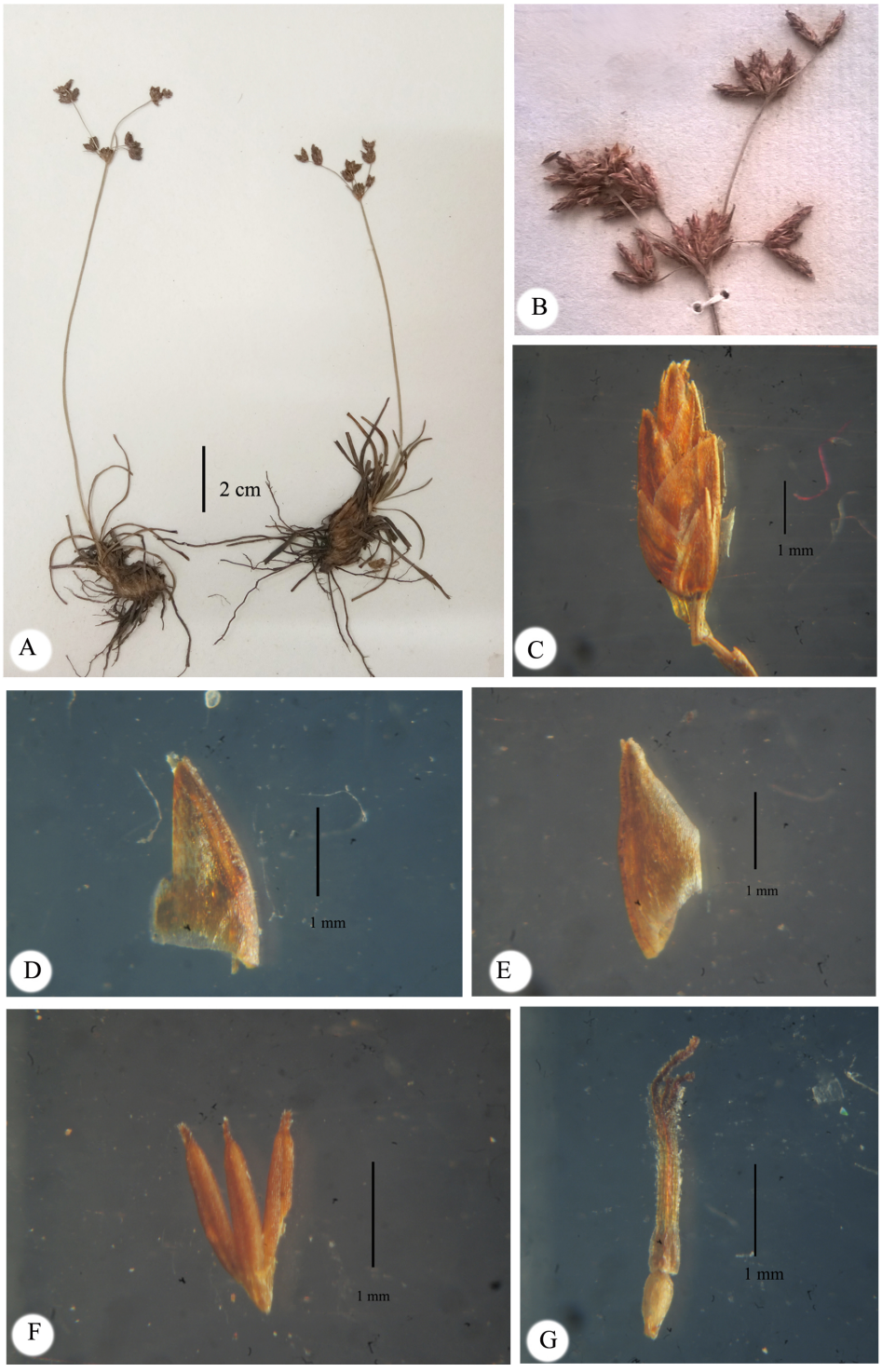

Plate: 19. ***Fimbristylis falcata*** (Vahl) Kunth; A - Habit, B - Inflorescence, C - Spikelet, D & E - Glumes, F -Stamens, G - Pistil

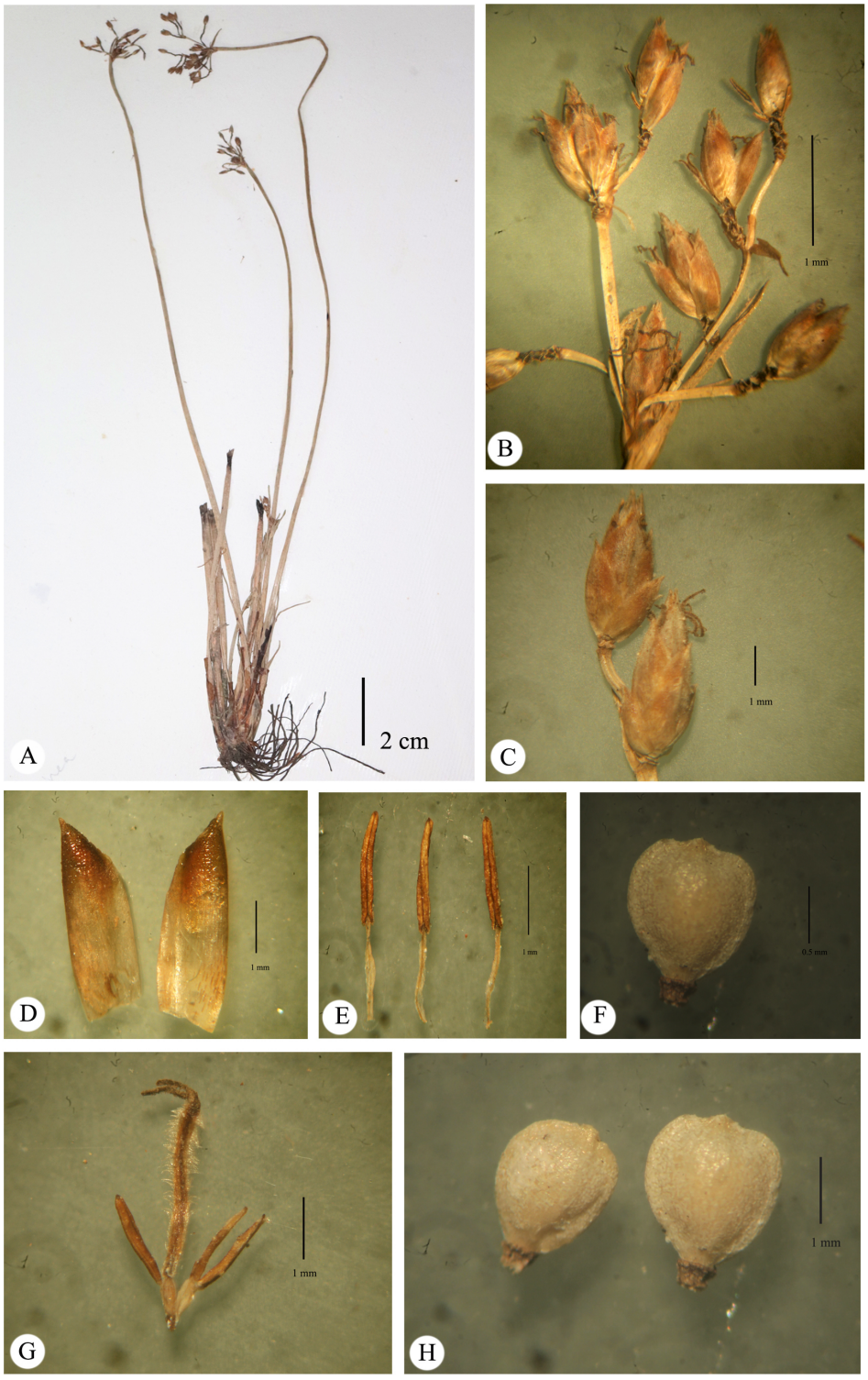

Plate: 20. ***Fimbristylis ferruginea*** (L.) Vahl; A - Habit, B - Inflorescence, C - Spikelets, D - Glumes, E - Stamens, F & H - Nuts, G - Pistil with Stamens

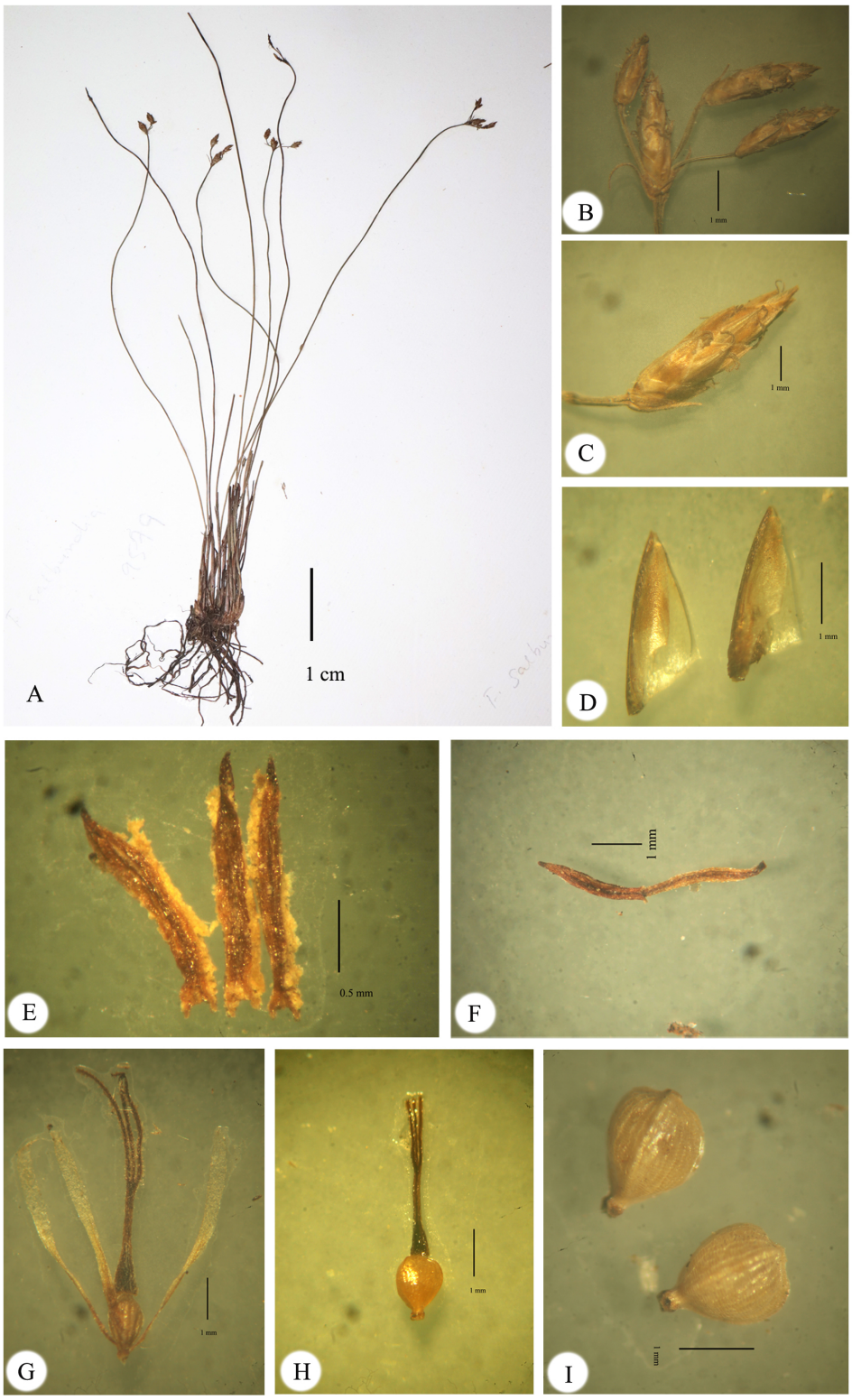

Plate: 34. ***Fimbristylis salbundia*** (Nees) Kunth; A - Habit, B - inflorescence, C - Spikelet, D - Glumes, E - Anthers, F - Stamens, G & H - Pistil, I - Nuts.

