Taxonomic Studies on Eragrostidinae (Poaceae: Chloridoideae: Eragrostideae) in Peninsular India

Thesis submitted to the
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DOCTOR OF PHILOSOPHY

IN

BOTANY

by

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Certificate

This is to certify that the thesis entitled **Taxonomic Studies on Eragrostidinae (Poaceae: Chloridoideae: Eragrostideae) in Peninsular India,** submitted to the University of Calicut by Mrs. Thoiba Kottekkattu, in partial fulfillment of the award of the degree of Doctor of Philosophy in Botany is a *bona fide* record of the research work carried out by her under my supervision and guidance. No part of the present work as formed the basis for the award of any other degree or diploma previously.

Calicut University
24th October 2018

Dr. A.K. Pradeep
(Supervising Teacher)

Declaration

The thesis entitled **Taxonomic Studies on Eragrostidinae (Poaceae: Chloridoideae: Eragrostideae) in Peninsular India,** submitted by me in partial fulfillment of the requirement for the award of the degree of Doctor of Philosophy in Botany of the University of Calicut is an original research work carried out by me in the Department of Botany, University of Calicut. No part of the work formed the basis for the award of any other degree or diploma of any University.

Calicut University
24th October 2018

Thoiba Kottekkattu

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Thoiba Kottekkattu

Contents

Chapter 1

Introduction

Chapter 1 Introduction

Grasses inhabit the earth in greater abundance than any comparable group of plants. In earlier days the word "grass" was used for any kind of herbage browsed by horses, cattle, and sheep. Today it has been narrowed in meaning to cover specifically the members of the plant family Gramineae (Gould, 1968; Moore, 1960). The grasses (Poaceae or Gramineae) are a very natural and distinctive family of flowering plants with remarkable diversity. Of all the flowering plants, they are the most successful in many ways. This success in competition for dominance may be attributed to the fact that they are wind pollinated. They diverge from all other families, particularly in the characters of their embryos, seeds, and fruits (Bews, 1929). The amazing diversity of shapes, sizes, texture and so on in the various parts that make up the vegetative and the reproductive shoot is alike the appreciation and exasperation of the taxonomist (Bor, 1960). Succinctly, the vegetative morphological resemblance and minute flowers of grasses may pose difficulties for the beginners to readily distinguish them one another. In truth, the recognition of even our common grasses is quite a task for botanists.

On account of their universal distribution and their great economic value grasses are of great importance to man. The grasses growing in pasture land and the cereals grown all over the world are of more value to man and his domestic animals than all the other plants taken together (Achariyar & Mudaliyar, 1921). The grass family occupies 23% of the land area of the world playing a significant role in the life of human beings and animals, and has a paramount role as a food provider, accounting for more than 80% of World's calories (FAOSTAT, 1999). The grasses furnish the principal breadstuffs of the World and a large part of the food of domestic animals; they are also used in the industrial arts and extensively as greensward and ornamentals in parks and gardens. In fact, the most important food plants for the human race are the cereals, including rice, wheat, corn (maize), barley, rye, oats and many kinds of grain

sorghums. This economic significance matched by an ecological dominance as grass cover about one fifth of the earth (Hitchcock, 1950; Shantz, 1954). Besides, several grasses are familiar for their rich fodder value and utility for controlling soil erosion. Some of them also can be used as good thatching material and also provide major raw materials for paper and alcohol industries (Kabeer & Nair, 2009).

By any reckoning, grasses undoubtedly form the most fascinating family of flowering plants, exceeding all others in their paramount uses, variety and value of their product, and in number of genera, behind Compositae, Leguminosae, Orchidaceae and Rubiaceae. Despite accelerated research on grasses, much remains to be discovered about this extremely versatile family comprising worldwide over 768 genera and about 11506 species ranging in size from our humble *Poa annua* to the arboreal giant such as *Dendrocalamus* amongst the bamboos of the tropics (Good, 1953; Clayton & Renvoize, 1986; Soreng *et al.,* 2017). Unlike other large families of angiosperms, grasses are rather uniformly distributed on all continents and in all climatic zones. In Arctic regions they often have more species than any other family, and in Antarctic they are included in the small number of species of flowering plants which inhabit that ice-covered region (Tzvelev, 1989). Almost the third of the species are concentrated in 10 largest genera (viz., *Agrostis, Aristida, Calamagrostis, Digitaria, Eragrostis, Festuca, Panicum, Paspalam, Poa* and *Stipa*), each with 200 or more species. With the few highly significant exceptions, the genera of family Poaceae are very homogeneous (Watson & Dallwitz, 1994).

The subfamily Chloridoideae (Eragrostoideae) has rather wide distribution in the tropical and sub tropical regions of the world. Geographical and taxonomic evidence indicates that it may have originated in Africa at least as early as the Oligocene (Hartley & Slater, 1960). This subfamily is floristically and agronomically important worldwide; most species of Chloridoideae grow open habitats with poor soils, and many occur in ruderal sites, city sidewalks, road sides (Clayton & Renvoize, 1986; Van den Borre & Watson, 1997), and their distribution exhibits wide altitudinal gradients from

sea level to 4000 m, and a broad variation in humidity and saline conditions from pluvial environments to xeric habitats (Giraldo-Canas *et al.,* 2012). Despite, the Chloridoideae have appeared monophyletic in all molecular studies; now, the classification within the subfamily has been controversial (Hilu & Alice, 2000; Peterson *et al.,* 2010, 2011; Soreng *et al.,* 2015).

The tribe *Eragrostideae* in the subfamily Chloridoideae includes approximately 80 genera and 1000 species or about one-tenth of all grasses. Within the *Eragrostideae* there is considerable variation in morphology, anatomy, and cytology. It is difficult, if not impossible to select diagnostic characteristics that exclusively delimit the *Eragrostideae* from other tribes in the Chloridoideae. However, the subtribe *Eragrostidinae* is of particular interest because it is well represented in Peninsular India with great percentage of endemism, and also appears to be the most diverse and taxonomically most difficult. The subtribe *Eragrostidinae* is charecterized by having hairy or glabrous culm nodes; short basal microhair cells (15–75 µm) on the abaxial epidermis of the leaf blade; hairy or glabrous rachillas; spikelets that are laterally compressed or terete; lower glumes 1–5-nerved; upper glumes 1–9-nerved shorter than or about the same length as the lower lemma; rachilla pronounced between the florets; florets 2–60 per spikelet usually with sterile florets (occasionally absent in *Eragrostis*); lemma apices that are entire; lemmas that are awnless, mucronate, or short-awned; glabrous or scabrous lemmas that are (1–) 3–9-nerved and hyaline, membranous, chartaceous, coriaceous, or indurate; paleas that are hyaline membranous or chartaceous; lodicules that are truncate, rounded, or acuminate; and true caryopsis with an adnate pericarp (Peterson *et al.,* 1995, 1997; Giraldo-Canas *et al.,* 2012).

In the last couple of years, a clear picture has formed of the phylogenetic analysis of the subtribe *Eragrostidinae*. Among the *Eragrostidinae*, the 15 genera and approximately 496 species present worldwide, roughly 8 genera 84 species and 16 varieties are reported from India. Within *Eragrostidinae*, the genus *Eragrostis* shows the maximum delineation. At present, the subtribe *Eragrostidinae* is represented by 7

genera (*Dinebra, Disakisperma, Eragrostiella, Eragrostis, Neyraudia, Trigonochloa,* and *Tripogon*) and 69 species and 7 varieties, forming the largest subtribe of the subfamily Chloridoideae in Peninsular India. Which are primarily distributed in sea level to high altitudes mountains. A study of character correlation in the subtribe shows that a number of general groups can be recognized, though these are too indefinite to warrant formal recognition.

The subtribe shows the greater percentage of endemism with 23 (35.38 %) out of the 69 Peninsular Indian taxa are endemic. In fact, the genus *Tripogon* soley manifests the 62.5 % of endemism in Peninsular India. Many of the Peninsular Indian taxa are rare and lack proper evidence to have prevailing distribution in their proper habitats. In spite of greater diversity, high degree of endemism and rarity of a few taxa, the subtribe has been largely neglected taxonomically in Peninsular India, with not much work carried out on it.

In Poaceae, *Eragrostidinae* represent one of the most diverse subtribes in India. Subsequent to Hooker's (1896) treatment in *Flora of British India*, the only significant work was Bor's (1960) treatment on *The Grasses of Burma, Ceylon, India and Pakistan*. But, there has been no taxonomic treatment specifically dealing with *Eragrostidinae* in Peninsular India. However, a few scattered publications describing several new taxa and distributional reports from this region are available (Sreekumar & Nair, 1991; Pradeep & Sunil, 1999; Sunil & Pradeep, 2001; Vivek *et al.,* 2012, 2013). A survey of literature reflects that *Eragrostidinae* is poorly studied and an extensive exploration in Peninsular India may certainly lead to the discovery of hitherto undescribed taxa. In addition, monitoring of rare, endemic species and their habitat diversity of the subtribe *Eragrostidinae* in Peninsular India is urgently needed. The current work aims to prepare an illustrated taxonomic account of species and infraspecific diversity of the subtribe *Eragrostidinae* in Peninsular India.

The present study aims at the following objectives.

1. Exploration of entire Peninsular India to study members of subtribe *Eragrostidinae* in the field and for collecting them for laboratory studies.

2. To resolve taxonomic and nomenclatural problems using relevant taxonomic literature and type specimens.

3. To publish descriptions of species new to science, if any resulting from the present study.

4. Intensive studies on the structural and biological characters of collected specimens leading to reinterpretation of their interrelationships.

5. To develop keys to identify the genera and species of the subtribe.

6. To assess the endemic species of *Eragrostidinae* in Peninsular India.

7. To develop a complete and updated taxonomic account on the subtribe *Eragrostidinae* in Peninsular India.

Area of the present study

Peninsular India, the area of the present study, comprises of seven states *viz.,* Andhra Pradesh, Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu, Telangana, and Union territories of Pondicherry and Mahe (**Fig. 1**). Peninsular India lies between the latitude 22^0 N and 8^0 N, and is covering an area of approximately 16 Lakh km^2. It is flanked on the east by Bay of Bengal, south by Indian Ocean, west by Arabian Sea, and on the north by Vidhya and Satpura ranges (Nayer, 1996). In India, the peninsular region has a high degree of endemism making it the second richest endemic centre after the Himalaya.

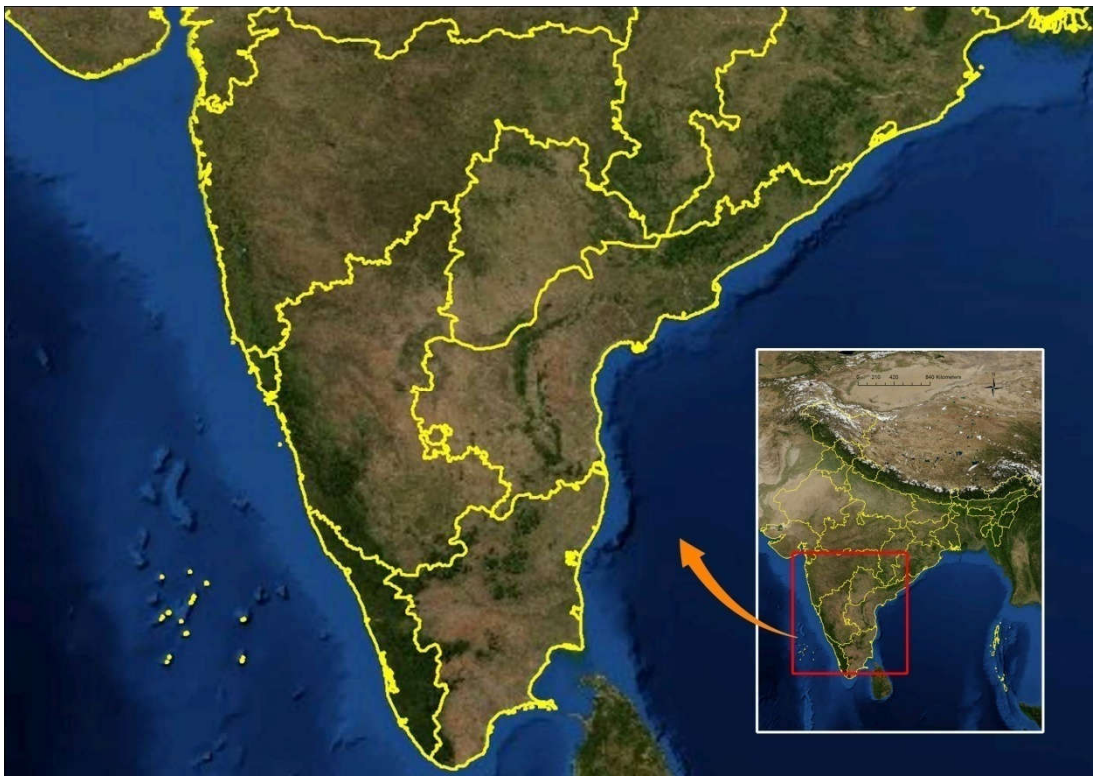

Fig. 1. Area of Present Study

Biogeography

Physiographically, Peninsular India is a part of the Gondwanaland landmass with a geological lineage of greater antiquity (Ahmedulla & Nayar, 1987). In fact, peninsular region is considered as a compact natural unit and is a 'shield' area extending from Vindhya-Satpura ranges in the north and Chota Nagpur Plateau in the North-East. It is an ancient table-land of Indian subcontinent and constitutes rocks of different age groups including Archean gneisses (Krishnan, 1968). The geography of the Peninsular India can be divided in to four zones, namely Malabar and Deccan Plateau, Eastern Ghats and Western Ghats or Sahyadari.

The *Malabar* is a long and narrow strip of land running parallel to the coast of Arabian Sea (Malabar Coast), west of the Western Ghats and south of Konkan. This region is floristically very rich and includes coastal plains and a series of hill ranges of the Western Ghats. Both the Malabar and Deccan regions together provide a wide

range of climatic and edaphic zones with mountain ranges, hillocks, valleys, swamps, marshy lowlands, sandy sea-coasts, fresh water streams and back waters on the sea-front and harbours diverse type of vegetation (Pradeep & Sivarajan, 1996).

The *Deccan Plateau* is the largest plateau in India, encircling most of Central and Southern India. It is the great table-land of the South Indian Peninsula, stretching from the Aravalis, Malwa, the Vindhyas, the Satpura and Chota Nagpur Hills in the north, almost right down to Kanyakumari in the south. In brief, this region is a dry elevated tableland interspersed with numerous isolated hills, light rainfall and dry climate (Henry *et al.,* 1996). It encompasses three distinct physiographic subdivisions *viz.,* North Deccan Plateau, South Deccan Plateau and East Deccan Plateau. Here, the second and third physiographic subdivisions fall within the present study area. The south Deccan Plateau consists of Karnataka plateau, Rayalaseema uplands, Tamil Nadu uplands, and Telengana plateau. The east Deccan Plateau is a mildly populated craggy terrain. Succinctly, the Deccan Plateau is flanked in between the Western and Eastern Ghats on either side. It is the rain shadow region of the Western Ghats and is characterised by the tropical deciduous forests whilst in the open plains it is replaced by drought resistant species and thorny shrubs. The eastern coastal plains of Deccan plateau is a broad strip running parallel to the coast of Bay of Bengal and gradually rising from it. It consists of fertile coastal plains mainly formed by the deltas of the Kaveri in Tamil Nadu, Godaveri and Krishna in Andhra Pradesh and a number of small rivulets and streams (Murthy *et al.,* 1996).

The *Western Ghats (Sahyadri)* is a chain of mountains along the western boarder of the Deccan, running more or less parallel to the coast in Peninsular India. It lies along the western side of the Indian peninsula, which is one among the 10 biogeographic zones of India (Rodgers & Panwar, 1988). It comprises an area of approximately 1.6 Km^2 and stretch as a narrow belt over a distance of 1600 Km from the mouth of the Tapti River Valley in Gujarat to Kanyakumari in Tamil Nadu, the southernmost tip of Indian Peninsula. Moreover, Western Ghats traverse through the

states of Gujarat, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu and give birth to all the leading rivers of South India. The more or less this region is treated as a one of the eight "hottest hot-spots" of biodiversity in the World. The floristically rich, the more or less continuous hills ranges of Western Ghats have a major discontinuity in the Palaghat gap separating the Nilgiri ranges from the Anamalais. The highest peak of Peninsular India is Anamudi having 2695 meters above sea level (Pradeep & Sivarajan, 1996; Myers *et al.,* 2000). By the virtue of geography, there are four major forest types in the Western Ghats: evergreen, semi-evergreen, moist deciduous, and dry deciduous. This harmonious vegetation supports the luxuriant growth of floral and faunal diversity. Out of the area provided, one-third of the area is covered by forests. Of the estimated 4,500 species of flowering plants are found in the Western Ghats region, of which 1,720 (> one third) species are endemic (Vajravelu & Vivekananthan, 1996).

The *Eastern Ghats* are broken chain of mountain ranges along the eastern boarder of the Deccan plateau. It traverses from the northern part of Odhisa through Andhra Pradesh to Tamil Nadu, in the southern parts of Karnataka and Wayanad region of Kerala also. Precisely, it extends over a length of 1750 km in Indian peninsula with an average width of 200 km in the north and 100 km in the south. The Eastern Ghats mark the eastern boarders of the Peninsular plateau and thus extend from the extreme northeast to the south of the Chota-Nagpur plateau, to the extreme southwest corner of the peninsula. Unlike the Western Ghats, the Eastern Ghats are not by any means of mountains or escarpment, but much broken and weathered relicts of the Peninsular Plateau, marked by a series of isolated hill. The eastern edge of the Nilgiri, Anamalai, and Palni Hills are also parts of the Eastern Ghats (Mani, 1974).

Rivers

The rivers on the Peninsular Indian terrain are mostly rain fed. It is drained by five major river systems: Mahanadi, Godavari, Krishna, Periyar and Cauvery. All rivers except Periyar are east flowing and finally empty into the Bay of Bengal. While the Periyar flows westwards and pour into Arabian Sea. The catchment area of the Godavari in the peninsula is the biggest in India, sheltering a territory of about 10

percentage of the entire nation. The geology and climate of Peninsular India are two superseding forcible checkups influencing the rivers of Peninsular India. The weather and geology also influence the whole process of erosion; transportation and sedimentological deposition within each river basin. The Deccan Rivers contribute about 30 percentage of total outflow of India (Meher Homji, 2001).

Vegetation

In addition to the Mangrove vegetation, Peninsular India comprises six major forest types *viz.,* Tropical thorn forests, Tropical dry deciduous forest, Tropical moist deciduous forest, Tropical dry evergreen forest, Tropical wet evergreen forest, and Tropical semi-evergreen forests. Despite, most of the geographical area of Peninsular India is covered by the Tropical thorn forests, Tropical dry and moist deciduous forests (Parrotta, 2001). Moreover, Meher Homji (2001) identified five different type of grassland vegetation in Peninsular Indian region *viz.*, Shrub-savannah, Tree-savannah, Shrub pseudo-steppe, Savannah-woodland, and Clump savannah (**Figs. 2–5**).

Geology and Soils

Chiefly, soils of Peninsular India are derived from the decomposition of ancient crystalline rocks of Gondwana, which forms the red sandy and loamy soil (Krishnan, 1968). The Deccan plateau consists of special black volcanic basalt soil. Chiefly, four types of soils are dominant in Indian Peninsula, *viz.,* Alluvial, Black, Red and Lateritic soil (Raychaudhuri, 1963). Red soil comprises red loam and sandy soils are distributed in Peninsular Indian states of Andhra Pradesh, Chhattisgarh, Karnataka, Odisha and Telangana. While Eastern Peninsular India and parts of Kerala subsist coastal alluvial soils of high fertility. The soil of western slopes and peaks of Western Ghats is typically lateritic. Lateritic soils are rich in hydrated oxides of aluminium and iron, and are distributed in the states of Chhattisgarh, southern Karnataka, Kerala, Maharashtra, and Orissa. Lateritic soil is distributed in areas receiving high rainfall with altering wet and dry periods (Anonymous, 1961).

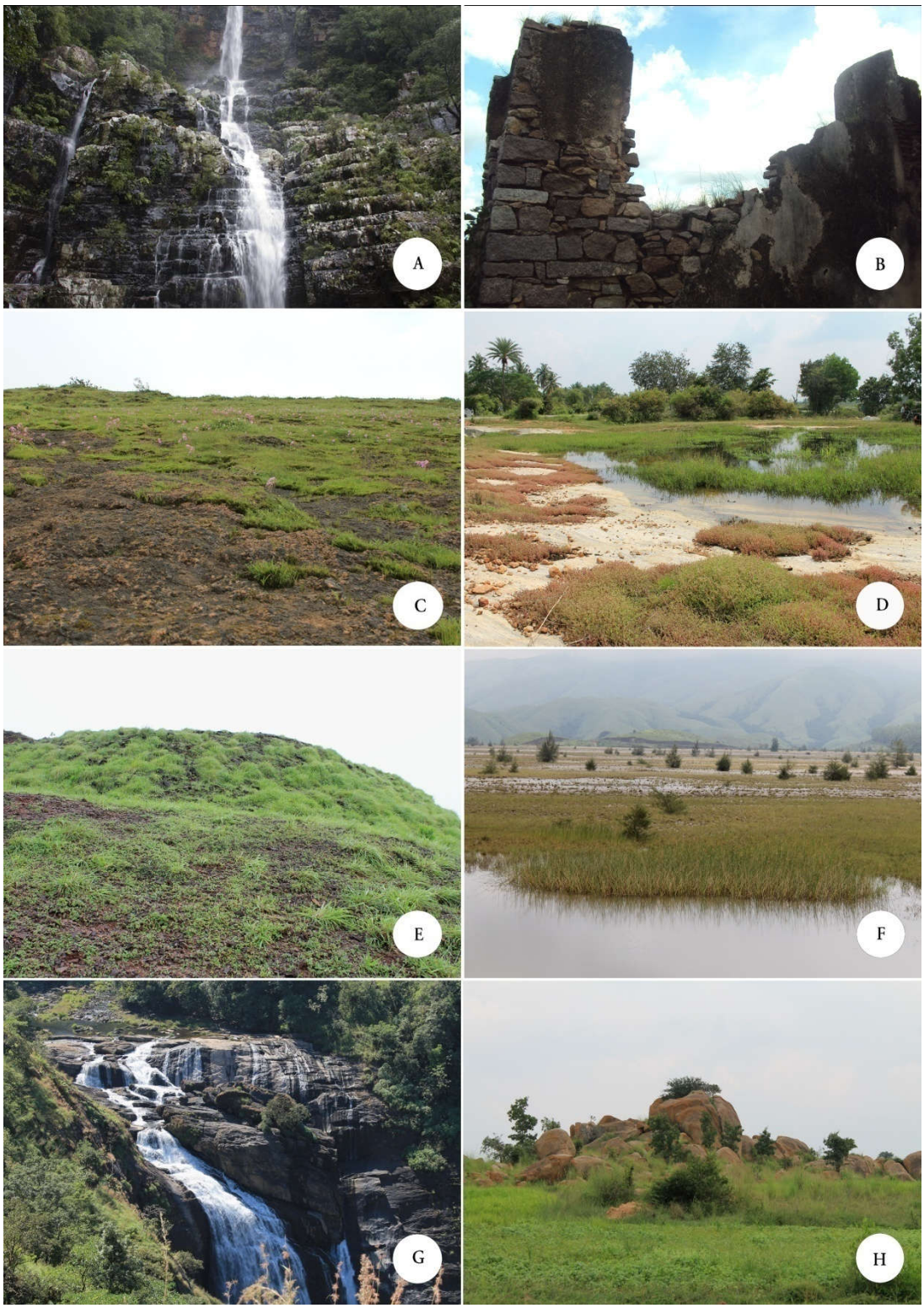

Fig. 2. Habitat diversity of Eragrostidinae: **A.** Talakona Waterfalls, Andhra Pradesh; **B.** Golkonda Fort, Telangana; **C.** Baba Budan Hills, Karnataka; **D.** Tumkur, Karnataka; **E.** Kudajadri Hills, Karnataka; **F.** Kudremukh National Park, Karnataka; **G.** Mallalli Waterfalls, Karnataka; **H.** Hassan, Karnataka.

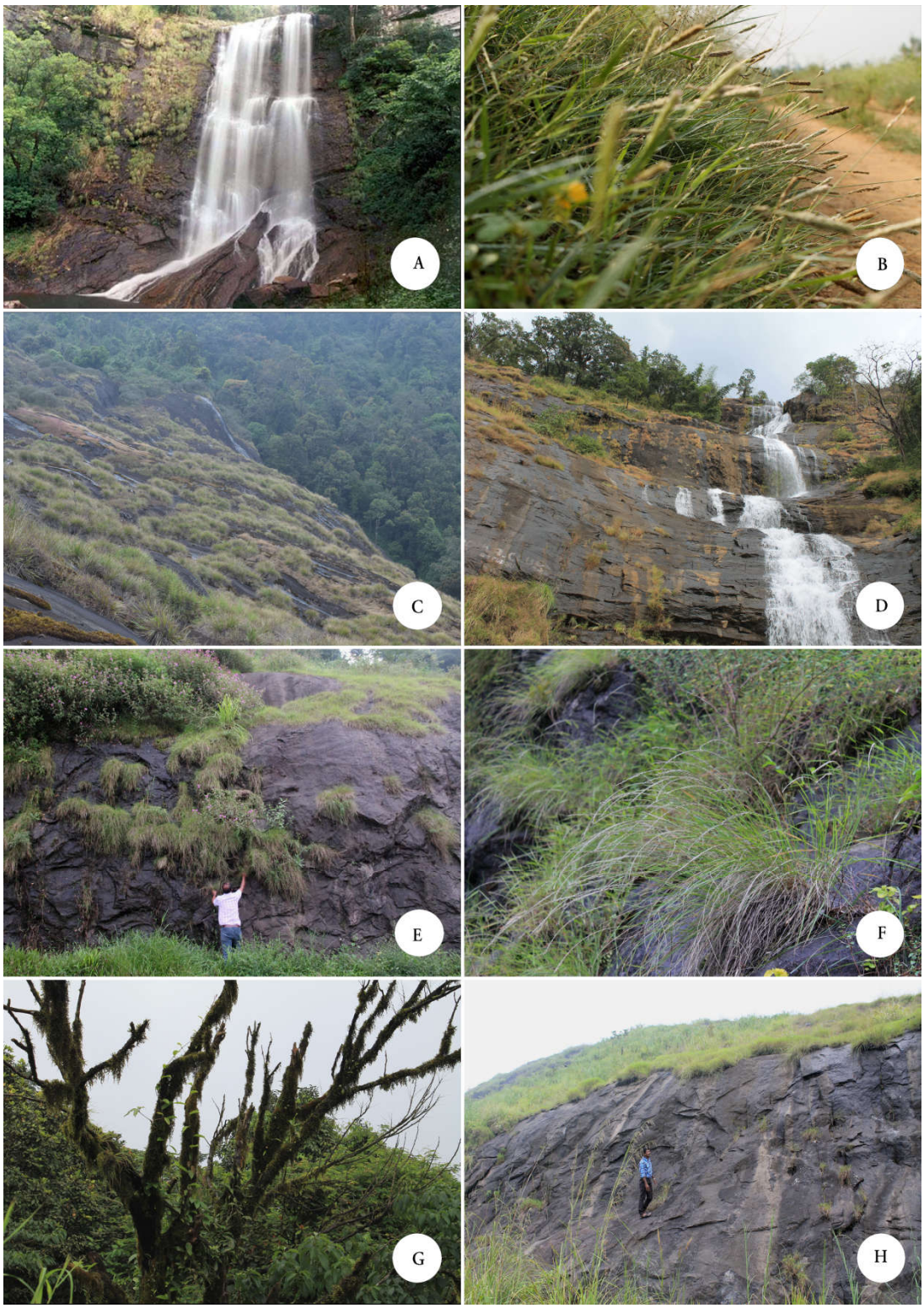

Fig. 3. Habitat diversity of Eragrostidinae: **A.** Manikyadhara Waterfalls, Karnataka; **B.** Mysore, Karnataka; **C.** Shoolamudi, Kerala; **D.** Cheeyappara Waterfalls, Kerala; **E.** Peerumedu, Kerala; **F.** Kurichyar Mala, Kerala; **G.** Gopalaswamy Hills, Karnataka; **H.** Vagamon, Kerala.

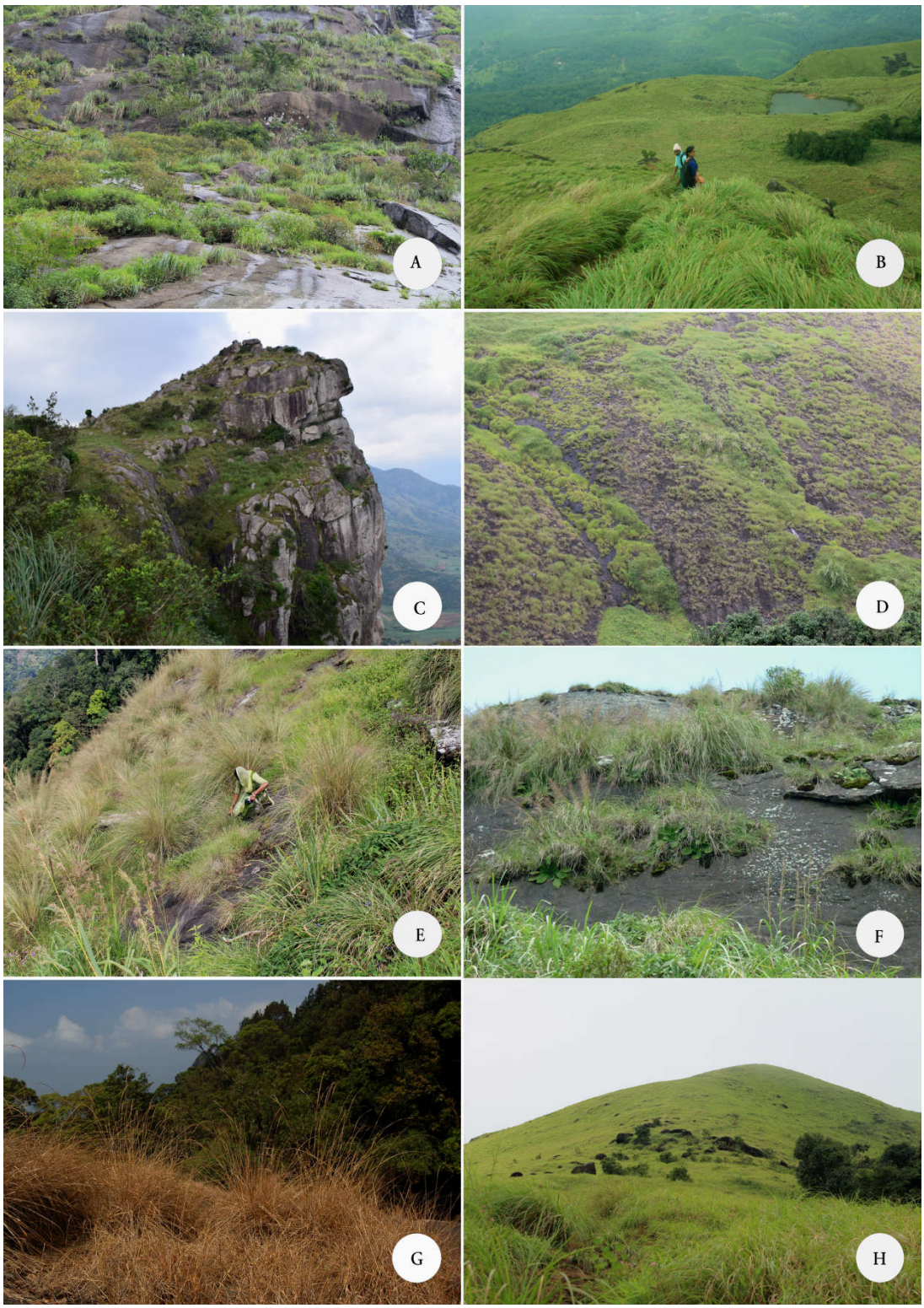

Fig. 4. Habitat diversity of Eragrostidinae: **A.** Kakkayam, Kerala; **B.** Chembra, Kerala; **C.** Ramakkalmedu, Kerala; **D.** Parunthumpara, Kerala; **E.** Kaeshavan Para, Kerala; **F.** Karimala, Kerala; **G.** Vellarimala, Kerala; **H.** Ranipuram, Kerala.

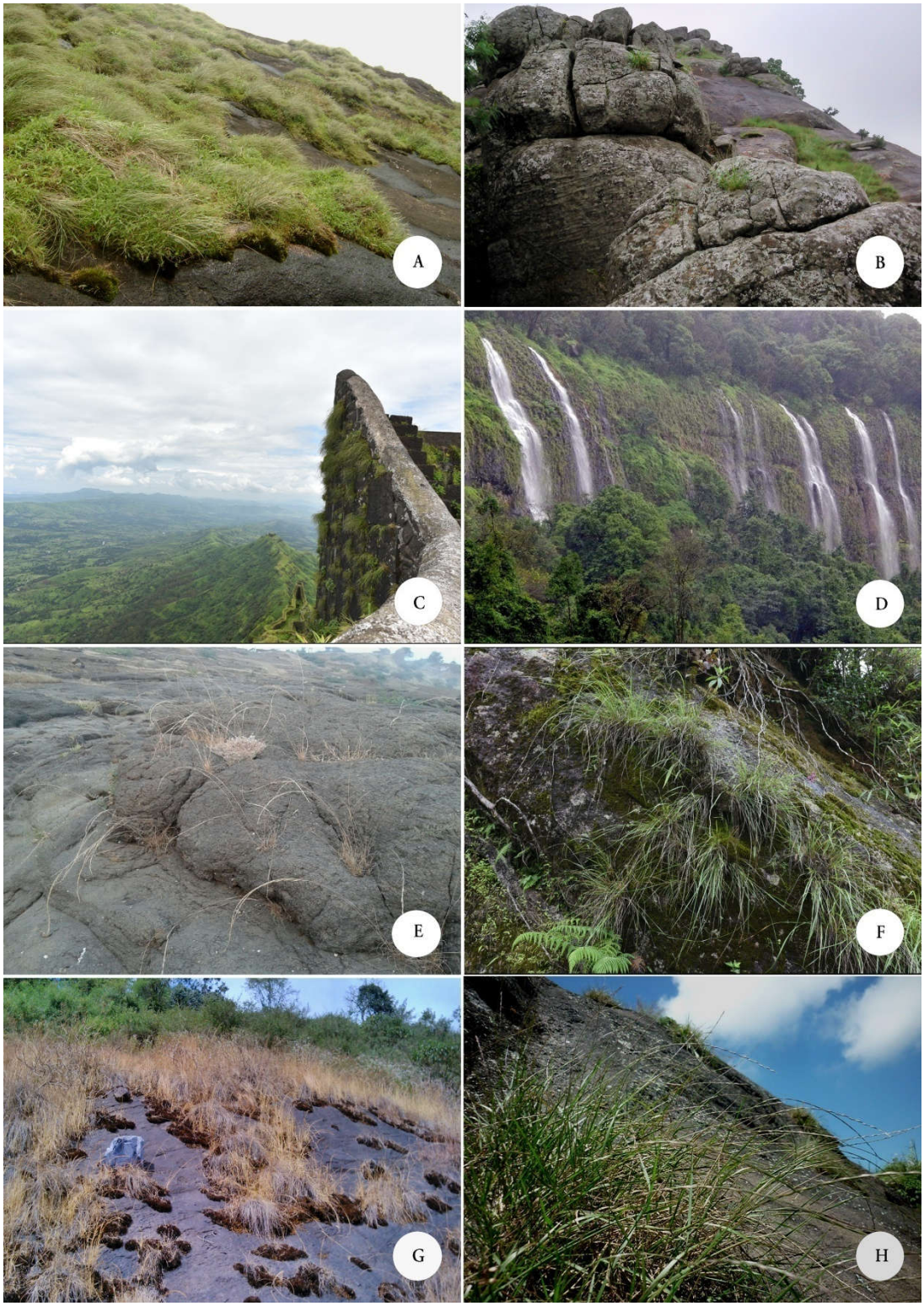

Fig. 5. Habitat diversity of Eragrostidinae: **A.** Velliangiri Hills, Tamil Nadu; **B.** Maruthwamalai, Tamil Nadu; **C.** Torna Fort, Maharashtra; **D.** Amboli Ghat, Maharashtra; **E.** Tapi River bed, Maharashtra; **F.** Mawsynram, Meghalaya; **G.** Malakkapara, Kerala; **H.** Vengoli Hills, Kerala.

Climate

The climate in Peninsular India is general and uniformly megathermal (Subramanyam *et al.,* 1965; Rao *&* Verma, 1972). However, the major portion of the Peninsular India represents a tropical climate with a strong seasonality. The four major climatic zones in Peninsular India are: Semi-arid zone of Deccan plateau, Tropical wet zone of Western Ghats and West Coast region, Tropical wet and dry zone of Eastern region and some parts of Deccan region and Humid sub-tropical zone of Central India.

Temperature fluctuation in different regions and during different season is also very great. In Peninsular India, the average annual temperature is lower in Western Ghats and Nilgiris than Deccan plateau and coastal regions. Similarly, the summer temperature in most of the regions rises to above 30–39^0 C. The minimum winter season temperature in south India rarely goes below 20^0 C. The humid regime predominates in southern districts of Kerala and high altitude locations around Coonor and Ooty (Tamil Nadu); whereas super humid, climatic regime occupies the smallest area, Kodaikanal in Tamil Nadu.

Peninsular India receives both north-east monsoon (October–December) and south-west monsoon (June–September). The former is more active in Tamil Nadu, Pondicherry and Andhra Pradesh, while the latter is more vigorous in Kerala and Coastal Karnataka (Pradeep & Sivarajan, 1996). Annual rain fall in Peninsular India is determined by seasonal fluctuations of the South-West monsoon with an extended dry season of 6–9 months depending on the locality. In every year, moisture rich south-west monsoon originating from the Indian Ocean together with Arabian Sea passes over the Indian subcontinent via Kerala region producing heavy rainfall in Western Ghats, whereas the Eastern Ghats receives moderate rainfall. However, the coastal districts of eastern Tamil Nadu usually receive the north-east monsoon (post monsoon) between October–November. Here, the rain occurs almost throughout the year with high temperature and humidity during the monsoon season. All these causes dramatic changes in the ecology and vegetation of the peninsular region.

Chapter 2

Review of Literature

Chapter 2 Review of Literature

The grasses: An Overview

An echo of agrostology can be traced back to John Ray (1703), who published a treatment *'Methodus Graminum Juncorum et Cyperorum Specialis'*. Subsequently, J. Scheuchzer (1708) released a paper to deal specifically with grasses in his *Agrostographiae Helvetica Prodromus* which can be considered as the starting point of agrostology, the science of grass classification. Thereafter, one of the first to take up the grass systematics was Linnaeus (1753), who catalogued a list of 38 grass genera (one of them actually a sedge!) with taxonomic keys in his *Species Plantarum*. Later, Jussieu (1789), who was primarily, introduced the name 'Gramineae' to the grasses. It was Robert Brown (1810) who realized the true nature of the spikelet and to recognize it as a reduced inflorescence branch. In 1814, he obviously accepted the two great subdivisions of the Gramineae, the 'Paniceae' and 'Poaceae' (later recognized as subfamilies 'Panicoideae' and 'Festcoideae'). In 1812, Palisot de Beauvois authored a symbolic work '*Essai d'une nouvelle Agrostographie',* in which he stated that grass family is undoubtedly the best known of the higher plant groups. Perhaps the greatest contribution of Beauvois to grass systematic was in the naming and describing of a large number of genera (Gould, 1968). In 1824, Dumortier presented the tribe Andropogoneae in the subfamily Panicoideae in his monograph *Observations sur les Graminees de la Flore Belgique*. Since then, Kunth (1833) classified Gramineae into 13 tribes, but recognized no subfamilies. The one of the outstanding among the natural systems was proposed subsequently by Bentham (1881), which was primarily based on morphological characters of the inflorescence and flower. Later, many agrostologist followed this classification with minor modifications by Hackel (1887, 1889), Stapf (1917, 1934), Hitchcock (1920, 1935, 1950), and Bews (1929).

Subsequently, Hackel (1887) presented his classification in Engler's well known *Die Naturlichen Pflanzenfamilien*. The genera in this system were arranged mainly according to the principle of gradual complication of spikelet structure: from one flowered to many-flowered spikelets. In 1895, Barnhart first used the name 'Poaceae' to the grass family Gramineae based on the tribe 'Poaceae' described by Robert Brown (1814). Consequently, Hitchcock, in the *Genera of Grasses of the United States, with special Reference to the Economic Species* (1920) and *Manual of the Grasses of the United States* (1935, 1951) seggregated the tribes Oryzeae and Zoysieae from the Panicoideae to the Festucoideae and erected yet another small tribe Zoysieae. In 1954, Hubbard treated 620 genera and 10,000 species of grasses to the family Poaceae. Since then, Pilger (1954), Jacques-Felix (1955), Beetle (1955), Stebbins (1956), Tateoka (1957), Gould and Shaw (1983), Clayton and Renvoize (1986) made remarkable contributions to agrostology. From these, the most outstanding contribution to grass systematics was made by Clayton and Renvoize (1986) in their monumental contribution *'Genera Graminum-Grasses of the World'.* They recognized about 651 genera and 10,000 species in 40 tribes. In 1992, Watson and Dallwitz provided a systematic account on the grass family (Poaceae) and recognize about 10,000 species and approximately 800 genera. Later, based on the classification of Clayton and Renvoize, Dassanayake *et al.* (1994) treated 345 species belonging to 136 genera of Poaceae from Sri Lanka.

In India, the primeval works were done by Griffith (1834), Duthie (1883, 1888), Symmonds (1886), and Coldstream (1889). Following, Lisboa (1896) worked out grasses of Bombay with their uses. Most exceptional works on grasses of India was provided by Hooker (1896) and Stapf (1896) in Hooker's *Flora of British India.* They have presented 700 species under 130 genera. Several other workers have also contributed much to the grass flora of India. Cooke (1901) presented an account of grasses in his *Flora of the Presidency of Bombay*. Later, the foundation of grass systematics in South India was carried out by Achariyar and Mudaliyar (1921)

described detailed account of South Indian grasses with illustrations. They focussed only on common grass species of this region with an illustration of vegetative and floral characters. Besides the morphology, anatomical characters such as diagnostic features of leaf epidermis and cross section of internodes were also included in their study. Fischer (1934) consolidated an account on grasses of Madras Presidency, which was followed by Blatter and Mc Cann's (1935) an illustrated account on *The Bombay Grasses*.

Great Moments in Indian Agrostology

The most voluminous literature on systematic studies on the grasses of India was of N.L. Bor's (1960) monumental work, *The grasses of Burma, Ceylon, India and Pakistan* covering not only India but the entire subcontinent. He has made a comprehensive study and reported 1165 infrageneric taxa (excluding bamboos) treated fewer than 220 genera from the present political boundary of India; he also underlined the demand for a detailed study of the lower ranks from the Indian region. In 1976, Singh *et al.* enumerated Poaceae of Karnataka. Matthew (1982, 1988) illustrated 184 taxa in 284 plates in his *Illustrations to Flora of Tamilnadu Carnatic* and Britto and Matthew (1983) provided descriptions for all 183 species and one variety. Karthikeyan *et al.* (1989) has treated a concise checklist of Indian grasses which covers 1181 species under 233 genera. Sreekumar and Nair (1991) worked on grasses of Kerala and described 296 species distributed in 103 genera including two new genera, 28 new species and four species as new record to the Indian grass flora. Since then, Moulik (1997) presented an audit of grasses and Bamboos of India. She reported 1185 species under 249 genera and also recorded 18 subspecies, three sub varieties, 131varieties and five formal taxa. From the state of Andhra Pradesh, Pullaiah (1997) catalogued 287 taxa under two subfamilies and 22 tribes in Poaceae. Later, Kabeer and Nair (2009) was worked on grasses of Tamil Nadu and treated 447 species and 19 intraspecific taxa of grasses belonging to 136 genera under 19 tribes in their *Flora of Tamil Nadu Grasses*. Yadav (2010) published a small but very useful book, *Know your Grass Genera through Hand Lens*, with a pictorial key for common grass genera. Of late, Potdar *et al.* (2012)

presented an account on *Grasses of Maharashtra* and treated 125 genera, 415 species, two sub species and 41 varieties of grasses from the state of Maharashtra.

Tribal-level Classification: A Historical Outline

The tribe Eragrostideae is placed in the subfamily Chloridoideae. Based on the earlier description of the sect. Chlorideae (Kunth, 1815), Beilschmied (1833) a German botanist and Pharmacist was first who validly published the subfamily Chloridoideae. Clayton and Renvoize (1986), Van Den Borre and Watson (1997) noted the distributional gradient of Chloridoideae from sea level to 4000 m, variations with respect to humidity and saline conditions from pluvial to xeric habitats. The subfamily contains few large genera but a host of very small ones and its development has apparently been dominated by vigorous adaptive radiation into a wide range of specialized, often stressful, habitats. According to Liu *et al.* (2010) and Peterson *et al.* (2010), Chloridoideae covers roughly 140 genera and 1420 species.

In 1898, Stapf first used the tribal name *Eragrostideae* (*Eragrosteae*) in his *Flora Capensis*, where he included four genera: *Desmostachya* (Hook.f.) Stapf, *Diplachne* Beauv. (= *Leptochloa* P.Beauv.), *Eragrostis* Wolf, and *Pogonarthria* Stapf. Afterwards, Pilger (1956) elevated the number of taxa in the Eragrostideae to comprise 53 genera in six subtribes in his subfamily Eragrostoideae. Subsequently, most of the agrostologists (Bor, 1960; Gould & Shaw, 1983; Clayton & Renvoize, 1986 and Peterson *et al.*, 1995, 1997) followed this system to a certain degree. Since then, Phillips (1982) circumscribed genera within the tribe Eragrostideae by the aid of numerical analysis. According to Clayton and Renvoize (1986), this tribe include 77 genera and approximately 1000 species inhabited in tropics and subtropics. Additionally, they represented the relationship of genera through a pictorial diagram and also noted the hallmark of Eragrostideae is its unspecialized, usually many-flowered, spikelets with 1–3-nerved lemmas. The Eragrostideae might have originated from Australia or from Africa and then radiated to all parts of the World (Peterson *et al.*, 2010).

It was Presl (1830) who first to established the subtribe *Eragrostidinae* under the tribe *Eragrostideae* in his *Reliquiae Haenkeanae.* He also described five genera (*Brizopyrum, Chascolytrum, Ceratochloa, Eragrostis* and *Megastachya*) with 30 species. He selected *Eragrostis* as the type of this subtribe, unfortunately, he failed to provide a description for the subtribe. After a while, Peterson *et al.* (1995, 1997) proposed the subtribal classification of the New World *Eragrostideae* and provided a detailed description for the subtribe *Eragrostidinae*. Of the species recognized under this subtribe, genus *Eragrostis* shows maximum number of species. Among them, five genera are represented in India: *Eragrostis* Wolf, *Eragrostiella* Bor, *Leptochloa* P.Beauv., *Neyraudia* Hook.f. and *Tripogon* Roth ex Roem. & Schult.

Generic Delimitation: An Overview

Taxonomy of grass family has been considered to be a difficult one among the flowering plants, and the genus *Eragrostis* Wolf in particular is supposed to be one of the most difficult group in the family Gramineae. Species belonging to this genus have overlapping characters and the hybradization of inter and intra-species categories produces a perplexing situation for the taxonomist working in the area. Key characters merely based on measurements (spikelets, inflorescence, leaf, stem, glumes and awns) are not good enough to separate the species distinctly. There should be a combination of two or preferably three characters in the key (Roy, 1976).

The genus *Eragrostis* is one of the hardest nut in almost all the oldest literature. It is first validly published by Wolf in 1776 in his *Genera Plantarum*, but the origin of the name remained somewhat obscure. But its history goes back to at least near one century, a specimen of *Eragrostis* was originally described by Rheede in 1693 (Hortus Malabaricus 12: 75, t. 41) under the name 'Tsjama-pullu'. It is the first printed comprehensive treatise that deals with plants of Asia and Tropics, especially the southern Western Ghats of India. The history of *Eragrostis* Wolf is complex. Many of the species currently treated under *Eragrostis* were earlier placed under many other

genera. Linnaeus (1753) placed species currently included under *Eragrostis* in *Poa.* He also cited Rheede's plate (Hortus Malabaricus 12: 75, t. 41) 'Tsjama-pullu' under *Poa amabilis.*

In 1812, Beauvois recognized the genus *Eragrostis* (8 species) and *Megastachya* (13 species). While, Nees (1829, 1841) and Trinius (1830, 1840) amalgamated many taxa of *Poa* to the genus *Eragrostis.* Later, Koch (1848) noted the variation in spikelet disarticulation. Based on the disparity of disarticulation, he detached one more taxa from *Eragrostis* and merged it in *Poa* [unranked] *Psilantha* K. Kotch. Consequently, Steudel (1854) was the pioneer to substantiate *Eragrostis* as a dominant group with 245 species under eight groups. But, he declined to present a key or other means of determining species. In 1864, Grisebach (1864) treated the eight species under two sections. In 1878, Döll had made two subdivisions within the genus, *Eragrostis* [unranked] *'Pteroessa'* and *Eragrostis* [unranked] *'Cataclastos'* Döll. In the same year, Bentham proposed a divergent sub division of *Eragrostis* in three sections; here, he used the characters disclosing to the spikelets and also mode of disarticulation of rachilla and palea. In agreement with Döll (1878), Boissier (1881) also treated two sections (*Eueragrostis* and *Pseuderagrostis*) based on the persistence of rachilla. Consequently, a coalescence of the Döll and Bentham subdivisions was amalgamated by Bentham and Hooker (1883), recognizing in six sections (*Myriostachya, Plagiostachya, Pteroessa, Cataclastos, Platystachya, Sclerostachya*) with the largest section covering three series. Hither, the characters promoting these sections were size and shape of the inflorescence, spikelets and their components, mode of disarticulation of florets, and the persistence of the palea. At a later date, Hackel (1887) accepted the sections recognized by Bentham and Hooker (1883). However, He eliminated two sections (*Plagiostachya, Sclerostachya*) from it. Although, Stapf (1896) in Hooker's *Flora of British India*, treated 31 species in four sections *viz., Cataclastos, Pteroessa, Desmostachy*a and *Plagiostachya;* but described *Myriostachya* Stapf as a monotypic genus characterized by spikelets falling along with entire pedicels. In 1900, Stapf in *Flora Capensis* added yet

another monotypic section *viz.*, *Lappula* Stapf based on the long rigid tubercle-based cilia on the lateral nerves of the lemma. Soon after, on account of the reproductive characters, Bush (1903) removed two species from *Eragrostis* and placed them in a new genus *Neeragrostis* Bush. Mattei (1909) studied specific groups of the genus having 'extra floral nectaries' and provided a key to them. Later, Domin (1915) made some slight changes in Bentham and Hooker's classification; he removed the series *Cylindrostachya* from the section *Pteroessa* and reinstated it as a separate section based on the nature of spikelets. While, Bews (1929) recorded 250 species all around the World and treated the genus in five sections (*Cataclastos, Myriostachya, Pteroessa, Platystachya,* and *Lappula*). In 1940, Bor erected the genus *Eragrostiella* Bor from the section *Plagiostachya* (Stapf, 1896). In Hooker's *Flora of British India* this section is treated as separate groups based on the compact, spicate inflorescence and winged palea veins. Hitchcock and Chase (1950) provided an account on all the species in the United States in two main sections such as *Cataclastos* and *Pteroessa.*

Subsequently, Pilger (1956) outlined an overview of the subdivisions within in the genus *Eragrostis*. He recognized 10 sections, reinstated sections such as *Acamptoclados*, *Neeragrostis, Cladoraphis, Plagiostachya (Eragrostiella)*. The classification was entirely based on characters of inflorescence, spikelet shape, and mode of spikelet disarticulation. Later, De Winter (1960) seggregated seven *Eragrostis* species into a new genus *Diandrochloa* De Winter. He used the characters for segregation was the membranous ligules and number of stamens (2). In 1967, Henry made three new combinations of *E. diarrhena, E. diplachnoides* and *E. japonica* with the new genus *Diandrochloa*, erected by De Winter (1960). Based on Koch's (1848) presentations, Cvelev (1976) made slight modifications in which he treated section *Psilantha* with *E. collina* and *Eragrostis* as separate subgenera. Roy (1976) studied about the genus from Rajasthan and noted the transfer of some species from the genus *Eragrostis* to *Diandrochloa* (De Winter, 1960; Henry, 1967) as debatable. Later, Clayton & Renvoize (1986) treated the genus *Eragrostis* with approximately 350 taxa throughout

the tropics and sub tropics of the World. Based on the spikelets disarticulation and persistency of the palea, species are subsumed in different sections such as *Psilantha, Eragrostis, Lappula, Platystachya*. Among them, section *Lappula* represents Old World taxa; and the section *Platystachya* is confined to Africa. They accepted *Myriostachya, Coelachyrum, Desmostachya, Ectrosiopsis* and *Eragrostiella* as distinct genera. While, Watson and Dallwitz (1994) accepted the segregate genera *Acamptoclados*, *Neeragrostis*, and *Diandrochloa*.

Van Den Borre and Watson (1994) made a detailed historical over view of the genus *Eragrostis*. Notably, they published an infrageneric classification based on 442 characters of 53 world-wide *Eragrostis* and three closely allied species, from which 58 morphological and 60 anatomical characters were analysed by phenetic and cladistic methods. Remarkably, this study recognized the subgenus *Eragrostis* and a new subgenus *Caesiae* Van den Borre & L. Watson. Moreover, the subgenus *Psilantha*, which is characterised by a fragile rachilla and entire disarticulating floret, is reduced in to the synonymy of *Eragrostis* with its strikingly different mode of disarticulation. In the same year, Dassanayake *et al.* (1994) recorded 16 species of *Eragrostis* from Sri Lanka in their *Revised Handbook to the Flora of Ceylon.*

The vast majority of publications on *Eragrostis* involve revisions and monographs based on morphology. Some significant taxonomic contributions include revision of the species of *Eragrostis* in Guianas (Judziewicz, 1991), Mexico (Beetle *et al.,* 1991; Peterson & Valdés Reyna, 2005), Mesoamerica (Davidse, 1994), Australia (Lazarides, 1997), Argentina (Nicora, 1998), Bolivia (Renvoize, 1998), Zambesiaca (Cope, 1998), Brazil (Boechat & Longhi-Wagner, 2000, 2001), Ecuador (Laegaard & Peterson, 2001), Malesia (Veldkamp, 2002), the United States and Canada (Peterson, 2003), Peru (Peterson & Vega, 2007), Colombia (Peterson & Giraldo-Cañas, 2008), North-Western South America (Giraldo-Cañas, Peterson & Vega, 2012), and Thailand (Chaisongkram, 2013). All these publication and distribution of *Eragrostis* world-wide have given us a good understanding of the species limits and distribution.

Out of the above list, Lazarides (1997) contributed an outstanding revision of Australian taxa of *Eragrostis* Wolf, constituting 69 endemic and exotic species presented in six groups. Furthermore, he proposed 17 taxa as new. He listed 10 new synonyms, and 11 species were lectotypified. The fruitful key character for correlating the infrageneric groups was based on the mode of disarticulation of the spikelets. Subsequently, Veldkamp (2002) presented an excellent study on the genus *Eragrostis* in Malesia. He recognized one new species with 11 new introduced species. Besides, he updated the synonymy and typification of all taxa existed in the group. Due to troublesome nature of *Eragrostis*, the following characters were used for the species delimitations: presence of glands, mode of fragmentation of the spikelets, number and size of the anthers and shape of the caryopses.

Ever since Hooker's (1896) account of Indian grasses, significant advances have been made on the systematics of Poaceae. Though, Bor (1940) published on the Poaceae of Assam which includes 15 *Eragrostis* species. Subsequently, an elaborate account of Indian grasses was done by Bor (1960) in his monumental work '*The grasses of Burma, Ceylon, India and Pakistan*'. The study comprises 39 species and three varieties of *Eragrostis* including two new species *viz.*, *E. deccanensis* and *E. maderaspatana.* Moreover, He also provided a checklist and prepared a detailed taxonomic key for the entire subcontinent. Roy (1976) was done the revision of the *Eragrostis* in Rajasthan and reported 18 species from the study area. Later, the most important monograph of monocotyledons was written by Karthikeyan *et al.* (1989), who recognised 36 species and three infraspecific taxa of *Eragrostis* from India. Subsequently, Moulik (1997) enumerated 36 species and 3 varieties in her work, *The Grasses and Bamboos of India*.

There are many large and small publications on the grasses of Peninsular India. Among the pioneers in the nineteenth to twentieth centuries, the floras of south Indian grasses were done by Cooke (1901–1908) he recorded 15 species from Bombay Presidency in his *Flora of Presidency of Bombay.* Soon after, the *Flora of Presidency of*

Madras was published by Fischer (1934–1936); he treated 24 species in his treatise. Later, an illustrated account on *The Bombay Grasses* was done by Blatter and McCann (1935) representing 17 species from the study area. Achariyar and Mudaliyar (1921) treated eight species of *Eragrostis* from South India with descriptions and illustrations. Matthew (1982, 1988) illustrated 13 taxa in his *Illustrations to Flora of Tamilnadu Carnatic* and Britto and Matthew (1983) provided descriptions for all the 14 taxa.

Apart from comprehensive treatments in India, several floristic works of the genus *Eragrostis* have been published from different states in Peninsular India. In relation to present study, some of the remarkable grass floras are: Poaceae of Karnataka–21 species (Singh *et al.,* 1976); *Flora of Kerala Grasses*–18 species (Sreekumar & Nair, 1991); *Flora of Andhra Pradesh*–22 species (Pullaiah, 1997); Family Poaceae in Goa (un published-Ph.D Thesis) Harshala and Janarthanam, 2007–09 species; *Flora of Tamil Nadu Grasses*–29 (Kabeer & Nair, 2009) and *Flora of Maharashtra*–22 species (Potdar *et al.,* 2012). Furthermore, a few scattered papers by various authors (Mohanan and Sreekumar, 1982; Umamaheshwari and Daniel, 1998; Vivek *et al.,* 2012, 2013a, 2013b, 2013c, 2013d, 2013e, 2013f; Vivek *et al.,* 2015, 2016) from different parts of the study area are available dealing with the genus *Eragrostis*.

Tripogon is a very natural genus, and the species are often superficially extremely similar. Nevertheless, they do not seem to intergrades, and once the distinguishing characters have been defined it is possible to name most specimens with confidence (Phillips & Chen, 2002). The disparities in the *Tripogon* species are taken from apparently very trifling characters, as, for instance, the development or reduction of awns. They are, however, within limited geographical areas remarkably constant, and coincide with a certain similarity in the habit which is not easy to convey in a short description (Stapf, 1892). Succinctly, the identity and delimitation of the species are still based on Bor's (1960) monumental work on the grasses of the Indian subcontinent, but the abundant specimens collected through fieldtrips sounds that a reassessment is now possible.

The genus *Tripogon* was originally established by Roemer and Schult (1817) who delineated the genus by using *Tripogon bromides* probably the specimen collected from Mysore in India. The holotype from Mysore is available at Museum Botanico Berolinense (B) in Germany with a handwritten (presumably by Roth) note on *Festuca mysorensis* Heyne affixed on it. Since it is the only element that can be attributed with some certainty to the original collection of *T. bromoides*. Subsequently, Roth recoded the floral charecteristics, and also the derivation of the name '*Tripogon'* in his unpublished manuscript *Novae Plantarum Species.'* At a later date, Sprengel (1825) treated *Tripogon bromoides* under the genus *Avena*, as *A. mysorensis* based on Heyne's name *Festuca mysorensis* which in turn is not validly published. Soon after, Nees (1841b) established the genus *Plagiolytrum* to include three species (currently treated under *Tripogon*) viz., *P. calycinum* Nees, *P. filiforme* Nees and *P. unidentatum* Nees, of which the former belongs to *T. bromoides* Roth *ex* Roem. & Schult., and latter two are conspecific and currently treated as synonyms of *T. filiformis* Nees *ex* Steud. The generic name *Tripogon* being the earliest (1817) published one, has priority over *Plagiolytrum* (1841) been accepted. In 1851, Jaubert described another species of *Tripogon*, *T. festucoides* apparently based on Perrottet's collection from "Indiae montibus Nelligherry" in 1834. The first systematic works of *Tripogon* was published by Steudel (1854), who enumerated nine species with appropriate diagnosis.

Later, Bentham and Hooker (1883) subsumed the genus *Tripogon* in *Genera Plantarum* with detailed latin description. Following, Joseph Dalton Hooker (1896) enumerated nine species and three varieties in *Flora of British India* including one new species and one new variety. Among them, all nine species are from the present political boundary of India. He categorised all the species into two groups based on the lobes at the apex of lemma, but did not assign any sectional rank to these groups. However, Bor (1960) segregated *T. pauperculus* Stapf from *Tripogon* and placed it under *Indopoa* as *I. paupercula* (Stapf) Bor.

Ever since its establishment, major contribution to American grasses was from great Amercian botanists Hitchcock, who published papers discussing systematics of the family Poaceae in the United States (Hitchcock, 1920, 1935, 1950). He studied the taxonomy of the American grasses including the single species of *Tripogon* [*T. spicatus* (Nees) Ekman] from United States. Bews (1929) provided an account on the global distribution and ecology of the genus *Tripogon*. In 1956, Pilger detailed the nomenclatural history of the genus *Tripogon*. Soon after, Gould (1968) made an excellent pedagogical account *Grass Systematics* for the United States. He dealt the morphology, vegetative and reproductive phenology of the genus *Tripogon* in America. Subsequently, Clayton and Renvoize (1986) have given a brief description of the genus *Tripogon* representing 30 species from the Old World tropics. He also noticed the similarity of the *Tripogon* to the genus *Leptochloa*, and also pointed out the similarity of *T. lisboae* to the genus *Eragrostiella* Bor. Lazarides (1994) treated the Poaceae of Sri Lanka in the *Revised Handbook to the Flora of Ceylon* and recorded only one species of *Tripogon* from Sri Lanka. However, 11 species of *Tripogon* was treated by Chen (2006) in Flora of China.

In India, several authors have contributed to grass systematics from different regions. Stapf (1892) studied the grasses of the western parts of India; he described two new species *viz., T. lisboae* Stapf and *T. jacquemontii* Stapf from Bombay and Poona of Maharashtra. Few years later, Duthie (1901) published yet another new species, *T. purpuresens* Duthie from Tons Valley, Western Himalayas. Another major contribution to the genus *Tripogon* from the western part of the country was done by Cook (1901–1908) in his *Flora of the Presidency of the Bombay* he also published the putative illustrated grasses of Bombay (Blatter and McCann, 1935). Karthikeyan *et al.* (1989) enumerated 12 species and three varieties of *Tripogon* from India, in his *Florae Indicae Enumeratio: Monocotyledonae*.

Norman Loftos Bor's role in the family Poaceae would be difficult to surpass. He described almost all genera in the Indian subcontinent. The productive career of

Bor (1940, 1941, 1957) in grass systematics was started through the publication of the grass flora of Assam he treated three species under the genus *Tripogon*. Subsequently, he started series of short manuscripts on Poaceae which culminated in the publication of the *Grasses of Burma, Ceylon, India and Pakistan (excluding Bambuseae)* (Bor, 1960), in which he gave a detailed systematic account of the genus *Tripogon* described by that time and recognized 13 species (including one new taxa: *T. hookerianus* Bor) mainly based on the number of lobes on the lemma apex. However, the new species *T. hookerianus* was not validly published in the absence of adequate specimens, and also description or diagnosis. Moreover, he synonymised the name *T. abyssinicus* Hook.f. under the species *T. purpuresens* Duthie. Later on, Moulik (1997) compiled 13 species in his account of the *Grasses and Bamboos of India.*

C.A. Barber, R.H. Beddome, J.D. Hooker, A. Meebold, William Roxburgh, Robert Wight and C.E.C. Fischer were the well known botanical explorators of erstwhile Madras. They have made intensive collections in various parts of Peninsular India. Their collections and field observations became the basis of Fischer's treatment of *Tripogon* in the *Flora of Presidency of Madras* (Fischer, 1934). After a lapse of many years, Matthew (1982, 1988) illustrated a single species in his *Illustrations to Flora of Tamilnadu Carnatic* and Britto and Matthew (1983) provided a description for the same.

The vast majority of publications on *Tripogon* comprise treatments of new species and taxonomic revisions based on morphology. Putative taxonomic contributions include revision of the species of *Tripogon* in Africa (Phillips & Launert, 1971) and China (Phillips & Chen, 2002). The other works include treatments of new species and a few scattered papers by various authors (Sreekumar *et al.,* 1983a, 1983b; Pradeep & Sunil, 1999; Sunil & Pradeep, 2001; Veldkamp & Phillips, 2003; Rúgolo de Agrasar & Vega, 2004; Bing, 2005; Murugesan & Balasubramaniam, 2008; Newmaster *et al.,* 2008; Kabeer *et al.,* 2009; Rao *et al.,* 2009; Rao *et al.,* 2012; Teerawatananon & Sungkaew, 2012; Chorghe *et al.,* 2013; Thoiba & Pradeep, 2014;

Chorghe *et al.,* 2015; Sunil *et al.,* 2015; Thoiba *et al.,* 2015; Arumugan & Murugan, 2017; Murugesan *et al.,* 2017; Thoiba & Pradeep, 2018; Rao & Anil Kumar, 2018; Rasingam & Swamy, 2018). Several other authors have contributed to grass flora of Peninsular India, such as, Sreekumar and Nair (1991), Pullaiah (1997), Kabeer & Nair (2009) and Potdar *et al.,* 2012.

There has been a considerable controversy regarding the circumscription and delimitation of the genus *Leptochloa s.l*. Recent studies by Peterson *et al.* (2012) based on molecular methods resulted in the dissolution of *Leptochloa* in to four segregated genera (*Dinebra* Jacq., *Diplachne* P. Beauv., *Disakisperma* Steud., and a new genus *Trigonochloa* P.M. Peterson & N. Snow).

J.D. Hooker (1896) treated five species of *Leptochloa* in his *Flora of British India*; he categorized all the species in two groups based on leaf characteristics. Later, Bews (1929), Hitchcock (1950), Clayton and Renvoize (1986), and Watson and Dallwitz (1992) provided a brief outline on the distribution and ecology of *Leptochloa* in the World. Later, Dassanayake *et al.,* 1994 treated four species from Sri Lanka; in the same year, Nowack (1994) recorded seven species from Malesia; Sharp and Simon (2002) treated nine species from Australia. In 2008, Snow *et al.* published an excellent revision of the genus *Leptochloa* in Colombia.

The Indian *Leptochloa* have been treated by various authors (Bor, 1940, 1960; Karthikeyan *et al.*, 1989; Moulik, 1997; Cook, 1901–1908; Achariyar & Mudaliyar, 1921; Blatter & McCann 1935; Fischer, 1934; Matthew, 1982, 1988; Britto & Matthew, 1983) in various floristic accounts. Several authors also published accounts of grasses for different states (Sreekumar & Nair, 1991; Pullaiah, 1997; Kabeer & Nair, 2009; Potdar *et al.,* 2012).

Phillips (1973) revised the genus *Dinebra* in Africa and described one new species for East Africa and one variety for South Africa. In 2012, Snow and Peterson carried out a systematic treatment of *Trigonochloa,* a genus recently segregated from

the polyphyletic *Leptochloa s.l.* Subsequently, Snow *et al.* (2013) published the revision of *Disakisperma* with detailed descriptions, geographical distributions, and a phylogram based on molecular markers.

Phylogenetic and Molecular Studies

Research continues into the origins of the grasses, and new avenues of inquiry are being explored as new methods of investigation become available. Molecular biologists have developed powerful tools to study the nucleotide sequences of RNA, and the nucleotide and gene sequences of nuclear and chloroplast DNA of living taxa (Stanley, 1999). With the rapid advancement in molecular systematic and bioinformatic tools, and in conjunction with a wealth of literature available on structural characters, a more refined picture of grass taxonomy and evolution is expected. However, caution needs to be exercised in our interpretations to avoid hasty decisions that can translate into regress rather than progress. This is an exciting time in the history of grass systematics and, undoubtedly, is a period of collaborative rather than individual effort (Hilu, 2007).

An echo of the concept on 'grass evolution' was emerged late in 19th Century (Celakovsky, 1889; Goebel 1895; Schuster, 1910). Outstanding papers concerned with grass phylogeny include those of Stebbins (1956), Prat (1960), Tateoka (1957, 1960), Stebbins and Crampton (1961), Parodi (1961), Jacques-Felix (1962), and Reader (1957, 1962), Butzin (1965), Clifford (1965), Clifford *et al.* (1969), Sharma (1979), Caro (1982), Hilu and Wright (1982), Watson *et al. (*1985), Clayton and Renvoize (1986), Soderstrom and Ellis (1987), Tzvelev (1977, 1989), Watson and Dallwitz (1992) and Zhang (2000).

In the last couple of years, a clear picture of the Poaceae has come out through a series of research publications. Despite, some of these studies have been blocked by limited sample sizes or inadequate numbers of variable bases. Formerly, Davis and Soreng (1993), developed the restriction site maps (RFLP) of the chloroplast genome to

study the genetic distances between the nuclear DNA among subfamilies. They recognized two contrasting clades within the family; clade one included subfamilies such as Panicoideae, Arundinoideae, Centothecoideae and Chloridoideae (PACC clade), clade two comprises the subfamilies like Bambusoideae, Ehrhartoideae, and Pooideae (BEP clade). In continuation with this, Soreng and Davis (1998) designed the molecular data based on 42 structural characters of chloroplast restriction sites. As a result, authors concluded that the subfamilies Panicoideae, Arundinoideae, Centothecoideae, Chloridoideae, Aristidoideae and Danthonoideae (PACCAD) group as an evolutionary clade.

Based on molecular markers, Hilu and Alice (1999) noted the phylogenetic position of Chloridoideae by using the plastid gene *matK*. This study brought out an insight into the affinity of the Chloridoideae to some 'Arundinoid' species. Subsequently, the Grass Phylogeny Working Group (2001) adopted an arduous task for the reconstruction of phylogenetic relationships wthin the family Poaceae and also with related outgroups. It is the first comprehensive and potent system of classification of grasses into subfamilies and tribes based on information from six molecular sequence data sets, chloroplast genome restriction sites and morphological data. This system rectified the problems related to monophyly of the *Anomochlooideae.*

Hilu and Alice (2001) studied the phylogeny of the subfamily Chloridoideae using the chloroplast gene *matK.* Authors noted the polyphyletic appearance of the two largest tribes Eragrostideae and Chlorideae. Although the infrageneric relationships in the genus *Chloris* and *Eragrostis* were unclear due to polytomy and weak support. However, these results provided an outline for further studies at the infrageneric levels towards a comprehensive systyematic treatment of the Chloridoideae. Besides morphological and anatomical characters, Soreng *et al.* (2007) used molecular markers for plastid encoding genes, to analyze the similarities among taxa of the subfamily Pooideae. Through these investigations, authors erected a new tribe *Poeae s.l.* with 21 subtribes.

Grass taxonomists have dialectic with the infrageneric classification of *Eragrostis* for many years. In this backdrop, Ingram and Doyle (2004, 2007) conducted a comprehensive phylogenetic analysis of *Eragrostis* species by using sequence data from the chloroplast locus *rps16* and a portion of the nuclear gene *waxy*. Authors brought out the monophyletic outlook of *Eragrostis* with the inclusion of diverse segregates, including *Acamptoclados, Diandrochloa,* and *Neeragrostis.* Therefore, the authors suggest that existing classification is not deficient to prove monophyly within the *Eragrostis* species. In the light of these evidences, authors recommended to revise the classification for better interpretations. Ragupathy *et al.* (2009) analysed DNA barcoding by three coding and non coding sequences (*rbcL, matK* and *trnH-psbA*) in selected *Tripogon* species of Western Ghats in southern India.

Later, Molecular studies in the subfamily Chloridoideae (Poaceae) was developed by Peterson *et al.* (2010) who analyzed six plastid DNA sequences and a single nuclear ITS DNA sequences in the data set of 95 genera and 246 species, to solve the existence of subtribal and infraspecific disputes. They have erected one new tribe *Trirahideae* and the subtribe *Aeluropodinae.* Moreover, the study provided an insight into the evolutionary plasticity at infrageneric level also.

Through an encyclopaedic analysis of molecular evidences, the Grass Phylogeny Working Group II (2012) proposed an updated phylogeny of entire Poaceae. Based on the combined sequences from chloroplast genetic markers (*rbcL, ndhF* and *matK*) and the *trnK* introns obtained from the GenBank, authors developed an enriched master molecular data matrix. Their study reflects two important taxonomic changes, such as the recognitions of the subfamily Micrairoideae and the merging of the subfamily Centothecoideae with Panicoideae.

The genus *Leptochloa s.l.* is generally considered as an assemblage of unrelated taxa. Peterson *et al.* (2012) conducted an updated genus-wide phylogenetic analysis of this genus based on five plastid (*rpL32-trn-L, ndhA* intron, *rps16* intron, *rps16-trnK*

and *ccsA*) and the two nuclear *ITS* sequences for 32 annual or perennial species. The molecular results corroborated the dissolution of *Leptochloa s.l.* into five strongly supported lineages: *Dinebra* Jacq. (23 species), *Diplachne* P. Beauv. *s.s.* (2 species), *Disakisperma* Steud. (3 species), *Leptochloa* P.Beauv. *s.s.* (5 species) and a newly erected genus *Trigonochloa* P.M. Peterson & N.Snow (2 species). Fabillo (2015) conducted the phylogenetic analysis of Australian *Tripogon* and affliated genera by using chloroplast DNA, *trn*L-F and nuclear DNA data. Unfortunately, the *Oropetium* and *Eragrostiella* nested in the tree. Therefore, the result indicates that the Australian *Tripogon* is non monophyletic.

Recently, Soreng *et al.* (2015b) presented an updated worldwide phylogenetic classification of entire Poaceae, based on two chloroplast DNA markers (*matK* and *ndhF*). They described six supertribes, 51 tribes, 80 subtribes and 12 subfamilies under Poaceae, and also established a new subtribe Calothecinae. In the same year, Kellog (2015) has undertaken a synthesis of molecular studies that have enormously added to traditional classifications based entirely on anatomy, cytology, and morphology. In order to reduce redundancy and circumscription she uses fewer ranks below the subfamily level classification. Soreng *et al.* (2017), revisited the classification based on latest information on this group and reinstated supertribes and supersubtribes in Poaceae.

Morphology in Grass Systematics

Morphology continues to predominate over other sources of characters in plant classification. Variations in morphological characteristics are crucial to taxonomic purpose, because these characters have innumerable variants that support delimitation and identification (Sivarajan, 1991). Broadly used morphological structures in agrostology are leaf, spikelets, and caryopsis. The gross morphology of the leaf and inflorescence of Chloridoid members have been recorded in various literature (Watson & Dallwitz, 1992; Phillips & Chen, 2002; Palmer & Weiller, 2005; Clayton *et al.,*

2006; Simon *et al.,* 2011). Scanning Electron Micrographs (SEM) are now commonly used to record micromorphological characters (Stace, 1991).

Seed surface morphology has been recognized as a good taxonomic character for delimiting species in various plant groups (Colbry, 1957; Martin & Barkley, 1961; Terrell & Peterson, 1993; Lazarides, 1997; Boechat & Longhi-Wagner, 2003; Peterson *&* Vega 2007). Davis and Heywood (1963) stated that seed morphological study may provide many systematically significant characters in plant taxonomy which are reliable and constant within a taxon. Since then, there were a number of studies on the seed morphology, especially by using the Scanning Electron Micrographs in diverse groups of plant families. At first, Snow (1996) studied the lemma micromorphology of the subtribe *Eleusininae* (including *Leptochloa s.l.*) using Scanning Electron Microscopy. Surprisingly, all the species of *Leptochloa* having cork cells, but the silica cells are totally absent within *Leptochloa* and related genera in *Eleusininae*. Later, Rúgolo de Agrasar and Vega (2004) observed the micromorphological features of leaf blades and spikelets in American Tripogons. Liu *et al.* (2005) studied the macro- and micro morphological characters of caryopsis to find out the recognition of three types of caryopses in Chloridoideae. Further, using the Scanning Electron Microscopy Liu *et al.* (2010) recorded five different lemma micromorphological features in the subfamily Chloridoideae.

In 2012, Giraldo-Cañas *et al.* brought out a putative revision of *Eragrostis* in northwestern South America. Here, authors carried out a detailed systematic study of various micromorphological features, and pointed out considerable variation between species in phytoliths (leaves), glands, surface ornamentation (spikelets), and pattern of cells, texture (caryopses) etc. Subsequently, Jettisha and Sabu (2012) studied phytoliths in eight genera of Chloridoideae in Kerala. Based on the frequency, size, and shape of the phytoliths, they also prepared a key for the subfamily Chloridoideae.

Gandhi *et al.* (2013) investigated the caryopses in nine species of the genus *Eragrostis* from India by using Light and Scanning Electron Microscope. As a part of revisionary studies of the genus *Eragrostis*, Vivek *et al.* (2013, 2016) have given an account of 44 species in India which includes SEM of caryopses. Particularly, authors observed the remarkable micromorphological differences in caryopses in genus *Eragrostis* may be usful for species delimitation. Similarly, Fabillo (2015) presented an account on the micromophological characters of *Tripogon loliformis* in Australia. Recently, Wróbel *et al.* (2017) examined the pattern of the lemma micromorphology of middle Asian *Eragrostis* species. The notable structures associated with the study are: cork and silica cells, prickles, microhairs and glands. Dinda and Mondal (2018) recently published a morphometric and numerical analysis on phytoliths in five species of *Eragrostis* in West Bengal, India.

Anatomy

Anatomical characters have been employed in plant taxonomy for over a century. However, a remarkable revolution in vascular plant taxonomy was observed in the recent years (Stace, 1991). The use of anatomical data in grass systematics is rather very limited, when compared to other plant groups. Achariyar and Mudaliyar (1921) discussed the importance of 'threads' (vascular bundles) in grasses. The use of the Scanning Electron Microscope in the study of epidermal patterns provided tremendous information on the systematics of many ranks. Previously, agrostologists delimited the subfamily Chloridoideae (=Eragrostoideae) was on the basis of differences in their leaf anatomy, particularly details of the mesophylls and vascular bundles (Renvoize, 1981). These clear cut structural discrepancies reflect distinctive functional differences and have been correlated with various photosynthetic pathways predominent in the Poaceae (Brown, 1977). Ellis (1984) recorded non-Kranz (C_3 photosynthetic pathway) leaf anatomy in Chloridoideae for the first time.

Anatomical studies proved to be an important tool to resolve the taxonomic problems within the tribe *Eragrostideae* (Ahmad *et al.,* 2011). A few isolated studies were carried out in one or two genera of the tribe by some authors. It was Amarasinghe and Watson (1990), who first analyzed microhair morphology types, and PCR (photosynthetic carbon reduction) sheath anatomy of 74 species of *Eragrostis*. The result point out the correlation of microhair morphology with PCR sheath anatomy. They observed three distinct types of microhairs, such as chloridoid, panicoid and enneapogon (intermediate). Here, chloridoid type shows the maximum representation and enneapogon shows the minimum. Recently, similar studies on microhair morphology of Indian *Eragrostis* was carried out by Vivek *et al.* (2016).

Ingram (2010) conducted an alternative classification system for the genus *Eragrostis* based on leaf blade anatomy. The characters were analyzed using DNA sequence from nuclear (GBSSI), and plastid (*rps 16, trnL-F*) loci. Hither, *Eragrostis* shows great variations in anatomy ranging from NAD-ME to PCK-like with some intermediaries between them. Ahmed *et al.* (2011) studied the foliar anatomy of some selected genera of *Eragrostideae* from Pakistan. The studies show taxonomically useful anatomical characters that can play critical role in identification and delimitation of taxa. Babu and Savithramma (2014) analyzed the variations in stomatal index and frequency in some slected genera of Poaceae from South India. Subsequently, Kumar and Nautiyal (2017) carried out the leaf anatomy of two genera of *Eragrostideae* from North India. The present investigation revealed *Eragrosti*s shows the maximum length of inter coastal long cells in a range of 90–165 micrometers. Fabillo (2015) studied in detail the anatomy of the leaf structure in *Tripogon* and affiliated genera. Based on their findings, leaf anatomical characters such as the number and type of vascular bundles are potentially informative for distinguishing species or between allied genera. She also observed three different lamina shapes in Asian species.

Cytology

In the last few decades, tremendous progress has been made in chromosomes studies. For more than 80 years, 'chromosomes' have been an important element in evaluating relationships and deducing phylogenetic sequences in the Angisperms (Raven, 1975). Russian Cytologist Avdulov (1931) was the pioneer to recognize the taxonomic significance of grass chromosomes. He reported the results of chromosome studies of some 232 grasses and correlated these data with other systematic studies. Later, Stebbins (1956) studied four major lines of evolution in grasses with the support of morphological and cytological evidences. It has been observed that chance of polyploidy was higher in Poaceae than in any other angiosperm family. About 80 percentage of grass species have undergone a ploidy change at some point in their evolution (Stebbins, 1985).

Investigations on the cytogenetics of grasses were carried out by many authors (Hubbard, 1948; Tateoka, 1957; Gould, 1958; Hartley and Slater, 1960; Raven, 1975; Clayton, 1981; Watson & Dallwitz, 1992). Askell Löve published series of papers on cytogenetic studies of grasses in different parts of the world (1966, 1967, 1970, 1971, 1972a, 1972b, 1973a, 1973b, 1975, 1976a, and 1976b). Subsequently, Akhtar (1986) analyzed the cytology of 37 species of *Eragrostis* in Ethiopia and prepared an annotated list of all published chromosome counts of *Eragrostis* species. He observed the 76 percentage of polyploidy within the genus. He also tested the relationship of pollen diameter with chromosome number. Later, Roodt and Spies (2003) studied the chromosome numbers of South African Chloridoideae.

In an India context, a prelude to cytogenetics was done by Kum Kum Roy (1965). He observed the meiotic stages in *Eragrostis diarrhena* Steud., and recorded the basic chromosome number for *Eragrostis* as five. Later, Christopher and Abraham (1974, 1976) studied the cytology of sub family *Eragrostoideae* and *Panicoideae* in South India. Later on, Mehra and Sharma (1975) conducted a cytological screening in

some central and Himalayan grasses. In 1978, Sharma *et al.* carried out a cytological study on selected grasses from the Odisha state. Here, authors have observed that the variations in the chromosome number from earlier reports were due to the change in ploidy levels.

Palynology

The progress in palynological research has been remarkably accelerated by the advent of the Electron Microscope in recent times (Blackmore, 1984). The major characters of pollen grains helpful for the systematists are: aperture variations, exine ornamentation and stratification patterns, pollen association, and pollen nuclear number (Sivarajan, 1991).