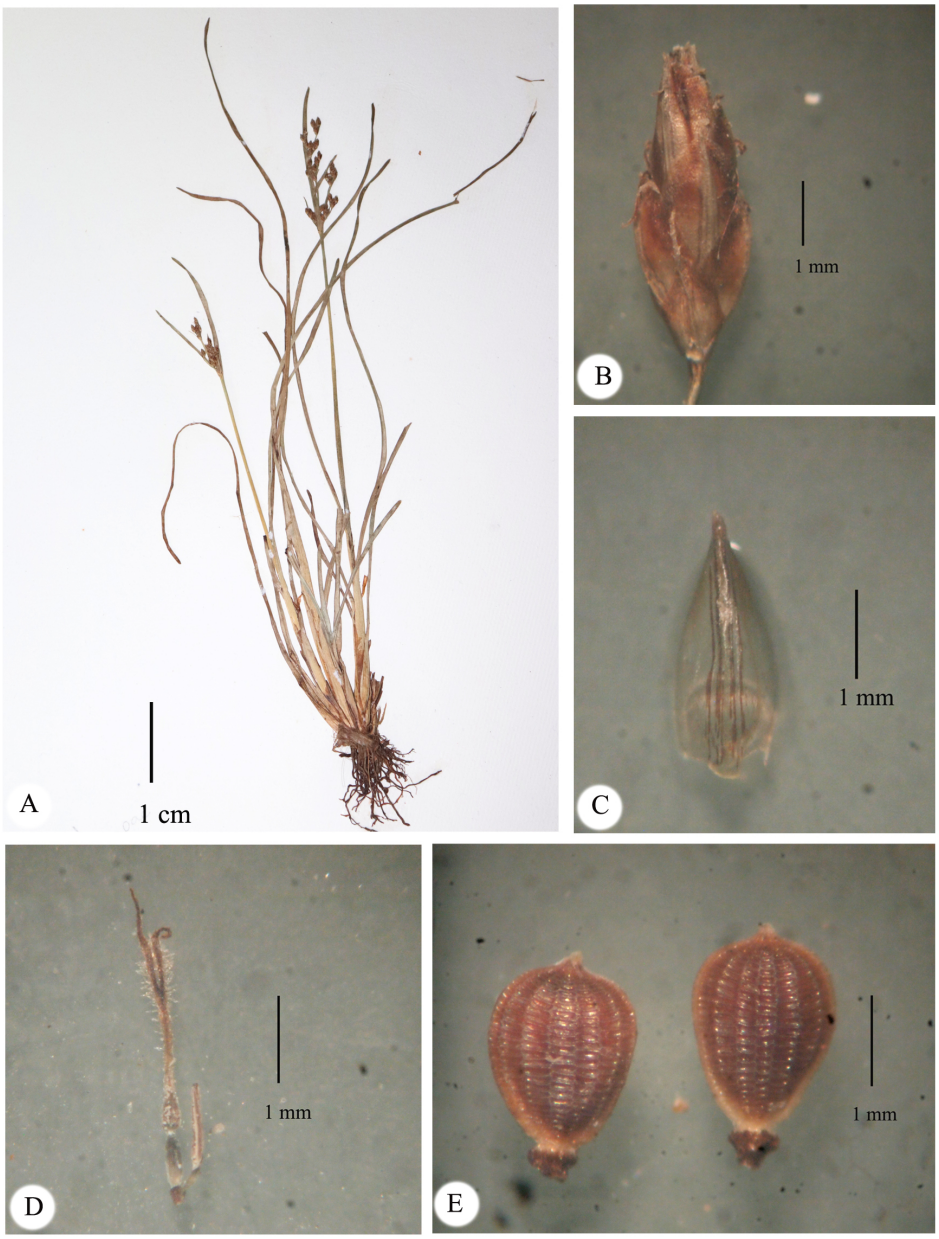

Plate: 35. ***Fimbristylis sanjappae*** W. Khan Chavan & Solanke; A - Habit, B - Spikelet, C - Glume, D - Pistil with Stamen, E - Nuts.

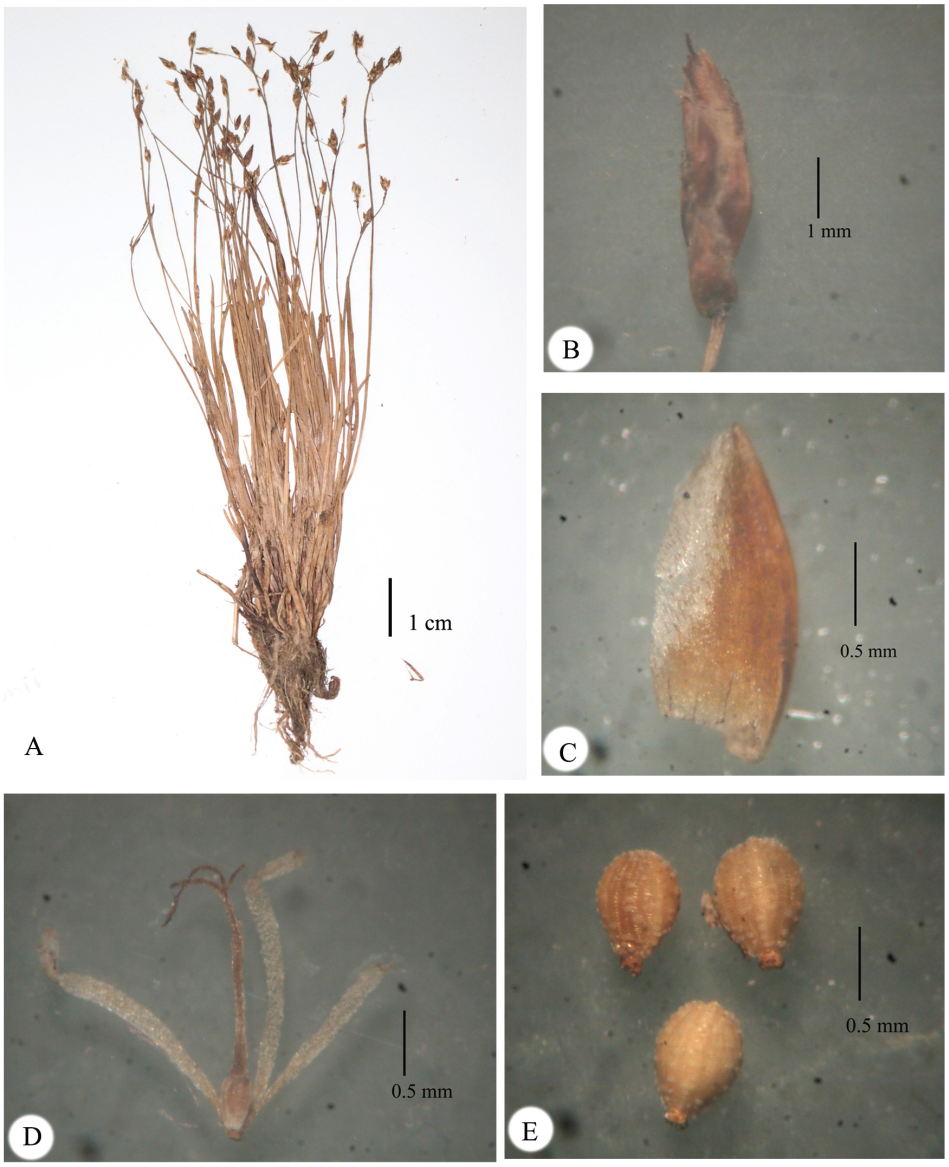

Plate: 38. ***Fimbristylis simpsonii*** Parasad & Singh; A - Habit, B - Spikelet, C - Glume, D - Pistil, E - Nuts

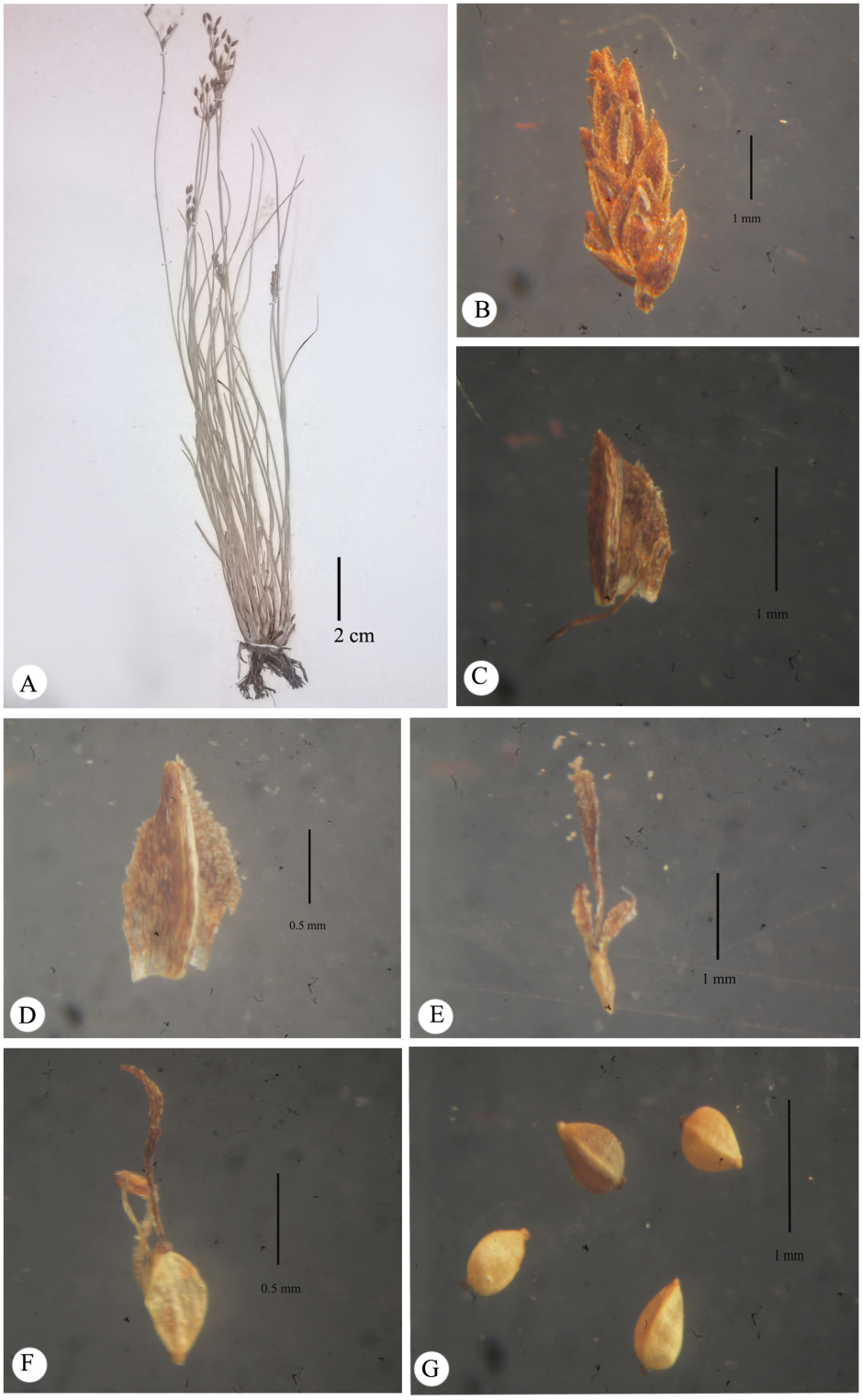

Plate: 40. ***Fimbristylis tenera*** Roem & Schult.; A - Habit, B - Spikelet, C & D - Glumes, E & F - Pistil with Stamen, G - Nuts

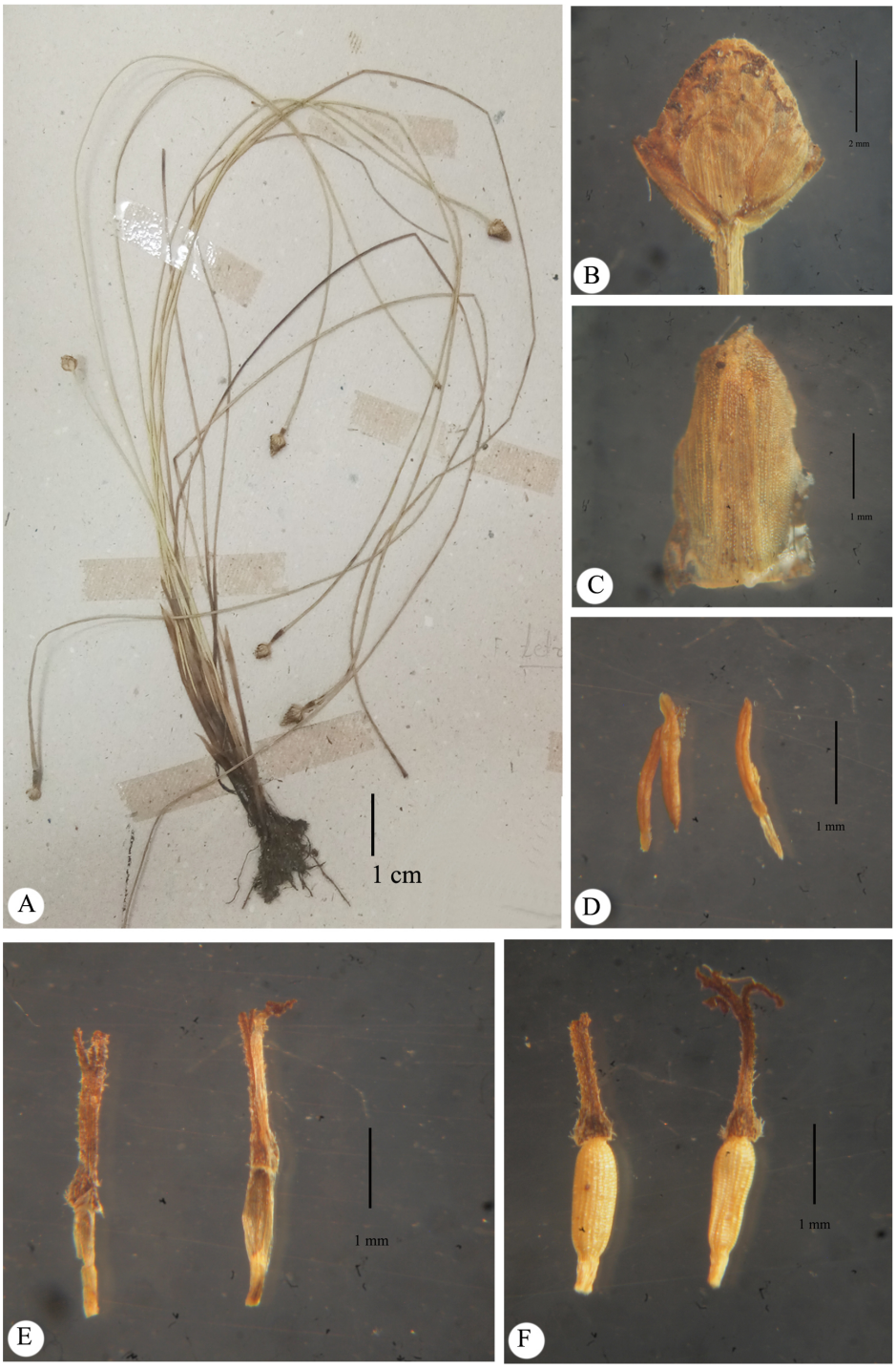

Plate: 41. ***Fimbristylis tetragona*** R. Br.; A - Habit, B - Spikelet, C - Glume, D - Anthers, E - Pistil, F - Nuts with style.