Grass pollen is the shortest-lived pollen among the angiosperms, and also it is viable for only a few hours in an open air, neither it travel far in a viable condition (Clayton & Renvoize, 1986). An earlier study on the pollen morphology of grass genera shows that, pollen characters have limited systematic value in delimiting taxa at generic level or above. The entire morphology of grass pollen is remarkably too uniform throughout the family (Liu *et al.,* 2004; Perveen & Qaiser, 2012; Mander *et al.,* 2013). Liu *et al.* (2004) investigated the pollen morphology of some selected genera of Chloridoideae by using Scanning and Transmission Electron Microscopy. They distinguished five different types of pollen from the Chloridoideae; out of these, two types of pollens are the first report from Poaceae. Remarkably, at specific instances, pollen may sharpen some generic boundaries; Clayton and Renvoize (1986) relegated the genus *Diplachne* to a synonymy under *Leptochloa* based on the spikelet morphology only. Later (2004) Liu and their team analyzed the pollen of both taxa and substantiated that pollen of *Diplachne* is small with sparsely insular exine, and *Leptochloa* with a medium compactly insular exine.

Since then, Perveen and Qaiser (2012) analyzed the pollen morphology of 30 genera of Poaceae in pollen flora of Pakistan. They indicate that, the pollen grain of Poaceae is stenopalynous type, hence, the size and shape alone are significant.

Therefore, palynology exclusively doesn't harmonize the tribal and generic delimitation; however, pollen morphology may significantly helpful at the specific levels also. Mander *et al.* (2013) studied the pollen morphology by using algorithms and histogram designs. In India, Ghosh and Karmakar (2017) investigated pollen morphology of Poaceae of West Bengal by light microscopy.

Physiology

In Poaceae, majority of grasses manifest the C_4 pathway for efficient carbon assimilation which has derived from the C_3 pathway in a few groups occupying dry and open habitats of the tropics. This pathway allay photorespiration (C_2 cycles) and it act as a physiological adaptation for a dry conditions. Many more studies have solicited to clear up the subfamilial and tribal level relationship of grasses with C_4 pathway and used it an additional specification in modern classifications. Smith and Brown (1973) studied the Kranz syndrome in the Gramineae using carbon isotopes; it is restricted to the three tropical subfamilies Arundinoideae, Chloridoideae, and Panicoideae. Hatch (1971) figure out the correlation of high temperature and low carbon dioxide condition may enhance the C_4 photosynthetic pathways by mitigating the effects of photorespiration (C_2 cycle).

Gutierrez *et al.* (1974) reported that the enzyme phosphopyruvate carboxykinase and NAD-malic enzyme have been found in the subfamily Eragrostoideae (Chloridoideae) with the exception of the genera *Panicum* and *Urochloa*. Later, Panarello and Sanchez (1985) checked Kranz syndrome in the tribe *Eragrostideae* by using carbon isotopic ratios. Afterwards, Ginbot (2002), Ginbot and Farrant (2011) studied the water deficit stress in selected species of *Eragrostis* by using molecular and physiological techniques. They screened cDNA libraries by radioactive cDNA from hydrated and dehydrated leaf samples. They also revealed two genes Nin-19, Nin-44; here, Nin-44 shows the best result for identifying water deficit stress responsive genes in different leaf samples. Balsamo *et al.* (2006) studied the leaf tensile properties and drought tolerance of selected *Eragrostis* species. They concluded that,

correlation between water status and position of leaf lamina may design the cell wall architecture, tensile strength, and tolerance.

Since then, Kreitschitz *et al.* (2009) studied the retention capacity of slime cells on the surface of *Eragrostis* seeds. They noticed the ability of slim cells to imbibe and retain moisture around the caryopsis is an adaptive earmark for *Eragrostis* growing in dry habitats. These retention capacities of slime cells create a suitable condition for rapid germination. Besides Fabillo (2015) and Karbaschi (2016) checked the resurrection capacity of the Australian *Tripogon loliformis* (F. Muell.) C.E. Hubb. The result indicates that, Australian *Tripogon* can withstand the extreme dehydration condition in an open air and recover upon by receiving water. Subsequently, Aidar *et al.* (2017) studied the capability of desiccation tolerance in Brazilian species of *Tripogon.*

Chapter 3

Materials and Methods

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The methodology and general outline of the study is primarily in accordance with that of Radford *et al. (*1974) and Bridson and Forman (1998). The materials for the present study are mostly based on the live specimens collected from different parts of Peninsular India through extensive field trips during the period of 2012–2018. About 265 field trips were conducted, spending 358 days in the field, ranging from sea level to 2695 m elevation. A large number of specimens (*c.* 2230 numbers from the entire Peninsular India) have been collected. Besides, the different physiographic regions of Peninsular India were repeatedly visited during all seasons as possible for studying the variations. The type localities of many taxa were explored for their collection. Moreover, the distributional status of all the species and varieties of the subtribe were checked. The collected specimens were processed to make standard herbarium following the guidelines of Vogel (1987).

In addition to the our own personal collections, the herbarium specimens housed in many Indian institutions such AHMA, BLAT, BSI, BSID, CAL, CALI, DEV, FRC, KFRI, JCB, MH, RHT, SUK, TBGT, and Goa University Herbarium were also consulted to study the variation and distribution pattern of each taxa. Digital images of type specimens were procured from virtual databases of different herbaria (B, BM, BR, C, FI, G, K, L, LD, P, PR, S, TI, W and WAG). Lists of herbaria cited with their details are provided in the Appendix III. Acronyms of herbaria were cited following Index Herbariorum (Theirs, 2011) and the examined specimens are indicated with exclamation mark (!). The voucher specimens collected and examined were deposited at Calicut Univeristy Herbarium (CALI), and type materials are also deposited in various Indian (CAL, MH) and foreign herbaria (BRIT, K, SING).

The information on the subtribe *Eragrostidinae* was collected from various sources such as libraries of institutions and information retrieval systems like internet.

The literature retrieval systems of Biodiversity Heritage Library (BHL) of New York Botanical Garden (http://www.biodiversityheritagelibrary.org), botanical literature from Missouri Botanical Garden Library (http;//botanicus.org), Gallica, the digital library of the *Bibliothèque nationale de France* (www.gallica.bnf.fr.), and online Hathi Trust Digital Library (https://www.hathitrust.org) were also utilized.

The citations of taxa followed by IPNI. The database of the International Plant Names Index (http://www.ipni.org) and World checklist of selected Plant Families, a database of Royal Botanic Garden Kew (http://apps.kew.org) were also utilized. The nomenclature of each species was updated as per the Shenzhen Code (Turland *et al.,* 2018). Author citations provided are based on followed by Brummitt and Powell (1992). For descriptions of taxa, the terminology was adopted from Stearn (1983), Simpson (2010), and Harris and Harris (1995).

Field trips for collection of *Eragrostidinae* specimens were organized based on the information available from taxonomic literature and herbarium specimens. Distribution areas were identified and trips of varying duration were organized to over the entire Peninsular India during the flowering and fruiting season. Field data were collected for all taxa and observations were directly recorded in the field book. Ecological information such as type of soil, associated taxa and habitat preferences were also recorded. Specimens were collected in quadruplicate and processed for the herbarium and laboratory studies following standard methods (Fosberg & Sachet, 1965). More than 2500 populations were observed in the field. Approximately 2360 accessions of specimens have been collected, during the period from November 2012 to May 2018. Live specimens of 60 out of 69 taxa were collected.

The fresh and dried samples were analysed for each species to evaluate the characters as well as to make sketches. For the measurements of floral parts, data sheets were prepared for each population studied. The data sheet includes information on locality, habitat and habit. In addition, information on the culm and leaf of the plant, width of the raceme-rachis, the spikelet parts such as pedicel, lower glume, upper

glume, lemma, palea, callus, rachilla, lodicules, stamen, stigma and caryopsis were also recorded for comparison.

All the specimens were examined through Carl Zeiss, Motic SMZ-168, Labomed Luxceo 4Z Stereo microscopes and colour photomicrographs were taken using Leica EZ4HD 3.0 and Leica MC190 HD Mega Pixel Digital Stereo Microscope with Leica Application Suite Version 2.0. Illustrations of the parts were made for each species using a Camera Lucida attached to WILD Stereo microscope and Leica M80 Stereo microscope. For the field photographs, DSLR Cannon EOS 1100D, NIKON D3300 and Cannon Digital Camera were used whenever necessary.

Scanning Electron Microscope (SEM) Carl-Zeiss Gemini 300 was used to study the ultra micro morphology of caryopses of the genus *Eragrostiella, Eragrostis, Tripogon* and two species of *Dinebra* and one species of *Disakisperma*. Dried seeds were taken to study the surface ornamentation. Mature caryopses surface was washed by ethyl alcohol and 2–4 were mounted on a stub coated with a thin film of gold-palladium mixture with the help of Mini Sputter Coater (SC7620, Quorum) and examined under the SEM.

Identification has been done referring of the keys provided in Bor's (1960) *The Grasses of Burma, Ceylon, India and Pakistan* and relevant revisions of Phillips and Chen (2002) and Veldkamp (2002). Type specimens and protologue were also consulted to confirm the determination. If any new synonyms are given, relevant notes on nomenclature and variations wherever necessary are provided. Many aspects related to identification, nomenclature and Latin translations were done with useful discussion with Dr. J.F. Veldkamp (National Herbarium, Netherlands) until his death in 12 November 2017. Detailed morphological characters were examined and variations were recorded.

Habitat and distribution data were compiled and integrated from which distribution map for all taxa were prepared. The generation of distribution dot maps is a very effective way of showing plant distribution. Micro-tip pens (Rotring Variant) equipped with 0.1, 0.2 and 0.3 points were used for preparation of illustrations.

Chapter 4

General Morphology

Chapter 4 General Morphology

The grasses (Poaceae or Gramineae) form an extremely natural family of flowering plants. They can be differentiated from all other families, notably in the characters of their leaves, fruits, seeds, and embryos. They are broadly herbaceous, but many bamboos have woody culms. Moreover, grasses show some resemblance to their allies, the sedge or Cyperaceae, in the characters of their flowers and vegetative organs as well. Likewise, both have naked flowers in the axils of glumes, arranged in spikelets. Despite, they differ in a number of characters: sedges have usually solid and triangular culms with leaves in three rows, while grasses have terete and hollow or solid culms with leaves in two rows. Sedges have closed-sheaths, but in grasses leaf sheaths are open on one side. The spikelets, a reproductive part common to both is believed to be not homologous. In sedges, each flower is subtended by a single bract (glume), while in grasses by a pair of bracts (lemma and palea). The fruit is an achene or a nut in sedges, but it is frequently a caryopsis in grasses. Besides, embryo of sedges is embedded in the endosperm, but it is peripheral in grasses. Sedges are relatively more primitive than grasses and they are predominantly hygrophilous (Bews, 1929; Bhat & Nagendran, 2001).

Grass: General morphology

Most of the grasses are herbaceous except certain bamboos and tall reed-like plants. Grasses may be annual or perennial, sometimes short lived biennial; usually terrestrial, sometimes aquatic. *Culms* usually erect or ascending, sometimes prostrate or decumbent for much of their length; nodes prominent, solid and often swollen, sometimes concealed by the leaf sheaths; internodes hollow or solid. *Leaves* are generally attached to the stem in two ranked, or sometimes spirally arranged. Grass leaf consist of two parts a *blade* which may be very flat or broad or rolled and narrow, and a basal *sheath* which surround the stem and often is at least as long as the blade. The area

where the blade and sheath merge is called the *collar* and usually there is membranous flap or a ring of hairs at the called *ligules*. Grasses have flower that is not showy and is simple composed of two united carpels surrounded by three stamens except bamboos and wild rice. Two tiny membranous scale *lodicules* can also be found associated with the reproductive organs. The flower is surrounded by two bracts, an inner *palea a*nd an outer *lemma.* This whole structure, the flower and two bracts is called a *floret*. One or more florets are then clustered together with two additional bracts, called *glumes*. The glumes may or may not resemble the lemmas. The lemmas and glumes may have an *awn* appendage usually attached at the tip or sometimes on the back. The cluster of florets and glumes is called *spikelet*. Spikelets are then arranged in various types of inflorescences such as spikes, racemes, panicles, or combinations of these. The panicle is the most common type of inflorescence in grasses. Once pollination occurs, the lemma and palea close and the two carpels together mature into a single one-seeded fruit, the *caryopsis* or grain.

Morphology of the subtribe *Eragrostidinae* J. Presl

Eragrostidinae is considered as one of the well known group of tribe Eragrostideae, subfamily Chloridoideae. It is hitherto represented by a seven genera in India. At first, Peterson *et al.* (1995) has given a general account on the morphology of New World genera of the subtribe *Eragrostidinae.* A detailed account on morphology of *Eragrostidinae* is presented here, which is chiefly based on the study of Peninsular Indian taxa, where it exhibits maximum diversity in Indian Subcontinent. This is the first comprehensive study on the taxonomy and morphology of the subtribe in peninsular India.

Vegetative morphology

The subtribe *Eragrostidinae* is highly variable in vegetative and floral morphology at generic and specific levels. A number of species are polymorphic and

also intergraded. They may be annual or perennial; rhizomatous, or stoloniferous, or caespitose, or decumbent (**Fig. 6**).

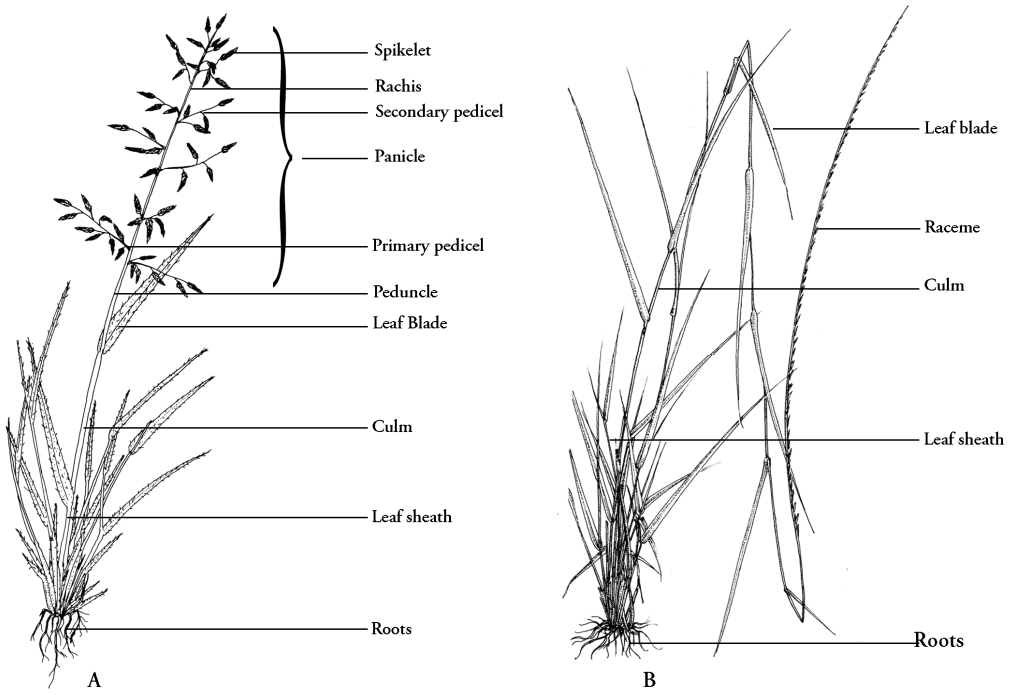


Fig. 6. Morphology of the subtribe Eragrostidinae: **A.** *Eragrostis* Wolf; **B.** *Tripogon* Roth *ex* Roem. & Schult.

Roots of the subtribe are always fibrous in nature and in certain circumstances are developed to an amazing degree. Majority of the roots arise from the lower nodes of the stems, it helps for anchoring the plant very firmly to the soil. Absolutely it is well known how difficult it is to pluck a tuft of grass from the ground. Some species produce roots from the nodes if pegged down on the soil (*Eragrostis unioloides, Tripogon velliangiriensis, T. wightii*). Many species are geniculate at the base for a short distance, each node producing roots, until they finally assume the upright habit *(Dinebra chinensis).*

The Culm is the stem of a grass plant. It is made up of a series of nodes separated by internodes. The nodes at the base of the plant are very close together and the lowest of them normally give rise to the roots. In *Eragrostidinae* culms are glabrous,

and there very few (*T. bromoides*, *T. filiformis*) are entirely hairy. Usually 2–200 cm high (or more); herbaceous; amply to sparsely branched above, or unbranched above. The branching simple, nodes glabrous.

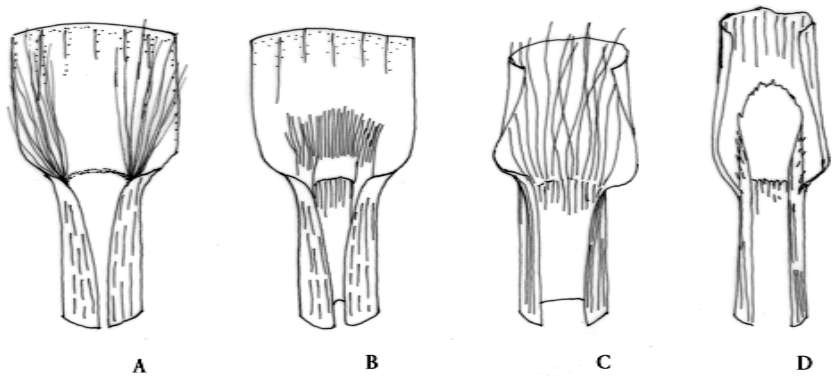


Fig. 7. Types of ligule in Eragrostidinae: **A.** Fringe of hairs at the ends; **B.** Membranous with ciliate margin; **C.** Rim of cilia at throat; **D.** Lacerate or membranous.

The Leaves consists of the sheath, the ligule and the leaf-blade. ***Leaf sheaths*** originate at the node of the stem. The sheaths are mostly terete, compressed or sharply keeled to the culms firmly. The surface of the sheath is usually glabrous and very often ridged and / or hairy (*T. bromoides*, *T. filiformis*). The hairs arise often from tubercles (*E. schweinfurthii*) and in some species pilose or sparsely hairy on single margins (*E. coarctata, E. maderaspatana*). ***Leaf blades*** are usually linear to lanceolate, filiform; flat or folded, or rolled. The laminas of the blades are folded or convolute (*T. velliangiriensis*, *T. wightii, T. jacquemontii, T. polyanthus*) and flat (*Eragrostis*), some species of *Tripogon* (*T. bromoides, T. lisboae, T. malabaricus, T. vellarianus* and *T. bimucronatus*). The leaf apices are acute or acuminate, serrulate, very rarely pungent (*T. pungens*) and clavate (*Eragrostiella brachyphylla*). The surfaces are glabrous or scabrid, rarely pilose; some species shows roughness mostly due to scabrid (*Disakisperma obtusiflorum*) or to the surfaces being covered with tubercle based hairs. Mostly margins of the blades are glabrous or comparatively quite smooth, some species

are gland dotted (*E. minor, E. maderaspatana*). ***Ligule*** is a structure which is closely adpressed to the culm at the junction of the sheath and blade on the inner side with great variability (**Fig. 7**). But experiences have shown that it is considered as a specific character they are fairly reliable for taxonomic delimitation. They vary very little in shape and size for a species. It may be a membrane (*Dinebra, Trigonochloa*), ciliate membrane or lacerate (*Eragrostiella, Eragrostis, Disakisperma*), or a line of hairs (*Tripogon*).

Reproductive morphology

The Infloresence of the grass plant is produced on shoots which may be terminal and axillary or very often only terminal. The subtribe *Eragrostidinae* shows the inflorescences like panicles (true panicles), racemes or spikes; most of them are terminal, rarely axillary. The spikes and racemes are solitary in the genera like *Eragrostiella* and *Tripogon*. Here, the spikelets are sessile or subsessile on a jointed or continuous axis. Panicles may be spiciform, open/effuse or contracted. Besides, the genus *Dinebra, Disakisperma, Eragrostis, Neyraudia* and *Trigonochloa* have the panicle type inflorescences. In *Eragrostis,* primary panicle branches up to 5 cm long, round, flattened, or terete; secondary panicle branches 0.5–15 cm long, bearing the pedicelled spikelets. Similarly, *Dinebra, Disakisperma*, and *Trigonochloa* have numerous racemes on the central axis of the panicles.

The Spikelets is the unit of inflorescences (**Fig. 8**). It consists essentially of a pair of distichous alternate bracts at the base called *glumes*, followed by a floret or floret that are arranged distichously or alternately on a short jointed or tough axis called *rachilla*. Each floret has two bracts enclosing the flower. The outer bract is called the *lemma* and inner *palea*. The glumes, rachilla and one to many florets together form a spikelet. As with every other organ, spikelet and its parts show the most fantastic variation. The spikelets may have one to forty or more florets (single flowered in *Trigonochloa uniflora* and *Dinebra neesii;* three or more in the species of *Eragrostis* and

Tripogon; more than 40-flowered in *E. unioloides, E. tremula, E. zeylanica* and *T. polyanthus*. The florets are hermaphrodite (bisexual). The perianth is reduced one to three scales called *lodicules*. Most of the *Eragrostidinae* have three stamens, rarely two in *T. mahendragiriensis*), and one is observed in *T. longearistatus* also. The pistil consists of a basal ovary having two separate styles with feathery stigmas. The ovary of a grass develops into a one-seeded grain (caryopsis). The spikelets sometimes bears usually hard pointed base known as *callus*. In most of the species of Tripogons, callus is usually bears numerous bristle like hairs at the base of each florets. The only way to get some idea of the range of variation in the spikelets is to take each part by itself.

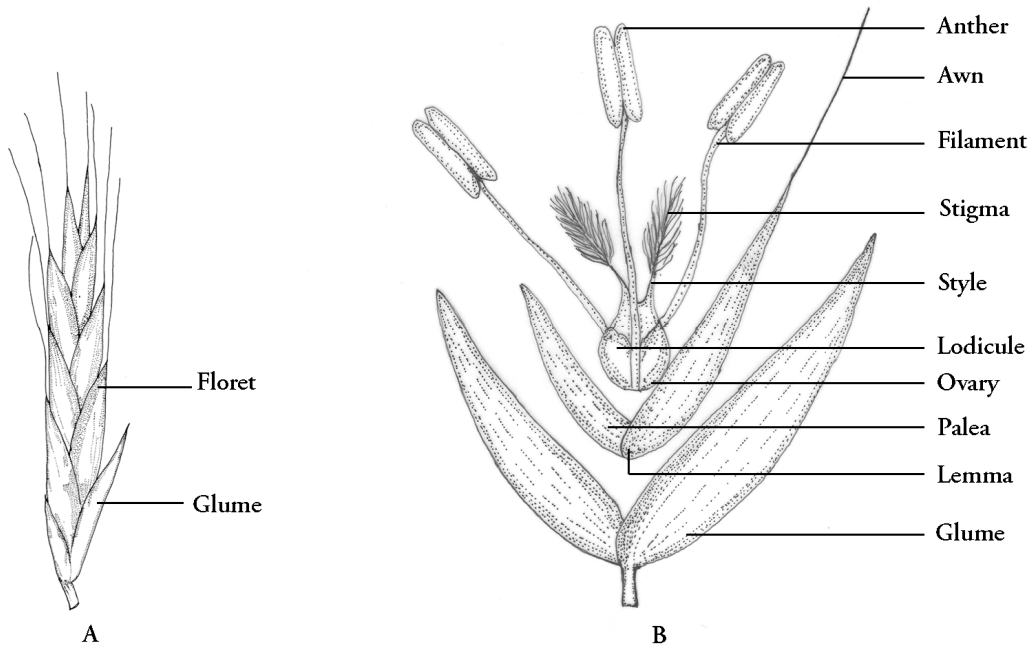


Fig. 8. Spikelet morphology of Eragrostidinae **A.** Spikelet; **B.** Diagramatic sketch of single floret with glumes.

The rachilla is the axis of the spikelet on which glumes and florets are distichously arranged. Rachilla may be terete to angled, smooth, glabrous, or scabrellate (*Tripogon*). The mode of disarticulation of rachilla is a good taxonomic character within the genus *Eragrostis*. It may break up either above or below the glumes and between the florets. The rachilla can be straight (*Tripogon, Eragrostiella*), flexuose or zig-zag (*Eragrostis*) in appearance.

The glumes are the two bracts arranged just one above the other and are designated as lower and upper glumes. Glumes are variable in size, shape, texture and in the number of nerves. In the genus *Eragrostis* both are almost subequal in size, commonly 1-nerved, and rarely nerveless (*E. maderaspatana, E. tenuifolia*), boat-shaped (*E. schweinfurthii*). While the lower glumes of *Tripogon* has sometimes oblique and a lobe or tooth on one side (*T. bromoides, T. narayanae* and *T. sivarajanii*); moreover, apex of the upper glumes may be bi-dentate, mucronate or shortly awned (*T. bromoides, T. ravianus, T. sivarajanii, T. velliangiriensis, T. wightii* and *T. zeylanicus*). They may be glabrous, pubescent, membranous or chartaceous.

The lemmas are the flower bearing bracts. Generally, in *Eragrostidinae* lemmas are entire, emarginate, lobed, or cleft; awned, mucronate, or unawned; glabrous or hairy; 3-nerved. In the genus *Eragrostis,* the apex of the lemma may be acute, acuminate, or obtuse. Moreover, the mode of disarticulation of lemma may be sub-persistent or caducous. The presence or absence of lemma awns provides a reliable character for identification. Whereas in *Tripogon*, number of lobes and texture of awns serve as key character for species delimitation. Awns may be hair-like long (*T. capillatus*), stout (*T. bimucronatus, T. malabaricus, T. sivarajanii* and *T. vellarianus*), or straight to curved (*T. velliangiriensis, T. wightii*). Similarly, the lemma cleft at the apex into two (*T. bimucronatus, T. jacquemontii, T. lisboae, T. malabaricus, T. polyanthus, T. svarajanii, T. vellarianus, T. velliangiriensis* and *T. wightii*), or more lobes (Eg: *T. borii, T. bromoides, T. filiformis, T. idukkianus, T. karnatakensis, T. munnarensis, T. narayanae).*

The paleas are a floral bract directly facing the lemma. The palea is oriented opposite the lemma facing its dorsal side against the rachilla. The lemma and palea together protect delicate grass flower. In *Eragrostidinae*, texture of the palea may be hyaline (*Dinebra neesii*), membranous, or chartaceous; 1–2-keeled or not, at times keels may be narrowly to broadly winged (*Eragrostiella bifaria* and *T. velliangiriensis, T. wightii*) with wings ciliate to scabrellate. In *Eragrostis*, the palea may be persistent, sub-persistent or caducous with its lemma.

The flower consists of lodicules, androecium and gynoecium. ***The lodicules*** are delicate, small to fairly large scales which are oblong, obcuneate-truncate to faintly lobed and glabrous. Generally, 1–3 lodicules are present at the base of ovary. The lodicules are capable of becoming highly turgid during the time of anthesis, and by this means the lemma and palea thrust apart so that the stigmas and stamens may emerge out. ***The androecium*** consists of stamens which may be one (*T. longearistatus*), two (*E. ciliaris, E. ciliata, E. gangetica, E. deccanensis, E. unioloides* and *T. mahendragiriensis*), two or three (*E. cumingii, E. brownii*) or three numbered. Each stamen consists of a long slender filament carrying a two-celled anther. The colour of the anthers is bright yellow or deep purple or even mottled. ***The gynoecium*** or pistil consists of ovary, style and stigmas. Ovary may be globose, narrow and elongate, oblong or ovoid. Usually ovary bears two feathery styles, but the ovary is considered as tricarpellary in nature on the basis of vascular system.

The caryopses, the dry one seeded and indehiscent fruit is peculiar in the family Poaceae. The mature caryopses are made up of embryo, endosperm, fused seed coat and pericarp. In *Tripogon* the caryopses long, linear and lanceolate with an adnate pericarp. The genus *Eragrostiella* and *Eragrostis* shows the ovoid, globose or subglobose type of caryospsis. In some species such as *Dinebra chinensis*, *Disakisperma obtusiflorum* and *Trigonochloa uniflora* grains are dorsally grooved along onside.

Pollination and Dispersal mechanisms

The modern grass flower (floret) is typically wind pollinated and composed of three stamens, two stigmas, and a single-chambered ovary with two lodicules at its base. These structures are covered and protected by the lemma and palea until the flower opens (Clayton, 1990; Stanley, 1999). Bees and other insects have been feeding on pollen, but their contribution to pollination would appear to be less. Therefore entomophilous mode is evidently a secondary adaptation. Floral reduction is associated with the transition from insect to wind pollination. In grasses, the reduction of stamen numbers from six to three, two, or one, stigma numbers from three to two or one, and the reduction of perianth to three to one small lodicules. So, floral reduction resulted in

a large energy savings for any species attained it. However, floral reduction created a different set of potential problems in grasses. In addition, grass pollen is the shortest-lived pollen among the angiosperms being viable for only few hours in the open air. During the time of wind, pollen may carry long distances, resulting in an effective pollination range of a few tens of meters under most circumstances. For minimising the attack of fungal spores at the time of anthesis, duration of grass flowering was scheduled to only 2–3 hours in a day. However, presence of many more flowers on the inflorescence increases the opportunity for wind borne pollen to encounter a receptive stigma (Clifford, 1961; Clayton & Renvoize, 1986). Similarly, the recognition of an apt partner is negotiated by a complex spectrum of antigens produced by the pollen grains.

The first stage in dispersal is the detachment of the seed from the branches of the inflorescences. Consistently the point of detachment is above the glumes and between the florets if there is more than one (Bor, 1960). Generally, grass seeds are dispersed by wind, water, rain or by the indirect transportation supplied by animals. Due to the lack of appendages in the caryopsis of *Eragrostidinae,* the dispersal mechanism may occur by special ways. Slashing of mature inflorescences stimulate the spreading of caryopses on the roadsides, it may aid burial or to travel long distance by wind. Similarly, it may disperse through the transport of animals moving between paddocks from different regions. For example, the sticky panicle of *Eragrostis viscosa* has been carried to different localities by adhering to the hooves of cattle. Hay cut may also carry caryopsis from infested paddocks to new area. Besides, seeds spreads through the animal fur, feather, or hooves seems possible at the time of transport. Moreover, it may spread in mud adhering to vehicles and machinery, or through heavy trade between the ports.

Chapter 5

Subtribal Classification

Chapter 5 Subtribal Classification

Historical Sketch

Hereafter its establishment, the infrasubtribal classification of the subtribe *Eragrostidinae* has been a problem of controversy among taxonomists. Now, it is pertinent to discuss the relevant classifications of this group relevant to the Indian context. The treatments by Hitchcock and Chase (1950, 1951), Pilger (1954, 1956), Gould and Shaw (1983), Clayton and Renvoize (1986), Watson and Dallwitz (1992), and Peterson *et al.*, (1995, 1997) are presented in chronological sequences. Hitchcock and Chase (1951) was the first to attempt an infratribal classification of New World Eragrostideae in his *Manual of Grasses of the United States*. They treated Eragrostideae in three tribes *viz., Agrostideae, Chlorideae, and Festuceae,* under the subfamily Festucoideae, solely based on the one or two morphological characters such as number and disarticulation of florets in the spikelets. He also recognized two subfamilies, 10 tribes (included 169 genera and 1398 species) with descriptions (**Fig. 9**).

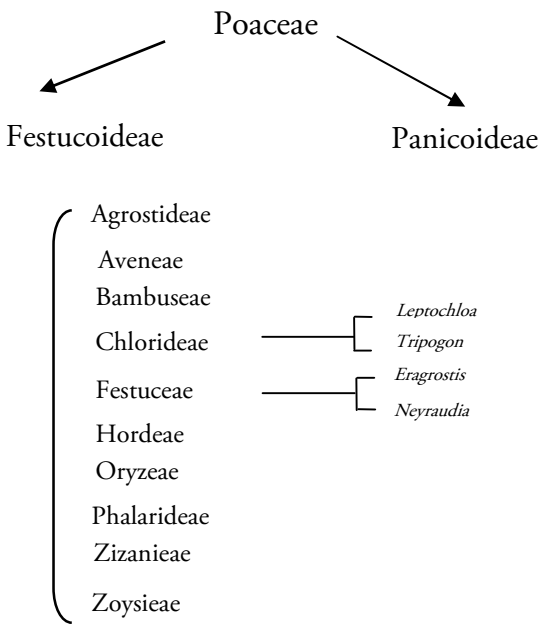


Fig. 9. Tribal Classification by Hitchcock & Chase (1951).

Subsequently, a progressive classification of the grass family was given by Pilger (1954, 1956), who placed nine different tribes (*Eragrosteae, Phaenospermeae, Chlorideae, Aristideae, Lappagineae, Jouveeae, Festuceae, Aveneae, Arundineae*) in two

different sub families (Eragrostoideae and Festucoideae). The tribe Eragrosteae consists of six subtribes (*Eragrostinae, Scleropogoninae, Lycurinae, Garnotiinae, Sporobolinae, Muhlenbergiinae*). Herein, the subtribe Eragrostinae was segregated from other tribes merely based on multi-flowered spikelets with perfect florets.

The classification presented by Gould and Shaw (1983) represents a significant modification of Hitchcock and Chase (1951). This modification was the result of Goulds's continuous studies in agrostology, especially in the areas of anatomy, cytology, ecology and morphology. They delineated six subfamilies (Festucoideae, Panicoideae, Eragrostoideae, Bambusoideae, Oryzoideae, Arundinoideae) of the Gramineae in the United States by 23 tribes, 122 genera, and 1083 species of native grasses. Moreover, the subfamily Eragrostoideae depicted eight tribes but failed to provide a key for the tribes; however, diagnostic characters can be extracted from the brief descriptions associated with each tribes.

Classification of Clayton and Renvoize (1986) was essentially a modification of that of Gould and Shaw (1983). They erected six subfamilies with 40 tribes and 34 subtribes. The subfamily Chloridoideae was systematically revised in to five tribes (*Pappophoreae, Orcuttieae, Eragrostideae, Leptureae, and Cynodonteae*) and nine subtribes; with five subtribes in Eragrostideae and four subtribes in the Cynodonteae. The hallmark of Eragrostideae is its unspecialized, usually many-flowered, spikelet with 1–3-nerved lemmas. They included all the genera included in the New World and Old World with a diagnostic description and circumscription. They also depicted the interrelationships between the species recognized under each tribe through a diagram (**Fig. 10**).

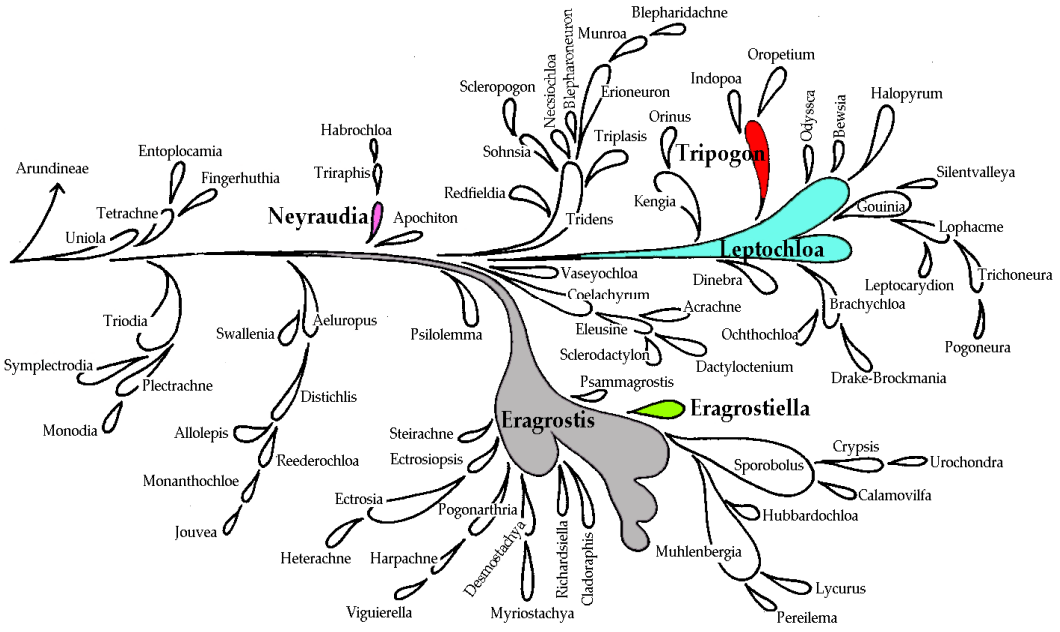


Fig. 10. Relationship in Eragrostideae (reproduced from the *Genera Graminium* by Clayton & Renvoize, 1986).

Later, in 1992 Watson and Dallwitz recognized four tribes (*Triodieae, Pappophoreae, Orcuttieae, and Chlorideae*) within subfamily Chloridoideae. But, they failed to provide a distinguishing characters of these tribes. Here, *Eragrostidinae* members are represented in the tribe Chlorideae without placing them in to separate subtribal categories. Consequently, Peterson *et al.,* (1995) proposed a sutribal classification for the 38 genera of Eragrostideae that occur in the New World. To classify the tribe *Eragrostideae*, they used the morphological data, phenetic analysis (Peterson *et al.,* 1997), and data from chloroplast DNA restriction site comparisons (Duvall *et al.,* 1994). They validated one new subtribe *Munroinae* Parodi *ex* P.M. Peterson and also recognized the seven subtribes *viz., Eleusininae, Eragrostidinae, Monanthochloinae, Muhlenbergiinae, Muroinae, Sporobolinae,* and *Uniolinae*. A detailed nomenclatural review of the subtribal classification of New World Eragrostideae was proposed by Peterson *et al.,* (1995, 1997), who revised the subtribal classification thoroughly and rectified all the nomenclatural problems pertinent to subtribal classification proposed by the previous authors. They included 15 genera

(*Eragrostis* Wolf, *Gounia* Benth., *Leptochloa* P. Beauv., *Neeragrostis* Bush, *Neesiochloa* Pilger, *Neyraudia* Hook.f., *Redfieldia* Vasey, *Scleropogon* Phil., *Sohnsia* Airy-Shaw, *Steirachne* Ekman, *Trichoneura* Anderss., *Tridens* Roem. & Schult., *Triplasis* P. Beauv., *Tripogon* Roth *ex* Roem. & Schult., *Vaseyochloa* Hitchc.) in the subtribe *Eragrostidinae* with description and nomenclatural types.

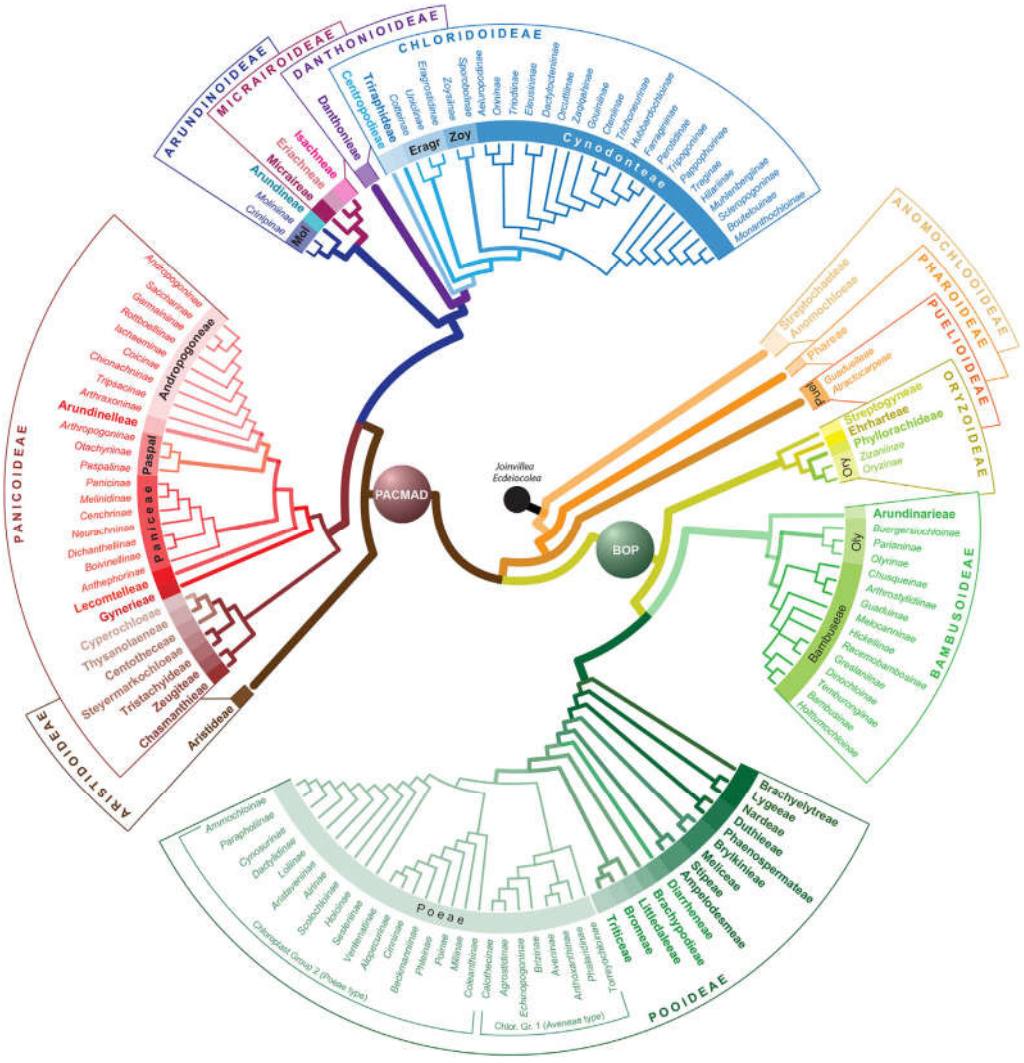


Fig. 11. Worldwide phylogenetic classification of Poaceae, includes 12 subfamilies, 53 tribes, and 90 subtribes evolving clockwise from Joinvillea and Ecdeiocolea (outgroups). BOP=Bambusoideae, Oryzoideae, and Pooideae; PACMAD=Panicoideae, Aristidoideae, Chloridoideae, Micrairoideae, Arundinoideae, and Danthonioideae. Thick branches represent subfamily splits; medium thick branches represent tribe splits; and thin branches represent subfamily splits (reproduced from Soreng *et al.,* 2017).

With the infusion of molecular data, there have been considerable changes in the understanding of relationships among grass genera, and species included in them in

the recent time. Based on recent molecular and morphological studies, Soreng *et al.,* (2015) presented a modern world wide phylogenetic classification of the Poaceae, recognising 12 subfamilies, 51 tribes and 80 subtribes. Here, some of the genera from the subtribe *Eragrostidinae* (Indian genera like *Eragrostiella* Bor, *Leptochloa* P. Beauv., *Neyraudia* Hook.f., *Tripogon* Roth *ex* Roem. & Schult. etc.) are segregated to other adjacent subtribes, may be due to the congruence of phylogenetic and morphological data. Consequently, Kellogg (2015) followed Clayton & Renvoize (1986); Watson & Dallwitz (1992) in his phylogenetic classification of the Poaceae. He reduced the number of tribes into 30 and subtribes to 53 and also omitted the supertribes category (Soreng *et al.,* 2015) from the classifications.

Since then, Soreng *et al.,* 2017 revised their classification in the second edition of their phylogenetic classification on Poaceae based on the latest data inferred from molecular and morphological studies and recognized 12 subfamilies, 52 tribes, five supertribes, and 90 subtribes (**Fig. 11**). Hither, only one genus (*Eragrostis*) is represented under the subtribe *Eragrostidinae* and some of them are segregated to adjoining subtribes. The present classification accepts the subtribal classification of Peterson *et al.* (1995), at the same time the generic concept of Soreng *et al.* (2017). All the segregate genera of *Leptochloa s.l.* was accepted in the present treatment and included in a more inclusive *Eragrostidinae*.

Table 1. A comparative chart of placement of genera treated under different subfamilies, tribes and subtribes by various authors

Hitchcock & Chase (1951)	**Pilger (1954, 1956)**	**Gould & Shaw (1983)**	**Clayton & Renvoize (1986)**	**Watson & Dallwitz (1992)**	**Peterson *et al.* (1995)**	**Soreng *et al.* (2015, 2017)**
Subfamily Festucoideae **Tribe** Chlorideae *Leptochloa* *Tripogon* **Tribe** Festuceae *Eragrostis* *Neyraudia*	**Subfamily** Eragrostoideae **Tribe** Eragrosteae **Subtribe** Eragrostinae *Eragrostis* *Leptochloa* *Neyraudia* *Tripogon*	**Subfamily** Eragrostoideae **Tribe** Eragrosteae *Eragrostis* **Tribe** Chlorideae *Leptochloa* *Tripogon* Not treated= *Neyraudia*	**Subfamily** Chloridoideae **Tribe** Eragrostideae *Eragrostis* *Eragrostiella* *Leptochloa* *Neyraudia* *Tripogon*	**Subfamily** Chloridoideae **Tribe** Chlorideae *Eragrostis* *Eragrostiella* *Leptochloa* *Neyraudia* *Tripogon*	**Subfamily** Chloridoideae **Tribe** Eragrostideae **Subtribe** Eragrostidinae *Eragrostis* *Eragrostiella* *Leptochloa* *Neyraudia* *Tripogon* Not treated= *Eragrostiella*	**Subfamily** Chloridoideae **Tribe** Triraphideae *Neyraudia* **Tribe** Eragrostideae **Subtribe** Eragrostidinae *Eragrostis* **Tribe** Cynodonteae **Subtribe** Perotidinae *Trigonochloa* **Subtribe** Eleusininae *Dinebra* *Disakisperma* **Subtribe** Tripogoninae *Eragrostiella* *Tripogon*

Hence the current treatment (modified from Peterson *et al.,* 1995) includes seven genera (*Dinebra* Jacq., *Disakisperma* Steud., *Eragrostis* Wolf, *Eragrostiella* Bor, *Neyraudia* Hook.f., *Trigonochloa* P.M. Peterson & N. Snow and *Tripogon* Roth *ex* Roem. & Schult.) under four different subtribes (**Table 1**). The subtribe Eragrostidinae *s.l.* has a history of unsetteled taxonomic problems at the generic and species levels. A checklist of subtribal classification of Soreng *et al.,* (2017) is provided in the flow chart (**Fig. 12**). The placements of genera in the present study are provided below.

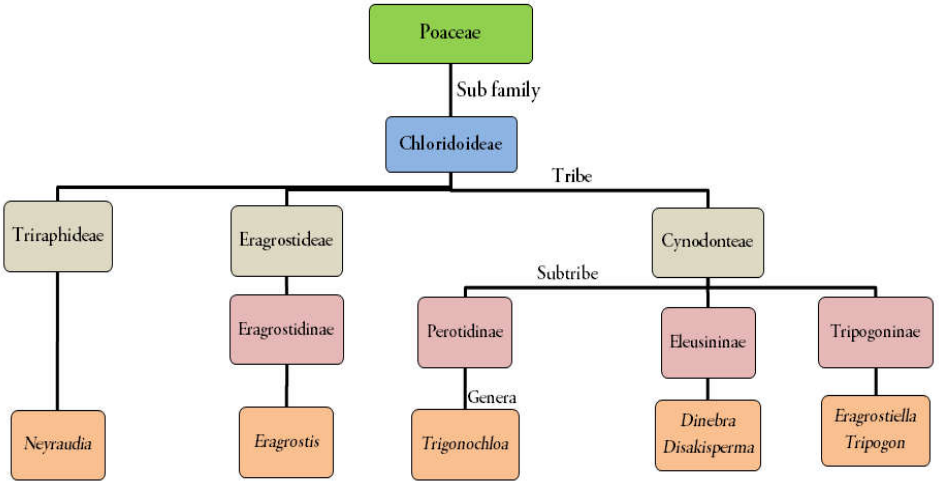


Fig. 12. Subtribal classification of Eragrostidinae *s.l.*

Chapter 6

Systematic Treatment

Chapter 6 Systematic Treatment

Eragrostidinae J. Presl

Eragrostidinae J. Presl, Rel. Haenk. 1:273. 1830; P.M. Peterson, R.D. Webster & Jesús Valdés-Reyna, Sida 16 (3): 539. 1995; P.M. Peterson, R.D. Webster & Jesús Valdés-Reyna, Smithsonian Contr. Bot. 45: 1997; P.M. Peterson, K. Romaschenko & G. Johnson, Mol. Phylogenetics Evol. 55: 92. 2010; E.A. Kellogg, The Families & Genera of Vascular Plants Vol. XIII. Flowering Plants. Monocots. Poaceae, 354. 2015; R.J. Soreng, G. Davidse, P.M. Peterson, F.O. Zuloaga, E.J. Judziewicz, T.S. Filgueiras, O. Morrone & K. Romaschenko, J. Syst. Evol. 53 (2): 128. 2015; R.J. Soreng, P.M. Peterson, K. Romaschenko, G. Davidse, J.K. Teisher, L.G. Clark, P. Barbera, L.J. Gillespie & F.O. Zuloaga, J. Syst. Evol. 55 (4): 289. 2017. **Type:**—*Eragrostis* Wolf.

Annual or perennial herbs, bisexual. ***Ligule*** a ciliate membrane, or a line of hairs. ***Leaf blades*** filiform, linear, or triangular. Primary branches of the inflorescence not digitate. ***Spikelets*** 1–40 mm long; laterally compressed or terete. ***Lower glume*** 1–5-nerved. ***Upper glumes*** shorter than or about the same length as the lower lemma; 1–9-nerved. ***Rachilla*** persistent between the florets. Florets 2–60 per spikelet. Sterile florets present (occasionally absent in *Eragrostis*). ***Lemmas*** entire, emarginate, lobed, or cleft; awned, mucronate, or unawned; glabrous or hairy; 3–9-nerved; hyaline, membranous, chartaceous, coriaceous, or indurate. ***Paleas*** hyaline, membranous, or chartaceous. ***Lodicules*** truncate, rounded, or acuminate. ***Caryopses*** with an adnate pericarp. Base chromosome number, x = 10, 20, or 30 (Peterson *et al.,* 1995).

Distribution:—Africa, Asia (including Arabian Peninsula) and South western United States.

The subtribe *Eragrostidinae* J. Presl is cosmopolitan, but occurs chiefly in the subtropical to tropical regions of Africa, Asia (including Arabian Peninsula) and United States. It is represented by approximately 18 genera and 570 species in the world (Peterson *et al.,* 1995, 1997; Soreng *et al.,* 2017). Eight genera, 84 species and 16 infra specific taxa occur in India and seven genera (including the recently described *Trigonochloa*), 69 species and 7 varieties occur in Peninsular India. The larger genera in Peninsular India are *Eragrostis* Wolf (36 species and four varieties), *Tripogon* Roth *ex* Roem. & Schult. (22 species and one variety), *Dinebra* Jacq. (four species) and *Eragrostiella* Bor (two species and two varieties). The rest of the genera, have one species each (*Disakisperma* Steud., *Trigonochloa* P.M. Peterson & N. Snow and *Neyraudia* Hook.f.). Members of this subtribe are cosmopolitan in distribution, and are found in open habitats and sometimes forests from sea level to high altitudes. They can be tufted annuals or perennials, Peninsular Indian species are primarily distributed in forests, grasslands, open habitats, rock crevices and granitic slopes along road sides.

Table 2. Genera treated under different tribes in the subfamily Chloridoideae (modified from Soreng *et al.,* 2017)

Triraphideae	**Eragrostideae**	**Cynodonteae**
*Neyraudia**	**Subtribe**	**Subtribe**
	Eragrostidinae	Perotidinae
	Eragrostis	*Trigonochloa*
		Subtribe
		Eleusininae
		Dinebra
		Disakisperma
		Subtribe
		Tripogoninae
		Eragrostiella
		Tripogon

* No subtribes

The diagnostic characteristics that exclusively delimit the *Eragrostidinae* from other subtribes in the subfamily chloridoideae has paniculate infloresences (occasionally

racemose), laterally compressed or terete (rarely dorsiventral) spikelets, lemmas 3-nerved (occasionally one or more than 3-nerved), and disarticulation typically above the glumes. Relationship among these genera has been problematic and agrostologists have attempted (Clayton & Renvoize, 1986; Peterson *et al.,* 1995) to sort out a classification that reflects common ancestors. The subtribal classification in this thesis is adopted from Soreng *et al. (*2017) based on the traditional classification of Peterson *et al.,* 1995, 1997, with minor modifications (**Table 2**). A key to seven genera present in Peninsular India is given below.

Key to the genera of Eragrostidinae *s.l.* in Peninsular India

1a. Infloresence a solitary raceme or spike like raceme…..... **2**

1b. Infloresence a panicle **3**

2a. Leaf blades convolute or clavate; inflorescence a solitary secund spike; spikelets awnless..... **3.*Eragrostiella***

2b. Leaf blades linear, flat or convolute; inflorescence spike like racemes; spikelets awned 7.***Tripogon***

3a. Panicles plumose or branched with racemosely arranged spike like racemes along the rachis…..... 4

3b. Panicles branched in to primary and secondary branches; lemma chartaceous or glandular; spikelets up to 70-flowered… 4.***Eragrostis***

4a. Tall, reed like perennials; panicles large, plumose; lemma margins villous near the base; sterile florets below fertile florets.....**5.*Neyraudia***

4b. Annuals or short-lived perennials; panicles branched with numerous racemes; florets fertile; lemma keeled, glabrousto puberulent…….....**5**

5a. Leaf blades thin, linear-broadly ovate, membranous, flat, broader; spikelets single flowered; caryopses trigonous…. **6.*Trigonochloa***

5b. Leaf blades linear, lanceolate, cartilaginous, narrow, finely serrulate; spikelets more than single flowered; caryopses shallowly furrowed or concave laterally… ...**6**

6a. Panicles lax, racemes scattered along central axis; apex of the lemma hairs clavicorniculate, base of lemma often indurate and sometimes 5-veined…….. .....**2.*Disakisperma***

6b. Panicles narrow, racemes alternate or spirally, arranged on the central axis; apex of the lemma hairs ovate to acute, base of lemma soft and 3-veined……..…… **1.*Dinebra***

Dinebra Jacq.

The name 'Dinebra' was coined by Jaquemont based on arabic vernacular name of its type species, *D. arabica* (= *D. retroflexa*). *Dinebra* is a small genus in the tribe *Eragrostideae* which until 1968 was represented only by a single species, *D. retroflexa* (Vahl) Panzer. It is a weedy species occurring from Africa eastwards to western India. *Dinebra* is closely related to the larger and more widespread genus *Leptochloa* P. Beauv., to which it resembles in having racemose inflorescence of 1–several-flowered spikelets which disarticulate between the florets, and the 3-nerved, keeled lemmas with pilose nerves and entire or toothed tips. *Dinebra* is distinguished from *Leptochloa* by its narrow, usually coriaceous and acuminate-aristate glumes exceeding the florets, in contrast to the membranous glumes of *Leptochloa* which are almost always shorter than the florets; and by its disarticulating spikes of closely imbricate sessile spikelets, whereas spikelets in *Leptochloa* are more loosely arranged along the axes of persistent racemes. (Phillips, 1973).

Recent molecular study (Peterson *et al.,* 2012) proposed splitting up the longer grass genus *Leptochloa* P.Beauv. into five segregate genera (*Dinebra, Diplachne, Disakisperma, Leptochloa* and *Trigonochloa*) based on molecular data from five plastid markers and the nuclear ITS regions. Currently, 23 species are included under this genus in the world. Out of which, 22 combinations are from the genus *Leptochloa*. Among them, four species are distributed in Peninsular India.

Dinebra Jacq., Fragm. Bot. 77, t. 121, f. 1: 1809; Hook.f., Fl. Brit. India 7: 296. 1896; C.E.C Fisch. in Gamble, Fl. Madras 3: 1840. 1934; Bor, Grass. Burma Ceylon India Pakistan 491. 1960; S.M. Phillips, Kew Bull. 28(3): 411; K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1843. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 210. 1989; L.Watson & Dallwitz, Revis. Grass Gen. World: 336. 1994; S. Moulik, Grass. Bam. India 2: 589. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1182. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 124. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 514. 2012; P.M. Peterson, K. Romaschenko, N. Snow & G. Johnson, Ann. Bot. 109: 1326. 2012. **Type:—***Dinebra retroflexa* (Vahl) Panz. Denkschr. Koenigl. Akad. Wiss. Muenchen 1813: 270. T.12. 1814.

Leptochloa s.l. P. Beauv., Ess. Agrostogr. 71: 1812; Hook.f., Fl. Brit. India 7: 297. 1896; C.E.C Fisch. in Gamble, Fl. Madras 3: 1819. 1934; Bor, Grass. Burma Ceylon India Pakistan 516. 1960; K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1872. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 235. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 395. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 297. 1994; L.Watson & Dallwitz, Revis. Grass Gen. World: 531. 1994; S. Moulik, Grass. Bam. India 2: 613. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1215. 1997; N. Snow., P.M. Peterson & D. Giraldo-Cañas, J. Bot. Res. Inst. Texas 2 (2): 862. 2008; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 158. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 551. 2012. *p.p. non* P.Beauv. 1812.

Annuals or perennials. ***Leaf Blades*** flattened or involute. ***Inflorescence*** of few to many spiciform racemes or cuneate racemes on a central axis; the raceme often whorled, sessile or subsessile, usually pubescent in the axils, with triquetrous rachis. ***Spikelets*** solitary, laterally compressed, closely imbricate, shortly pedicellate, second and biseriate; rachilla disarticulating above the glumes and between the florets, glabrous. Florets several or rarely one, bisexual; callus minute obtuse, with sparse short hairs. ***Glumes*** persistant, 1–3-nerved, membranous, more or less keeled, glabrous; sometimes longer than and enclosing florets. ***Lemmas*** dorsally convex or obtusely keeled upwards, membranous or hyaline, pubesecent or sometimes glabrous, smooth, acute or obtuse, entire or emarginated, muticous or mucronulate, 3-nerved, with faint submarginal lateral nerves. ***Paleas*** subequal to the lemmas, thinly membranous or hyaline, obtuse, scaberulous or pubescent on the keels upwards, smooth. ***Lodicules*** cuneate. ***Stamens*** 2 or 3. Styles distinct; stigmas short, plumose, laterally exserted. ***Caryopsis*** oblong-elliptic, compressed or trigonous, closely embraced by the lemma and palea, concave or grooved, loose or adnate to the pericarp.

Distribution:—About 23 species in the world; 4 in India and Peninsular India, throughout the tropics; warm temperate parts of America and Australia.

Habitat:—Known from the dry zone lowlands, ephemeral pools, in cultivated field, irrigation channels, similar marshy habitats and riparian corridors, and on seasonally wet clays.

Etymology:—The generic name *Dinebra* is based on the Arabic vernacular name of the type species (Clifford & Bostock, 2007).

Key to the species of *Dinebra* in Peninsular India

1a. Spikelets 1-flowered; ligules membranous; grain more or less smooth, turgid not grooved…….....…**2. *D. neesii***

1b. Spikelets 2–7-flowered; ligules a fringed membrane with hairy apex; grain wrinkled or rugulose, shallowly convex laterally..…….....…**2**

2a. Panicles narrow; racemes reflexed at maturity; spikelets 2 or 3-flowered.....…. ….....***D. retroflexa***

2b. Panicles effuse; racemes curved at maturity; spikelets 2–7-flowered….....**3**

3a. Ligule ciliate; spikelets 1–1.5 mm long, 2–3-flowered; grain obtusely trogonous, wrinkled on surface…….....**3. *D. panicea***

3b. Ligule a fringed membrane; spikelets 2.5–3.5 mm long, 6–7-flowered; grain dorsally compressed, rugulose…… .....**1. *D. chinensis***

1. Dinebra chinensis (L.) P.M. Peterson & N. Snow, Ann. Bot. 109: 1326. 2012. *Leptochloa chinensis* (L.) Nees, Syll. Ratisb. 1: 4. 1824; Hook.f., Fl. Brit. India 7: 299. 1896; C.E.C Fisch. in Gamble, Fl. Madras 3: 1820. 1934; Bor, Grass. Burma Ceylon India Pakistan 516. 1960; K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1872. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 235. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 395. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 298. 1994; S. Moulik, Grass. Bam. India 2: 613. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1182. 1997; Sasidh., Biodiv. Doc. Kerala–Fl. Pl. 580. 2004; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 158. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 553. 2012. *Poa chinensis* L., Sp. Pl. ed. 1. 1: 69. 1753; P.M. Peterson, K. Romaschenko, N. Snow & G. Johnson, Ann. Bot. 109: 1326. 2012. **Type:—**India [probably an error for China], *Osbeck s.n.* (LINN-87.32, image!). **Figs. 13–15, 20**

Poa malabarica Retz., *nom. illeg. hom.*, Obs. Bot. 5: 19.1798. *non* L. 1753. Type:—Not seen.

Tufted annuals. ***Culms*** herbaceous, slender, erect or geniculate, usually rooting from the lower nodes, 10–80 cm high; nodes glabrous. ***Leaf blades*** linear-lanceolate, 5–25 × 0.3–0.6 cm, scaberulous adaxially and glabrous abaxially, midrib prominent with more secondary nerves, margins scaberulous, acute or acuminate at apex. ***Leaf sheaths*** 4–12 cm long, chartaceous, glabrous, strongly nerved, keeled towards apex; ***ligules*** 1–1.5 mm long, membranous with an emarginate fringed apex, collar and auricles glabrous. ***Panicles*** oblong or ovate-oblong, 10–60 × 6–15 cm, effuse or lax, pyramidal, curved at maturity; peduncle 5–20 cm long, glabrous, terete or compressed. ***Racemes*** many, alternate or sub fasciculate in 2 or 3 basal nodes, spiciform, 3–11 cm long; rachis zigzag, terete to triquetrous, margins serrulate. ***Spikelets*** oblong or lanceolate, subsecund, alternate, 2.5–4 × 0.5–1 mm, 3–6-flowered. Glumes persistent. ***Lower glumes*** oblong-lanceolate, 1–1.5 × 0.4–0.5 mm, chartaceous, 1-veined, keeled, scabrid, acuminate apex. ***Upper glumes*** oblong-lanceolate, 1–1.8 × 0.5–0.7 mm, keeled, 1-veined. ***Lemmas*** ovate-lanceolate, 1.3–2 × 0.5–0.8 mm, keeled, entire, chartaceous, 3-nerved, nerves hairy below the middle or not, notched or muticous, emarginated, acute to acuminate towards apex. ***Paleas*** elliptic or oblong, 1–1.5 × 0.5–0.8 mm, hyaline, 2-keeled, 2-nerved, keels ciliolate. ***Lodicules*** 2, *c.* 0.2 mm long, hyaline, truncate at apex. ***Stamens*** 3; anthers 0.25–0.5 mm long; filaments 0.25–0.5 mm long, hyaline. ***Ovary*** *c.* 0.3 mm long, obovate to elliptic; styles 2, slender, hyaline, *c.* 0.2 mm long; stigma 0.2–0.3 mm long, plumose. ***Caryopses*** oblong or elliptic-oblong, 0.8–1 × 0.3–0.5 mm, acute, deeply grooved or convex ventrally, light brown.

Habitat & Ecology:—Common in wetlands, bunds of banana fields, rice fields, sugarcane fields and fallow fields, irrigation channels and similar marshy habitats in association with *Commelina* sp., *Digitaria ciliaris* (Retz.) Koeler, *Eleusine indica* (L.) Gaertn., *Eragrostis amabilis* (L.) Wight & Arn., *Eragrostis unioloides* (Retz.) Nees ex Steud., *Glinus oppositifolius* (L.) A. DC., *Isachne globosa* (Thunb.) O. Ktze., *Ischaemum* sp., *Leptochloa neesii* (Thw.) Benth., *Rotala fimbriata* Wight and *Utricularia* sp.

Fig. 13. ***Dinebra chinensis*** (L.) P.M. Peterson & N. Snow: **A.** Habit; **B.** Ligule; **C.** Enlarged portion of raceme; **D. & E.** Spikelet; **F.** Leaf blade - adaxial view; **G.** Lower glume; **H.** Upper glume; **I.** Floret; **J.** Lemma; **K.** Palea; **L.** Stamens & Pistil; **M.** Caryopsis.

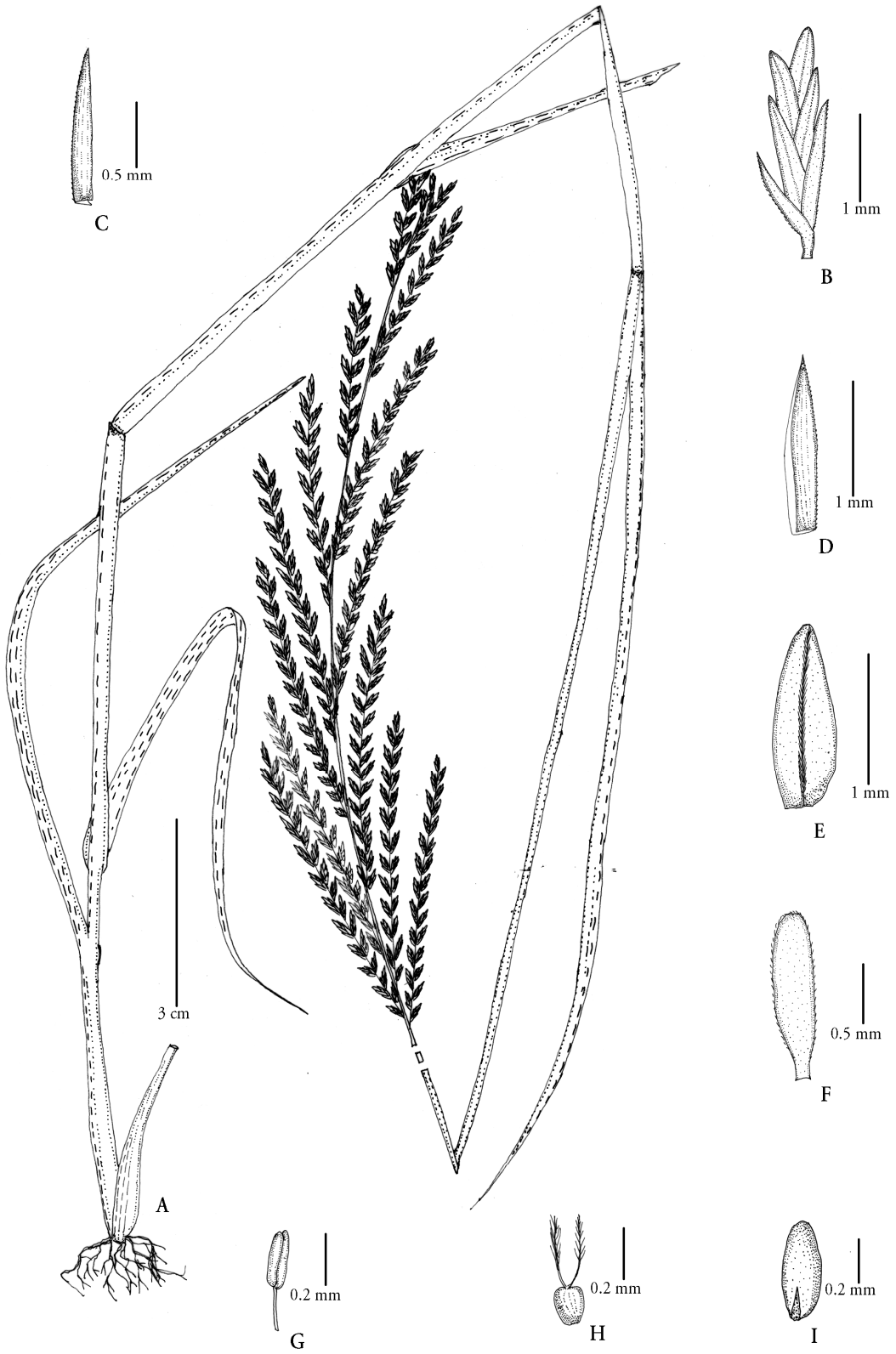


Fig. 14. ***Dinebra chinensis*** (L.) P.M. Peterson & N. Snow: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamen; **H.** Pistil; **I.** Caryopsis.

Distribution:—Widespread in Asia, Africa, Australia, India (Andhra Pradesh, Bihar, Gujarat, Karnataka, Kerala, Maharashtra, Orissa, Tamil Nadu, Telangana, and West Bengal) and Sri Lanka.

Flowering & Fruiting:—May–December

Specimens examined:—India, **Andhra Pradesh,** East Godaveri Dist.: Medapadu, 04 Apr. 1902, *C.A. Barber 4326* (MH). Krishna Dist.: Atapaka, Kaikaluru, 27 Nov. 1986, *P. Venkanna 5420* (MH). Nellore Dist.: Gudur, 03 Feb. 1929, *K. Cherian Jacob 18524* (MH). West Godaveri Dist.: Kolleru Lake Road, 24 Jan. 1958, *K. Subramanyam 5120* (MH); Palagudem, 08 Oct. 1930, *V. Narayanaswami 4475* (MH). **Karnataka,** Bangalore Dist.: Bommanahalli, way to Tumkur, 29 Sept. 2015, *Thoiba K. 144190* (CALI); *s.loc.*, *s.coll. 617* (MH). Dharwad Dist.: Kalgeri Tank, 06 Sept. 1911, *R.K. Bhide s.n.*; *Ibid.*, 20 Oct., *W.A. Talbot 2381* (BSI); *s.loc.*, 10 Sept. 1890, *W.A. Talbot 9785* (BLAT). **Kerala,** Palakkad Dist.: Melarcode, 17 July 1922, *s.coll. s.n.* (MH); Alathur, 26 Dec. 1919, *s.coll.* 16329 (MH); Walayar River Bed, 22 June 1964, *E. Vajravelu 19025* (MH). **Tamil Nadu,** Chengalpattu Dist.: Villiambakkam, Kumarapalayam, 07 May 1984, *D. Narasimhan 506* (MH); Sandrorpalayam, 23 Oct. 1984, *D. Narasimhan 648* (MH); Red hills tank, 07 Dec.

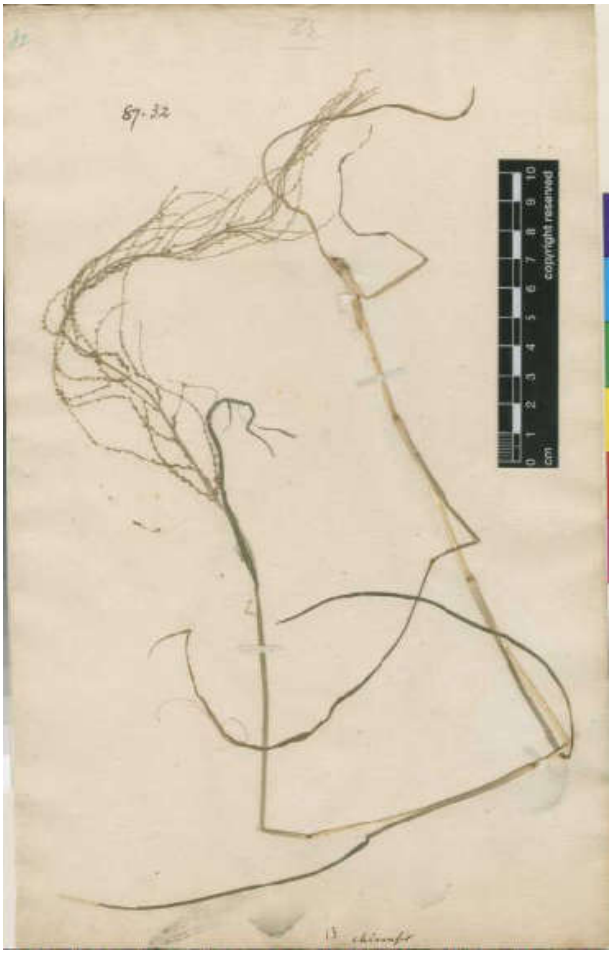


Fig. 15. Type specimen of *Dinebra chinensis* (L.) P.M. Peterson & N. Snow [*Osbeck s.n.* (LINN-87.32)] © The Board Trustees of the Linnean Society, London.

1902, *C.A. Baeber 5519* (MH). Coimbatore Dist.: Anaikatti, 29 Dec. 2001, *KAA Kabeer 113065* (MH); *s.loc.*, Aug. 1902, *C.A. Barber 4888* (MH). Cudallore Dist.: Annamalai University Ground, 22 Oct. 1939, *K.C. Jacob 6383* (MH); *Konankuppam*, 04 Feb. 1931, *V. Narayanaswami 5082* (MH); Sonanchavadi, 19 Sept. 1979, *K. Ramamurthy 64165* (MH); Chidambaram, Mahendra Palli, 08 October 1976, *K.M. Mathew* & *Alphonse Amalraj 4396* (RHT). Dharmapuri Dist.: Denkanikottai, 19 Dec. 1978, *Diraviam 20549* (RHT). Dindigul Dist.: Udumelpet, Amaravathi Dam, 10 Nov. 1986, *K.M. Mathew 47228* (RHT); Kolli Dam, 26 Aug. 1967, *K.M. Mathew 7649*; *Ibid.*, *0*6 Feb. 1969, *K.M. Mathew 9947* (RHT). Kanyakumari Dist.: Nagercoil, Kumaracoil, 29 Oct. 2015, *Thoiba K.* & *Mohammed Yoonus T 146651* (CALI). Thiruchirapalli Dist.: Thiruvalar, 05 Feb. 1977, *K.M. Mathew 6632* (RHT); Srirangam Isl, 23 Feb. 1978, *Periyanayagam 12176* (RHT); Lalgudi, 19 Feb. 1980, *Periyanayagam* & *Diraviadoss 26564*; *Ibid.,* 12 March 1982, *Fieldman 29073* (RHT). Thiruvallur Dist.: *s. loc.*, 23 Aug. 2002, *K.M. Mathew 74106* (RHT). Tirunelveli Dist.: Kanyakumari-Tirunelveli National Highway, 30 Oct. 2015, *Thoiba K. 146676* (CALI). Madurai Dist.: Sewage Farm, 17 May 1949, *Daniel Sundaraj* & *Sankharam Rao s.n.* (MH). Nagapattinam Dist.: Mayiladuthurai, 21 Aug. 1987, *Ragupathy* & *V.J. Nair 419* (MH). Ramanathapuram Dist.: Somathur, 23 Dec. 1989, *V. Balasubramaniam 2299* (MH); Mudukulathur, 01 Jan. 1988, *V. Balasubramaniam 1492* (MH). Sivaganga Dist.: Rajagambiram, Manamadurai, 25 June 1978, *N.C. Nair 57486* (MH). Vellore Dist.: Ranipet, 14 Mar. 1917, *s.coll.*, 14739 (MH). **Telangana,** Jagtail Dist.: Kodimial, 28 Sept. 1965, *G.V. Subbarao 25667* (MH).

Notes:—*Dinebra chinensis* (= *Leptochloa chinensis*) shows close similarity with *Disakisperma obtusiflorum* (= *L. obtusiflora*) in appearance. But it differs in having numerous racemes on the panicles; peduncles being not exserted from the leaf sheaths and broader spikelets (up to 1.2 mm).

2. Dinebra neesii (Thwaites) P.M. Peterson & N. Snow, Ann. Bot. 109: 1326. 2012.

Leptochloa neesii (Thw.) Benth. J. Linn. Soc. (Bot.) 19: 108. 1881; Bor, Grass.

Burma Ceylon India Pakistan 517. 1960; K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1873. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 235. 1989; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 299. 1994; S. Moulik, Grass. Bam. India 2: 613. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1216. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 160. 2009. *Cynodon neesii* Thw., Enum. Pl. Zeyl. 371. 1864; P.M. Peterson, K. Romaschenko, N. Snow & G. Johnson, Ann. Bot. 109: 1326. 2012. **Type:—** Ceylon, Eastern Province, Tricomalee, *Thwaites CP 3749* (Holotype: PDA, Isotype: K000032500, image!). **Figs. 16,17, 20**

Tufted annuals or perennials. ***Culms*** decumbent, slender, erect or geniculate, branched, usually rooting from the lower nodes, 60–105 cm high; nodes glabrous. ***Leaf blades*** linear-lanceolate, 8–20 × 0.3–0.4 cm, flat to involute, scaberulous on both sides, strongly nerved, margins cartilaginous, serrulate, glaucous, acuminate at apex. ***Leaf sheaths*** 6–12 cm long, firmly chartaceous, glabrous, strongly nerved, keeled towards apex; ***ligules*** 1.5–2.5 mm long, ovate, membranous, lacerate collar and auricles glabrous. ***Panicles*** oblong or ovate-oblong, 16–30 × 2–5 cm, loose to rather dense, shortly exserted; peduncle 15–20 cm long, terete, glabrous, scaberulous, strongly striate. ***Racemes*** many, alternate or faciculate, spiciform, 3–4.5 cm long; rachis flat to triquetrous, margins serrulate. ***Spikelets*** ovate-oblong, secund, 1–1.5 × 0.5–0.8 mm, 1-flowered. Glumes persistent. ***Lower glumes*** ovate-lanceolate, 1.2–1.5 × 0.4–0.5 mm, chartaceous, 1-veined, keeled, scabrid, acute-acuminate apex. ***Upper glumes*** ovate-lanceolate, 1.2–1.8 × 0.5–0.6 mm, 1-veined, keeled, scabrid, acute-acuminate apex. ***Lemmas*** ovate, 1–1.3 × 0.5–0.6 mm, keeled, entire, chartaceous, 3-nerved, lateral nerves faint and near outer margins, nerves and keels finely ciliate dorsally, margins ciliolate, acute at apex. ***Paleas*** ovate to elliptic, 1–1.2 × 0.4–0.5 mm, hyaline, 2-keeled, 2-nerved, keels ciliolate. ***Lodicules*** 2, *c.* 0.2 mm long, hyaline, truncate at apex.

Fig. 16. ***Dinebra neesii*** (Thwaites) P.M. Peterson & N. Snow: **A.** Panicle; **B.** Ligule; **C.** Enlarged portion of leaf blade – adaxial view; **D.** Enlarged portion of raceme; **E.** Spikelet; **F.** Glumes; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Caryopsis.

Stamens 3; anthers 0.25–0.5 mm long; filaments 0.25–0.5 mm long, hyaline. ***Ovary*** 0.3–0.4 mm long, oblong to elliptic; styles 2, slender, hyaline, *c.* 0.2 mm long; stigma 0.5–0.7 mm long, plumose. ***Caryopses*** oblanceolate to ovate, 0.4–0.6 × 0.3–0.4 mm, acute, brownish, smooth, deeply grooved or convex ventrally.

Flowering & Fruiting:—October–February

Habitat & Ecology:—In the lowlands of the dry, semi-arid and wet zones up to 160 m elevation, being common and widespread in a wide range of habitats including broad, shallow seasonally flooded depressions, mud wallows, drainage ditches, swamps, and rice fields, often in clayey soils. Major associated plants are *Ammannia baccifera* L., *Commelina* sp., *Glinus oppositifolius* (L.) A. DC., *Isachne globosa* (Thunb.) O. Ktze., *Ischaemum* sp. and *Eragrostis japonica* (Thunb.) Trin.

Distribution:—Australia, India (Andhra Pradesh, Tamil Nadu), Indonesia, Myanmar and Sri Lanka.

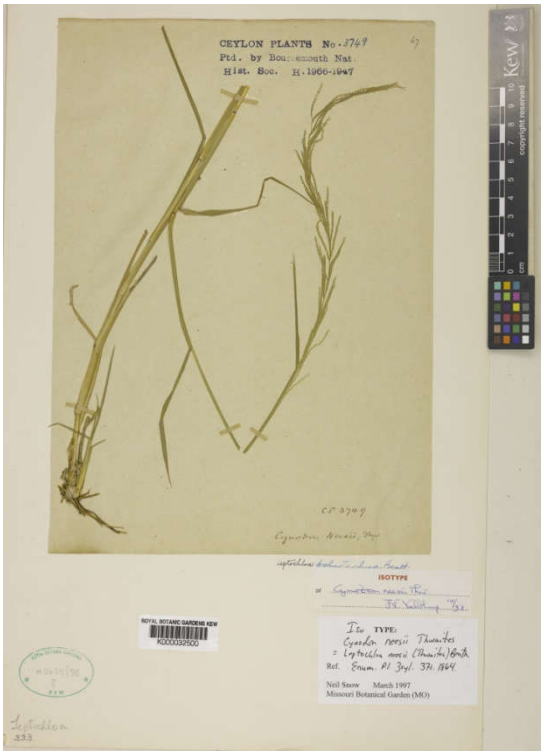


Fig. 17. Isotype of *Dinebra neesii* (Thwaites) P.M. Peterson & N. Snow [*Thwaites CP 3749* (K000032500)] © The Board Trustees of the Royal Botanic Gardens, Kew.

Specimens examined:—Andhra Pradesh, Krishna Dist.: Rayanapadu, 20 Aug. 1907, *C.A. Barber 8227* (MH); Vijayaroi, 30 Aug. 1907, *C.A. Barber 8242* (MH). Godavari Dist.: Mundapeta, 17 Mar. 1902, *C.A. Barber 8298*; *Ibid.*, 17 Mar. 1902, *C.A. Barber 4709* (MH). Vizianagaram Dist.: Salur, 11 Sept. 1962, *N.P. Balakrishnan s.n.* (CAL). **Tamil Nadu,** Chengalpettu Dist.: Vandalur, 07 Feb. 1915, *s.coll. 11489* (MH). Cuddalore Dist.: Chidambaram, 15 Apr. 1977, *K.M. Matthew 7358* (RHT). Erode Dist.: Ammapettai, 08 Aug. 1961, *K. Ramamurthy 13057* (CAL, MH); *Ibid.*, 25 Aug. 1930, *Narayanaswamy 4174a*; *Ibid.*, 25 Aug. 1930, *Narayanaswamy 4174b* (MH). Kanchipuram Dist.: EC Road, 21 Dec. 2002, *K.M. Mathew 74328* (RHT); Pudhupettai, Gopalapuram Burial Ground, 15 Feb. 1979, *N.C. Nair 60819* (MH). Madurai Dist.: Gomathikulam, 22 Sep. 1957, *K. Subramanyam 4331*(CAL, MH); Natham, 30 Oct. 1977, *M. Chandrabose 51727* (MH). Pudukottai Dist.: Kulathur, 02

Dec. 1978, *K.M. Matthew 16053* (RHT). Ramanathapuram Dist.: Kamuthakudi, 15 Jan. 1989, *V. Balasubramaniam 2110* (CAL); Santhanur, Paramakuri, 21 Feb. 1953, *J. Satharam Rao 21711*(MH); Thiruvadanai 18 Sep. 1988, *V. Balasubramaniam 1822* (MH). Sivaganga Dist.: Selugai, *11 Jan. 1989, V. Balasubramaniam1980* (MH). Thanjavur Dist.: Alapangudi, 12 Nov. 1988, *S. Ragupathy 515* (MH). Thiruchirappalli Dist.: Narthamalai, 30 Nov. 1967, *K.M. Matthew 8210* (RHT); Edamamaipatty, 15 Jan. 1970*, K.M. Matthew 10908* (RHT). Thiruvallur Dist.: Chennai-Pulicat, 28 Nov. 1999, *K.M. Matthew* & *J. Jayanthi 70334* (RHT); Athippattu, Pudunagar, 26 Mar. 2000, *K.M. Matthew 71408* (RHT). Tirunelveli Dist.: Kanyakumari-Tirunelveli National Highway, 30 Oct. 2015, *Thoiba K. 146677* (CALI).