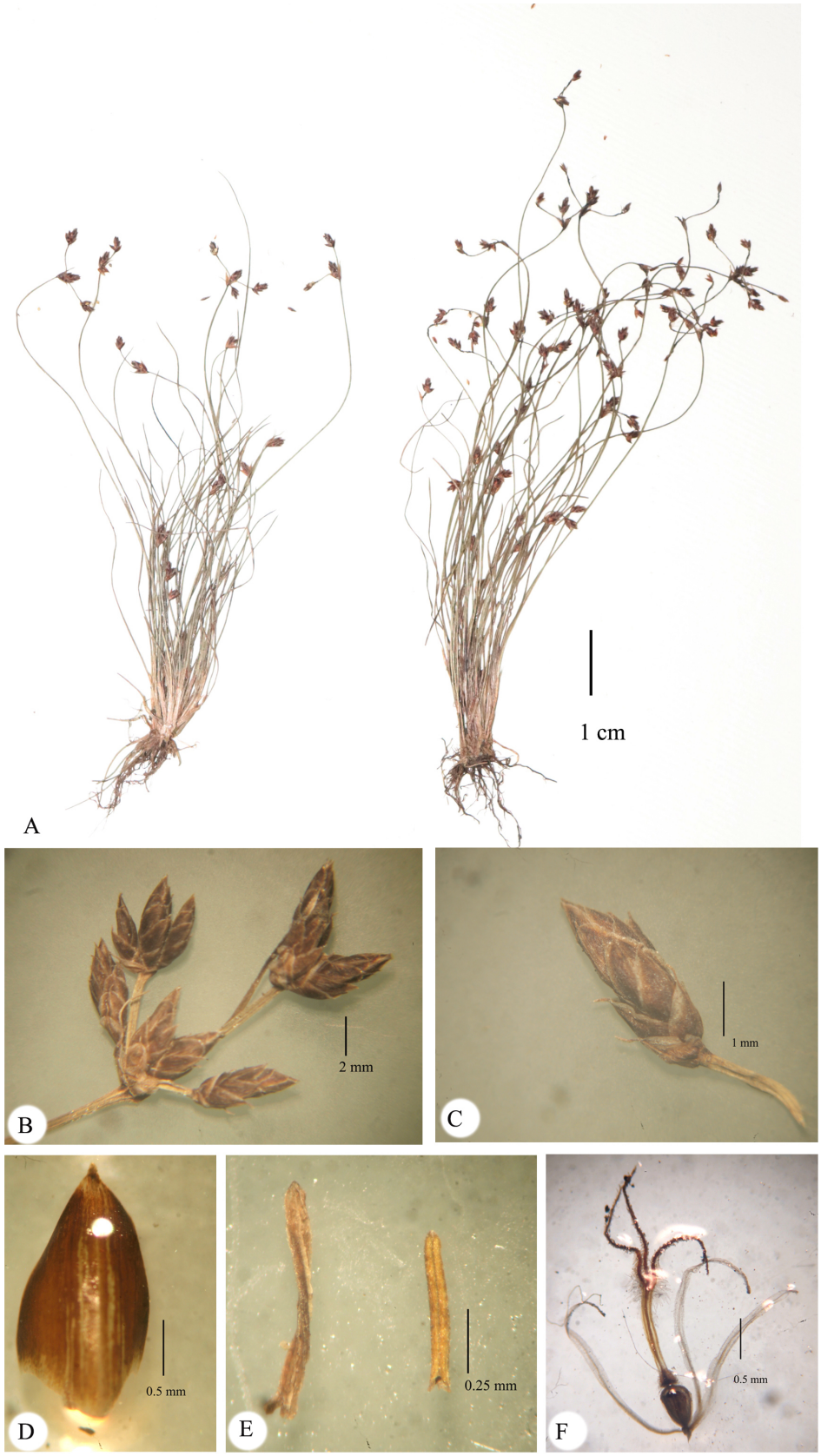

Plate: 43. ***Fimbristylis uliginosa*** Steud.; A - Habit, B - Inflorescence, C - Spikelet, D - Glume, E - Anthers, F - Pistil

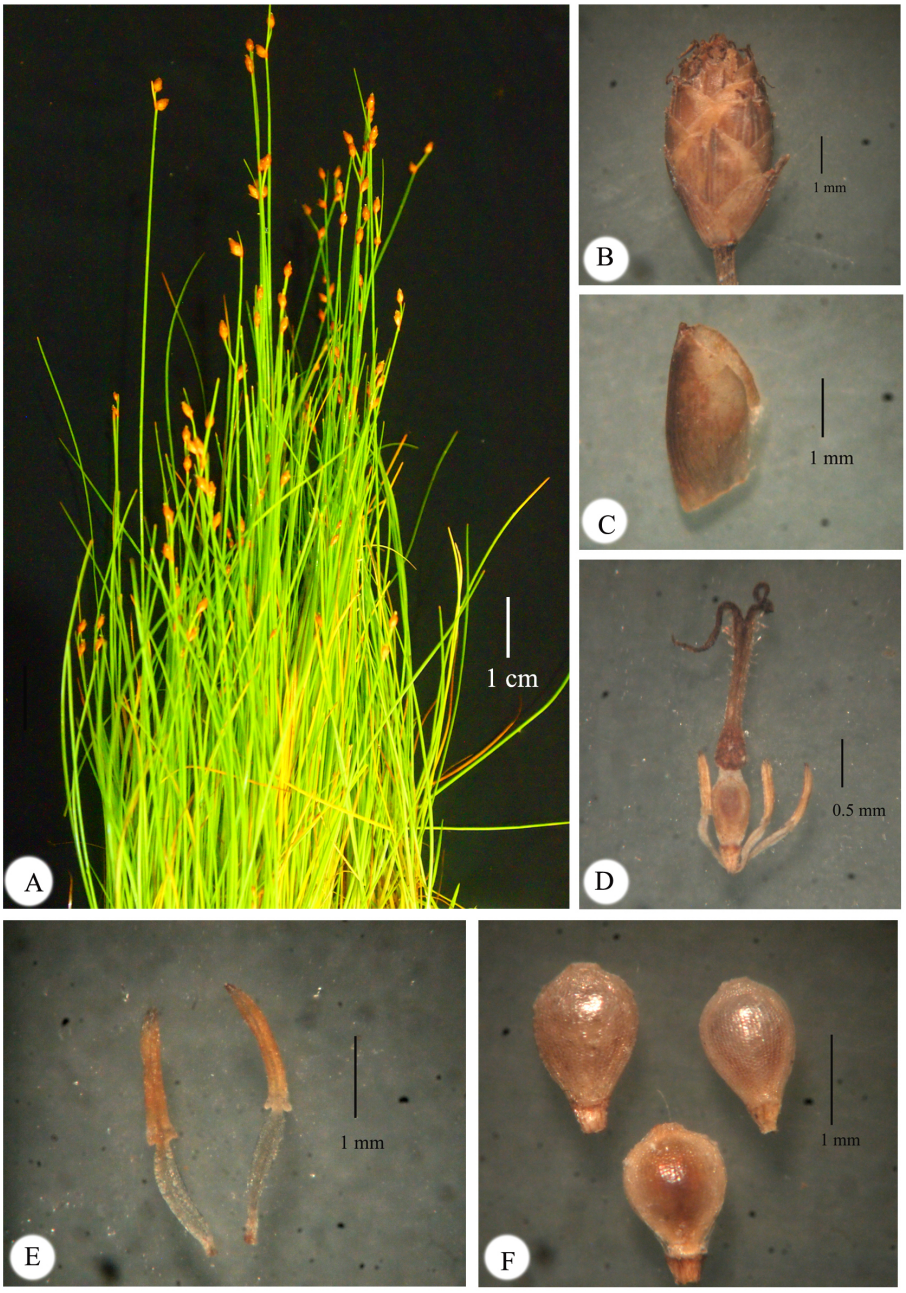

Plate: 36. ***Fimbristylis schoenoides*** (Retz.) Vahl. A - Habit, B - Spikelet, C - Glume, D - Pistil with Satmens, E - Stamens, F - Nuts

Plate 25 B. Lectotype of *Fimbristylis narayanii* Fischer (K000974041 © Royal Botanic Gardens Kew)

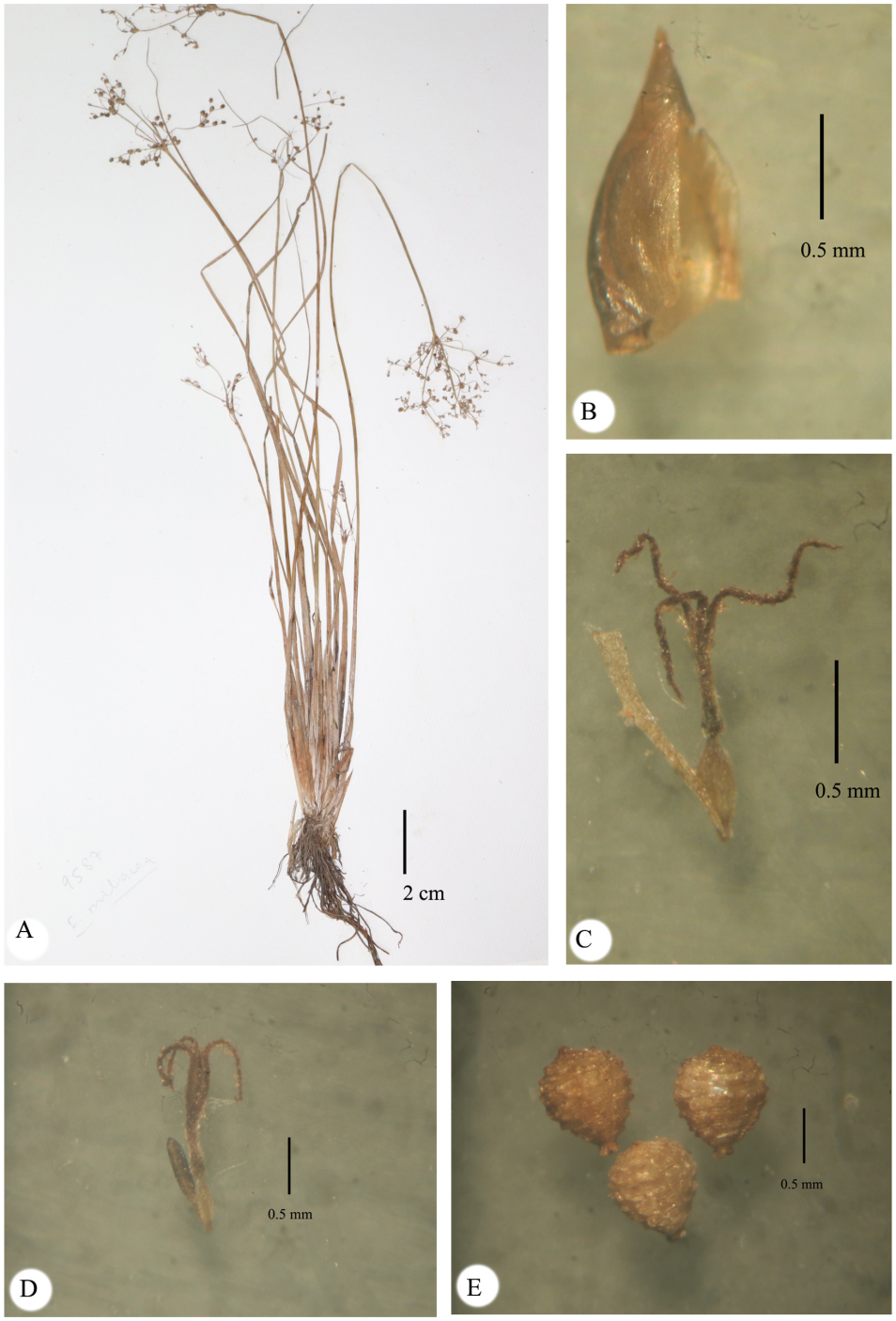

Plate: 33. ***Fimbristylis quinquangularis*** (Vahl) Kunth; A - Habit, B - Glume, C - Pistil with filament, D - Pistil, E - Nuts

Plate: 37. Fibristylis schultzii Boeck; A - Habit, B - Inflorescence, C - Involucral bract, D - Glume, E - Stamens, F - Pistil, G - Nuts

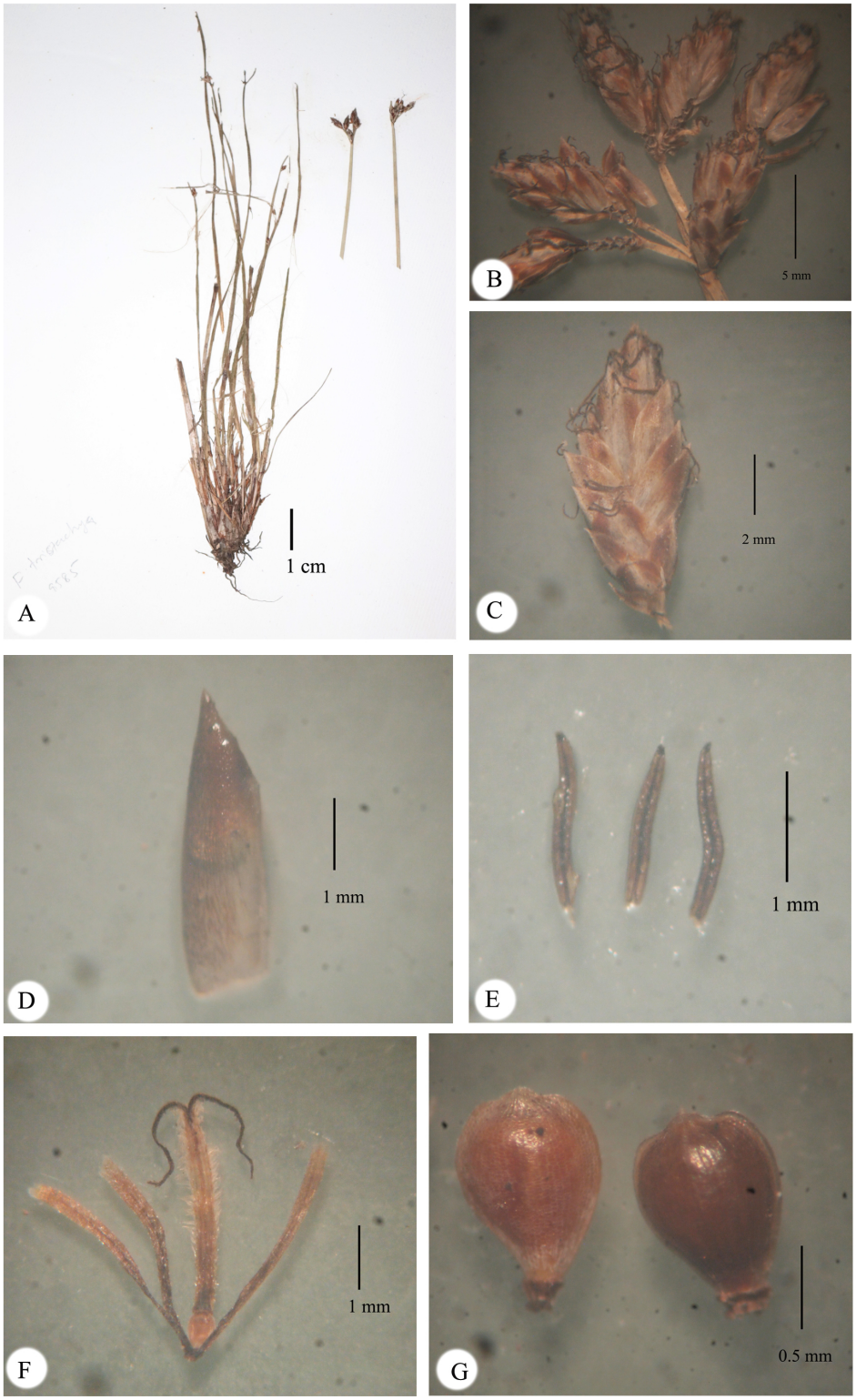

Plate: 42. ***Fimbristylis triflora*** (L.) Schum.; A - Habit, B - Inflorescence, C - Spikelet, D - Glume, E - Anther, F - Pistil, G - Nuts

Plate: 45. ***Fimbristylis zatei*** W. Khan & Chavan D.P.

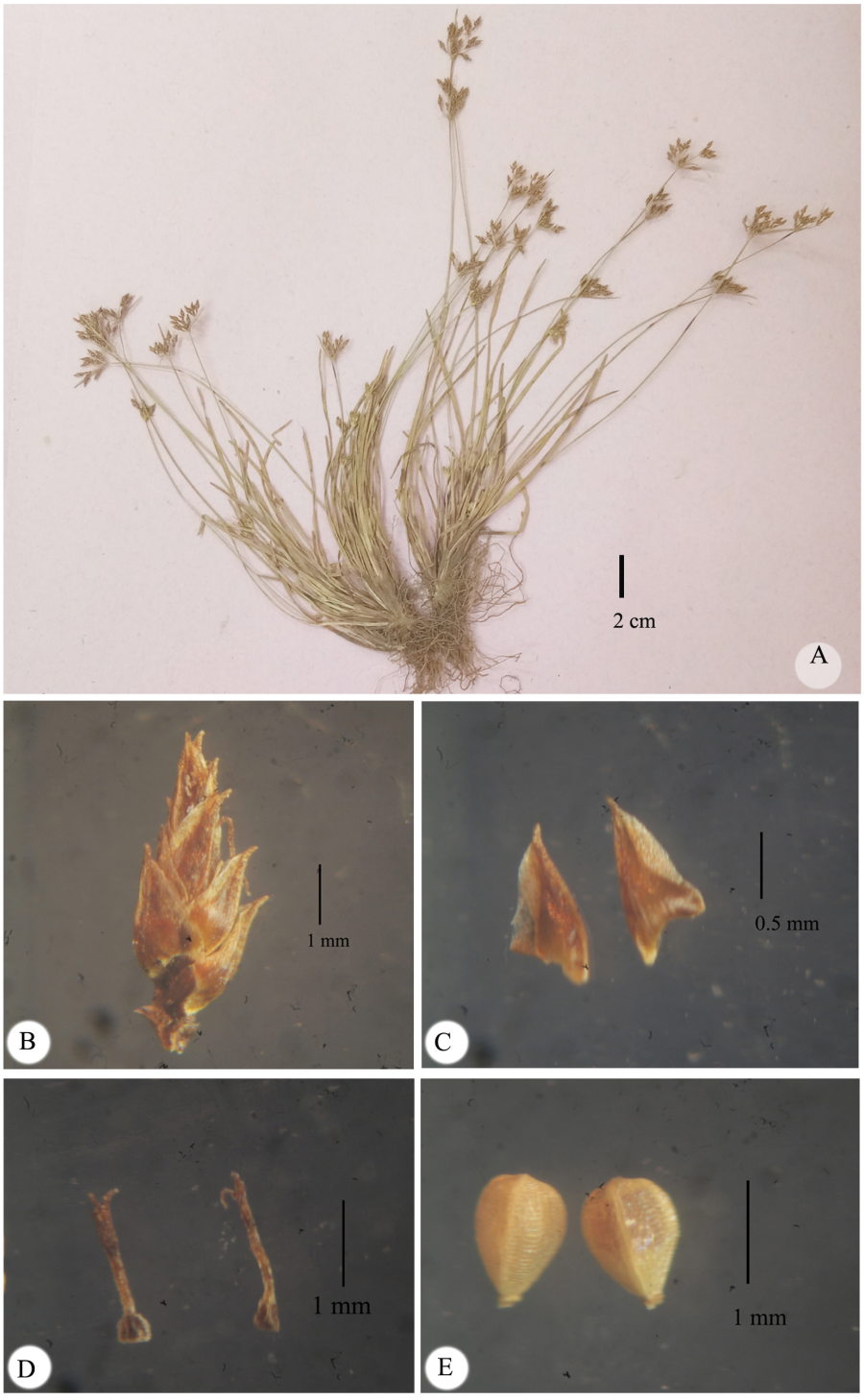

Plate 44. ***Fimbristylis woodrowii*** Clarke. A - Habit, B - Spikelets, C - Glumes, D - Style, E - Nuts

Plate : 5. ***Fimbristylis aphylla*** Steud.; A - habit, B - Spikelet, C - Glume, D - Nut, E - Anther, F - Pistil

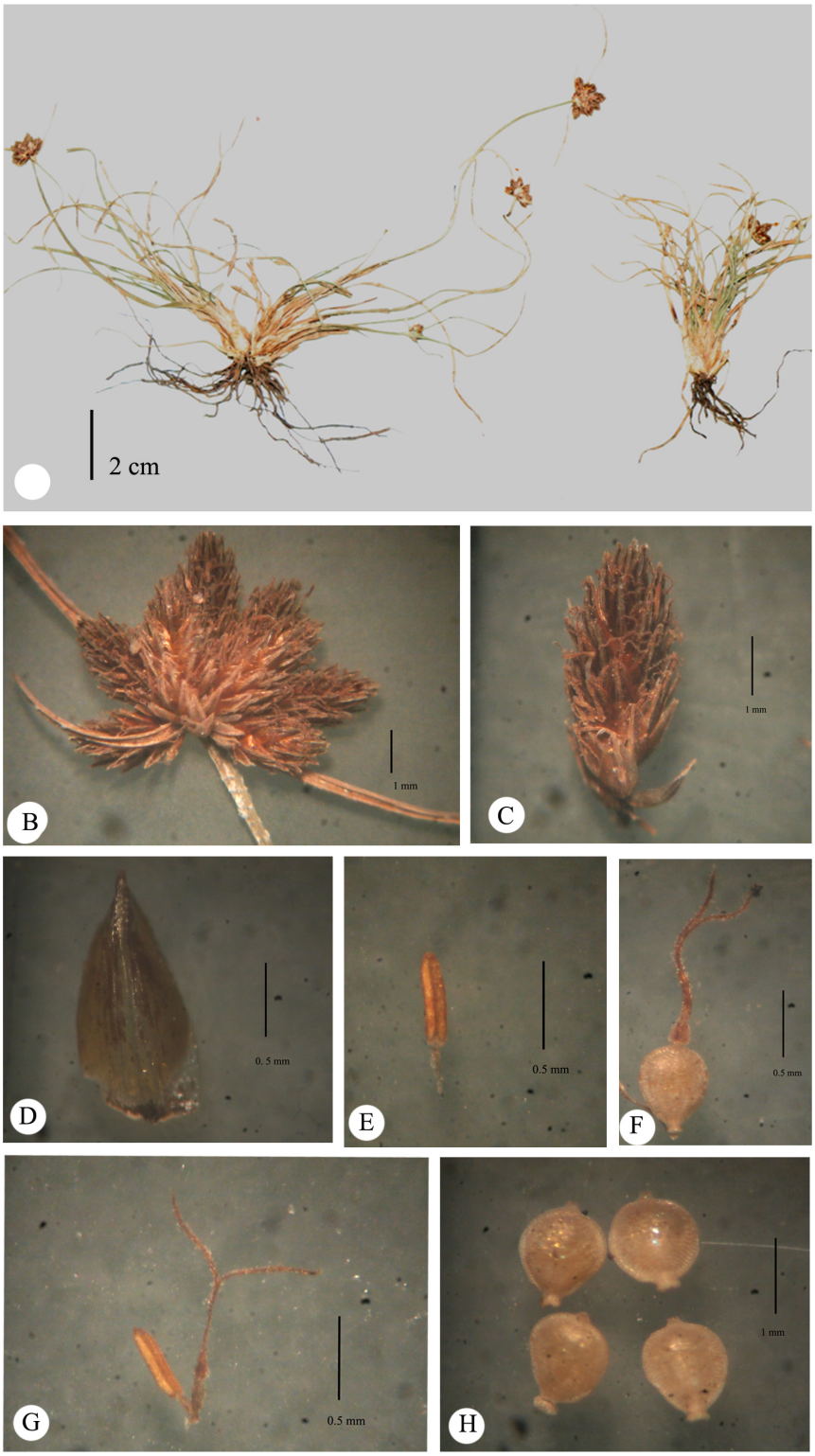

Plate:6. ***Fimbristylis argentea*** (Rottb.) Vahl. A - Habit, B - inflorescence, C - spikelets, D - Glume, E - Stamen, Nut with style, G - Pistil with stamen, H - Nuts.

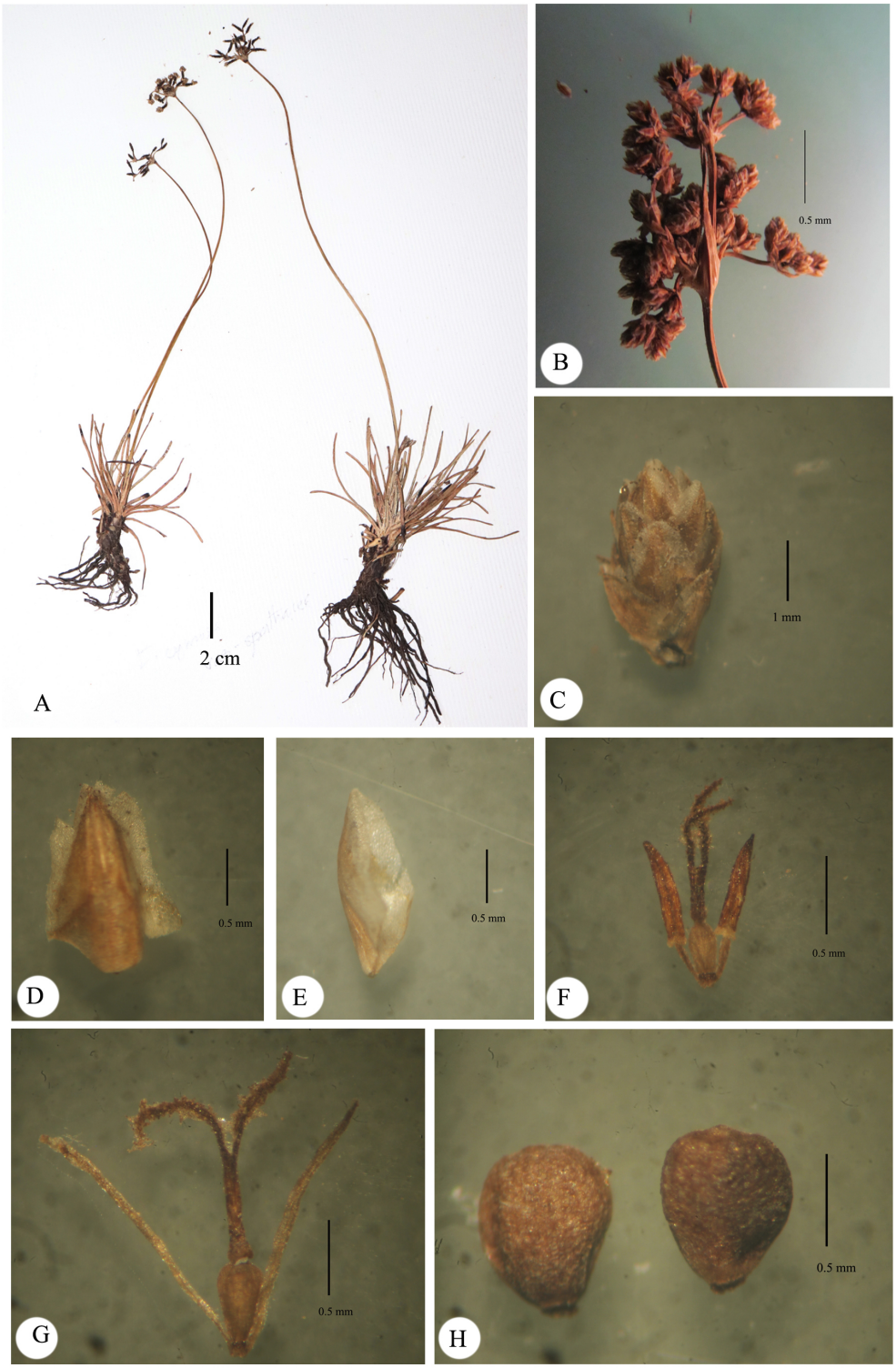

Plate: 12. ***Fimbristylis cymosa var. spathacea*** (Roth) Koyama. A - Habit, B - Inflorescence, C - Spikelets, D & E _ Glumes, F - Psistil with Satmens, G - Pistil with filaments, H - Nuts

Plate: 17. ***Fimbristylis eligulata*** Govind.