Notes:—This species can easily be identified from others by its single flowered spikelets on the panicles. The plant is common in seasonally flooded localities.

3. Dinebra panicea (Retz.) P.M. Peterson & N. Snow, Ann. Bot. 109: 1326. 2012. *Leptochloa panicea* (Retz.) Ohwi Bot. Mag. (Tokyo) 55: 311. 1941; Bor, Grass. Burma Ceylon India Pakistan 517. 1960; K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1873. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 235. 1989; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 300. 1994; S. Moulik, Grass. Bam. India 2: 614. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1216. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 160. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 553. 2012. *Poa panicea* Retz., Obs. Bot. 3: 11. 1783; P.M. Peterson, K. Romaschenko, N. Snow & G. Johnson, Ann. Bot. 109: 1326. 2012. **Type:**—China, *P.J. Bladh s.n.* (Holotype: LD, Acc. No. 1296347, image!). **Figs. 18–20**

Aira filiformis Koen. ex Roxb., Fl. Ind. 1: 328. 1820. Lectotype (designated by Neil Snow, 1997):—India, Coramandel, *J.G. Koenig s.n.* (BM0000959485, image!).

Leptochloa filiformis s.l. Hook.f., Fl. Br. Ind. 7: 298. 1896. *non* P. Beauv., Ess. Agrostogr. 71. 1812.

Tufted annuals or perennials. ***Culms*** herbaceous, slender, erect or geniculate, 30–65 cm high; nodes glabrous. ***Leaf blades*** linear-lanceolate, 5–15 × 0.4–0.6 cm, involute and filiform midrib prominent with more secondary nerves, margins scaberulous, acute or acuminate at apex. ***Leaf sheaths*** 3–12 cm long, chartaceous, margins glabrous to ciliate, keeled towards apex; ***ligules*** ciliate with 1–3 mm long hairs, membranous, lacerate, collar and auricles glabrous. ***Panicles*** oblong or ovate-oblong, 7–18 × 6–15 cm, effuse or lax, lowest branches whorled, rest alternate; peduncle 10–16 cm long, glabrous, ribbed. ***Racemes*** many, alternate or sub fasciculate in 2 or 3 basal nodes, spiciform, 3–7 cm long; rachis, triquetrous, margins serrulate. ***Spikelets*** secund, alternate, ovate-oblong, 1.5–1.8 × 1–1.3 mm, 2–3-flowered. Glumes persistent. ***Lower glumes*** lanceolate, 1–1.2 × 0.4–0.5 mm, chartaceous, 1-veined, keeled, serrulate, acute at apex. ***Upper glumes*** oblong-lanceolate, 1.2–1.3 × 0.4–0.5 mm, keeled, 1-veined acuminate or mucronate at apex. ***Lemmas*** oblong-elliptic, 0.75–1 × 0.4–0.5 mm, keeled, entire, chartaceous, 3-nerved, pubescent, emarginate, muticous, acute or retuse at apex. ***Paleas*** elliptic or oblong 0.7–0.8 × *c.* 0.4 mm, hyaline, 2-keeled, 2-nerved, sparsely and appressedly pubescent. ***Lodicules*** 2, *c.* 0.2 mm long, hyaline, truncate at apex. ***Stamens*** 3; anthers 0.2–0.3 mm long; filaments 0.3–0.6 mm long, hyaline. ***Ovary*** *c.* 0.3 mm long, obovate to elliptic; styles 2, slender, hyaline, *c.* 0.2 mm long; stigma 0.3–0.5 mm long, plumose. ***Caryopses*** oblong or elliptic-oblong, 0.3–0.5 × 0.2–0.3 mm, obtusely trigonous, shallowly concave on one face, obtuse at apex.

Flowering & Fruiting:—May–January

Habitat & Ecology:—Dry and wet zone lowlands, in dry, sandy soil as a roadside weed and mostly in shade in evergreen scrub.

Distribution:—Africa, Asia, China, India (almost throughout), Japan and Sri Lanka.

Fig. 18. ***Dinebra panicea*** (Retz.) P.M. Peterson & N. Snow: **A.** Enlarged portion of raceme; **B.** Ligule; **C. & D.** Leaf blade - adaxial & abaxial view; **E.** Spikelet; **F.** Floret; **& G.** Lower glume; **H.** Upper glume; **I.** Lemma; **J.** Palea; **K.** Stamens; **L.** Caryopsis.

Specimens examined:—India, **Andhra Pradesh,** East Godaveri Dist.: Samalkota, 21 Sep. 1921, *s.coll., s.n.*; *Ibid*., 16 Jan. 1916, *s.coll*. 12486 (MH); Vizianagaram Dist.: Gajapathinagaram, 12 Oct. 1930, *V. Narayanaswami 4582* (MH); Vishakapatanam Dist.: Anakapalle, 4 Jan. 1917, *s.coll. 14138* (MH). **Gujarat,** Navsari Dist.: Pethan, 16 Aug. 2010, *Rinku J. Desai 288* (BARO). Surat Dist.: Athwa Farm, Oct. 1911, *R.K. Bhide s.n.* (BLAT, BSI); Gandhi Garden, 04 May 1957, *S.K. Jain 17389* (BSI). **Madhya Pradesh,** Satna Dist.: *s. loc.*, 21 Sep. 1959, *K. M. Sebastine 8904* (MH). **Maharashtra,** Mumbai City Dist.: Vasai, Salsette, July 1918, *s.coll. s.n.* (BLAT); Victoria Garden, July 1917, *s.coll. 3638* (BLAT); Byculla, July 1918, *C. Mcann A40* (BLAT); Parel, Oct. 1896, *W.A. Talbot s.n.* (BSI). Nashik Dist.: Yeola, 1917, *s.coll. s.n.* (BLAT).**Tamil Nadu,** Thanjavur Dist.: Aduthurai, 06 Sep 1988, *S. Ragupathy* & *V.J. Nair 796* (CAL); *Ibid.*, 09 Sep. 1930, *S.N. Chandrabose* & *Sakharam Rao s.n.*; *Ibid.*, 06 Sep 1988, *S. Ragupathy* & *V.J. Nair 796* (MH). Thiruvarur Dist.: *s.loc.*, 28 May 1978, *V.J. Nair 57164* (CAL). West Bengal, Bankura Dist.: Kotalpur, Hoogly, 21 Aug. 1968, *s.coll. 659* (CAL). Thiruvarur Dist.: *s.loc.*, 28 May 1978, *V.J. Nair 57164* (MH). **Telangana,** Hanamkonda Dist.: *s.loc.*, 20 Sep. 1995, *R.K. Premnath 105364* (MH). *s.loc.*, 01 Apr. 1966, *V.S. Sharma S. 221* (CAL).

Fig. 19. Type specimen of *Dinebra panicea* (Retz.) P.M. Peterson & N. Snow [*P.J. Bladh s.n.* (LD1296347)] © Lund University, Sweden.

Notes:—*Dinebra panicea* shows some resemblance with *D. chinensis*, but it differs in having very slender racemes with 2–3-flowered spikelets.

4. Dinebra retroflexa (Vahl) Panz., Denkschr. Koenigl. Akad. Wiss. Muenchen 1813: 270. T.12. 1814; C.E.C Fisch. in Gamble, Fl. Madras 3: 1841. 1934; Bor, Grass. Burma Ceylon India Pakistan 491. 1960; S.M. Phillips, Kew Bull. 28(3): 412; K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1843. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 210. 1989; S. Moulik, Grass. Bam. India 2: 589. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1182. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 125. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 514. 2012; P.M. Peterson, K. Romaschenko, N. Snow & G. Johnson, Ann. Bot. 109: 1326. 2012. *Cynosurus retroflexus* Vahl, Symb. Bot. 2: 20. 1791. **Holotype:**—India, *Lamark s.n.* (C10016881, image!). **Figs. 21**

Dinebra arabica Jacq., Fragm. Bot. 77: 121. 1809. *Leptochloa arabica* Jacq. (Kunth), Revis. Gramin 1: 91. 1829. Type:—Cultivated at the Vienna Botanic Garden (Holotype: W).

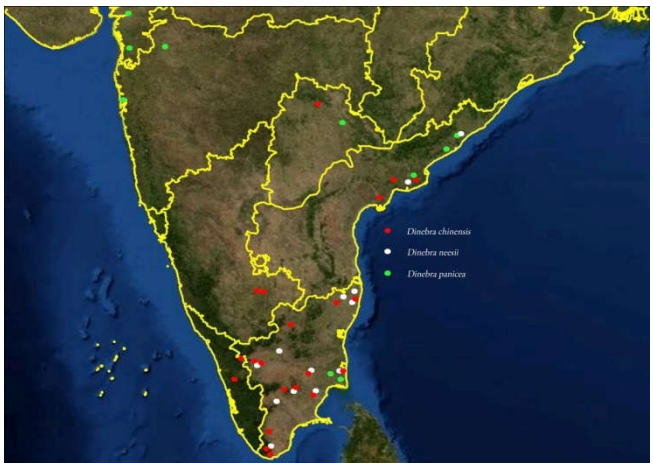


Fig. 20. Distribution of *Dinebra chinensis* (L.) P.M. Peterson & N. Snow (●), D. *neesii* (Thwaites) P.M. Peterson & N. Snow (○) and D. *panicea* (Retz.) P.M. Peterson & N. Snow (●)

Eleusine calycina Roxb., Fl. Ind. 1: 347. 1820. Type:—India, *Roxburg s.n., p.p.* (BM000959521, image!).

Tufted annuals or perennials. ***Culms*** herbaceous, slender, erect or geniculate, 20–75 cm high, pinkish. ***Leaf blades*** linear-lanceolate, 4–24 × 0.2–0.8 cm, rounded or truncate at base, sparsely tuberculate hairy adaxially, margins cartilaginous, finely serrulate,

acuminate to attenuate at apex. ***Leaf sheaths*** 3–8 cm long , chartaceous, margins glabrous to sparsely tuberculate hairy, margins smooth; ***ligules*** ovate, 2–2.2 mm long hairs, membranous. ***Panicles*** oblong or ovate-oblong, 6–26 cm long, effuse, branches alternate to spiral towards apex, rachis flat or triquetrous, margins serrately winged; peduncle 10–20 cm long, glabrous, ribbed. ***Racemes*** many, alternate to spiral towards apex, spiciform, 1–4.5 cm long; reflexed at maturity, ***Spikelets*** secund, alternate, aristate, elliptic, *c.* 4.5 × 1.5 mm, narrowly acute at base, 2–3-flowered; disarticulating above persistent glumes and in between florets. Glumes persistent. ***Lower glumes*** lanceolate, 4–4.2 × 0.4–0.5 mm, chartaceous, 1-veined, keeled, serrulate, aristate at apex. ***Upper glumes*** oblong-lanceolate, 4.3–5.3 × 0.4–0.5 mm, similar to lower glumes.

Lemmas broadly ovate, 1.8–2.1 × 0.6–0.7 mm, 3-nerved, keeled, keels serulate, chartaceous, pubescent, emarginate, muticous, acute or retuse at apex. ***Paleas*** elliptic or oblong 1.3–1.5 × 0.4–0.5 mm, acute, membranous, hyaline, 2-keeled, 2-nerved, keels narrowly winged towards apex. ***Lodicules*** 2, *c.* 0.2 mm long, hyaline, truncate at apex. ***Stamens*** 3; anthers 0.3–0.4 mm long; filaments 0.3–0.6 mm long, hyaline. ***Ovary*** *c.* 0.3 mm long, oblong to globose; styles 2, slender, hyaline, 0.2–0.6 mm long; stigma 0.6–0.8 mm long, plumose. ***Caryopses*** oblong or elliptic-oblong, 0.1–0.2 × 0.2–0.4 mm, dorsally flat, shallowly furrowed laterally.

Fig. 21. Holotype of *Dinebra retroflexa* (Vahl) Panz. [*Lamark s.n.* (C1001688)] © The Board Trustees of the Museum Botanicum Hauniense, University of Copenhagen, Denmark.

Flowering & Fruiting:—Almost throughout the year.

Habitat & Ecology:—On bare slopes, and in cultivated and dry fallow fields.

Distribution:—South Africa, through tropical Africa to Egypt, India, Iraq. In Peninsular India, it is distributed in all states except Kerala.

Specimen examined:—India, **Maharashtra**, Bombay, *s. die.*, *Mc Cann 5050* (BLAT).

Notes:—*Dinebra retroflexa* is used as a good fodder before flowering stage.

Disakisperma Steud.

Recent molecular studies by Peterson *et al.* (2010, 2012) determined *Leptochloa* P. Beauv. *s.l.* (Snow, 1997) to be polyphyletic, with its sampled species partitioned into five strongly supported clades. *Disakisperma* Steud. was one of the proposed segregate genera (Peterson *et al.* 2012), but the generic name has not been used widely since its description by Steudel (1854). *Disakisperma* Steud. is a genus of four predominantly perennial C_4 (NAD-ME) species in the Americas, Africa, and Asia. Its species previously were treated in *Eleusine, Eragrostis, Coelachyrum, Cypholepis, Leptochloa,* or *Diplachne* by almost all authors (Valls 1978; McNeill, 1979; Snow 1997). It includes the widespread North and South American amphitropical disjunct *Disakisperma dubium* (Kunth) P.M. Peterson & N. Snow (type of the genus), *D. eleusine* (Nees) P.M. Peterson & N. Snow from southern Africa, *D. obtusiflorum* (Hochst.) P.M. Peterson & N. Snow from central and northern Africa to southern Asia, and *D. yemenicum* from eastern and southern Africa to Yemen (Snow *et al.,* 2013).

The genus *Disakisperma* was first described by Steudel (1854) based on *D. mexicana* Steud.; the latter name probably first placed in synonymy of *Leptochloa dubia* by Chase and Niles (1962). Historically, four species are included under this genera; *Disakisperma dubium* was first described as *Chloris dubia* by Kunth (1816);

Disakisperma eleusine (Nees) P.M. Peterson & N. Snow was first recognized as *Diplachne eleusine* by Nees von Esenbeck (1841); the basionym of *Disakisperma obtusiflorum* (Hochst.) P.M. Peterson & N. Snow is *Leptochloa obtusiflora*, first described by Hochstetter (1855); and *Disakisperma yemenicum* (Schweinf.) P.M. Peterson & N. Snow was first described as *Coelachryum yemenicum* by Schweinfurth (1894).

Disakisperma Steud., Syn. Pl. Glumac. 1: 287. 1854; P.M. Peterson, K. Romaschenko, N. Snow & G. Johnson, Ann. Bot. 109: 1327. 2012; N. Snow, P.M. Peterson, K. Romaschenko, Phytokeys 26: 29. 2013. **Type:—** *Disakisperma dubium* (Kunth) P.M. Peterson & N. Snow (=*Disakisperma mexicana* Steud.), Ann. Bot. (Oxford), n.s. 109: 1327. 2012.

Plants perennial, rarely annual in a few population, occasionally stoloniferous. *Culms* 30–200 cm long, solid, decumbent or clambering to erect; nodes glabrous. ***Leaf sheaths*** half as long to slightly longer than internodes, glabrous or ciliate apically along the margins; ***ligule*** membranous, 0.5–1.5 mm long, ciliate or fimbriate apically. ***Leaf blades*** cauline, linear. ***Inflorescence*** apical and exserted at maturity or cleistogamous in lower leaf sheaths, a panicle composed of several to numerous unilateral racemes, racemosely or subdigitately scattered along a central axis; branches at maturity slightly reflexed to ascending or steeply erect. ***Spikelets*** sessile to subsessile, dorsally rounded to flattened, typically overlapping, disarticulation above the glumes; florets 4–13; ***glumes*** 2, 1-nerved or occasionally with remnants of two additional nerves near the base, mucronate or emucronate; ***lemmas*** 3-nerved, rarely with remnants of two additional nerves near base, sometimes cartilaginous towards base, macrohairs acute, obtuse, or clavicorniculate; ***paleas*** often somewhat cartilaginous towards base. ***Stamens*** 3. ***Lodicules*** 2, flabellate. ***Caryopses*** dorsally flattened, broadly concave on the hilar surface; pericarp weakly adnate to endosperm.

Distribution:—India west to Saudia Arabia, Yemen and Somalia. About 4 species in the world; only one species, *D. obtusiflorum* is known from India.

Habitat:—Known in a variety of semi-open or disturbed habitats in rocky areas or sandy to heavy soils, from sea level to 1900 m .

Etymology:—The name *Disakisperma* is derived from Greek words dis, twice; akis, point; sperma, seed referring to its apex of grain biscupid (Clifford & Bostock, 2007).

Disakisperma obtusiflorum (Hochst.) P.M. Peterson & N. Snow, Annals of Bot. 109: 1327. 2012. *Leptochloa obtusiflora* Hochst., Flora 38: 203. 1855; Hook.f., Fl. Brit. India 7: 299. 1896; C.E.C Fisch. in Gamble, Fl. Madras 3: 1820. 1934; Bor, Grass. Burma Ceylon India Pakistan 517. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 235. 1989; Moulik, Grass. Bam. India 2: 614. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 160. 2009. *Eleusine obtusiflora* (Hochst.) Blatt. Rec. Bot. Surv. India 8; Fl. Arab. Pt. 5: 505. 1936. **Type:—** Ethiopia, Gageros, 15 Sept. 1854, *W. Schimper 1204* (Holotype: STR, Isotype: L, P00439430, image!, S). **Figs. 22–25**

Tufted annuals or perennials. ***Culms*** slender, erect or geniculate, usually rooting from the lower nodes, 10–90 cm high; nodes glabrous. ***Leaf blades*** linear-lanceolate, 14–30 × 0.5–0.6 cm, scaberulous adaxially and glabrous abaxially, midrib prominent with more secondary nerves, margins scaberulous, acuminate to attenuate at apex. ***Leaf sheaths*** 6–12 cm long, chartaceous, glabrous, more or less ribbed, keeled towards apex; ***ligules*** 1–1.6 mm long, membranous with long fimbriate hairs at apex, collar and auricles glabrous. ***Panicles*** oblong or ovate-oblong, 10–40 × 6–12 cm, effuse or lax, central axis angled, scabrid; peduncle 15–35 cm long, exerted from uppermost leaf sheath. ***Racemes*** 9–12, usually compact on central axis, spiciform, 4.5–12 × 0.4–0.5 cm; rachis triquetrous, scabrid. ***Spikelets*** oblong, alternate, 3.5–4 × 1.5–2 mm, 7–9-flowered. Glumes persistent. ***Lower glumes*** ovate-lanceolate, boat shaped, 1–1.5 × 0.8–1.2 mm,

Fig. 22. ***Disakisperma obtusiflorum*** (Hochst.) P.M. Peterson & N. Snow: **A.** Habit; **B.** Enlarged portion of panicle; **C.** Enlarged portion of raceme; **D. & E.** Ligule; **F. & G.** Leaf blade - adaxial & abaxial view; **H.** Spikelet; **I.** Lower glume; **J.** Upper glume; **K.** Floret; **L. & M.** Lemma – ventral & dorsal view; **N.** Palea; **O.** Lodicule; **P.** Anthers; **Q.** Caryopsis.

Fig. 23. ***Disakisperma obtusiflorum*** (Hochst.) P.M. Peterson & N. Snow: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicule; **H.** Stamen; **I.** Pistil; **J.** Caryopsis.

chartaceous, 1-veined, keeled, scabrid, acute to subacute at apex. ***Upper glumes*** ovate-lanceolate, 1.5–1.8 × 0.8–1 mm, 1-veined, keeled, keels serrulate, apex subacute-retuse or minutely mucronate. ***Lemmas*** ovate to elliptic-lanceolate, 2–2.2 × 1.2–1.5 mm, 3-nerved, keeled, nerves and keels ciliate, cilia falling at maturity, acute to retuse at apex. ***Paleas*** oblong-elliptic 1.7–1.8 × *c.* 0.8 mm, hyaline, 2-keeled, 2-nerved, keels ciliolate, subacute to retuse at apex. ***Lodicules*** 2, *c.* 0.2 mm long, hyaline, truncate at apex. ***Stamens*** 3; anthers 0.5–0.6 mm long; filaments 0.25–0.5 mm long, hyaline. ***Ovary*** 0.3–0.6 mm, obovate to elliptic; styles 2, slender, hyaline, *c.* 0.4 mm long; stigma 0.5–0.6 mm long, plumose. ***Caryopses*** oblong or elliptic-oblong, 1–1.2 × 0.8–1.2 mm, brownish, shallowly concave dorsally, light

Fig. 24. Isotype of *Disakisperma obtusiflorum* (Hochst.) P.M. Peterson & N. Snow [*W. Schimper 1204* (P00439430)] © The Board Trustees of the Muséum National d'Histoire Naturelle, Paris.

Fig. 25. Distribution of *Disakisperma obtusiflorum* (Hochst.) P.M. Peterson & N. Snow ( )

brown, acute to obtuse at apex.

Flowering & Fruiting:—July–December

Habitat & Ecology:—Along road sides of hill tracks, semi-open or disturbed habitats in rocky areas or sandy to heavy soils, from sea level to 1900 m. in association with *Digitaria ciliaris* (Retz.) Koeler, *Eleusine indica* (L.) Gaertn., *Eragrostis amabilis* (L.) Wight & Arn., *E. collinensis* Vivek, G.V.S. Murthy & V.J. Nair, *E. nigra* Nees ex Steud., *Isachne* sp., *Ischaemum* sp., *Tripogon bromides* Roth *ex* Roem. & Schult. and *T. sivarajanii* Sunil.

Distribution:—Arabia, East Africa, Yemen, South India (Tamil Nadu).

Specimens examined:—India, **Tamil Nadu,** Coimbatore Dist.: Agricultural College Road, 27 Sept. 1964, *M. Chandrabose 28548* (CAL, MH); Agricultural College Estate, 22 June 1957, *K. Subramanyam 3523* (MH); Suriyanallur, 08 Aug. 1908, *C.A. Barber 4442* (MH); Kurudimalai, 08 Dec. 1970, *M.V. Viswanadhan MVV840* (MH). Dindigul Dist.: Sirumalais, 12 Oct. 1959, *J. Pallithanam 5235* (RHT). Madurai Dist.: Uthamapalayam, Palani Hills, Kurangani Ghat Road, 18 Nov. 1986, *K.M. Matthew 4748* (RHT); *Ibid.*, Bodi Foot Hills, Valasa Road, 16 Nov. 1987, *K.M. Matthew* & *M. Charles 51266* (RHT). Nilgiri Dist.: Masinagudi, *s.die.*, *C.A. Barber 2656* (MH).

Notes:—*Disakisperma obtusiflorum* (*L. obtusiflora*) shows close similarity with *L. chinensis* in appearance. But it differs in having few racemes on the panicles; peduncle well exserted from the leaf sheath, spikelets 1.8–2 mm broad and Hooker (1896) suggested that the presence of this species in southern India in Kochi "Cochin" was an introduction due to heavy trade between that port and Africa.

Eragrostiella Bor

Bor in 1940 described *Eragrostiella* from the diminutive of the related genus *Eragrostis* Wolf., which are segregated primarily on the basis of their spicate inflorescence and

their compact habit of basal leaves and persistent leaf sheaths (Lazarides, 1976). *Eragrostiella* form a monophyletic group which is sister to the *Tripogon* Roth *ex* Roem. & Schult. and *Oropetium* Trin. (Fabillo, 2015). They share features such as terminal spikes or racemes with compactly arranged spikelets and 3-nerved lemmas with winged paleas.

The genus consists of six taxa distributed in the tropics and subtropics of the world, of which about five species and two varieties occur in India. Out of these, two species and three varieties are known from Peninsular India. It grows mostly on wet rocks, grasslands and lateritic soils in addition to the road sides and open lands.

Eragrostiella Bor, Ind. For. 66: 269. 1940; Bor, Grass. Burma Ceylon India Pakistan 493. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1851. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 374. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 199. 1994; L. Watson & Dallwitz, Revis. Grass Gen. World: 381. 1994; S. Moulik, Grass. Bam. India 2: 592. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1188. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 130. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 521. 2012; **Type:—***Eragrostiella leioptera* Stapf (Bor), Indian Forester 66: 270. 1940.

Eragrostis P. Beauv., sect. IV. *Plagiostachya* Benth., Stapf, Hook.f., Fl. Brit. India 7: 325. 1896.

Tufted perennial, densely caespitose. ***Culms*** erect or geniculately ascending, 1–4 noded. ***Leaf sheaths*** persistent, becoming fibrous; ligules membranous with ciliate fringe. ***Leaf blades*** complicate-convolute or rarely flat, often filiform. ***Infloresence*** a single raceme. ***Spikes*** terminal, slender, prominently exerted. ***Spikelets*** solitary, laterally compressed, linear or ovate-oblong, biseriate, subsecund, imbricate or sometimes distant, subsessile on the rachis of a spike; florets 6–40, perfect or the uppermost somewhat reduced and

neuter, closely imbricate. ***Glumes*** equal or not; lower glumes 1-nerved, acutely keeled; upper glumes 1–3-nerved, rounded on the back in the lower part and keeled upwards. ***Rachilla*** continous or sometimes tardily disarticulating between the florets, glabrous, angular, the internodes slightly thickened upwards. ***Lemmas*** deciduous, ovate or lanceolate, acute or obtuse, membranous or chartaceous, glabrous, 3-nerved, rounded on the back or keeled. ***Paleas*** as long as their lemmas or slightly shorter, persistent, with or without wings on the keels. ***Lodicules*** 2, small, cuneate, fleshy. ***Stamens*** 3. ***Ovary*** glabrous; styles distinct, terminal; stigmas plumose, laterally exserted. ***Caryopses*** obtusely trigonous to almost terete, the embryo about half as long.

Distribution:—About 6 species, widely distributed in Eastern Africa to Burma and northern Australia. From these, 5 species are distributed in India (two species and two varieties occur in Peninsular India).

Habitat:—It is found in dry bushlands and grasslands on shallow soil.

Key to the species of *Eragrostiella* in Peninsular India

1a. Leaf blades convolute, pilose adaxially, attenuate towards apex; keels of paleas broadly winged.....*E. bifaria*

1b. Leaf blades flat, falcate or complicate, glabrous or finely coriaceous adaxially, sub-acute to obtuse at apex; keels of paleas narrowly winged.....*E. brachyphylla*

1. Eragrostiella bifaria (Vahl) Bor, Ind. For. 66: 269. 1940; Bor, Grass. Burma Ceylon India Pakistan 494. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1851. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 374. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 199. 1994; S. Moulik, Grass. Bam. India 2: 594. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1189. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 130. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 521. 2012. *Poa bifaria* Vahl, Sym.

Bot. 2: 19. 1791. *Eragrostis bifaria* (Vahl) Wight *ex* Steud., *nom. nud.*, Nom. Bot. ed. 2(1): 562. 1840 nomen *et* Syn. Pl. Glum. 1: 264. 1854. **Type:—**India Oriental, *Hb. Vahlian* (C10015011, image!). **Figs. 26, 27, 34**

Poa coromandeliana Koen. *ex* Rottl. In Ges. Natur. Freunde Berlin, Neue Schrift 4: 191. 1803; *Eragrostis coromandeliana* (Koenig *ex* Rottler) Trin., Mem. Acad. Imp. Sci. Saint- Pétersbg Sér. 6. 1: 415. 1830, as "*coromandelina*". Type:—India, Madras: Trakenbar

Key to the varieties

1a. Culms 1–2-noded; leaves shorter than the spikes…..……...**2**

1b. Culms 2–4-noded; leaves narrow, flat or complicate, evenly distributed, sometimes spikes and leaves are almost of the same size; spikelets olive green or leaden green ……...……...……...……**1c. var. *walkeri***

2a. Leaves narrow, pallid, filiform, never reaching the base of the spikes; spikelets olive green to straw coloured or leaden green……...……**1a. var. *bifaria***

2b. Leaves narrow rolled or convolute, almost reaching to the base of the spikelets; spikelets leaden green……...…….....……...…**1b. var. *secunda***

1a. var. bifaria

Tufted perennials, 30–65 cm high, roots fibrous. ***Culms*** 10–40 cm high, geniculate nodes glabrous, 1–4-noded. ***Leaf sheaths*** 3–9.5 cm long, enrolled to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 4–20 × *c.* 0.2 cm, apex attenuate, serrulate; adaxially pilose, coreaceous, margins entire, slightly scabrid or not; ***ligules*** fine membranous with long ciliate hairs, cilia 2–5 mm long. ***Spikes*** terminal, 9–28 × 1–2 cm, with alternate sessile spikelets, compactly arranged; peduncle 8–22 cm long, round, glabrous, rachis triangular, slightly coriaceous or serrulate at angles. ***Spikelets*** linear oblong or ovate-lanceolate, 6–20 × 2–3 mm, 5–20 (-40)-flowered, olive green-leaden grey in colour. ***Lower glumes*** lanceolate, 2.3–5 × 0.5–0.7 mm, chartaceous, 1-nerved,

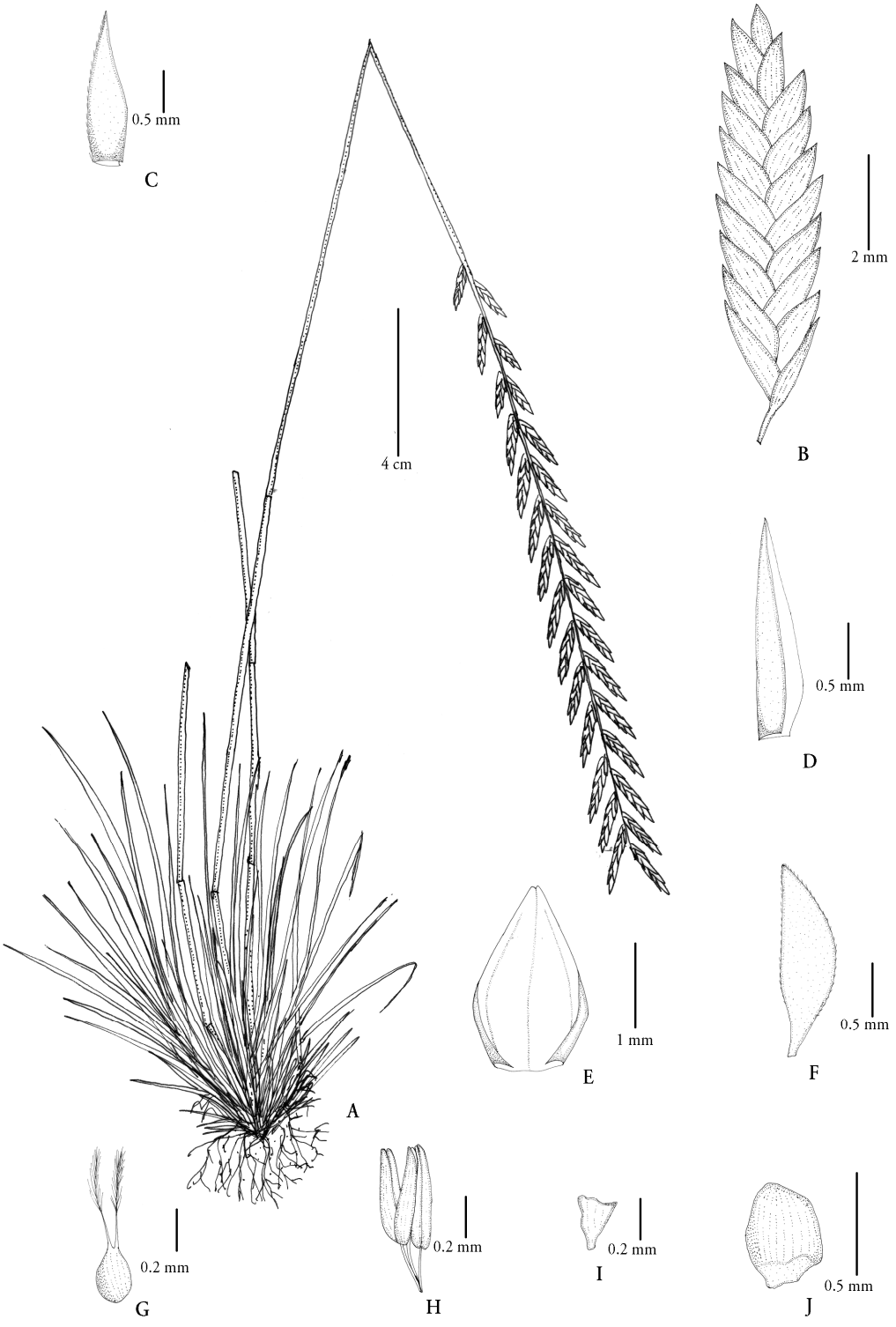


Fig. 26. ***Eragrostiella bifaria*** (Vahl) Bor: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Pistil; **H.** Stamen; **I.** Lodicule; **J.** Caryopsis.

1-keeled, keels serrulate, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 2.5–5 × 0.5–0.7 mm, 1-nerved, 1-keeled, keels scabrid, chartaceous, acute to acuminate at apex. ***Lemmas*** ovate-lanceolate, 2.3–2.8 × 1.2–1.8 mm, 3-nerved, apex acute or obtuse, muticous, punctuate, caducous, leaden green in colour. ***Paleas*** ovate to elliptic, 1.8–2.2 × 0.8–1 mm, chartaceous, sub persistent, hyaline, broadly winged, 2-nerved, keels ciliate, acute or puberlous at apex. ***Rachilla*** smooth, glabrous, olive green in colour, 0.2–0.3 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 3, anthers 0.6–0.9 mm long, yellowish purple; filaments *c.* 0.3 mm long. ***Ovary*** 0.2–0.3 mm long, globose, style 0.5–0.8 mm long, slender; stigma plumose, 0.6–0.8 mm long. ***Caryopses*** 0.3–0.5 × 0.2–0.3 mm long, ovate to globose, light brown.

Fig. 27. Type specimen of *Eragrostiella bifaria* (Vahl) Bor [*Vahlian s.n.* (C10015011)] © The Board Trustees of the Museum Botanicum Hauniense, University of Copenhagen, Denmark.

Flowering & Fruiting:—August–May

Habitat & Ecology:—It is widespread in the dry and wet zones in lowland to mid-upland elevations, moist soils in grasslands, thickets, savannahs, and also in dry forests, usually in open sites, roadside wasteland, sandy soils adjacent to the granitic rocks. Usually found growing in association with *Eragrostis amabilis* var. *insularis* (C.E.Hubb.) P. Umam. & P. Daniel, *E. unioloides* (Retz.) Nees ex Steud., *Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult., *Ischaemum ciliare* Retz.,

Mollugo pentaphylla L.*, Oldenlandia umbellata* L., *Tripogon bromoides* Roth *ex* Roem. & Schult. and *Tripogon sivarajanii* Sunil.

Distribution:—Australia, Burma, East Africa, India, Indonesia, and Thailand. In India it is widely distributed in drier parts of all states.

Specimens examined:—India, **Andhra Pradesh,** East Godaveri Dist.: Maredumilli, 24 Aug. 1995, *M. Mohanan 105102* (BSID). Nellore Dist.: Emmuluru Hills, 27 Oct. 1998, *P. Venu 110124* (BSID). **Karnataka,** Chamarajanagar Dist.: Gundlupet, 28 Sept. 2015, *Thoiba K. 144172* (CALI). Hassan Dist.: Sakalaeshpur, 12 Dec. 2012, *Manudev 5679* (CALI). Mysore Dist.: *s.loc.,* 29 Sept. 2015, *Thoiba K. 144198* (CALI). **Kerala,** Idukki Dist.: Pius Nagar, Kanthallur, 13 Nov. 2012, *Thoiba K. 134402* (CALI). Thrissur Dist.: Vengoli Hills, Parambikulam Tiger Reserve, 26 Sept. 2013, *Thoiba K. 138037* (CALI). **Odisha,** Mayurbhanj Dist.: Simplipal Biosphere Reserve, Jenabil Range, 26 Sept. 2011, *Alok 2342* (BSID). **Tamil Nadu,** Coimbatore Dist.: Maruthamalai, *s.die., s.coll. 4111*(CALI). Dindigul Dist.: Kodaikanal, Periakulam Path, 19 Dec. 1989, *K.T. Mathew 54121* (RHT). Kanyakumari Dist.: Maruthwamalai, 09 Aug. 2014, *Thoiba K. 138096* (CALI); *Ibid.,* 30 Oct. 2015, *Thoiba K.* & *M. Yoonus T. 146663* (CALI); Vellimalai, Perunchilambu, 08 Dec. 1980, *M.S. Swaminathan 68973* (CAL). Madurai Dist.: Usilampatti, 14 Feb. 1985, *K. Ravikumar 2779* (CAL). Salem Dist.: Sankagiri, Edappadi, 08 Dec. 1978, *K.M. Mathew 19830* (RHT). **Telangana,** Nalgonda Dist.: Sheripally, Pinnarwar, 22 Nov. 2011, *Baleshwar Reddy A. 1116* (BSID); Bothyananda, 11 Dec. 2010, *Baleshwar Reddy A. 1136* (BSID).

Notes:—The spikelets of var. *bifaria* are narrow, pallid, and usually very long with numerous florets at mature stage.

1b. var. secunda (Nees ex Steud.) Lazarides, Contr. Herb. Austral. 22: 6. 1976; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 201. 1994. *Eragrostis secunda* Nees ex Steud., Syn. Pl. Glumac 1: 264. 1854; Hook.f. in Trimen,

Handb. Fl. Ceylon 5: 298. 1900; Stapf, Hook.f., Fl. Brit. India 7: 326. 1896; Bor, Grass. Burma Ceylon India Pakistan 495. 1960. *Eragrostiella secunda* (Nees ex Steud.) Bor, Indian For. 66: 270. 1940; Bor, Grass. Burma Ceylon India Pakistan 495. 1960. **Type:—**Ceylon, Sabaragamuwa Prov.: Galagama, Feb 1846, *Thwaites C.P. 60, p.p.* (Holotype: P, Isotype: CAL, K000245120, image!, PDA). **Figs. 28, 29, 34**

Tufted perennials, 30–55 cm high ,roots fibrous. ***Culms*** 10–40 cm high, geniculate nodes glabrous, 1–2 noded. ***Leaf sheaths*** 3–10 cm long, enrolled to the culm, ciliate towards apex. ***Leaf Blades*** linear-lanceolate, sometimes convolute, 8–20 × 0.2–0.25 cm, apex attenuate, serrulate; adaxially pilose, coreaceous, margins entire, finely scabrid; ***ligules*** fine membranous with long ciliate hairs, cilia 2–5 mm long. ***Spikes*** terminal, 9–25 × 1–2 cm, with alternate sessile spikelets, compactly arranged, olive green coloured; peduncle 8–20 cm long, round, glabrous, rachis triangular, slightly coriaceous or serrulate at angles. ***Spikelets*** linear oblong or ovate-lanceolate, 9–20 × 2–4 mm, 5–20 (-30)-flowered, olive green or leaden grey in colour, strongly compressed, closely imbricate. ***Lower glumes*** lanceolate, 3–5 × 0.5–0.7 mm, chartaceous, 1-nerved, 1-keeled, keels serrulate, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 3–5.5 × 0.5–0.7 mm in size, 1-nerved, 1-keeled, keels scabrid, chartaceous, acute to acuminate at apex. ***Lemmas*** ovate-lanceolate, 2–3 × 1–2 mm, 3-nerved, apex acute to acuminate or muticous, punctuate, caducous, leaden green in colour. ***Paleas*** ovate to elliptic, 2.3–2.8 × 1–1.3 mm, chartaceous, sub persistent, hyaline, broadly winged, 2-nerved, keels ciliate, acute at apex. ***Rachilla*** smooth, glabrous, olive green in colour, 0.2–0.3 mm long. ***Lodicules*** 2, 0.2–0.3 mm, dentate-triquadrate. ***Stamens*** 3, anthers 1–1.3 mm long, yellowish purple; filaments 0.3–0.5 mm long. ***Ovary*** 0.2–0.3 mm, globose, style 0.5–0.8 mm long, slender; stigma plumose, 0.6–0.8 mm long. ***Caryopses*** ovate to elliptic 0.3–0.5 × 0.2–0.3 mm, light brown.

Flowering & Fruiting: —August–May

Fig. 28. ***Eragrostiella bifaria*** (Vahl) Bor *var.* ***secunda*** (Nees ex Steud.) Lazarides: **A.** Habit; **B.** Enlarged portion of panicle; **C. & D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Palea with flower; **L.** Lodicules & stamens; **K.** Pistil; **M.** Caryopsis.

Habitat & Ecology:—It occurs in mid-upland elevations, moist soils in grasslands in association with *Anisochilus scaber* Benth., *Apluda mutica* L., *Arundinella pumila* (Hochst. *ex* A. Rich.) Steud., *Desmodium* sp., *Heteropogon contortus* (L.) P.Beauv. *ex* Roem. & Schult., *Justacia* sp., *Leucas* sp., *Sehima nervosum* (Rottler *ex* Roem. & Schult.) Stapf, *Tripogon bromoides* Roth *ex* Roem. & Schult., *Tripogon borii* Kabeer, V.J. Nair & G.V.S. Murthy.

Fig. 29. Isotype of *Eragrostiella bifaria* var. *secunda* (Nees ex Steud.) Lazarides [*Thwaites C.P. 60, p.p.* (K000245120)] © The Board Trustees of the Royal Botanic Gardens, Kew.

Distribution:—It was earlier reported from Sri Lanka, the present collection from South India shows an extended distribution.

Specimens examined:—India, **Kerala,** Idukki Dist.: Ramakkalmedu, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137585a*; *Ibid.,* 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137585b, 137585c, 137585d* (CALI).

Notes:—*Eragrostiella bifaria* var. *secunda* is closely resembling those of the typical variety in many diagnostic characters, and differs mainly in the dimensions, shape and colour of the spikelets. Besides, leaf blades are narrow, convolute, as long as the length of spikes or at least at the base of the spikes.

1c. var. walkeri (Stapf) Lazarides, Contr. Herb. Austral. 22: 70. 1976; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 201. 1994; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 130. 2009. *Eragrostis walkeri* Stapf, Trimen, Handb. Fl. Ceylon 5: 298. 1900; C.E.C Fisch. in Gamble, Fl. Madras 3: 1828. 1934; Bor,

Grass. Burma Ceylon India Pakistan 495. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 202. 1994; S. Moulik, Grass. Bam. India 2: 594. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1190. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 131. 2009. *Eragrostiella walkeri* (Stapf) Bor, Indian Forester 66: 270. 1940; Bor, Grass. Burma Ceylon India Pakistan 495. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 202. 1994; S. Moulik, Grass. Bam. India 2: 594. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1190. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 131. 2009. **Lectotype** (designated by M. Lazarides, 1994)**:—**Ceylon, *Walker s.n.* (K000245121, image). **Figs. 30, 31, 34**

Tufted perennials, 30–65 cm high, roots fibrous. ***Culms*** 10–65 cm high, geniculate nodes glabrous, 2–4 noded. ***Leaf sheaths*** 2.5–7 cm long, enrolled to the culm, ciliate towards apex. ***Leaf Blades*** linear or convolute, sometimes cauline, 10–25 × 0.1–0.2 cm, apex attenuate, serrulate; adaxially pilose, coreaceous, margins entire, slightly scabrid or not; ***ligules*** fine membranous with long ciliate hairs, cilia 2–4 mm long. ***Spikes*** terminal, 9–28 cm × 1–2 cm, with alternate sessile spikelets, compactly arranged; peduncle 8–22 cm long, round, glabrous, rachis triangular, slightly coriaceous or serrulate at angles. ***Spikelets*** linear oblong or ovate-lanceolate, 6–20 × 2–3 mm, 5–20 (-40)-flowered, olive green-leaden grey in colour. ***Lower glumes*** lanceolate, 2.3–5 × 0.5–0.7 mm, chartaceous, 1-nerved, 1-keeled, keels serrulate, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 2.5–5 × 0.5–0.7 mm in size, 1-nerved, 1-keeled, keels scabrid, chartaceous, acute to acuminate at apex. ***Lemmas*** ovate-lanceolate, 2.25–2.8 × 1.2–1.8 mm, 3-nerved, apex acute or obtuse, muticous, punctuate, caducous, leaden green in colour. ***Paleas*** ovate to elliptic, 2–2.2 × 0.8–1.3 mm, chartaceous, sub persistent, hyaline, broadly winged, 2-nerved, keels ciliate, acute or puberlous at apex.***Rachilla*** smooth, glabrous, olive green in colour, 0.2–0.3 mm long. ***Lodicules*** 2, 0.2–0.3 mm, dentate-triquadrate. ***Stamens*** 3, anthers 0.6–0.9 mm long, yellowish

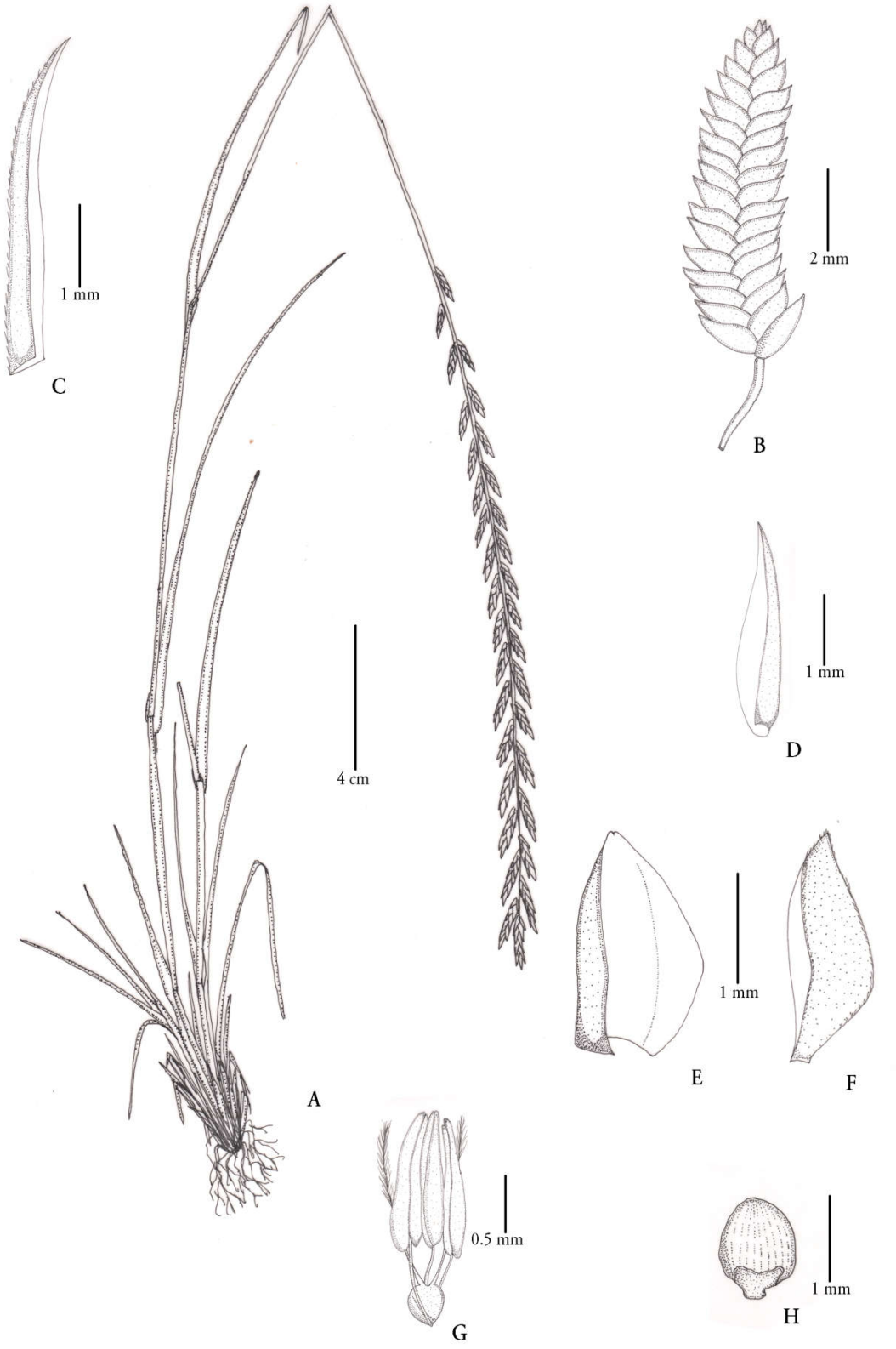


Fig. 30. ***Eragrostiella bifaria*** (Vahl) Bor var. ***walkeri*** (Stapf) Lazarides: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamens & pistil; **H.** Caryopsis.

purple; filaments *c.* 0.3 mm long. ***Ovary*** 0.2–0.3 mm, globose, style 0.5–0.8 mm long, slender; stigma plumose, 0.6–0.8 mm long. ***Caryopses*** ovate to elliptic, 0.3–0.6 × 0.3–0.4 mm, light brown.

Flowering & Fruiting:—August–May

Habitat & Ecology:—It spreads at high elevation grasslands adjacent to the granitic rocks seen in association with *Apluda mutica* L., *Arundinella pumila* (Hochst. *ex* A. Rich.) Steud., *Chrysopogon* sp., *Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult.*, Leucas sp., Scutellaria wightiana* Benth., *Tripogon bromoides* Roth *ex* Roem. & Schult.

Fig. 31. Lectotype of *Eragrostiella bifaria* var. *walkeri* (Stapf) Lazarides [*Walker s.n.* (K000245121) designated by Lazarides, 1994] © The Board Trustees of the Royal Botanic Gardens, Kew.

Distribution:—Known from Southern India and Sri Lanka.

Specimens examined:—India, **Andhra Pradesh,** Anantapur Dist.: S.K. University Campus, *s.die., P. Priyadarsini* & *BRP Rao 37208* (BSID). **Karnataka,** Mysore Dist.: Chammundi Hills, 30 June 2015, *Thoiba K. 144192* (CALI). **Tamil Nadu,** Kanyakumari Dist.: Maruthwamalai, 30 Oct. 2015, *Thoiba K.* & *M. Yoonus T. 146664* (CALI); *Ibid.,* 30 Oct. 2015, *Thoiba K.* & *M. Yoonus T. 146657, 146659* (CALI); Mambazhathuraiyar Reservoir, 29 Oct. 2015, *Thoiba K.* & *M. Yoonus T. 146649* (CALI); *Ibid.,* 29 Oct. 2015, *Thoiba K.* & *M. Yoonus T. 146646* (CALI). **Telangana,** Hyderabad Dist.: Golconda Fort, 13 Sept. 2014, *A.K. Pradeep 90084* (CALI).

Notes:—*Eragrostiella bifaria* var. *walkeri* is different from other verities by having the more robust habit with 2–4-noded culms and longer blades, which are also wider, usually flat or complicate rather than convolute and filiform.

2. **Eragrostiella brachyphylla** (Stapf) Bor, Indian Forester 66: 270. 1940; Bor, Grass. Burma Ceylon India Pakistan 494. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1852. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 202. 1994; S. Moulik, Grass. Bam. India 2: 594. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1189. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 131. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 523. 2012. *Eragrostis brachyphylla* Stapf, Hooh.f. Fl. Br. India 7: 327. 1896; C.E.C Fisch. in Gamble, Fl. Madras 3: 1828. 1934. **Lectotype** (designated here):—India, *Wallich Cat. No. 3827A* (K000907168, image!, Isolectotype: CAL). **Figs. 32–34**

Tufted perennials, 30–55 cm high, roots fibrous. ***Culms*** 10–40 cm high, geniculate nodes glabrous, 2-noded. ***Leaf sheaths*** 1.5–7 cm long, enrolled to the culm, ciliate towards apex. ***Leaf Blades*** flat or complicate, 2.5–12.5 × 0.1–0.15 cm, incurved, surfaces glabrous or finely hispidulous, subacute to obtuse at apex; ***ligules*** fine membranous with long ciliate hairs, cilia 0.1–0.4 mm long. ***Spikes*** terminal, 10–30 cm × 1–2 cm, with alternate sessile spikelets, compactly arranged or sometimes all along in oneside; peduncle 8–20 cm long, round, glabrous, rachis triangular, slightly coriaceous or serrulate on margins. ***Spikelets*** linear oblong-ovate, 4–16 × 1.8–3 mm, 14–28-flowered, olive green or straw coloured. ***Lower glumes*** ovate-lanceolate, 2–2.2 × 0.5–0.75 mm, chartaceous, 1-nerved, 1-keeled, keels serrulate, acute to acuminate at apex. ***Upper glumes*** ovate to oblong-lanceolate, 2.5–3 × 0.7–0.8 mm in size, 1-nerved, 1-keeled, keels scabrid, chartaceous, acute to retuse at apex. ***Lemmas*** ovate-lanceolate, 2.3–2.8 × 1–1.5 mm, 3-nerved, caducous, acute to retuse or obtuse at apex, leaden green in colour. ***Paleas*** narrowly elliptic, 1.6–1.8 or 2–2.2 × 0.7–1 mm, chartaceous,

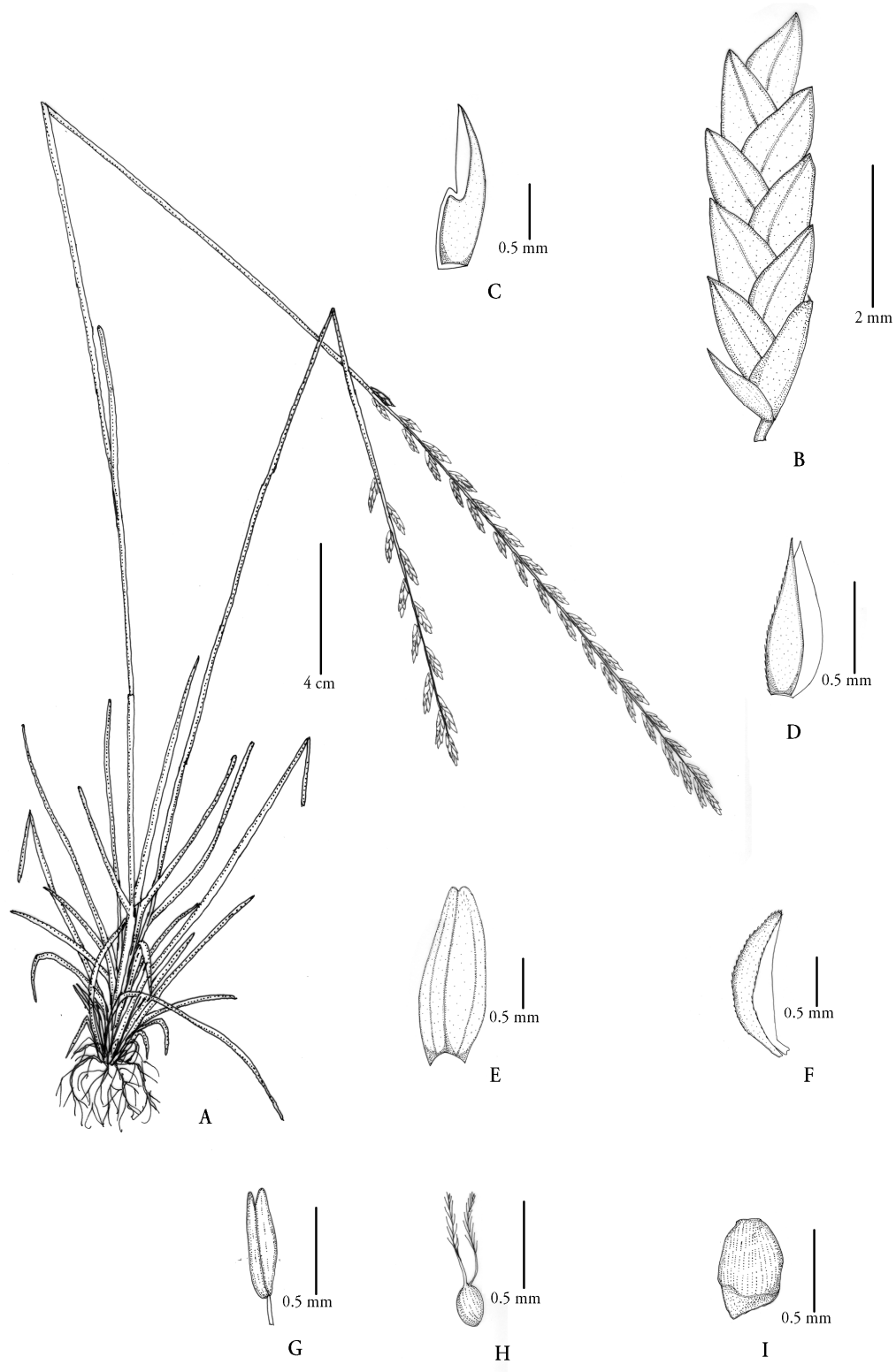


Fig. 32. ***Eragrostiella brachyphylla*** (Stapf) Bor: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamen; **H.** Pistil; **I.** Caryopsis.

sub persistent, hyaline, broadly winged, 2-nerved, keels ciliate, acute or puberlous at apex. ***Rachilla*** smooth, glabrous, olive green in colour, 0.3–0.5 mm long. ***Lodicules*** 2, 0.2–0.3 mm, dentate-triquadrate. ***Stamens*** 3, anthers 0.6–0.7 mm long, yellowish purple; filaments *c.* 0.3 mm long. ***Ovary*** 0.2–0.3 mm, globose, style 0.5–0.8 mm long, slender; stigma plumose, 0.6–0.8 mm long. ***Caryopses*** 0.4–0.6 × 0.3–0.4 mm, ovate to globose, light brown.

Fig. 33. Lectotype of *Eragrostiella brachyphylla* (Stapf) Bor [*Wallich 3827A* (K000907168) designated here] © The Board Trustees of the Royal Botanic Gardens, Kew.

Flowering & Fruiting:—June–November

Habitat & Ecology:—At present, it is known to occur at low and high elevations grasslands adjacent to the granitic rocks and rock outcrops in dry forests. Major associatives are *Apluda mutica* L., *Arundinella pumila* (Hochst. *ex* A. Rich.) Steud., *Chrysopogon* sp., *Crotalaria* sp., *Heteropogon contortus* (L.) P.Beauv. *ex* Roem. & Schult., *Leucas* sp., *Tripogon bromoides* Roth *ex* Roem. & Schult.

Distribution:—Only in India and Sri Lanka. In India, it was distributed in almost all states.

Specimens examined:—India, **Andhra Pradesh,** Anantapur Dist.: Kalasamudram, *B.R.P. Rao* & *P. Priyadarsini 37099* (BSID). Chittor Dist.: Nagalapuram, Pitchattor, 28 Oct. 2017, *Nikhil Krishna* & *M. Yoonus T. 146759* (CALI). Nellore Dist.: *s.loc., s.die., C.E.C. Fischer 4137* (CAL). Prakasam Dist.: Basarapuram, 07 Aug. 1986, *V.B. Hosagoudas 83991* (BSID); Kurnool, *s.die., B. sadasivaiah* & *S. Khader Basha 29396* (BSID). **Karnataka,** Chamarajanagar Dist.: Gopalaswamy Hills, 30 Sept. 2015, *Thoiba*

K. 144168 (CALI). Tumkur Dist.: Bommanahalli, 29 Sept. 2015, *Thoiba K. 144178* (CALI). **Maharashtra,** *s.loc., s.die., s.coll. 4247* (CALI). **Odisha,** Ganjam Dist.: Balipadar, 19 Aug. 2013, *Alok 10220* (BSID). Koraput Dist.: Kundali, 25 Aug. 2013, *Alok 10231* (BSID). **Tamil Nadu,** Pudukottai Dist.: Keeranur, 03 Oct. 1982, *S.J. Britto 29295* (RHT). Villupuram Dist.: Puthuppet, 11 Dec. 2001, *K.M. Mathew 73549* (RHT). **Telangana,** Khammam Dist.: Bandi Reserve forest, 26 Aug. 1995, *R. Chandrasekaran 104300* (BSID). Warangal Dist.: *s.loc.,* 10 Aug. 1961, *K.M. Sebastine 13160* (CAL).

Notes:—It differs by having spikelets leaden or straw coloured; leaves linear or narrowly apiculate, coriaceous, often complicate and falcate with narrowly winged paleas. *Eragrostiella brachyphylla* was originally described as *Eragrostis brachyphylla* by Stapf (1896) in Hooker's Flora of British India under section IV: Plagiostachya from South India. He cited five specimens simultaneously from Wallich and Wight's Catalogues as ''*Wall. Cat. n. 3827 A., Wight Cat. n. 1773 C., 1773b, Herb. n. 3528, 3356*". Dassanayake *et al.* (1994) cited the type as "*Syntypes: from India, Herbarium Wight, no. 1773b (K) and Wallich Cat. No. 3827A (CAL)*", without specifically referring to a single specimen. In 1940, Bor established the genus *Eragrostiella* and he transferred all the taxa coming under Hooker's section IV: Plagiostachya to the genus *Eragrostiella*. While searching for the original specimens at different herbaria, we traced nine sheets from K herbarium. Out of these, 5 sheets are duplicates of the remaining sheets. Among them, 4 sheets are from *Wight Catalogue* (*1773 b, 3528, 3356*) and 1 from *Wallich Catalogue* (*3827 A*). However, from the

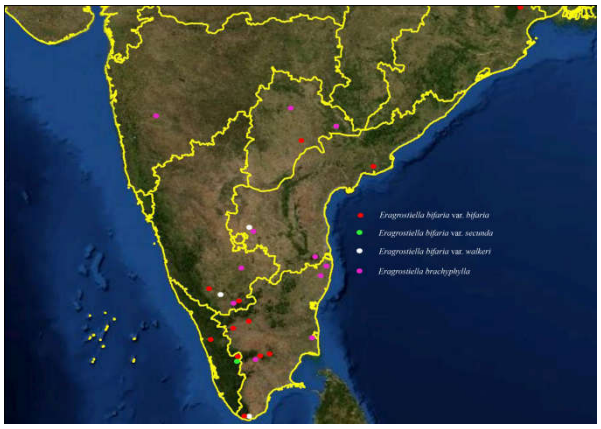


Fig. 34. Distribution of *Eragrostiella bifaria* (Vahl) Bor (●), *E. bifaria* var. *secunda* (Nees ex Steud.) Lazarides (●), *E. bifaria* var. *walkeri* (Stapf) Lazarides (○) and *E. brachyphylla* (Stapf) Bor (●)

available materials, the sheet *Wallich Cat. No. 3827 A* Barcode K000907168 (left hand side specimen) has the annotation and also dissected floral parts. The other sheets are with more than two specimens mounted on a single sheet mixed with other taxa of *Eragrostiella.* Therefore, among the original materials from K Herbarium, the sheet *3827A* (K000907168) is well preserved specimen matching exactly with the protologue and is designated here as the lectotype of *Eragrostiella brachyphylla*.

Eragrostis Wolf

Eragrostis Wolf with *c.* 441 species is the largest chloridoid genus in the derived subtribe Eragrostidinae. It is distributed throughout the tropical, subtropical, and warm temperate regions of the world (Clayton & Renvoize 1986; Peterson *et al.,* 1995, 1997; Lazarides 1997; Veldkamp 2002; Ingram & Doyle 2007; Peterson & Sanchez Vega 2007; Watson & Dallwitz 2008; Ingram 2010; Chaisongkram *et al.,* 2013), but evolution seems to have been most active in Africa, where many members of the genus occur (Clayton & Renvoize 1986). The genus is characterized by having many-flowered spikelets where the disarticulation of the lemma and palea occurs separately, lemmas that are usually 3-nerved and unawned, longitudinally bowed-out paleas with ciliolate keels, paniculate infloresences, and leaves with ciliate ligules (Peterson *et al.,* 1997). Greater species of *Eragrostis* occupy open habitats with poor soils, and many occur in ruderal sites (Clayton & Renvoize 1986; Vanden Borre & Watson 1994), and their distribution exhibits wide altitudinal gradients and a high variation in humidity conditions, from sea level to 3600(-4000)m, and from pluvial environments to xeric habitats, respectively.

The genus *Eragrostis* used to be attributed prior to P. Beauv. (1812). Ross (1966) assuredly argues out that it should be credited to Wolf (1776) as his work constitutes a valid publication. *Eragrostis* is notorious for its troublesome infrageneric and specific delimitation (Veldkamp, 2002; Ingram, 2010). The characters used, e.g.

presence of glands, mode of fragmentation (disarticulation) of the spikelet, number and size of the anthers, shape of the caryopses, etc., are often difficult to observe and assess.

Eragrostis Wolf, Gen. Pl. 23: 1776; Stapf in Hook.f., Fl. Brit. India 7: 104. 1896; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1820. 1934; Bor, Grass. Burma Ceylon India Pakistan 495. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1852. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 375. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 203. 1994; L. Watson & Dallwitz, Revis. Grass Gen. World: 382. 1994; S. Moulik, Grass. Bam. India 2: 595. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1190. 1997; Lazarides, Aust. Syst. Bot. 10: 77. 1997; Veldkamp, Blumea 47: 160. 2002; P.M. Peterson & I.S. Vega, Ann. Missouri Bot. Gard. 94: 747. 2007; P.M. Peterson & Giraldo-Cañas, J. Bot Res. Inst. Texas 2(2): 876. 2008; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 133. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 524. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 111. 2013. **Lectotype** (designated by Ross, 1966):—*Eragrostis minor* Host, Icon. Descr. Gram. Austriac., 4: 15. 1809.

Eragrostis Wolf sect. *Ectrosiopsis* Ohwi, Bull. Tokyo Sci. Mus. 18. 1. 1947; *Ectrosiopsis* Jansen, Acta Bot Neerl. 1(3): 474. 1952. Lectotype (designated by Blake, 1969):—*Ectrosiopsis subtriflora* (Ohwi) Jansen (=*Eragrostis lasioclada* Merr.).

Diandrochloa De Winter, Bothalia 7(2): 387. 1960. Type:—*Diandrochloa namaquensis* (Schrad.) DeWinter (=*Eragrostis japonica* (Thunb.) Trin.).

Roshevitzia Tzvelev, Bot. Zhurn. (Moscow & Leningrad) 53: 311.1968. Type:—*Roshevitzia diarrhena* (Schult. & Schult.f.) Tzvelev (=*Eragrostis japonica* (Thunb.) Trin.).

Annuals or perennials, then branching intra- and extra- vaginally at base, rhizomes and stolons absent. ***Culms*** hollow, erect or geniculately ascending, slightly compressed or terete. ***Leaf sheaths*** loose, coriaceous to membranous. ***Leaf blades*** apex acute to acuminate or attenuate. ***Ligules*** usually a line of hairs, rarely membranous. ***Panicles*** contracted to lax, branches ending in a spikelet. ***Spikelets*** pedicelled, more or less laterally compressed, muticous, 2–many flowered, disarticulating above the glumes. ***Glumes*** early deciduous, unequal to subequal, shorter than to subequal to the adjacent lemmas, acute to mucronate; lower glumes 0- or 1-nerved; upper glumes 0–3-nerved. ***Rachilla*** persistent or not, ending in a more or less reduced floret. ***Lemmas*** without a distinct callus, keeled or rounded on the back, 3-nerved, acute to mucronate. ***Paleas*** 2-nerved. ***Lodicules*** 2. ***Stamens*** 1–3. Styles 2, free to base. ***Ovary*** glabrous. ***Caryopses*** with adherent pericarp, usually falling with the deciduous lemma or sometimes enclosed by the lemma and palea.

Distribution:—About 441 species widely distributed in tropical to temperate regions of the world. Among them, 212 species in Africa, 74 species in Australia, 56 in tropical Asia, and 51 in temperate Asia (Peterson *et al.,* 2010), of which 46 species occurs in India (36 in Peninsular India).

Habitat:—It is found in open habitats and sometimes forests from sea level to high altitudes.

Etymology:—The origin of the name is somewhat ambiguous. Wolf (1776), who first named *Eragrostis*, without any statements concerning the origin of its name. Clifford (1996) and Clifford & Bostock (2007) provided three possible derivations: from "eros" (love), and "Agrostis" (the Greek name for an indeterminate herb); from the Greek "er" (early) and "agrostis" (Wild), referring to the fact that some species of *Eragrostis* are early invaders of arable land; or the Greek "eri-"(a prefix meaning "very" or "much"), suggesting that the name means many-flowered "Agrostis". Watson & Dallwitz (2008) announce that the derivation of *Eragrostis* is "from the Greek 'eros' (love) or 'era'

(earth) and 'agrostis' (a grass), probably alluding to the characteristic, earthy (human) female aroma of the infloresences of many species".

Key to the species of *Eragrostis* in Peninsular India

1a. Spikelets breaking up at maturity, except *E. superba*……..……..…**2**

1b. Spikelets not breaking up at maturity,1.5 mm wide, olive to leaden grey; lower glumes upto 1 mm long; lemmas lanceolate-acute; anthers 0.25–0.5 mm long; caryopses ovate oblong or oblong ellipsoid, 0.5–1.2 mm long…… .....***E. tef***

2a. Spikelets disarticulating from pedicel apex as a single unit; spikelets broadly elliptic to ovate, yellowish or reddish; lemmas upto 4.2 mm long paleas with winged keels…….....…***E. superba***

2b. Spikelets disarticulating above glumes in various ways and not falling as a single unit…… ..... ……**3**

3a. Spikelets breaking up from above downwards; rachis fragile… ..... …...**4**

3b. Spikelets breaking up from below upwards; rachis tough..... **13**

4a. Lemmas ciliate on the margins… **5**

4b. Lemmas not ciliate on the margins..... 7

5a. Lemmas acuminate, mucronate or cuspidate **6**

5b. Lemmas obtuse, 1–2 mm long; cilia on the margins often reduced to a few at the base; keels of palea short to long ciliate.....***E. coarctata***

6a. Panicles clavate, dense, shining, sometimes shortly interrupted towards base; lemmas 2.5–3 mm long, very straight on the keel, shortly ciliate with firm margins; keels of the palea narrowly winged.....***E. deccanensis***

6b. Panicles spiciform, compact; spikelets rather dull, matt; lemmas 1.5–2.5 mm long, margins long ciliate, rather stiff; keels of palea not winged ..... ***E. ciliata***

7a. Keels of the paleas more or less ciliate or scabrid..... **8**

7b. Keels of the paleas scabrid or smooth, not ciliate..... **11**

8a. Panicles spiciform compact or dense..... **9**

8b. Panicles effuse… **10**

9a. Annuals; lemmas ciliate (at least the upper) on the keels; lateral nerves close to the margins of the lemma; cilia on keels of palea soft, longer than the width of the palea… .....***E. ciliaris***

9b. Perennials; lemmas not ciliate on the keels; nerves equally distant on the lemma; palea keels ciliate… .....***E. riparia***

10a. Plants viscid with particles of soil adhering to the sticky areas along the sheaths, culms and blades… ..... ***E. viscosa***

10b. Plants not viscid and without particles of soil adhering to vegetative portions…..... .....***E. amabilis***

11a. Panicles thyrsiform or very broadly oblong with numerous capillary branches bearing long pedicelled spikelets..... .**12**

11b. Panicles oblong or linear, not more than 5 cm wide, very long or slender; branches which are solitary or more or less whorled .....***E. japonica***

12a. Panicles thyrsiform, 25–65 cm long; spikelets olive green to purple tinged; lemmas 1.3– 1.6 mm long, markedly truncate ..... ***E. aspera***

12b. Panicles very broadly oblong or effuse-lax, about the half of the plant; spikelests grey-ash; lemmas 2–2.5 mm long, acute or obtuse ..... ***E. paniciformis***

13a. Annuals or short lived perennials; lemmas 1–2 mm long..... **14**

13b. Perennials; lemmas 1.25–3 mm long..... **21**

14a. Plants glandular; the glands may be raised glands on the keels of the lemmas.....**15**

14b. Plants eglandular…..... **19**

15a. Lowest branches of the panicles fascicled or whorled, axis pilose, spikelets long pedicellate .....***E. pilosa***

15b. Lowest branches not as above..... **16**

16a. Pedicles of the spikelets with a pitted gland with raised margins; a broad glandular patch on the axis below the panicle branches..... **17**

16b. Pedicels of the spikelets without a pitted gland, culms viscid below the panicle; pedicels and branches with glandular spots; lemmas pale brown or white..... ... .***E. rottleri***

17a. Leaf margins eglandular; lower glumes nerveless; lemmas broadly elliptic, acute…..... .....***E. maderaspatana***

17b. Leaf margins mostly often with raised glands; lower glumes 1-nerved; lemmas broadly ovate-obtuse **18**

18a. Spikelets up to 25 mm long, slightly curved at maturity; florets up to 55 in number; lemmas elliptic to narrowly ovate.....***E. henryi***

18b. Spikelets up to 15 mm long, not curved; florets up to 45 in number; lemmas broadly ovate to subrotund…..... .....***E. minor***

19a. Panicles sub erect and open; spikelets more or less fascicled on the primary or secondary branches, or shortly pedicelled in narrow racemes…..... **20**

19b. Panicles drooping; spikelets not fascicled, seated on long pedicels in panicles, spikelets leaden green or blackish.…. ..... ***E. macilenta***

20a. Plants more than 20 cm high; lemmas 1–1.25 mm long, acute or obtuse at apex…..... ..... ***E. gangetica***

20b. Plants dwarf, not more than 20 cm high; lemmas 1.25–1.5 mm long, tips sharply acute at apex… ..... ***E. multicaulis***

21a. Plants decumbent or erect; secondary pedicels on the panicle upto 3.5 cm long…… **22**

21b. Plants erect; panicle branches capillary, axils pilose; Spikelets 10–70-flowered, pale green or purplish; pedicles over 5 mm long ..…..... ***E. tremula***

22a. Panicle open, contracted or effuse… **23**

22b. Panicle fasicled or effuse-lax… **24**

23a. Spikelets olive green to purple tinged… **27**

23b. Spikelets leaden green or blackish..... **33**

24a. Panicles open densely spiculate or not; palea sub persistant… **25**

24b. Panicles effuse to lax; palea caducous… **29**

25a. Panicles open, branches alternate; spikelets distantly arranged on the pedicels; anthers 0.3–0.6 mm long…..... ***E. brownii***

25b. Panicles open, branches fasicled; spikelets crowded… **26**

26a. Basal leaves flat; spikelets 10–60-flowered; lemmas 2–2.5 mm long, acuminate.. …… ..... ***E. zeylanica***

26b. Basal leaves filiform; spikelets 5–20-flowered; lemmas 1.5–2 mm long, acute ……... ..... ***E. cumingii***

27a. Spikelets up to 4 mm wide; with or without glands all over the plants; lemmas 2–2.8 mm long; stamens 3.....***E. cilianensis***

27b. Spikelets up to 5 mm wide; eglandular; lemmas 1.5–2 mm long; stamens 2 or 3…….....**28**

28a. Panicles primary branches having up to 15 or more spikelets; lemmas ovate to elliptic-lanceolate, up to 2.2 mm long; stamens 2….....***E. unioloides***

28b. Panicles primary branches having up to 10 broad spikelets; lemmas elliptic-lanceolate, up to 2 mm long; stamens 3… ..... ***E. collinensis***

29a. Spikelets 1.5–2.5 mm wide; paleas deciduous or not with lemmas…. **30**

29b. Spikelets 1–1.5 mm wide; paleas sub persistent…… ....….**32**

30a. Panicles lower branches whorled and axils pilose; spikelets dark green; glumes unequal with persistent palea… ..... .***E. curvula***

30b. Panicles branches alternate, axils glabrous; spikelets leaden grey or purplish green….....**31**

31a. Panicles loosely spiculate, subsecund; spikelets oblong-lanceolate, purplish green; florets up to 24…… .....***E. subsecunda***

31b. Panicles lax; spikelets ovate-lanceolate, leaden grey; florets up to 40..... .... ***E. atrovirens***

32a. Panicles contracted, not more than 5 cm wide; spikelets crowded, straight; lemmas oblong, 1.5 mm long; caryopses ellipsoid-globose... ..... ***E. nutans***

32b. Panicles widely spreading; more than 3 cm wide; spikelets loose, slightly curved; lemmas ovate to elliptical, 1.7 mm long; caryopsis oblong-ellipsoid…..... ....***E. papposa***

33a. Panicles effuse-lax or drooping; spikelets dark green or blackish… **34**

33b. Panicles open, contracted or densely spiculate; spikelets dark green or olive green…..35

34a. Panicles effuse; nodes brownish to purplish with a glandular band below each node; glumes 0.7–1.5 mm long; anthers 0.2–0.3 mm long.. .....***E. nilgiriensis***

34b. Panicles effuse-lax or sometimes drooping; nodes without glandular band; glumes 1.2–2 mm long; anthers 0.4–0.6 mm long…..*E. nigra*

35a. Leaves prominently tuberculate and hirsute; spikelets ovate-oblong lanceolate, olive green to leaden grey; glumes boat-shaped and nerved; stamens 2…..... ....***E. schweinfurthii***

35b. Leaves sparsely pilose; spikelets laterally compressed, margins serrate, leaden green; glumes not prominently keeled, nervless or faintly nerved; stamens 3……..... ....***E. tenuifolia***

1. Eragrostis amabilis (L.) Wight & Arn., Cat. Indian Pl. 2: 105. 1834; Hook.f., Fl. Brit. India 7: 315. 1896; Bor, Grass. Burma Ceylon India Pakistan 513. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1857. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 390. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 205. 1994; S. Moulik, Grass. Bam. India 2: 608. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1199. 1997; Lazarides, Aust. Syst. Bot. 10: 157. 1997; Veldkamp, Blumea 47: 164. 2002; P.M. Peterson & I.S. Vega, Ann. Missouri Bot. Gard. 94: 750. 2007; P.M. Peterson & Giraldo-Cañas, J. Bot Res. Inst. Texas 2(2): 910. 2008; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 135. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 543. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 120. 2013. *Poa amabilis* L. Sp. Pl. 1: 68. 1753. **Lectoype** (designated by Veldkamp,

2000):—Sri Lanka, *Herb. Hermann 2: 59, no. 46* (BM000621703, image!). **Figs. 35, 36, 41**

Poa tenella L. Sp. Pl. 1: 69. 1753. *Eragrostis tenella* (L.) P. Beauv. *ex* Roem *et* Schult. Syst. Veg. 2: 576. 1817. *Megastachya tenella* (L.) Bojer, Hort. Maurit. 369. 1837. Lectotype (designated by Veldkamp, 2002):—India, *Herb. Linn. No. 87.33* (LINN, image!).

Poa plumosa Retz., Obs. Bot. 4: 20. 1786. *Eragrostis plumosa* (Retz.) Link, Hort. Berol. 1: 192. 1827. Type:—*König s.n. in Herb. Retzius 378* (Holotype: LD, K000643376, image!, fragm.).

Eragrostis amabilis var. *peramangalamensis* P. Umam. & P. Daniel, J. Econ. Tax. Bot. 22(1): 216, t. 2. 1998. Type:—Tamil Nadu, Tiruchirapalli Dist.: Peramangalam, along sandy river banks, 26.11. 1978, *K.M. Matthew, V.S. Manickam* & *C. Manoharan RHT 19276* (Holotype: K, MH Photo, Isotype: RHT).

Key to the varieties

1a. Panicle effuse, branches 1–5 cm long, axils hairy…….. .....**1a. var. *amabilis***

1b. Panicle contracted, branches less than 1 cm long, axils glaborus……..... .... **1b. var. *insularis***

1a. var. amabilis

Tufted annual to perennial, 10–50 cm high, roots fibrous. ***Culms*** 10–30 cm long, nodes glabrous. ***Leaf sheaths*** 5–15 cm long, margins with tubercle based hairs, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 7–15 × 0.4–1 cm, base slightly cordate, apex acute-acuminate; surface scabrid, sparsely ciliate adaxially and glabrous abaxially; margins entire and eglandular; ***ligules*** ciliate rim, cilia 0.2–0.4 mm long. ***Panicles*** ovate, effuse, 5–20 × 3–8 cm, branch node with long villous hairs, at a time with glandular

bands on axis, branches alternate; peduncle 3–20 cm long, glabrous; primary pedicel 1–3 cm long, coriaceous; secondary pedicel 0.5–2 cm long, flat to triquetrous, more or less capillary, margins serrulate. ***Spikelets*** ovate to oblong-lanceolate, 2–3.4 × 0.8–1.2 mm, 4–8-flowered, olive green to purple, disarticulation of florets from above downwards. Glumes unequal, persistent or falling later. ***Lower glumes*** oblong-lanceolate, 0.4–0.7 × 0.4–0.6 mm, 1-nerved, 1-keeled, keels scaberulous. ***Upper glumes*** lanceolate, 0.6–1 × 0.4–0.5 mm, 1-nerved, 1-keeled, keels serrulate towards apex. ***Lemmas*** ovate-lanceolate, 0.8–1.2 × 0.5–0.7 mm, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex acute, obtuse to emarginate, keels serrulate towards apex, smooth or scabrellate. ***Paleas*** elliptic-lanceolate, 0.6–1 × 0.4–0.6 mm, winged, deciduous or not, 2-nerved, keels ciliate; cilia 0.5 mm long, straight initially and curved at maturity, acute-oblong at apex. ***Rachilla*** zigzag, 0.4–0.7 mm long, disarticulating from above downwards. ***Lodicules*** 2, 0.2–0.3 mm long, dentate. ***Stamens*** 3; anthers 0.2–0.4 mm long, white. ***Ovary*** 0.4–0.6 mm long, globose; style *c.* 0.3 mm long, slender; stigma plumose, 0.3–0.4 mm long. ***Caryopses*** obovoid-ellipsoid, 0.3–0.5 × *c.* 0.3 mm, light to deep brown.

Flowering & Fruiting:—July–February

Habitat & Ecology:—The species is a cosmopolitan weed of gardens, lawns and road sides; it occurs usually in sandy soils and also in woodland clearings, cultivated fields, beach sands, and in shallow soils over laterite and also common in open waste places, between stones, locally abundant in sea level to high altitudes. Usually occurs in association with *Eragrostis amabilis* var. (C.E. Hubb.) P. Umam. & P. Daniel*, E. unioloides* (Retz.) Nees *ex* Steud.*, Heteropogon contortus* (L.) P. Beauv. *ex* Roem. & Schult.*, Ischaemum ciliare* Retz.*, I. rangacharianum* C.E.C. Fisch.*, Leucas aspera* (Willd.) Link, *Mollugo pentaphylla* L.*, Oldenlandia umbellata* L., *Sida acuta* Burm.f. and *Trachys muricata* (L.) Pers. *ex* Trin.

Distribution:—Native in India (throughout all states); introduced in U.S.A., Mexico, Central America, Caribean, Brazil, Bolivia, Columbia, Ecuador, Guianas, Paraguay, Peru, and Venezuela (Nicora, 1998; Peterson & Boechat, 2001).

Specimens examined:—India, **Andhra Pradesh,** Godaveri Dist.: *s.loc.*, 20 Jan. 1916, *s.coll. s.n.* (FRC). Visakhapatanam Dist.: Araku Valley, 16 Sept. 1961, *N.P. Balakrishnan 621* (CAL); Galikonda, 15 June 1964, *G.V. Subba Rao 19584* (MH). **Gujarat,** Ahmedabad Dist.: Shardanagar, 06 Feb. 2005, *Rani B. Bhagat s.n.* (AHMA). Narmada Dist.: Karaya, Rajpipla, 17 Sept. 1957, *S.K. Jain 24012* (BSI). Surat Dist.: *s.loc.*, 12 Oct. 1959, *P.S. Toor 25676* (BSI). Rajkot Dist.: Saurashtra, Gumuli, 11 Oct. 1949, *H. Santapau 10387* (BLAT). **Karnataka,** Bellary Dist.: Benkal Plantation, 12 Sept. 1974, *N.P. Singh 132901* (BSI); Belgaum Dist.: Ukkad, *s.die.*, *S.D. Mahajan 29908* (BSI); Chitradurga Dist.: Daveje Road, 02 Nov. 1975, *N.P. Singh 141266* (BSI); Kolar Dist.: Tumkur–Chickballapur Road, 03 Jan. 1976, *N.P. Singh 142028* (BSI); Raichur Dist.: Raichur–Hyderabad Road, 15 Nov. 1975, *N.P. Singh 141728*; *Ibid.*, Kushtagi Rao Road, 11 Nov. 1975, *N.P. Singh 141577* (BSI); Tumkur Dist.: Bukkapatna S.F., 29 Oct. 1975, *N.P. Singh 141147* (BSI). Chamarajanagar Dist.: Gundlupet, 28 Sept. 2015, *Thoiba K. 146605* (CALI); Dekshina Kannada Dist.: Kadaba, Nattana, 05 Mar. 2013, *Mohammed Yoonus* & *Thoiba K. 134418* (CALI); Mysore Dist.: Chammundi Hills, Temple Compound, 30 Sept. 2015, *Thoiba K. 144196*; *Ibid.,* 30 Sept. 2015, *Thoiba K. 144197* (CALI). Hassan Dist.: 29 Sept. 2015, *Thoiba K. 144183* (CALI). **Kerala,** Alappuzha Dist.: Pallana, 13 Mar. 1980, *P.V. Sreekumar 66732*(MH); Edathur, 10 June 1980, P.V. Sreekumar 67167 (MH); Champakkulam, *s.die*, *Sunil C.N. 1822* (CALI); Vandanam, 28 Jan. 2014, *Thoiba K. 138058* (CALI). Ernakulam Dist.: Airport-Cochin, 22 June 1980, *P.V. Sreekumar 67707* (MH); Cherai, 25 June 1979, *C.R. Suresh* & *K.S. Manilal 32904* (CALI). Kollam Dist.: Chavara, 16 Mar. 1980, *P.V. Sreekumar 67104* (MH); Shancott, 15 June 1960, *s.coll. 63039* (BSI). Kottayam Dist.: Kudamaloor, 26 June 1980, *P.V.*

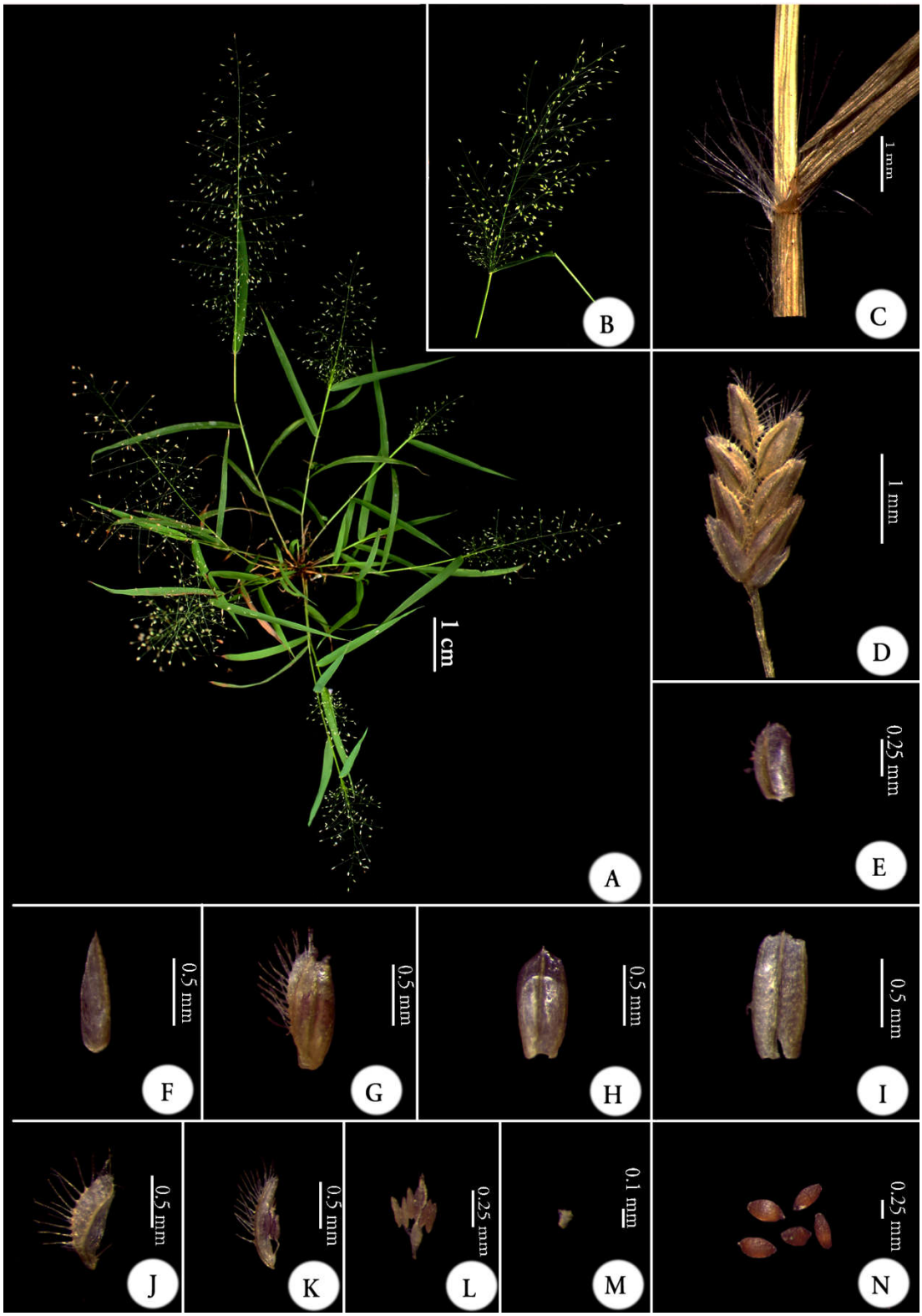


Fig. 35. ***Eragrostis amabilis*** (L.) Wight & Arn.: **A.** Habit; **B.** Enlarged portion of panicle; **C.** Ligule; **D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Floret; **H. & I.** Lemma; **J.** Palea; **K.** Palea with flower; **L.** Stamens & Pistil; **M.** Lodicule; **N.** Caryopsis.

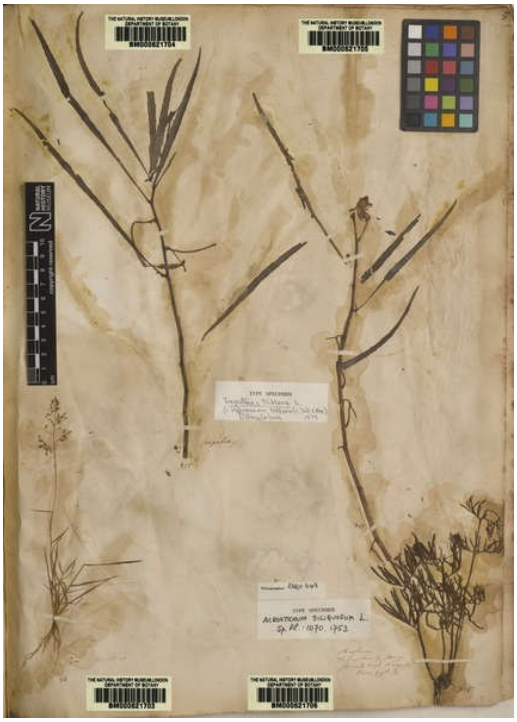


Fig. 36. Lectotype of *Eragrostis amabilis* (L.) Wight & Arn. [*Herb. Hermann 2: 59, no. 46* (BM000621703) designated by Veldkamp, 2000] © The Board Trustees of the British Museum of Natural History, London.

Sreekumar 67726 (MH). Kozhikode Dist.: Devagiri, 14 Nov. 1983, *M.M. Matthew, s.n.*; *Ibid.*, 05 Nov. 2002, *Vijesh, P.K. 000079*; *Ibid.*, 06 Nov. 2002, *K. Premjith 000692* (DEV); Railway Station, 10 Nov. 2012, *Thoiba K. 138041* (CALI); Mundakkal, Kunnamangalam, 04 Nov. 2014, *Thoiba K.* & *P.E. Sreejith 137543* (CALI). Malappuram Dist.: Nilambur, *s.die*, *s.coll. 34419*; *Ibid.*, *s.die*, *s.coll. 34334* (CALI); Calicut University, 28 Aug. 1970, *V.V. Sivarajan 427*; *Ibid.,* 10 June 1971, *V.V. Sivarajan 1213*; *Ibid.,* 21 Oct. 1970, *V.V. Sivarajan 668*; *Ibid.*, 10 June 1971, *V.V. Sivarajan 1213*; *Ibid.*,10 Oct. 1970, *s.coll. 573*; *Ibid.*, 02 Feb. 1983, *Geetha, M. 36085*; *Ibid.*, 18 Dec. 1970, *V.V. Sivarajan 870* (CALI); Calicut University, Ladies Hostel, 14 Oct. 2000, *Jayasree S. 74326* (CALI); Nilambur, Pookottupadam, 24 Jan. 2013, *Fabeena* & *Thoiba K. 134410* (CALI); Vattapara, 17 Feb. 1957, *G.S. Puri 15193* (BSI). Palakkad Dist.: Walayar, 06 Jan. 1911, *Fischer 2447* (FRC); Kunthipuzha River Basin, Mannarkkad, 06 Nov. 2013, *Thoiba K. 134495* (CALI); Pattambi, Bharathapuzha River Basin, 22 Jan. 2013, *Thoiba K. 138043* (CALI); Victoria College Ground, 05 Dec. 2015, *Drisya V.* & *Thoiba K. 146694* (CALI). Pathanamthitta Dist.: Chittar, 15 Aug. 1988, *N. Venkatasubramanian N.V. 1642* (FRC); Chittoor, 30 Jan. 2013, *Mohammed Yoonus* & *Thoiba K. 138040* (CALI). Thiruvananthapuram Dist.: Kazhakuttam, 24 Mar. 1980, *P.V. Sreekumar 67142* (MH); *s.loc.*, 18 Mar. 1991, *N. Mohanan 11338* (TBGT); Peroorkada, SAP Parade Ground, 08 August 2014, *Thoiba K. 138091* (CALI). Thrissur Dist.:

Guruvayoor, 02 Feb. 2013, *Thoiba K. 134403*; *Ibid.*, 02 Feb. 2013, *Thoiba K 138051* (CALI); *s.loc.*, 26 Jan. 2014, *Thoiba K. 138046* (CALI); Triprayar, Thalikulam, Snaehatheeram Beach, 27 Nov. 2015, *Thoiba K.* & *A.K. Pradeep 146685*; *Ibid.*, 27 Nov. 2015, *Thoiba K. 146686* (CALI); Kodungallur, Mathilakam, Koolimuttam, 27 Nov. 2015, *Thoiba K.* & *A.K. Pradeep 146687* (CALI); Amala Hospital, 31 Dec. 2015, *Thoiba K.* & *P.E. Sreejith 144123* (CALI). **Maharashtra,** Amravati Dist.: Dhargad, 04 Oct. 1992, *S.R. Yadav 7534* (SUK). Beed Dist.: Pokhari Ghat, 20 Oct. 1956, *J.A. Vasavada 8544* (BSI). Kolhapur Dist.: Shivaji University Campus, 09 Nov. 2016, *Thoiba K. 146735* (CALI); Gadhinglaj, 09 Sept. 1990, *S.R. Yadav 7617* (SUK). Pune Dist.: 2 Miles before Sirur, 01. Jan. 1950, *G.S. Puri 6733*; *Ibid.*, Shivneri Hills, 12 Oct. 1962, *Hemadri 83725* (BSI); Fergusson College Campus, 15 Oct. 1956, *V.D. Vartak 6277* (AHMA); Yavat, Daund, 04 Sept. 2005, *Varsha Gaikwad s.n.* (AHMA). Ratnagiri Dist.: Khed, 18 Oct. 1993, *C.B. Salunkhe 7913* (SUK). Sangli Dist.: Ashta, 26 Sept. 1993, *C.B. Salunkhe 7369* (SUK). Solapur Dist.: Great Indian Bustard Sanctuary, Korti, 11 Dec. 2011, *J. Jayanthi 199336* (BSI). **Odisha,** Ganjam Dist.: *s.loc.*, Dec. 1949, *W. Wight 3036* (CAL). **Tamil Nadu,** Chengalpattu Dist.: Kortalaiyar River Bed, Pallipuram, 10 May 1985, *D. Narasimhan s.n.* (MH); Thirukazhukundram, 04 Sept. 1992, *P. Ravichandran 273* (MH). Chennai Dist.: Palar, Madras-Mysore Boarder, 19 July 1968, *K.N. Subramanian 3488* (FRC); *s.loc.*, 1887, *J.S. Gamble s.n.* (MH). Coimbatore Dist.: Velliangiri Hills, 13 Jan. 2016, *A.K. Pradeep* & *Thoiba K. 146716* (CALI); Pollachi, 31 Aug. 2014, Alfred Joe & *Thoiba K. 138098* (CALI); Silviculture Nursery, Forest College Estate, 18 Nov. 1964, *K.N. Subramanian 1754* (FRC); IFGTB Campus, 25 Sept. 2001, *N. Venkatasubramanian* & *R. Tamilarasi s.n.* (FRC). Cuddalore Dist.: Kovalarithittu, Pichavaram R.F., 04 Mar. 1970, *K.N. Subramanian 3911* (FRC). Dharmapuri Dist.: Hogenakkal, 11 July 1964, *E. Vajravelu 20543* (MH). Dindigul Dt.: Kodaikanal, 24 Feb. 2014, *Thoiba K.* & *K.M. Lemiya 138074* (CALI); Kodaikanal Reserve Forest, 02 Feb. 1987, *S. Ragupathy 151* (CAL); Kodaikanal, Zigzag, 19 Dec. 1905, *C.A. Barber 9472*; *Ibid.*, 19 Dec. 1905,

C.A. Barber 7472 (MH); Pachalur Ghat Road, 12 Dec. 1989, *K.T. Mathew, S. Periyanayagam* & *S. Sebastian 53774* (RHT); Dindigul Rock, 20 Dec. 1969, *K.M. Matthew 10626* (RHT); Kodaikanal, Law's Ghat Road, 04 Dec. 1987*, K.M. Matthew 51948* (RHT); Parappalae Dam, 12 Dec. 1989, *K.T. Mathew, S. Periyanayagam* & *S. Sebastian 53769* (RHT). Erode Dist.: Bhavanisagar, 03 Oct. 1987, *N. Venkatasubramanian 719* (FRC). Kancheepuram Dist.: Vedanthangal Bird Sanctuary, 25 Jan. 1976, *A.N. Henry 47025* (MH); Vandalur, *s.die*., *R. Ananthkrishnan 4953* (RHT). Kanyakumari Dist.: Nagercoil, Maruthwamala, 09 Aug. 2014, *Thoiba K. 138092*; *Ibid*., 09 Aug. 2014, *Thoiba K. 138093* (CALI); Nagercoil, Mambazhathuraiyar Reservoir, 29 Oct. 2015, *Thoiba K.* & *Mohammed Yoonus 146653*; *Ibid.*, Kanyakumari–Tirunelveli National Highway, 30 Oct. 2015, *Thoiba K.* & *Mohammed Yoonus 146669*; *Ibid.*, 30 Oct. 2015, *Thoiba K.* & *Mohammed Yoonus 146670* (CALI). Madurai Dist.: Ammayanayakanur, 01 Dec. 1898, *Bor N.L. 1982* (MH). Namakkal Dist.: Komarapalayam, 27 Dec. 2014, *Thoiba K.* & *K.M. Lemiya 144109* (CALI). Nilgiri Dist.: Anaikatty, 21 Aug. 1970, *G.V. Subba Rao 36150* (MH); Kallar, *s.die*., *Remya J. 72245* (TBGT). Pudukottai Dist.: Viralimalai, 11 Aug. 1984, *C. Arulappan 143* (MH). Theni District.: Gudalur, 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146624* (CALI); Periakulam, 22 Nov. 1985, *K.M. Matthew, A. Usha* & *N. Rajendren 43047* (RHT). Tiruchirappalli Dist.: Bharathidasan University, 01 Nov. 2014, *Thoiba K. 137541*; *Ibid.*, 01 Nov. 2014, *Thoiba K. 137542* (CALI); Pachamalais, 30 Dec. 1969, *K.M. Matthew 10840* (RHT). Thiruvannamalai Dist.: MG Nager Road, Ponganur, 18 Jan. 2016, *Thoiba K.* & *K.M. Lemiya 146689* (CALI); Hoganakkal–Dharmapuri National Highway, 18 Jan. 2016, *Thoiba K.* & *K.M. Lemiya 146691*; *Ibid.*, 18 Jan. 2016, *Thoiba K.* & *K.M. Lemiya 146692* (CALI); Thiruvallur Dist.: Sethukarai, 23 Dec. 1986, *V. Balasubramaniam 1150* (CAL). **Telangana,** Warangal Dist.: Subedari, 14 Sept. 1995, *R.K. Premnath 105235* (MH).

Notes:—According to Nicolson *et al*., (1988), Munro, 1862 united the taxonomic synonyms *Poa amabilis* L. and *P. tenella* L. (1753) published at the same time, for the

first time and choose *P. amabilis* L. as the correct name for the combined taxon. Therefore, *Eragrostis amabilis* (L.) Wight & Arn. is the correct name for this species.

1b. var. *insularis* (C.E. Hubb.) P. Umam. & P. Daniel, J. Econ. Taxon. Bot. 22: 216, f.2. 1998. *Eragrostis tenella* (L.) Roem. & Schult. var. *insularis* C.E. Hubb., Bull. Misc. Inform. Kew 1939: 654. 1939; Bor, Grass. Burma Ceylon India Pakistan 514. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1857. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 218. 1989; S. Moulik, Grass. Bam. India 2: 608. 1997; Veldkamp, Blumea 47: 166. 2002; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 136. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 545. 2012. **Type:—**Mauritius, cane fields near Moka, Apr. 1939, *Vaughan 1937* (Holotype: K, MH Photo!, Paratype: roadside near Quatre Bornes, *Vaughan A/70* K, Without precise locality, Dec. 1864, *M. Bouton G-33* K). **Figs. 37, 41**

Tufted annual to perennial, 20–70 cm high, roots fibrous. ***Culms*** 10–60 cm long, nodes glabrous. ***Leaf sheaths*** 5–20 cm long, more or less ribbed, margins villous hairy on one side or both glabrous. ***Leaf blades*** linear-lanceolate, 7–15 × 0.4–1.3 cm, rounded at base, apex acuminate to attenuate; surface sparsely tuberculate hairy adaxially and glabrous abaxially; margins serrulate; ***ligules*** membranous with fimbriate apex, cilia 0.1–0.2 mm long. ***Panicles*** 5–20 × 1–2 cm, ovate, contracted, greenish to purplish; peduncle 6–10 cm long, glabrous; primary pedicel 1–3 cm long, axil nodes glabrous; secondary pedicel 0.4–1 cm long, flat to triquetrous, more or less capillary, margins serrulate. ***Spikelets*** ovate to oblong, 1.8–3.6 × 0.8–2 mm, 6–9-flowered, florets getting reduced towards apex, green to purple, disarticulation of florets from above downwards. Glumes unequal, persistent or falling later. ***Lower glumes*** ovate-lanceolate, 0.5–1 × 0.4–0.5 mm, 1-nerved, 1-keeled, keels scaberulous at apex. ***Upper glumes*** lanceolate, 0.8–1.2 × 0.4–0.5 mm, 1-nerved, 1-keeled, keels serrulate towards apex. ***Lemmas*** ovate-lanceolate, 0.8–1.4 × 0.5–0.7 mm, 3-nerved, lateral nerves prominent as

Fig. 37. ***Eragrostis amabilis*** var. ***insularis*** (C.E. Hubb.) P. Umam. & P. Daniel: **A.** Habit; **B.** Enlarged portion of panicle; **C.** Ligule; **D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Stamens & Pistil; **K.** Pistil; **L.** Caryopsis.

long as middle nerve, deciduous, chartaceous, obtuse to emarginated at apex. ***Paleas*** Obovate to elliptic-oblanceolate, 0.8–1.2 × 0.4–0.6 mm, winged, deciduous or not, 2-nerved, keels ciliate; cilia 0.3 mm long, curved, acute-oblong at apex. ***Rachilla*** zigzag, 0.4–0.7 mm long, disarticulating from above downwards. ***Lodicules*** 2, 0.2–0.3 mm long, dentate. ***Stamens*** 3 or rarely 2; anthers 0.3–0.4 mm long, white. ***Ovary*** 0.2–0.3 mm long, globose; style *c.* 0.2 mm long, slender; stigma plumose, 0.3–0.4 mm long. ***Caryopses*** ovate to elliptic, 0.3–0.5 × *c.* 0.3 mm, light to deep brown.

Flowering & Fruiting:—Almost throughout the year

Habitat & Ecology:—It is common in sandy shores of the mainland coast and island, railway tracks, wastelands, bunds of cultivated fields. Usually occurs with *Aerva lanata* L. Juss., *Cyperus arenarius* Retz., *Eragrostis amabilis* var. *amabilis* (L.) Wight & Arn., *Spinifex littoreus* (Burm.f.) Merr. and *Vigna trilobata* (L.) Verdc.

Distribution:—India (Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu and West Bengal), Madagascar and Mascarenes and Sri Lanka.

Specimens examined:—India, **Gujarat,** Narmada Dist.: Karaya, Rajpipla, 03 Sept. 1967, *R.D. Pataskar s.n.* (BSI). **Kerala,** Alappuzha Dist.: Medical College Campus, 17 June 1980, *P.V. Sreekumar 67671* (MH); Pallana, 25 June 1980, *P.V. Sreekumar 67652* (MH); Champakkulam, 11 June 1980, *P.V. Sreekumar 67172* (MH); Pallathuruthy, 09 June 1980, *P.V. Sreekumar 67162* (MH); Thannermukkam, 18 June 1980, *P.V. Sreekumar 67611* (MH). Kasargod Dist.: Nileshwaram, 29 Jan. 1979, *V.J. Nair* & *R. Ansari 59985* (MH). Kollam Dist.: Thenmala, 08 July 1977, *M. Ramesh 9460* (CALI). Kottayam Dist.: Town, 24 June 1980, *P.V. Sreekumar 67715* (MH). Kozhikode Dist.: Kappad Beach, 30 Oct. 2014, *Thoiba K.* & *K.M. Lemiya 137540* (CALI); Beypore, 21 Oct. 1986, *T.G. Jaisonlal 4529* (CALI); **Maharashtra,** Chandrapur Dist.: Muhasli, 21. Oct. 1972, *B.M. Wadhwa 130252* (BSI); Dhonda, 25 Nov. 1952, *S.K. Jain 9598* (BSI). Pune Dist.: Khandala, Jumnapatti Water pipe, 20 Dec. 1958, *N.A. Irani NI 2731* (BLAT); Junnar, Ajnawale, Nov. 2005, *S.S.*

Rahangdale s.n. (AHMA); Yavat, Daund, 04 Sept. 2005, *Varsha Gaikwad s.n.* (AHMA); Vetal Hill, 08 Oct. 1987, *V.N. Jhoshi s.n.* (AHMA). Raigad Dist.: Karnala, 15 Nov. 1975, *V.D. Vartak 1087* (AHMA). Raigarh Dist.: Kanonya, Uran, 29 Oct. 1961, *P. Divakar PD 2864* (BLAT). Solapur Dist.: Great Indian Bustard Sanctuary, Wadala, 29 Sept. 2010, *J. Jayanthi* & *S.C. Yadav 198268* (BSI). Thane Dist.: Chiuchui, Dec. 1924, *E. Blatter s.n.* (BLAT). Washim Dist.: Adan River, Kharad, 16 Feb. 1977, *S. Karthikeyan 149066* (BSI). **Tamil Nadu,** Cuddalore Dist.: Chidambaram, Picchavaram, 08 October 1976, *K.M. Matthew 4361*; *Ibid.,* 09 Jan. 1978, *A. Mohan 11152* (RHT). Kanyakumari Dist.: Sunset Beach, 30 Oct. 2015, *Thoiba K.* & *Mohammed Yoonus. 146668* (CALI); *s.loc.*, 13 June 1977, *Majid 15575* (CALI). Madurai Dist.: Palani, 27 Nov. 1985, *K.M. Matthew* & *N. Rajendran 43263*; *Ibid.*, 19 Nov. 1986, *s.coll. 47593* (RHT).Nagapattinam Dist.: Kodiakkarai Beach, 13 Feb. 1985, *K.R. Sasidharan 10989* (FRC). Pudukottai Dist.: Narthamalai, 31 Mar. 1984, *K.M. Matthew 30040* (RHT). Theni Dist.: Uthamapalayam, Sothupparai, *s.die.*, *K.M. Matthew s.n.* (RHT). Thiruchirappalli Dist.: Pettavaithalai, 26 Sept. 1967, *K.M. Matthew 7891*(RHT); Srirangam, Oosipalam, 03 Dec. 1975, *K.M. Matthew 177* (RHT).

Notes:—This is a variety with long linear contracted panicle and erect branches and said to be a coastal species (Umamaheswari & Daniel, 1998; Veldkamp, 2002).

2. Eragrostis aspera (Jacq.) Nees, Fl. Afr. Austral. Ill.3: 408. 1841; Stapf in Hook.f., Fl. Brit. India 7: 104. 1896; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1825. 1934; Bor, Grass. Burma Ceylon India Pakistan 501. t.55 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1853. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; S. Moulik, Grass. Bam. India 2: 597. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1191. 1997; Veldkamp, Blumea 47: 166. 2002; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 136. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass.

Maharashtra 525. 2012. *Poa aspera* Jacq. Hort. Bot. Vindob. 3: 32. t. 56. 1776. **Holotype:—***Herb. Jacquin* (Ac. No. W0000344, image!). **Figs. 38–41**

Poa paniculata Roxb., *Fl. Ind.* 1: 341. 1820. *Eragrostis paniculata* (Roxb.) Steud., Syn. Pl. Glum. 1: 266. 1854. Type:—India (Not seen).

E. laxiflora Schrad., *nom. nud*. Linnaea 12: 451. 1838. Type:—South Africa, *Drége 4285* (Holotype: LE!).

Tufted annuals or perennials, 30–90 cm high, more or less ribbed, greenish, branched from base; nodes brownish. ***Culms*** 20–65 cm long, nodes glabrous. ***Leaf sheaths*** 5–10 cm long, glabrous to sparsely long ciliate along margins and apex, bearded at mouth. ***Leaf blades*** linear-lanceolate, 17–39 × 0.4–0.8 cm, base minutely cordate, mid rib prominent, scabrid, margins serrulate, apex attenuate; surface glabrous and coriaceous adaxially and glabrous abaxially; margins entire and eglandular; ***ligules*** minutely membranous, 4–7 mm long hairs on back and apex. ***Panicles*** thyrsiform, ovate, open, effuse-lax, leaden green or black, 25–65 × 10–35 cm long, branches alternate, base of primary pedicels long pilose or floccose, greenish, branchlets capillary, mature spikelets at apex and younger ones at the base; Peduncle 6–14 cm long, glabrous, enclosed by leaf sheath. Primary pedicel 1.4–4.5 cm, capillary, base glandular and ciliate, scabrid, serrulate, greenish; secondary pedicel longer than primary pedicel, 1–5 cm long, scabridulose. ***Spikelets*** pedicelled, oblong, 2.5–7 × 0.8–1.3 mm, acute, greenish, 6–12-flowered; disarticulation of florets from above downwards. Glumes almost persistent, unequal. ***Lower glumes*** ovate-lanceolate, 0.8–1.2 × 0.4–0.5 mm, 1-nerved, 1-keeled, keels scabrid, acute, mucronulate, margins serrulate apex. ***Upper glumes*** ovate-lanceolate, 1–1.5 × 0.4–0.5 mm, 1-nerved, 1-keeled, bifid, mucronulate, chartaceous, hyaline to greenish ith purple tinge at apex. ***Lemmas*** oblong, 1.3–1.6 × 0.5–1 mm, 3-nerved, lateral nerves prominent, deciduous, chartaceous, scabrid on midrib apex, infolded near base, greenish to purplish. ***Paleas*** obovate-oblanceolate, 1–1.3 × 0.4–0.6 mm, winged, caducous, 2-nerved, keeled, keels scabrid, truncate at base, tip aristulate,

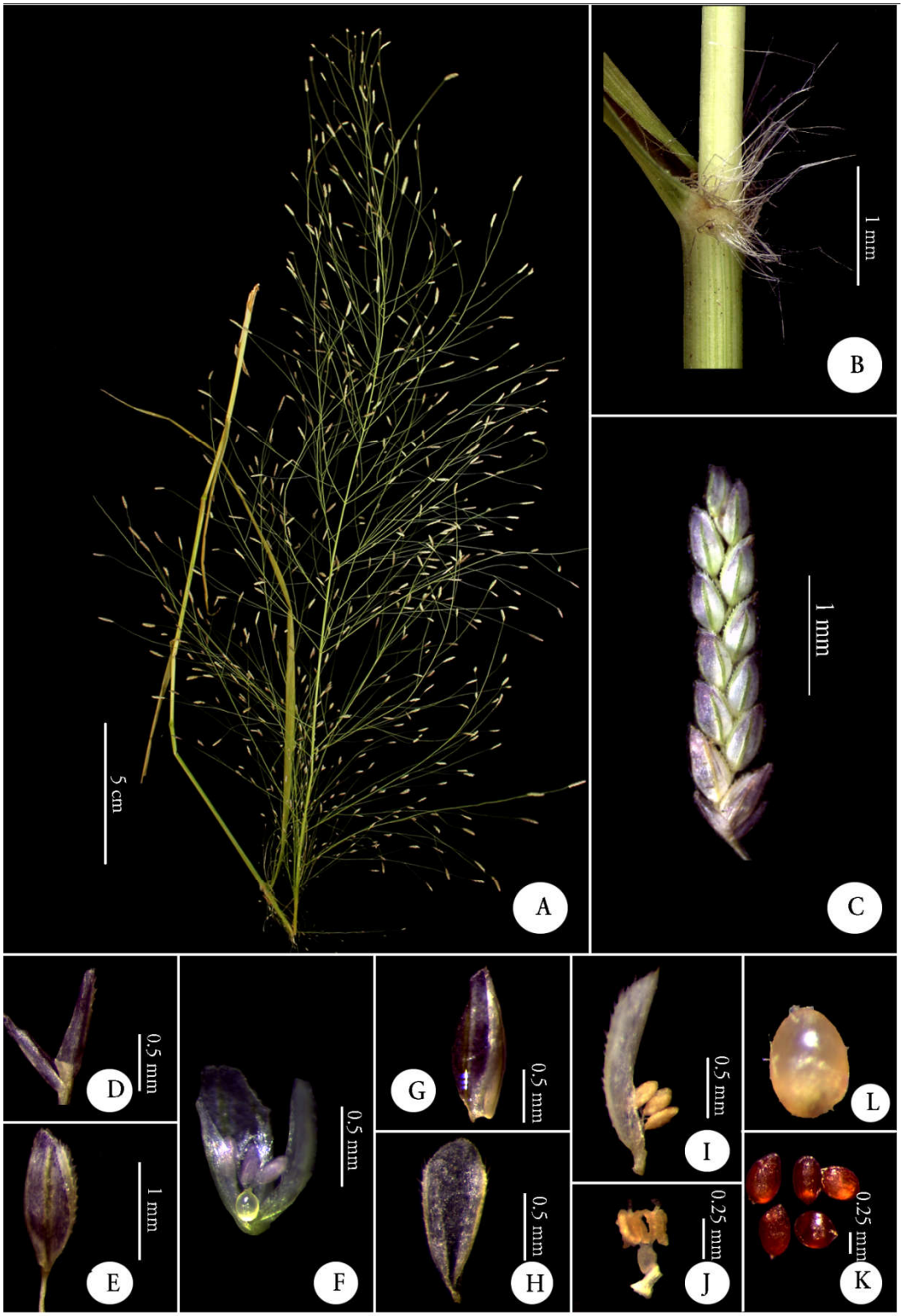


Fig. 38. ***Eragrostis aspera*** (Jacq.) Nees: **A.** Habit; **B.** Ligule; **C.** Spikelet; **D.** Glumes; **E.** & **F.** Floret; **G.** Lemma; **H.** Palea; **I.** Palea with flower; **J.** Lodicules, stamens & pistil; **K.** & **L.** Caryopsis.

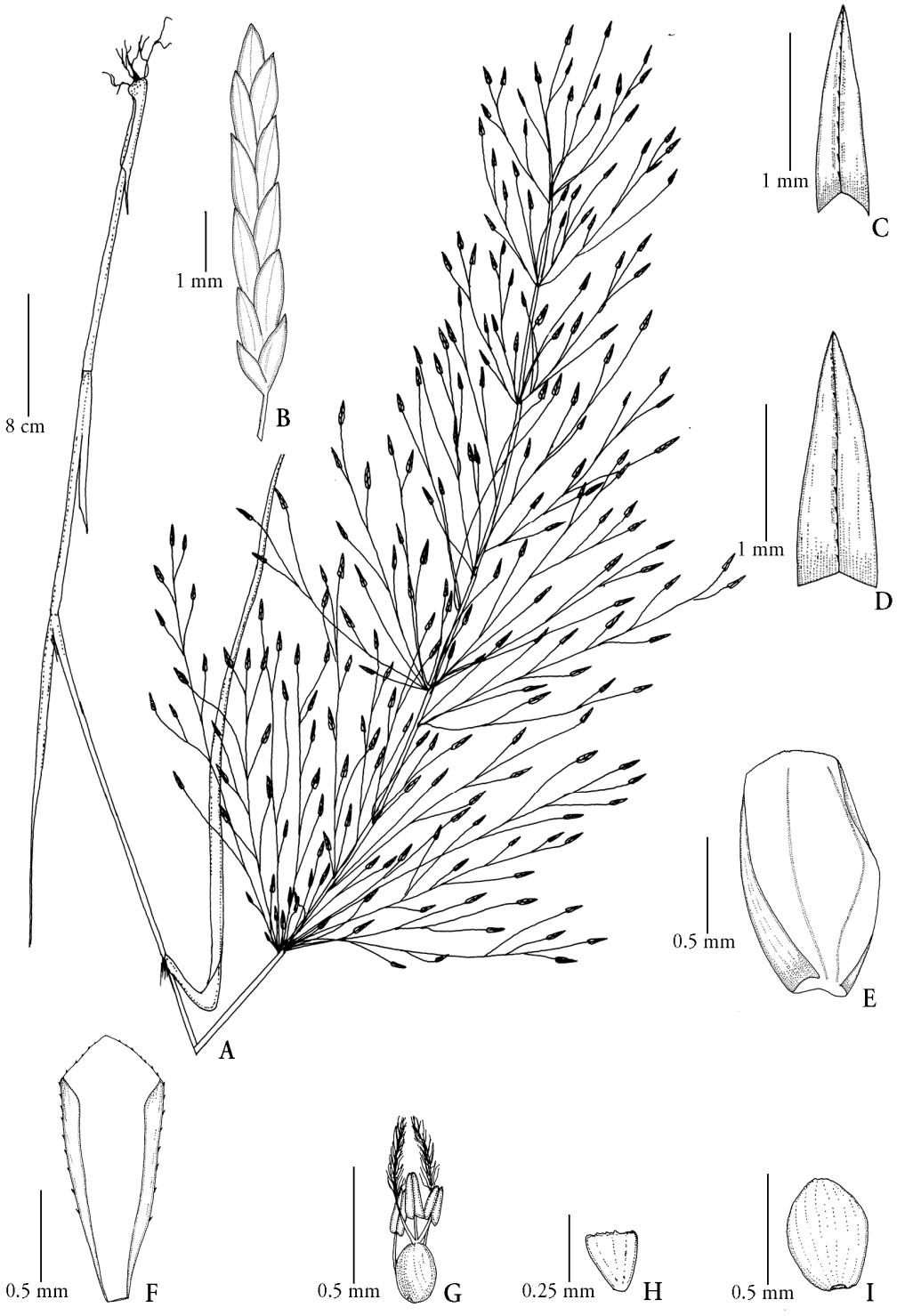


Fig. 39. ***Eragrostis aspera*** (Jacq.) Nees: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamens & pistil; **H.** Lodicule; **I.** Caryopsis.

acute-oblong and at apex. ***Rachilla*** zigzag, 0.5–0.8 mm, not persistent. ***Lodicules*** 2, obovate, 0.2–0.3 mm, dentate. ***Stamens*** 3; anthers *c.* 0.3 mm long, greenish to yellowish purple; filaments *c.* 0.4 mm, hyaline. ***Ovary*** ovate-elliptic, c. 0.2 × 0.1 mm, globose; style 0.4 mm long, hyaline, delicate; stigma plumose, 0.2–0.3 mm long. ***Caryopses*** ovate-subglobose, 0.4–0.5 × 0.2, deep brwon.

Flowering & Fruiting:—November–February

Habitat & Ecology:—It is common in road sides and hill slopes in high altitudes above 700 m. Major associated plants are *Aerva lanata* (L.) Juss., *E. amabilis* var. *amabilis* (L.) Wight & Arn., *Tripogon bromoides* Roth ex Roem. & Schult., *Themeda triandra* Forssk., and *Vigna trilobata* (L.) Verdc.

Distribution:—Africa and Mascarenes Islands. In Peninsular India, it was reported from Andhra Pradesh, Goa, Karnataka, Maharashtra, Orissa and Tamil Nadu.

Specimens examined:—India, **Andhra Pradesh,** Kurnool Dist.: Anugondapalam, 01 Nov. 1982, *N. Yesoda 1046* (MH). **Karnataka,** Chamarajanagara Dist.: Madeswaramalai, 10 Feb. 1930, *V. Narayanaswamy 19767* (MH). **Karnataka,** Belgaum Dist.: Gokak-Belgaum Road, 02 Dec. 1961, *M.Y. Ansari 78755* (BSI). Bellary Dist.: Kudatini, 17 Nov. 1979, *B.R. Ramaesh* & *S.R. Ramaesh 10513* (CAL); along a stream near Kudligi, 11 Jan. 1980, *B.R. Ramaesh* & *S.B. Manohar 10744* (JCB). Raichur Dist.: Lingasugur, Humnabad Road, 13 Nov. 1975, *N.P.*

Fig. 40. Holotype of *Eragrostis aspera* (Jacq.) Nees [*Herb. Jacquin* (W0000344)] © The Board Trustees of the Natural History Museum Vienna, Austria.

Singh 14167 (BSI). *s.loc.*, Nov. 1910, *R.K. Bhide s.n.* (BSI). **Maharashtra,** Satara Dist.: Pusegaon, 30 Sept. 1992, *C.B. Salunkhe 8270* (SUK). *s.loc.*, Oct. 1912, *s.coll. s.n.* (BLAT). **Tamil Nadu,** Coimbatore Dist.: Velliangiri Hills, 13 Jan. 2016, *A.K. Pradeep* & *Thoiba K. 146715*; *Ibid.*, 13 Jan. 2016, *A.K. Pradeep* & *Thoiba K. 146717* (CALI); *s.loc.*, 25 Feb. 1963, *C.P. Sreemahavan CP 5466* (MH); Manguli, 16 Dec. 1970, *M.V.V. Viswanadhan MVV850* (MH); Thekkumalai, 19 Nov. 1956, *K.M. Sebastine 1386*; *Ibid.*, 06 Dec. 1956, *K.M. Sebastine 1638* (MH). *s.loc.*, 17 Dec. 1900, *C.A. Barber 2566* (MH); Dinhalli, 13 Nov. 1906, *Fischer s.n.* (FRC). Cuddalore Dist.: *s.loc.*, 06 Feb. 1983, *K. Ramamurthy 77344* (CAL).

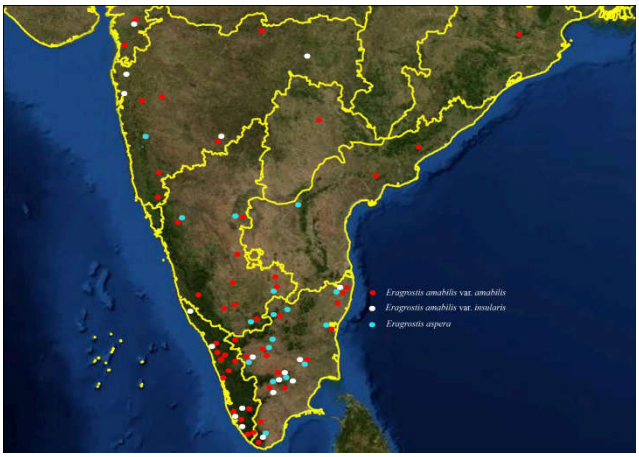


Fig. 41. Distribution of *Eragrostis amabilis* (L.) Wight & Arn. (●), *E. amabilis* var. *insularis* (C.E. Hubb.) P. Umam. & P. Daniel (○) and *E. aspera* (Jacq.) Nees (●)

Dharmapuri Dist.: Harur, Chitteri hills, 13 Jan. 1979, *N. Venugopal 20918* (RHT). Dindigul Dist.: Sirumalai Hills, 26 Feb. 1978, *M. Chandrabose 54300* (MH); Sirumalais, 26 May 1958, *J. Pallithanam 3480*; *Ibid.*, 26 May 1958, *J. Pallithanam 4361*, *J. Pallithanam 5681*(RHT); Anna, Kodaikanal, Tandigudi Ghat Road, 02 Jan. 1986, *K.M. Matthew 43751*(RHT); Law's Ghat Road, 04 Dec. 1987, *K.M. Matthew 51939* (RHT); Thalayar Banks, *K.M. Matthew 51995* (RHT). Erode Dist.: Kodumudi Estate, Thirukurungudi, 26 Nov. 1969, *B.V. Shetty 322916* (MH). Krishnagiri Dist.: *s.loc.*, 23 Dec. 1916, *s.coll. 13873a*; *Ibid.*, 23 Dec. 1916, *s.coll. 13873b* (MH). Madurai Dist.: *s.loc.*, 29 Mar. 1898, *Bor N.L. 1981* (MH); Periakulam, Kumbakkarai, 15 Dec. 1989, *S. Perianayagam 53949* (RHT); Way to Sirumalai, 26 Feb. 1978, *M. Chandrabose 54300* (CAL). Nilgiri Dist.: Munnar, 06 Nov. 1900, *C.A. Barber 2662* (MH). Salem Dist.: Yercaud, Guntur, Nov. 1976, *D.I. Arockiasamy 5094*

(RHT); Attur, Periakalrayans, Sengattupputtur, 08 Dec. 1976, *K.M. Matthew* & *D.I. Arockiasamy 5202* (RHT); Chinnakalrayans, Thumbal Extension R.F., 09 Jan. 1978, *V. Alphonse amalraj 11011* (RHT). Thiruchirappalli Dist.: Thuraiyur, Pacchaimalai, 02 Jan. 1976, *K.M. Matthew* & *C. Rajamani 627* (RHT). Tirunelveli Dist.: Anakaraimalai, 15 Jan. 1930, *T.R. Naganathan 19480* (MH); Kodamudy Estate, Thirukkurangudi, 26 Nov. 1969, B.V. Shetty 32916 (CAL). Villupuram Dist.: Gomukhi-Vellimalai Ghat, 06 Feb. 1983*, K. Ramamurthy 77344* (MH); Kallakurichi, Kalrayans, Pudur Village, 31 Jan. 1980, *K.M. Matthew 26228* (RHT); K.G. Jaghir, Serappattu, 17 Mar. 1984, *K.M. Matthew* & *S.J. Britto 29793* (RHT).

Notes:—*E. aspera* is easily distinguished from other taxa by thyrisiform panicles with numerous capillary branches bearing long pedicelled spikelets.

3. Eragrostis atrovirens (Desf.) Trin *ex* Steud., Nom. Bot. ed. 2(1): 562. 1840; Bor, Grass. Burma Ceylon India Pakistan 5.3. 1960; K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1854. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 377. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 203. 1994; S. Moulik, Grass. Bam. India 2: 597. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1192. 1997; Lazarides, Aust. Syst. Bot. 10: 97. 1997; Veldkamp, Blumea 47: 167. 2002; P.M. Peterson & I.S. Vega, Ann. Missouri Bot. Gard. 94: 758. 2007; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 137. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 525. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 112. 2013. *Poa atrovirens* Desf., Fl. Atlant. 1: 73. t. 14. 1798. *Eragrostis atroviridis* Maire, Bull. Soc. Hist. Nat. Afr. Nord. 28: 385. 1937. **Type:—**Algeria, Barberia, La Calle, *Desfontaines 160* (Holotype: FI012554, image!, Picture K. *p.p.* 6828 image!, Isotypes: BAA, BRI, P). **Figs. 42, 43, 52**

Eragrostis luzoniensis Steud., Syn. Pl. Glumac. 1: 266. 1854. Type:—Philippines, Luzon, *H.Cuming 1416* (Holotype: P, Isotypes: BM, E, K, L).

Tufted perennials, 40–120 cm high, roots fibrous. ***Culms*** 10–30 cm long, nodes glabrous, internodes 3–18 cm long. ***Leaf sheaths*** 5–15 cm long, enrolled to the culm, slightly keeled. ***Leaf blades*** linear-lanceolate, 10–35 × 0.5–2 cm, base shallowly cordate, apex acute-acuminate; surfaces glabrous; margins entire and eglandular; ***ligules*** membranous, a ciliate rim, cilia 1–6 mm long. ***Panicles***, effuse-lax, 10–40 × 3–10 cm, branches alternate. Peduncle 6–26 cm long, glabrous, eglandular. Primary pedicel 0.5–5cm long, glabrous, secondary pedicel 0.5–2 cm long. ***Spikelet*** ovate-lanceolate, 4–6 × 0.75–0.2 mm, 5–40-flowered, leaden grey, disarticulation of florets from below upwards. Glumes deciduous, almost equal. ***Lower glumes*** lanceolate, 1.3–1.8 × 0.8–1.2 mm, 1-nerved, 1-keeled. ***Upper glumes*** lanceolate, 1.5–2.2 × 0.75–1.2 mm, 1-nerved, 1-keeled. ***Lemmas*** ovate-lanceolate, 1.5–3 × 0.5–2 mm, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex sharply acute, leaden grey in colour. ***Paleas*** elliptic-lanceolate, 2–3 × 0.8–1.8 mm, winged, deciduous or not, 2-nerved, keels scabrid, acute-oblong at apex. ***Rachilla*** persistent, zigzag, *c.* 1 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 3; anthers 0.5–1 mm long, purple. ***Ovary*** 0.2–0.4 mm long, globose; style c. 0.5 mm long, slender; stigma plumose, 0.5–1.5 mm long. ***Caryopses*** ellipsoid to oblong, 0.5–0.8 × 0.3–0.5 or 0.6–0.9 mm, deep brown.

Flowering & Fruiting:—July–February

Habitat & Ecology:—It grows in hard, stony soil, clay, along path, fields, railways, waste places, roads, beaches, ditches, banks of rivers and streams in hilly areas. Major associations are *Chrysopogon aciculatus* (Retz.) Trin., *Eragrostis gangetica* (Roxb.) Steud.*, E. nutans* (Retz.) Nees *ex* Steud., *E. unioloides* (Retz.) Nees *ex* Steud. and *Rotala malampuzhensis* R.V. Nair *ex* C.D.K. Cook.

Distribution:—Native in northern America and Asia; introduced in U.S.A., mexico, central America, Caribbean, Bolivia, chile, argentina, peru and Venezuela (Nicora, 1998; Peterson & Boechat, 2001). In India, it is distributed in all states.

Fig. 42. ***Eragrostis atrovirens*** (Desf.) Trin ex Steud.: **A.** Panicle; **B.** Ligule; **C. & D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Lemma; **H.** Palea; **I.** Palea with flower; **J.** Lodicules, stamens & pistil; **K.** Caryopsis.

Specimens examined:—India, **Andhra Pradesh,** Anantapur Dist.: Reddypalle Farm, 15 Aug. 1981*, N. Yesoda 281* (MH); Chittoor Dist.: Horolykonda, 05 May 1918, *s. coll., 15476* (MH); Seethalam River Bed, 25 Sept. 1974, *M. Chandrabose 45101* (MH). Cuddaph Dist.: Balapalle, 19 July 1962, *J.L. Ellis 14271*(MH); Puttangi, 28 Nov. 1917, *s. coll. 15375* (MH). Kurnool Dist.: Diguvametta, 07 Aug. 1972, *J.L. Ellis 42180* (MH); Gundlakamma, Nallamala Hills, 01 Apr. 1965, *J.L. Ellis* 23838 (MH); *s.loc.*, 21 Oct. 1964, *J.L. Ellis 22130* (MH). Visakahapatanam Dist.: Matryagundam, 03 June 1968, *G.V. Subba Rao 30067* (MH); Anantagiri, 18 Oct. 1964, *G.V. Subba Rao 21759* (MH); *s.loc.*, 12 May 1964, *G.V. Subba Rao 19505* (MH); Araku Valley, 10 May 1956, *S.K. Wagh 2455* (BLAT). **Goa,** South Goa Dist.: Qulerm, 16 Oct. 1996, *s.coll. 220* (Goa University Herbarium); Cuncolim, 23 August 1998, *M.K. Janarthanam, Vaishali C. Joshi* & *S. Rajkumar 1619* (Goa University Herbarium). **Karnataka,** Bidar Dist.: Humnabad-Gulberga Road, 11 Aug. 1976, *N.P. Singh 142859* (BSI). Chamarajanagar Dist.: Himavad Gopalaswamy Hills, 30 Sept. 2015, *Thoiba K. 144170* (CALI). Chitradurga Dist.: Jogimath S.F., 10 Jan. 1976, *N.P. Singh 142259* (BSI). Dekshina Kannada Dist.: Kadaba, 17 Nov. 2013, *Thoiba K. 138003* (CALI); HBSS Kadaba, 20 Dec. 2014, *Thoiba K. 144126* (CALI). Dharmasthala, Nethravathi River Basin, 26 Dec. 2013, *Thoiba K. 138036* (CALI); Chikmagalur Dist.: Kudremukh National Park, Lakya Dam, 14 Sept. 2014, *Thoiba K. 137508* (CALI); Baba Budan Hills, 13 Sept. 2014, *Thoiba K. 137511*(CALI). Hassan Dist.: Sakalaeshpur, 13 Sept. 2014, *Thoiba K. 137528* (CALI); Belur, 13 Sept. 2014, *Thoiba K. 137532* (CALI); Arsikere, 29 Sept. 2015, *Thoiba K. 144186* (CALI); *s. loc.*, 29 Sept. 2015, *Thoiba K. 146604* (CALI); Nagapuri, 16 July 1969, *C.J. Saldanha 14142* (JCB). Kodagu Dist.: Pusphagiri Hills, 24 Nov. 2014, *Thoiba K. 137550* (CALI). Mysore Dist.: Hardoor River Sangam, 10 Oct. 1961, *Dr. A.S. Rao 75051* (BSI). Raichur Dist.: Sindhanur, Siruguppa Road, 18 Aug. 1976, *N.P. Singh 143064* (BSI). Shimoga Dist.: Sagar, Honnemaradu, 08 Sept. 2015, *Thoiba K. 144149* (CALI); Asarmuke, Sambankattae, 09 Sept. 2015, *Thoiba K. 144160* (CALI); Talaguppa

Railway Station, 09 Sept. 2015, *Thoiba K. 144162* (CALI). **Kerala,** Alappuzha Dist.: Kayamkulam, Thamarakulam, Chethiyara, 30 Jan. 2014, *Thoiba K. 138066* (CALI); Muhamma, *s.die*, *Sunil C.N. 2400* (CALI); Kalavoor, *s.die, Sunil C.N. 1416* (CALI); R. Block, 24 June 1980, *P.V. Sreekumar 6745* (MH);

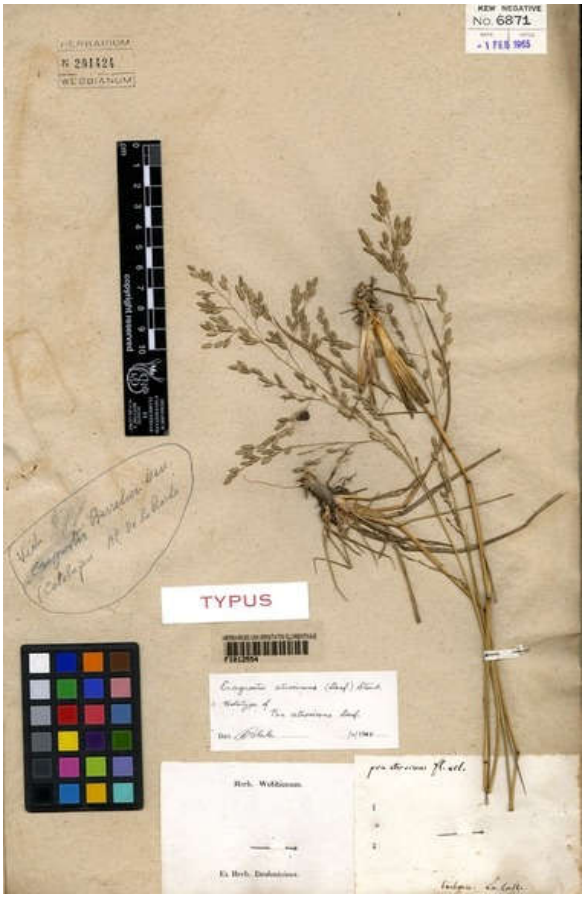


Fig. 43. Holotype of *Eragrostis atrovirens* (Desf.) Trin *ex* Steud. [*Desfontaines 160* (FI012554)] © The Board Trustees of the Museo di Storia Naturale dell'Università, Firenze, Italy.

Thrikunnapuzha, 13 Mar. 1980, *P.V. Sreekumar 66739* (MH); Nedumudy, 08 June 1980, *P.V. Sreekumar 67157* (MH). Idukki Dist.: Munnar, Mattupetty, 15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137567*; *Ibid.*, 15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137575* (CALI); Devikulam, 16 Dec. 2014, *Thoiba K. 137582*; *Ibid.,* 16 Dec. 2014, *Thoiba K.137586* (CALI); Munnar, Eravikulam National Park, 19 June 2015, *Thoiba K.* & *V. Drisya 144130* (CALI); Periyar Tiger Reserve, 04 Mar. 1961, *A.N. Henry 1189* (BLAT); Thannikkudy, 25 Mar. 1994, *Jomy Augustine 14155* (CALI); Mattupetty, 12 Apr. 1987, *s.coll. 12235* (CALI); *Ibid.*, 12 Apr. 1981, *K.P. Saira 11637* (CALI); Anamudi, 12 June 1997, *S.D. Biju 36737* (TBGT). Kannur Dist.: Madayippara, Oorathumpara, Irikkur, 28 Nov. 2013, *Thoiba K.* & *C. Pramod 138050* (CALI); Kanayi Kanam, 26 July 2014, *Thoiba K. 144120* (CALI). Kottayam Dist.: *s.loc.*, 13 June 1963, *K.M. Sebastine 16441* (CAL). Kozhikode Dist.: Kakkayam, 19 Sept. 2013, *Thoiba K. 134438*; *Ibid.*, 19 Sept. 2013, *Thoiba K.134443*; *Ibid.*, 21 Aug. 2013, *Thoiba K.* &

A.K. Pradeep 138095 (CALI). Malappuram Dist.: Calicut University Botanical Garden, 08 Feb. 2013, *Thoiba K. 134412* (CALI); Calicut University Campus, 14 Nov. 1983, *s.coll.*, *s.n.* (DEV); Calicut University Campus, 12 Oct. 1986, *T.G. Jaisonlal 4380*; *Ibid.*, 02 Feb. 2001, *Jayasree, S. 74351* (CALI); Kooriyad, 07 Feb. 2013, *Thoiba K. 134416* (CALI). Palakkad Dist.: Nelliyampathy, Seetharkundu, 17 Sept. 2013, *Thoiba K. 134440* (CALI); Kunthipuzha River Basin, Mannarkkad, 06 Nov. 2013, *Thoiba K. 134487* (CALI); Silent Valley, Sispara, 25 Mar. 1982, *Prasannakumar SV 10321*(CALI); Parathode, 19 June 2008, *Remya J.* & *Prasanna 63138* (TBGT). Thiruvananthapuram Dist.: Agasthyamala, Pongalapara, 15 May 1988, *N. Mohanan 9835*; *Ibid.,* 14 Mar. 1988, *N. Mohanan 9750* (CALI); Athirumala, 04 February 1988, *N. Mohanan 8922* (CALI); Kottur Forest Division, 04 May 1979, *P. Farooqui* & *V.K. Nallaswamy 24* (FRC). Thrissur Dist.: Parambikulam Tiger Reseve, Vengoli Hills, 25 Sept. 2013, *Thoiba K. 134459* (CALI). Wayanad Dist.: Tirunelli, 10 Jan. 2013, *C. Pramod* & *Thoiba K. 134404* (CALI); Soochipara, 23 Aug. 2013, *Thoiba K. 134432* (CALI); Nadavayal, 22 Aug. 2015, *Thoiba K.* & *A.K. Pradeep 144141* (CALI); Tholpetty, 08 Feb. 1978, *V.S. Ramachandran 52393a*; *Ibid.*, 08 Feb. 1978, *V.S. Ramachandran 52393b* (CAL); Chembra, 12 Oct. 2012, *Remya J.* & *Prasanna 74527* (TBGT). **Maharashtra,** Ahmednagar Dist.: Khandgaon, Oct. 1986, *R. Shinde 733* (BLAT); Chandrapur Dist.: Jari, 05. Mar. 1971, *B.M. Wadhwa 133722* (BSI); Kateghari Plot 116, 27 Feb. 1971, *B.M. Wadhwa 133541* (BSI). Kolhapur Dist.: Pachgaon, Parvati, 25 Jan. 1981, *K. Kulkerni 313* (AHMA). Nagpur Dist.: Ratangarh-Ratanwadi River bed, 01 Oct. 1970, *B.W. Wadhwa 127933* (BSI). Pune Dist.: Bhor, 20 Dec. 1958, *V.D. Vartak 13706* (AHMA); Lonavala, 25 Apr. 1964, *B. Venkata Reddi 97758* (BSI). Raigad Dist.: Karjat, Mar. 1917, *Blatter* & *Hallberg A3* (BLAT); Mangaon, 20 Oct. 1991, *C.B. Salunkhe 8123* (SUK). **Tamil Nadu,** Coimbatore Dist.: Valparai, Shivamalai, 13 Dec. 2013, *Thoiba K. CU 138012*; *Ibid.*, 13 Dec. 2013, *Thoiba K. 1380013* (CALI); Malakkapara, Myladum Para-NC, 13 Dec. 2013, *Thoiba K. 138020* (CALI). Dharmapuri Dist.: Harur, Chitteri hills, Alavar, 12 Aug. 1978,

K.M. Matthew 16338 (RHT). Dindigul Dist.: Kodaikanal, 24 Feb. 2014, *Thoiba K.* & *K.M. Lemiya 138075* (CALI); Kodaikanal, Palni Hills,19 May 1984, *K.M. Matthew 18191*; *Ibid.,* 09 Aug. 1984*, K.M. Matthew 40773*; *Ibid.,07* Feb. 1985, *K.M. Matthew 40926*; *Ibid.,*21 Mar. 1985, *K.M. Matthew 41155*; *Ibid.,*05 Aug. 1985, *K.M. Matthew 41699*; *Ibid.,*09 May 1986, *K.M. Matthew* & *N. Rajendran 44854*; *Ibid.,*20 May 1986, *K.M. Matthew 45295*; *Ibid.,* 29 July 1986*, K.M. Matthew 46034*; *Ibid.,*16 Aug. 1986, *K.M. Matthew* & *M. Charles 46280*; *Ibid.,* 12 Jan. 1987, *K.M. Matthew 48292*; *Ibid.,*14 Jnu. 1987, *K.M. Matthew 48397,* 09 Mar. 1987, *K.M. Matthew* & *N. Rajendren 48592*; *Ibid.,* 17 May 1987, *K.M. Matthew* & *N. Rajendren 49520*; *Ibid.,* 05 July 1987, *K.M. Matthew 49875*; *Ibid.*, 11 Aug. 1987, *K.M. Matthew 50055*; *Ibid., K.M. Matthew 50061*; *Ibid.,* 28 Aug. 1987*, K.M. Matthew 50456*; *Ibid.,* 30 Aug. 1987*, K.M. Matthew* & *K.T. Mathew 50595*; *Ibid.,* 04 Nov. 1987, *K.M. Matthew* & *K.T. Mathew 51088* (RHT). Erode Dist.: Dhimbam to Bannari, Hairpin bend 27, 26, 04 Oct. 1987, *N. Venkatasubramanian N.V. 869* (FRC). Kanyakumari Dist.: Nagercoil, Mambazhathuraiyar Reservoir, 02 Oct.2015, *Thoiba K.* & *Mohammed Yoonus 146656* (CALI). Madurai Dist.: Uthamapalayam, 17 Nov. 1987, *K.M. Matthew* & *M. Charles 51336* (RHT); Palamalai, 03 Dec. 1987, *K.M. Matthew 51900* (RHT). Nilgiri Dist.: Naduvattom, 25 July 2012, *Remya J.* & *Prasanna 73759* (TBGT); Coonor, *s.die.*, *Remya J. 72233* (TBGT); Coonor, May 1920, *C. Meccan s. n.* (BLAT); Udagamandalam, 01 Sept. 2014, *Thoiba K.* & *Santhosh Kumar 138100* (CALI). Tirunelveli Dist.: Courtallam, Therkkumalai, 10 Apr. 1974, *K.K.N. Nair 1094* (CALI). **Telangana,** Warangal Dist.: Pakhal Lake, 06 Apr. 1988, *Rama Rao* & *Ravi Shanker 86105* (MH).

Notes:—This species can be easily recognized by its blue-green and glaucous appearance. Distinguishing characters include persistent and stout rachilla with winged, ribbed internodes; florets falling entire upwards; paleas with relatively short entirely scaberulous keels; a turgid, or almost so, caryopses free pericarp on moistening.

4. Eragrostis brownii (Kunth) Nees, Cat. Indian Pl.:105. 1834; Lazarides, Aust. Syst. Bot. 10: 101. 1997; Veldkamp, Blumea 47: 169. 2002; Chaison., Chantar. & Hodk., ScienceAsia 39: 112. 2013; Thoiba & Pradeep, Taiwania 63(1): 84. 2018. *Poa brownii* Kunth, Revis. Gramin. 1: 112. 1829; *nom. nov.* for *Poa polymorpha* R.Br. Prodr. 180. 1810, non Wibel 1799. **Lectotype** (designated by Lazarides, 1997)**:**—Australia, Queensland, Port Curtis District, *R. Brown 6284* (Lectotype: BM, Isolectotype: K000643446, image !). **Figs. 44–46, 52**

Uniola spicata Llanos Fragm. Pl. Filip.: 33. 1851. Non L. Sp. Pl.: 71. 1753. Type:—Philippines, Luzon, *E.D. Merrill Sp. Blancoan 170* (Neotype: US image!, Isoneotypes: BM, K, L, P!).

Eragrostis spartinoides Steud., Syn. Pl. Glumac. 1: 265. 1854. Type:—Philippines, Luzon, Laguna, *Cuming 668* (Holotype: P image!, Isotypes: BM, E, G, K, L!).

Eragrostis santapaui K.G. Bhat & C.R. Nagendran **syn. nov.**, Reinwardtia 10: 127. 1985. Type:—India, Karnataka, Coorg District, Mercara, 18 Dec. 1980, *K.G. Bhat 794A* (Holotype: CAL!, Isotype: K!).

Perennial, 10–75 cm high, roots fibrous. ***Culms*** 10–32 cm long, errect. ***Leaf sheaths*** 3–5 cm long, keeled or involute to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 10–20 × 0.1–0.4 cm, base slightly cordate, apex acute-acuminate; surfaces villous adaxially and glabrous abaxially; margins scabridulose; ***ligules*** a fringe of hairs, hairs 2–3 mm long. ***Panicles*** ovate, open, effuse or interrupted, 10–28 × 5–11 cm long, branches alternate. Peduncles 5–16 cm long, glabrous; rachis 0.5–6 cm long, glabrous. Primary pedicel 0.5–2 mm long, axis pilose; secondary pedicel 1.5–3 cm long, flat or quadrangular, glabrous. ***Spikelets*** ovate-lanceolate, 5–10 × 1.5–2.8 mm, pale green to purple, 05–25-florets, arranged alternately, disarticulate from below upwards, margins serate. Glumes deciduous, unequal, purple tinged. ***Lower glumes*** ovate-lanceolate, 0.8–1.5 × 0.5–0.7 mm, 1-nerved, 1-keeled, keels scabrid, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 1–1.8 × 0.5–0.8 mm, 1-nerved; 1-keeled; keels scabrid, purple

tinged, acute at apex. ***Lemmas*** oblong-lanceolate, 1.4–2.8 × 1–1.5 mm, keeled, keels scabrid, 3-nerved, lateral nerves prominent, deciduous, chartaceous, acute at apex. ***Paleas*** elliptic-oblong, 1.2–1.8 × 0.6–0.9 mm, persistant, winged, 2-nerved, keeled; keels ciliate, obtuse at apex. ***Rachilla*** minutely zigzag, 0.3–0.75 mm long. ***Lodicules*** 2, 0.25–0.5 mm long, 2 or 3 toothed, cuneate. ***Stamens*** 3; anthers 0.4–0.6 mm long, purple. Ovary 0.2–0.5 mm long, globose; style 0.2–0.5 mm long, slender; stigma plumose, 0.3–0.8 mm long. ***Caryopses*** ellipsoid, 0.4–0.75 × 0.3–0.5 mm long, slightly flattened, pericarp finely striate, dark brown.

Flowering and Fruiting:—August–December.

Habitat & Ecology:—Due to its notorious diversity no threat factor was observed against the habitat of the species. The populations are represented by many healthy individuals. It grows on open ground, road sides and also along forest margins in association with *Anisomeles malabarica* (L.) R.Br. *ex* Sims., *Aristida adscensionis* L., *Calotropis gigantea* (L.) Dryand., *Croton bonplandianus* Baill. *Eragrostis atrovirens* (Desf.) Trin. *ex* Steud., *Eragrostis cilianensis* (All.) Vignolo *ex* Janch., *Eragrostis nutans* (Retz.) Nees *ex* Steud., *Eragrostis unioloides* (Retz.) Nees *ex* Steud., *Lantana camera* L., *Leucas aspera* (Willd.) Link, *Parthenium hysterophorus* L., *Mimosa pudica* L., *Themeda tremula* (Nees *ex* Steud.) Hack., *Ischaemum* sp. and *Pteridium aquilinum* (L.) Kuhn.

Distribution:—*Eragrostis brownii* is widely distributed in tropical to temperate regions of the world. Occasionally, the genus is found in open habitats and sometimes in forests from sea level to high altitudes. The present collections are from south-west Karnatak

Specimens examined:—India, **Karnataka,** Kodagu Dist.: Somvarpet, Mallalli Falls, 24 Nov. 2014, *Thoiba K. 137556* (CALI). Chikmagalur Dist.: Kudremukh, Kudremukh National Park, 14 Sep. 2014, *Thoiba K. 137506* (CALI). Dekshina Kannada Dist.:

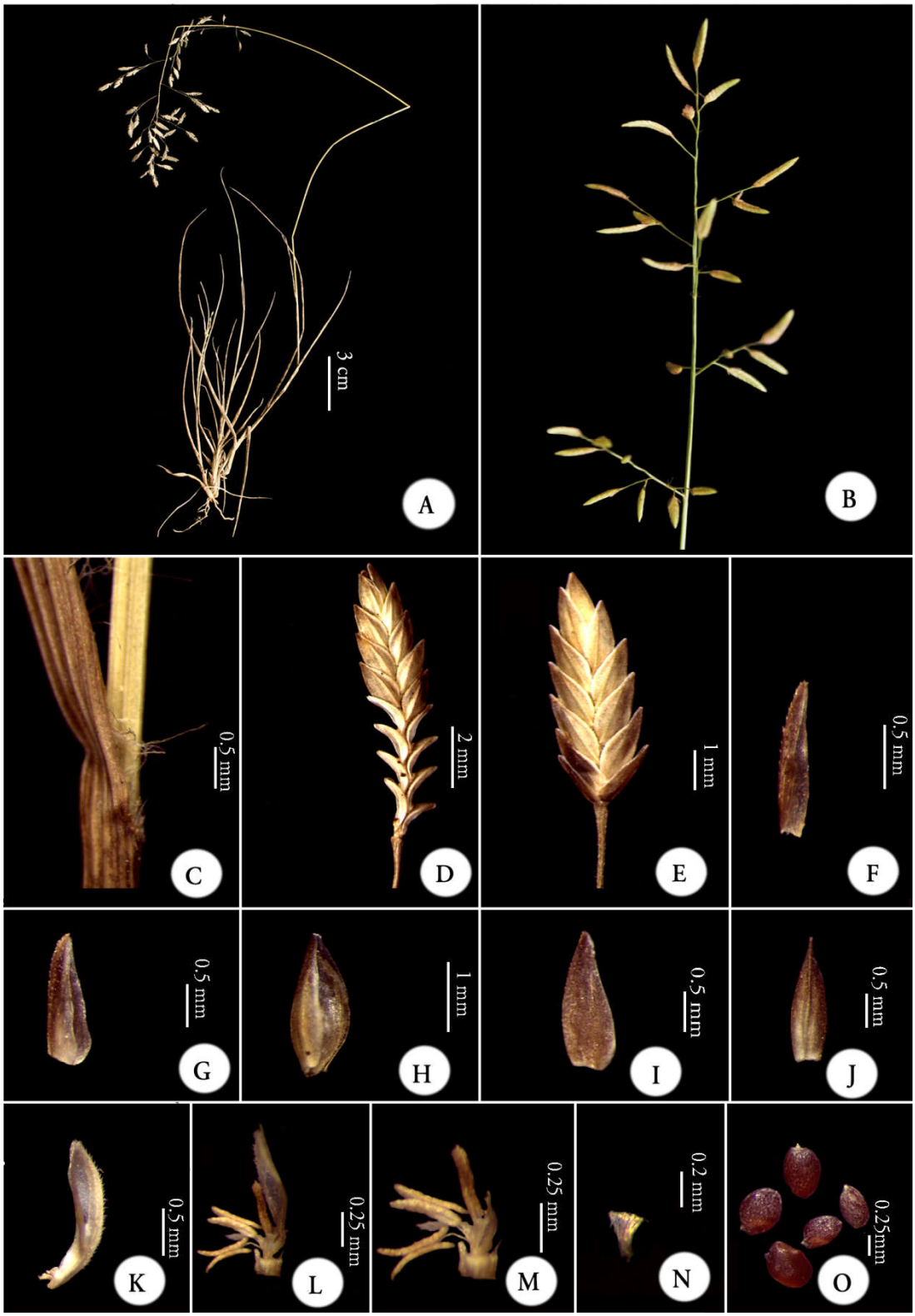


Fig. 44. ***Eragrostis brownii*** (Kunth) Nees: **A.** Habit; **B.** Enlarged portion of panicle; **C.** Ligule; **D.& E.** Spikelet; **F.** Lower glume; **G.** Upper glume; **H.** Floret; **I. & J.** Lemma - lateral & dorsal view; **K.** Palea; **L.** Palea with flower; **M.** Lodicules, stamens & pistil; **N.** Lodicule; **O.** Caryopsis.

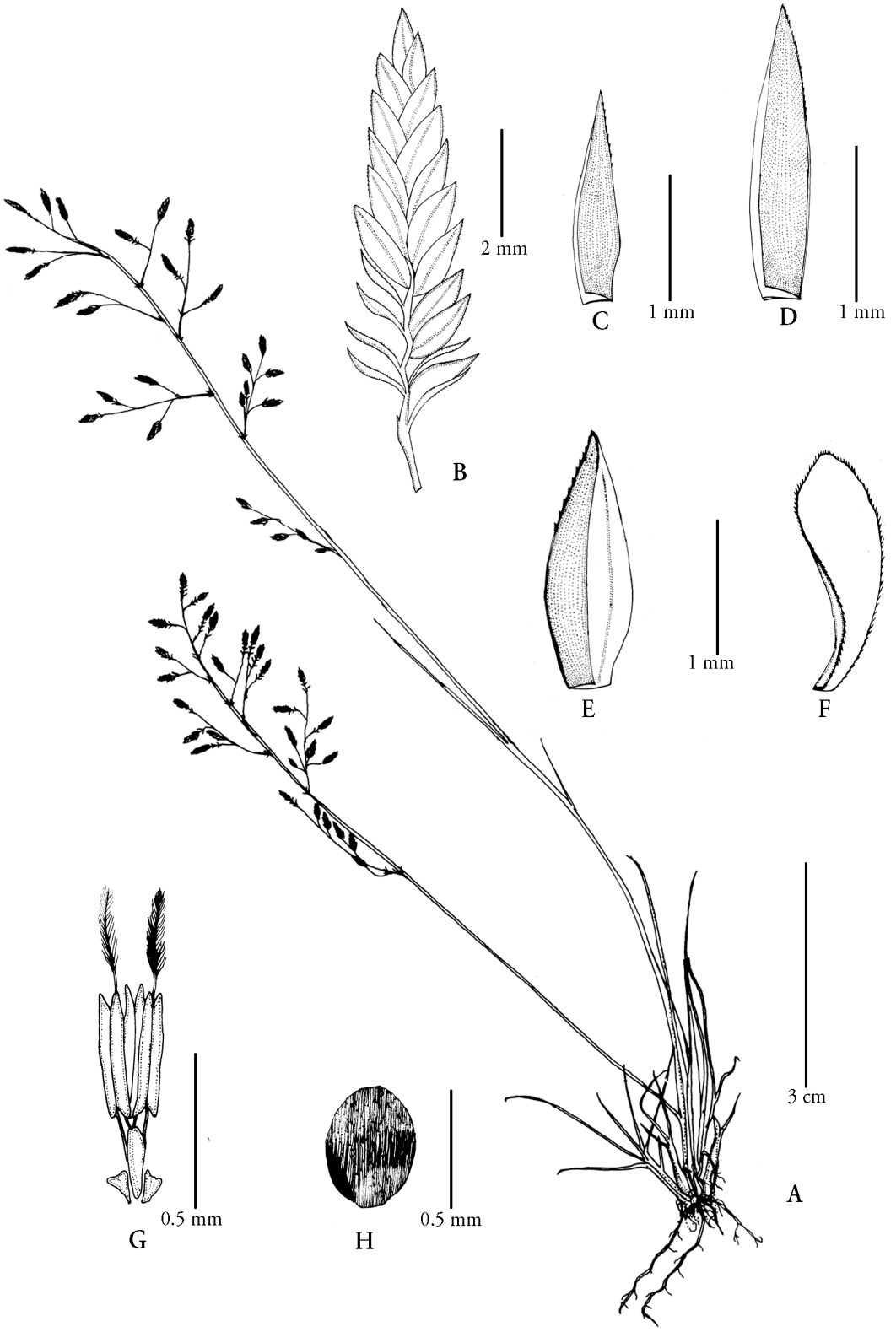


Fig. 45. ***Eragrostis brownii*** (Kunth) Nees: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicules, stamens & pistil; **H.** Caryopsis.

Kadaba, HBSS Kadaba Campus, 15 Sept. 2014, *Thoiba K. 137522*; *Ibid.*, 22 Jan. 2015, *Thoiba K. 144111* (CALI). Hassan Dist.: Belur, 13 Sep. 2014, *Thoiba K. 137512*; *Ibid.*, 13 Sep. 2014, *Thoiba K. 137518* (CALI); Sakalaeshpur, *Thoiba K. 137513* (CALI). Kodagu Dist.: Pusphagiri Hills, 24 Nov. 2014, *Thoiba K. 137553* (CALI). Shimoga Dist.: Sagar, Honnemaradu, 08 Sept. 2015, *Thoiba K. 144148* (CALI); Jog Falls, 08 Sept. 2015, *Thoiba K. 144154* (CALI). **Maharashtra,** Dhule Dist.: Khandesh, *s.loc.*, *s.coll. 5114* (BLAT).

Notes:—*Eragrostis brownii* is often confused with *E. minor* Host (=*Eragrostis pooides* P. Beauv.) and *E. cilianensis* (All.) Vignolo *ex* Janch. However, the former can easily be distinguished by its linear acute leaf blades, panicle without crateriform glands, branch axis being pilose; spikelets being purple tinged, linear lanceolate with 05–25-florets, anthers being 0.4–0.6 mm long. Bhat and Nagendran (1985) compared their new species, *Eragrostis santapauii* with *E. cilianensis* and *E. minor* (*E. pooides*), probably without being aware of the occurrence of the Australian *E. brownii* in India. It also share some silmilarity with *E. cumingii*, but differs from it is being tufted perennial, panicle branches more or less appressed to patent, anthers more or less globose, 0.3–0.6 mm long.

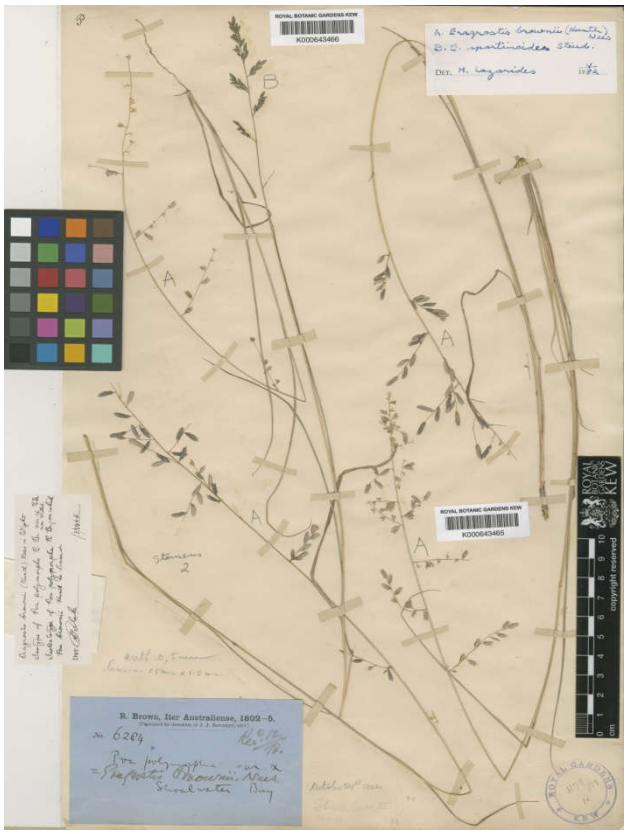


Fig. 46. Isolectotype of *Eragrostis brownii* (Kunth) Nees [*R. Brown 6284* (K000643446) designated by Lazarides, 1997] © The Board Trustees of the Royal Botanic Gardens, Kew.

Many authors (Eg. Veldkamp 2002, Chaisongkram *et al.,* 2013) considered *E. zeylanica* Nees & Meyen (1841c) as conspecific with *E. brownii* (Kunth) Nees. An examination of the protologue and type of *E. zeylanica* showed it as a distinct species.

5. Eragrostis cilianensis (All.) Vignolo *ex* Janch., Mitt. Naturwiss. Vereins Univ. Wein 5: 110. 1907; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1820. 1934; Bor, Grass. Burma Ceylon India Pakistan 503. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 379. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 209. 1994; S. Moulik, Grass. Bam. India 2: 598. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1192. 1997; Lazarides, Aust. Syst. Bot. 10: 105. 1997; Veldkamp, Blumea 47: 171. 2002; P.M. Peterson & I.S. Vega, Ann. Missouri Bot. Gard. 94: 762. 2007; P.M. Peterson & Giraldo-Cañas, J. Bot Res. Inst. Texas 2(2): 885. 2008; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 138. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 528. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 115. 2013. *Poa cilianensis* All., Fl. Pedem. 2: 246. 1785. **Lectotype** (designated by Vignolo, F., 1904)**:**—Italy: In agro Patrio Ciliani, *Bellardi s.n.* TO-8242 (Photo K), Isolectotypes: BRI, K photo neg. 19571). Figs. 47, 52

Poa eragrostis (Linn.) *nom. illeg. hom.*, Brot., Fl. Lusit. 1: 103. 1804. *Eragrostis major* (Linn.) Host *nom. illeg. Superfl.*, Gram. Austr. 4: t. 24. 14. 1809. *Eragrostis megastachya* (Koel.) Link, Hort. Berol. 1: 187. 1827. Lectotype (designated by Veldkamp 2002):—*Kalm in Herb. Linn. 88.8* (Holotype: LINN, microfisch IDC).

Poa flexuosa Roxb. *nom. illeg. hom.*, Fl. Ind. 1: 340. 1820. *Poa roxburghiana* Schult., Mant. 2: 314. 1824. *Poa tortuosa* Spreng. *nom. illeg. superfl.*, Syst. Veg. 1: 345. 1825. *Eragrostis flexuosa* (Roxb.) Steud., Syn. Pl. Glum. 1:266. 1854. Type:—India, growing on tufts on old walls (not seen).

Tufted annuals, 15–65 cm high, roots fibrous. ***Culms*** 10–35 cm long, errect or geniculate. ***Leaf sheaths*** 5–8 cm long, keeled, involute to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 5–20 × 0.3–0.7 cm, base slightly cordate, apex acute-acuminate; surface sparsely villous adaxially and glabrous abaxially; margins entire; ***ligules*** tufts of hairs, hairs 1–4 mm long. ***Panicles*** ovate, open, effuse, 4–35 × 2–8.5 cm long, olive green to purple. Peduncle 4–16 cm long, glabrous; rachis 0.5–4 cm long, glabrous. Primary pedicel 1–3.3 cm long, glabrous, secondary pedicel 1–3 cm long, glabrous. ***Spikelets*** ovate-oblong, 5–20 × 2–4 mm, 5–40-flowered; disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** ovate-lanceolate, 1.2–2.5 × 0.5–1mm, 1-nerved, 1-keeled, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 2.2–2.6 × 0.5–1 mm, 3-nerved; lateral nerves not prominent, 1-keeled, acute at apex. ***Lemmas*** oblong-lanceolate, 2–2.8 × 1–1.5 mm, 3-nerved, minutely keeled, lateral nerves prominent, deciduous, chartaceous, margins long ciliate, acuminate at apex. ***Paleas*** elliptic-oblong, 1.2–2.2 × 0.5–1 mm, winged, caducous, 2-nerved, keeled; keels ciliate, obtuse at apex. ***Rachilla*** straight, 0.3–0.5 mm long, glabrous. ***Lodicules*** 2, 0.2–0.3 mm long, truncate at apex. ***Stamens*** 3; anthers 0.5–1 mm long, yellow to purple. ***Ovary*** 0.2–0.3 mm long, globose; style 0.2–0.5 mm long, slender; stigma plumose, 0.3–0.6 mm long. ***Caryopses*** globose to orbicular, 0.4–0.75 × 0.3–0.5 mm, reddish brown.