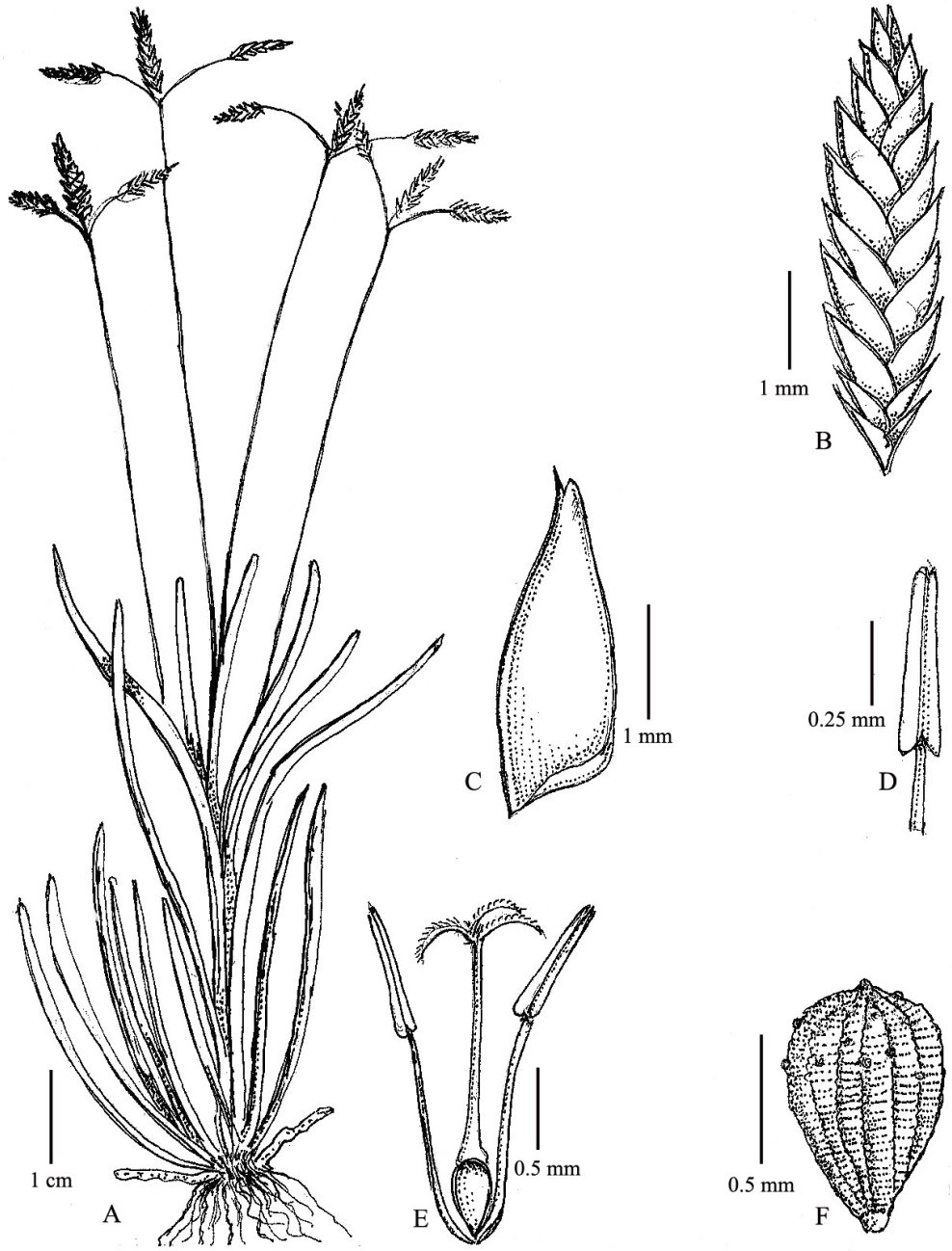

Plate: 25 A. ***Fimbristylis narayanii*** Fischer; A - Habit, B - Spikelet, C - Glume, D - Stamen, E - Pistil with stamens, F - Nut

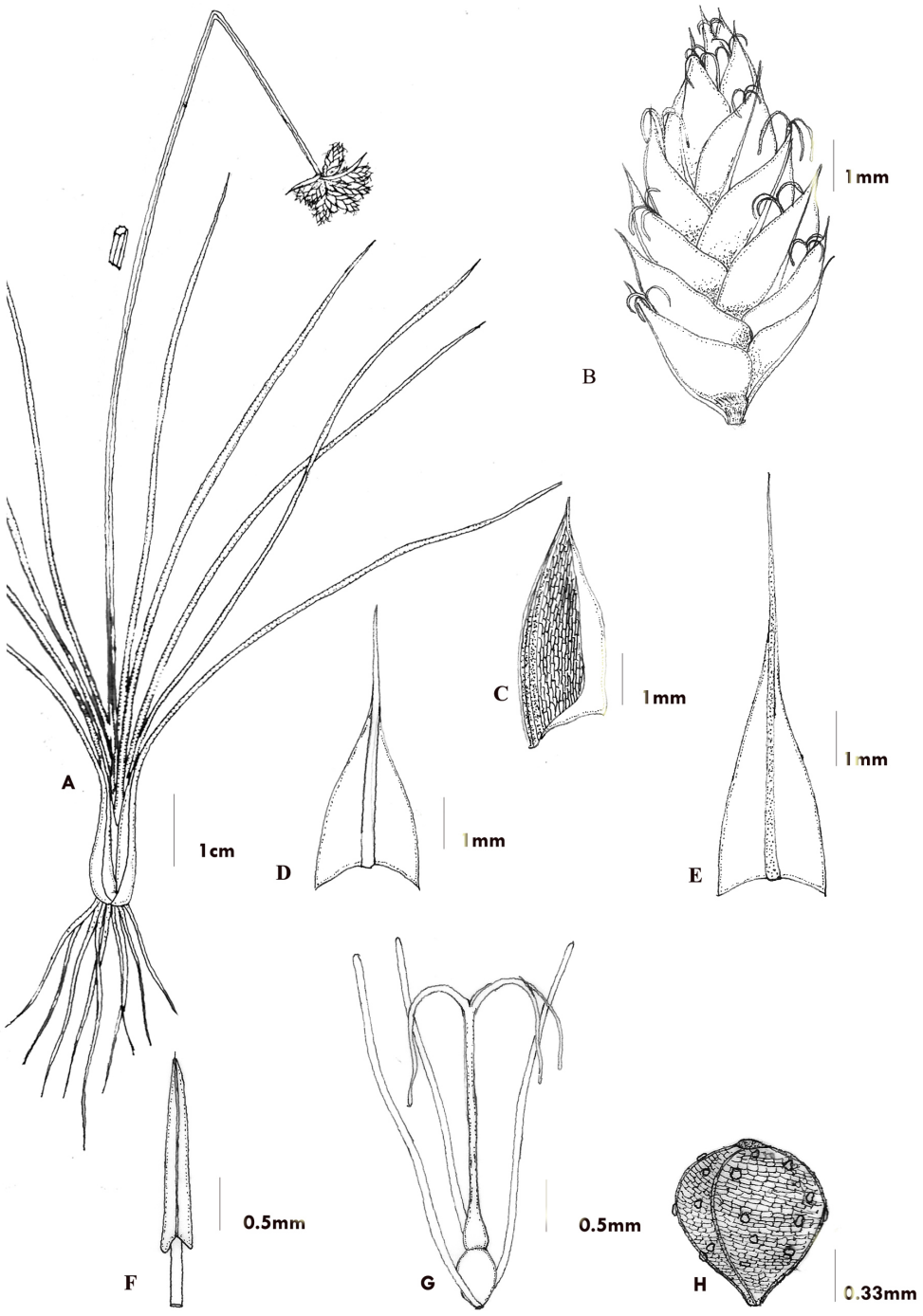

Plate: 37 A. Fibristylis schultzii Boeck.; A -Habit, B - SPikelet, C - Glume, D & E - Involucral bract, F - Stamen, G - Pistil, H - Nut

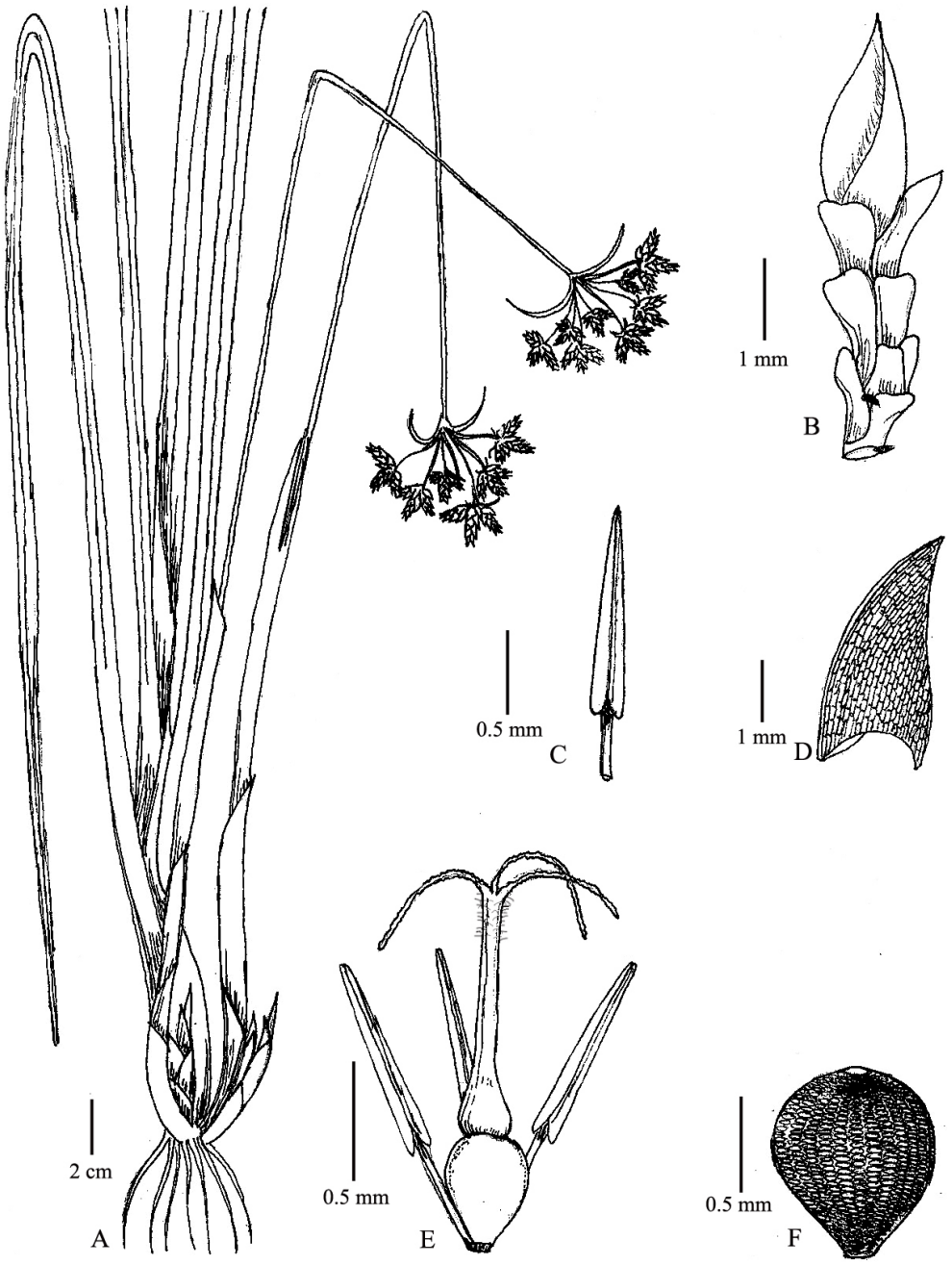

Plate: 4. ***Fimbristylis angamoozhiensis*** Ravi & Anilkumar; A - Habit, B - Spikelet, C - Stamen, D - Glume, E - Pistil with stamens, F - Nut