Flowering & Fruiting:—May–December

Habitat & Ecology:—The species occurs in exposed areas like riverbeds and foothills, dry evergreen and deciduous forests. It is seen in association with *Aristida setacea* Retz., *Eragrostis brownii* (Kunth.) Nees, *Eragrostis collinensis* Vivek, G.V.S. Murthy & V.J. Nair, *Themeda triandra* Forssk., *Pseudanthistiria umbellata* (Hack.) Hook.f. and *Pteridium aquilinum* (L.) Kuhn.

Distribution:—Native to Europe; Africa, Asia, Australia, North and South America, and Pacific. In India it is distributed in almost all states.

Specimens examined:—India, **Gujarat,** Bharuch Dist.: Kabirvad, 20 Dec. 1904, *G.A. Gammie s.n.* (BSI). Kutch Dist.: Adesar, 13 Sept. 1968, *R.S. Raghavan 114713*; *Ibid.*,

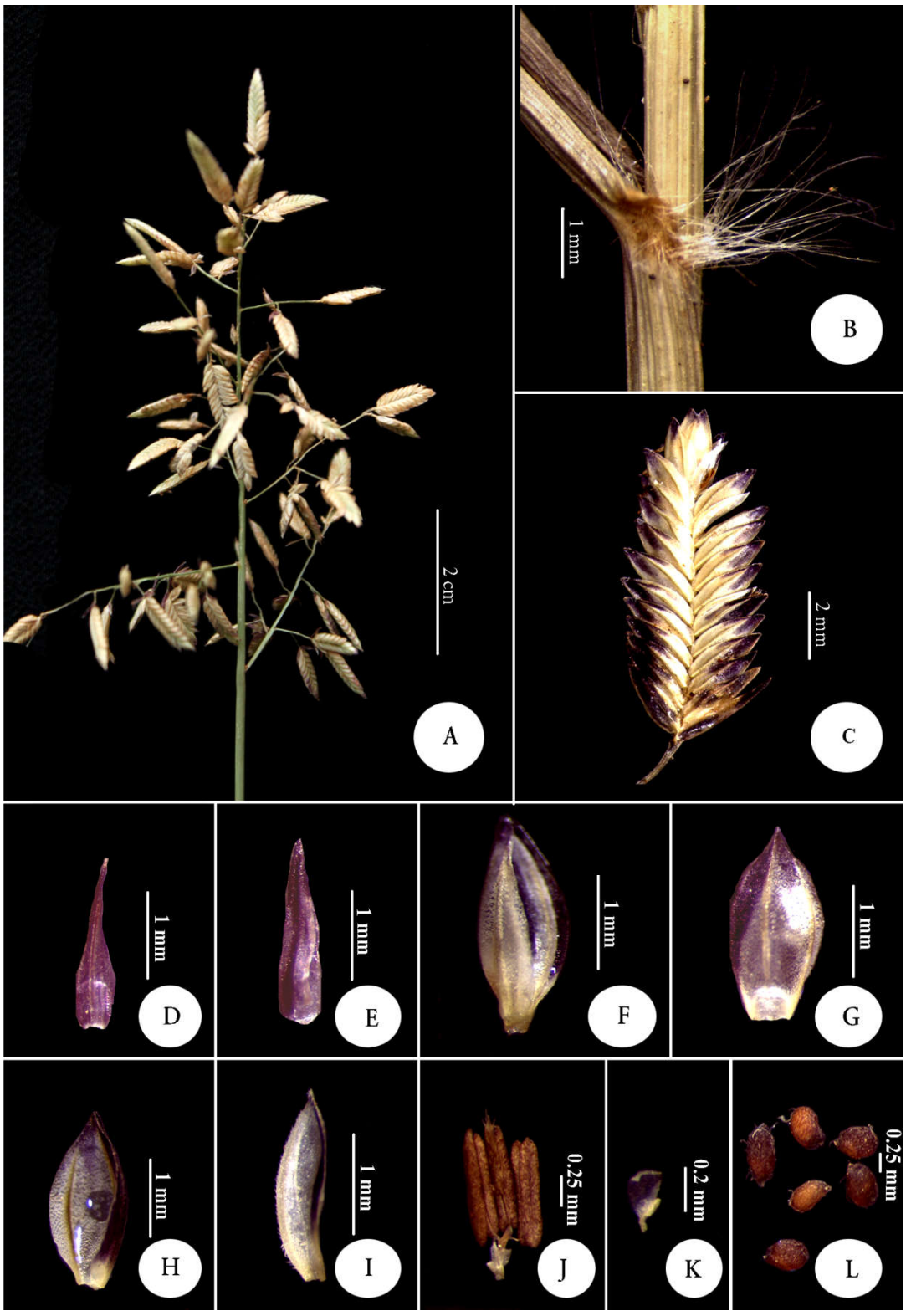


Fig. 47. ***Eragrostis cilianensis*** (All.) Vignolo ex Janch.: **A.** Panicle; **B.** Ligule; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Floret; **G. & H.** Lemma - dorsal & ventral view; **I.** Palea; Palea with flower; **J.** Lodicules, stamens & pistil; **K.** Lodicule; **L.** Caryopsis.

13 Sept. 1968, *R.S. Raghavan 114725* (BSI); Sumrasar, 21 Sept. 1968, *R.S. Raghavan 115057* (BSI); Naliya, 17 Oct. 1959, *W.J. Stower C64* (BSI). **Karnataka,** Bellary Dist.: Kottur, 12 Oct. 1919, *s.coll. 15961* (MH); Nagari, 20 Sept. 1916, *s.coll. 13793* (MH); Ramandrug, 09 Oct. 1919, *s.coll. 15930* (MH). Kodagu Dist.: Pusphagiri Hills, 24 Nov. 2014, *Thoiba K. 137554* (CALI). Mysore Dist.: Manasagangotri, 08 July 1971, *R. Raghavendra Rao 1371* (JCB); *s.loc.*, 05 Oct. 1903, *s.coll. 6137* (MH); St. Philomena's College, 10 Mar. 1964, *K.M. Sebastine 188715* (MH). **Kerala,** Idukki Dist.: Munnar, Eravikulam National Park, 15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137577* (CALI); Kumily, Forebay Dam, 22 June 1959, *K. Subramanyam 8126* (MH). Palakkad Dist.: Panthanthode, 21 Aug. 1966, *E. Vajravelu 27574* (MH). Thrissur Dist.: Parambikulam, 28 Oct. 1964, *K.M. Sebastine 22388* (MH). Wayanad Dist.: Kurichiyarmala, 28 Oct. 2013, *Thoiba K. 134478* (CALI). **Maharashtra,** Akola Dist.: Patur, 29 Feb. 1978, *S.Y. Kamble 152797* (BSI). Jalgaon Dist.: Erandol, 19 Aug. 1956, *S.D. Mahajan 6433* (BSI). Mumbai City Dist.: *s.loc.*, 04 Sept. 1944, *H. Santapau 4806* (BLAT). Pune Dist.: Mutha River side, 08 Apr. 1955, *V.D. Vartak 631* (AHMA); Khandala, July 1916, *s.coll. 5445*; *Ibid.*, Piranther Hill, 28 Dec. 1945, *H. Santapau 8309* (BLAT); Parvati Hill, 22. July 1960, *M.Y. Ansari 64381* (BSI); Chinchwad, 30 Dec. 1956, *G.S. Puri 8371* (BSI); BSI Compound, 01 Aug. 1960, *P.J. Cherian 63502* (BSI). Sangli Dist.: Kundali River bank, 22 Jan. 1925, *E. Blatter s.n.* (BLAT); Xavier College Ground, *s.die.*, *s.coll. 1846* (BLAT). Sindhudurg Dist.: Amboli, 10 Sept. 1989, *C.B. Salunkhe 8486* (SUK). **Tamil Nadu,** Chennai Dist.: Sadivayil, 03 Apr. 1963, *K.N. Subramanian 204* (FRC). Coimbatore Dist.: *s.loc.*, 15 Oct. 1966, *K.M. Sebastine 586* (CAL); *s.loc.*, 27 Nov. 1956, *K. Subramanyam 1461* (CAL); Varapalayam, 25 July 1956, *K. Subramanyam 381* (CAL); *s.loc.*, 28 Nov. 1906, *Fisher s.n.* (FRC); Dinhalli, 13 Nov. 1906, *Fisher s.n.* (FRC). Erode Dist.: Arachalur, 07 Sept. 1910, *Fisher 2151* (FRC). Dindigul Dist.: Sirumalais, 10 May 1958, *J. Pallithanam 53833*; *Ibid.*, 10 May 1958, *J. Pallithanam 53834* (RHT); Tope stream, Sept. 1956, *K.M. Matthew 725* (RHT); Kodaikanal, Ganesapuram-Palani path, 05 Aug. 1988, *K.M. Matthew 53356*

(RHT). Krishnagiri Dist.: Hosur Cattle Farm, 07 June 1930, *V. Narayanaswami 2953* (MH). Nilgiri Dist.: Manar, Gundah River Bank, 11 Aug. 1975, *E. Vajeravelu 46410* (MH); Cauvery Peak, 04 Nov. 1968, *D.B. Deb 31301* (MH); Kalhatty, Masanagudi, 23 Aug. 1970, *B.D. Sharma 35739*; *Ibid*., Apr. 1910, *C.A. Barber 2667* (MH). Tirunelveli Dist.: Mundathurai Ghat, *s.die.*, *C.A. Barber 2773* (MH).

Notes:—This species is easily recognised from other taxa by its having pale, often slate or leaden grey spikelets; glands in most parts and 3-nerved upper glumes.

6. Eragrostis ciliaris (L.) R.Br., Narr. Exped. Zaire 478: 1818; Stapf in Hook.f., Fl. Brit. India 7: 314. 1896; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1825. 1934; Bor, Grass. Burma Ceylon India Pakistan 506. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 210. 1994; S. Moulik, Grass. Bam. India 2: 598. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1193. 1997; P.M. Peterson & I.S. Vega, Ann. Missouri Bot. Gard. 94: 764. 2007; P.M. Peterson & Giraldo-Cañas, J. Bot Res. Inst. Texas 2(2): 885. 2008; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 139. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 530. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 115. 2013. *Poa ciliaris* Linn., Syst. Nat. ed. 10. 2: 875. 1759. *Megastachya ciliaris* (L.) P. Beauv., Ess. Agrostogr. 74. 167. 174. 1812. *Cynodon ciliaris* (L.) Rasp. In Ann. Sci. Nat. 5: 302. 1825. **Lectotype** (designated by Hitchcock, 1908)**:**—Jamaica, *P. Browne s.n.* (LINN- 87.66, image!). **Figs. 48, 49, 52**

Key to the varieties

1a. Panicle effuse, 1–2.5 cm wide, spikelets scattered on branches..…..**6c. var. *clarkei***

1b. Panicle spiciform or compact and dense, spikelets tightly packed on the rachis… **2**

2a. Panicle spiciform, more or less lobed or interrupted……. ..... **.6a. var. *ciliaris***

2b. Panicle short, thick, compact…… .....**6b. var. *brachysatachya***

6a. var. ciliaris

Tufted annuals, 10–75 cm high, roots fibrous. ***Culms*** 10–65 cm long, erect or decumbent to geniculate. ***Leaf sheaths*** 1–5 cm long, tubercle base hairs, margins ciliate, auricles bearded with long hairs. ***Leaf blades*** linear-lanceolate, 1.5–5 × 0.1–0.2 cm, base rounted to subcordate, apex acute-acuminate; surfaces scabrellate, sparsely tuberculate adaxially and glabrous abaxially; margins entire; ***ligules*** membranous with fringe of hairs, hairs 0.2–0.5 mm long. ***Panicles*** spiciform, compact, lanceolate to oblong, 2.5–17 × 0.2–1.5 cm long, branches alternate to subwhorled, axils glabrous or sometimes sparsely hairy, racemes and pedicels with dotted glands, pedicels 0.1–1cm long. Peduncle 1.5–12 cm long, glabrous; rachis 0.5–4 cm long, angled, scabrellate. ***Spikelets*** ovate-oblong or lanceolate, 1.8–3.2 × 1.2–1.5 mm, 5–11-flowered; disarticulation of florets from above downwards. Glumes deciduous, unequal. ***Lower glumes*** oblong-lanceolate, 0.3–0.5 × 0.2–0.3 mm, 1-nerved, 1-keeled, keels scabrellate, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 0.6–0.8 or 0.8–1.6 × 0.2–0.3 mm, 1-nerved; 1-keeled, acute at apex. ***Lemmas*** ovate to oblong-lanceolate, 0.8–1.3 × 0.3–0.6 mm, 3-nerved, minutely keeled, keels scabrid to ciliate, lateral nerves prominent and submarginal, excurrent, deciduous, chartaceous, mucronate, obliquely truncate at apex. ***Paleas*** elliptic-lanceolate, 0.7–1 × 0.3–0.4 or 0.5–0.6 mm, winged, caducous, 2-nerved, keeled; keels ciliate, cilia 0.5–0.7 mm, cilia longer than width of palea, acute or obtuse, retuse at apex. ***Rachilla*** *c.* 0.3 mm long, apex truncate. ***Lodicules*** 2, *c.* 0.2 mm long, truncate at apex. ***Stamens*** 2; anthers 0.1–0.3 mm long, purple. ***Ovary*** ovate to oblong, 0.1–0.2 mm long; style 0.2–0.3 mm long, slender; stigma plumose, 0.3–0.6 mm long. ***Caryopses*** ovate-elliptic, 0.3–0.5 × 0.2–0.3 mm, light brown.

Flowering & Fruiting:—May–January

Habitat & Ecology:—The species growing along road sides, on waste sites, in xerothermic vegetation, saline habitats, and city sidewalks. It is seen in association with *Perotis indica* (L.) Kuntze*, Anisomeles malabarica* (L.) R.Br. *ex* Sims, *Bulbostylis*

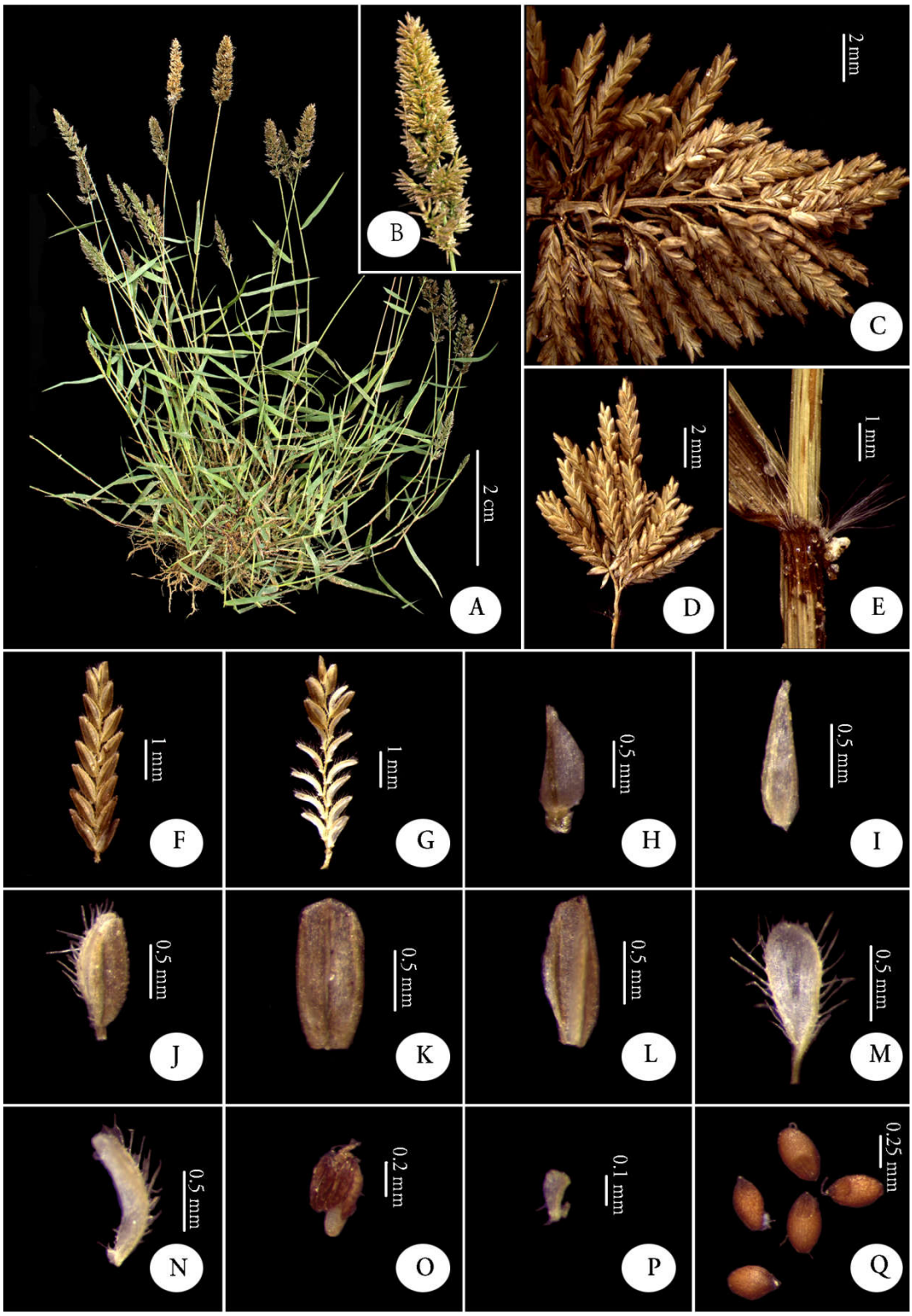


Fig. 48. ***Eragrostis ciliaris*** (L.) R.Br.: **A.** Habit; **B. & C.** Enlarged portion of panicle; **D.** Primary pedicel with spikelets; **E.** Ligule; **F. & G.** Spikelets; **H.** Lower glume; **I.** Upper glume; **J.** Floret; **K. & L.** Lemma – dorsal & ventral view; **M. & N.** Palea - dorsal & lateral view; **O.** Stamens & pistil; **P.** Lodicule; **Q.** Caryopsis.

barbata (Rottb.) C.B. Clarke, *Cyperus arenarius* Retz., *Eragrostis amabilis* var. *insularis* (C.E. Hubb.) P. Umam. & P. Daniel, *E. atrovirens* (Desf.) Trin *ex* Steud. and *Spinifex littoreus* (Burm.f.) Merr.

Distribution:—North and South America, Africa, Asia, Australia, and Pacific. In Peninsular India, this taxon was reported in all states except Kerala.

Specimens examined:—India, **Goa,** North Goa Dist.: Panaji Coast, 06 Nov. 1962, *S.R. Rolla 84368* (BSI). **Gujarat,** Ahmedabad Dist.: Shardanagar, 17 Nov. 2004, *Rani B. Bhagat s.n.* (AHMA). Anand Dist.: Vasad, 24 Sept. 1957, *P.S. Toor 28603* (BSI). Bharuch Dist.: Coast, 19 Oct. 1957, *P.S. Toor 25862* (BSI); Dahej, 20 Oct. 1957, *P.S. Toor 25959* (BSI); Devbhoomi Dwarka Dist.: Okha Sea Shore, 23 Sept. 1964, *S.R. Rolla 102814* (BSI); Mendroda Beach, 29 Dec. 1959, *M.Y. Ansari 54299* (BSI); Bet Dwarka, 23 Sept. 1964, *S.R. Rolla 102863* (BSI). Kheda Dist.: Nadiad, Mahi Canal-Bank, 16 Aug. 1957, *P.S. Toor 14337* (BSI). Kutch Dist.: Dhinodhar, 16 Sept. 1968, *R.S. Raghavan 114909* (BSI); Nakhatrana, 31 Jan. 1957, *S.K. Jain 11509* (BSI); Wandh, Bhuj, 28 Sept. 1964, *S.R. Rolla 103136* (BSI). Mehsana Dist.: Taranga Hill, 28 Jan. 1957, *S.K. Jain 11340* (BSI, CAL); *Ibid.*, 28 Jan. 1957, *S.D. Mahajan 11297* (BSI). Narmada Dist.: Juna-Raj, Rajpipla, 03 Sept. 1967, *R.D. Pataskar 105982* (BSI). Jamnagar Dist.: Jodiya Port, Nawaugon, 16 Nov. 1945, *H. Santapau 8002* (BLAT); Rajkot Dist.: Riiver bed, 20 Oct. 1957, *H. Santapau 13640* (BLAT). **Karnataka,** Belgaum Dist.: Londa Road, 01 Jan. 2007, *Arun N. Chandore 207* (SUK). Chikkaballapur Dist.: *s.loc.*, 02 Mar. 1975, *N.P. Singh 135557* (BSI). Kodagu District.: Kushalanagar, 06 June 1902, *C.A. Barber 4429* (MH). Kolar Dist.: Bagepalli, 28 Feb. 1975, *N.P. Singh 134558*; *Ibid.*, 28 Feb. 1975, *N.P. Singh 134550* (BSI). Mysore Dist.: Chammundi Hills, 30 Sept. 2015, *Thoiba K. 144195* (CALI); way to Mysore, 29 Sept. 2015, *Thoiba K. 144200* (CALI); Nanjangud, Sujata Puram, 29 Sept. 2015, *Thoiba K. 144181*; *Ibid.*, 30 Sept. 2015, *Thoiba K. 144180* (CALI). Uttara Kannada Dist.: Syke's Point, 04 Nov. 1945, *H. Santapau 7966* (BLAT). **Maharashtra,** Aurangabad Dist.: Daulatabad, Ellora, 07 Oct. 1963, *S.S. Rolla 92670* (BSI). Buldhana

Dist.: Taradi Forest, 22. Dec. 1982, *P.G. Diwaker 164780* (BSI). Jalgaon Dist.: Bhusaval-Yawal, 23 Sept. 1963, *S.S. Rolla 92221* (BSI). Mumbai City Dist.: St. Xavier College Campus, July 1917, *C. Meccan 4527* (BLAT); Dandi, 13. Oct. 1957, *P.S. Loor 25445* (BSI). Mumbai Suburban Dist.: Malad, Marve Road, 21 Sept. 1917, *G. L. Shah Shah 827* (BLAT); Abbey, Sandy shore, 21 Sept. 1917, *Moses Ezekiel 8690* (BLAT). Nasik Dist.: Trayambakeswhar Road, 17 Oct. 2001, *s.coll.*, *s.n.* (SUK); Prawarnagar, 16 Oct. 2001, *s.coll. s.n.* (SUK). Pune Dist.: Dive Ghat, 04 Sept. 2005, *Varsha Gaikwad VG 14* (AHMA); Tall-Ram, 01 Sept. 2005, *S.S. Rahangdale s. n.* (AHMA); Katraj, 17 Nov. 1955, *V.D. Vartak 2311*(AHMA); Bhor, 29 Oct. 1958, *V.D. Vartak 14483* (AHMA); Ghargaon-Mool River, 11 Oct. 1962, *S.R. Rolla 83666* (BSI). Ratnagiri Dist.: 15 Oct. 1990, *C.B. Salunkhe 7532* (SUK); Herne Port Dapoli, 21 Oct. 2001, *s.coll. s.n.* (SUK). Satara Dist.:

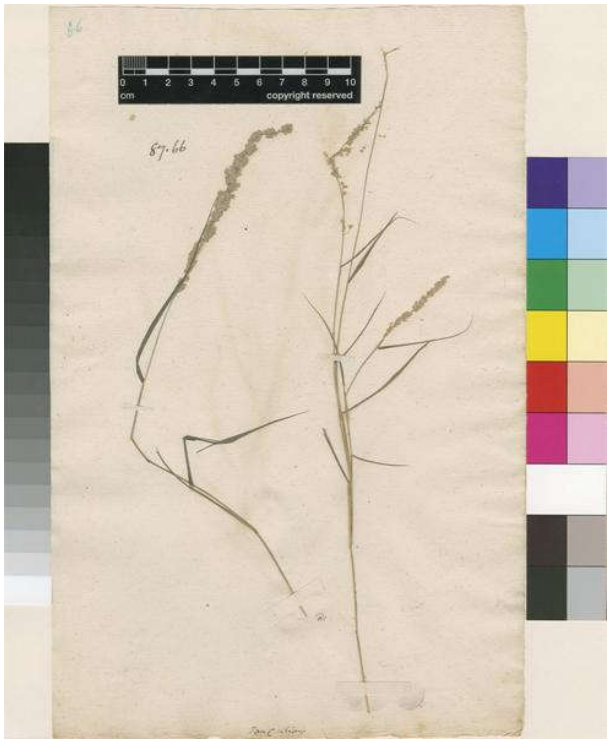


Fig. 49. Lectotype of *Eragrostis ciliaris* (L.) R.Br. [*P. Browne s.n.* (LINN- 87.66) designated by Hitchcock, 1908] © The Board Trustees of the Linnean Society, London.

Yeralwadi, 08 Oct. 1994, *S.R. Yadav 7652* (SUK). Sindhudurg Dist.: Shiroda, 02 Oct. 1993, *C.B. Salunkhe 8114* (SUK). **Odhisa,** Ganjam Dist.: Berhampur, 20 Oct. 1930, *V. Narayanaswami 4719* (MH). **Tamil Nadu,** Coimbatore Dist.: Thekkumalai Hills, 12 Dec. 1956, *K.M. Sebastine 1731* (CAL, MH). Cuddalore Dist.: Chidambaram, 16 Jan. 1977, *K.M. Matthew* & *D.I. Arockiasamy 6350*; *Ibid.*, 15 Apr. 1977, *K.M. Matthew 7345*(RHT); *s.loc.*, 10 Jan. 1978, *A. Mohan 11219* (RHT). Kancheepuram Dist.: Mahabalipuram, 27 Sept. 1970, *A.R.K. Sastry*

7621(CAL). Krishnagiri Dist.: Hosur, 12 Dec. 1917, *s.coll. 15431* (MH). Nagapattinam Dist.: Vedaranyam, BNHS Office, 01 Oct. 1986, *S.J. Britto* & *M. Charles 30501* (RHT). Thiruchirappalli Dist.: Pettavaithalai, 26 Sept. 1967, *K.M. Matthew 7866* (RHT). **Telangana,** Nalgonda Dist.: Krishna River bank, 16 Dec. 1959, *K.M. Sebastine 9819* (CAL, MH).

Notes:—This taxon was misidentified with *Eragrostis riparia* and *E. amabilis* but differs from both in having woolly contracted and spiciform panicle, tubercular bulbous based cilia on palea, and 2 stamens.

6b. var. *brachystachya* Boiss., Fl. Orient. 5(2): 582. 1884; Stapf in Hook.f., Fl. Brit. India 7: 315. 1896; Bor, Grass. Burma Ceylon India Pakistan 506. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; S. Moulik, Grass. Bam. India 2: 598. 1997. **Type:**—Saudia Arabia, Makkah Al-Mokarramah, Jeddah, Prope Dscheddam., 22 Jan. 1836, *G.H.W. Schimper s.n.* (Isotype: WAG0001502, image!). **Figs. 50, 52**

Tufted annuals, 10–25 cm high, roots fibrous. ***Culms*** 9–15 cm long, erect or decumbent to geniculate. ***Leaf sheaths*** 1–3 cm long, tubercle base hairs, margins ciliate, auricles bearded with long hairs. ***Leaf blades*** oblong-lanceolate, 1.5–2 × 0.1–0.2 cm, base slightly cordate, apex acute-acuminate; surfaces scabrellate, sparsely tuberculate adaxially and glabrous abaxially; margins entire; ***ligules*** membranous with fringe of hairs, hairs 0.2–0.5 mm long. ***Panicles*** spiciform to cylindrical or globular, compact, 1–6 × 1–1.3 cm long, branches alternate to subwhorled, base and axils glabrous; peduncle 1.5–9 cm long, glabrous; rachis 0.5–4 cm long, angled, scabrellate. ***Spikelets*** ovate-lanceolate, 1.8–4 × 1.2–2 mm, 5–10-flowered; disarticulation of florets from above downwards. Glumes deciduous, unequal. ***Lower glumes*** oblong-lanceolate, 0.3–0.5 × 0.2–0.3 mm, 1-nerved, 1-keeled, keels scabrid with 2–5 cilia along keel, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 0.6–1.2 × 0.2–0.3 mm, 1-nerved; 1-keeled, acute at apex. ***Lemmas*** ovate to oblong-lanceolate, 0.8–1.2 × 0.3–0.6 mm, 3-nerved, minutely keeled, keels scabrid to ciliate, lateral nerves prominent and

submarginal, deciduous, chartaceous, mucronate, obliquely truncate at apex. ***Paleas*** elliptic-lanceolate, 0.8–1 × 0.2–0.4 mm, winged, caducous, 2-nerved, 2-keeled; keels tuberculate ciliate, cilia stiff, longer than the width of palea, 0.5–0.7 mm long, acute or obtuse, retuse at apex. ***Rachilla*** *c.* 0.3 mm long, glabrous. ***Lodicules*** 2, *c.* 0.2 mm long, truncate at apex. ***Stamens*** 2; anthers 0.1–0.3 mm long, purple. ***Ovary*** ovate to oblong, *c.* 0.2 mm long; style 0.2–0.3 mm long, slender; stigma plumose, 0.3–0.6 mm long. ***Caryopses*** oblong-elliptic, 0.3–0.5 × 0.2–0.3 mm, finely subacute at apex.

Flowering & Fruiting:—October–January

Habitat & Ecology:—The species growing along road sides, on waste sites, beaches, sandy areas.

Distribution:—North and South America, Africa, Asia, Australia, and Pacific. In Peninsular India, this taxon was reported in Tamil Nadu and Karnataka.

Fig. 50. Isotype of *Eragrostis ciliaris* var. *brachystachya* Boiss. [*G.H.W. Schimper s.n.* (WAG0001502)] © The Board Trustees of the Naturalis Biodiversity Center, Leiden, Netherland.

Specimens examined:—India, **Gujarat,** Kutch Dist.: Bhuj Hill, Dec. 1907, *s.coll. 3768* (BLAT). Mehsana Dist.: *s.loc.*, 27 Dec. 1977, *V. singh 5476* (CAL). **Maharashtra,** Dhule Dist.: Khandesh, Dec. 1916, *Blatter* & *Hallberg 5114* (BLAT). Palghar Dist.: Bordi Sea coast, 10 Jan. 1968, *K.V. Billore 113408* (BSI). Pune Dist.: Narayangaon, Nasik Road, 47th mile, 11 Oct. 1965, *K. Hemadri 106989* (BSI). **Tamil Nadu,** Coimbatore Dist.: Chidambaram Park, 04 Oct. 1964, *M. Chandrabose 28576* (MH).

Notes:—This variety can be easily identified by contracted, cylindric and compact panicles.

6c. var. clarkei Stapf in Hook.f., Fl. Brit. India 7(22): 315. 1897; Bor, Grass. Burma Ceylon India Pakistan 506. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 215. 1989; S. Moulik, Grass. Bam. India 2: 598. 1997. **Holotype:—**Delhi, *C.B. Clarke s.n.* (CAL0000002456, image!). **Figs. 51, 52**

Tufted annuals, 03–75 cm high, roots fibrous. ***Culms*** 10–35 cm long, erect or decumbent to geniculate, nodes brownish. ***Leaf sheaths*** 2–5 cm long, tubercle base hairs, margins ciliate, auricles bearded with long hairs. ***Leaf blades*** oblong-lanceolate, 1–5 × 0.1–0.2 cm, base slightly cordate, apex acute-acuminate; surfaces scabrellate, sparsely tuberculate adaxially and glabrous abaxially; margins entire; ***ligules*** membranous with fringe of hairs, hairs 0.2–0.5 mm long. ***Panicles*** open, contracted, 1–7 × 1–2.5 cm long, branches alternate, base and glabrous, racemes and pedicels with dotted glands. Peduncle 1.5–5 cm long, glabrous; rachis 0.5–4 cm long, angled, scabrellate. ***Spikelets*** ovate-lanceolate, 1.8–4 × 1.2–2 mm, 5–10-flowered; disarticulation of florets from above downwards. Glumes deciduous, unequal. ***Lower glumes*** oblong-lanceolate, 0.3–0.5 × 0.2–0.3 mm, 1-nerved, 1-keeled, keels scabrellate,

Fig. 51. Holotype of *Eragrostis ciliaris* var. *clarkei* Stapf [*C.B. Clarke s.n.* (CAL0000002456)] © Botanical Survey of India, Kolkata.

with or without cilia along keels, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 0.8–1.6 × 0.2–0.3 mm, 1-nerved; 1-keeled, acute at apex. ***Lemmas*** ovate to oblong-lanceolate, 0.8–1.3 × 0.5–0.6 mm, 3-nerved, deciduous, minutely keeled, keels scabrid to ciliate, lateral nerves prominent and submarginal, deciduous, chartaceous, mucronate, obliquely truncate at apex. ***Paleas*** oblong-elliptic, 0.8–1 × 0.5–0.6 mm, winged, caducous, 2-nerved, keeled; keels tuberculate ciliate, cilia 0.5–0.7 mm, cilia longer than the width of palea, acute or obtuse, retuse at apex. ***Rachilla*** *c.* 0.3 mm long, glabrous. ***Lodicules*** 2, *c.* 0.2 mm long, truncate at apex. ***Stamens*** 2; anthers 0.1–0.3 mm long, purple. ***Ovary*** ovate to oblong, *c.* 0.1 mm long; style 0.2–0.3 mm long, slender; stigma plumose, 0.3–0.6 mm long. ***Caryopses*** oblong-elliptic, 0.3–0.5 × 0.2–0.3 mm, finely subacute at apex.

Flowering & Fruiting:—October–January

Habitat & Ecology:—The species growing along road sides, on waste sites, beaches, sandy areas, city sidewalks.

Distribution:—North and South America, Africa, Asia, Australia, and Pacific. In Peninsular India, this taxon was reported from Karnataka.

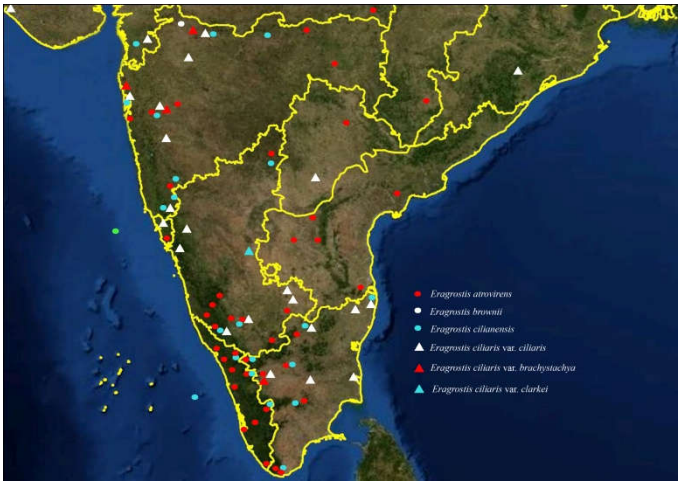


Fig. 52. Distribution of *Eragrostis atrovirens* (Desf.) Trin *ex* Steud. (●), *E. brownii* (Kunth) Nees (○), *E. cilianensis* (All.) Vignolo *ex* Janch. (●), *E. ciliaris* (L.) R.Br. (△), *E. ciliaris* var. *brachystachya* Boiss. (▲) and *E. ciliaris* var. *clarkei* Stapf (▲)

Specimen examined:—Karnataka, Chitradurga Dist.: Hosakere, 13 Nov. 1978, *K.P. Sreenath* & *S.R. Ramaesh 4201* (CAL).

7. **Eragrostis ciliata** (Roxb.) Nees, Agrost. Bras. 2(1): 512. 1829; Stapf in Hook.f., Fl. Brit India 7: 313. 1896; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1825. 1934; Bor, Grass. Burma Ceylon India Pakistan 506. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 216. 1989; S. Moulik, Grass. Bam. India 2: 601. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1193. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 139. 2009; Chaison., Chantar. & Hodk., ScienceAsia 39: 116. 2013. *Poa ciliata* Roxb., Fl. Ind. 1: 336. 1820. **Lectotype** (designated by Chaisongkram *et al.,* 2013):—India orientalis, *Wallich 5015* (BM000797909, image!, Isolectotype: K000643388, image!). **Figs. 53, 54, 60**

Poa incurvata Rottl. *ex* Stapf *nom. inval.*, Stapf in Hook.f., Fl. Brit. Ind. 7: 313. 1896. Type:—India, *Rottler* (*Wallich Cat. No. 5014*).

Poa rupestris Roth *ex* Roem. *et* Schult. *hom. illeg.*, Syst. Veg. 2: 592. 1817; non Withering, Bot.Arr. Brit. Pl.ed. 3(2): 146. 1796. *In:* Roth, Nov. Sp. 71. 1821. *Megastachya rupestris* (Roth) Roem. *et* Schult., Syst. Veg. 2: 592. 1817. *Eragrostis rupestris* (Roem. & Schult.) Steud., Syn. Pl. Glum. 1: 265. 1854. Type:—Not seen.

Perennial, 15–85 cm high, roots fibrous. ***Culms*** 15–70 cm long, errect or geniculate; ring like glandular area near the node. ***Leaf sheaths*** 3–6 cm long, keeled, involute to the culm, tubercle based cilia on one margin towards apex. ***Leaf blades*** linear-lanceolate, 10–15 × 0.1–0.2 cm, base slightly cordate, apex acute-acuminate; surfaces tubercle based hairs adaxially and abaxially; margins inrolled; ***ligules*** membranous with a fringe of hairs, hairs 2–4.5 mm long. ***Panicles*** compact, spiciform, cylindrical or oblong, 4–8 × 0.8–1.5 cm, plumose, branches bearded in axils, axils hairy. Peduncle 4–6 cm long, more or less ribbed, glabrous to ciliate at the apical node; rachis 0.3–1 cm long, glabrous, axils ciliate. Primary pedicel 0.4–0.6 cm long, glabrous, secondary pedicel 1–4 mm long, glabrous. ***Spikelets*** oblong, 3.8–5.5 × 1.2–1.6 mm, 7–12-flowered; disarticulation of florets from above downwards. Glumes deciduous, unequal. ***Lower glumes*** oblong-lanceolate, 1.2–1.3 × 0.3–0.4 mm, 1-nerved, 1-keeled, keels serrulate,

Fig. 53. ***Eragrostis ciliata*** (Roxb.) Steud.: **A.** Habit; **B.** Ligule; **C.** Primary pedicel with spikelets; **D.** Spikelets; **E.** Lower glume; **F.** Upper glume; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Palea with flower; **K.** Flower; **L.** Lodicules; **M.** Caryopsis.

margins ciliate, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 1.3–1.4 × 0.4–0.5 mm, 1-nerved, 1-keeled, acute at apex. ***Lemmas*** oblong-lanceolate, 1.5–2.5 × 0.5–0.8 mm, 3-nerved, minutely keeled, keels finely serulate, lateral nerves prominent, deciduous, chartaceous, margins long ciliate, apex sharply mucronate. ***Paleas*** elliptic-lanceolate, 1.2–1.4 × 0.3–0.4 mm, not winged, caducous, 2-nerved, keeled; keels tuberculate, margins long ciliate, cilia 0.5–0.6 mm long, obtuse at apex. ***Rachilla*** straight, 0.3–0.5 mm long, glabrous. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 3; anthers 0.3–0.4 mm long, purple. ***Ovary*** 0.3–0.4 mm long, globose; style c. 0.2 mm long, slender; stigma plumose, 0.2–0.4 mm long. ***Caryopses*** ovate to elliptic, 0.4–0.5 × 0.3–0.4 mm, deep brown.

Flowering & Fruiting:—May–January

Habitat & Ecology:—The species growing along road sides, on waste sites, sandy soil and sometimes on the beach. It is seen in association with *Eragrostis amabilis* var. *insuularis* (C.E. Hubb.) P. Umam. & P. Daniel, *Chloris barbata* Sw., *Commelina benghalensis* L.

Distribution:—Temperate and tropical Asia. In Peninsular India, this taxon was reported in all states except Kerala.

Specimens examined:—India, **Andhra Pradesh,** East Godaveri Dist.: Addateegala, 16 Sept. 1956,

Fig. 54. Lectotype of *Eragrostis ciliata* (Roxb.) Nees [*Wallich 5015* (BM000797909) designated by Chaisongkram *et al.,* 2013] © The Board Trustees of the British Museum of Natural History, London.

S.K. Wagh 3914 (BLAT); Samalkot, 17 Jan. 1916, *s.coll., 12488* (MH); Annavaram, 17 Jan. 1916, *s.coll. 12570* (MH). Guntur Dist.: Kothapalli, 05 Sept. 1907, *C.A. Barber 8273* (MH). Srikakulam Dist.: Ichchapuram, 08 Dec. 1923, *K.C. Jacob 17097* (MH). Vishakapatanam Dist.: Maripille, 13 Oct. 1930, *V. Narayanaswamy 4597* (MH). **Karnataka,** Hassan Dist.: 29 Sept. 2015, *Thoiba K. 144184* (CALI); Arsikere, 29 Sept. 2015, *Thoiba K. 144187* (CALI). **Maharashtra,** Chandrapur Dist.: Kalsa Forest Plot 20, Hirdinale, 17 Mar. 1971, *B.M. Wadhwa 133917* (BSI). Poona Dist.: Pashan Tank, 18 Oct. 1960, *V.D. Vartak 17269* (AHMA). Thane Dist.: Bordi Coast, Bordi Range, 10 Jan. 1968, *K.V. Billore 113409* (BSI). **Odhisa,** Khurda Dist.: Bhubaneswar, IMMT Campus, 03 Dec. 2011, *A.K. Pradeep* & *Thoiba K. 138073* (CALI). **Tamil Nadu,** Tirunelveli Dist.: Mundathurai, 22 Sept. 1943, *D. Daniel* & *S.R. Raju 20431* (MH); Mundathurai Ghat, 14 June 1901, *C.A. Barber 2759* (MH).

Notes:—The distinctive characters of *E. ciliata* are its spiciform panicle and the inflorescence axis with long hairs.

8. Eragrostis coarctata Stapf in Hook.f., Fl. Brit. India 7: 313. 1896; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1825. 1934; Bor, Grass. Burma Ceylon India Pakistan 507. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 216. 1989; S. Moulik, Grass. Bam. India 2: 601. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1193. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 140. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 530. 2012. **Holotype:—** *Wallich 5003 p.p.* (K00643386, image!). **Figs. 55, 60**

Perennial, 15–70 cm high, roots fibrous. ***Culms*** 10–60 cm long, errect or geniculate. ***Leaf sheaths*** 2.2–6 cm long, glabrous to sparsely tuberculate hairy, margins ciliate on one side. ***Leaf blades*** 5–20 × 0.4–0.5 cm, linear-lanceolate, base slightly cordate, apex acute-acuminate; margins incurved; ***ligules*** ciliate, cilia 0.4 mm long. ***Panicles*** spiciform, sub-clavate, 4–15 × 0.8–1.8 cm, rachis short, villous hairy at the node, hairs falling at the maturity. Peduncle 4–12 cm long, glabrous. ***Spikelets*** oblong, compressed, 2–4.5 × 1–2 mm, 3–12-flowered; disarticulation of florets from above

downwards. Glumes deciduous, unequal. ***Lower glumes*** oblong-lanceolate, 0.8–1.2 × 0.7–0.8 mm, 1-nerved, 1-keeled, keels scabid towards apex, margins ciliate, acute at apex. ***Upper glumes*** ovate-lanceolate, 1.2–1.6 × 0.7–0.8 mm, 1-nerved, 1-keeled, acute at apex. ***Lemmas*** oblong-lanceolate, 1–2 × 0.8–1.2 mm, 3-nerved, minutely keeled, keels scabrid towards apex, lateral nerves prominent, deciduous, chartaceous, margins long ciliate, obtuse at apex. ***Paleas*** oblong-elliptic, 1.2–1.4 × 0.3–0.6 mm, winged, caducous, 2-nerved, keeled; keels ciliate, cilia 0.4—0.7 mm long, acute to obtuse at apex. ***Rachilla*** straight, 0.3–0.4 mm long, zigzag, glabrous. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 3; anthers 0.3–0.4 mm long, purple. ***Ovary*** 0.3–0.4 mm long, globose to elliptic; style c. 0.2 mm long, slender; stigma plumose, 0.4–0.8 mm long. ***Caryopses*** ovoid to elliptic, 0.3–0.5 × 0.2–0.4 mm, deep brown.

Flowering & Fruiting:—October–February

Habitat & Ecology:—The species growing rarely along road sides, stream sides, and sandy shores. It is seen in association with *Chloris barbata* Sw., *Digitaria ciliaris* (Retz.) Koeler., *Eragrostis amabilis* var. *insularis* (C.E. Hubb.) P. Umam. & P. Daniel and *Perotis indica* (L.) Kuntze.

Distribution:—Bangladesh, Myanmar, Nepal. In Peninsular India, this taxon was reported in all states except Kerala.

Fig. 55. Holotype of *Eragrostis coarctata* Stapf [*Wallich 5003 p.p.* (K00643386)] © The Board Trustees of the Royal Botanic Gardens, Kew.

Specimens examined:—India, **Andhra Pradesh,** East Godaveri Dist.: Addateegala, 16 Sept. 1956, *S.K. Wagh 3904* (BLAT); Samalkot, 27 Aug. 1902, *C.A.*

Barber 4537 (MH); *s.loc.*, 08 Dec. 1902, *C.A. Barber 5256* (MH); Marudumilli, 16 Feb. 1994, *M. Mohanan 101241*(MH); 22 Oct. 1993, *M. Mohanan 100818* (MH). Karimnagar Dist.: Eklaspur, 27 July 1964, *G.V. Subba Rao 20237* (MH). Nellore Dist.: Kollurupad, 15 Dec. 1917, *Fischer 4222* (FRC). Visakhapatanam Dist.: Sunkarametta, 11 May 1956, *S.K. Wagh 2553* (BLAT); Barnakonda R.F., 09 Dec 1923, *K.C. Jacob 17281*(MH); Forest near Araku, 26 Sept. 1960, *N.P. Balakrishnan 10873* (MH); Korada R.F., 12 May 1979, *G.V. Subba Rao 62382* (MH); Kuntada R.F., 16 Feb. 1994, *M. Mohanan 101241* (MH). Karnataka, Banglore Dist.: *s.loc.*, Sept. 1910, *A. Meebold 11349* (CAL). Udupi Dist.: Malpe Coast, 24 Nov. 1972, *J.A. Rao 10093* (CAL). **Maharashtra,** Sindhudurg Dist.: Shiroda, 17 Nov. 1991, *S.R. Yadav 7720* (SUK). **Odisha,** Ganjam Dist.: *s.loc.*, Dec. 1949, *W. Wight 3035* (CAL). Kalahandi Dist.: Thuamul Rampur, 27 Aug. 1963, *B. Safui 13527* (CAL); Lanjigarh Road, 04 Sept. 1983, *B. Safui 13669* (CAL). Kendrapara Dist.: False Point, 31 Jan. 1961, *G. Panigrahi 23538* (CAL); *s. loc.*, Mar. 1967, *N.C. Majundar 23* (CAL).**Telangana,** Khammam Dist.: Lakshmipuram Forest, 21 Nov. 1993, *R. Chendrasekaran 98910* (MH). Ranga Reddy Dist.: Anantagiri, 13 May 1956, *S.K. Wagh 2701*(BLAT); Anantagiri Estate Bungalow, 13 May 1964, *G.V. Subba Rao 19550* (MH).

Notes:—It can be easily identified by its eglandular subspiciform panicle and ciliate margins of glumes and lemmas.

9. Eragrostis collinensis Vivek, G.V.S. Murthy & V.J. Nair, Indian J. Forest. 36(3): 401. 2013. **Type:—**India, Tamil Nadu, Nilgiri Dist.: Avalanche, 1925 m, 14.10.1972, *K. Vivekanandan 42954* (Holotype: CAL!, Isotype: MH!). **Figs. 56, 57, 60**

Tufted perennials, 10–60 cm high, roots fibrous. ***Culms*** 10–30 cm long, nodes glabrous. ***Leaf sheaths*** 3–5 cm long, enrolled to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 15–25 × 0.5–1 cm, base slightly cordate, apex acute-acuminate;

surface scabrid, sparsely ciliate adaxially and glabrous abaxially; margins entire and eglandular; ***ligules*** ciliate rim, cilia 0.2–0.4 mm long. ***Panicles*** ovate, open, 5–13 × 3–7 cm, branches alternate, angled, base of primary branches eglandular. Peduncle 5–8 cm long, glabrous, eglandular. Primary pedicel 1–3cm long, coriaceous; secondary pedicel 0.5–2 cm long. ***Spikelets*** ovate-lanceolate, 4–10 × 3–5 mm, 5–40-flowered, purplish to dark pink or chocolate brown, margins serrate in appearance, disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** lanceolate, 1.3–1.8 × 0.3–0.4 mm, 1-nerved, 1-keeled, keels scabrid above the lower halves. ***Upper glumes*** lanceolate, 1.5–2 × 0.3–0.5 mm, 1-nerved, 1-keeled, keels scabridulose, acute at apex. ***Lemmas*** elliptic-lanceolate, 1.5–2 × 0.5–2 mm, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex sharply acute. ***Paleas*** elliptic-lanceolate, 1.5–2 × 0.3–0.8 mm, winged, deciduous or not, 2-nerved, keels scabrid, acute-oblong at apex. ***Rachilla*** zigzag, *c.* 1 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 3; anthers 0.5–1 mm long, purple. ***Ovary*** 0.2–0.4 mm long, globose; style *c.* 0.5 mm long, slender; stigma plumose, 0.3–0.5 mm long. ***Caryopses*** obovoid-ellipsoid, 0.5–0.8 × 0.3–0.5 mm, laterally compressed, reddish brown.

Flowering & Fruiting:—Throughout the year.

Habitat & Ecology:—Growing along ghat road sides, hilly tracts, foothills above 700 m. It is seen in association with *Crotalaria beddomeana* Thoth. & A.A. Ansari, *Didymocarpus meeboldii* W.W.Sm. & Ramaswami, *Eragrostis unioloides* (Retz.) Nees *ex* Steud.*, E. atrovirens* (Desf.) Trin. *ex* Steud., *Leucas beddomei* (Hook.f.) Sunojk. & P.Mathew., *Murdania semiteres* (Dalzell) Santapau, *Swertia lawii* (Wight & Arn.) Burkill, *Tripogon bromides* var. *bromides* Roth *ex* Roem. & Schult. and *T. sivarajanii* Sunil.

Distribution:—This species was reported only from South India (Kerala and Tamil Nadu). Recently this species was reported from Goa and Karnataka.

Specimens examined:—Karnataka, Kodagu Dist.: Pusphagiri Hills, 24 Nov. 2014, *Thoiba K. 137552* (CALI); Tadiyandamol Hills, 26 Nov. 2014, *Thoiba K. 137557*

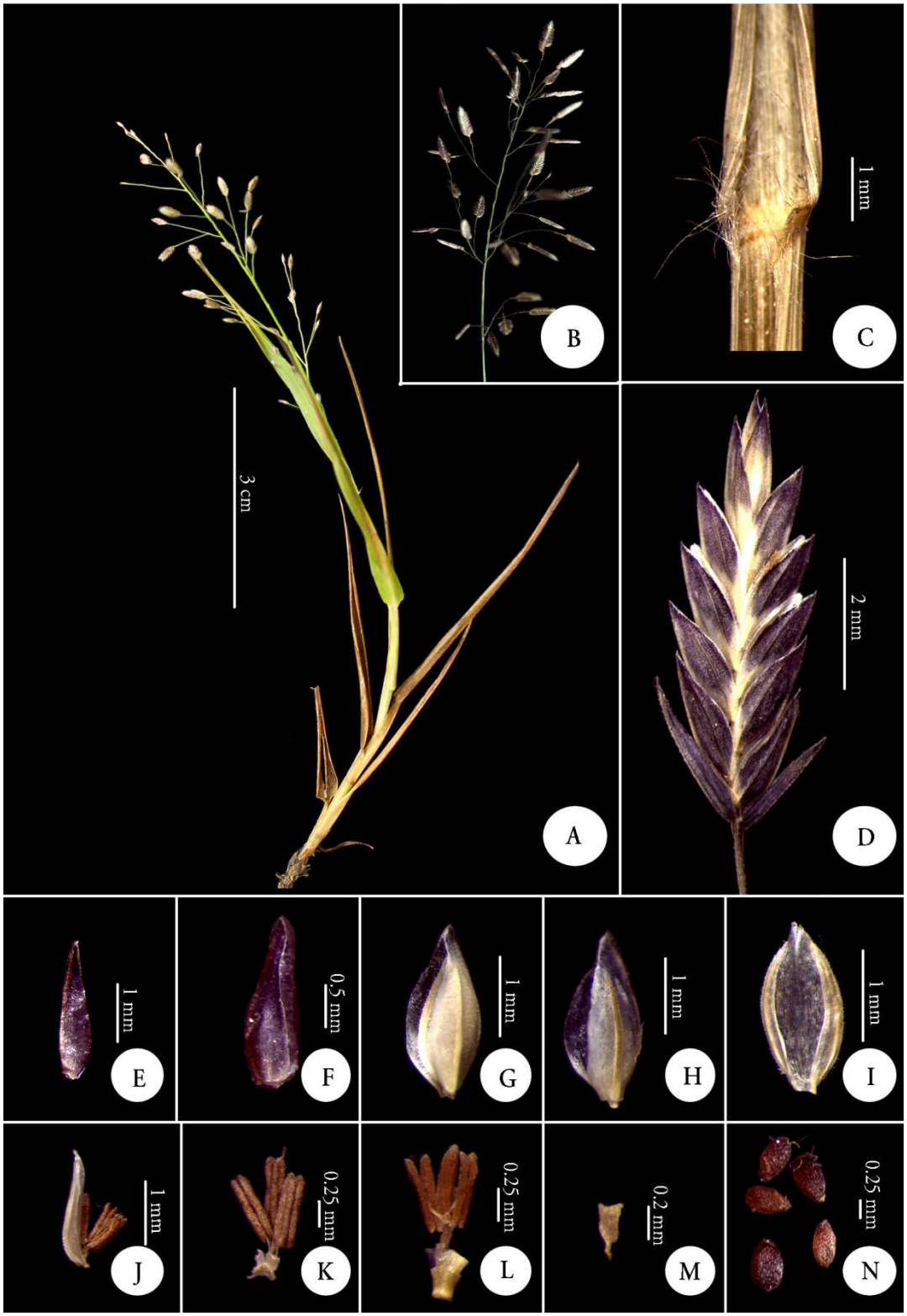


Fig. 56. ***Eragrostis collinensis*** Vivek, G.V.S. Murthy & V.J. Nair: **A.** Habit; **B.** Panicle; **C.** Ligule; **D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Palea with flower; **K. & L.** Flower; **M.** Lodicule; **N.** Caryopsis.

(CALI). **Kerala,** Ernakulam Dist.: Shoolamudi, Variyam, 14 Dec. 2016, *Nikhil Krishna* & *Thoiba K. 146744* (CALI). Idukki Dist.: Mathikettan Shola National Park, 19 Dec. 2016, *Shinoj* & *Thoiba K. 146767* (CALI); Munnar, 06 Oct. 2014, *Alfred Joe* & *Thoiba K. 137534*; *Ibid.,* 06 Oct. 2014, *Alfred Joe* & *Thoiba K. 137535* (CALI); Mattupetty, 15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137566* (CALI); Yellapetty, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137596*; *Ibid.,* 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137600* (CALI); Top Station, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137578* (CALI); Periyakanal Water Falls, 15 Nov. 2014, *Thoiba K.* & *A.K. Pradeep 137549* (CALI); Devikulam, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137587*; *Ibid.*,16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137592* (CALI); Munnar, Eravikulam National Park, 15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 144106*; *Ibid.*, 19 June 2015, *Thoiba K.* & *V. Drisya 144133* (CALI); Peermade, Parunthumpara, 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146615* (CALI); Thrisangu Hills, Thekkady, 17 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146639* (CALI); Rajamala, 22 June 1997, *S.D. Biju 12* (TBGT); Narakakkanam, 18 Aug. 1977, *K. Vivekananthan 49681* (CAL); Thannikkudy, 06 Jan. 1994, *Jomy Augustine 13077* (CALI); Devikulam, 17 June 1963, *K.M. Sebastine 16538* (MH); Upper Vagavurrai, 08 Aug. 1967, *B.V. Shetty 28336* (MH). Kollam Dist.: Anathode, 10 Nov. 1975, *K. Vivekananthan 46598* (CAL, MH); Pamba, 24 Mar. 1978, *C.N. Mohanan 54365* (MH). Kottayam Dist.: Kurishumala, 09 Aug. 2014, *Thoiba K.* & *A.P. Janeesha 138088* (CALI). Thrissur Dist.: near Malakkapara, 25 Dec. 2014, *Thoiba K. 144124* (CALI). **Tamil Nadu,** Coimbatore Dist.: Anamalai Tiger Reserve, Nallamudi, Poonjolai, 13 Dec. 2013, *Thoiba K. 138014* (CALI); Malakkapara, Shaekalmudi, Mudiyankunnu, 12 Dec. 2013, *Thoiba K. 138025* (CALI); Anamalai Hills, 17 Nov. 1980, *M. Chandrabose s.n.* (CAL); Konalar, Anamalai Hills, 17 Nov. 1980, *M. Chandrabose* & *V. Chandrasekaran 69001* (MH); Poonachi, Anamalais, 10 Oct. 1901, *s.coll. 3725* (MH). Dindigul Dist.: Kodaikanal Hills, 11 Sept. 1905, *C.A. Barber 7235* (MH); Kodaikanal Leaving Path, Oct. 1955, *s. coll. 35* (CAL); Kodaikanal, 16 Sept. 1956, *Pallithanam*

Fig. 57. Holotype of *Eragrostis collinensis* Vivek, G.V.S. Murthy & V.J. Nair [*K. Vivekanandan 42954* (CAL0000025522)] © Botanical Survey of India, Kolkata.

2216; *Ibid.,* 01 June 1984, *K.M. Matthew* & *S.J. Britto 40219* (RHT); Berijam, 09 Aug. 1984, *K.M. Matthew 40767* (RHT); Korappur, 08 July 1987, *K.T. Mathew 49962*; *Ibid.,* 10 Aug. 1987, *K.M. Matthew* & *K.T. Mathew 50016* (RHT); Shembaganur, 29 July 1985, *K.M. Matthew 41552*; *Ibid.,* 21 Aug. 1986, *K.M. Matthew, N. Charles* & *N. Rajendren 46406* (RHT); Kukkal, 24 Aug. 1986, *K.M. Matthew, N. Charles* & *N. Rajendren 46610* (RHT); Palani hills, 12 Dec. 1986, *K.M. Matthew 47873*; *Ibid.,* 14 Dec. 1986, *K.M. Matthew 47994* (RHT). Nilgiri Dist.: Gudallur, Shooting Point, 12 Dec. 2015, *Thoiba K. 146705* (CALI); Naduvattam, 23 June 2016, *Nikhil Krishna* & *Thoiba K. 146777* (CALI); Udagamandalam, 23 Dec. 2017, *Nikhil Krishna* & *Thoiba K. 146793* (CALI); Hulical Droog, 27 Aug. 1957, *K.M. Sebastine 4131* (CAL); Coonoor, Lamb's Rock, 27 Feb. 1972, *B.D. Sharma 40314* (MH); Ooty, Fox how, 27 Aug. 1901, *C.A. Barber 3481* (MH); Pykara, 14 Sept. 1918, *s.coll. 15585* (MH); *Ibid.*, 08 Mar. 2012, *Remya J.* & *Prasanna 67194*; Emerald, 27 July 2012, *Remya J.* & *Prasanna 73769*; Kunda, 24 Mar. 2012, *Remya J.* & *Prasanna 72223* (TBGT). Thiruchirappalli Dist.: Perumol, *s.die.*, *s.coll. 4935* (RHT). Yercaud Dist.: Balmadies,

05 Nov. 1955, *A.V.N. Rao 26970* (CAL); Balmadies, 05 Nov. 1955, *A.V.N. Rao 26970* (MH); Cauvery Peak, 04 Nov. 1968, *D.B. Deb 31301* (MH).

Notes:—*Eragrostis collinensis* is similar to *E. unioloides* mainly by the deciduous florets disarticulating from below upwards; scabrous palea keels and obovoid caryopsis, but differs from it by the presence of only few spikelets on primary panicle branches which are much broader and deep brown, florets being loosely arranged on a rachilla with internodes of about double the length in comparison to *E. unioloides*; lemma is much longer and erect with straight lateral nerves, palea keels wingless; anthers 3, much longer and broader.

10. Eragrostis cumingii Steud., Syn. Pl. Glumac. 1: 266. 1854. Bor, Grass. Burma Ceylon India Pakistan 507. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 216. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 380. 1991; Lazarides, Aust. Syst. Bot. 10: 109. 1997; Veldkamp, Blumea 47: 172. 2002; Chaison., Chantar. & Hodk., ScienceAsia 39: 116. 2013. **Lectotype** (designated by Lazarides, 1997)**:**—Philippines, *Cuming 1104* (K000290379, image!, Kew negative 6904, Isolectotype: G00301770, image!, P, P00622473, image!, P00622472, image!). **Figs. 58–60**

Eragrostis distans Hack. in Philipp. Gov. Lab. Bull. 35: 81. 1906. Type:—Philippiens: Luzon Is., Kias, Benguet, vi 1904, *Elmer 6608* (Holotype: W, W 17346; photo in K).

Tufted annuals, 10–30 cm high, roots fibrous. ***Culms*** 10–15 cm long, errect or geniculate. ***Leaf sheaths*** 1–6 cm long, keeled, involute to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 2.5–8 × 0.1–0.2 cm, base slightly cordate, apex acute-acuminate; surface sparsely villous adaxially and glabrous abaxially; margins entire; ***ligules*** a fringe of hairs, hairs 2–3 mm long. ***Panicles*** ovate, open, effuse, 5–15 × 3–6 cm long; branches alternate, 2–3 cm long, axils sparsely villous and scabrid, each branch with 2–8 spikelets. Peduncle 2–5 cm long, glabrous, pink; rachis 2–5 cm long; primary pedicel 0.5–2 cm long, villous or tuberculate hairy on the axils; secondary pedicel 3–5

Fig. 58. ***Eragrostis cumingii*** Steud.: **A.** Habit; **B. & C.** Enlarged portion of panicle; **D.** Ligule; **E.** Spikelet; **F.** Lower glume; **G.** Upper glume; **H.** Floret; **I.** Lemma - dorsal & ventral view; **J. & K.** Palea – dorsal & ventral view with flower; **L.** Caryopsis.

mm long, flat or quadrangular, glabrous. ***Spikelets*** oblong-lanceolate, 2–10 × 1.5–2 mm, 5–20-flowered, pink tinged at apex; disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** ovate-lanceolate, 1–1.5 × 0.5–0.7 mm, 1-nerved, 1-keeled, keels scaberulose, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 1.5–2 × 0.5–0.8 mm, 1-nerved, 1-keeled, keels scaberulose, acute at apex. ***Lemmas*** oblong-lanceolate, 1.5–2 × 1–1.3 mm, 3-nerved, nerves slightly scabrid, minutely keeled, lateral nerves prominent, deciduous, chartaceous, acuminate at apex. ***Paleas*** oblanceolate, 1.5–2 × 0.3–0.5 mm, winged, persistant, 2-nerved, keeled; keels ciliate, obtuse at apex. ***Rachilla*** zigzag, 0.2–0.3 mm long, glabrous. ***Lodicules*** 2, 0.1–0.2 mm long, obovate. ***Stamens*** 3; anthers 0.3–0.4 mm long. ***Ovary*** 0.2–0.3 mm long, globose; style 0.2–0.3 mm long, slender; stigma plumose, 0.3–0.5 mm long. ***Caryopses*** ovate to globose, 0.5–0.75 × 0.3–0.5 mm long, deep brown.

Flowering & Fruiting:—July–February.

Habitat & Ecology:—The species is widespread in seasonally wet, open areas, banks of water resources and sandy soils. It is seen in association with *Eragrostis gangetica* (Roxb.) Steud., *E. zeylanica* Nees & Meyen, *Mollugo pentaphylla* L., *Oldenlandia corymbosa* L., *Trianthema portulacastrum* L. and *Zaleya decandra* (L.) Burm.f.

Distribution:—America, Asia and Australia. In India, it was reported from Kerala and Maharashtra. Recently this species was reported from Karnataka.

Fig. 59. Lectotype of *Eragrostis cumingii* Steud. [*Cuming 1104* (K000290379) designated by Lazarides, 1997] © The Board Trustees of the Royal Botanic Gardens, Kew.

Specimens examined:—India, **Kerala,** Alappuzha Dist.: Pathirappally Radio Station, 29 Jan. 2014, *Thoiba K. 138059* (CALI); Vandanam, *s.die.*, *Sunil C.N. 1627* (CALI). Kannur Dist.: Chandanathode, 17 June 1979, *V.S. Ramachandran 62649* (MH). Malappuram Dist.: Calicut University Campus, near Central Library, 04 July 2001, *Jayasree S. 74352* (CALI). Thiruvananthapuram Dist.: Veli, 30 July 1979, *M. Mohanan 63327* (CAL, MH); *Ibid.*, 04 Aug. 1979, *M. Mohanan 58563* (CAL). **Maharashtra,** Mumbai Suburban Dist.: Malad, Marve–Madh Road, 05 Jan. 1957, *G.L. Shah Shah 8438* (BLAT).

Notes:—This species is often confused with the annual species *E. brownii*, especially in the size and the shape of its inflorescence. But, *E. cumingii* differs by having shortly pedicellate clustered primary branches, pedicels much shorter than the spikelets, gibbous lemmas, and 0.1–0.2 mm long globose anthers.

11. Eragrostis curvula (Schrad.) Nees, Fl. Fr. Afr. Austral. Ill. 3: 397. 1841. Bor, Grass. Burma Ceylon India Pakistan 507. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 216. 1989; S. Moulik, Grass. Bam. India 2: 602. 1997; Lazarides, Aust. Syst. Bot. 10: 111. 1997; Veldkamp, Blumea 47: 173. 2002; P.M. Peterson & I.S. Vega, Ann. Missouri Bot. Gard. 94: 764. 2007; P.M. Peterson & Giraldo-Cañas, J. Bot Res. Inst. Texas 2(2): 887. 2008; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 140. 2009. *Poa curvula* Schrad., Gött. Anz. Ges. Wiss. 3: 2073. 1821. **Type:—**South Africa: Cape Province, Cape of Good Hope, *Hess s.n Herb. Trinius 23271.01* [lower middle specimen], (Holotype: LE, Isotype: LE). **Fig. 60**

Eragrostis robusta Stent in Bothalia 2: 288. 1927. Type:—South Africa: Pietermaritzburg, 28 Mar. 1917, *Angus, M. 2* (Isotype: PRE00291980, image!).

Tufted perennials, 30–120 cm high, roots fibrous. ***Culms*** 20–60 cm long, errect or geniculate. ***Leaf sheaths*** 6–16 cm long, strongly striate, nerves with more prominent ridges. ***Leaf blades*** involute to fliform, 12–32 × 0.2–0.3 cm, base slightly cordate,

acuminate to attenuate at apex; margins incurved; ***ligules*** ciliate, cilia 0.4–0.5 mm long. ***Panicles*** effuse-lax, spreading, 6–30 × 5–9 cm, lower branches solitary or semi-whorled and pilose at axils. Peduncle 5–15 cm long, glabrous. ***Spikelets*** oblong, compressed, 4–10 × 1–1.5 mm, 4–13-flowered; disarticulation of florets from base upwards. Glumes deciduous, unequal. ***Lower glumes*** oblong-lanceolate, 1.5–1.8 × 0.8–1.2 mm, 1-nerved, 1-keeled, acuminate at apex. ***Upper glumes*** ovate-lanceolate, 2.2–2.6 × 0.8–1.2 mm, 1-nerved, 1-keeled, acuminate at apex. ***Lemmas*** ovate-elliptic, 2.1–2.6 × 0.1–1.5 mm, 3-nerved, lateral nerves prominent, chartaceous, acute to obtuse at apex. ***Paleas*** oblong-elliptic, 1.2–1.4 × 0.3–0.6 mm, winged, persistent, 2-nerved, keeled; keels scaberulous or smooth upwards, acute to obtuse at apex. ***Rachilla*** persistent, 0.2–0.3 mm long, glabrous. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 3; anthers 0.8–1 mm long. ***Ovary*** 0.3–0.4 mm long, globose to elliptic; style c. 0.2 mm long, slender; stigma plumose, 0.4–0.8 mm long. ***Caryopses*** elliptic to prismatic, 0.7–1 × 0.2–0.3 mm, ventrally grooved/cordate, dorso-ventrally compressed, light brown.

Flowering & Fruiting:—September–January.

Habitat & Ecology:—Densely tufted perennial in high altitudes. It is seen in association with *Arundinella leptochloa* (Steud.) Hook.f., *A. mesophylla* Nees ex Steud., *Briza maxima* L., *Chrysopogon hackelii* (Hook.f.) C.E.C. Fisch. and *Eragrostis nigra* Nees *ex* Steud.

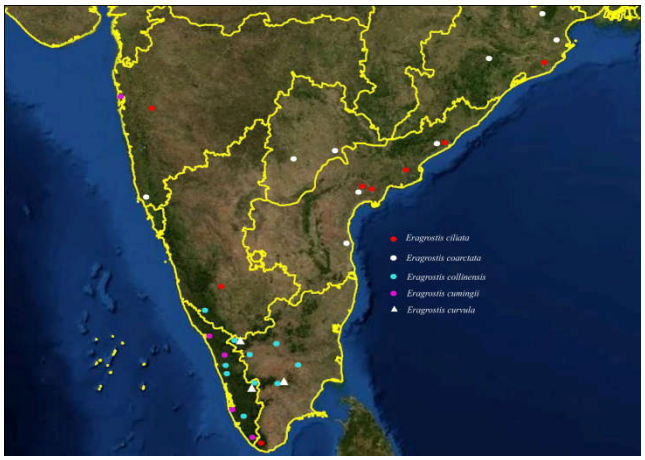


Fig. 60. Distribution of *Eragrostis ciliata* (Roxb.) Nees (●), *E. coarctata* Stapf (○), *E. collinensis* Vivek, G.V.S. Murthy & V.J. Nair (●), *E. cumingii* Steud. (●) and *E. curvula* (Schrad.) Nees (△)

Distribution:—Native to southern Africa; introduced throughout tropics. In India, it is only known from Kerala and Tamil Nadu.

Specimens examined:—India, **Kerala,** Idukki Dist.: Eravikulam, Anamudi, 22 June 1997, *S.D. Biju 35575*; *Ibid.*, 22 June 1997, *S.D. Biju 35576*; *Ibid.*, 22 June 1997, *S.D. Biju 37985* (TBGT). **Tamil Nadu,** Dindigul Dist.: Kodaikanal, 25 Oct. 1960, *K.M. Matthew 1821* (BLAT); Kodaikanal, La Providence, 25 Oct. 1960, *K.M. Matthew 1821* (RHT). Nilgiri Dist.: Naiyanad, 28 Jan. 1952, *D. Daniel Sunder Raj s.n.*; *Ibid.*, Ooty, Sheep Farm, Sept. 1956, *s.coll., s.n.* (MH). Nilgiri Dist.: Kunda, 26 July 2012, *Remya J.* & *Prasanna 73780*; *Ibid.*, 24 Mar. 2012, *Remya J.* & *Prasanna 72219* (TBGT); Muthorai Palada, 26 July 2012, *Remya J.* & *Prasanna 72803* (TBGT); Ketti, 26 July 2012, *Remya J.* & *Prasanna 72832* (TBGT).

Notes:—*E. curvula* is characterized by long flat or filiform leaves; extremely variable, dense or lax and divaricate panicles.

12. Eragrostis deccanensis Bor, Grass. Burma Ceylon India Pakistan 507. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 216. 1989; S. Moulik, Grass. Bam. India 2: 602. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 141. 2009. *Dactylis phleoides* Koenig in Herb. Rottl. Nomen; Klein *ex* Steud. Nom. Bot. (ed. 2) 1: 478. 1840. **Type:—***B. Heyne 5015* (Holotype: K000643390, image!, Isotype: CAL0000002457, image!). **Figs. 61, 62,** 74

E. phleoides Stapf *ex* Hook.f., Fl. Brit. Ind. 7: 213. 1896. *non* Hillebr. 1888. Type:—India, *Heyne s.n.* (*Wallich Cat. No. 1595*).

E. spicata Jedwabn., Bot. Archiv 5: 185. 1924. *non* Vasey 1891. Type:—Not seen.

Perennial, 23–100 cm high, roots fibrous. ***Culms*** 10–60 cm long, geniculate. ***Leaf sheaths*** 2.2–5 cm long, glabrous to sparsely tuberculate hairy, margins ciliate on one side. ***Leaf blades*** 5–15 × 0.5–0.6 cm, oblong, linear-lanceolate, base slightly cordate, sparsely villous adaxially, margins incurved, apex acute-acuminate; ***ligules*** ciliate, cilia 2–5 mm long. ***Panicles*** spiciform, compact, oblong, linear, 5–15 × 0.8–1.5 cm, racemes appressed to rachis. Peduncle 5–15 cm long, glabrous. ***Spikelets*** oblong, lanceolate,

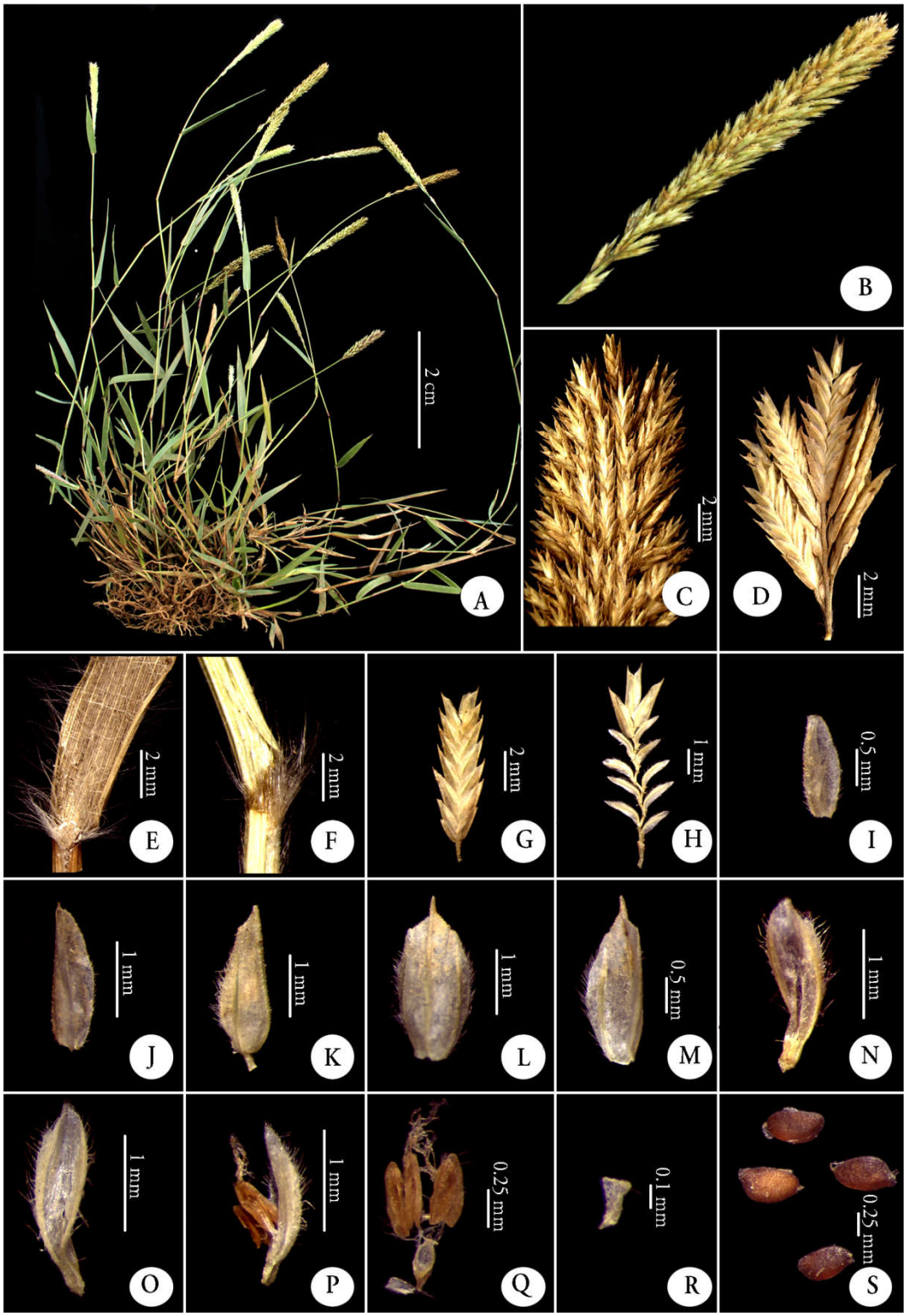


Fig. 61. ***Eragrostis deccanensis*** Bor: **A.** Habit; **B.** Panicle; **C.** Enlarged portion of panicle; **D.** Primary pedicel with spikelets; **E. & F.** Ligule; **G. & H.** Spikelets; **I.** Lower glume; **J.** Upper glume; **K.** Floret; **L. & M.** Lemma – dorsal & ventral view; **N. & O.** Palea - ventral & dorsal view; **P.** Palea with flower; **Q.** Flower; **R.** Lodicule; **S.** Caryopsis.

compressed, 4–5.5 × 1–2 mm, olive green, 5–12-flowered, densely imbricate; disarticulation of florets from above downwards. Glumes deciduous, unequal. ***Lower glumes*** oblong-lanceolate, 1.5–2 × 0.5–1 mm, 1-nerved, margins ciliate below middle, 1-keeled, keels scabrid towards apex. ***Upper glumes*** ovate-lanceolate, *c.* 2 × 0.8–1 mm, 1-nerved, 1-keeled, margins serrulate towards apex. ***Lemmas*** oblong-lanceolate, 2–3 × 1–1.5 mm, 3-nerved, minutely keeled, keels scabrid towards apex, lateral nerves prominent, deciduous, chartaceous, acute-acuminate, shortly ciliate with firm margins, apex mucronulate or cuspidate, obtuse when spread. ***Paleas*** oblong-elliptic, 1.2–1.6 × 0.3–0.4 mm, narrowly winged, caducous, 2-nerved, keeled; keels long ciliate, cilia 0.3–0.7 mm long, acute to obtuse at apex. ***Rachilla*** straight, 0.3–0.4 mm long, slightly zigzag. ***Lodicules*** 2, 0.1–0.2 mm long, dentate-triquadrate. ***Stamens*** 3; anthers 0.4–0.6 mm long, purple; filaments 0.5 mm long. ***Ovary*** 0.3–0.4 mm long, globose to elliptic; style *c.* 0.3 mm long, slender; stigma plumose, 0.4–0.8 mm long. ***Caryopses*** ovoid to elliptic, 0.4–0.9 × *c.* 0.3 mm, yellowish brown.

Fig. 62. Holotype of *Eragrostis deccanensis* Bor [*B. Heyne 5015* (K000643390)] © The Board Trustees of the Royal Botanic Gardens, Kew.

Flowering & Fruiting:—September–October

Habitat & Ecology:—The species growing in fields, maize fields, cattle farm, open areas. It is seen in association with *Digitaria ciliaris* (Retz.) Koeler., *Eragrostis amabilis* var. *amabilis* (L.) Wight & Arn., *Heliotropium marifolium* J. Koenig *ex* Retz.,

Pseudanthistiria umbellata (Hack.) Hook.f. and *Themeda tremula* (Nees *ex* Steud.) Hack.

Distribution:—This taxon is endemic to Penninsular India.

Specimens examined:—India, **Karnataka,** Banglore Dist.: *s.loc.*, Sept. 1910, *A. Meebold 11349* (CAL); *s.loc.*, 04 Nov. 1990, *Barghavan 635* (MH). Hassan Dist.: Koravangala, 29 Sept. 2015, *Thoiba K. 144182* (CALI); 10 km before Ariskere Town, Tiptur-Ariskere Road, 02 Dec. 1970, *C. Saldanha* & *T.P. Ramamoorthy HFP 1128* (JCB). **Maharashtra,** Ratnagiri Dist.: *s.loc.*, 28 October 2007, *K.V.C. Gosavi 2833* (SUK). **Tamil Nadu,** Dindigul Dist.: Sirumalai Hills, 12 Oct. 1938, *K.C. Jacob 471* (MH). Krishnagiri Dist.: Hosur Cattle Farm, 08, June 1930, *V. narayanaswamy 3027* (MH).

Notes:—*E. deccanensis* is closely similar to *E. ciliata* but differs by its compact leathery spiciform panicles, cilia of lemma margins numerous, small, and closely arranged.

13. Eragrostis gangetica (Roxb.) Steud., Syn. Pl. Glum. 1: 268. 1854; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1826. 1934; Bor, Grass. Burma Ceylon India Pakistan 508. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1854. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 216. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 380. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 211. 1994; S. Moulik, Grass. Bam. India 2: 602. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1195. 1997; Veldkamp, Blumea 47: 175. 2002; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 142. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 533. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 117. 2013. *Poa gangetica* Roxb., Fl. Ind. 1: 341. 1820. **Type:—**India, *Roxburgh s.n.* (Holotype: K, Isotype: BM000578754, image!). **Figs. 63, 64, 74**

E. stenophylla Hochst. *ex* Miq., Anal. Bot. Ind. 2: 27. 1851. Type:—India, Mangalore, *Metz 664* (Holotype: L, Isotype: G).

E. dayanandanii Ravich., Krishnan & N.P. Samson, Kew Bull. 5(1): 155. 1996. Type:––India, Tamil Nadu, Chengalpattu Dist.: 24.01.1992, *Azhakanandan, Krishnan, Ravichandran* & *Samson 235* (Holotype: MH!, Isotypes: K, Madras Christian College Herbarium, Chennai).

Tufted annuals, 20–80 cm high, roots fibrous. ***Culms*** 10–60 cm long, nodes glabrous, brownish. ***Leaf sheaths*** 3–10 cm long, inrolled to the culm, slightly keeled. ***Leaf blades*** linear-lanceolate, 6–25 × 0.3–0.4 cm, base shallowly cordate, apex acute-acuminate; surfaces glabrous; margins entire and eglandular; ***ligules*** membranous, a ciliate rim, cilia 1–2 mm long. ***Panicles*** open, lax, ovate, 6–30 × 3–8 cm, branches alternate; peduncle 5–15 cm long, glabrous, eglandular; primary pedicel 0.5–5cm long, glabrous; secondary pedicel 0.5–2 cm long. ***Spikelets*** lanceolate, 3–8 × 1–1.3 cm, 5–20-flowered, disarticulation of florets from below upwards. Glumes deciduous, almost equal. ***Lower glumes*** lanceolate, 0.75–1 × 0.3–0.5 mm, 1-nerved, 1-keeled. ***Upper glumes*** lanceolate, 1–1.3 × 0.3–0.5 mm, 1-nerved, 1-keeled, keels scabrid. ***Lemmas*** 1–1.25 × 0.75–1 mm, ovate-lanceolate, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex acute or obtuse, slate grey in colour. ***Paleas*** elliptic-lanceolate, 1–1.2 × 0.5–0.8 mm, winged, deciduous or not, 2-nerved, keels scabrid, acute-oblong at apex. ***Rachilla*** persistent, zigzag, c. 0.5 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 2; anthers 0.3–0.5 mm long, purple. ***Ovary*** 0.2–0.4 mm long, globose; style *c.* 0.3 mm long, slender; stigma plumose, 0.2–0.4 mm long. ***Caryopses*** ovate to elliptic, 0.3–0.5 × 0.3–0.4 mm, deep brown.

Flowering & Fruiting: —Almost throughout the year.

Habitat & Ecology:—The species growing in cultivated fields, open areas, road sides, sandy soiles, and waste places. It is seen in association with *Ammania multiflora* Roxb.*, E. amabilis* var. *amabilis* (L.) Wight & Arn.*, E. atrovirens* (Desf.) Trin. ex Steud.*,*

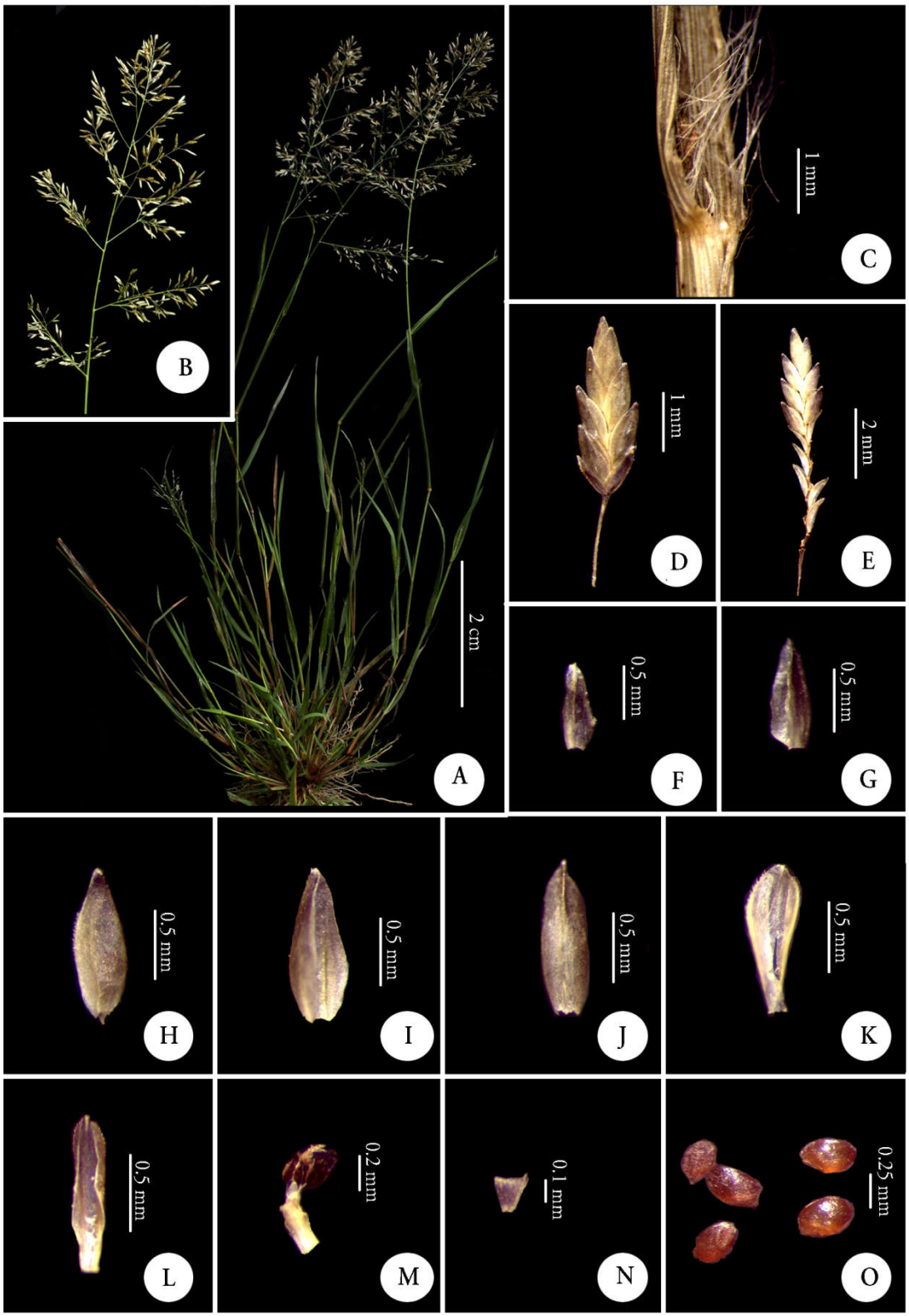


Fig. 63. ***Eragrostis gangetica*** (Roxb.) Steud.: **A.** Habit; **B.** Panicle; **C.** Ligule; **D. & E.** Spikelet; **F.** Lower glume; **G.** Upper glume; **H.** Floret; **I. & J.** Lemma - lateral & dorsal view; **K.** Palea – dorsal & ventral view; **L.** Palea with flower; **M.** Stamens & pistil; **N.** Lodicule; **O.** Caryopsis.

E. nutans (Retz.) Nees ex Steud., *E. pilosa* (L.) P. Beauv., *Lindernia crustacea* (L.) F.Muell., *Mollugo pentaphylla* L., *Oldenlandia corymbosa* L., *Rotala densiflora* (Roth *ex* Roem. & Schult.) Koehne and *Rotala occultiflora* Koehne.

Distribution:—North and South America, Africa and Tropical Asia.

Fig. 64. Isotype of *Eragrostis gangetica* (Roxb.) Steud. [*Roxburgh s.n.* (BM000578754)] © The Board Trustees of the British Museum of Natural History, London.

Specimens examined:—India, **Andhra Pradesh,** East Godaveri Dist.: Anigeri, 25 Sept. 1980, *G.V. Subba Rao 68552* (MH). Srikakulam Dist.: Naupada, Jan. 1890, *G.S. Gamble 21610* (BLAT). **Karnataka,** Dekshina Kannada Dist.: Kadaba, 17 Nov. 2013, *Thoiba K. 138002* (CALI); Hassan Dist.: Belur, 13 Sept. 2014, *Thoiba K. 137515*; *Ibid.,* 13 Sept. 2014, *Thoiba K. 137517* (CALI); Nagpuri, 03 Sept. 1970, *F.M. Jarrett, C. Saldanha* & *T.P. Ramamoorthy s.n.* (JCB). Raichur Dist.: Derdurga, Jalhalli R.R., 14 Nov. 1975, *N.P. Singh 141714* (BSI). Shimoga Dist.: Kundadri, 08 Sept. 2015, *Thoiba K. 144155* (CALI); Asarmuke, Sambankattae, 09 Sept. 2015, *Thoiba K. 144150*; *Ibid.,* 09 Sept. 2015, *Thoiba K. 144157* (CALI). **Kerala,** Alappuzha Dist.: Kalavoor, *s.die*, *Sunil C.N. 1457* (CALI); Kumarakam, 17 June 1980, *P.V. Sreekumar 67607* (MH). Kasargod Dist.: Mugu, 23 Dec. 2014, *Thoiba K.* & *K.M. Lemiya 144107* (CALI); *s.loc.*, 02 Oct. 1982, *R. Ansari 74440* (CAL, MH); Cheruvathur, 26 Sept. 1982, *R. Ansari 74308* (MH). Kozhikode Dist.: Malabar Wildlife Sanctuary, Kakkayam, 19 Sept. 2013, *Thoiba K.134446* (CALI). Malappuram Dist.: Bharathapuzha River Basin, 19 Oct. 2013, *Thoiba K. 134473* (CALI); Calicut University, 21 Jan. 1971, *V.V. Sivarajan 925*; *Ibid.,* 04 Oct. 1970, *V.V. Sivarajan 541* (CALI); Near Main Gate of Botanic

Garden, 25 Aug. 2000, *Jayasree, S. 74305*(CALI); Nilambur, 16 Aug. 2011, *Remya J. 67158* (TBGT); CU Campus, 16 Aug. 2011, *Remya J. 67166* (TBGT). Palakkad Dist.: Kunthipuzha River Basin, Mannarkkad, 06 Nov. 2013, *Thoiba K. 134489* (CALI); Nelliyampathy, Kaeshavan Para, 07 Nov. 2013, *Thoiba K. 134491* (CALI); s.*loc*., 20 July 1964, *K.M. Sebastine 20839* (CAL); Water tank hillock, 30 June 1964, *E. vajravelu 19126* (MH). Thrissur Dist.: Parambikulam Tiger Reserve, Vengoli Hills, 25 Sept. 2013, *Thoiba K. 134466* (CALI); Kariyamchola, 27 Sept. 2013, *Thoiba K. 134448* (CALI); Kodungallur, MES Asmabi College Ground, 08 August 2015, *Thoiba K. 144140* (CALI); Vellanikara, 17 Aug. 1980, *P.V. Sreekumar 67742* (MH). **Maharashtra,** Chandrapur Dist.: Hirdinale, 12 Mar. 1971, *B.M. Wadhwa 133944* (BSI). Mumbai Suburban Dist.: Malad, Quarry Hills-Main Road, 25 Sept. 1954, *G. L. Shah Shah 736*; *Ibid*., 26 Sept. 1954, *G. L. Shah Shah 762A* (BLAT). Nagpur Dist.: Bhidae Tank, 13 Nov. 1957, *K. Subramanyam 4551* (MH). Satara Dist.: Pusegaon, 30 Sept. 1992, *C.B. Salunkhe 7206* (SUK). Pune Dist.: Mutha River side, 18 Dec. 1956, *V.D. Vartak 7778* (AHMA); Narayangaon Bund site, Junnar, 14 Oct. 1965, *K. Hemadri 107094*; *Ibid*., 14 Oct. 1965, *K. Hemadri 107097* (BSI); Lonavala, Bhoma Hill, 11 Nov. 1956, *S.K. Jain 8937* (BSI). **Tamil Nadu,** Chengalpettu Dist.: Vedanthangal, Foot Hills of Pasamur, 10 Aug. 1995, *P. Ravichandran* & *N.P. Samson 505* (MH). Dharmapuri Dist.: Denkanikotta, 17 Dec. 1978, *K.M. Matthew* & *V. Venugopal 20344*; *Ibid*., 17 Dec. 1978, *K.M. Matthew* & *V. Venugopal 20371* (RHT). Salem Dist.: Namakkal, Solakkadu, Thennipparuthai, 15 Oct. 1977, *K.M. Matthew* & *V. Karunanidhi 9637* (RHT); Sankagiri, 08 Dec. 1978, *K.M. Matthew 19836* (RHT); Attur, 20 Feb. 1979, *T.S. Jayaseelan 21904* (RHT). Thiruchirapalli Dist.: Trichy, 24 Jan. 2014, *Thoiba K. 138071* (CALI); Srirangam Isl, 03 Dec. 1975, *K.M. Matthew 172*; *Ibid.,* 03 Dec. 1975, *K.M. Matthew 186* (RHT); Lalgudi, Cauvery bank, 17 Nov. 1958, *K.M. Matthew, C. Manoharan* & *S. Alanolu 19177* (RHT); Thuraiyur, Pachai hills, 23 Jan. 1980, *K.M. Matthew 25980* (RHT). Thiruvannamalai Dist.: MG Nager Road, Ponganur, 18 Jan. 2016, *Thoiba K.* & *K.M. Lemiya 146690*

(CALI). Viluppuram Dist.: Ulundurpettai, Pulloorkkadu, 11 Dec. 1979, *K.M. Matthew 24999* (RHT). **Telangana,** Khammam Dist.: Ballepalli, 04 Dec. 1917, *s.coll. 15413* (MH).

Notes:—*E. gangetica* shows close morphological similarity with *E. atrovirens* and *E. nutans.* But it is normally smaller and its palea ultimately disarticulates. It was treated by Stapf as *E. stenophylla* which matches the type of *Poa gangetica* housed at BM, but the epithet *'gangetica'* has priority. Vivek *et al.* (2015b) considered *E. dayanandanii* as conspecific with *E. gangetica,* which is in corroboration with our observation.

14. Eragrostis henryi Vivek, G.V.S. Murthy & V.J. Nair, Nelumbo 54: 10. 2012.
Type:—India, Tamil Nadu, Kanyakumari Dist.: near Anjugramam, 27.03.1979, *A.N. Henry 6156* (Holotype: CAL!, Isotypes: MH!). **Figs. 65, 66,** 74

Tufted annuals or short lived perennial; 10–30 cm high, roots fibrous. ***Culms*** 10–20 cm long, nodes glabrous with a glandular circle below each node; internodes 2.5–4.5 cm long. ***Leaf sheaths*** 2–5 cm long, glabrous, rolled to the culm. ***Leaf blades*** 3–4 × 0.3–0.4 cm, linear-lanceolate, base slightly subcordate, apex acute-acuminate; surface glabrous or scabridulose, glandular dots along the midrib, sparsely hairy on both sides; margins scabrid and glandular; ***ligules*** ciliate, a fringe of cilia 2–3 mm long. ***Panicles*** ovate, open, 5–13 × 3–2 cm long; primary branches alternate, stiff with prominent cateriform glands, 5–10 cm long. Peduncle 2–4 cm long, smooth or minutely scabrid; primary pedicel 0.5–0.8 cm long, gland dotted, glabrous or minutely scabridulose; secondary pedicel 0.2–0.4 cm long and gland dotted. ***Spikelets*** ovate-lanceolate, 5–25 × 1.5–2 mm long, 5–55-flowered, olive green, long linear to curved at maturity; disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** lanceolate, 0.8–1 × 0.3–0.5 mm, 1-nerved, 1-keeled, keels scabridulose. ***Upper glumes*** lanceolate, 1–1.3 × 0.3–0.5 mm, 1-nerved, 1-keeled, keels scabridulose, acute at apex. ***Lemmas*** elliptic-narrowly ovate, 1.5–2 × 0.7–1 mm, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex acute to obtuse, gland dotted. ***Paleas*** elliptic-

Fig. 65. ***Eragrostis henryi*** Vivek, G.V.S. Murthy & V.J. Nair: **A.** Panicle; **B.** Ligule; **C. & E.** Spikelet; **D.** Enlarged portion of leaf sheath; **F.** Lower glume; **G.** Upper glume; **H.** Floret; **I.** Lemma; **J.** Palea; **K.** Palea with flower; **L.** Caryopsis.

oblanceolate, 1.5–2 × 0.5–0.8 mm, winged, persistant or not, 2-nerved, keels scabrid above the lower half, acute-oblong at apex. ***Rachilla*** zigzag, 0.5–0.7 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-truncate. ***Stamens*** 3; anthers 0.3–0.4 mm long, white to pink. ***Ovary*** *c.* 0.2 mm long, globose; style *c.* 0.4 mm long, slender; stigma plumose, 0.3–0.4 mm long. ***Caryopses*** ovate, 0.5–0.6 × 0.3–0.4 mm, laterally flattened ventrally grooved, yellowish brown.

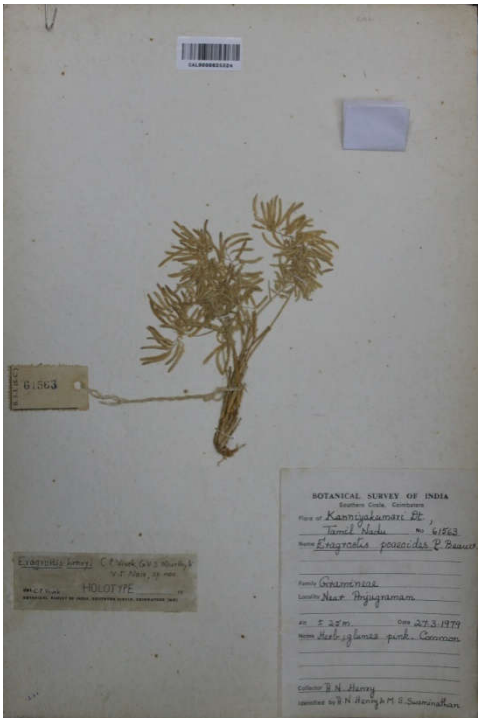


Fig. 66. Holotype of *Eragrostis henryi* Vivek, G.V.S. Murthy & V.J. Nair [*A.N. Henry 6156* (CAL0000025524)] © Botanical Survey of India, Kolkata.

Flowering & Fruiting:—September–March.

Habitat & Ecology:—This species is found open areas, road sides, sidewalks, sandy soils, and waste places at an altitude of 20–150 m. It is seen in association with *Eragrostis amabilis* var. *amabilis* (L.) Wight & Arn.*, E. minor* Host, *Eragrostiella bifaria* (Vahl) Bor*, Lantana camera* L., *Leucas nepetifolia* Benth.*, Plectranthus malabaricus* (Benth.) R.H. Willemse and *Prosopis juliflora* (Sw.) DC.

Distribution:—Endemic to South India, Tamil Nadu.

Specimens examined:—India, **Karnataka,** Mysore Dist.: Chammundi Hills, 30 Sept. 2015, *Thoiba K. 144191* (CALI). **Tamil Nadu,** Kanyakumari Dist.: near Anjugramam, 27 Mar. 1979, *A.N. Henry 6156* (CAL, MH); Nagercoil, Maruthwamala, 09 Aug. 2014, *Thoiba K.* & *Mohammed Yoonus. 138089*; *Ibid.*, 30 Oct. 2015, *Thoiba K.* & *Mohammed Yoonus. 146666* (CALI); Anjugramam, 30 Oct. 2015, *Thoiba K.* & *Mohammed Yoonus. 146673* (CALI).

Notes:—*E. henryi* closely resembles with *E. minor* by having prominent crateriform glands on pedicels and panicle branches, but is distinctively differs by spikelets with upto 55 florets, caryopsis laterally flattened to grooved and yellowish green with truncate base.

15. Eragrostis japonica (Thunb.) Trin., Mém. Acad. Imp. Sci. St.-Pétersbourg Ser. 6, Sci. Math. 1: 405. 1831; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1826. 1934; Bor, Grass. Burma Ceylon India Pakistan 509. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1855. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 216. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 382. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 212. 1994; S. Moulik, Grass. Bam. India 2: 603. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1195. 1997; Veldkamp, Blumea 47: 176. 2002; P.M. Peterson & I.S. Vega, Ann. Missouri Bot. Gard. 94: 766. 2007; P.M. Peterson & Giraldo-Cañas, J. Bot Res. Inst. Texas 2(2): 891. 2008; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 142. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 533. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 117. 2013. *Poa japonica* Thunb.,Fl. Jap.: 51. 1784. *Eragrostis tenuissima* Schrad. *ex* Nees, *nom. superfl.* Fl. Afr. Austr. 409: 1841. *Eragrostis intterrupta* var. *tenuissima* (Schrad. ex Nees) Stapf in Hook.f., Fl. Brit. Ind. 7: 316. 1896. **Type:—** Japan, *Herb. Thunberg 2252* (Holotype: UPS, fragm. in BRI, photo K, Isotype: LD, Acc. No. 1288607, image!). **Figs. 67–69, 74**

Poa tenella R.Br., *s.l.* Prodr. 181. 1810., non L. 1753. *Poa tenellula* Kunth, Rev. Gram. 1: 113. 1829.*Eragrostis tenellula* (Kunth) Steud., Syn. Pl. Glum. 1. 279. 1854. Type:—*R. Brown 6269* (Holotype: BM, K, photo fragm. in BRI).

Poa diarrhena Schult. & Schult.f., Mant. 2: 616. 1827. *Eragrostis diarrhena* (Schult. & Schult.f.) Steud., Syn. Pl. Glumac. 1: 266. 1854. Type:—Herb. *Roxburgh s.n.* (Holotype: BM, Isotypes: CAL, K000245081, image!, fragm. in BRI).

Fig. 67. ***Eragrostis japonica*** (Thunb.) Trin.: **A.** Habit; **B., C. & D.** Enlarged portion of panicle; **E.** Ligule; **F.** Spikelet; **G.** Glumes; **H.** Floret; **I.** Lemma; **J.** Palea; **K.** Stamen; **L.** Pistil; **M.** Caryopsis.

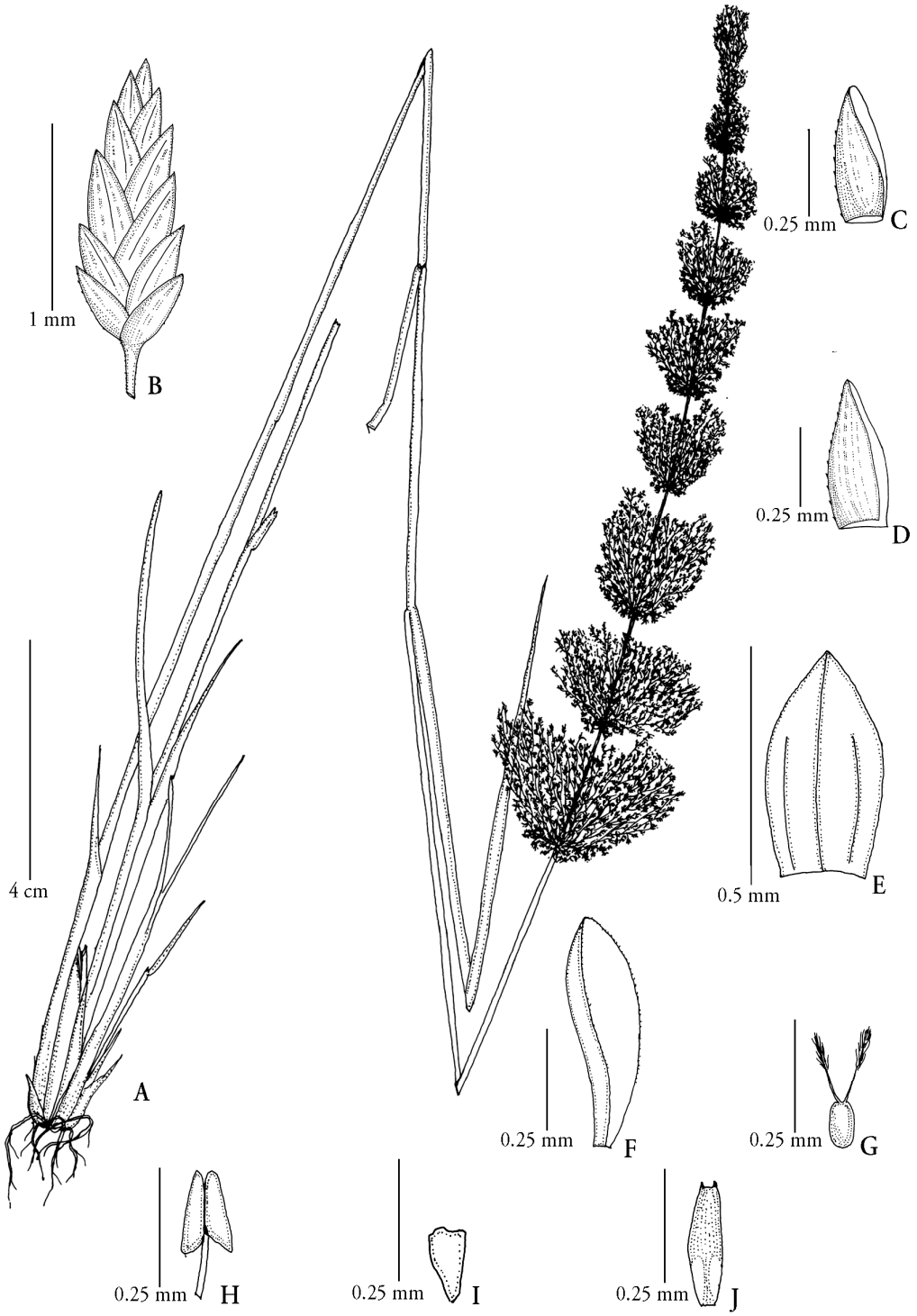


Fig. 68. ***Eragrostis japonica*** (Thunb.) Trin.: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Pistil; **H.** Stamen; **I.** Lodicule; **J.** Caryopsis.

Eragrostis diplachnoides Steud., Syn. Pl. Glumac. 1: 268. 1854. Type:—Africa: Sudan, *Kotschy 346* (Holotype: UPS, Isotype: K, L).

Tufted annuals or perennials, 40–120 cm high, roots fibrous. ***Culms*** 10–80 cm long, nodes glabrous, internodes 3–20 cm long. ***Leaf sheaths*** 10–20 cm long, inrolled to the culm, slightly keeled. ***Leaf blades*** 10–30 × 0.5–0.9 cm, linear-lanceolate, base shallowly cordate, apex acute-acuminate; surfaces glandular; margins entire and eglandular; ***ligules*** membranous. ***Panicles*** contracted to open, oblong, 10–65 × 1.5–5 cm, branches whorled or sub verticillate, at times alternate, lower most branches 2–4.5 cm; peduncle 6–27 cm long, glabrous, eglandular; rachis 3–10 cm long, glabrous; primary pedicel 2–13 mm long, glabrous; secondary pedicel 1–4 mm long, scaberulose. ***Spikelets*** ovate-lanceolate, 2–4.5 × 1–2 mm, 4–13-flowered, olive green or purple tinged in colour, disarticulation of florets from above downwards. Glumes deciduous, almost equal. ***Lower glumes*** lanceolate, 1–1.6 × 0.3–0.5 mm, 1-nerved, 1-keeled. ***Upper glumes*** lanceolate, 1–1.5 × 0.4–1 mm, 1-nerved, 1-keeled. ***Lemmas*** ovate-acute, 1–1.5 × 0.6–1 mm, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex acute to acuminte. ***Paleas*** ovate-elliptic, 1–1.5 × 0.4–0.6 mm, winged, deciduous or not, 2-nerved, keels scabrid, acute-oblong at apex. ***Rachilla*** fragile, 0.1–0.2 mm long, glabrous. ***Lodicules*** 2, *c.* 0.1 mm long, dentate. ***Stamens*** 2; anthers 0.6–0.8 mm long, white. ***Ovary*** 0.3–0.4 mm long, globose; style 0.3–0.5 mm long, slender; stigma plumose, 0.4–0.5 mm long. ***Caryopses*** obovoid, 0.2–0.25 × 0.1–0.2 mm, light brown.

Flowering & Fruiting:—Almost throughout the year

Habitat & Ecology:—Usually found growing along banks of rivers, field bunds, open water logged areas and stream sides. It is seen in association with *Ammania baccifera* L., *Cyperus digitatus* Roxb., *Eragrostis atrovirens* (Desf.) Trin. *ex* Steud., *E. gangetica* (Roxb.) Steud., *E. nutans* (Retz.) Nees *ex* steud., *E. pilosa* (L.) P. Beauv., *Lindernia antipoda* (L.) Alston, *Panicum repens* L., *Rotala macrandra* Koehne, *Rotula aquatica* Lour., *Saccharum officinarum* L. and *Torenia fournieri* Linden *ex* E.Fourn.

Distribution:—Tropical and subtropical Asia, Africa and Australia. In India, it was reported from all states.

Fig. 69. Holotype of *Eragrostis japonica* (Thunb.) Trin. [*Herb. Thunberg 2252* (LD1288607)] © Lund University, Sweden.

Specimens examined:—India, **Andhra Pradesh,** Kurnool Dist.: Velugode, *s.die.*, *S.K. Wagh 4890* (BLAT); Gazalapalle, 12 Dec. 1963, *J.L. Ellis 18074* (MH). **Goa,** North Goa Dist.: Querim, 16 Oct. 1996, *M.K. Janarthanam, Vaishali C. Joshi* & *S. Rajkumar 228* (Goa University Herbarium). Taleigão, Goa University Campus, 18 Oct. 1997, *Vaishali C. Joshi* & *S. Rajkumar 1128* (Goa University Herbarium); Ghodemal, Quepem, 15 Nov. 2005, *Harshala Gad 314* (Goa University Herbarium). **Gujarat,** Navsari Dist.: Unai, 30 May 1953, *H. Santapau 17007* (BLAT). **Karnataka,** Belgaum Dist.: *s. loc.*, 23 Feb. 2008, *Arun N. Chandore 602* (SUK). Bellary Dist.: Bellary–Hospet Road, 14 Jan. 1976, *N.P. Singh 142457* (BSI). Belgaum Dist.: On way Belgaum to Kolhapur, 24 Nov. 1962, *S.S. Rolla 85084* (BSI). Chitradurga Dist.: Harihar-Marpanhalli Road, 30 Dec. 1975, *N.P. Singh 141873* (BSI). Mysore Dist.: Nanjangod, 03 Feb. 1979, *K.P. Sreenath* & *P. Prakash 5698* (JCB). **Kerala,** Alappuzha Dist.: Sharanga Kavu, Venmony, *s. die*, *Sunil C.N. 1825* (CALI). Kannur Dist.: Tirunelli, 08 May 1979, *V.S. Ramachandran 62719* (MH). Kollam Dist.: Shendurney River Valley, 01 June 1964, *K.N. Subramanian 1511* (FRC). Kozhikode Dist.: Feroke, 30 Mar. 1971, *V.V. Sivarajan 1049* (CALI). Malappuram Dist.: Thalappara, 15 Jan. 2013, *Thoiba K. 134406* (CALI); Kooriyad,

08 Feb. 2013, *Thoiba K. 134414* (CALI); Bharathapuzha River Basin, 19 Oct. 2013, *ThoibaK. 134475* (CALI); Angadipuram, 10 Nov. 2015, *Thoiba K.* & *A.K. Pradeep 146696* (CALI). Palakkad Dist.: Kunthipuzha River Basin, Mannarkkad, 06 Nov. 2013, *Thoiba K. 134496* (CALI); Pattambi, Bharathapuzha River Basin, 22 Jan. 2013, *Thoiba K. 138045* (CALI); Teak Research Plantation Plot, Walayar, 22 Dec. 1973, *K.N. Subramanian 4685* (FRC); Thannimoodu, Mukkali, 27 Jan. 1980, *P. Bhargavan 65724* (MH); Vadakkancheri, 27 Dec. 1919, *s.coll. 16332* (MH); Mukkali, 06 Nov. 2012, *Remya J.* & *Prasanna 72273* (TBGT); *s.loc.*, 21 Dec. 1916, *s.coll. 14218* (MH). Thrissur Dist.: Chalakkudy, Athirapilly, 20 Apr. 2013, *A. K. Pradeep* & *Thoiba K. 134422* (CALI); Chalakudy River Sides, 22 Mar. 1980, *K. Ramamurthy 66289* (MH); *s.loc.*, 05 Oct. 2014, *Thoiba K. 144118* (CALI). Wayanad Dist.: Kalloor, 05 Dec. 2016, *Shimi Cheriyan* & *Thoiba K. 146763* (CALI). **Maharashtra,** Akola Dist.: Kashmar, 28 Feb. 1978, *S.Y. Kamble 152922* (BSI). Buldhana Dist.: Taradi Forest, 22. Dec. 1982, *P.G. Diwaker 164787* (BSI). Chandrapur Dist.: Ramdigi, Narvegaon, 19. Oct. 1972, *B.M. Wadhwa 130220* (BSI). Jalgaon Dist.: Parola, 11 Jan. 1962, *N.Y. Das 5536* (BLAT). Nandurbar Dist.: Ashta, 05 Jan. 1957, *S.D. Mahajan 11009* (BSI). Pune Dist.: Junnar, Khireshwar, Dec. 2006, *S.S. Rahangdale s.n.* (AHMA); Sinhagad, Khamgaon, 12 Dec. 1956, *V.D. Vartak 7646* (AHMA); Katraj, 29 Aug. 1958, *V.D. Vartak 13613* (AHMA); Donaje, 02 Dec. 1964, *M.Y. Ansari 101942* (BSI); Bhovargiri, Khed Taluk, 22. Feb. 1961, *K.P. Janardhanan 69119* (BSI); Satara–Pune Road, 11 Oct. 1963, *A.S.Rao 71759* (BSI); Shivaji–Lonavle, 10 Apr. 1964, *B. Venkata Reddi 96160* (BSI); Mula River at Nandgaon, Ambawane, 01 Feb. 1964, *B. Venkata Reddi 95901* (BSI). Raigad Dist.: Chowk, 02 Sept. 1990, *C.B. Salunkhe 8195* (SUK). Sangli Dist.: Kundali River bank, 22 Jan. 1925, *E. Blatter s.n.* (BLAT); Kundali River Beds, 27 Jan. 1961, *K.P. Janardhanan 70287* (BSI). Satara Dist.: Shivanagar, 05 October 1989, *C.B. Salunkhe 8036* (SUK); Pusegaon, 30 Mar. 1992, *C.B. Salunkhe 7113* (SUK). Sindhudurg Dist.: Vengurla, 10 Oct. 1993, *C.B. Salunkhe 8009* (SUK). Washim Dist.: Adan River, Kharad, 16 Feb. 1977, *S. Karthikeyan 149065* (BSI). *s.loc.*,

22 Dec. 1960, *K.P. Janardhanam 70047* (CAL). **Tamil Nadu,** Coimbatore Dist.: Velliangiri Hills, 26 Apr. 1957, *K.M. Sebastine 3110* (CAL). Cuddalore Dist.: Chidambaram, 03 Apr. 1978, *K.M. Matthew 12695*; *Ibid.,* 03 Apr. 1978, *K.M. Matthew 12710* (RHT). Dharmapuri Dist.: Hogenakkal, 10 Feb. 1976, *K.M. Rajendran* & *C. Rajamani 1088* (RHT). Krishnagiri Dist.: Denkanikottai, 17 Dec. 1978, *K.M. Matthew* & *V. Venugopal 20397*; *Ibid.,* 17 Dec. 1978, *K.M. Matthew* & *V. Venugopal 20922* (RHT). Ramanathapuram Dist.: Mudukulathur, 21 Feb. 1988, *V. Balasubramaniam 1587* (CAL). Sivaganga Dist.: Somathur, 23 Dec. 1989, *V. Balasubramaniam 2300* (CAL). Thiruchirappalli Dist.: Thuvarankurichi, 14 Dec. 1967, *K.M. Matthew 8280* (RHT); Lalgudi, 07 Mar. 1968, *K.M. Matthew 8587*; *Ibid.,*19 Feb. 1980, *Periyanayagam* & *Diravialoss 26546* (RHT); Thiruvalar Solai, 05 Feb. 1977, *K.M. Matthew 6615* (RHT); Srirangam Isl, 14 Feb. 1978, *Rajendran* & *Diraviam 11841*; *Ibid.,* 21 Feb. 1978, *Perianayagam 12036* (RHT); Kilikoodu, *s.die.*, *Rajendran* & *Diraviam 12133* (RHT); Mukkombu, 28 Dec. 1976, *K.M. Matthew 5663* (RHT); Thuraiyur, 30 Nov. 1978, *C. Manoharan 19563* (RHT); Srirangam, 06 Apr. 1984, *K.M. Matthew* & *S.J. Britto 30056* (RHT). Tirunelveli Dist.: Kanyakumari-Tirunelveli National Highway, 30 Oct. 2015, *Thoiba K.146675* (CALI); MS University Campus, 23 Mar. 2011, *Remya J.* & *Prasanna 67115* (TBGT); Kodanad View Point, 08 Nov. 2012, *Remya J.* & *Prasanna 75455* (TBGT). Thiruvallur Dist.: 29 Jan. 2000, *K.M. Matthew* & *J. Jayanthi 70899* (RHT). Thiruvannamalai Dist.: Javadi hills, Veerappanur, 04 Jan. 2002, *K.M. Matthew 73695* (RHT). Villupuram Dist.: *s.loc.*, 20 Feb. 1979, *K. Ramamurthy 60357* (CAL); *s.loc.*, 10 Feb. 1901, *s.coll. 2694* (FRC).

Notes:—This is is an extremely polymorphic species. In 1982, Thomas A. Cope synonymised *E. diarrhena* and *E. diplachnoides* under *E. japonica* based on the intergrading diagnostic characters. This species is distinct from other species by virtue of its whorled or sub-digitate panicles and oblong inflorescences, sometimes the lowest branch is whorled, sub-verticillate or with longest racemes. But, the diagnostic

characters are equal in three species, except some numerical variations and also some variations based on the maturity of spikelets. While, Bor (1960) treated them as distinct species based on the inflorescence branching. From field observations, I noticed that three types are growing together or not.

16. Eragrostis macilenta (A.Rich.) Steud., Syn. Pl. Glumac. 1: 268. 1854; Bor, Grass. Burma Ceylon India Pakistan 495. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; S. Moulik, Grass. Bam. India 2: 604. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 143. 2009. *Poa macilenta* A. Rich., Tent. Fl. Abyss. 2: 428.1850. **Type:—**Ethiopia, Quartin-Dillon *et* Petit, Abyssinie, Trigre, Adua (Holotype: P00484394, image!, Isotype: LE). **Figs. 70, 71, 74**

Tufted annuals. 30–70 cm high. ***Culms*** 20–60 cm long, erect or ascending geniculatey, nodes glabrous. ***Leaf sheaths*** 3–9 cm long, glabrous to sparsely pilose along margins and apex, bearded at mouth. ***Leaf blades*** linear-lanceolate, 6–20 × 0.2–0.4 cm, flaccid, base nerves prominent, scabrid, margins glabrous or scabridulose, apex attenuate; surface scabrous adaxially and glabrous, sometimes sparsely pilose abaxially; ***ligules*** minutely membranous, 2–3.5 mm long fimbriate hairs. ***Panicles*** open, effuse-lax, drooping, leaden green or blackish, 10–35 × 6–12 cm, branches alternate or opposite; peduncle, glabrous, 5–12 cm long; rachis angular, 0.5–4 cm long; primary pedicel 0.4–2.5 cm long, capillary, base ciliate or not; secondary pedicel longer than primary pedicel, 1–3.5 cm long, angular, scabridulose. ***Spikelets*** pedicelled, oblong, 3–6 × 1–1.5 mm, acute, greenish, 4–12-flowered; disarticulation of florets above downwards. Glumes caducous, unequal. ***Lower glumes*** ovate-lanceolate, 1.3–1.8 × 0.3–0.5 mm, 1-nerved, 1-keeled, keels scabrid, apex acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 1.5–2.2 × 0.4–0.5 mm, 1-nerved, 1-keeled, chartaceous, acute to acuminate at apex. ***Lemmas*** ovate to oblong, 1.25–2 × 0.5–1 mm, hyaline, 3-nerved, lateral nerves obscure, 1-keeled, keels smooth or scabridulose, acuminate at apex. ***Paleas*** obtuse, 1.5–2.2 × 0.4–0.5 mm, winged, caducous, 2-nerved, keeled, keels ciliolate above the half,

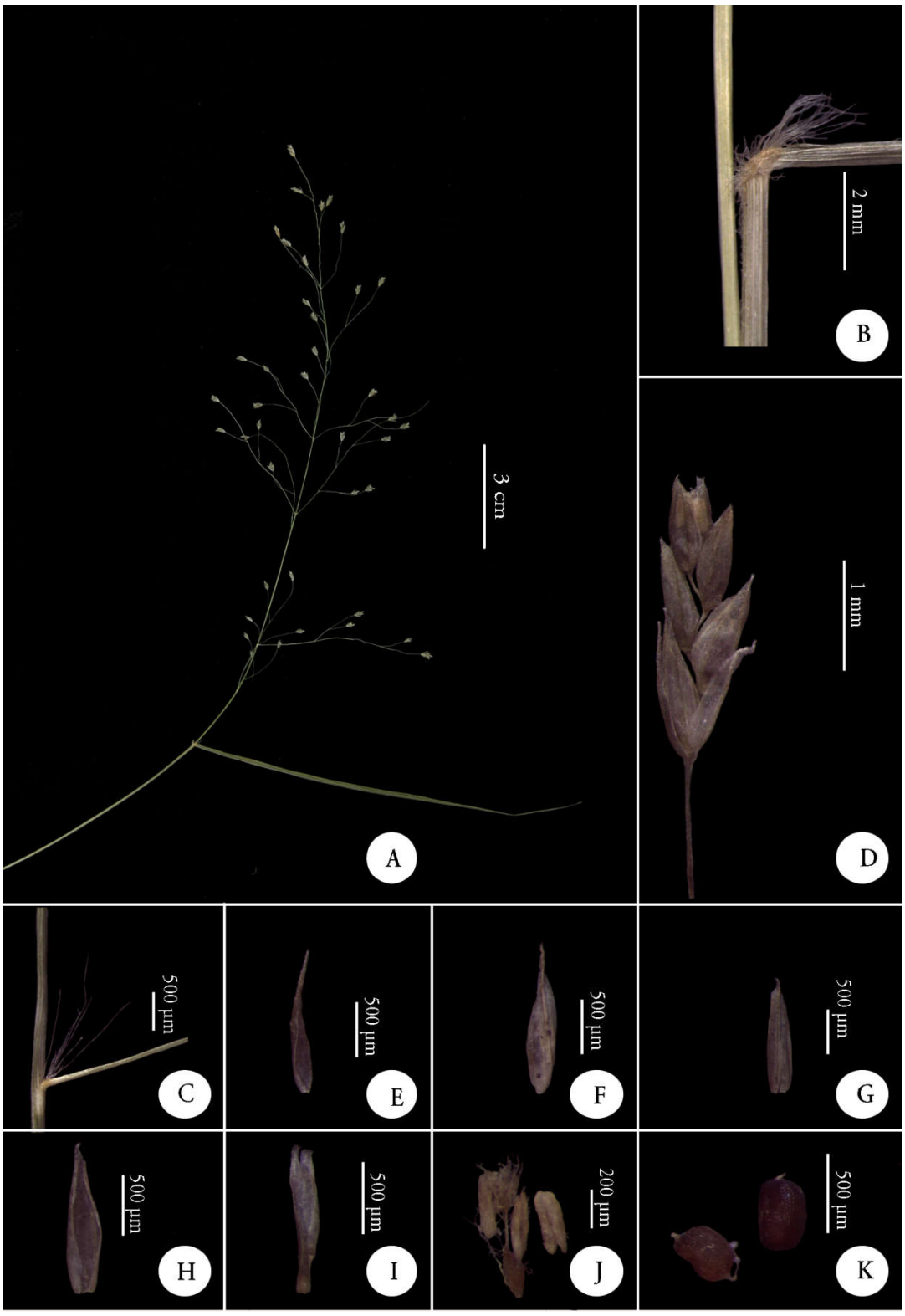


Fig. 70. ***Eragrostis macilenta*** (A. Rich.) Steud.: **A.** Panicle; **B.** Ligule; **C.** Axis of primary pedicel; **D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Lemma; **H.** Palea; **I.** Palea with flower; **J.** Stamens & pistil; **K.** Caryopsis.

emarginated at apex. ***Rachilla*** 0.8–1.2 mm, glabrous and slightly zigzag, caducous. ***Lodicules*** 2, obovate, 0.2–0.3 mm, dentate. ***Stamens*** 3; anthers 0.4–0.8 mm long, greenish to yellowish purple; filaments 0.2–0.4 mm, hyaline. ***Ovary*** ovate-elliptic, 0.3–0.4 × 0.1 mm, globose; style 0.3–0.4 mm, hyaline, delicate; stigma plumose, 0.4–0.7 mm long. ***Caryopses*** oblong, 0.3–0.5 × 0.2–0.3, ventrally grooved, dark brown.

Fig. 71. Holotype of *Eragrostis macilenta* (A.Rich.) Steud.[*s.coll.* (P00484394)] © The Board Trustees of the National Museum of Natural History, France.

Flowering & Fruiting:—February–August

Habitat & Ecology:—The species is found growing in open areas, sidewalks, roadsides especially in high altitudes. It is seen in association with *Eragrostis atrovirens* (Desf.) Trin. *ex* Steud., *E. nigra* Nees *ex* Steud., *Hypericum mysurense* Wall. *ex* Wight & Arn., and *Tripogon bromoides* Roth *ex* Roem. & Schult.

Distribution:—East Africa. In India, it was reported from Tamil Nadu and Andhra Pradesh.

Specimens examined:—**Tamil Nadu,** Nilgiri Dist.: Udagamandalam, Ootty, 01 June 2014, *Thoiba K. 138080*; *Ibid.*, 20 June 2015, *Thoiba K. 146786* (CALI).

Notes:—*E. macilenta* shows close similarity with *E. nigra*, but it differs in having drooping, dark leaden-grey panicles and spikelets being seated on long pedicels with filiform branches; florets with smaller lemmas.

17. Eragrostis maderaspatana Bor, Grass. Burma Ceylon India Pakistan 509. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; S. Moulik, Grass. Bam. India 2: 604. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1196. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 144. 2009. **Lectotype** (designated by Vivek *et al.,* 2015a):—India, *s.die.*, *Wight s.n.*, *Herb. Wight p.p. 1779* (K000245101, image!). **Figs. 72–74**

Tufted annuals or short lived perennials, 10–50 cm high, roots fibrous. ***Culms*** 10–40 cm long, nodes glabrous, glandular ring below the node. ***Leaf sheaths*** 2–6 cm long, inrolled to the culm, glabrous, sparsely long hairy on one margin, scabrid on both or one margin. ***Leaf blades*** linear-lanceolate,5–8 × 0.2–0.3 cm, base shallowly cordate, apex acute-acuminate; surfaces long tuberculate or hirsute, villous hairy adaxially and glabrous abaxially; margins eglandular; ***ligules*** membranous, a fringe of cilia at the apex, cilia 2–4.5 mm long. ***Panicles*** contracted, 6–17 × 2–6 cm, branches alternate, 8–12 spikelets on each primary branch; peduncle 5–15 cm long, glabrous, glandular; primary pedicel 0.3–0.5cm long, glabrous; secondary pedicel 0.3–0.8 cm long. ***Spikelets*** linear-lanceolate, 5–17 × 1.3–1.75 mm, 10–35-flowered, olive green, disarticulation of florets from below upwards. Glumes deciduous, almost equal. ***Lower glumes*** ovate, 0.75–1.3 × 0.3–0.5 mm, nerveless, margins scabrellate towards apex. ***Upper glumes*** ovate-lanceolate, 1.2–1.3 × 0.5–0.8 mm, 1-nerved, 1-keeled, keels scabridulose. ***Lemmas*** elliptic-acute, 1.25–2 × 0.75–1 mm, slightly keeled, keels scabridulous; 3-nerved, lateral nerves close to margins, not prominent at the tip, deciduous, chartaceous, subacute at apex. ***Paleas*** elliptic-oblanceolate, 1.4–1.7 × 0.4–0.7 mm, minutely winged, deciduous or not, 2-nerved, keels ciliate more at the apex, acute-oblong at apex. ***Rachilla*** persistent, glabrous, zigzag, 0.5–0.8 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-truncate. ***Stamens*** 3; anthers 0.3–0.5 mm long, purple. ***Ovary*** 0.2–0.4 mm long, globose; style 0.3–0.5 mm long, slender; stigma plumose, 0.3–0.6 mm long. ***Caryopses*** oblong-elliptic, 0.5–0.9 × 0.3–0.5 mm, grooved ventrally, yellowish brown.

Flowering & Fruiting:—August–May

Fig. 72. ***Eragrostis maderaspatana*** Bor: **A.** Habit; **B.** Ligule; **C. & D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Floret; **H. & I.** Lemma - ventral & dorsal view; **J. & K.** Palea - dorsal & ventral view; **L.** Stamens & pistil; **M.** Lodicules; **N.** Caryopsis.

Habitat & Ecology:—The species is found growing in open areas, roadsides, sidewalks and scrub jungles. It is seen in association with *Aerva lanata* (L.) Juss., *Chloris barbata* Sw., *Cynodon dactylon* (L.) Pers., *Eragrostis atrovirens* (Desf.) Trin. *ex* Steud., *Emilia sonchifolia* (L.) DC. *ex* DC., *Euphorbia hirta* L., *Heliotropium keralense* Sivarajan & Manilal and *Sphagneticola trilobata* (L.) Pruski.

Fig. 73. Lectotype of *Eragrostis maderaspatana* Bor [*Wight p.p. 1779* (K000245101) designated by Vivek *et al.,* 2015] © The Board Trustees of the Royal Botanic Gardens, Kew.

Distribution:—India and Sri Lanka. In India, it was known from Peninsular India.

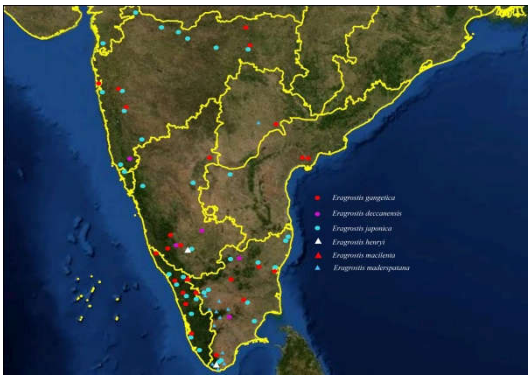


Fig. 74. Distribution of *Eragrostis gangetica* (Roxb.) Steud. (●), *E. deccanensis* Bor (●), *E. japonica* (Thunb.) Trin. (●), *E. henryi* Vivek, G.V.S. Murthy & V.J. Nair (△), *E. macilenta* (A.Rich.) Steud. (▲) and *E. maderaspatana* Bor (▲)

Specimens examined:—India, **Karnataka,** Hassan Dist.: Ariskere, 21 Jan. 1970, *C.J. Saldanha 16052* (JCB). **Tamil Nadu,** Coimbatore Dist.: Agricultural University Campus, 03 Apr. 2013, *Thoiba K. 134419* (CALI); *s.loc.*, 18 Nov. 1963, *K.N. Subramanian 899* (FRC). Dindigul Dist.: Udumelpet, Amaravathi, 10 Nov. 1986, *K.M. Matthew 47174* (RHT); Kodaikanal, Law's Ghat Road, 08 Sept. 1985, *K.M. Matthew, S.J. Britto & A. Usha 42189*; *Ibid.,* 04 Dec. 1987, *K.M. Matthew 51944* (RHT); Panneikkadu-Tandigudi Road, 17 Oct. 1987, *K.M. Matthew 50705* (RHT). Kanyakumari Dist.: Vivekananthapuram Complex, 04 Jan. 1994, *R.N. Kayal K15*

(CAL). Madurai Dist.: Periakulam, 23 Nov. 1985, *K.T. Mathew, N. Rajendren* & *A. Usha 43100* (RHT). Theni Dist.: Uthamapalayam, Theni-Virappankoil, 19 Nov. 1987, *K.M. Matthew 51484* (RHT); Gudalur, 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146623*; *Ibid.,* 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146626* (CALI). Tirunelveli Dist.: Kanyakumari-Tirunelveli National Highway, 30 Oct. 2015, *Thoiba K. 146671*; *Ibid.,* Valliyoor, Nanguneri, *Thoiba K. 146674* (CALI). **Telangana,** Hyderabad Dist.: Golkonda Fort, 02 Feb. 2018, *Thoiba K. 146628* (CALI).

Notes:—*E. maderaspatana* is closely similar to *E. minor*, this species is characterized by broader (1.3–1.75 mm) spikelets; eglandular leaf margins; 0.5–0.75 mm long lower glumes; lemmas being broadly elliptic and caryopses truncate at both ends.

18. Eragrostis minor Host, Icon. Descr. Gram. Austriac. 4: 15. 1809; Stapf in Hook.f., Fl. Brit. India 7: 321. 1896; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1855. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 383. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 219. 1994; S. Moulik, Grass. Bam. India 2: 604. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1196. 1997; Lazarides, Aust. Syst. Bot. 10: 77. 1997; Veldkamp, Blumea 47: 136. 2002; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 144. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 536. 2012. *Poa eragrostis* L., Sp. Pl. 1: 68.1753. *Eragrostis poaeoides* P. Beauv. *nom. illeg. superfl.*, Ess. Agrostogr. 162. 1812; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1827. 1934; Bor, Grass. Burma Ceylon India Pakistan 512. 1960. **Lectotype** (designated by Clayton *et al.,* 1974)**:**—Italy: *D. Baecker s.n. in Herb. LINN (*LINN 87:23, image!). **Figs. 75, 76, 84**

Tufted annuals, 10–60 cm high, roots fibrous. ***Culms*** 5–50 cm long, nodes glabrous, glandular ring below the node. ***Leaf sheaths*** 2–6 cm long, inrolled to the culm, glandular, sparsely hairy on one margin. ***Leaf blades*** linear-lanceolate, 3–12 × 0.3–0.5

cm, base shallowly cordate, flat to infolded, acuminate at apex; surfaces sparsely villous adaxially and glabrous abaxially, glands pitted along mid nerve and margins; ***ligules*** membranous, a fringe of cilia at the apex, cilia a fringe of 1–2 mm long hairs. ***Panicles*** open, dense or effuse, or contracted, 5–20 × 2–6 cm, branches alternate, 6–9 spikelets on each primary branch; peduncle 4–10 cm long, glabrous, glandular; primary pedicel 3–4 mm long, glabrous and angular; secondary pedicel 2–4 mm long. ***Spikelets*** linear-lanceolate, 5–15 × 1.3–2.5 mm, 10–45-flowered, olive green, disarticulation of florets from below upwards. Glumes deciduous, almost equal. ***Lower glumes*** ovate, 0.5–0.8 × 0.3–0.5 mm, 1-nerved, 1-keeled, keels at times glandular. ***Upper glumes*** oblong-lanceolate, 1–1.3 × 0.3–0.5 mm, 1-nerved, 1-keeled, keels scabridulose. ***Lemmas*** ovate-subrotund, 1.3–1.5 × 0.75–1 mm, slightly keeled, keels scabridulose; 3-nerved, lateral nerves not prominent at the tip, deciduous, glandular, obtuse at apex. ***Paleas*** elliptic-oblanceolate, 1–1.5 × 0.4–0.6 mm, minutely winged, deciduous or not, 2-nerved, keels scabrid, acute-oblong at apex. ***Rachilla*** persistent, glabrous, zigzag, 0.4–0.5 mm long. ***Lodicules*** 2, *c.* 0.2 mm long, dentate or truncate. ***Stamens*** 3; anthers 0.2–0.3 mm long, purple. ***Ovary*** 0.2–0.4 mm long, globose; style 0.3–0.5 mm long, slender; stigma plumose, 0.3–0.6 mm long. ***Caryopses*** oblong to elliptic globose, 0.6–0.8 × 0.3–0.5 mm, slightly flattened ventrally, reddish brown.

Flowering & Fruiting:—June–March

Habitat & Ecology:—Cosmopolitan in distribution. It is found growing in hill tracks, ghat road sides, rocky crevices, open grasslands, railway tracks, valleys and as a weed in gardens and cultivated fields, sidewalks, scrub jungles. It is seen in association with *Anisomeles malabarica* (L.) R.Br. *ex* Sims, *Chrysopogon hackelii* (Hook.f.) C.E.C.Fisch., *Eragrostiella bifaria* (Vahl) Bor, *Eragrostis tenuifolia* (A. Rich.) Hochst. *ex* Steud., *Stachytarpheta indica* (L.) Vahl.

Distribution:—Warm temperate and subtropical regions of Old World. In India, it is widely distributed in all states.

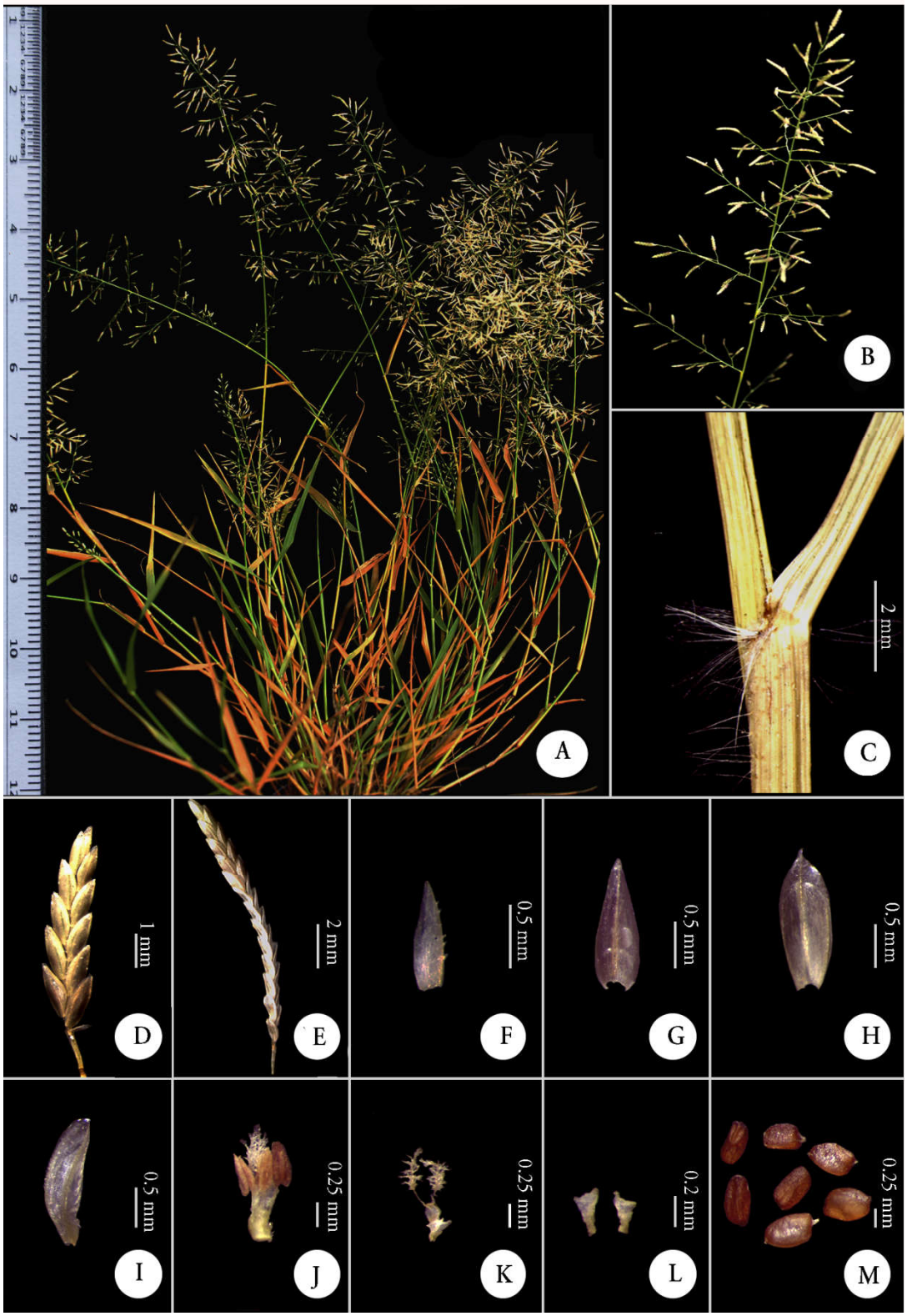


Fig. 75. ***Eragrostis minor*** Host: **A.** Habit; **B.** Panicle; **C.** Ligule; **D. & E.** Spikelet; **F.** Lower glume; **G.** Upper glume; **H.** Lemma; **I.** Palea; **J.** Flower; **K.** Lodicules & Pistil; **L.** Lodicules; **M.** Caryopsis.

Specimens examined:—India, **Karnataka,** Bellary Dist.: Kottur, 13 Nov. 1975, *S.R. Ramaesh* & *K.P. Sreenath KFP 4220* (JCB); Hagari Farm, 19 Sept. 1916, *s.coll. 13771* (MH). Chamarajanagar Dist.: Gundlupet, 09 Nov. 2016, *Thoiba K. 146737* (CALI); *Ibid.*, 28 Sept. 2015, *Thoiba K. 144171* (CALI). Kodagu Dist.: Mancharihalli, *s.die.*, *R.K. Arora 46056* (BSI). Mysore Dist.: Chammundi Hills, 30 Sept. 2015, *Thoiba K. 144175* (CALI); Marase, 29 Sept. 2015, *Thoiba K. 144176* (CALI). **Maharashtra,** Ahmednagar Dist.: Khandgaon, 03 May 1985, *R. Shinde 388* (BLAT); Ghadechap, Takali Dhokaeshwar, 28 Aug. 1964, *K.P. Janardhanam 98889* (BSI); Bhodhegaon, 28 Aug. 1964, *K.P. Janardhanan 98964* (BSI). Akola Dist.: Patur, 23 Feb. 1978, *S.Y. Kamble 152799* (BSI); Karla, 18 July 1978, *S.Y. Kamble 156570* (BSI). Auragabad Dist.: Daulatabad, 01 Oct. 1963, *R.S. Rao 92683* (BSI). Jalgaon Dist.: Khandesh, Umale, Dec. 1916, *Blatter* & *Hallberg 5180*; *Ibid.*, Tapti, Dec. 1916, *Blatter* & *Hallberg 4449* (BLAT). Kolhapur Dist.: Shivaji University Campus, 09 Nov. 2016, *Thoiba K. 146736* (CALI); Aajra, 13 Oct. 1991, *C.B. Salunkhe 7278* (SUK). Pune Dist.: Supa, Baramati, 09 Sept. 2005, *V.C. Ben s.n.* (AHMA); Vetal Hill, 30 Aug. 1987, *V.N. Jhoshi VH 356* (AHMA); Bhor, 14 Sept. 1958, *V.D. Vartak 13710* (AHMA); Narayangaon, 11. Oct. 1965, *K. Hemadri 106975* (BSI); Law College, Pune, 20 Aug. 1957, *S.D. Mahajan 18426* (BSI, CAL); 10 miles from A' Nagar to Pune Road in Ghats, 01 Sept. 1956, *G.S. Puri 6703* (BSI). Sangli Dist.: Tasgaon, 12 Sept. 1993, *C.B. Salunkhe 7692* (SUK). Satara Dist.: *s.loc.*, July 1994, *M.P. Bachulkar-Chockkar 6124* (SUK); Pusegaon, 15 Oct. 1989, *C.B. Salunkhe 7049* (SUK). Solapur Dist.: Pandharpur, Mahud Road, 14th Mile, 26 Aug. 1963, *R.S. Rao 90607* (BSI). **Odisha,** Ganjam Dist.: Chatrapur, 12 July 1917, *Moses Ezekiel 9474* (BLAT). Kutch Dist.: Anjar, 01 Sept. 1956, *G.S. Puri 6703* (BSI). **Tamil Nadu,** Coimbatore Dist.: Marudhamalai, 28 June 1930, *V. Narayanaswami 3260* (MH); *s.loc.*, Aug 1902, *C.A. Barber 4877* (MH). Cuddalore Dist.: Capper hill, 12 Dec. 2001, *K.M. Matthew 73602*; *Ibid.*, 12 Dec. 2001, *K.M. Matthew 73619* (RHT). Madurai Dist.: Kodaikanal, La Providence, 14 June 1986, *K.M. Matthew 45501*; *Ibid.,* 15 June 1990, *K.T.*

Fig. 76. Lectotype of *Eragrostis minor* Host [*Baecker s.n.* (LINN - 87.23) designated by Clayton *et al.,* 1974] © The Board Trustees of the Linnean Society, London.

Mathew 54328 (RHT); Periakulam, Kumbakkaram, 15 Dec. 1989, *K.M. Matthew 53953* (RHT). Nilgiri Dist.: Naduvattam, 23 June 2016, *Nikhil Krishna* & *Thoiba K. 146774*(CALI). Ramanathapuram Dist.: Perunazhi, 14 Jan. 1989, *V. Balasubramaniam 2060* (CAL); Uttarakosamangai, 01 Jan. 1988, *V. Balasubramaniam 1514* (MH). Salem Dist.: Yercad, Louis villa, 11 May 1978, *A. Mohan 13628* (RHT); *s.loc.*, 19 Aug. 1918, *s.coll. 15509* (MH); *s.loc.*, 20 Dec. 1913, *s.coll. 9716* (MH). Theni Dist.: Cumbam–Theni Road, 10 Aug. 2017, *C.N. Sunil* & *Thoiba K. 146756* (CALI). Tirunelveli Dist.: Mancholai, 25 June 1957, *K.M. Sebastine 3621* (MH). Virudhunagar Dist.: Mandapasalai, 15 Nov. 1989, *V. Balasubramaniam 2231* (MH).

Notes:—*E. minor* is characterized by 1.3–2.5 mm wide spikelets; leaf margins most often with raised glands on the margins; glumes subequal; lemmas broadly ovate-obtuse; caryopses oblong to elliptic globose.

19. Eragrostis multicaulis Steud., Syn. Pl. Glum. 1: 426. 1854; Bor, Grass. Burma Ceylon India Pakistan 510. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; S. Moulik, Grass. Bam. India 2: 604. 1997; Veldkamp, Blumea 47: 181. 2002; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 538. 2012. *Eragrostis pilosa* (L.) P. Beauv. f. *multicaulis* (Steud.) I.C. Chung., J. Wash. Acad. Sci. 45(7): 215. 1955. **Lectotype**

(designated by Veldkamp, 2002):—Japan, *s.die.*, *Bürger s.n.* (L908.97-2116, Isolectotype: L0038584, image!). **Figs. 77, 84**

Tufted annuals, 9–30 cm high, roots fibrous. ***Culms*** 5–20 cm long, nodes brownish. ***Leaf sheaths*** *c.* 1.3 cm long, eglandular, glabrous or shortly hairy, mouth naked. ***Leaf blades*** linear-lanceolate, 1.5–9 × *c.* 0.15 cm, base more or less rounded, margins eglandular, acuminate at apex; ***ligules*** a fringe of cilia at the apex, cilia upto 0.25 mm long. ***Panicles*** 3–9 × 0.8–3 cm, open, somewhat lax, lowermost branches alternate; peduncle 4–10 cm long, glabrous, glandular; primary pedicel 3–4 mm long, glabrous and angular; secondary pedicel 2–4 mm long. ***Spikelets*** linear-lanceolate, 2–4.75 × 1.25–1.75 mm, 4–8-flowered, disarticulation of florets from below upwards. Glumes deciduous, almost equal. ***Lower glumes*** ovate to lanceolate, 0.3–0.7 × 0.3–0.5 mm, nerve1ess or 1-nerved, 1-keeled, keels at times glandular. ***Upper glumes*** oblong-lanceolate, 0.8–1.25 × 0.3–0.5 mm, 1-nerved, 1-keeled, keels scabridulose. ***Lemmas*** ovate-lanceolate, 1.25–1.5 × 0.6–1 mm, slightly keeled, keels scabridulose; 3-nerved, lateral nerves not prominent at the tip, deciduous, glandular, sharply acute at apex. ***Paleas*** elliptic-oblanceolate, 1.3–1.5 × 0.4–0.6 mm, minutely winged, sub persistent, 2-

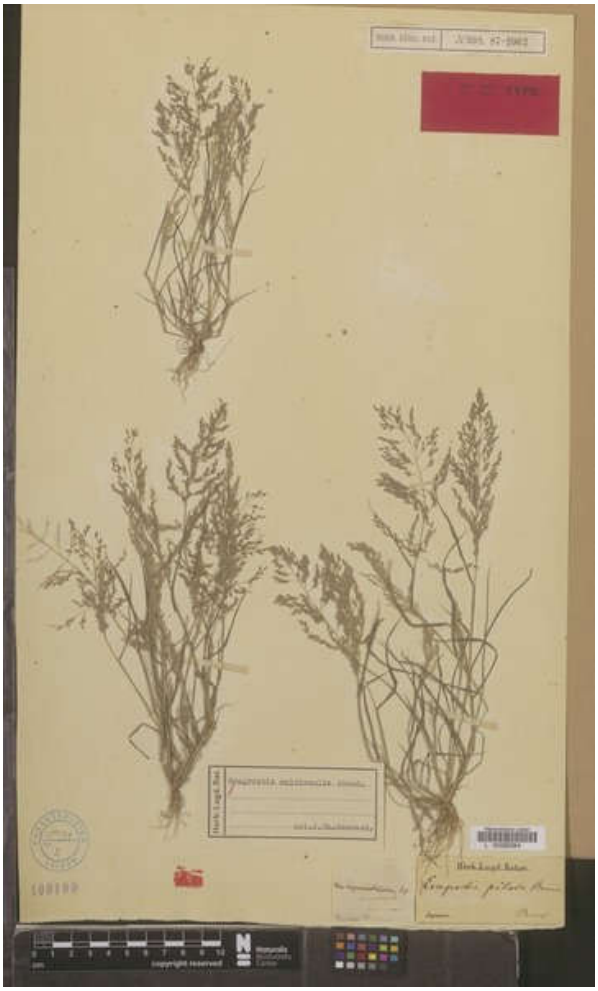


Fig. 77. Isolectotype of *Eragrostis multicaulis* Steud. [*Bürger s.n.* (L0038584) designated by Veldkamp, 2002] © The Board Trustees of the Naturalis Biodiversity Center, Leiden, Netherlands.

nerved, keels scabrid, acute-obtuse at apex. ***Rachilla*** persistent, glabrous, zigzag, 0.4–0.5 mm long. ***Lodicules*** 2, *c.* 0.2 mm long, dentate or truncate. ***Stamens*** 3; anthers 0.2–0.3 mm long, purple. ***Ovary*** 0.2–0.4 mm long, globose; style 0.3–0.5 mm long, slender; stigma plumose, 0.3–0.6 mm long. ***Caryopses*** oblong to elliptic- globose, 0.5–0.8 × 0.3–0.4 mm, reddish brown.

Flowering & Fruiting:—June–March

Habitat & Ecology:—It is growing along hill slopes upto 2000 m elevation.

Distribution:—Europe, North America, Japan and South East Asia. In Peninsular India, it occurs in Karnataka and Maharashtra.

Specimens examined:—India, **Karnataka,** Yadgiri Dist.: Hattikuni, 09 May 1977, *N.P. Singh 147034* (BSI).

Notes:—The description provided here is based on a single specimen (*Singh 147034*) from Karnataka. Though its distribution is extended to Maharashtra (Potdar *et al.,* 2012), no specimen were seen housed at any Indian herbaria. This taxon is allied to *E. pilosa* and *E. gangetica*, but it differs by having the culms up to 30 cm high; basal solitary branches without whorls.

20. Eragrostis nigra Nees ex Steud., Syn. Pl. Glumac. 1: 267. 1854; Stapf in Hook.f., Fl. Brit. India 7: 324. 1896; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1827. 1934; Bor, Grass. Burma Ceylon India Pakistan 511. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1856.1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 384.1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 214. 1994; S. Moulik, Grass. Bam. India 2: 605. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1196. 1997; Veldkamp, Blumea 47: 181. 2002; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 146. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 538. 2012; Chaison., Chantar. &

Hodk., ScienceAsia 39: 118. 2013. **Lectoype** (designated by Veldkamp, 2002):––India, Peninsular India Orientalis, *Wight Herb. 1782* (LE (TRIN-2370.2), Isolectotype: G00301779, image!, K, K000245108, image!). **Figs. 78, 79, 84**

Tufted perennials, 20–100 cm high, roots fibrous. ***Culms*** 10–80 cm long, erect or geniculate, nodes glabrous. ***Leaf sheaths*** 3–13 cm long, keeled, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 10–28 × 0.1–0.4 cm, base minutely cordate, apex acuminate to attenuate, nerves prominent, sparsely long hairy; margins minutely serrulate, scabrid towards apex; ***ligules*** a fringe of hairs, hairs 0.25–0.8 mm long. ***Panicles*** ovate or effuse-lax, leaden green or black, 15–38 × 4–14 cm long, branches alternate. Peduncle 8–17 cm long, glabrous. Primary pedicel 0.4–2 cm long, glabrous, triangular; secondary pedicel 1–3.5 cm long, scabridulose. ***Spikelets*** ovate to oblong-lanceolate, 3–7 × 1–2.5 mm, 3–14-flowered dark green to black; disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** ovate-lanceolate, 1.2–2 × 0.3–0.6 mm, 1-nerved, 1-keeled, keels scabrid, acute at apex. ***Upper glumes*** lanceolate, 1.5–2 × 0.4–0.6 mm, 1-nerved, 1-keeled, keels scabrid, acute at apex. ***Lemmas*** ovate-lanceolate, 1.4–2.2 × 0.7–1 mm, 1-keeled, keels scabridulose, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex sharply acute. ***Paleas*** elliptic-ovate or boat shaped, 1.2–1.6 × 0.5 mm, winged, caducous, 2-nerved, keeled, keels serrulate, acute-obtuse at apex. ***Rachilla*** zigzag, 0.7–1 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, truncate. ***Stamens*** 3; anthers 0.4–0.6 mm long. ***Ovary*** oblong to elliptic, 0.5–0.6 mm long, globose; style 0.3–0.5 mm long, slender; stigma plumose, 0.5–1 mm long. ***Caryopses*** oblong or quadrangular, 0.4–0.8 × 0.3–0.5 mm, ventrally grooved, cordate, dark brown.

Flowering & Fruiting:—June–March

Habitat & Ecology:—It is found growing along roads, fallow fields, forest margins, plantations in hilly areas in association with *Acmella calva* (DC.) R.K. Jansen, *Anaphalis leptophylla* (DC.) DC., *Arundinella pumila* (Hochst.) Steud., *Calceolaria*

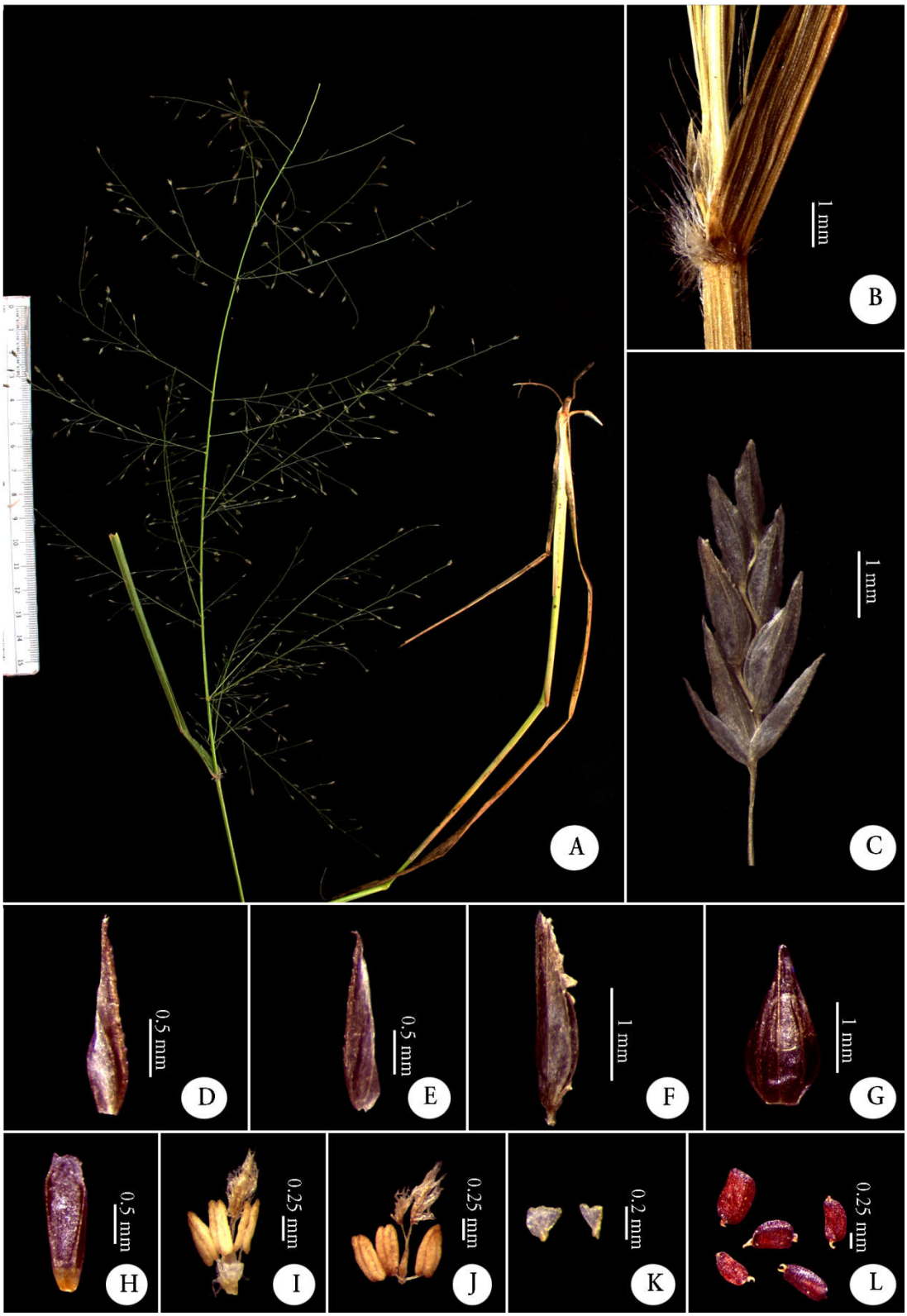


Fig. 78. ***Eragrostis nigra*** Nees ex Steud.: **A.** Habit; **B.** Ligule; Panicle; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Floret; **G.** Lemma; **H.** Palea; **I.** Flower; **J.** Stamen & Pistil; **K.** Lodicules; **L.** Caryopsis.

Mexicana Benth., *Eragrostis atrovirens* (Desf.) Trin. *ex* Steud., *E. collinensis* Vivek, G.V.S. Murthy & V.J. Nair, *Chrysopogon hackelii* (Hook.f.) C.E.C. Fisch., *C. zeylanicus* (Nees) Thwaites, *Crotalaria grahamiana* Wight & Arn., *Jansenella griffithiana* (C.Muell.) Bor and *Sporobolus piliferus* (Trin.) Kunth.

Distribution:—Tropical and Temperate Asia. In India, it is widely distributed in all states.

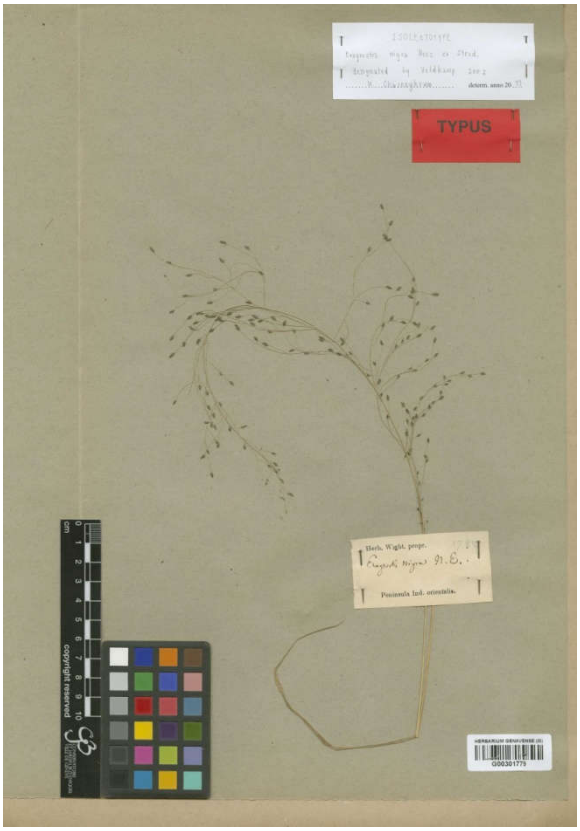


Fig. 79. Isolectotype of *Eragrostis nigra* Nees ex Steud. [*Wight 1782* (G00301779) designated by Veldkamp, 2002] © The Board Trustees of the Conservatory and Botanical Garden of the City of Geneva, Switzerland.

Specimens examined:—India, **Karnataka,** Bellary Dist.: Kudligi, 18 July 1979, *S.R. Ramaesh* & *S.B. Manohar 5851* (JCB). **Kerala,** Idukki Dist.: Munnar, Top station, 15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137568*; *Ibid.*,15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137574* (CALI); Devikulam, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137594* (CALI); Mattupetty, Yellapetty, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137597*; *Ibid.*, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137598* (CALI); *s.loc., s.die., s.coll.* 25513 (CALI); Chinnar Wildlife Sanctuary, 24 Oct. 2017, *A.K. Pradeep* & *Thoiba K. 146751* (CALI). Vagavurrai, 23 Aug. 1980, *P.V. Sreekumar 67771* (MH); Munnar, 22 Aug. 1980, *P.V. Sreekumar 67766* (MH); *s.loc.*, 30 May 1944, *K.C. Jacob 20486* (MH); Devikulam, 08 Aug. 1967, *B.V. Shetty 28337* (MH); Poovar, 24 June 1998, *S.D. Biju 38205* (TBGT); Anamudi, 22 June 1997, *S.D. Biju 35079* (TBGT); Eravikulam, *s.die.*, *S.D. Biju 36757*; *Ibid.*, *s.die.*, *S.D. Biju 36734* (TBGT). **Maharashtra,** Pune Dist.: Khandala, Sept. 1918, *s.coll. 5050* (BLAT).

Odisha, Ganjam Dist.: *s.loc.*, 19 Aug. 1931, *V. Narayanaswami 5917* (MH). **Tamil Nadu,** Dharmapuri Dist.: Pennagaram R.F., 02 Dec. 1964, *E. Vajravelu 22404* (MH). Dindigul Dist.: Kodaikanal, Pulney Hills, 10 July 1898, *Bor 1039* (MH). Madurai Dist.: Palni Hills, *s.die.*, *G. Foreau s.n.* (BLAT); Kodaikanal, Shembaganur, 23 July 1984, *K.M. Matthew 40464*; *Ibid.*, 22 July 1984, *K.M. Matthew 40411* (RHT); Charlier's Path, *s.die., K.M. Matthew 724* (RHT); *s.loc.*,16 Sept. 1956, *J. Pallithanam 2212* (RHT); Sirumalai, 23 Dec. 1959, *J. Pallithanam 5525* (RHT); Kudai, *s.die., K.M. Matthew 4946* (RHT). Nilgiri Dist.: Naduvattam, 23 June 2016, *Nikhil Krishna* & *Thoiba K. 146776*; *Ibid.*, 23 June 2016, *Nikhil Krishna* & *Thoiba K. 146779* (CALI); Coonor, Carolina Estate, April 1920, *C. Meccan s.n.* (BLAT); Otacamund, May 1920, *C. Meccan s.n.* (BLAT); Udagamandalam, 15 Sept. 2014, *Santhosh Kumar* & *Thoiba K. 138099* (CALI); Coonor, *J.S. Gamble 12132* (CAL); Resource Forest Near Picnic Park, 15 May 1957, *K.M. Sebastine 3257* (CAL); Sullikadu R.F., 28 July 1970, *E. Vajravelu 35140* (MH); Kailas Pillai Estate to Sirur, 06 Sept. 1970, *G.V. Subba Rao 36532* (MH); Governor Shola, Ooty, 09 July 1970, *J.L. Ellis 34557* (MH); Ooty, 24 Jan. 1957, *K.M. Sebastine 2234* (MH); near Picnic Park, Coonor, 15 May 1957, *K.M. Sebastine 3257* (MH); Doddabetta R.F., 28 Feb. 1972, *B.D. Sharma 40333* (MH); Ootacamund, 11 Sept. 1918, *s.coll. 15541* (MH); Fox House, Ootacamund, 26 Aug 1901, *C.A. Barber 3461* (MH). Salem Dist.: Yercaud, Shevaroy Hills, 19 June 1965, *A.V.N. Rao 26772* (MH).

Notes:—*E. nigra* is a very common grass at elevations above 500 m. It can be easily identified by its dark green, strongly imbricate spikelets.