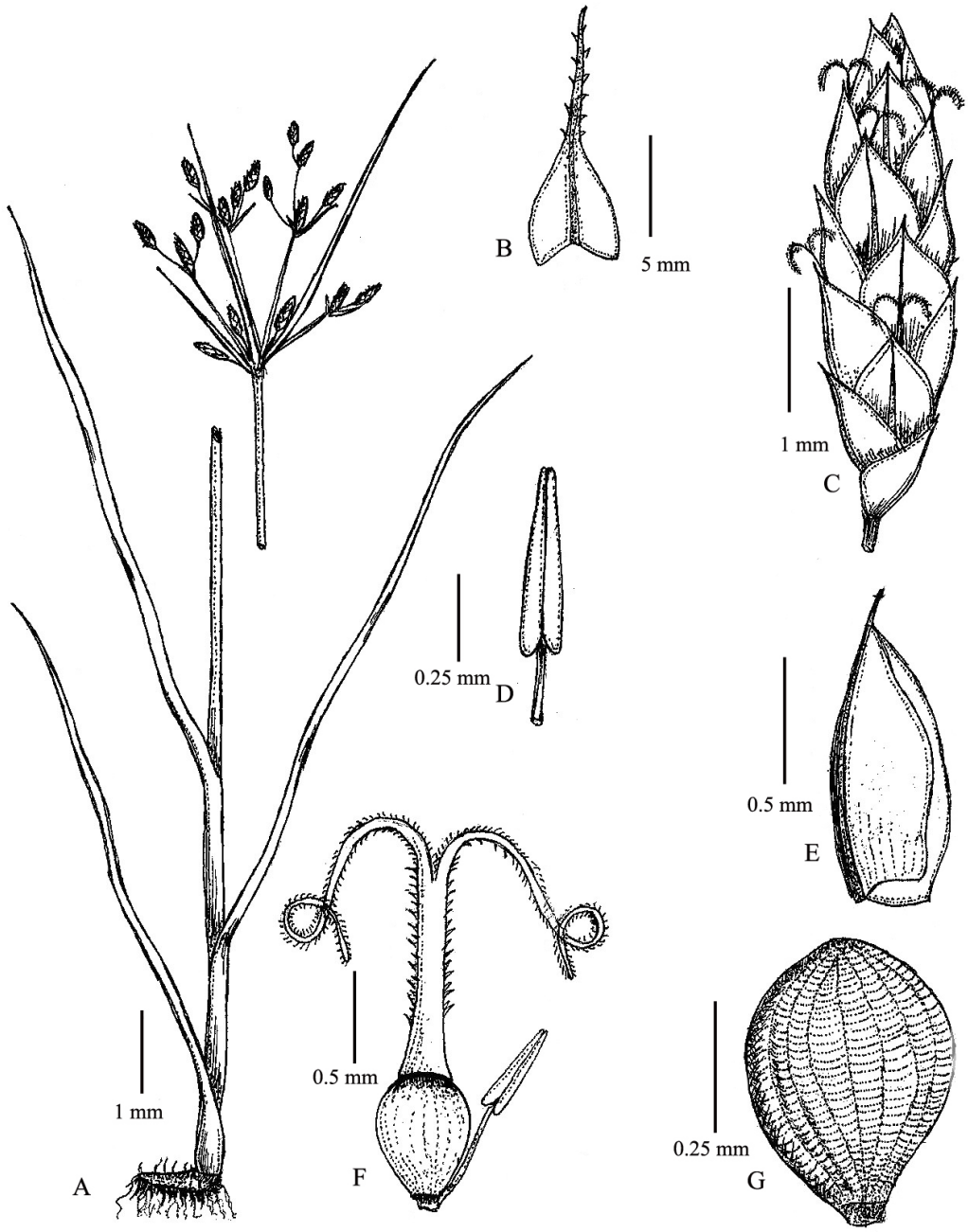

Plate: 8A. ***Fimbristylis bisumbellata*** (Forssk.) Bub.; A - Habit, B - Involucral bract, C - Spikelet, D - Stamen, E - Glume, F - Pistil with stamen, G - Nut

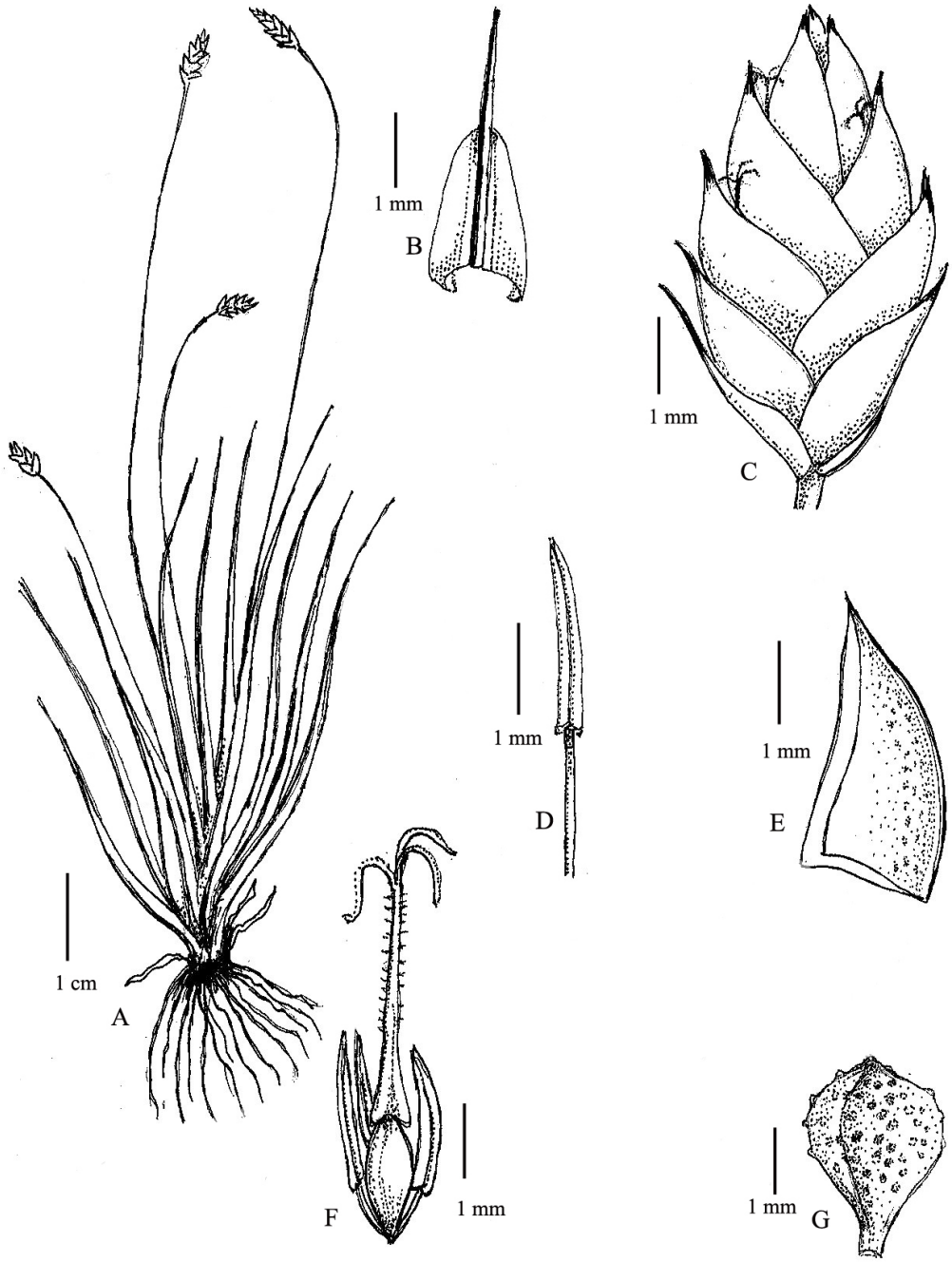

Plate: 26 A. ***Fimbristylis ovata*** (Burm.f.) Kern; A - Habit, B - Involucral bract, C - Spikelet, D - Stamen, E - Glume, F - Pistil with Stamens, G - Nut

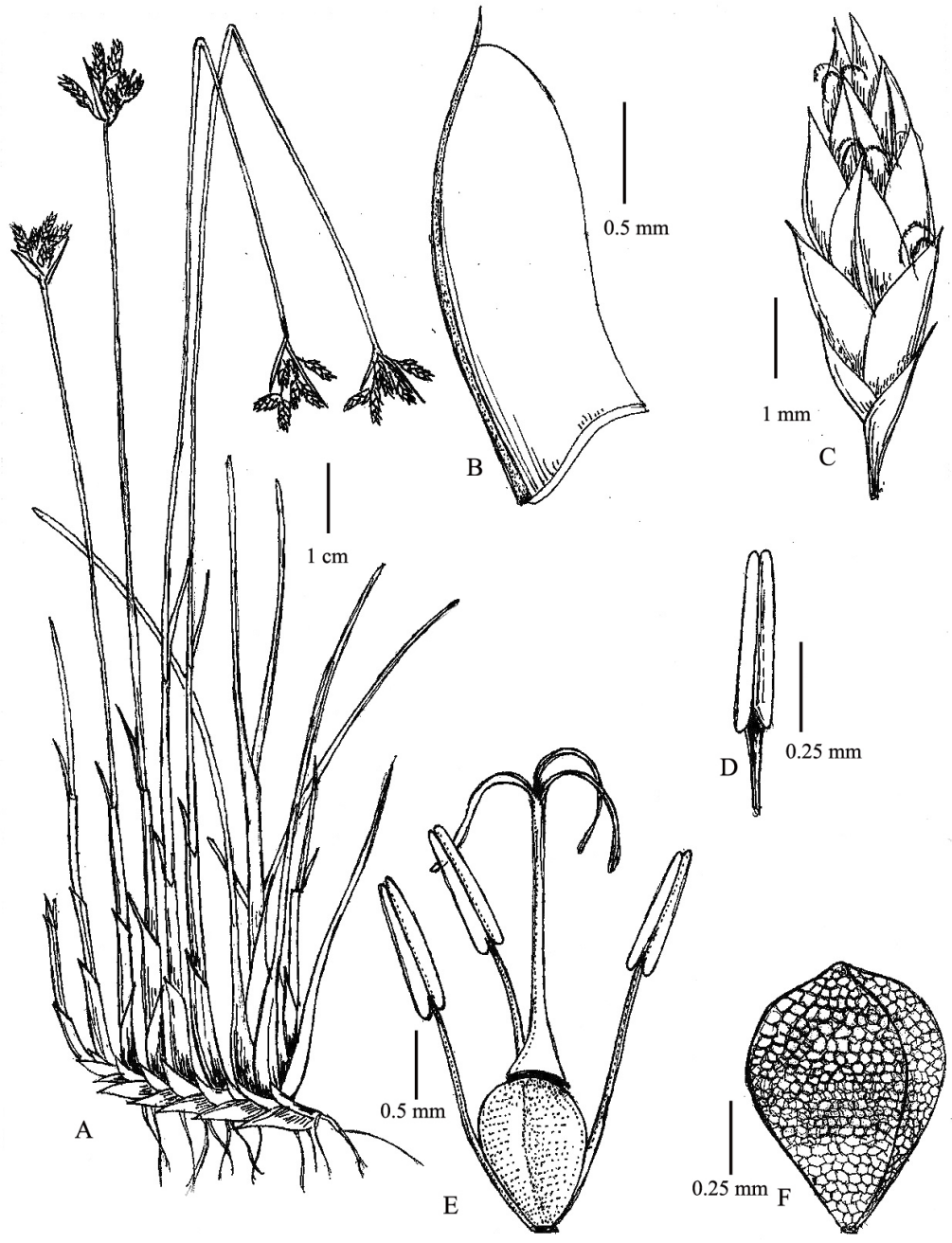

Plate: 28A. ***Fimbristylis pierotii*** Miq.; A - Habit, B - Glume, C - Spikelet, D - Stamen, E - Pistil with Stamens, F - Nut

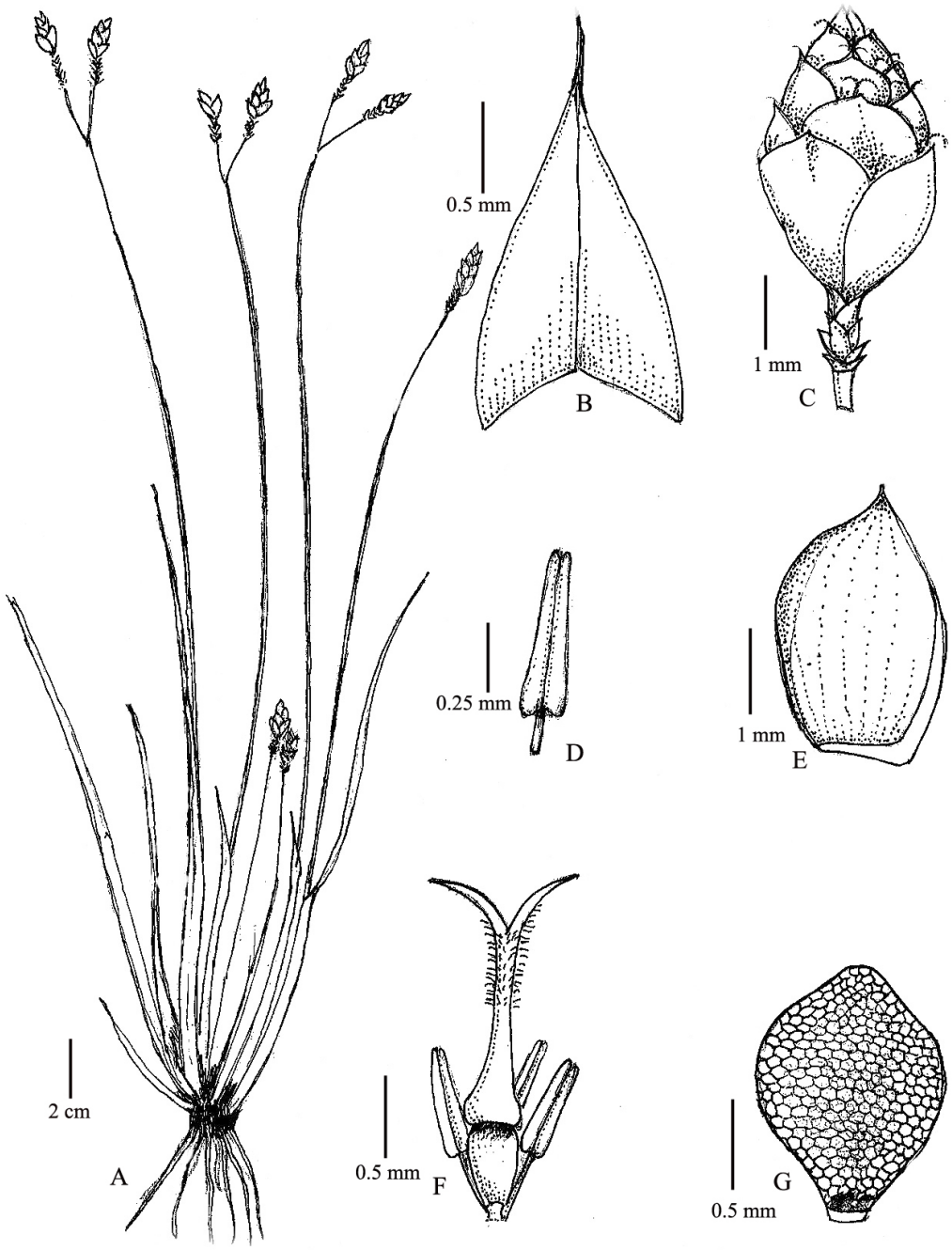

Plate: 29 A. ***Fimbristylis polytrichoides*** (Retz.) R. Br.; A - Habit, B - Involucral bract, C - Spikelet, D - Stamen, E - Glume, F - Pistil with stamens, G - Nut

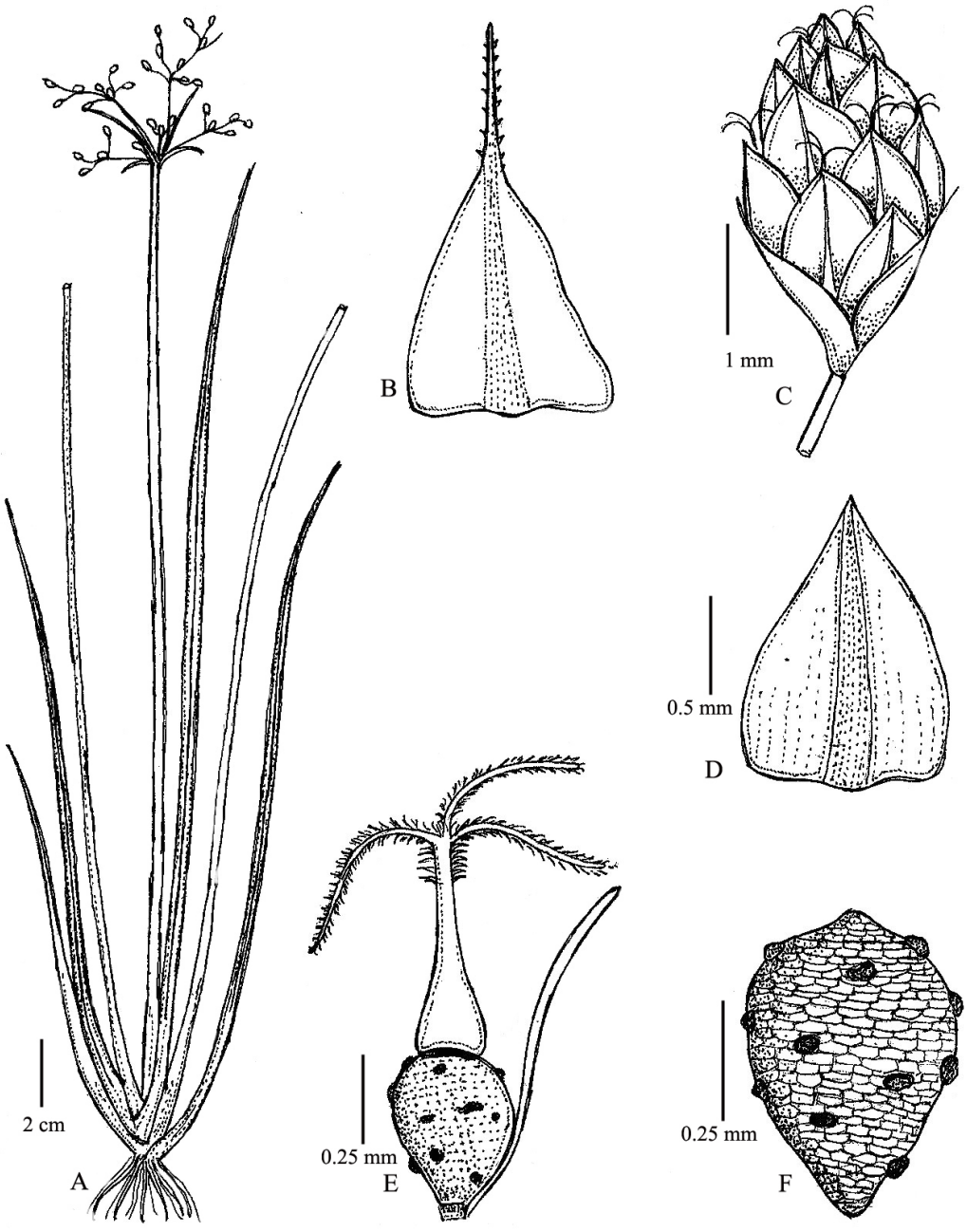

Plate: 33 A. ***Fimbristylis quinquangularis*** (Vahl) Kunth; A - Habit, B - Lower glume, C - Spikelet, D - Glume, E - Pistil, F - Nut

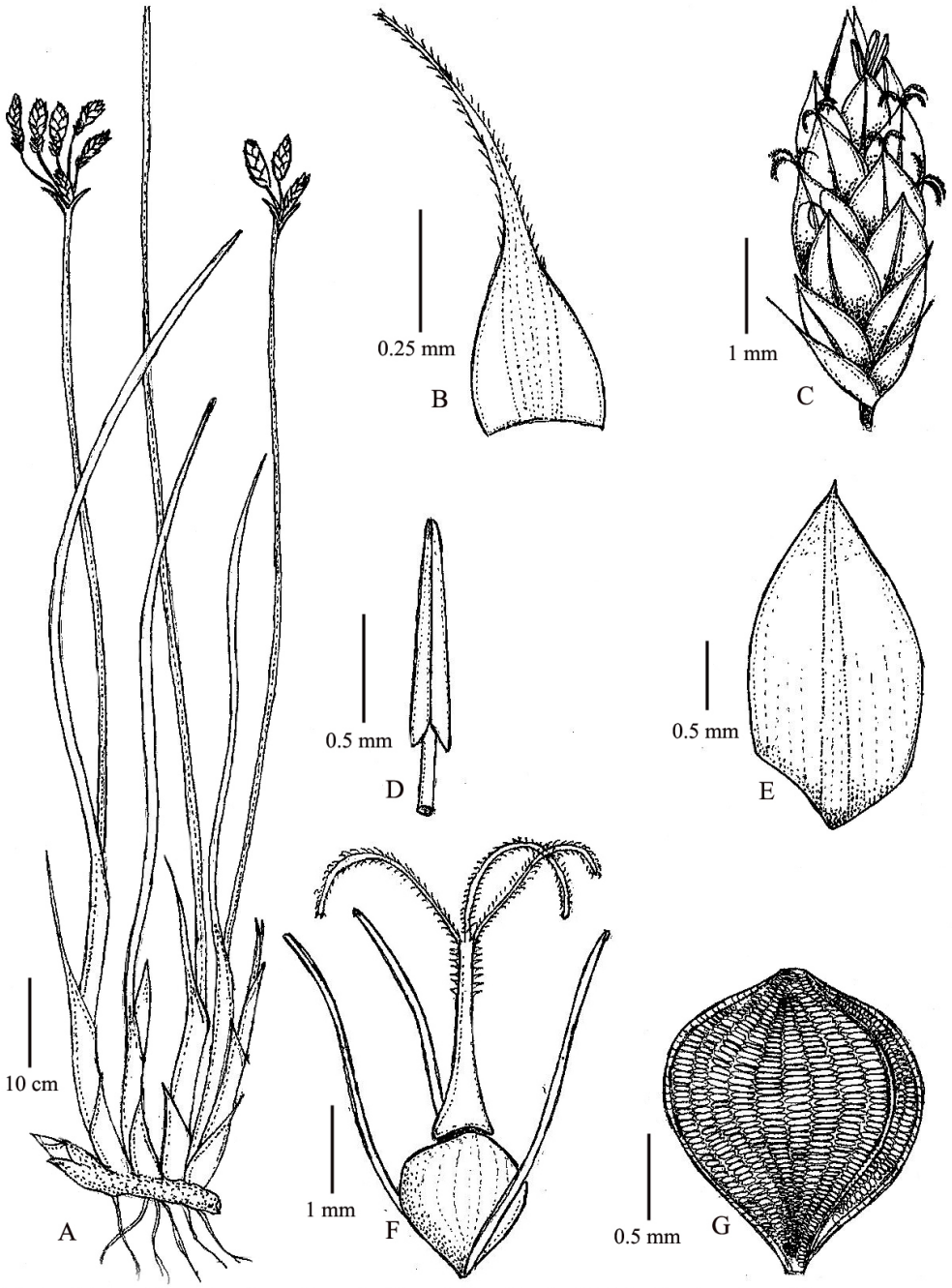

Plate: 34 A. ***Fimbristylis salbundia*** (Nees) Kunth; A - Habit, B - Involucral bract, C - Spikelet, D - Stamen, E - Glume, F - Pistil, G - Nut

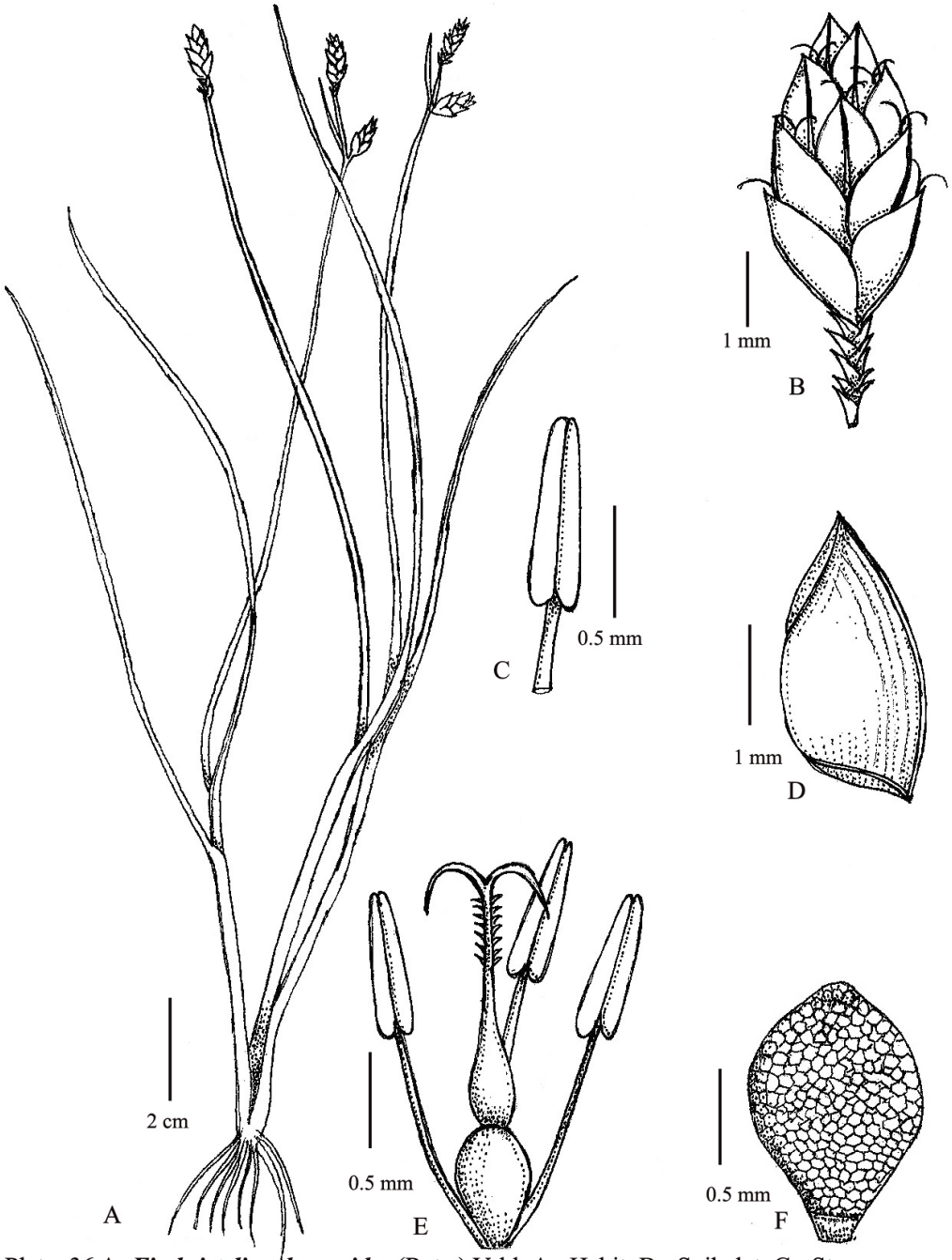

Plate: 36 A. ***Fimbristylis schoenoides*** (Retz.) Vahl; A - Habit, B - Spikelet, C - Stamen, D - Glume, E - Pistil with Stamens, F - Nut.