21. Eragrostis nilgiriensis Vivek, G.V.S. Murthy & V.J. Nair, Nordic J. Bot. 31(6): 700. 2013. **Type:—**India: Tamil Nadu, Nilgiri Dist.: Coonor, ($10^0$20'37.13''N, $76^0$47'40.98''E) 1700 m, 22 Oct. 2011, *C.P. Vivek 126153* (Holotype: CAL!, Isotypes: MH!). **Figs. 80, 81, 84**

Tufted annuals or short term perennials, 5–45 cm high, roots fibrous. ***Culms*** 15–35 cm long, geniculate, nodes glabrous, brownish to purplish, a glandular band below each node. ***Leaf sheaths*** 2–5 cm long, one margin ciliate, bearded at apex. ***Leaf blades*** linear-lanceolate, 3–7 × 0.2–0.45 cm, base subcordate, sparsely villous adaxially and glabrous abaxially; margins eglandular and scabridulose, acuminate at apex; ***ligules*** a fringe of hairs, hairs 0.5–2.2 mm long. ***Panicles*** ovate-oblong, effuse, leaden green or black, 3–10 × 1.5–5 cm, branches alternate, glandular, glands punctate, up to 4 cm long. Peduncle 3–11 cm long, glabrous, broad glandular band below the panicle. Primary pedicel 2–4 mm long, glabrous, angular; secondary pedicel 1–5 mm long, scabridulose. ***Spikelets*** ovate to linear-lanceolate, 4–13 × 1–1.65 mm, 3–28-flowered dark green to grey or blackish; disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** ovate-lanceolate, 0.7–1.1 × 0.3–0.5 mm, 1-nerved, 1-keeled, keels minutely scabrid, dark green with purple tinged, acute at apex. ***Upper glumes*** ovate-lanceolate, 1–1.5 × 0.4–0.6 mm, 1-nerved, 1-keeled, keels scabrid, acute at apex. ***Lemmas*** elliptic-ovate, 1.3–1.8 × 0.8–1 mm, 1-keeled, keels scabridulose, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex minutely apiculate. ***Paleas*** elliptic-oblanceolate, 1.3–1.7 × 0.5–0.6 mm, winged, caducous, 2-nerved, keeled, keels ciliate, acute-obtuse at apex. ***Rachilla*** straight or minutely zigzag, 0.7–1 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, truncate. ***Stamens*** 3; anthers 0.2–0.3 mm long; filaments *c.* 0.3 mm long. ***Ovary*** oblong to elliptic, 0.2–0.3 mm long, ovoid; style 0.2–0.3 mm long, slender; stigma plumose, 0.3–0.4 mm long. ***Caryopses*** ellipsoid to oblong, 0.4–0.7 × 0.3–0.4 mm, narrowly flattened ventrally, yellowish brown.

Flowering & Fruiting:—September–November

Habitat & Ecology:—It inhabits mountains and hilly areas with black soil in association with *Digitaria abludens* (Roem. & Schult.) Veldkamp, *Eragrostis tenuifolia* (A.Rich.) Hochst. *ex* Steud., *E. nigra* Nees *ex* Steud., *E. pilosa* (L.) P. Beauv., *Eleusine indica* (L.) Gaertn.

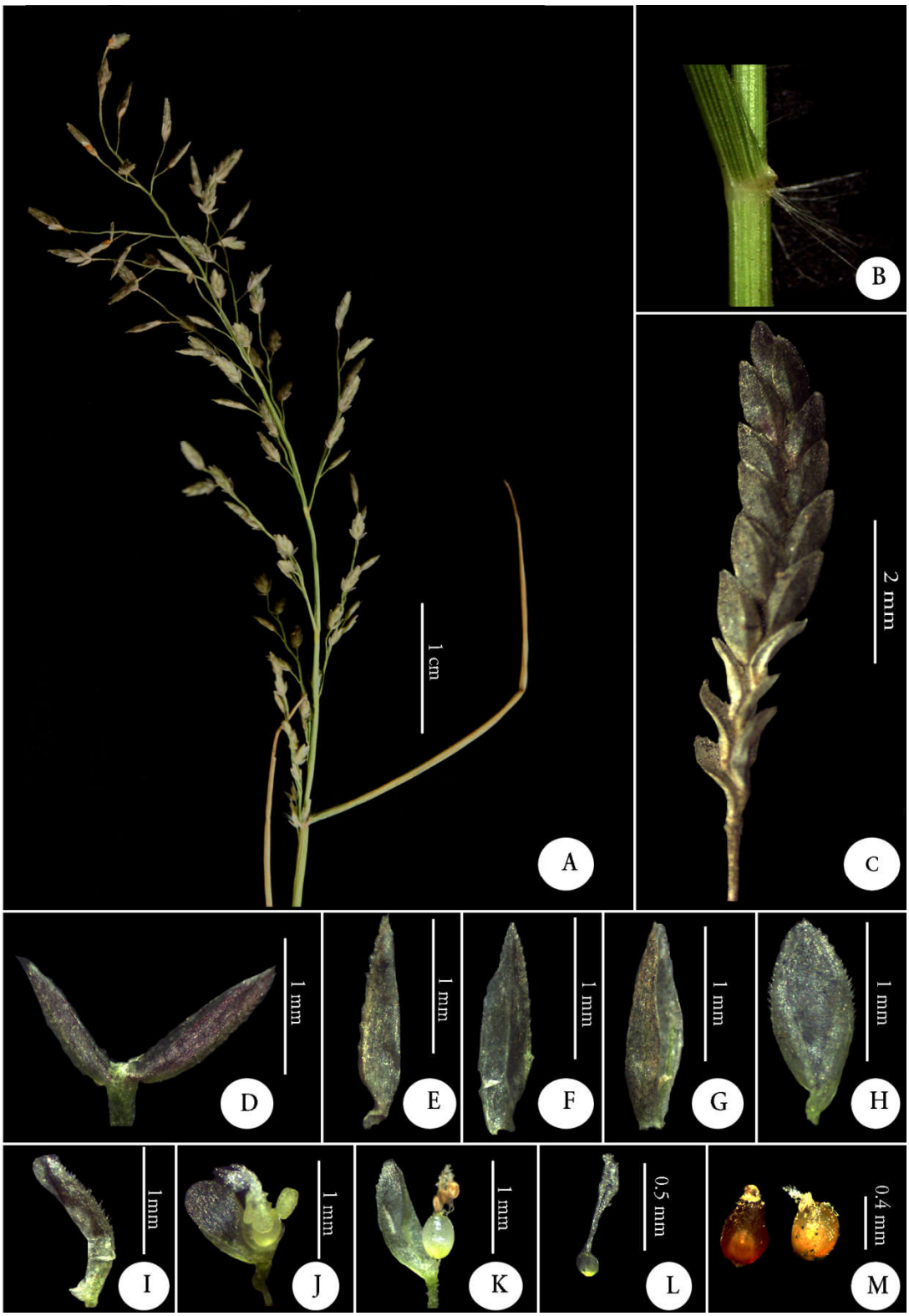


Fig. 80. ***Eragrostis nilgiriensis*** Vivek, G.V.S. Murthy & V.J. Nair: **A.** Panicle; **B.** Ligule; **C.** Spikelet; **D.** Glumes; **E.** Lower glume; **F.** Upper glume; **G.** Lemma; **H.** Palea – dorsal & lateral view; **I.** Flower; **J. & K.** Palea with flower; **L.** Pistil; **M.** Caryopsis.

Distribution:—in India it is known only from the type locality, Coonor in Nilgiri in South India.

Specimens examined:—Tamil Nadu, Nilgiri Dist.: Coonor, 22 Oct. 2011, *C.P. Vivek 126153* (CAL, MH); Coonor, near Sims Park, 12 Dec. 2015, *Thoiba K. 146710* (CALI); Coonor, 12 Dec. 2015, *Thoiba K. 146711* (CALI); Ootacamund, 11 Sept. 1918, *s.coll.*, *s.n.* [MH Ac. No. 95567]; *Ibid.*, 13 Sept. 1918, *s.coll.*, *s.n.* [MH Ac. No. 58427] (MH).

Notes:—*E. nilgiriensis* shows more resemblense to *E. minor* and *E. nigra*, but it differs in having the panicles with puctate glands at the base of branches, spikelets dark green to grey or blackish and longer lemma (up to 1.8 mm).

Fig. 81. Holotype of *Eragrostis nilgiriensis* Vivek, G.V.S. Murthy & V.J. Nair [*C.P. Vivek 126153* (CAL0000025523)] © Botanical Survey of India, Kolkata.

22. Eragrostis nutans (Retz.) Nees *ex* Steud., Nomencl. Bot. ed. 2.1: 563. 1840; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1826. 1934; Bor, Grass. Burma Ceylon India Pakistan 511. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1856.1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 385.1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 216. 1994; S. Moulik, Grass. Bam. India 2: 605. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1197. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 148. 2009; G.G.

Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 538. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 119. 2013. *Poa nutans* Retz., Observ. Bot. 4: 19. 1786. **Lectoype** (designated by Bor, 1960):—India, Tranquebaria, *Köenig s.n.* (LD, Isolectotype: C, K000643354, image!, fragm.). **Figs. 82–84**

Poa elegans Roxb. Hort. Bengl. 82. 1814; *Poa elegantula* Kunth, *nom. illeg. suprfl.* Rev. Gram. 1: 114. 1829. *Eragrostis elegantula* (Kunth) Nees *ex* Steud., *nom. illeg.,* Syn. Pl. Glum. 1: 266. 1854. *non* Nees 1851.Type:—India, moist, pasture ground.

E. elegantula Nees, Anal. Bot. Ind. 4: 39. 1851. Type:—India, *Wight 1781b* (Syntype: K000245091, image!)

Tufted perennials, 40–110 cm high, roots fibrous. ***Culms*** 10–80 cm long, nodes glabrous, internodes 3—18 cm long. ***Leaf sheaths*** 5–15 cm long, inrolled to the culm, slightly keeled. ***Leaf blades*** linear-lanceolate, 10–20 × 0.5–0.8 cm, base shallowly cordate, apex acute-acuminate; surfaces glabrous; margins entire and eglandular; ***ligules*** membranous, a ciliate rim, cilia 2–3 mm long. ***Panicles*** effuse, contracted, 10–40 × 2–5 cm, branches alternate. Peduncle 6–12 cm long, glabrous, eglandular; rachis 1.5–10 cm long, glabrous; primary pedicel 0.5–5mm long, glabrous; secondary pedicel 2–6 mm long, scaberulose. ***Spikelets*** ovate-lanceolate, 4–5 × 1–1.5 mm, 7–12-flowered, leaden grey, disarticulation of florets from below upwards. Glumes deciduous, almost equal. ***Lower glumes*** lanceolate, 1–1.2 × 0.3–0.5 mm, 1-nerved, 1-keeled. ***Upper glumes*** lanceolate, 1–1.5 × 0.4–0.6 mm, 1-nerved, 1-keeled. ***Lemmas*** oblong-acute, 1–1.5 × 0.6–0.7 mm, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex sharply acute, leaden grey in colour. ***Paleas*** elliptic-lanceolate, 1–1.5 × 0.4–0.5 mm, winged, sub-persistent, 2-nerved, keels scabrid, acute-oblong at apex. ***Rachilla*** persistent, zigzag, 0.3–0.4 mm long, glabrous. ***Lodicules*** 2, 0.2–0.3 mm long, membranous. ***Stamens*** 3; anthers 0.4–0.5 mm long, purple. ***Ovary*** 0.3–0.4 mm long, globose; style 0.3–0.5 mm long, slender; stigma plumose, 0.4–0.5 mm long. ***Caryopses*** ellipsoid-globose, 0.3–0.6 × 0.2–0.5 mm, deep brown.

Fig. 82. ***Eragrostis nutans*** (Retz.) Nees *ex* Steud.: **A.** Habit; **B.** Panicle; **C.** Ligule; **D.** Primary pedicel with spikelets; **E.** Spikelet; **F.** Lower glume; **G.** Upper glume; **H.** Floret; **I.** Lemma; **J.** Palea **K.** Flower; **L.** Lodicules; **M.** Caryopsis.

Flowering & Fruiting:—Almost throughout the year

Habitat & Ecology:—It grows in bunds of paddy fields, cultivated fields, along forest margins, pond sides, river banks, water logged areas in association with *Eragrostis atrovirens* (Desf.) Trin. *ex* Steud., *E. gangetica* (Roxb.) Steud., *Isachne globosa* (Thunb.) Kuntze, *Ischaemaum rangacharianum* C.E.C.Fisch., *I. ciliare* Retz., *Lindernia antipoda* (L.) Alston, *Panicum repens* L. and *Rotala malampuzhensis* R.V. Nair *ex* C.D.K. Cook.

Distribution:—North America, Africa, China, Japan, Malaysia, Philippines and Sri Lanka. In India, it was distributed in almost all states.

Specimens examined:—India, **Andhra Pradesh,** Chittoor Dist.: Kambakam Hills, 26 Sept. 1974, *M. Chandrabose 45128* (MH). East Godaveri Dist.: Rajavomangi, 27 Jan. 1916, *s.coll. 12643* (MH); *s.loc.*, 02 Sept. 1907, *C.A. Barber 8254* (MH). West Godaveri Dist.: *s.loc.*, 02 Sept. 1907, *s.coll. 8254* (MH). Srikakulam Dist.: Mandasa Mandal, 15 Oct. 1930, *V. Narayanaswamy 4622* (MH). **Goa,** South Goa Dist.: Chandranath, 16 Sept. 1997, *Vaishali C. Joshi* & *S. Rajkumar 967* (Goa University Herbarium). **Karnataka,** Bellary Dist.: *s.loc.*, 25 Oct. 1979, *S.B. Manohar* & *S.R. Ramaesh KFP 9821* (CAL). Dekshina Kannada Dist.: Kadaba, 17 Nov. 2013, *Thoiba K. 138001* (CALI); Subramanya, Kumaradhara River basin, 17 Nov. 2013, *Thoiba K. 138006* (CALI). Hassan Dist.: Belur, 13 Sept. 2014, *Thoiba K. 137519* (CALI); Arsikere, 29 Sept. 2015, *Thoiba K. 144185*; *Ibid.*, 29 Sept. 2015, *Thoiba K. 144188* (CALI). Mysore Dist.: Nanjangud, Sujata Puram, 30 Sept. 2015, *Thoiba K. 144179* (CALI). Shimoga Dist.: Asarmuke, Sambankattae, 09 Sept. 2015, *Thoiba K. 144158* (CALI). Tumkur Dist.: Jogihalli, 09 Jan. 1980, *B.R. Ramaesh* & *S.B. Manohar 10675* (JCB). **Kerala,** Idukki Dist.: Uppermanalar, 28 Aug. 1994, *Jomy Augustine 16954* (CALI). Kollam Dist.: *s. loc.*, 22 May 1978, *C.N. Mohanan 55729* (MH). Malappuram Dist.: Bharathapuzha River Basin, 19 Oct. 2013, *Thoiba K. 134476* (CALI); Calicut University, Botanical Garden, 23 Oct. 2013, *Thoiba K. 134477*;

Ibid., 27 Nov. 2013, *Thoiba K. 138009*; *Ibid.*, 13 Oct. 2014, *Thoiba K. 144122*; *Ibid.*, 19 Oct. 2000, *Jayasree S. 74338* (CALI). Palakkad Dist.: Pattambi, 22 Jan. 2013, *Thoiba K. 134420* (CALI). Thiruvananthapuram Dist.: Veli, 22 May 1978, *M. Mohanan 54886* (CAL); Kottur R.F., 04 Apr. 1973, *J. Joseph 44024* (MH). **Maharashtra,** Poona Dist.: Solapur Road, 14th Mile, 02 Oct. 1956, *S.D. Mahajan 7435* (BSI). **Tamil Nadu,** Cuddalore Dist.: *s.loc.*, 19 Sept. 1979, *K. Ramamurthy 64176* (CAL); Mount Capper, 12 Dec. 1979, *K.M. Matthew 25049* (RHT); Narthamalai, 30 Aug. 1970, *K.M. Matthew 12269* (RHT); Chidambaram, Mariappa Nagar, 09 Jan. 1978, *A. Mohan 11185* (RHT); *Ibid.*, *s.loc.*, 27 Jan. 1979, *N. Venugopal 21306* (RHT); Capper hill, 12 Dec. 2001, *K.M. Matthew 73621* (RHT). Kanyakumari Dist.: Nagercoil, Mambazhathuraiyar Reservoir, 29 Oct. 2015, *Thoiba K.* & *Mohammed Yoonus. 146655* (CALI). Ramanathapuram Dist.: Mudukulathur, 21 Feb. 1988, *V. Balasubramaniam 1587* (MH).Tiruchirapalli Dist.: Bharathidasan University, 01 Nov. 2014, *Thoiba K. 137537* (CALI). Tiruvarur Dist.: Mannargudi, Puthukottai, 13 Sept. 1977, *K. Ramamurthy 51198* (MH).Viluppuram Dist.: Ulundurpettai, 11 Dec.1979, *K.M. Matthew 24984*; *Ibid.*, 11 Dec.1979, *K.M. Matthew 24992*; *Ibid.*, 30 Jan. 1980,

Fig. 83. Lectotype of *Eragrostis nutans* (Retz.) Nees *ex* Steud. [*Köenig s.n.* (K000643354) designated by Bor, 1960] © The Board Trustees of the Royal Botanic Gardens, Kew.

K.M. Matthew 26200; *Ibid.,* 01 Feb. 1980, *K.M. Matthew 26253*; *Ibid.,* 28 Dec. 1981, *K.M. Matthew, S.J. Britto* & *N. Rani 28692* (RHT).

Notes:—*E. nutans* is more similar to *E. atrovirens* and *E. gangetica,* but can be recognized by its linear, narrow, somewhat congested panicles, very long oblong spikelets, persistent paleas and globose caryopses.

23. Eragrostis papposa (Roem. & Schult.) Steud., Nomencl. Bot. ed. 2: 564. 1840; Stapf in Hook.f., Fl. Brit. India 7: 322. 1896; Bor, Grass. Burma Ceylon India Pakistan 511. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; Pullaiah, Fl. Andhra Pradesh 3: 1197. 1997. *Poa papposa* Duf., Roem. & Schult., Syst. Veg. 2: 585. 1817. *Megastachya papposa* Roem. & Schult. *nom. illeg.*, Syst. Veg. 2: 585. 1817. **Type:—**Spain, Sagundo, *Dufour s.n.* (Holotype: NTM). **Fig. 84**

Tufted perennials, 10–60 cm high, erect or ascending, nodes brownish; roots fibrous. ***Culms*** 10–50 cm long, nodes glabrous, internodes 3–7 cm long. ***Leaf sheaths*** 3–4.5 cm long, inrolled to the culm, slightly keeled, one margin ciliate. ***Leaf blades*** linear-lanceolate, 10–20 × 0.5–0.8 cm, base shallowly cordate, apex acute-acuminate; surfaces glabrous; margins entire and eglandular; ***ligules*** membranous, a fringe of cilia. ***Panicles*** ovate, 3–22 × 8–14 cm, widely spreading, branches alternate, scabrous along angles, up to 8 cm long. Peduncle 20 cm long, eglandular. ***Spikelets*** elliptic-lanceolate, 3.5–11 × *c.* 1 mm, up to 8–18-flowered, grey to green or purplish, disarticulation of florets from below upwards. Glumes deciduous, almost equal. ***Lower glumes*** lanceolate, 0.3–1 × 0.3–0.5 mm, 1-nerved, 1-keeled. ***Upper glumes*** ovate-lanceolate, 0.8–1.3 × 0.4–0.6 mm, 1-nerved, 1-keeled. ***Lemmas*** ovate-elliptic, 1.1–1.7 × 0.7–0.8 mm, 3-nerved, keeled, lateral nerves prominent, deciduous, chartaceous, apex obtuse, margins entire. ***Paleas*** elliptic-lanceolate, *c.* 1 × 0.3 mm, winged, sub persistent, 2-nerved, keels scabridulose, acute-oblong at apex. ***Rachilla*** persistent, zigzag. ***Lodicules*** 2, membranous. ***Stamens*** 3; anthers 0.1–0.25 mm long, purple. ***Ovary*** 0.2–0.4 mm long,

globose; style 0.2–0.4 mm long, slender; stigma plumose, 0.2–0.4 mm long. ***Caryopses*** oblong-ellipsoid, 0.6–1.6 × 0.3–0.4 mm, yellowish brown.

Flowering & Fruiting:—November–May

Habitat & Ecology:—It grows along stream banks in West and East Godavari Districts.

Distribution:—North Africa through the Middle East Spain, Sudan to Arabia. In India, it was reported from Andhra Pradesh, Gujarat, North-West India and Sikkim.

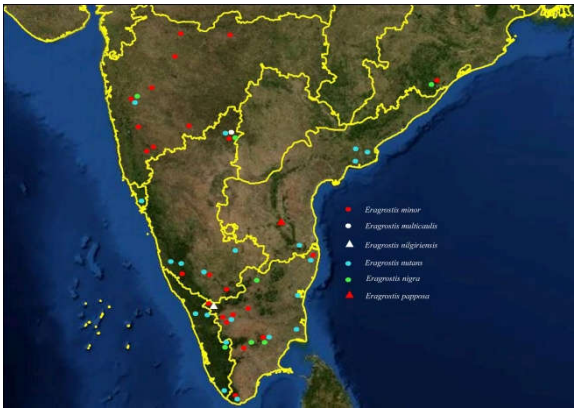


Fig. 84. Distribution of *Eragrostis minor* Host (●), *E. multicaulis* Steud. (○), *E. nilgiriensis* Vivek, G.V.S. Murthy & V.J. Nair (△), *E. nutans* (Retz.) Nees *ex* Steud. (●), *E. nigra* Nees ex Steud. (●) and *E. papposa* (Roem. & Schult.) Steud. (▲)

Specimen examined:—North West India, Baluchistan, *s.die.*, *Heob R.E.P. 19813* (CAL).

Notes:—Couldn't see any specimens other than from Baluchistan. So, the descrption was prepared based on the previous literature.

24. Eragrostis paniciformis (A. Braun) Steud., Syn. Pl. Glumac. 1: 268. 1854; Lazarides, Aust. Syst. Bot. 10: 138. 1997; Veldkamp, Thoiba & Pradeep, Rheedea 27(1): 46–49. 2017. *Poa paniciformis* A. Braun, Flora 24(1): 274.1841. **Type:**—Ethiopia, cultivated in the Carlsruhe Botanical Garden, A. Braun *s.n.* **Lectotype** (designated by Veldkamp *et al.*, 2017):—Ethiopia, 1841, *A. Braun s.n.* (K000366406, image!, Isolectotype: K000366405, image!).

Figs. 85–87, 98

Tufted Perennials, 60–100 cm high, roots fibrous. ***Culms*** 30–60 cm long, nodes glabrous, errect or geniculate, node brownish. ***Leaf sheaths*** 6–15 cm long, enrolled to

the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 10–25 × 0.5–1.5 cm, base slightly cordate, apex acute-acuminate; surface sparsely pilose adaxially and glabrous abaxially, mid rib prominent; margins entire and eglandular; ***ligules*** a fringe of tubercled hairs, hairs 2–6 mm long. ***Panicles*** broadly oblong, effuse-lax, 8–28 × 4–9 cm long, branches alternate, base of primary branches eglandular. Peduncle 10–30 cm long, glabrous, eglandular; rachis 1.5–5 cm long, glabrous; primary pedicel 0.5–1.5 mm long, scabrid; secondary pedicel 1–2 mm long. ***Spikelets*** ovate-lanceolate, 2.5–14 × 2–4 mm, 10–30-flowered, grey-ash; disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** ovate-lanceolate, 1.8–2 × 0.5–1 mm, 1-nerved, 1-keeled, acute- acuminate at apex. ***Upper glumes*** ovate-lanceolate, 2–2.2 × 0.75–1 mm, 1-nerved, 1-keeled, apex acute-acuminate at apex. ***Lemmas*** oblong-lanceolate, 2–2.5 × 1.5–2 mm, 3-nerved, lateral nerves not prominent towards apex, deciduous, chartaceous, black dotted, acute or obtuse at apex. ***Paleas*** elliptic-oblong, 2–2.3 × 1–1.3 mm, winged, caducous, 2-nerved, keeled, keels scabrid or ciliate; more on base, cilia 0.2–0.3 mm long, oblong at apex. ***Rachilla*** zigzag, persistent, 0.3–0.4 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, truncate. ***Stamens*** 3; anthers 0.5–0.75 mm long. ***Ovary*** 0.25–0.3 mm long, globose; style 0.5–1 mm long, slender; stigma plumose, 0.75–1 mm long. ***Caryopses*** obovoid-ellipsoid or slightly curved, 1–1.3 × 0.3–0.4 mm, deep brown.

Flowering & Fruiting:—October–April

Habitat & Ecology:—Found in seasonally wet soils in deciduous bushland, swamp grassland, stream sides, wet flushes, and roadsides between 1075 and 2300 m elevation associated with *Chrysopogon hackelii* (Hook.f.) C.E.C. Fisch., *Heteropogon contortus* (L.) P. Beauv. *ex* Roem. & Schult., *Hypericum mysurense* Wight & Arn. and *Sporobolus piliferus* (Trin.) Kunth.

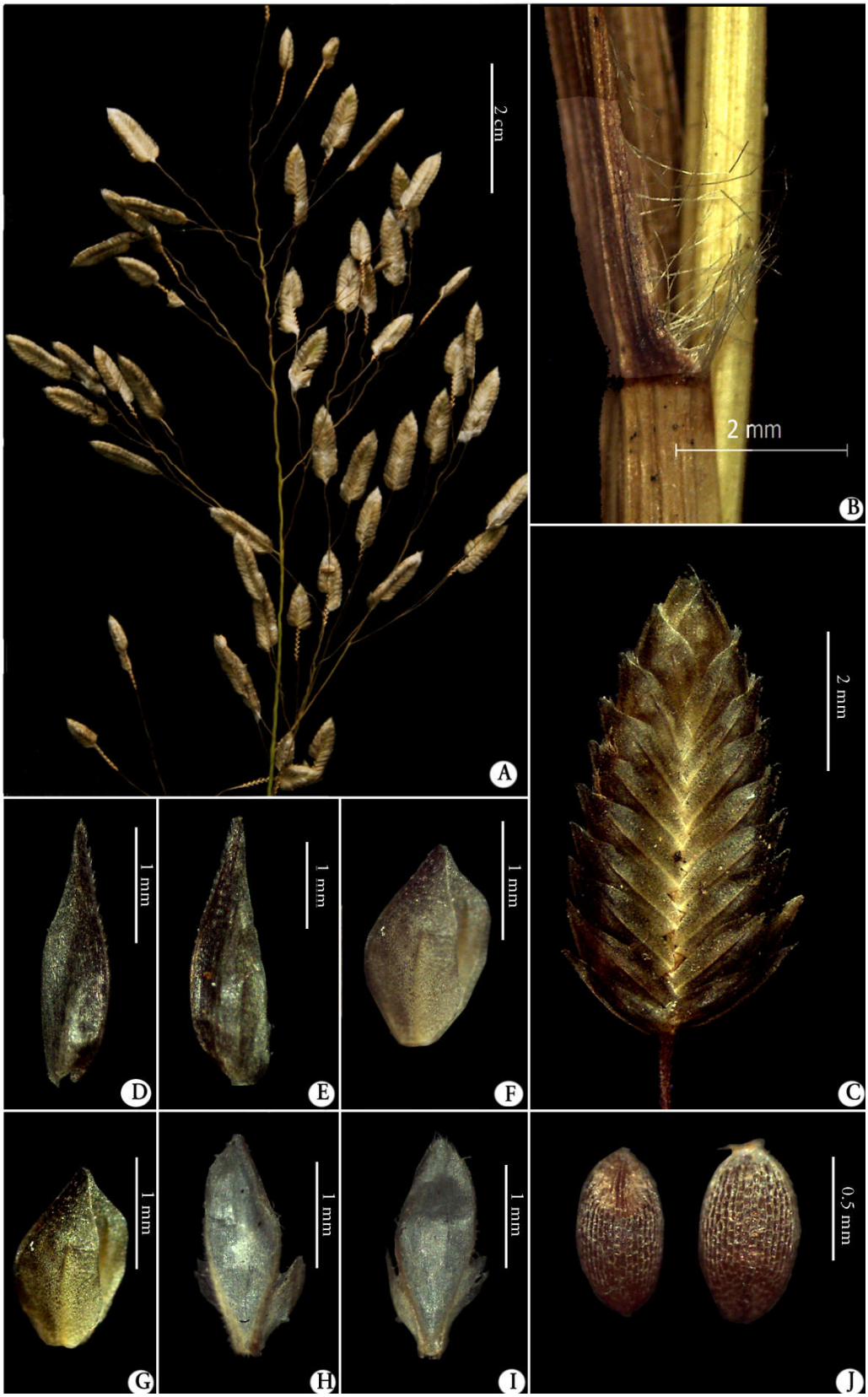


Fig. 85. ***Eragrostis paniciformis*** (A. Braun) Steud.: **A.** Panicle; **B.** Ligule; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Floret; **G.** Lemma; **H & I.** Palea; **J.** Caryopsis.

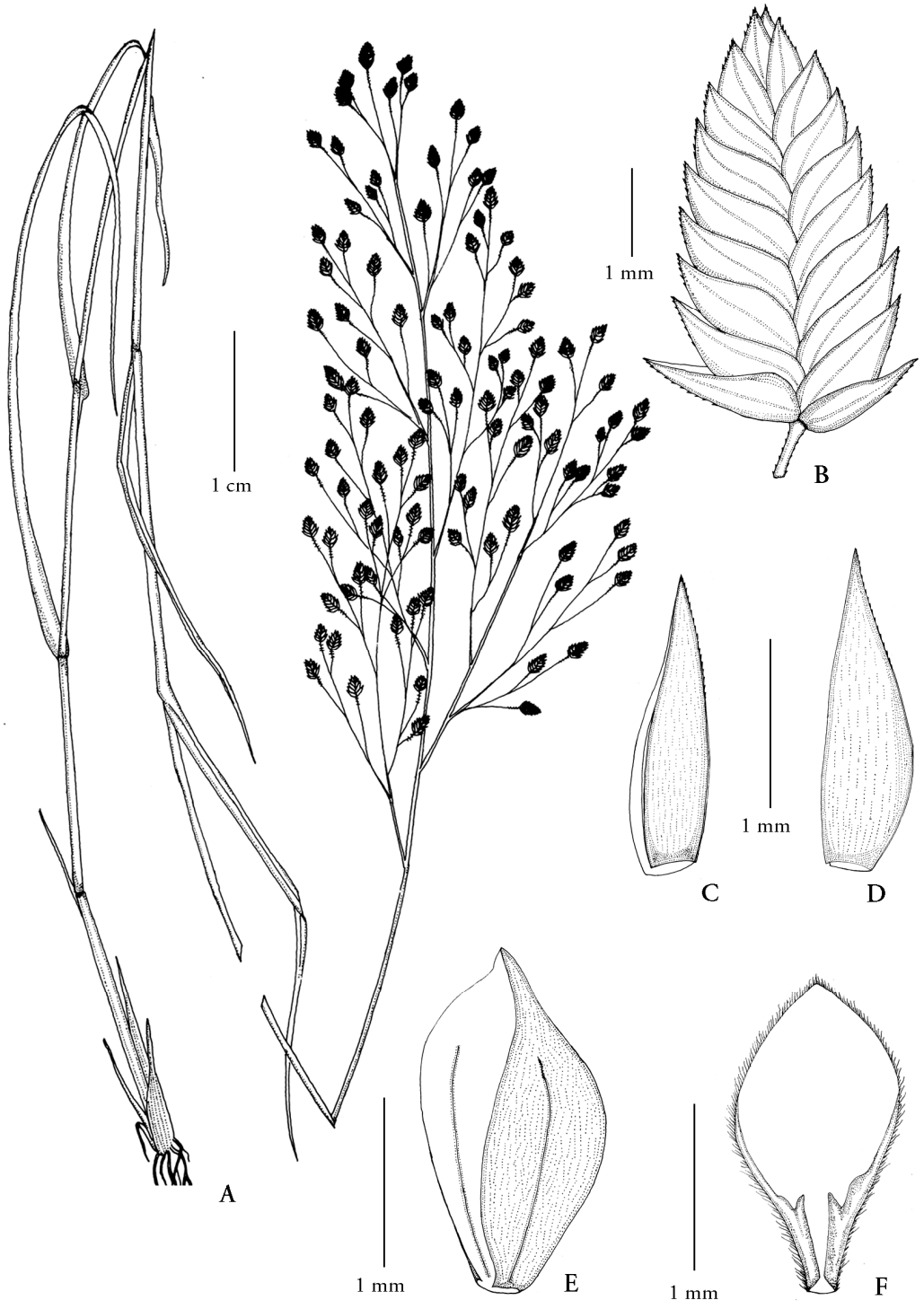


Fig. 86. ***Eragrostis paniciformis*** (A. Braun) Steud.: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea.

Distribution:—East Africa from Sudan, Eritrea to Malawi and Zambia. Introduced in Australia (SE Queensland), Brazil, Niger and Venezuela. Recently, it is reported for the first time from Munnar, Idukki District, Kerala, India.

Specimens examined:—Kerala, Idukki Dist.: Munnar, Mattupetty, Yellapatty, 10° 08'00.0" N, 077°12'35.0" E, 1421 m,16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137599* (CALI, MH, L).

Fig. 87. Lectotype of *Eragrostis paniciformis* (A. Braun) Steud. [*A. Braun s.n.* (K000366406) designated by Veldkamp *et al.*, 2017] © The Board Trustees of the Royal Botanic Gardens, Kew.

Notes:—It is closely similar to *E. curvula* but can be distinguished by its much long (up to 1 m) culms, glabrous basal sheaths, an open sparse panicle with long-pedicelled spikelets on secondary branches, closely imbricate florets with granular curved lemmas; caducous paleas, and terete, turgid caryopses.

25. Eragrostis pilosa (L.) P. Beauv., Ess. Agrostogr.: 71,162, 175. 1812; Stapf in Hook.f., Fl. Brit. India 7: 323. 1896; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1827. 1934; Bor, Grass. Burma Ceylon India Pakistan 512. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1856. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 385. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 217. 1994; S. Moulik, Grass. Bam. India 2: 606. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1198. 1997; Lazarides, Aust. Syst. Bot. 10: 142. 1997; Veldkamp, Blumea 47: 183. 2002; P.M. Peterson & I.S. Vega, Ann. Missouri Bot. Gard. 94: 782. 2007; P.M. Peterson & Giraldo-Cañas, J.

Bot Res. Inst. Texas 2(2): 906. 2008; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 148. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 540. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 119. 2013. *Poa pilosa* L. Sp. Pl. 1: 68. 1753. **Lectotype** (designated by Koch (1974) and Du Puy *et al.* (1993)**:—**Italy, Icon in Scheuchzer Agrostographia. Epitype (designated by Scholz in Cafferty *et al.*, 2000):— A. Kneucker, Gram. Exsicc. XII, 344; 9–10 Aug. 1902; Italy: an Wegen zwischen den Reisfeldern von Pldenico unweit Vercelli in Oberitalien (Epitype: B, Isoepitype: L0064312, image, US-557051). **Figs. 88, 89, 98**

Tufted annuals, 10–50 cm high, roots fibrous. ***Culms*** 10–30 cm long, nodes glabrous, internodes 5–10 cm long. ***Leaf sheaths*** 1.5–6 cm long, enrolled to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 05–15 × 0.5–1 cm, base slightly cordate, apex acute-acuminate; surface glabrous; margins entire and eglandular; ***ligules*** ciliate rim, cilia 1.5–2.5 mm long, fimbriate. ***Panicles*** ovate, open, 10–25 × 5–12 cm, lowest branch whorled, others alternate, base of primary branches pilose. Peduncle 3–8 cm long, glabrous, eglandular; primary pedicel 3–7 mm long, glabrous; secondary pedicel 2–3.5 mm long, rachis 0.5–4 cm long. ***Spikelets*** ovate-lanceolate, 3–8 × 0.75–1.2 mm, 8–10-flowered, olive green, margins smooth appearance, disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** lanceolate, 0.7–1 × 0.3–0.4 mm, 1-nerved, 1-keeled, membranous. ***Upper glumes*** lanceolate, 1–1.2 × 0.3–0.4 mm, 1-nerved, 1-keeled, acute at apex. ***Lemmas*** ovate-lanceolate, 1.5–2.5 × 1–1.2 mm, chartaceous, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex sharply acute. ***Paleas*** elliptic-lanceolate, 1.5–2 × 0.3–0.8 mm, winged, deciduous or not, 2-nerved, keels ciliolate, acute-oblong at apex. ***Rachilla*** prominent, 0.6–0.8 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, dentate. ***Stamens*** 3; anthers 0.4–0.6 mm long. ***Ovary*** 0.2–0.4 mm long, globose; style 0.4–0.5 mm long, slender; stigma plumose, 0.3–0.6 mm long. ***Caryopses*** ellipsoid-oblong, 1–1.4 × 0.3–0.5 mm, light brown.

Flowering & Fruiting:—October–March

Fig. 88. ***Eragrostis pilosa*** (L.) P. Beauv.: **A.** Habit; **B.** Ligule; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Floret; **G.** Lemma; **H & I.** Palea; **J.** Palea with flower; K. Lodicule; **L.** Caryopsis.

Habitat & Ecology:—It is found growing along city sidewalks, cultivated fields, disturbed habitats, forest margins, gardens, pond sides, railway tracks, river banks, road sides, water logged areas in association with *Apluda mutica* L.*, Chrysopogon festucoides* (C.Presl) Veldkamp*, Eragrostis atrovirens* (Desf.) Trin ex Steud., *E. gangetica* (Roxb.) Steud., *E. japonica* (Thunb.) Trin., *Panicum repens* L., *Isachne globosa* (Thunb.) Kuntze, *Lindernia antipoda* (L.) Alston, *Ischaemum mangaluricum* (Hack.) Stapf *ex* C.E.C.Fisch., *Ischaemum ciliare* Retz., *Rotala macrandra* Koehne and *Justicia procumbens* L.

Distribution:—America, Europe, Africa, Asia, Australia and Pacific. In India, it is rather widely distributed and known from almost all states.

Fig. 89. Isoepitype of *Eragrostis pilosa* (L.) P. Beauv. [*A. Kneucker s.n.* (L0064312) designated by Cafferty *et al.*, 2000] © The Board Trustees of the Naturalis Biodiversity Center, Leiden, Netherlands.

Specimens examined:—India, **Andhra Pradesh,** Guntur Dist.: Nagarjuna Nagar, 11 Nov. 1989, *M.R. Rajendra Prasad 656* (MH). **Goa,** North Goa Dist.: Taleigão, Goa University Campus, 28 Apr. 1997, *Vaishali C. Joshi* & *S. Rajkumar 761* (Goa University Herbarium). **Gujarat,** Kutch Dist.: Chitrod, 18 Oct. 1958, *S.K. Jain 4677*; *Ibid.*, *s.loc.*, 19 Oct. 1958, *S.K. Jain 46818* (BSI). Narmada Dist.: Karaya, Rajpipla, 03 Sept. 1967, *R.D. Pataskar 112109* (BSI). Rajkot Dist.: Nr. Ditch, 17 Oct. 1957, *H. Santapau 13514* (BLAT). **Karnataka,** Banglore Dist.: Bommanahalli, way to Tumkur, 29 Sept. 2015, *Thoiba K. 144194* (CALI). Belgaum Dist.: Londa, 30

Aug. 1909, *R.K. Bhide s.n.* (BSI). Bellary Dist.: Hampi, 04 Oct. 1919, *s. coll. 15982* (MH). Chamarajanagar Dist.: Gundlupet, 29 Sept. 2015, *Thoiba K. 144173* (CALI). Chitradurga Dist.: Harihar, Harpanhalli Road, 30 Dec. 1975, *N.P. Singh 141881* (BSI). Hassan Dist.: Jayachamarajapuram, 07 Dec. 1940, *K.C. Jacob 20128* (MH); Sakalaeshpur, 13 Sept. 2014, *Thoiba K. 137526* (CALI). Kodagu Dist.: Kushalnagar, 06 June 1902, *C.A. Barber 4411* (MH). Mysore Dist.: Nanjangud, Sindhuvalli, 09 Sept. 2015, *Thoiba K.144167* (CALI); Kawal R.F. 12 Dec. 1940, *K.C. Jacob 20144* (MH). Shimoga Dist.: Asarmuke, Sambankattae, 09 Sept. 2015, *Thoiba K. 144159* (CALI). **Kerala,** Alappuzha Dist.: Cherthala Railway Station, *s. die*, *Sunil C.N. 2223* (CALI). Idukki Dist.: Munnar, 30 June 1944, *K.C. Jacob 20482* (MH); Vellimala, 16 Aug. 1994, *Jomy Augustine 14047* (CALI); Munnar, Top station, 15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137569* (CALI). Kasargod Dist.: Hosdurg, 29 Jan. 1979, *V.J. Nair 59997* (CAL); Malappuram Dist.: Anangadi, Vallikunnu, 15 June 2016, *A.K. Pradeep & Thoiba K. 146780* (CALI); Calicut University, 22 Aug. 1974, *V.V. Sivarajan 1079* (CALI); Kooriyad, 08 Feb. 2013, *Thoiba K. 134413*; *Ibid.*, Bharathapuzha River Basin, 19 Oct. 2013, *Thoiba K. 134474* (CALI); Angadipuram, 18 Sept. 2015, *Thoiba K.* & *A.K. Pradeep 146699* (CALI). Palakkad Dist.: Pathanthode, 21 Aug. 1966, *Vajravelu 275571* (CAL, MH); Pattambi, 22 Jan. 2013, *Thoiba K. 134407*; *Ibid.*, Nenmara, Thiruvayiyad, 07 Nov. 2013, *Thoiba K. 134482* (CALI). Thrissur Dist.: Mannuthy, Agricultural University Campus, 20 July 2014, *Thoiba K* & *V. Drisya 144119* (CALI); Sholayar, Thottapura, 11 Dec. 2013, *Thoiba K. 138022* (CALI). **Maharashtra,** Dhule Dist.: Laling, 08 Oct. 1969, *R.D. Pataskar 118347* (BSI). Kolhapur Dist.: Shivaji University Campus, 13 Sept. 1992, *C.B. Salunkhe 7380* (SUK). Mehsana Dist.: Chandan Dura Hill Junction, 30 Aug. 1963, *R.S. Rao 90898A* (BSI). Mumbai City Dist.: Vihar Lake, 24 July 1954, *Santapau 18957* (BLAT); Nandurbar Dist.: Toranmal, 17 Aug. 1965, *R.D. Pataskar 105787* (BSI). Nashik Dist.: Saptashrungi Dongar, 16 Sept. 1966, *Jhon Cheriyan 104679* (BSI). Palghar Dist.: Nandore Sport Hills, 07 Sept. 1966, *Jhon Cherian 109247* (BSI).

Pune Dist.: Junnar, Darya Ghat, Aug. 2006, *S.B. Nagarkon s.n.*; *Ibid.*, Ingluk–Durgawadi Road, 26 Oct. 2002, *S.S. Rahangdale 1541* (AHMA); Katraj Ghat Lake, 18 Feb. 1958, *S.D. Mahajan 20538*; *Ibid.*, Valvan Dam, Lonavle, 18 Aug. 1964, *B. Venkata Reddi 98624* (BSI). Raigad Dist.: Dhak, Aug. 2003, *S.B. Nagarkar s.n.* (AHMA); Pimpri River near Dango, 24 Oct. 1955, *Santapau 20136* (BLAT); Narayangaon, Nasik Road Junnar, 11 Oct. 1965, *Hamadri K. 106975*; *Ibid.*, 05 Oct. 1965, *Hemadri K. 106833* (CAL); Karandi, Nov. 1992, *C.B. Salunkhe 3123* (SUK). Sangli Dist.: Kundali River bank, 22 Jan. 1925, *E. Blatter s. n.* (BLAT); Ashta, 26 Sept. 1993, *C.B. Salunkhe 7028* (SUK). Solapur Dist.: Great Indian Bustard Sanctuary, Mardi, 16 Sept. 2010, *J. Jayanthi* & *S.C. Yadav 198268* (BSI). Satara Dist.: Pusegaon, 30 Sept. 1992, *C.B. Salunkhe 7264*; *Ibid.*, Kashil, 26 Sept. 1994, *C.B. Salunkhe 7241* (SUK). Yavatmal Dist.: Sunna-Tipeshwar, 10 Aug. 1979, *S. Karthikeyan 160123* (BSI). **Tamil Nadu,** Coimbatore Dist.: 17 Feb. 1930, *Narayanaswami 20040* (MH); Malakkapara, Myladum Para-NC, 13 Dec. 2013, *Thoiba K. 138018*; *Ibid.*, Malakkapara, Shaekalmudi, Mudiyankunnu, 12 Dec. 2013, *Thoiba K. 138024,* (CALI). Dindigul Dist.: Kodaikanal, 31 Dec. 2013, *Thoiba K. 138033,* (CALI); Sirumalai, 20 Sept. 1955, *J. Pallithanam 792* (RHT); Narthamalai, 30 Aug. 1970, *K.M. Matthew 12277* (RHT). Madurai Dist.: Soranganar Falls, 23 June 1959, *K. Subramanyam 8165* (MH). Namakkal Dist.: Kolli Hills, 01Jan. 2014, *Thoiba K. 138032,* (CALI). Nilgiri Dist.: Kunda, 26 July 2012, *Remya J.* & *Prasanna73785* (TBGT); Kodanad View Point, 08 Nov. 2012, *Remya J.* & *Prasanna75455* (TBGT). Pudukkottai Dist.: Ponnamaravathi, 17 Sept. 1985, *C. Arulappan 499* (MH). Salem Dist.: Namakkal, 17 Oct. 1977, *K.M. Matthew* & *V. Karunanidhi 9775* (RHT); Yercad, Louis villa, 19 Dec. 1977, *D.I.Arockiasamy 10345* (RHT). Tiruchirappalli Dt.: Bharathidasan University, 01 Nov. 2014, *Thoiba K. 137536*; *Ibid.*, 01 Nov. 2014, *Thoiba K. 137539* (CALI). Tirunelveli Dt.: Courtallam, 04 July 1979, *R. Ashok Kumar 31271* (CALI).

Notes:—Distinguishing characters include the glandular plants; basal panicle branches that are usually whorled and stiffly bearded in the axils; a loosely flowered spikelet with a zigzag rhachilla.

26. Eragrostis riparia (Willd.) P. Beauv., Ess. Agrostogr.: 162. 1812; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1825. 1934; Bor, Grass. Burma Ceylon India Pakistan 513. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1857. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 386. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 220. 1994; S. Moulik, Grass. Bam. India 2: 606. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1198. 1997; Veldkamp, Blumea 47: 184. 2002; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 149. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 540. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 119. 2013. *Poa riparia* Willd., Ges. Naturf. Freunde Berlin, Neue Schriften 4: 185. 1803. *Megastachya riparia* (Willd.) Roem. & Schult., Syst. Veg. 2: 593. 1817. *Eragrostis tenella* (L.) Roem. & Schult. var. *riparia* (Willd.) Stapf in Hook.f., Fl. Brit. India 7: 315. 1896. *Eragrostis amabilis* Nees var. *riparia* (Willd.) A. Camus, Fl. Gén. Indo-Chine 7: 557. 1923. **Type:**—India, *Rottler s.n. in Herb. Willdenow 1940/2* (Holotype: B, fragm. K000643374, image!). **Figs. 90, 91, 98**

Tufted perennials, 10–60 cm high, roots fibrous. ***Culms*** 10–50 cm long, nodes glabrous, internodes 3–20 cm long. ***Leaf sheaths*** 4–8 cm long, inrolled to the culm, slightly keeled. ***Leaf blades*** linear-lanceolate, 3–12 × 0.3–0.4 cm, base shallowly cordate, apex acute-acuminate; surfaces glabrous, margins entire; ***ligules*** ciliate rim, cilia 2–4 mm long. ***Panicles*** contracted and spiciform; 5–15 × 0.5–3 cm, glandular on axis and raceme, branches alternate; peduncle 6–27 cm long, glabrous, glandular; rachis 1–3 mm long, glabrous; primary pedicel 0.1–1mm long, glabrous. ***Spikelets*** ovate-lanceolate, 2–2.5 × 0.5–1 mm, 3–6-flowered, disarticulation of florets from above downwards. Glumes deciduous, subequal. ***Lower glumes*** lanceolate, 1–1.3 × 0.2–0.5

mm, 1-nerved, 1-keeled, chartaceous. ***Upper glumes*** lanceolate, 1.2–1.5 × 0.3–0.4 mm, 1-nerved, 1-keeled, chartaceous. ***Lemmas*** oblong-lanceolate, 1–1.2 × 0.4–0.5 mm, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex sharply acute. ***Paleas*** elliptic-lanceolate, 1–1.2 × 0.3–0.4 mm, winged, persistent, 2-nerved, keels more or less ciliate, acute-oblong at apex. ***Rachilla*** persistent, zigzag, 0.2–0.3 mm long, glabrous. ***Lodicules*** 2, 0.2–0.3 mm long, truncate at apex. ***Stamens*** 3; anthers 0.2–0.3 mm long, white. ***Ovary*** 0.2–0.3 mm long, globose; style 0.2–0.3 mm long, slender; stigma plumose, 0.4–0.5 mm long. ***Caryopses*** ellipsoid to ovoid, 0.3–0.6 × 0.2–0.4 mm, light brown.

Flowering & Fruiting:—Almost throughout the year

Habitat & Ecology:—It is usually found growing along city sidewalks, coastal plaines, open grounds, railway tracks, road sides, in association with *Alternanthera sessilis* (L.) R.Br. *ex* DC., *Ipomoea aquatic* Forssk., *Eragrostis amabilis* (L.) Wight & Arn., *E. cumingii* Steud., *E. zeylanica* Nees & Meyen, *E. brownii* (Kunth) Nees, *E. unioloides* (Retz.) Nees *ex* Steud., *Ischaemum ciliare* Retz., *Hygrophila ringens* (L.) Steud.

Distribution:—India, Sri Lanka, Malesia and Thailand. In India, it is distibuted in South India.

Specimens examined:—India, **Andhra Pradesh,** Anantapur Dist.: Kalasamudram R.F., 08 Feb. 1983, *W. Yesoda 1166* (MH). Krishna Dist.: Ivunna, 05 Feb. 1956, *P. Venkanna 5921* (MH). Nellore Dist.: Raia Palace, Aug. 1883, *J.S. Gamble 12683* (MH); Allur, 19 Aug. 1907, *C.A. Barber 7940* (FRC). **Karnataka,** Hassan Dist.: Yettinahalli, 11 Apr. 1970, *C.J. Saldanha 16797* (JCB). Kolar Dist.: Chaitamani–Bogalapalli Road, 05 Jan. 1976, *N.P. Singh 142112* (BSI); Tumkur–Chickballapur Road, 03 Jan. 1976, *N.P. Singh 142027* (BSI). Tumkur Dist.: Bukkapatna S.F., 29 Oct. 1975, *N.P. Singh 141148a*; *Ibid.*, 29 Oct. 1975, *N.P. Singh 141148b* (BSI). North Kanara, 25 Jan. 1890, *W.A. Talbot 2207* (BLAT). **Kerala,** Alappuzha Dist.: Vandanam, Medical College Ground, 28 Jan. 2014, *Thoiba K.138056* (CALI);

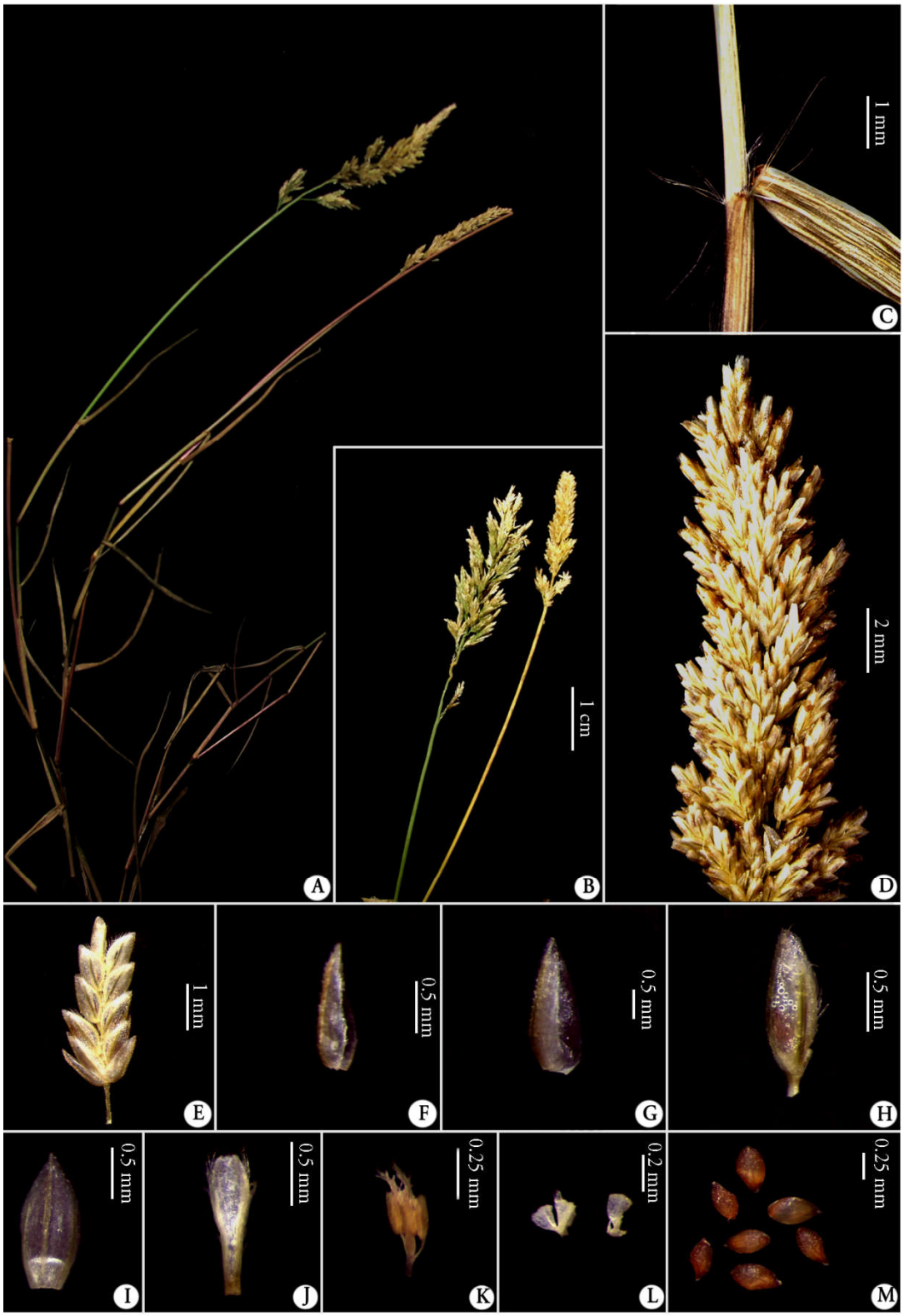


Fig. 90. ***Eragrostis riparia*** (Willd.) P. Beauv.: **A.** Habit; **B.** Panicles; **C.** Ligule; **D.** Enlarged portion of panicle; **E.** Spikelet; **F.** Lower glume; **G.** Upper glume; **H.** Floret; **I.** Lemma; **J.** Palea; **K.** Stamens & Pistil; **L.** Lodicules; **M.** Caryopsis.

Fig. 91. Type specimen of *Eragrostis riparia* (Willd.) P. Beauv.[*Willdenow 1940/2* (K000643374)] © The Board Trustees of the Royal Botanic Gardens, Kew.

Ambalapuzha, 28 Jan. 2014, *Thoiba K. 138069* (CALI); Vandanam, *s.die*, *Sunil C.N. 1829* (CALI); *Ibid.*, 18 June 1980, *P.V. Sreekumar 67680* (MH). Malappuram Dist.: Calicut University, 18 Dec. 1970, *V.V. Sivarajan 870* (CALI). Thiruvananthapuram Dist.: Peroorkada, SAP Parade Ground, 08 Aug. 2014, *Thoiba K. 138090* (CALI). **Tamil Nadu,** Chennai Dist.: *s.loc.*, 02 Sept. 1902, *C.A. Barber 4387*; *Ibid.*, 02 Sept. 1902, *C.A. Barber 4385* (MH); Adyar, July 1889, *J.S. Gamble 20786* (MH). Coimbatore Dist.: Nilgiri Biosphere Park, 05 Mar. 2015, *Thoiba K.144113* (CALI); Thekkumalai Hills, 12 Dec. 1956, *K.M. Sebastine 1731* (MH); Perur Dam, Noyyal River, 15 Feb. 1957, *K. Subramanyam 2328*a; *Ibid.*, 15 Feb. 1957, *K. Subramanyam 2328b* (MH); Palamalai, 14 July 1970, *M.V.V. Viswanathan 701* (MH). Cuddalore Dist.: Kovalarithittu, 04 Mar. 1970, *K.N. Subramanian 3921* (FRC). *s.loc.*, 05 Mar. 1905, *C.A. Barber 4263* (MH); Chidambaram, 25 Jan. 1979, *N. Venugopal* & *T.S. Jayaseelan 21144* (RHT); Karithurai, 09 June 1981, *K.M. Matthew, S.J. Britto* & *W. Rani 28349*; *Ibid.,* 11 Oct. 1977, *K.M. Matthew* & *V. Alphonse Amalraj 4477*; *Ibid.,* 07 Jan. 1977, *D.I. Arockiasamy 6413* (RHT). Dharmapuri Dist.: Harur, Chitteri hills, 11 Aug. 1978, *K.M. Matthew 16245* (RHT); Denkanikotta, Anchetty R.F., 13 Feb. 1980, *T.S. Jayaseelan 26490* (RHT). Nagapattinam Dist.: Tarangambadi Beach, 24 Nov. 1998, *K.M. Matthew* & *K.T. Augustine 60115* (RHT). Nilgiri Dist.: Theppakadu, 25 Nov. 1963, *K. Ramamurthy*

17691 (MH). Thiruchirapalli Dist.: Puliyancholai, 08 Aug. 1958, *K.M. Sebastine 6232* (CAL). Thiruvannamalai Dist.: *s.loc.*, 20 Jan. 1985, *M.B. Viswanathan 781* (MH). Viluppuram Dist.: Marakkanam, 16 Feb. 1979, *K. Ramamurthy 60230* (CAL). **Maharashtra,** Raigad Dist.: Borkhar, 19 Nov. 2000, *s.coll.*, *s.n.* (SUK).

Notes:—*E. riparia* shows resemblances with *E. amabilis* and *E. viscosa* but differs in having non viscous culms with condensed spiciform panicles.

27. Eragrostis rottleri Stapf in Hook.f., Fl. Brit. India 7: 321. 1896; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1827. 1934; Bor, Grass. Burma Ceylon India Pakistan 513. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; S. Moulik, Grass. Bam. India 2: 606. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 150. 2009. **Lectotype** (designated by Vivek *et al.*, 2013b)**:**––India, Tamil Nadu, Nagapattinam District, Tranquebar (Tharangampadi), 1799, *Rottler s.n. p.p.* (Lectoype: K000518040, excluding top left hand specimen, image!). **Figs. 92, 93, 98**

Tufted annuals, 25–60 cm high, roots fibrous. ***Culms*** 30–60 cm long, straight or geniculate; nodes glabrous slighty brownish in colour. ***Leaf sheaths*** 3–10 cm long, inrolled to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 4–10 × 0.2–0.25 cm, base slightly cordate and gland dotted, apex acute-attenuate; surface sparsely pilose and gland dotted adaxially and glabrous abaxially; margins entire; ***ligules*** a fringe of hairs, hairs 0.5–1.3 mm long. ***Panicles*** ovate, open, effuse-contracted, viscous, 6–17 cm long, branches alternate; peduncle 4–13 cm long; rachis 2–3 mm long, glandular; primary pedicel 0.5–0.8 cm long, glabrous; secondary pedicel 0.3–0.5 cm long, axils slightly glandular and plumose. ***Spikelets*** linear-lanceolate, 4–6 × 1.2–1.3 mm, 5–12-flowered, pink to grey; disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** ovate-lanceolate, 0.8–0.9 × 0.3–0.4 mm, 1-nerved, 1-keeled, purple tinged in colour, acute at apex. ***Upper glumes*** ovate-lanceolate, 0.8–1 × 0.4–0.5 mm, 1-nerved, 1-keeled, acute at apex. ***Lemmas*** elliptic-lanceolate, 1–1.3 ×

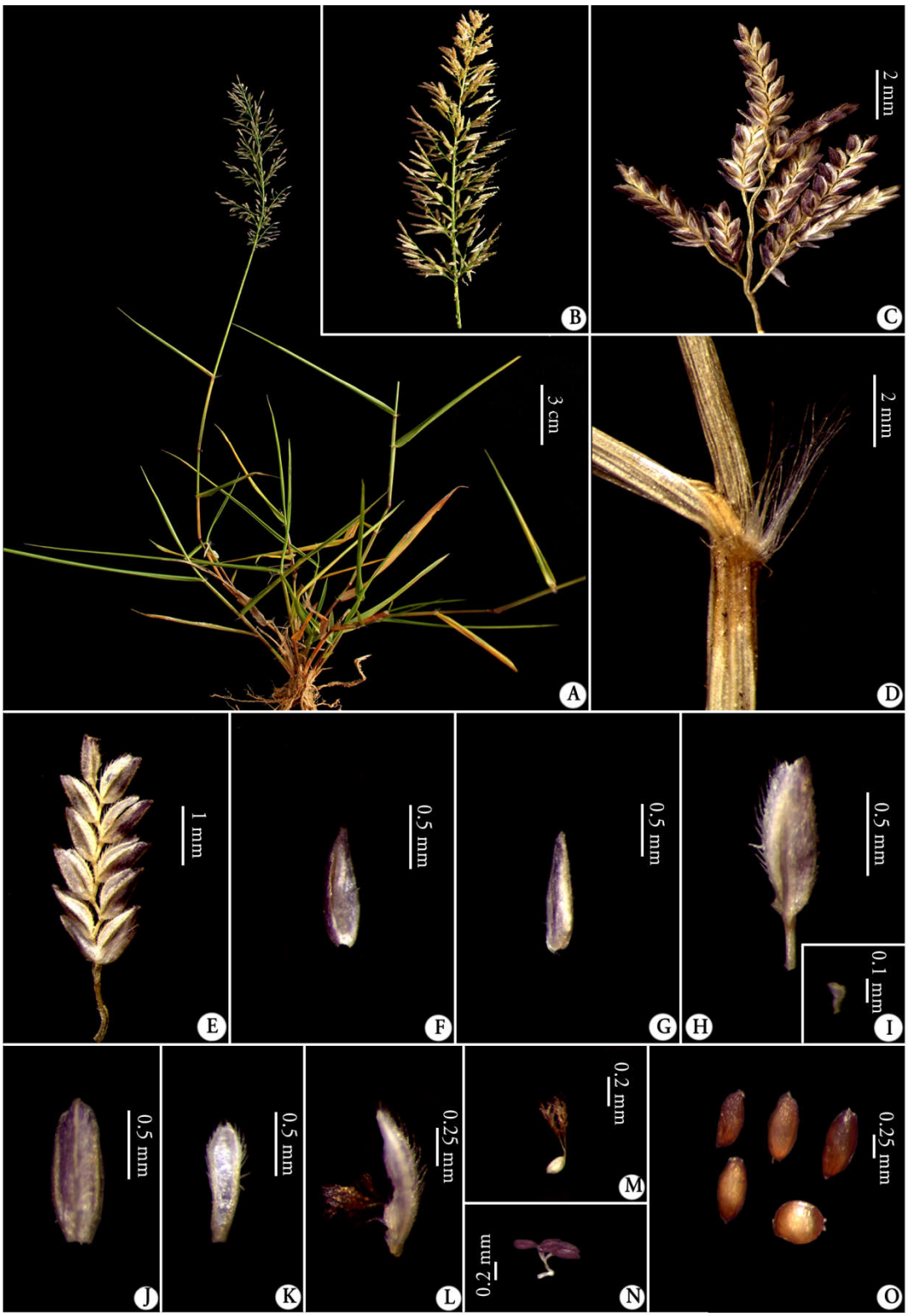


Fig. 92. ***Eragrostis rottleri*** Stapf: **A.** Habit; **B.** Panicles; **C.** Enlarged portion of Spikelets; **D.** Ligule; **E.** Spikelet; **F.** Lower glume; **G.** Upper glume; **H.** Floret; **I.** Lodicule; **J.** Lemma; **K.** Palea; **L.** Palea with flower; **M.** Pistil; **N.** Stamens; **O.** Caryopsis.

0.5–1 mm, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex sharply acute. ***Paleas*** elliptic-lanceolate, 1–1.2 × 0.3–0.4 mm, winged, caducous, 2-nerved, keeled, keels ciliolate, obtuse at apex. ***Rachilla*** straight, 0.3–0.4 mm long, scabridulose. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 3; anthers *c.* 0.3 mm long, purple. ***Ovary*** 0.2–0.3 mm long, globose; style *c.* 0.2 mm long, slender; stigma plumose, 0.2–0.4 mm long. ***Caryopses*** sub-globose, 0.4–0.6 × *c.* 0.2 mm, deep brown.

Flowering & Fruiting:—September–January

Habitat & Ecology:—It grows along city sidewalks, coastal plaines, road sides, in association with *Apluda mutica* L., *Aristida funiculate* Trin. & Rupr., *Cuscuta chinensis* Lam., *Eragrostis amabilis* (L.) Wight & Arn., *E. minor* Host, *Merremia hederacea* (Burm. f.) Hallier f. and *Themeda tremula* (Nees ex Steud.) Hack.

Distribution:—India, Pakistan?. In India, presently it is reported from Karnataka and Tamil Nadu.

Specimens examined:—India, **Karnataka,** Mysore Dist.: Rajiv Gandhi National Park, 10 Dec. 2014, *A.K. Pradeep* & *Thoiba K. 137561* (CALI). **Tamil Nadu,** Coimbatore Dist.: Maruthamalai, 04 Mar. 2015, *Thoiba K. 144115* (CALI). Thiruchirapalli Dist.: Trichy, 24 Jan. 2014, *Thoiba K. 138072* (CALI); Bharathidasan University Campus, 01 Nov. 2014, *Thoiba K. 137538* (CALI). Thiruvannamalai Dist.: MG Nager Road, Ponganur, 18 Jan. 2016, *Thoiba K.* & *K.M. Lemiya 146688* (CALI).

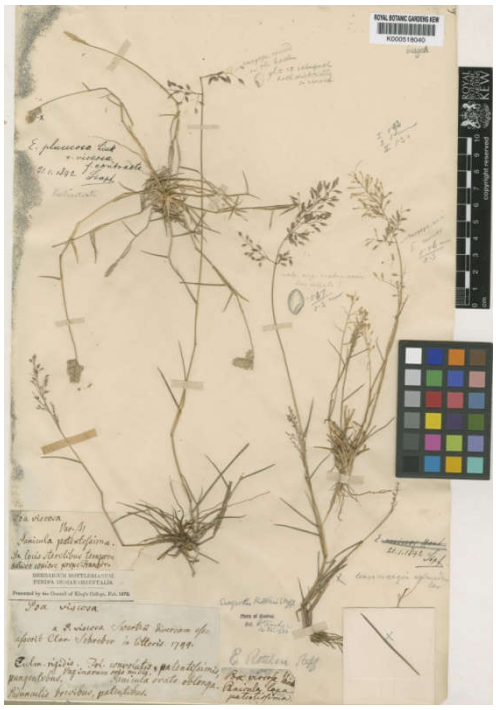


Fig. 93. Lectotype of *Eragrostis rottleri* Stapf [*Rottler s.n.* (K000518040) designated by Vivek *et al.,* 2013] © The Board Trustees of the Royal Botanic Gardens, Kew.

Notes:—*E. rottleri* is a distinctive species having some resemblance to *Eragrostis minor* Host and *E. viscosa* (Retz.) Trin. It differs from *E. minor* mainly by complete absence of pitted glands on the pedicels of spikelets; lemma pale brown or white. While, due to the presence of a viscid culm portion below the panicle, it can easily be mistaken for *E. viscosa*, but in *E. rottleri* branches are glandular, sometimes a specific odour may feel in live specimens from the field itself.

Based on the specimen in Kew Herbarium, *R.R. Stewart 26395* from Giljit of Pakistan, gives the distribution of *E. rottleri* in Pakistan. Cope (1982), working on the Poaceae for the Flora of Pakistan, examined the *Stewart* specimens thoroughly and found a close similarity with the type specimens. However, he was reluctant to add this to the Flora of Pakistan based as more materials are not available. I collected this specimen after a lapse of 187 years from lowlands of Thiruchirappalli District of Tamil Nadu and also one more collection from Mysore District of Karnataka.

28. Eragrostis schweinfurthii Chiov., Annuario Reale Ist. Bot. Roma 8(3): 368–369. 1908; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 150. 2009. **Type:—**Eritea-Ocule Cusai, 23 Sept. 1902, *A. Pappi 1245* (BR0000008758002, image!).

Figs. 94–96, 98

Eragrostis chalcantha Schweinf., Samml. Arab. Aeth. Pflanz. Ser. 1: 100. 1896. *nom. illeg.*, *non* Trin. 1830.

Key to the varieties

1a. Panicle effuse with short alternate racemes; branches 1–5 cm long, axils hairy…… ..... **1a. var. *schweinfurthii***

1b. Panicle contracted, spiciform; branches less than 1 cm long, axils glaborus…… ..... **1b. var. *kiwuensis***

1a. var. *schweinfurthii*

Tufted annuals or short lived perennials, 10–50 cm high, roots fibrous. ***Culms*** 10–40 cm high, nodes glabrous. ***Leaf sheaths*** 2–3.5 cm long, enrolled to the culm, ciliate or hirsute towards apex. ***Leaf blades*** linear-lanceolate, 2–5 cm × 0.2–0.4 cm, base slightly cordate, apex acute-acuminate, surface with tuberculate or hirsute hairs on both sides, margins tubercled, slightly scabrid; ***ligules*** fine membranous with long ciliate hairs; 2–4 mm long. ***Panicles*** terminal, 5–9 × 1–2 cm, olive green-leaden grey in colour, slightly contracted with alternate raceme; peduncle 2–4 cm long, round, glabrous, rachis triangular, slightly coriaceous; primary pedicel 1–2mm long, coriaceous; secondary pedicel 1–2 mm long. ***Spikelets*** ovate-oblong lanceolate, 4–8 × 1.3–1.8 mm, 5–15-flowered, olive green-leaden grey in colour, disarticulation occurs between the florets. ***Lower glumes*** lanceolate, 1–1.2 × 0.5–0.7 mm, papery, 1-keeled, 1-nerved, nerves scabrid, slightly purplish in colour at tip &margins, acute at apex. ***Upper glumes*** lanceolate, 1.3–1.5 × 0.5–0.7 mm in size, 1-nerved, 1-keeled, nerves scabrid, papery, slightly purple at the tip and margins. ***Lemmas*** oblong-lanceolate, 1.3–1.5 × *c.* 1 mm, 3-nerved, lateral nerves not prominent, apex sharply acute, leaden grey in colour. ***Paleas*** elliptic-lanceolate, 1–1.2 × 0.5–0.6 mm, winged, 2-nerved, keels scabrid, oblong at apex. ***Rachilla*** smooth, glabrous, olive green in colour, 0.4 mm long. ***Lodicules*** 2, 0.2–0.3 mm, dentate-triquadrate. ***Stamens*** 2, purple, anthers 0.3–0.4 mm long. ***Ovary*** 0.2–0.3 mm, globose, style *c.* 0.2 mm long, slender; stigma plumose, 0.3–0.4 mm long. ***Caryopses*** globose to orbicular, 0.4–0.8 × 0.3–0.5 mm, deep brown.

Flowering & Fruiting:—May–November

Habitat & Ecology:—Grows in high ranges between 1000–2300 m elevations on road sides and hilly areas in association with *Anaphalis aristata* (DC.) DC., *Spermacoce articularis* L.f., *Tripogon ravianus* Sunil & Pradeep and *Xerochrysum bracteatum* (Vent.) Tzvelev.

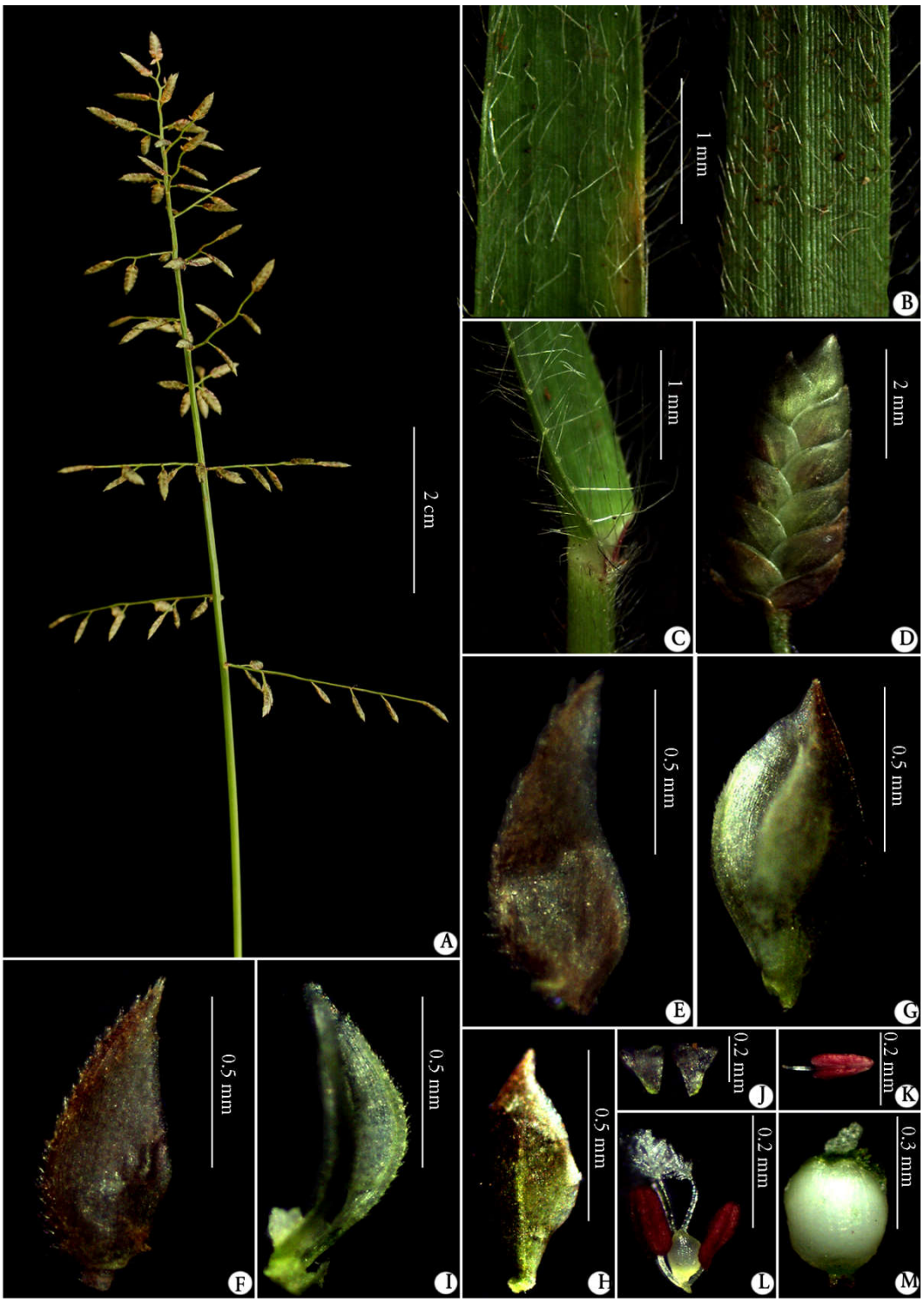


Fig. 94. ***Eragrostis schweinfurthii*** Choiv.: **A.** Panicle; **B.** Enlarged portion of leaf surfaces; **C.** Ligule; **D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Lodicules; **K.** Stamen; **L.** Stamens & Pistil; **M.** Caryopsis.

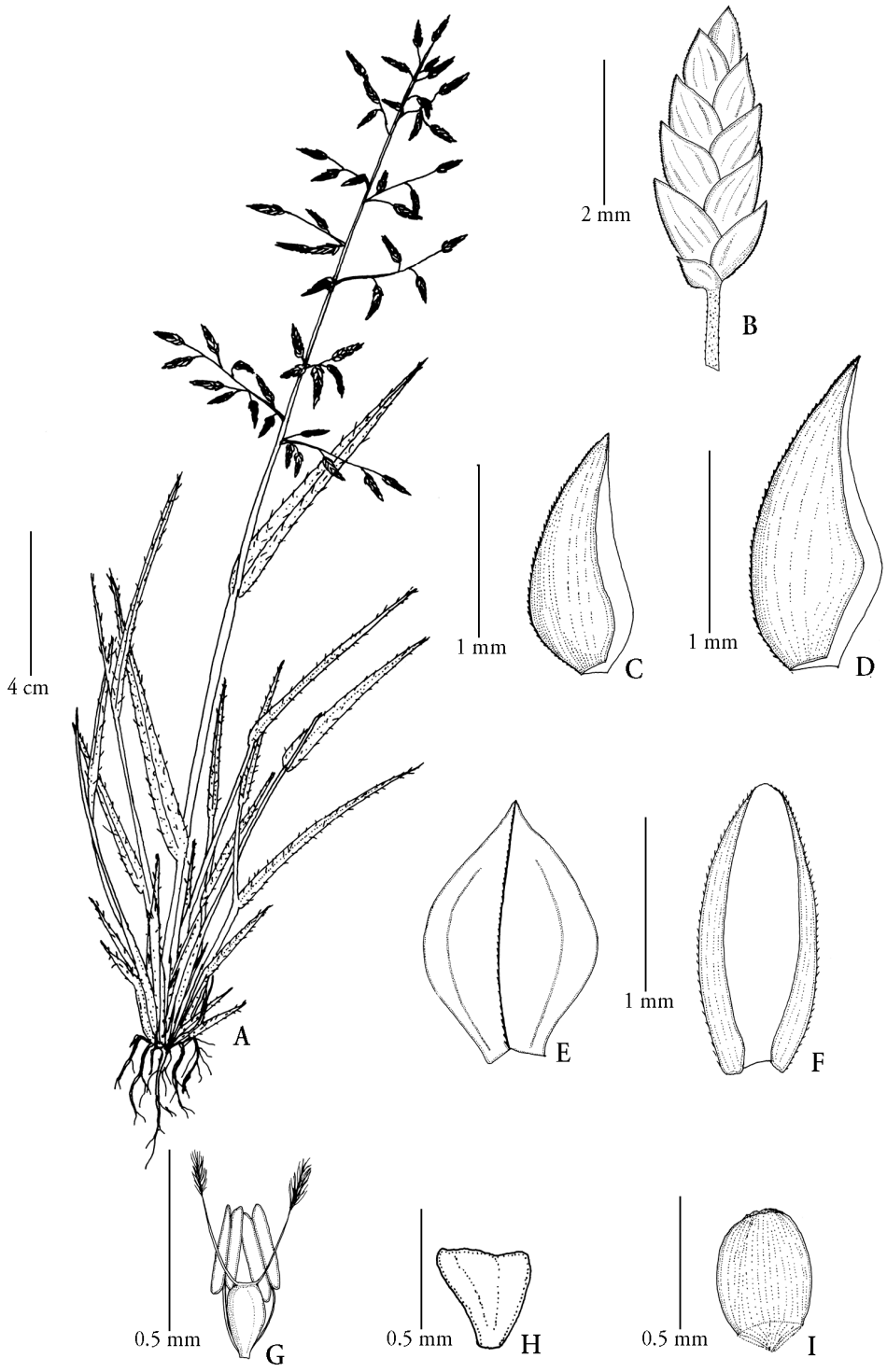


Fig. 95. ***Eragrostis schweinfurthii*** Choiv.: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamens & pistil; **H.** Lodicule; **I.** Caryopsis.

Distribution:—Tropical Africa, Arabia and Sri Lanka. In India, it is presently known only from Tamil Nadu.

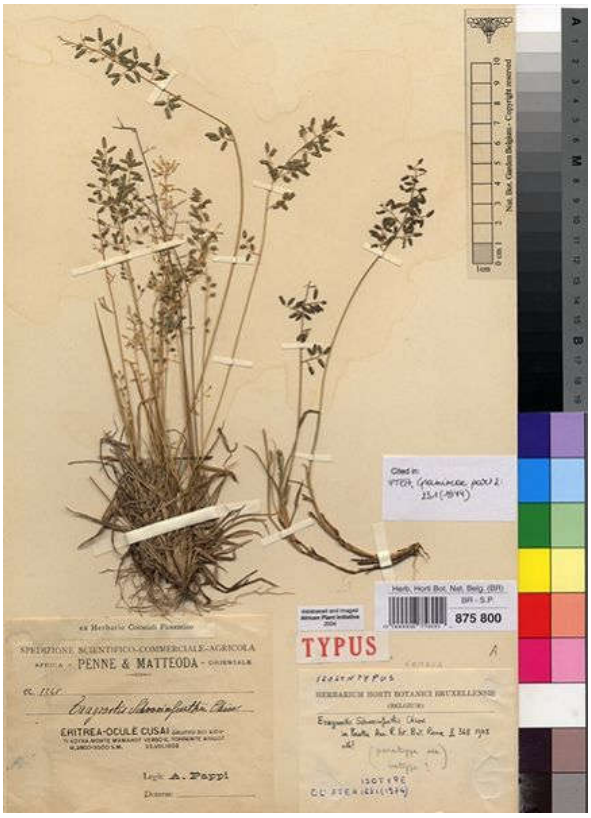


Fig. 96. Type specimen of *Eragrostis schweinfurthii* Chiov. [*A. Pappi 1245* (BR0000008758002)] © The Board Trustees of the National Botanic Garden of Belgium, Meise, Belgium.

Specimens examined:—India, **Tamil Nadu,** Madurai Dist.: Kodaikanal, Konalar, 05 Nov. 1987, *K.M. Matthew 51126* (RHT); Berijam view, 15 June 1990, *K.T. Mathew 54305* (RHT). Nilgiri Dist.: Gudallur, Shooting Point, 31 May 2014, *Thoiba K. 138078* (CALI); Gudallur, 22 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146645* (CALI); *Ibid.*, 12 Dec. 2015, *Thoiba K. 146702* (CALI); Pykara Waterfalls, 12 Dec. 2015, *Thoiba K. 146706* (CALI); Pykara, 12 Dec. 2015, *Thoiba K. 146712* (CALI); Doddabetta, 27 July 2012, *Remya J.* & *Prasanna 73810* (TBGT); Muthorai Palada, 26 July 2012, *Remya J.* & *Prasanna 73806* (TBGT); Upper Bhavani, 09 Nov. 2012, *Remya J.* & *Prasanna 75495* (TBGT).

Notes:—*E. schweinfurthii* var. *schweinfurthii* can be identified by the presence of tuberculate to villous hairs on leaf blades; panicle with short alternate racemes; dark olive green and acute spikelets, lower glumes being boat like in shape.