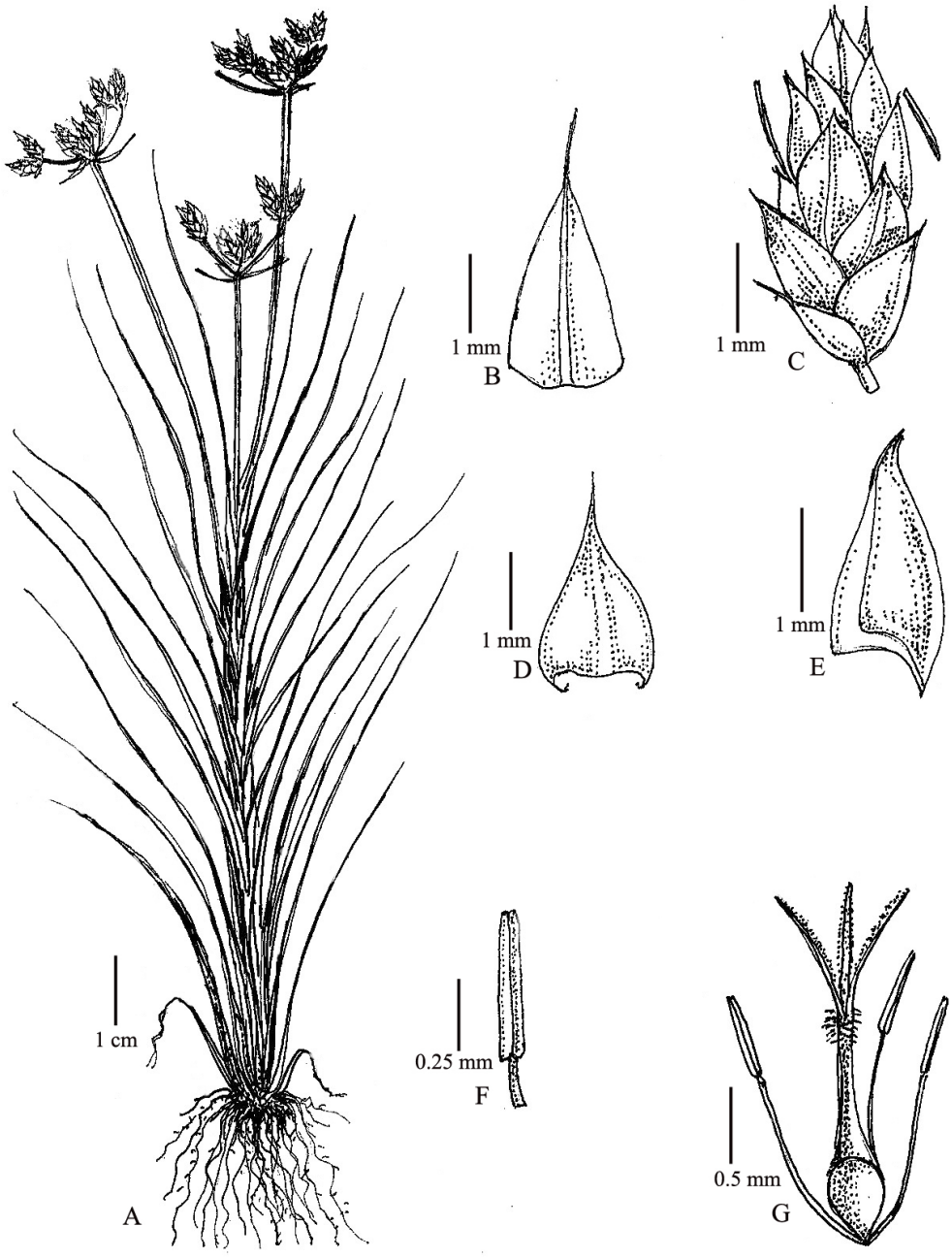

Plate: 43 A. ***Fimbristylis uliginosa*** Steud.; A - Habit, B & D - Lower glumes, C - Spikelet, E - Glume, F - Stamen, G - Pistil with stamens.

6.1. Table No. 1. Distribution, Conservation status and Habitat of *Fimbristylis* Vahl in South India

Sl. no	Name of Species	Distribution	Conservation status	Habitat
1	*Fimbristylis acuminata* Vahl	KL, KA	Least Concern	Marshes, swamps, rice fields and river banks.
2	*Fimbristylis aestivalis* (Retz.) Vahl	KL	-	Streams and ponds, open damp places and swampy areas
3	*Fimbristylis alboviridis* Clarke	KL, KA	Least Concern	Edges of pools, moist and shady places and dry grassland
4	*Fimbristylis angamoozhiensis* Ravi & Anilkumar	KL	-	Open wet areas near forest streams
5	*Fimbristylis aphylla* Steud.	KL, TN, KA	Least Concern	Water lodged areas, marshy area and near paddy fields
6	*Fimbristylis argentea* (Rottb.) Vahl	Kl, TN, KA	Least Concern	Dried out rice fields, waste places and along sea shores
7	*Fimbristylis bispicula* Govind.	KL, KA, AP	-	Wet open grasslands
8	*Fimbristylis bisumbellata* (Forssk.) Bub.	KL, TN, KA, AP	Least Concern	Streams and rivers, along road and common in rice fields.
9	*Fimbristylis cinnamometorum* (Vahl) Kunth	KL, TN, KA, AP	Least Concern	In swamps and marshy areas of dry deciduous forest, wet places of at low altitude
10	*Fimbristylis complanata* (Retz.) Link	KL, TN, KA, AP	Least Concern	Common in moist soil, muddy river banks, swampy grass fields, rice fields and on their margins
11	*Fimbristylis consanguinea* Kunth	KL, KA, TN	Least Concern	Swampy areas and wet grasslands

12	*Fimbristylis cymosa* var. *spathacea* (Roth) Koyama	KL, TN, KA	-	Usually seen in sandy areas near sea shores, river beds and marshy low lands.
13	*Fimbristylis dichotoma* (L.) Vahl	KL, TN, KA, AP	Least Concern	Rice fields, river banks and wet grasslands
14	*Fimbristylis dimorphonucifera* Govind.	KL, TN, KA	-	Marshy soil and wet habitats
15	*Fimbristylis dispacea* (Rottb.) Clarke	TN, AP	-	Occasional in Muddy areas of lake sides, river banks, wet rice fields, open marshy areas and wet sandy areas at low altitude
16	*Fimbristylis dura* (Zoll. & Moritz.) Merr.	KL, TN, AP	-	Along the margins of water courses
17	*Fimbristylis eligulata* Govind.	TN, AP	-	Along the shores, sandy banks of the back water river, wet grass lands
18	*Fimbristylis eragrostis* (Nees & Mey. Ex Nees) Hance	KL, KA,AP	-	Near forest streams and wet grasslands.
19	*Fimbristylis falcata* (Vahl) Kunth	KL,KA,AP	-	Occasional in open grass lands, wet rocky localities, slopes of hills, moist humus soil, sandy areas on hills
20	*Fimbristylis ferruginea* (L.) Vahl	KL,TN,KA	Least Concern	Grows in wet and marshy places, especially with sandy or clayish soil, shallow water and in brackish water near the sea and also grows in river and lake sides
21	*Fimbristylis fusca* (Nees) Clarke	AP	-	In open rather dry to wet grasslands
22	*Fimbristylis lawiana* (Boeck.) Kern	KA	Least Concern	Common in open grasslands, rice field and among grasses on hill slopes

23	*Fimbristylis ligulata* Govind.	KA		Semi-wet marshes and wet open grasslands
24	*Fimbristylis microcarya* F. V. Muell	KL, KA, AP	Least Concern	Common in open lands near the river, margins of lakes, and open grass lands
25	*Fimbristylis narayanii* Fischer	KL, KA	-	Moist rocky slopes
26	*Fimbristylis ovata* (Burm.f.) Kern	KL, TN, KA, AP	Least Concern	A common wide spread species found in sunny or partly shaded grasslands, shady places along roadsides, on rocks of beach sides, buds of cultivated fields and edges of pools and streams
27	*Fimbristylis paupercula* Boeck.	TN		River bank, moist grassland and wet cultivated land.
28	*Fimbristylis pierotii* Miq.	KL	-	In open moist grasslands in hilly area
29	*Fimbristylis polytrichoides* (Retz.) R. Br.	KL, TN, KA	Least Concern	Found in Marshes, wet hollows, ditches on saline mud or sandy soil near to the coast
30	*Fimbristylis pseudomicrocarya* Govind.	KL, KA, AP	-	Common in grasslands
31	*Fimbristylis pseudonarayanii* Ravi & Anilkumar	KL	-	Moist places in hilly areas
32	*Fimbristylis pubisquama* Kern	KL		In open grasslands, along margins of water course, coastal sandy soil
33	*Fimbristylis quinquangularis* (Vahl) Kunth	KL,TN,KA,AP	Least Concern	Rice field and wet roadsides

34	*Fimbristylis salbundia* (Nees) Kunth	KL	-	Growing in wet open places, marshes, swamps and grasslands, usually found in high altitudes
35	*Fimbristylis sanjappae* W. Khan, Chavan & Solanke	KL, TN, KA	-	Common in wet grass lands, hills lopes and around agriculture land
36	*Fimbristylis schoenoides* (Retz.) Vahl.	KL KA,TN,KA	Least Concern	Common in grass lands, open areas in forest, rice fields and edges of tanks and canals
37	*Fibristylis schultzii* Boeck.	KL	-	In wet grasslands
38	*Fimbristylis simpsonii* Parasad & Singh	KA	-	Growing in rocky slopes near river lets
39	*Fimbristylis subdura* Ohwi	TN		Swampy grass field and wet rice fields
40	*Fimbristylis tenera* Roem & Schult.	KL,KA,AP	-	Among grasses in sandy soil, along road sides
41	*Fimbristylis tetragona* R. Br. Prodr.	KL, KA, AP	Least Concern	In open wet places, swampy grasslands, wet rice fields, near streams, marshes and swamps, mossy base of rocky river beds, along with shot grass in wet soil
42	*Fimbristylis triflora* (L.) Schum. ex Engler	KL,TN, AP	-	Saline swamp and in shallow lakes
43	*Fimbristylis uliginosa* Steud.	KL, TN, AP	-	Near the streams and moist open areas of hill stations
44	*Fimbristylis woodrowii* Clarke	KL,KA	-	Among grasses in open areas, river beds, rocky crevices, cultivated fields and roadsides
45	*Fimbristylis zatei* W. Khan & Chavan D.P.	KL	-	Marshes along road sides

Publications based on data presented in thesis

1. **Anoop, K. P**., R. Prakashkumar, P. V. Madhusoodanan. 2018. New distribution record of *Fimbristylis bispicula* Govind. for Kerala, India. International Journal of Science and Research 7(9):

2. **Anoop K.P.**, R. Prakshkumar, P.V. Madhusoodanan and R. Ansari 2015. Conservation of RET aquatic plants of South India at MBGIPS, Kozhikode, Kerala. *Proceedings of Gregor Mendel Foundation 342 – 346.*

Other publications authored and co-authored

1. **Anoop, K.P**. and Rajan, P.P. 2010. Evaluation of plant extracts against *Phytophthora capsicii*, the foot rot pathogen of black pepper., *Proc. Ind. Phytopathological Society,*

2. Swapana, M.M., Prakashkumar, R., **Anoop, K.P**., Manju, C.N. and Ranjith, N.P. 2011. A review on the medicinal and edible aspects of aquatic and wetland plants of India. *Journal of Medicinal Plant Research 5(33): 7163-7176*

3. Manju, C.N., Prajitha, B., Rajilesh, V.K., **Anoop, K.P**. and R. Prakashkumar 2012. *Trichosteleum stigmosum* Mitt (Sematophyllaceae) from Silent Valley National Park, a new record for India; *Taiwania, 57(2): 222-224.*

4. Swapna, M.M. Swapna, V.K. Rajilesh, **K.P. Anoop**, R. Ansari and R. Prakashkumar. V.K. Rajilesh, K.P. Anoop, R. Ansari and R. Prakashkumar.Florostic Analysis of the wetlands of Wayanad district, Kerala, South India. *J. Econ. Taxon. Bot. Vol. 36 No.2, 2012.* (ISSN: 0250-9768)

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Papers presented

1. **Anoop, K.P**., R. Prakashkumar, Rajilesh V.K., P.V. Madhusoodanan, R. Ansari.2017 *Fimbristylis schultzii* (*Cyperaceae*) from Agasthyamala biosphere reserve Kerala, a new record for India. *Gregor Mendel Foundation national seminar, University of Kerala, Kariavattom, Thiruvananthapuram.*

2. **Anoop, K. P**., R. Prakashkumar and P. V. Madhusoodanan 2016. New distribution record of *Fimbristylis pierotii* Miq. for Peninsular India. U.G.C. sponsored national seminar, St. Mary's College, Wayanad.