1b. var. kiwuensis (Jedwabn.) S.M. Phillips, Kew Bull. 42(4): 930. 1987. *Eragrostis kiwuensis* Jedwabn., Bot. Arch. 5(3–4): 206. 1924; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 143. 2009. **Type:**—Africa Orient., Rwanda, NO Kiwu

Randberge südöstl. Karisimbi, Nov. 1907, *J. Mildbraed 1784* (Holotype: B100167419, image!, Isotype: BR0000008758149, image!). **Figs. 97, 98**

Fig. 97. Holotype of *Eragrostis schweinfurthii* var. *kiwuensis* (Jedwabn.) S.M. Phillips [*J. Mildbraed 1784* (B100167419)] © The Board Trustees of the Museum Botanicum Berolinense, Berlin, Germany.

Tufted annuals or short lived perennials, 10–50 cm high, geniculately ascending, rooting at lower nodes. ***Culms*** 10–40 cm high, nodes glabrous. ***Leaf sheaths*** 2–5 cm long, enrolled to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 4–10 cm × 0.2–0.4 cm, flat; ***ligules*** fine membranous with long ciliate hairs; 2–4 mm long. ***Panicles*** terminal, 5–15 × 0.1 cm, olive green-leaden grey in colour, contracted, spiciform; peduncle 2–4 cm long, round, glabrous, rachis triangular, slightly coriaceous. ***Spikelets*** ovate-oblong, *c.* 1 × 0.1–0.2 cm, 10–30-flowered, olive green-leaden grey. Glumes broadly ovate, cymbiform, subequal. ***Lower glumes*** broadly ovate, 1–1.5 × 0.5–0.7 mm, papery, 1-keeled, 1-nerved, nerves scabrid, acute at apex. ***Upper glumes*** broadly ovate, 1.3–1.5 × 0.5–0.7 mm in size, 1-nerved, 1-keeled, nerves scabrid. ***Lemmas*** broadly ovate, 1.3–2 × *c.* 1 mm, 3-nerved, lateral nerves not prominent, apex sharply acute, leaden grey in colour. ***Paleas*** elliptic-lanceolate, 1–1.2 × 0.5–0.6 mm, winged, 2-nerved, keels scabrid, oblong at apex. ***Rachilla*** smooth, glabrous, persistent, 0.4 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 2, purple, anthers 0.3–0.4 mm long. ***Ovary*** 0.2–0.3 mm long, globose, style 0.2 mm long, slender; stigma plumose, 0.3–0.4 mm long. ***Caryopses*** globose, 0.6–0.7 × 0.4–0.5 mm.

Flowering & Fruiting:—May–November

Habitat & Ecology:—Grows in high altitudes between 1000–2400 m elevations on road sides and hilly areas.

Distribution:—Ethiopia, Yemen, Zaire. In India, presently it is known only from Tamil Nadu–Palni Hills in Peninsular India.

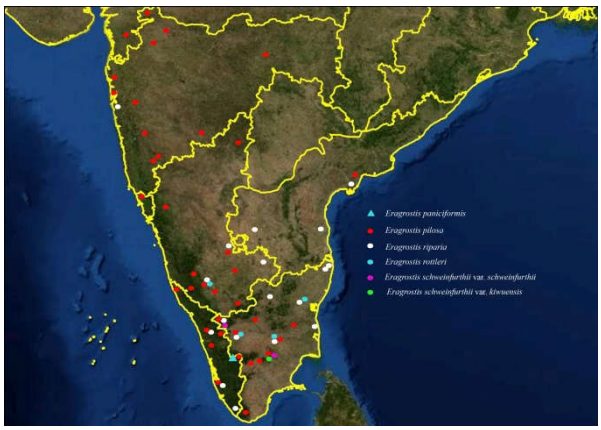


Fig. 98. Distribution of *Eragrostis paniciformis* (A. Braun) Steud. (▲), *E. pilosa* (L.) P. Beauv. (●), *E. riparia* (Willd.) P. Beauv. (○), *E rottleri* Stapf (●), *E. schweinfurthii* Chiov. (●) and *E. schweinfurthii* var. *kiwuensis* (Jedwabn.) S.M. Phillips (●)

Specimens examined:—India, **Tamil Nadu,** Dindigul Dist.: Kodaikanal, Vembadi slopes, 19 Nov. 1985, *K.M. Matthew, A. Usha* & *N. Rajaendren 42790* (RHT); Berijam, Geranium Plot Board Road side, 17 Dec. 1989, *S. Perianayagam 53987* (RHT); Gundar, Vembadi path, 17 Dec. 1989, *K.M. Matthew* & *K.T. Mathew 53991* (RHT); Berijam, 15 June 1990, *K.T. Mathew 54313* (RHT).

Notes:—*E. schweinfurthii* var. *kiwuensis* can be easily identified by its linear spiciform panicles; broadly ovate cymbiform glumes.

29. Eragrostis subsecunda (Lam.) E.Fourn., Mexico Pl. 2: 118. 1886; Sreek. & V.J. Nair, Fl. Kerala Grass. 386. 1991; Lazarides, Aust. Syst. Bot. 10: 154. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 152. 2009. *Poa susecunda* Lam., Tabl. Encycl. 1: 184. 1791. **Type:—**East China, Herb. Lamarck, *Sonnerat s.n.* (Holotype: P, photo in K, Isotype: C, C10016922, image!). **Figs. 99, 100, 109**

Tufted perennials, 30–120 cm high, roots fibrous. ***Culms*** 20–90 cm long, errect or geniculate. ***Leaf sheaths*** 6–16 cm long, slightly keeled. ***Leaf blades*** 5–22 × 0.2–0.3 cm, linear-lanceolate, base rounded, acuminate at apex; ***ligules*** obscure or fringe of small hairs. ***Panicles*** effuse-lax, loosely spiculate, subsecund, 10–30 × 5–9 cm. Peduncle 5–15 cm long, glabrous. ***Spikelets*** oblong or oblong-lanceolate, compressed, 3–10 × 1.5–2.5

Fig. 99. ***Eragrostis subsecunda*** (Lam.) E. Fourn.: **A.** Habit; **B.** Ligule; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Lemma; **G.** Palea; **H. & I.** Lodicules, stamens & pistil; Flower; **J.** Caryopsis.

mm, 10–24-flowered, purplish green; disarticulation of florets from base upwards. Glumes deciduous, unequal. ***Lower glumes*** lanceolate, 1–2 × 0.5–1 mm, 1-nerved, 1-keeled, acuminate at apex. ***Upper glumes*** ovate-lanceolate, 2–2.5 × 0.5–1 mm, 1-nerved, 1-keeled, acuminate at apex. ***Lemmas*** broadly ovate, 2–2.5 × 1–1.5 mm, 3-nerved, lateral nerves prominent, chartaceous, acute at apex. ***Paleas*** elliptic-lanceolate, 1.5–2 × *c.* 1 mm, winged, persistent, 2-nerved, keeled; keels ciliolate, acute to obtuse at apex. ***Rachilla*** persistent, 0.2–0.3 mm long, glabrous. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 3; anthers 0.3–0.5 mm long. ***Ovary*** 0.3–0.5 mm long, oblong; style *c.* 0.2 mm long, slender; stigma plumose, 0.4–0.8 mm long. ***Caryopses*** ovoid to globose, 0.5–1 × 0.2–0.3 mm, deep brown.

Flowering & Fruiting:—March–September.

Habitat & Ecology:—It grows along the banks of canals, streams and also in wetlands and water logged areas. It is seen in association with *Arundinella leptochloa* (Steud.) Hook.f., *Eragrostis atrovirens* (Desf.) Trin. *ex* Steud., *Leptochloa chinensis* (L.) Nees and *Saccharum spontaneum* L.

Distribution:—East China, Bangladesh, Sri Lanka. In India, it is reported from Assam, Kerala and Tamil Nadu.

Fig. 100. Isotype of *Eragrostis subsecunda* (Lam.) E.Fourn. [*Sonnerat s.n.* (C10016922)] © The Board Trustees of the Museum Botanicum Hauniense, University of Copenhagen, Denmark.

Specimens examined:—India, **Kerala,** Alappuzha Dist.: Chathiyara, Thamarakulam *s.die*, *Sunil C.N. 1782* (CALI); Pathirapilly, *s.die.*, Sunil C.N. 2496 (CALI); Pallana, 25 June 1980, *P.V.*

Sreekumar 67647 (MH); Kumarakodi, 25 June 1980, *P.V. Sreekumar 67650* (MH). Kollam Dist.: Neendakkara, 17 Mar. 1980, *P.V. Sreekumar 67113* (MH).

Notes:—This species can be distinguished from other taxa by its panicles being ovate in outline, almost as wide as long with thickened scabrous stiffly spreading branches.

30. Eragrostis superba Peyr., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl. 38: 584. 1860; Bor, Grass. Burma Ceylon India Pakistan 513. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; S. Moulik, Grass. Bam. India 2: 606. 1997; Lazarides, Aust. Syst. Bot. 10: 156. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 152. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 540. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 120. 2013. **Holotype:—**Africa, Angola, Benguela, *Wawra 244* (W0000253, image!, Fragm. (spikelet) in K!). **Figs. 101, 102, 109**

Tufted perennials, 50–130 cm high, roots fibrous. ***Culms*** 21–90 cm long, terete, more or less ribbed. ***Leaf sheaths*** 8–16 cm long, slightly keeled. ***Leaf blades*** linear-lanceolate, 16–33 × 0.4–0.6 cm, margins incurved, finely serrulate, at times glaucous, attenuate at apex; ***ligules*** a densely bearded rim, hairs 2–3 mm long, shaggy. ***Panicles*** linear or spreading when mature, 26–35 × 3–5 cm, central axis smooth to finely ribbed, scabrid towards apex. Peduncle 28–40 cm long, glabrous, racemes 7–8 cm, alternate and compact along central axis when young. ***Spikelets*** broadly elliptic ovate, 9–11 × 8–9 mm, 6–16-flowered, flat, yellowish; entire spikelts disarticulating from pedicel apex. Glumes subequal. ***Lower glumes*** oblong-lanceolate, 4–4.2 × 0.8–1.2 mm, 1-nerved, acutely keeled, chartaceous to subcoriaceous, acuminate at apex. ***Upper glumes*** ovate-lanceolate, 3.8–4 × 0.8–1 mm, 1-nerved, 1-keeled, coriaceous, acuminate at apex. ***Lemmas*** broadly ovate-lanceolate, 4–4.2 × 1–1.3 mm, boat shaped 3-nerved, lateral nerves prominent, chartaceous, acuminate to mucronulate and retuse at apex. ***Paleas*** ovate-lanceolate, 3.5–4 × *c.* 1 mm, broadly winged, persistent, 2-nerved, keeled; keels

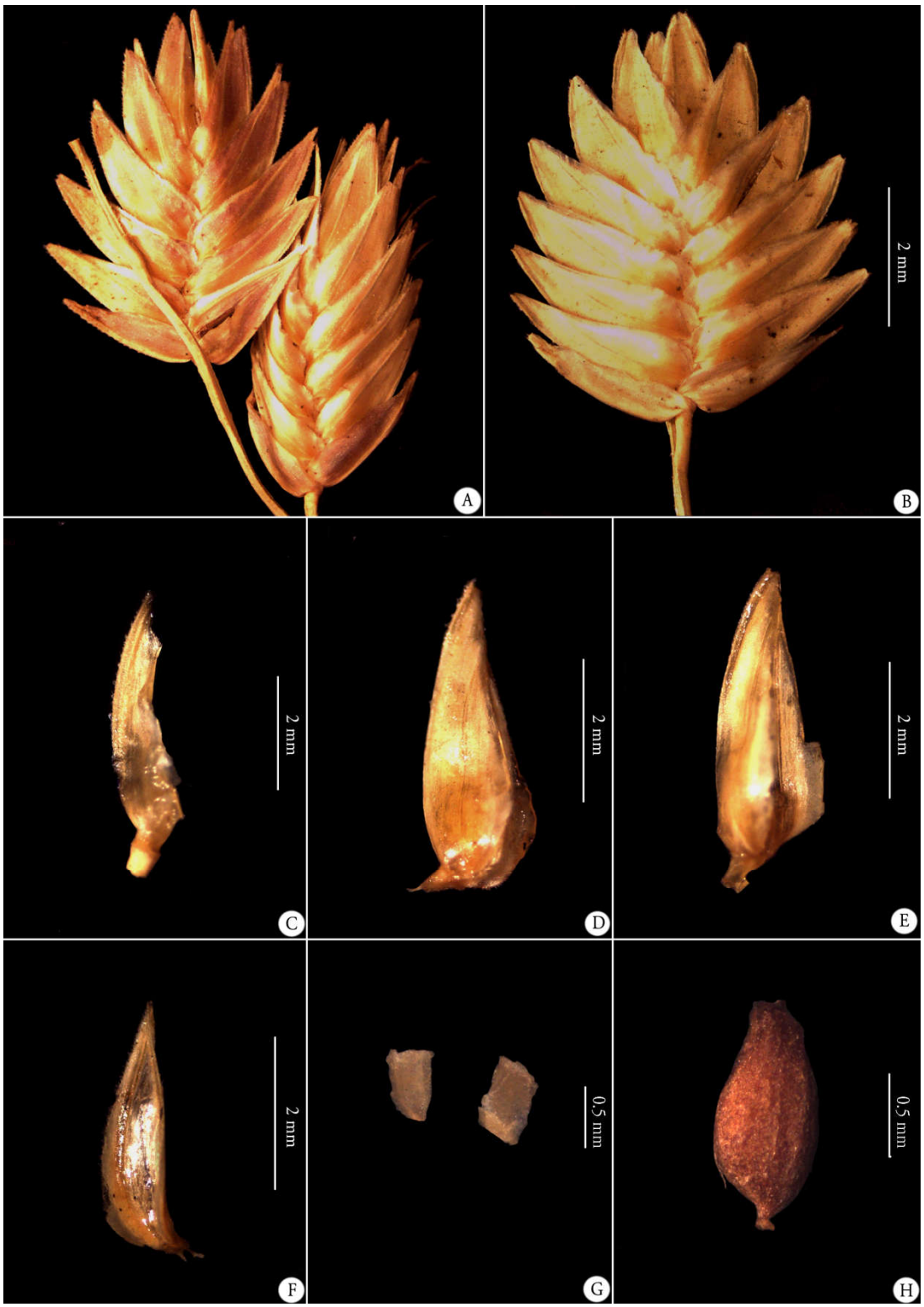


Fig. 101. ***Eragrostis superba*** Peyr.: **A.** Spikelets; **B.** Spikelet enlarged; **C.** Lower glume; Spikelet; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicules; **H.**Caryopsis.

scabrellate, margins infolded, acuminate to retuse at apex. ***Rachilla*** persistent, 0.3–0.4 mm long, thick. ***Lodicules*** 2, *c.* 0.3 mm long, truncate at apex. ***Stamens*** 3; anthers 1.2–2.2 mm long. ***Ovary*** elliptic, 0.5–0.6 mm long; style *c.* 1.5 mm long, slender; stigma plumose, 0.6–0.8 mm long. ***Caryopses*** ellipsoid or ovate, 1–1.5(–2) × 0.7–0.8 mm, laterally compressed, deep brown.

Flowering & Fruiting:—January–June.

Habitat & Ecology:—It grows as weed along the road sides. It is introduced from Africa.

Distribution:—Tropical Africa, In India, it is reported from Karnataka and Tamil Nadu.

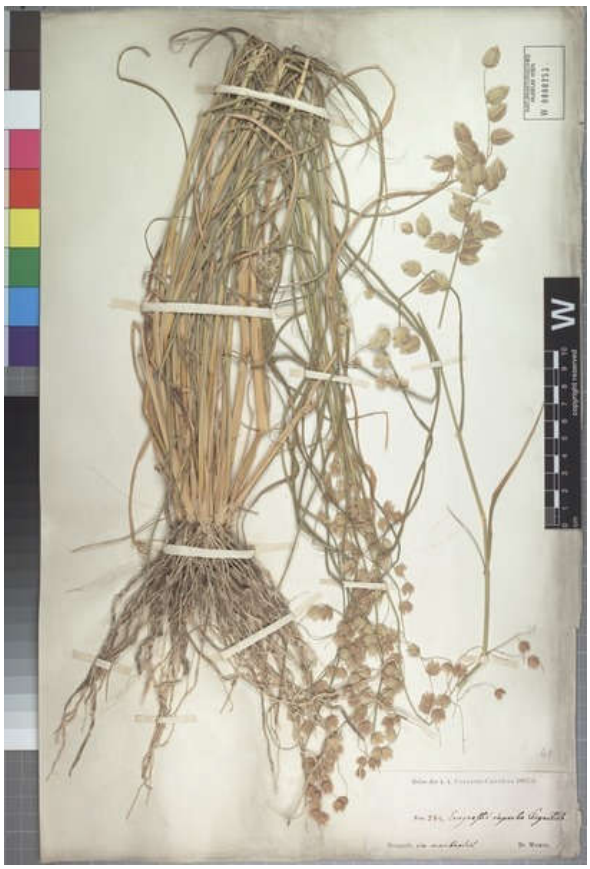


Fig. 102. Holotype of *Eragrostis superba* Peyr. [*Wawra 244* (W0000253)] © The Board Trustees of the Natural History Museum Vienna, Austria.

Specimens examined:—India, **Karnataka,** Mysore Dist.: Manasagangotri, Botanical Garden, 14 May 1970, *R. Raghavendra Rao 636* (JCB). **Maharashtra,** Pune Dist.: Fergusson College Campus, 07 June 1956, *V.D. Vartak 4636*; *Ibid.*, 10 May 1956, *V.D. Vartak 4506* (AHMA). **Tamil Nadu,** Coimbatore Dist.: Coimbatore, 21 Feb. 1957, *G.S. Puri 15785* (BSI, CAL); Agricultural College Estate, 22 June 1957, *K. Subramanyam 3538* (MH).

Notes:—The disarticulation (falling entire) of spikelet is a distinctive character of the species, spikelets yellowish, a spiciform interrupted panicle; lemmas that are partly indurated and flattened.

31. Eragrostis tef (Zucc.) Trotter, Boll. Soc. Bot. Ital. 62: 1918; Bor, Grass. Burma Ceylon India Pakistan 513. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 217. 1989; S. Moulik, Grass. Bam. India 2: 608. 1997; Lazarides, Aust. Syst. Bot. 10: 157. 1997; Veldkamp, Blumea 47: 186. 2002; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 153. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 543. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 120. 2013. *Poa tef* Zuccagni, Diss. Ditef: 1775. **Type:—**Africa, Ethiopia; cultivated at Florence, *Bruce s.n.* (Holotype: FI). **Figs. 103, 109**

Tufted prostrate or errect perennial, 20–40 cm high, roots fibrous. ***Culms*** 10–60 cm long, erect or geniculate, nodes glabrous. ***Leaf sheaths*** 3.5–6 cm long, inrolled to the culm, slightly keeled. ***Leaf blades*** linear-lanceolate, 3–25 × 0.2–0.4 cm, base shallowly cordate, apex acute-acuminate; surfaces spasely villous adaxially and glabrous abaxially, margins entire; ***ligules*** ciliate rim, cilia 2–4 mm long. ***Panicles*** open or contracted, 10–15 × 0.5–1 cm long, lowest branch whorled or not, axils glabrous or bearded; peduncle 6–12 cm long, glabrous, glandular; rachis 0.5–3 cm long, glabrous; primary pedicel 2–6 mm long, glabrous. ***Spikelets*** ovate-lanceolate, 2.5–4 × 0.5–1 mm, 4–12-flowered, disarticulation of florets from above downwards. Glumes deciduous, subequal. ***Lower glumes*** lanceolate, 0.5–1 × 0.3–0.5 mm, 1-nerved, 1-keeled, chartaceous. ***Upper glumes*** lanceolate, 0.8–1 × 0.4–0.6 mm, 1-nerved, 1-keeled, chartaceous. ***Lemmas*** ovate-oblong, 1–1.5 × 0.7–1 mm, 3-nerved, lateral nerves prominent, acute at apex. ***Paleas*** oblong or elliptic-oblong, 1–1.2 × 0.25–0.4 mm, hyaline, persistent or not, 2-nerved, keels ciliate, acute-oblong at apex. ***Rachilla*** deciduous, 0.2–0.3 mm long, glabrous. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 3; anthers 0.25–0.5 mm long, white. ***Ovary*** 0.1–0.2 mm long, globose; style 0.2–0.3 mm long, slender; stigma plumose, 0.3–0.4 mm long. ***Caryopses*** ovoid-oblong or oblong-ellipsoid, 0.5–0.6 (-1–1.2) × 0.3–0.45 (-0.4–0.5) mm, yellowish brown.

Fig. 103. ***Eragrostis tef*** (Zucc.) Trott.: **A.** Habit; **B.** Panicle; **C.** Enlarged portion of panicle; **D.** Ligule; **E.** Spikelet; **F.** Glumes; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Palea with flower; **K.** Stamens & Pistil; **M.** Caryopsis.

Flowering & Fruiting:—September–December

Habitat & Ecology:—It grows as weed along the road sides and bank of backwaters, sandy sea-coast. It grows in association with *E. amabilis* (L.) Wight & Arn., *Mollugo pentaphylla* L. and *Eragrostis pilosa* (L.) P. Beauv.

Distribution:—Native of Ethiopia; introduced in several parts of world. In Peninsular India, it is reported from Kerala, Maharashtra and Tamil Nadu.

Specimens examined:—Kerala, Alappuzha Dist.: Sea View Park, 27 Jan. 2014, *Thoiba K. 138052* (CALI); Vandanam, Medical College Ground, 28 Jan. 2014, *Thoiba K. 138055* (CALI); Ambalapuzha, *s.die*, *Sunil C.N. 1832* (CALI); *s.loc.*, *s.die.*, *Sunil C.N. 1627* (CALI). **Maharashtra,** Mumbai Suburban Dist.: Malad, Quarry Hills–Main Road, 23 Sept. 1959, *G. L. Shah s.n.* (BLAT). **Tamil Nadu,** Salem Dist.: *s.loc.*, 30 Dec. 1916, *s.coll. 13983* (MH).

Notes:—This species is quite different from other taxa in having spikelets not breaking up at maturity; subhyaline glumes; subpersistent florets, lemmas; strongly compressed and reddish brown caryopses.

32. Eragrostis tenuifolia (A. Rich.) Hochst. *ex* Steud., Syn. Pl. Glumac. 1: 268. 1854; Stapf in Hook.f., Fl. Brit. India 7: 322. 1896; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1827. 1934; Bor, Grass. Burma Ceylon India Pakistan 514. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1858. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 218. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 391. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 223. 1994; S. Moulik, Grass. Bam. India 2: 609. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1199. 1997; Lazarides, Aust. Syst. Bot. 10: 160. 1997; Veldkamp, Blumea 47: 187. 2002; P.M. Peterson & I.S. Vega, Ann. Missouri Bot. Gard. 94: 784. 2007; P.M. Peterson & Giraldo-Cañas, J. Bot Res. Inst. Texas 2(2): 911. 2008; Kabeer & V.J. Nair, Fl. Tamil

Nadu Grass. 153. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 545. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 121. 2013. *Poa tenuifolia* A. Rich., Tent. Fl. Abyss. 2: 425. 1850. **Lectotype** (designated by S.M. Phillips, 1995):—Ethiopia, 18 Sept. 1837, *G.H.W. Schimper 92* (P, Isolectotype: FR0031316, image!, K, G, L, W, WAG). **Figs. 104–106, 109**

Eragrostis parviglumis Hochst. ex Steud., Syn. Pl. Glumac. 1: 267. 1854. Type:—India, Tamil Nadu, Coimbatore in montibus Nilgiri, *Metz 936* (Isotype: G!)

Caespitose perennials, 20–75 cm high, roots fibrous. ***Culms*** 10–50 cm long, straight; nodes glabrous. ***Leaf sheaths*** 3–10 cm long, keeled, inrolled to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 4–30 × 0.2–0.3 cm, base slightly cordate and glaucous, apex acute-attenuate; surfaces glabrous; margins entire; ligules a fringe of hairs, hairs 0.2–0.4 mm long. ***Panicles*** ovate, open, effuse, 6–20 × 8–10 cm long, branches alternate, axils glabrous or pilose; peduncle 4–13 cm long; rachis 2–3 cm long, glabrous; primary pedicel 3–15 mm long, glabrous; secondary pedicel 0.3–0.5 cm long, axils slightly glandular and plumose. ***Spikelets*** linear-lanceolate, 4–12 × 1–3 mm, 4–15-flowered, leaden green; disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** ovate-lanceolate, 0.6–0.9 × 0.3–0.4 mm, acute at apex. ***Upper glumes*** ovate-oblong, 0.5–1.2 × 0.4–0.5 mm, 1-nerved, narrowly keeled, keels serulate. ***Lemmas*** elliptic-lanceolate, 1–2 × 1–1.6 mm, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex sharply acute. ***Paleas*** elliptic-lanceolate, 1–1.2 × 0.3–0.6 mm, winged, persistant, 2-nerved, keeled, keels scaberulose, obtuse at apex. ***Rachilla*** zigzag, 0.6–1 mm long, scabridulose. ***Lodicules*** 2, obovate, 0.2–0.3 mm long, truncate at apex. ***Stamens*** 3; anthers 0.3–0.9 mm long, creamy yellow with purple tinged in colour. ***Ovary*** 0.2–0.5 mm long, globose; style 0.2–0.6 mm long, slender; stigma plumose, 0.3–0.6 mm long. ***Caryopses*** ellipsoid to oblong, 0.6–1 × c. 0.4 mm, ventrally grooved, cordate, deep brown.

Fig. 104. ***Eragrostis tenuifolia*** (A. Rich.) Hochst. ex Steud.: **A.** Habit; **B.** Ligule; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Glumes; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Flower; **K.** Caryopsis.

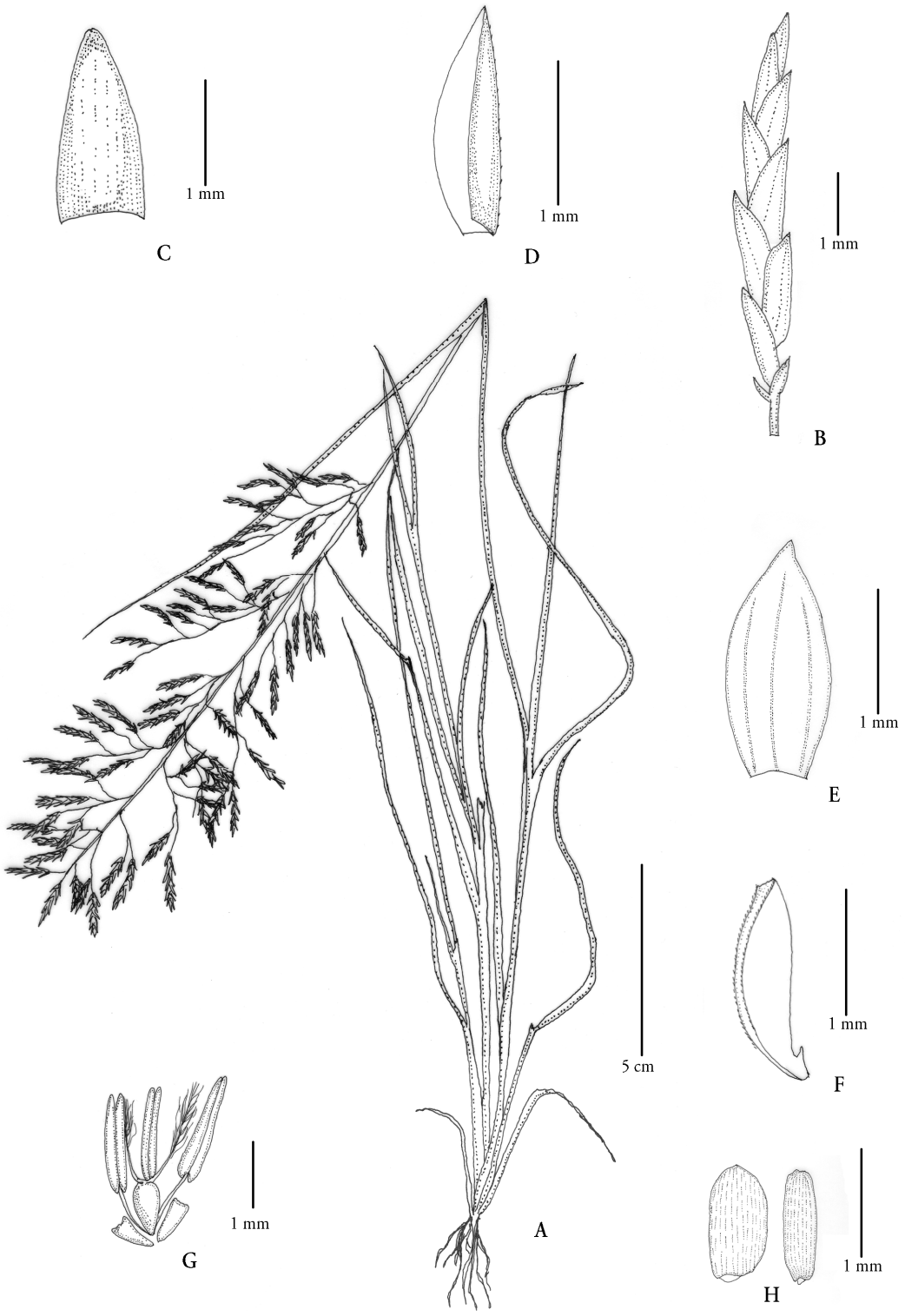


Fig. 105. ***Eragrostis tenuifolia*** (A. Rich.) Hochst. ex Steud.: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicules, stamens & pistil; **H.** Caryopsis.

Flowering & Fruiting:—June–March

Habitat & Ecology:—It grows as a weed along the road sides, forest margins and tea plantations. It grows usually in association with *Apluda mutica* L., *Eragrostiella bifaria* (Vahl) Bor, *Eragrostis minor* Host, *E. unioloides* (Retz.) Nees *ex* Steud., *Pennisetum hohenackeri* Hochst. *ex* Steud. and *Sporobolus tenuissimus* (Schrank.) Kuntze.

Distribution:—Native in North Africa and Asia. In Peninsular India, it is known to occur in almost all states.

Fig. 106. Isolectotype of *Eragrostis tenuifolia* (A. Rich.) Hochst. *ex* Steud. [*G.H.W. Schimper 92* (FR0031316) designated by S.M. Phillips, 1995] © The Board Trustees of the Herbarium Senckenbergianum Frankfurt/M, Germany.

Specimens examined:—India, **Andhra Pradesh,** Chittoor Dist.: Tirumalai Hills, 12 Oct. 1938, *K.C. Jacob 475* (MH). Visakhapatanam Dist.: Arakuvalley, 16 Sept. 1952, *D. Daniel Sundar Raj 21375* (MH). **Gujarat,** Valsad Dist.: Pardi, 06 Aug. 1957, *G.S. Puri 22708A* (BSI). **Karnataka,** Belgaum Dist.: Ramdurg, 09 Oct. 1919, *s.coll. 15942* (MH); *s.loc.*, 27 Aug. 2001, *C.B. Salunkhe s.n.* (SUK). Chamarajanagar Dist.: Gundlupet, 29 Sept. 2015, *Thoiba K. 144174* (CALI). Chikmagalur Dist.: Kudremukh National Park, 14 Sept. 2014, *Thoiba K. 137505* (CALI). Chitradurga Dist.: Jagimatti S.F., 15 Sept. 1974, *N.P. Singh 133048* (BSI). Dekshina Kannada Dist.: Kadaba, Mardala, 22 Jan. 15, *Thoiba K. 144112* (CALI). Dharwad Dist.: *s.loc.*,

05 Oct. 1975, *M.S. Mahalingappa 1* (MH). Hassan Dist.: Sakalaeshpur, 13 Sept. 2014, *Thoiba K. 137514*; *Ibid.*, 13 Sept. 2014, *Thoiba K. 137529*; *Ibid.*, 08 Nov. 2013, *Thoiba K. 134497* (CALI); Arsikere, 29 Sept. 2015, *Thoiba K. 144189* (CALI); Byra-Road to Magge, 09 Oct. 1969, *C.J. Saldanha 15241* (JCB). Kodagu Dist.: Makut, 08 Jan. 1959, *R.K. Arora 47591*(BSI); Kushalnagar, 1955, *P.G. Muddiah s.n.* (MH); Gonikoppa, 07 Oct. 2010, *Remya J. 69588* (TBGT). **Kerala,** Idukki Dist.: Kanthallur, 22 Nov. 2013, *A.K. Pradeep 138007* (CALI); Periyakanal Waterfalls, 14 Nov.2014, *Thoiba K.* & *A.K. Pradeep 137548* (CALI); Adimali, 14 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137564* (CALI); Munnar, Top station, 15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep137570*; *Ibid.,* 15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137576* (CALI); Eravikulam National Park, 19 June 2015, *Thoiba K.* & *V. Drisya 144131* (CALI); Vagamon, way to Pullikanam, 15 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146613* (CALI); Panchalimedu, near Kuttikanam,17 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146636* (CALI); Ramakkalmedu, 23 Oct. 2017, *A.K. Pradeep* & *Thoiba K. 146750* (CALI); *s.loc.*, 25 Sept. 1987, *C.N. Mohanan 71966* (CAL); Thekkady, 10 Jan. 1994, *Jomy Augustine 13082* (CALI); Meenmutty, 28 May 1982, *C.N. Mohanan 74088* (MH). Kannur Dist.: Begur, 03 Mar. 1979, *V.S. Ramachandran 62035* (MH); Tholpetty, 06 July 1978, *V.S. Ramachandran 54153* (MH). Kottayam Dist.: Kurishumala, 09 Aug. 2014, *Janeesha A.P.* & *Thoiba K.138087* (CALI). Kozhikode Dist.: Kakkayam, 19 Sept. 2013, *Thoiba K.134444* (CALI); Anakkampoyil, 09 Oct. 2013, *Thoiba K. 134469* (CALI). Malappuram Dist.: Nilambur, *s.die.*, *s.coll. 34589* (CALI). Palakkad Dist.: Nelliyampathy, Seetharkundu, 17 Sept. 2013, *Thoiba K. 134441*(CALI); *s.loc.*, 08 Oct. 1979, *N.C. Nair 64432* (CAL); way to Silent Valley, near Panthenthode, 13 Oct. 1983, *Sathish Kumar S.V. 11524* (CALI); Aruvampara, 08 Oct. 1979, 1979, *N.C. Nair 66432* (MH). Thrissur Dist.: Parambikulam Tiger Reseve, Thunakadavu Dam, 24 Sept. 2013, *Thoiba K.134464* (CALI); Vengoli Hills, 25 Sept. 2013, *Thoiba K. 134457* (CALI); Anakkalvayal, 27 Sept. 2013, *Thoiba K. 134456* (CALI); Sholayar, Thottapura, 11 Dec. 2013, *Thoiba K. 138023* (CALI).

Thiruvananthapuram Dist.: Ponmudi, 25 May 1979, *M. Mohanan 63248* (MH). Wayanad Dist.: Kanthanpara, 23 Aug. 2013, *Thoiba K.134426* (CALI); Muthanga Wildlife Sanctuary, 21 Aug. 2013, *Thoiba K.134428* (CALI); Chambra Hills, 22 Aug. 2013, *Thoiba K. 134429* (CALI); Periya, 08 Nov. 2012, *Thoiba K. 138039* (CALI); Mananthavady, Anjukunnu, 09 July 2014, *A.K. Pradeep 138082* (CALI); Pakramthalam, *A.K. Pradeep 138084* (CALI); *s.loc.*, 08 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137560* (CALI); Kalpetta, 22 August 2015, *Thoiba K.* & *A.K. Pradeep 144142* (CALI); Amba–Sugandhagiri, 10 Oct. 2012, *Remya J. 73884* (TBGT). **Maharashtra,** Pune Dist.: Katraj, 15 Oct. 1955, *V.D. Vartak 1397* (AHMA); Taleran, May 2005, *S.S. Rahangdale JT1529* (AHMA); Khed, Mahalunge, 02. Nov. 1961, *K.P. Janardhanan 72961*(AHMA); *s.loc.*, 29 Jan. 1961, *K.P. Janardhanan 69046* (BSI); Khandala, 20 Sept. 1902, *G.A. Gammie 15398* (BSI); Sinhagad, 20 Sept. 1957, *S.D. Mahajan 26716* (BSI); Mahalunge, 02 Nov. 1961, *K.P. Janardhanam 72961* (CAL). Ratnagiri Dist.: Islampur, 26 Sept. 1993, *S.R. Yadav 7076* (SUK). Satara Dist.: Pusegaon, 15 Oct. 1989, *C.B. Salunkhe 7598* (SUK); Panchgani, Oct. 1908, *E. Blatter 5081*(BLAT); Table Land, Oct. 1920, *Blatter* & *Hallberg 1313* (BLAT).Thane Dist.: Shirnagar, 05 Oct. 1989, *C.B. Salunkhe 7194* (SUK). Washim Dist.: Kinhiraja, 30 Aug. 1977, *S.Y. Kamble 156271* (BSI). **Tamil Nadu,** Coimbatore Dist.: Anamalai Tiger Reserve, Nallamudi, Poonjolai, 13 Dec. 2013, *Thoiba K. 138015* (CALI); Malakkapara, Myladum Para-NC, 13 Dec. 2013, *Thoiba K. 138019* (CALI); Shaekalmudi, Mudiyankunnu, 12 Dec. 2013, *Thoiba K. 138029* (CALI); *s. loc.*, 07 Dec. 1956, *K. Subramanyam 1653* (CAL); Palamalai, 17 Sept. 1969, *M.V. Viswanathan 168* (MH); Siruvani, 07 Dec. 1956, *K.M. Sebastine 1653* (MH). Dindigul Dist.: Kodaikanal, Kodai Hills, 26 Sept. 1979, *K.M. Matthew 16956* (RHT); Manalur, 05 Aug. 1985, *K.M. Matthew 41754* (RHT); Vadakavunchi, 14 Aug. 1987, *K.M. Matthew* & *K.T. Mathew 50184* (RHT); Perumal Peak, 14 Dec. 1989, *K.T. Mathew* & *S. Sebastain 53842* (RHT); Shembaganur, 15 June 1990, *K.M, Matthew* & *K.T. Mathew 54330* (RHT). Erode Dist.: Sathyamangalam, 02 Aug. 1987, *N.*

Venkatasubramanian 599 (FRC). Krishnagiri Dist.: Hosur Cattle Farm, 08 Oct. 1926, *s.coll. 16940* (MH). Nilgiri Dist.: Ootacamund, Fox How, 26 Aug. 1901, *C.A. Barber 3462* (MH); *s.loc.*, 01 Sept. 1957, *K.M. Sebastine 3991* (MH); Pandalur, 14 Apr. 2013, *P.I. Jettisha* & *Thoiba K. 134421* (CALI); Gudallur, Shooting Point, 31 May 2014, *Thoiba K. 138079* (CALI); Coonor, Sims Park, 22 Oct. 2015, *A.K. Pradeep 146644* (CALI); Coonor, 12 Dec. 2015, *A.K. Pradeep* & *Thoiba K. 146701* (CALI); Gudallur, Shooting Point, 12 Dec. 2015, *Thoiba K. 146703* (CALI); Gudallur, Suicide Point, 12 Dec. 2015, *Thoiba K. 146709* (CALI); Naduvattam, 23 June 2016, *Nikhil Krishna* & *Thoiba K. 146778* (CALI); Abayarangam Rest House, 15 May 2003, *K.N. Subramanian 670* (FRC). Salem Dist.: Yercaud, 27 Dec. 2014, *Thoiba K.* & *K.M. Lemiya 144110* (CALI); Pandalur, 23 July 2012, *Remya J.* & *Prasanna 73724* (TBGT); Theppakadu, 07 Nov. 2012, *Remya J.74600* (TBGT). **Telangana,** Ranga Reddy Dist.: Anantagiri, 11 May 1964, *G.V. Subba Rao 19470* (MH).

Notes:—This species can be easily recognisable by its dark green and jagged spikelets with relatively shorter lower glumes, and the very flat, dorsally grooved caryopses.

33. Eragrostis tremula Hochst. *ex* Steud., Syn. Pl. Glumac. 1: 269. 1854; Stapf in Hook.f., Fl. Brit. India 7: 320. 1896; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1827. 1934; Bor, Grass. Burma Ceylon India Pakistan 514. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 218. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 392. 1991; S. Moulik, Grass. Bam. India 2: 609. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1199. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 154. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 547. 2012. *Poa tremula* Lam., Tabl. Encycl. 1: 185. 1791. **Type:—**Africa, Senegal, *Roussillon s.n.* (Holotype: P, Isotypes: K000366429, image!, G00022166, image!, M0103461, image!, STU000115, image!).

Figs. 107–109

Poa multiflora Roxb. *nom. illeg.,* Fl. Ind., ed.1: 340. 1820. *non* Forssk. 1775. Type:—India, *Roxburgh s.n.* (?)

Tufted annuals, 20–100 cm high, roots fibrous. ***Culms*** 10–85 cm long, errect or geniculate. ***Leaf sheaths*** 2–12 cm long, keeled, involute to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 4–20 × 0.3–0.4 cm, base slightly cordate, apex acute-acuminate; surface sparsely villous adaxially and ribbed abaxially; margins entire; ***ligules*** a fringe of hairs, hairs 2–3 mm long. ***Panicles*** ovate, open, lax, 7–35 × 5–10 cm long, olive green to grey; peduncle 6–25 cm long, glabrous; rachis 2–5 cm long, glabrous; primary pedicel 0.5–2 mm long, minutely hairy; secondary pedicel 3–5 mm long, flat or quadrangular, glabrous. ***Spikelets*** ovate-oblong, 1.5–8(-5–25) × 1.5–2 mm, 10–70-flowered; disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** ovate-lanceolate, 1.4–1.6 × 0.5–1 mm, 1-nerved, 1-keeled, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 1.5–1.7 × 0.5–1 mm, 1-nerved; lateral nerves not prominent, 1-keeled, acute at apex. ***Lemmas*** oblong-lanceolate, 1.8–2 × 0.6–0.9 mm, 3-nerved, nerves slightly scabrid, minutely keeled, lateral nerves prominent, deciduous, chartaceous, acuminate at apex. ***Paleas*** elliptic-oblong, 1.5–2 × 0.5–1 mm, winged, caducous, 2-nerved, keeled; keels ciliate, obtuse at apex. ***Rachilla*** zigzag, 0.3–0.5 mm long, glabrous. ***Lodicules*** 2, 0.2–0.3 mm long, triquadrate. ***Stamens*** 3; anthers 0.4–0.5 mm long. ***Ovary*** 0.2–0.3 mm long, globose; style 0.2–0.5 mm long, slender; stigma plumose, 0.3–0.8 mm long. ***Caryopses*** subglobose to orbicular, 0.4–0.75 × 0.3–0.5 mm long, narrowly compressed laterally, yellowish brown.

Flowering & Fruiting:—August–November

Habitat & Ecology:—It grows along the road sides, open grounds, forest margins, field margins and wetlands, in association with *Alternanthera sessilis* (L.) R.Br. *ex* Dc., *Eragrostis amabilis* (L.) Wight & Arn., *E. atrovirens* (Desf.) Nees *ex* Steud., *E. brownii* (Kunth) Nees, *E. unioloides* (Retz.) Nees *ex* Steud., *E. zeylanica* Nees & Meyen, *Euphorbia hirta* L., *Hyptis suaveolens* (L.) Poit., *Hemidesmus indicus* (L.) R.Br. *ex* Schult., *Spermacoce hispida* L. and *Pseudanthistiria umbellata* (Hack.) Hook.f.

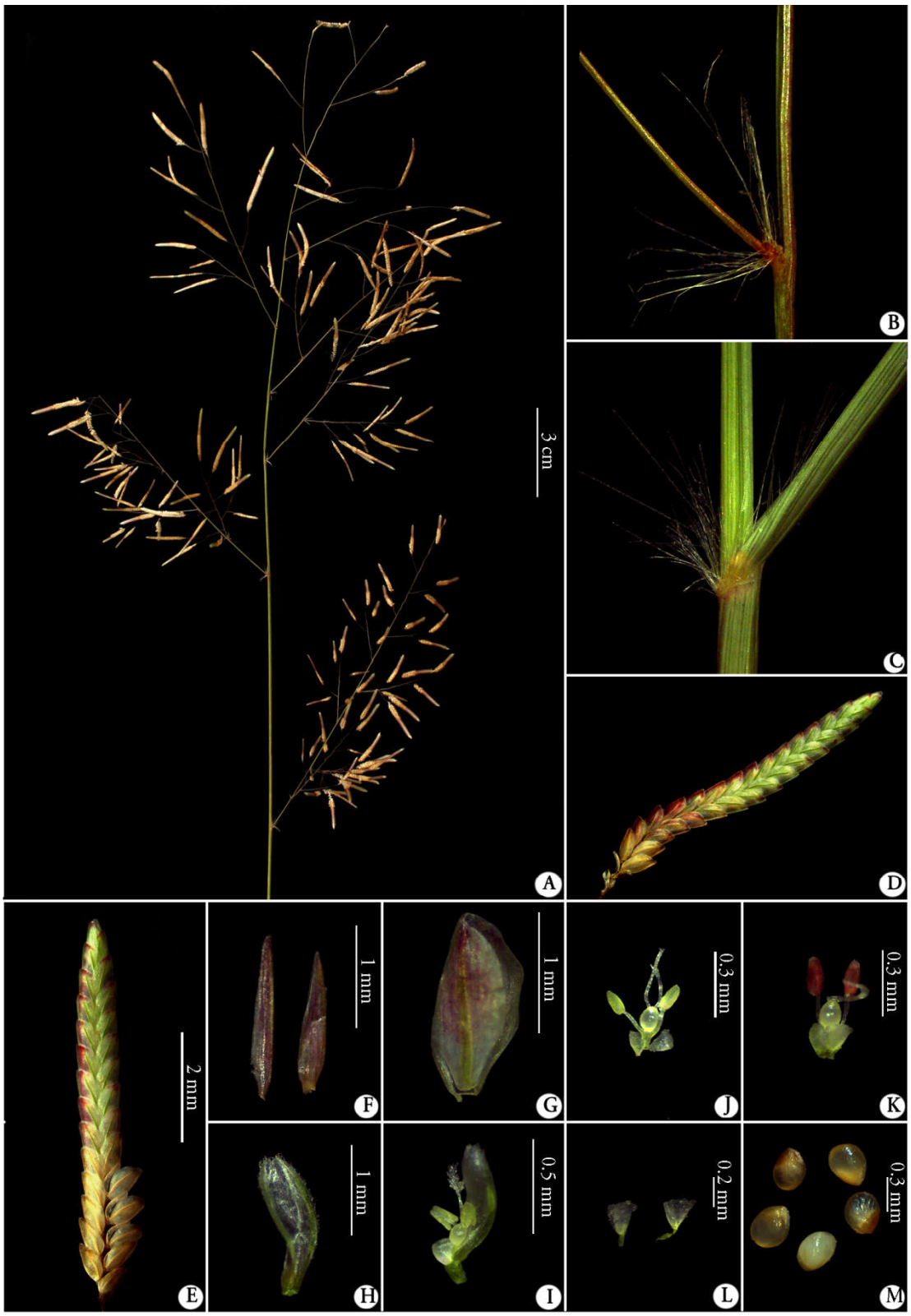


Fig. 107. ***Eragrostis tremula*** Hochst. *ex* Steud.: **A.** Panicle; **B.** Enlarged portion of pedicel axis; **C.** Ligule; **D. & E.** Spikelet; Lower glume; **F.** glumes; **G.** Lemma; **H.** Palea; **I.** Palea with flower; **J. & K.** Flower; **L.** Lodicules; **M.** Caryopsis.

Distribution:—Afganisthan, Myanmar, Tropical Africa, In India, it is known to occur in almost all states.

Fig. 108. Isotype of *Eragrostis tremula* Hochst. *ex* Steud. [*Roussillon s.n.* (K000366429)] © The Board Trustees of the Royal Botanic Gardens, Kew.

Specimens examined:—Andhra Pradesh, East Godaveri Dist.: *s.loc.*, 10 Dec. 1902, *s.coll. 5181*; *Ibid.*, *s.loc.*, 10 Dec. 1902, *s.coll. 5281* (MH). Kurnool Dist.: Gazalapalle, 30 Aug. 1936, *K.C. Jacob s.n.* (MH). West Godaveri Dist.: Eluru, 09 Oct. 1930, *V. Narayanaswami 4516* (MH); Kondepudi, 08 Dec. 1902, *C.A. Barber 5189* (MH). **Goa,** North Goa Dist.: St. Gung, 25 Mar. 1998, *M.K. Janarthanam* & *Vaishali C. Joshi 1464* (Goa University Herbarium); Miramar, 13 Nov. 2005, *Harshala Gad 95* (Goa University Herbarium). **Gujarat,** Kutch Dist.: Wandh, 28 Sept. 1964, *K. Hemadri* & *S.R. Rolla 103120* (BSI); Nakhatrana, 31 Jan. 1957, *S.K. Jain 11570* (BSI); Mandvi, 20 Sept. 1968, *R.S. Raghavan 115017* (BSI). Kheda Dist.: Nadiad, Ahmedabad, 25 Nov. 1907, *H.M. Chibben s.n.* (BSI); *s.loc.*, 8 Dec. 1911, *R.K. Bhide s.n.* (BSI); *s.loc.*, Nov. 1890, *P.S. Bamithar s. n.* (BSI); Surendranagar Dist.: *s.loc.*, 05 Feb. 1957, *S.K. Jain 11795* (BSI). **Karnataka,** Belgaum Dist.: Londa, 27 Oct. 1910, *R.K. Bhide s.n.*; *Ibid.*, 06 May 1956, *G.S. Puri 2005* (BSI). Bijapur Dist.: Guledagudda, 14 Sept. 1979, *S.R. Ramaesh* & *B.R. Ramaesh 9272* (JCB). Dekshina Kannada Dist.: Kadaba, 25 Apr. 2014, *Thoiba K. 138076* (CALI); HBSS Campus Kadaba, 15 Sept. 2014, *Thoiba K. 137521*(CALI); *Ibid.*, 20 Dec. 2014, *Thoiba K. 144125* (CALI); *s.loc.*, 09 Nov. 1917, *s.coll. 15315* (MH). Raichur Dist.: Raichur-

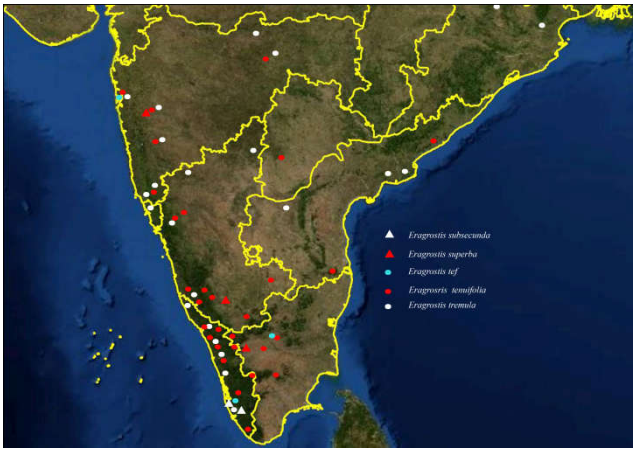


Fig. 109. Distribution of *Eragrostis subsecunda* (Lam.) E.Fourn. (△), *E. superba* Peyr. (▲), E. tef (Zucc.) Trotter (●), *E. tenuifolia* (A. Rich.) Hochst. *ex* Steud. (●) and *E. tremula* Hochst. *ex* Steud. (○)

Hyderabad Road, 15 Nov. 1975, *N.P. Singh 141732* (BSI). **Kerala,** Alappuzha Dist.: Cherthala, Pallipuram, *s.die.*, *Sunil C.N. 1459* (CALI). Ernakulam Dist.: Nadakkavu, 13 Dec. 1998, *S. Kumari Prameela 40126* (TBGT). Kannur Dist.: Muzhappilangad, 16 Dec. 1979, *V.S. Ramachandran 65259* (MH). Kasargod Dist.: Nileshwaram, 06 Dec. 1919, *s.coll. 16310*; *Ibid.*, 12 Dec. 1931, *G.V. Narayana 6313* (MH). Malappuram Dist.: Purathur, *s.die.*, *A.V. Sreya s.n.* (CALI); Thrissur Dist.: Kodungallur, MES Asmabi College Ground, 08 Aug.2015, *Thoiba K. 144139* (CALI). **Maharashtra,** Amravati Dist.: Dhargad, 04 Oct. 1992, *C.B. Salunkhe 7319* (SUK). Mumbai Suburban Dist.: Malad, Marve–Madh Road, 28 Oct. 1956, *G.L. Shah Shah 7875* (BLAT). Pune Dist.: Talegaon, 24 Sept. 1965, *V.D. Vartak 24117* (AHMA). Ratnagiri Dist.: Dapoli, 17 Oct. 1993, *C.B. Salunkhe 7230* (SUK); Pawas, 29 Sept. 1991, *C.B. Salunkhe 7494* (SUK). Satara Dist.: Pusegaon, 15 Oct. 1989, *C.B. Salunkhe 8089* (SUK). Sindhudurg Dist.: Devbag, 03 Oct. 1993, *C.B. Salunkhe 7769* (SUK); Terekhol, Shiroda, 16 Nov. 1965, *B.G. Kulkarni 108018* (BSI); Malvan, 01 Oct. 1970, *B.G. Kulkarni 121343* (BSI). Yavatmal Dist.: Mukutban, 14 Dec. 1976, *S. Karthikeyan 148436* (BSI). **Odisha,** Cuttack Dist.: *s.loc.*, 22 May 1967, *M.K. Ghosh 238* (CAL); Sundargarh Dist.: Kunchpani, 23 Nov. 1987, *D. Namhata MN2653* (CAL).

Notes:—This species commonly exhibits pilose hairs at the base of panicle branches; pedicels longer than the spikelets, flexuous; spikelets pale green to purple tinged with 10–70 florets.

34. Eragrostis unioloides (Retz.) Nees *ex* Steud., Syn. Pl. Glumac. 1: 264. 1854; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1826. 1934; Bor, Grass. Burma Ceylon India Pakistan 515. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1858. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 218. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 392. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 224. 1994; S. Moulik, Grass. Bam. India 2: 609. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1200. 1997; Lazarides, Aust. Syst. Bot. 10: 163. 1997; Veldkamp, Blumea 47: 187. 2002; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 155. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 547. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 121. 2013. *Poa unioloides* Retz., Obs. Bot. 5: 19. 1789. *Uniola indica* Spreng., Syst. Veg. 1: 349. 1824. **Type:—** India, 1776, *König s.n. in Herb. Retzius* (Holotype: LD1289627, image!, photo and fragm. in BRI, fragm. in K000643356, image!), Syntype: BM000578811, image!). **Figs. 110, 111, 116**

Eragrostis unioloides var. *tremula* K.C. Jacob, J. Bombay Nat. Hist. Soc. 47: 48. 1947. Type:— India, Travancore, Tiruvalla, 100 feet, Nov. 1941, *K.C. Jacob 2020* (Holotype: MH!).

Eragrostis jainii Vivek, G.V.S. Murthy & V.J. Nair **syn. nov.,** Nelumbo 55: 1. 2013. Type:—India: Kerala, Kannur Dist.: Manjeshwar, 100 m, 13.1.1979, *R. Ansari 64888* (Holotype: CAL!, Isotypes: MH!).

Tufted Perennials, 10–110 cm high, roots fibrous. ***Culms*** 10–60 cm long, erect or geniculate, nodes glabrous. ***Leaf sheaths*** 3–8 cm long, involute to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 2–18 × 0.5–1.5 cm, stiff or not, base slightly cordate, margins entire and eglandular, surface sparsely villous adaxially and glabrous abaxially, apex acute-acuminate; ***ligules*** membranous with a ciliate rim, cilia 2–3 mm long. ***Panicles*** very variable, effuse-lax, sometimes contracted and interrupted

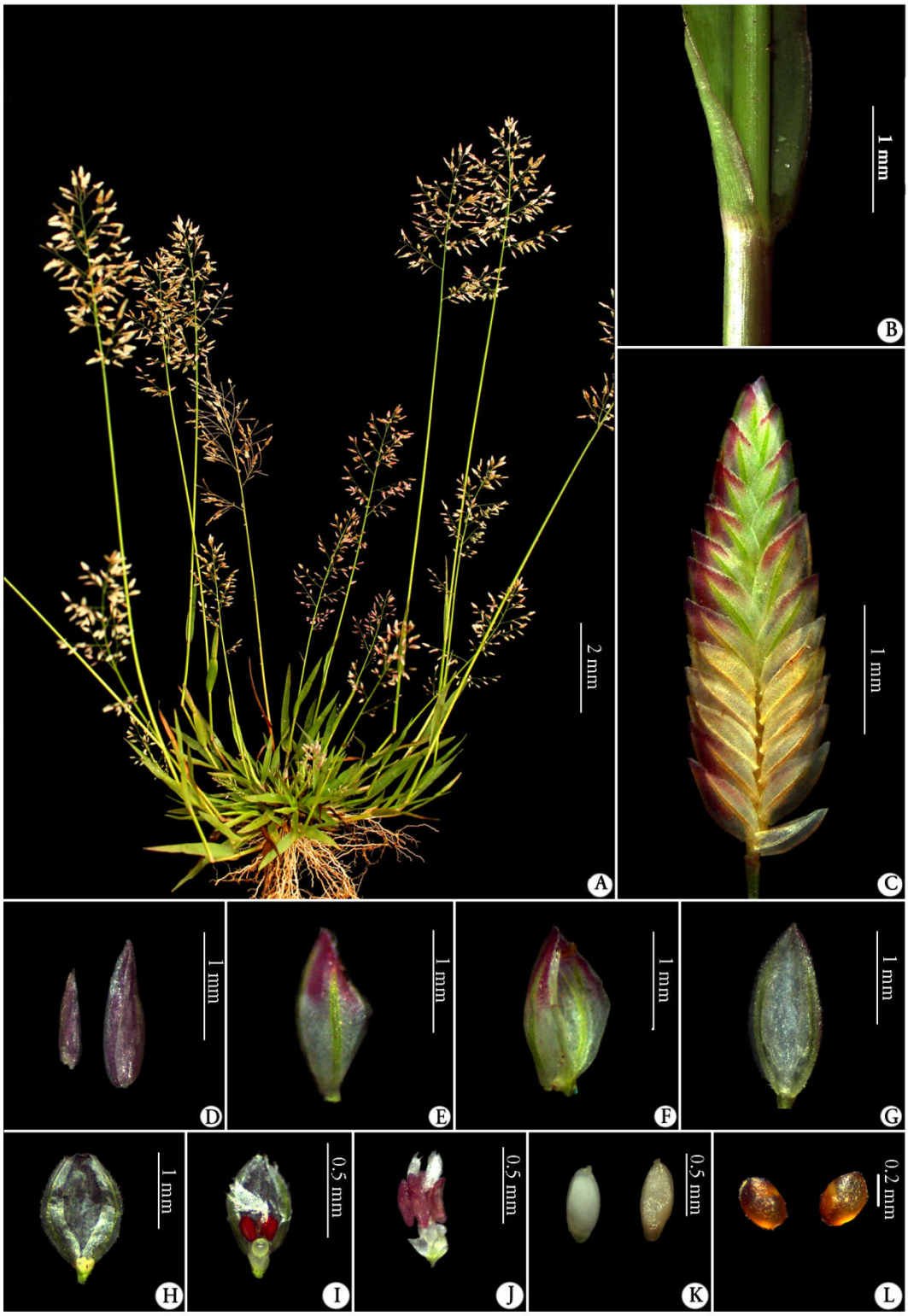


Fig. 110. ***Eragrostis unioloides*** (Retz.) Nees *ex* Steud.: **A.** Habit; **B.** Ligule; **C.** Spikelet; **D.** Glumes; **E.** Floret; **F.** Lemma; **G. & H.** Palea; **I.** Palea with flower; **J.** Flower; **K. & L.** Caryopsis.

or adpressed to the main axis, 4–35 × 2–8 cm, branches alternate, base of primary branches eglandular, smooth or scaberulous. Peduncle 5–11 cm long, glabrous, eglandular; primary pedicel 0.5–2cm long, glabrous; secondary pedicel 0.5–17 mm long, much shorter to longer than the spikelet. ***Spikelets*** ovate-lanceolate or ovate-oblong, 4–12 × 1.5–4 mm, 5–80-flowered, florets vary in size towards apex, purplish to olive green; disarticulation of florets from below upwards. Glumes caducous, unequal, keeled, keels saberulose, marigns hairs or not. ***Lower glumes*** lanceolate, 1–1.8 × 0.2–0.4 mm, 1-nerved, 1-keeled, acute to acuminate apex. ***Upper glumes*** lanceolate, 1.5–2.5 × 0.3–0.5 mm, 1-nerved, 1-keeled, acute to subacuminate at apex. ***Lemmas*** ovate or elliptic-lanceolate, 1.25–2.2 × 0.7–1 mm, 3-nerved, lateral nerves prominent, caducous, granular, often pinkish, chartaceous, apex acute to obtuse or acutish. ***Paleas*** elliptic-lanceolate, 1.5–2 × 0.4–0.8 mm, winged, caducous, 2-nerved, keeled, keels ciliolate, acute-oblong or bidentate, retuse or sharply acuminate at apex. ***Rachilla*** slightly zigzag, 0.2–0.4 mm long. ***Lodicules*** 2, 0.1–0.2 mm long, dentate-triquadrate. ***Stamens*** 2; anthers 0.3–0.4 mm long. ***Ovary*** 0.2–0.4 mm long, globose; style 0.5–0.6 mm long, slender; stigma plumose, 0.5–0.7 mm long. ***Caryopses*** obovoid-ellipsoid, 0.4(–0.6)–1 × 0.25(–0.3)–0.4 mm, reddish brown.

Flowering & Fruiting:—Almost throughout the year

Habitat & Ecology:—*E. unioloides* is a locally abundant species grows along the road sides, open grounds, sandy soils, forest margins, field margins and wetlands and moist places in association with *Eragrostis amabilis* (L.) Wight & Arn., *E. atrovirens* (Desf.) Trin. *ex* Steud., *E. brownii* (Kunth) Nees, *Euphorbia hirta* L., *Hyptis suaveolens* (L.) Poit., *Lindernia anagallis* (Burm.f.) Pennell, *Lindernia viscosa* (Hornem.) Merr., *Ischaemum ciliare* Retz., *I. rangacharianum* C.E.C. Fisch., *Panicum repens* L., *Oldenlandia corymbosa* L. etc.

Distribution:—Native from South East Asia, now pantropical. In India, it is perhaps the most common 'Eragrostis' in South India, which can thrive in diverse habitats.

Fig. 111. Holotype of *Eragrostis unioloides* (Retz.) Nees *ex* Steud. [*König s.n.* (LD1289627)] © Lund University, Sweden.

Specimens examined:—India, **Andhra Pradesh,** East Godaveri Dist.: *s.loc.*, 16 Oct. 1994, *M. Mohanan 102503* (MH). *s.loc.*, 23 Aug. 1960, *N.P. Balakrishnan 10782* (CAL). **Goa,** North Goa Dist.: *s.loc.*, 11 Nov. 2016, *Syam Radh S.* & *Thoiba K. 146738* (CALI); Umberkoi, 06 Nov. 1970, *M.Y. Ansari 121903* (BSI); Baga Jungle, 05 sept. 1965, *Jhon Cherian 88597* (BSI); Querim, 13 Sept. 1965, *Jhon Cherian 106147* (BSI); Burncol, 30 Sept. 1970, *N.P. Singh 124823* (BSI); Panaji Sea Shore, 04 Sept. 1965, *Jhon Cherian 88547* (BSI); Angidev, 24 Sept. 1965, *Jhon Cherian 106639* (BSI); Taleigão, Goa University Campus, 20 Sept. 1997, *Vaishali C. Joshi* & *S. Rajkumar 980* (Goa University Herbarium). South Goa Dist.: Butpal, 10 Oct. 1964, *R.S. Raghavan 103457* (BSI); Molem–Belgaum Road, 19 Sept. 1970, *N.P. Singh 124388* (BSI); Butpal, 10 Oct. 1964, *U.R. Deshpande 103457* (CAL). **Gujarat,** Banaskantha Dist.: Vadgam, 08 Apr. 1959, *G.S. Puri 50781* (BSI). Dang Dist.: Ahwa–Chinchili Road, 23 Nov. 1959, *B.M. Wadhwa 60694*; *Ibid.*, 27 Aug. 1958, *S.K. Jain 43067* (BSI); Waghai-Dangs, 01 Sept. 1958, *S.K. Jain 43595* (BSI). **Karnataka,** Bijapur Dist.: Andheri, 18 Oct. 1953, *C. Saldanha 692* (JCB). Chikmagalur Dist.: Baba Budan Hills, 09 Nov. 2013, *Thoiba K. 134499* (CALI); Kudremukh National Park, Lakya Dam, 14 Sept. 2014, *Thoiba K. 137509*; *Ibid.*, 14 Sept. 2014, *Thoiba K. 137507* (CALI). Dekshina Kannada Dist.: Kadaba, Nattana, 05 Mar. 2013, *Mohammed*

Yoonus & *Thoiba K. 134417*; *Ibid.,* 17 Sept. 2013, *Mohammed Yoonus* & *Thoiba K. 134437*; *Ibid.*, 17 Nov. 2013, *Thoiba K. 138005* (CALI); Osmatta, Nethravathi River basin, 15 Nov. 2013, *Thoiba K.138004* (CALI); Dharmasthala, Nethravathi River basin, 26 Dec. 2013, *Thoiba K. 138035* (CALI); Sullia, 25 Oct. 1900, *C.A. Barber 2175* (FRC); HBSS Campus Kadaba, 15 Sept. 2014, *Thoiba K.137523*; *Ibid.,* 12 Oct. 2014, *Mohammed Yoonus.* & *Thoiba K. 137551* (CALI); Mangluru, *s.die.*, *C.A. Barber 4808* (MH). Hassan Dist.: Sakaleshpur, 08 Nov. 2013, *Thoiba K. 134498*; *Ibid.*, 12 Nov. 2013, *Thoiba K. 138048*; *Ibid.*, 13 Sept. 2014, *Thoiba K. 137527* (CALI); Mallipatna, 08 Dec. 1969, *C.J. Saldanha 15738* (JCB). Kodagu Dist.: Abbey Falls, 03 Nov. 1976, *B.C. Baneyer 11606* (CAL). Mysore Dist.: *s.loc.*, 26 Oct. 1978, *S.R. Ramaesh* & *S.B. Manohar 3914* (CAL). Kolar Dist.: Royal Pad S.F.I., 04 Jan. 1976, *N.P. Singh 142073* (BSI). Shimoga Dist.: Kollur Forest, Mookambika Wildlife Sanctuary, 24 Aug. 2007, *P.G. Diwaker* & *R.K. Singh 191736* (BSI); 10 Nov. 2013, *Thoiba K. 134500*; *Ibid.*, 20 Dec. 2014, *Thoiba K.* & *A.P. Janeesha 144127* (CALI). Hosur Forest, Yedur, *s.die.*, *R. Sundara Raghavan 82988* (BSI); Agumbe, Naluri, 01 Nov. 1960, *R.S. Raghavan 68041* (BSI); Barakana, 04 Nov. 1960, *R.S. Raghavan 68116* (BSI); Begar, 02 Sept. 1963, *R.S. Raghavan 90384* (BSI); Karodi, Thirthahalli, 28 Sept. 1962, *R.S. Raghavan 82760* (BSI); *Ibid.*, 08 Sept. 2015, *Thoiba K. 144152* (CALI); Kundadri, 08 Sept. 2015, *Thoiba K.144156* (CALI); Talaguppa Railway Station, 09 Sept. 2015, *Thoiba K. 144161; Ibid.,* 09 Sept. 2015, *Thoiba K. 144151* (CALI). Tumkur Dist.: Machena Halli, 08 Sept. 2015, *Thoiba K. 144153* (CALI). Yadgiri Dist.: Talalgra R.F., 16 Nov. 1975, *N.P. Singh 141764* (BSI). **Kerala,** Alappuzha Dist.: Vandanam, 28 Jan. 2014, *Thoiba K.138057*; *Ibid., s.die*, *Sunil C.N. 1125* (CALI); Kayamkulam, Thamarakulam, Chethiyara, 30 Jan. 2014, *Thoiba K. 138064* (CALI); Valavanadu, 29 Jan. 2014, *Thoiba K. 138067* (CALI); Trikunnapuzha, 13 Mar. 1980, *P.V. Sreekumar 67740* (MH); Karthigapally, 18 Mar. 1980, *P.V. Sreekumar 66724* (MH); Pallana, 25 June 1980, *P.V. Sreekumar 67651* (MH); Nedumudy, 15 June 1980, *P.V. Sreekumar 67200* (MH); Pallathuruthy, 13

June 1980, *P.V. Sreekumar 67183* (MH); Thakazhy, 07 June 1980, *P.V. Sreekumar 67155* (MH). Ernakulam Dist.: Shoolamudi, Variyam, 14 Dec. 2016, *Nikhil Krishna* & *Thoiba K. 146745* (CALI); N. Paravur, 02 Aug. 1978, *C.R. Suresh 13484* (CALI); Makarachal, Malayatoor, 23 Sept. 1987, *K.N. Subramanian, N. Venkatasubramanian* & *K.R. Sasidharan 13321* (FRC). Idukki Dist.: Pius Nagar, Kanthallur, 11 Dec. 2015, *A.K. Pradeep* & *Thoiba K. 146713* (CALI); Eravikulam National Park, 22 Oct. 2017, *A.K. Pradeep* & *Thoiba K. 146748* (CALI); Vagamon, 20 Sept. 2013, *A.P Janeesha.* & *Thoiba K. 138047* (CALI); Kulamavu, 10 Nov. 2015, *Drisya V.* & *Thoiba K. 146695* (CALI); Vagamon, Pullikanam, 15 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146609* (CALI); Parunthpara, 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146630* (CALI); Panchalimedu, near Kuttikanam,17 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146635* (CALI); Anchuruli, 17 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146642* (CALI); Thannikkudy, 06 Sept. 1993, *Jomy Augustine 13902* (CALI); Thekkady, Periyar Tiger Reserve, 26 Nov. 1987, *K.R. Sasidharan s.n.* (FRC); Thrisangu Hills, Thekkady, 17 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146640* (CALI); Udumbanchola, Mundiyeruma, 16 Dec. 2014, *Thoiba K. & A.K. Pradeep 144102* (CALI); Thodupuzha, Meenuliyan Para, 20 July 2015, *Thoiba K. & V. Drisya 144134*; *Ibid.*, 20 July 2015, *Thoiba K. & V. Drisya 144135* (CALI); Neriamangalam, Mullaringad 20 July 2015, *Thoiba K. & V. Drisya 144137*; *Ibid.*, 20 July 2015, *Thoiba K. & V. Drisya 144138* (CALI). Kannur Dist.: Eazhimala, 27 Nov. 2016, *Shinoj* & *Thoiba K. 146761* (CALI); Madayippara, 28 Nov. 2013, *Thoiba K.* & *C. Pramod 138049* (CALI); Manjeshwar, 100m, 13 Jan. 1979, *R. Ansari 64888* (CAL, MH); Muzhappilangad Beach, 30 Oct. 2013, *Thoiba K. 134494* (CALI); *Ibid.,* 50m, 16 Dec. 1979, *V.S. Ramachandran 65258* (MH); Vilayancode, 21 Oct. 1984, *Sowmini, M.V. 1022*; *Ibid.*, 10 Oct. 1984, *Shaji Sebastain 1417* (CALI); Badagara, 15 Aug. 1985, *Pradeep A.K. 5801*(CALI); Payyannur, 23 Feb. 1987, *Sreenivasan Ettammal 2698* (CALI). Kasargod Dist.: Mugu, 23 Dec. 2014, *Thoiba K.* & *K.M. Lemiya 144108* (CALI); Periya, Bekal Fort, 20 Sept. 2015, *Thoiba K.144165* (CALI); Periya, 02 Oct.

1982, *R. Ansari 74456* (CAL); Bovikanam, 14 Sept. 1983, *K.N. Subramanian 9595* (FRC); Thalassery, 18 Nov. 1917, *V.S. Ramachandran 52200* (MH); Kollam Dist.: Upper Moozhiyar, Ranni, 20 Oct. 1983, *K.N. Subramanian 9682*; *Ibid.*, 19 Oct. 1983, *K.N. Subramanian 9671* (FRC); Vilakudy, 04 Dec. 2009, *Remya J. 65477* (TBGT). Kasargod Dist.: Nileshwar, 07 Dec. 1919, *s.coll.* 16288; *Ibid.*, 08 Nov. 1917, *s.coll. 15310* (MH). Kottayam Dist.: Chemmala, 28 Nov. 1972, *Sworrupanandhan K. 225* (CALI). Kozhikode Dist.: Kakkayam, 19 Sept. 2013, *Thoiba K. 134442* (CALI); *Ibid.*, 21 Aug. 2013, *Thoiba K.* & *A.K. Pradeep 138097* (CALI); Kakkadampoyil, 09 Oct. 2013, *Thoiba K. 134470* (CALI); Mundakkal, Kunnamangalam, 04 Nov. 2014, *Thoiba K.* & *P.E. Sreejith 137544* (CALI); Feroke, 10 Dec. 1981, *s.coll. 134*; *Ibid.*, 30 Dec. 1987, *C.P. Suja 160*; *Ibid.,* 28 Mar. 1978, *Mercy Jacob 24113* (CALI); Kallai, 02 Jan. 1967, *s.coll. 240* (CALI); Devagiri, 01 Jan. 1968, *P. Raghavan s.n.* (CALI); Chaliyam, 16 Oct. 1988, *V.P. Premalatha 3035*; *Ibid.,* 16 Nov. 1986, *T.G. Jaisonlal, 4305* (CALI); Peruvannamuzhi, 15 Jan. 1991, *N.M. Jaffer 1784* (CALI); Pokunnu, *s.die. K. Bindu Kurup 40* (CALI); Calicut, 12 May 1978, *Asha Nair 24222* (CALI); Koorachund, Kattullamala, 29 July 2010, *A.K. Pradeep* & *Santhosh Nampy 3050* (DEV); Devagiri, 29 Aug. 1991, *Fr. K.M. Joseph 1079*; *Ibid.*, 05 Jan. 1987, *S.S. Meenakshy 2583* (DEV); Chevayoor, 26 Feb. 2002, *Ramya 4567* (DEV); *Ibid.,* Thamarassery, 02 Oct. 1983, *Shobha 2583* (DEV). Malappuram Dist.: Perinthalmanna, 03 Dec. 2016, *Shimi Cheriyan* & *Thoiba K. 146762* (CALI); Kadampuzha, 23 Jan. 2013, *Mohammed Yoonus* & *Thoiba K. 134409* (CALI); Kooriyad, 08 Feb. 2013, *Thoiba K.134415* (CALI); Thamburankolli, Kudaranji, 30 Oct. 2013, *Thoiba K. 134479* (CALI); Nilambur, *s.die.*, *s.coll. 34352* (CALI); Nellikuth, 23 Jan. 1982, *s.coll. 33066* (CALI); Canoli, 23 June 1981, *Philip mathew 28463* (CALI); Kanjirakadavu, 21 Oct. 1981, *Philip mathew 33207* (CALI); Calicut University Campus, 30 Sept. 2014, *Thoiba K. 137533; Ibid.,*10 Oct. 1987, *Ajitha, P.S. 13241*; *Ibid.,* 10 Feb. 1987, *Revathy Rugmini, K.S. 1064*; *Ibid.,* 12 Dec. 1974, *Geetha, M. 1274*; *Ibid.,* 12 Feb. 1983, *M. Geetha 1286*; *Ibid.,* 01 Apr. 1983, *V.T.*

Nandakumar 1100; *Ibid.,* 08 Sept. 1986, *K. Laxmana 3448*; *Ibid.,*10 Oct. 1983, *C.C. Leena 1234*; *Ibid.,* 02 March 1984, *C.K. Ratna Kumari 1190*; *Ibid.,* 20 Nov. 1987, *Eby. T. Paul 154*; *Ibid.,* 11Oct. 1981, *M. Rema 153*; *Ibid.*, 20 Dec. 1981, *C.P. Suja 141*; *Ibid.,* 19 July 1980, *M.S. Baby Usha Kiran 6849*; *Ibid.,*16 July 1970, *V.V. Sivarajan 268*; *Ibid., s.die. V.V. Sivarajan 1240*; *Ibid.*, 30 Nov. 1982, *Shanthi K. Nair 2007*; *Ibid.,* 16 August 1982, *K. Mary mathew 1625*; *Ibid.*,16 Nov. 1986, *U.M. Naseem Bhanu 3851*; *Ibid.,* 06 June 1986, *C. Neena 8933*; *Ibid.*, 02 Sept. 1983, *K. Sheela Francis1234*; *Ibid.,* 18 Mar. 1983, *E.K. Sumathi 2303*; *Ibid.,* 30 Aug. 1978, *A.R. Raju 25328*; *Ibid.,* 09 July 1981, *Kutty Sankaran 1983*; *Ibid.,*16 July 1970*, s. coll. 268*; *Ibid.,* 24 Apr. 1986, *Karthiayani, K.P. 6584*; *Ibid.*,10 Aug. 1991, *U. Sreekala 5183,* 09 Sept. 1982, *E.O. Kochuthrassia, 1537*; *Ibid.*, 05 Sept. 1982, *K.P. Vasanthaprabha 2404*; *Ibid.,* 07 Aug. 1979, *C.P. Ratha 31656*; *Ibid.,*10 June 1976, *A. Jose 18363*; *Ibid.,*13 Feb. 1982, *A.P. Vilasini 2693*; *Ibid.,* 07 Aug. 1982, *A. Vijaya 37096*; *Ibid.,* 05 Aug. 1991, *C.G. Solly 4486*; *Ibid.,* 12 Nov. 1990, *, P.T. Nazeemol 987*; *Ibid.,* 10 Oct. 1987, *Mohanan, K. 10141,* 08 Aug. 1988, *V. Geetha, 1910*; *Ibid.,* 12 Dec. 1988, *N.B. Sreedevi, 1211*; *Ibid.,* 26 Sept. 1987, *A.K. Prasitha 13154*; *Ibid.,* 16 Oct. 1987, *M.M. Letha 10450*; *Ibid.,*12 Oct. 1984, *T. Sujaya, 11053*; *Ibid.,* 07 September 1984, *E.N. Vanaja 2640*; *Ibid.,*17 Aug. 1991, *V.T. Smitha 3942*; *Ibid.,*03 Mar. 1986, *K.C. Baby Jayalekha, 8094*; *Ibid.,* 19 Jan. 1991, *P.K. Bindhu 2508,* 29 Oct. 1991, *T.P. Sheeja 3088*; *Ibid., s.die., A.V. Sreeja 4784*; *Ibid.,* 25 Oct. 2003, *V. Mini 94431,* 19 Jan. 2004, *K.C. Rakendu 97175*; *Ibid.,* 19 Dec. 2003, *N.K. Sairabanu 93825*; *Ibid.,*10 Oct. 1988, *P. Elsie Ouesph, 43369*; *Ibid.,* 02 Sept. 2000, *S. Jayasree 74309*; *Ibid.,* 15Oct. 1988, *P. Elsie Ouesph, 43287* (CALI); Idimuzhikkal, 28 Apr. 1971, *V.V. Sivarajan 1120* (CALI); Kottaparamba, 15 Jan. 1970, *V.V. Sivarajan 13* (CALI); Chemmaniyode, 21 June 1986, *P.A. Naseem 5694*; *Ibid.,* 21 June 1986, *M.P. Anitha 5060* (CALI); Eramangalam, 18 Sept. 1990, *P.K. Shalima 3251* (CALI); Tanur, 02 Feb. 1992, *T. Rajasree 2821* (CALI); Kakkanchery, 08 June 1992, *Jaisy Emmanual 1482* (CALI); Thachinganadam, 03 Oct. *1986, P. Geetha 6650* (CALI). Palakkad Dist.:

Pattambi, 22 Jan. 2013, *Thoiba K. 134408* (CALI); Kunthipuzha River Basin, Mannarkkad, 06 Nov. 2013, *Thoiba K. 134488* (CALI); Nenmara, Thiruvayiyad, 07 Nov. 2013, *Thoiba K. 134484* (CALI); Nelliyampathy, Kaesavan Para, 17 Sept. 2015, *Thoiba K. 134445* (CALI); Silent Valley, Valiyaparathode, 07 Sept. 1982, *T. Sabu SV 1080* (CALI); Chembotti, *Sathish Kumar SV 11221* (CALI); Alanallur, 03 Mar. 1984, *P.E. Rajasekharan 1299* (CALI); Dhoni, 01 Dec. 1991, *A.A. Pushpamani 2565* (CALI); Victoria College Ground, 05 Dec. 2015, *Drisya V.* & *Thoiba K. 146693* (CALI). Pathanamthitta Dist.: Chittoor, 15 Jan. 2013, *Mohammed Yoonus* & *Thoiba K.1334405* (CALI). Thiruvananthapuram Dist.: Agasthyamala, Koviltherimala, 23 Jan. 1987, *N. Mohanan 9204* (CALI); Tappukadu, 18 July 1991, *N. Mohanan 10886* (CALI). Thrissur Dist.: Chalakkudy, Athirapilly, 20 Apr. 2013, *A. K. Pradeep* & *Thoiba K. 134423*; *Ibid.*, 20 Apr. 2013, *A. K. Pradeep* & *Thoiba K. 134424*, *A. K. Pradeep* & *Thoiba K. 134425* (CALI); Parambikulam Tiger Reserve, Thunakadavu Dam, 24 Sept. 2013, *Thoiba K. 134463* (CALI); Vengoli Hills, 25 Sept. 2013, *Thoiba K. 134452* (CALI); Kariyamchola, 27 Sept. 2013, *Thoiba K.134450*; *Ibid.*, 27 Sept. 2013, *Thoiba K. 134458* (CALI); Anakkal Vayal, 27 Sept. 2013, *Thoiba K. 134455* (CALI); Sholayar, Thottapura, 11 Dec. 2013, *Thoiba K. 138021* (CALI); *Ibid.*, Athirappally, 20 July 2014, *Thoiba K.* & *K.P. Smisha 138086* (CALI); Kodungallur, Mathilakam, Koolimuttam, 27 Nov. 2015, *Thoiba K.* & *A.K. Pradeep 146683* (CALI); Triprayar, Thalikulam, Snaehatheeram Beach, 27 Nov. 2015, *Thoiba K.* & *A.K. Pradeep 146684* (CALI); Thumburmuzhi Forest, 22 Mar. 1980, *K. Ramamurthy 66258* (CAL); Engandiyur, 21June 1991, *T.S. Devi 1060* (CALI); Cheruvathani, 02 Mar. 1992, *Sheena Jacob 3587* (CALI); Vellanikara, 17 Aug. 1980, *s.coll.* 67736 (MH); Vazhachal, 16 Oct. 1996, *A.G. Pandurangan* & *C. Rajkumar 31159* (TBGT); *s.die.,* 30 Nov. 2014, *Alfred Joe* & *Thoiba K. 144114* (CALI). Wayanad Dist.: Bhavani River side, 13 Aug. 2016, *Shimi Cheriyan* & *Thoiba K. 146770* (CALI); Soochipara, 23 Aug. 2013, *Thoiba K. 134433* (CALI); Chembra Hills, 22 Aug. 2013, *Thoiba K. 134434* (CALI); Kurichiyarmala, 28 Oct. 2013, *Thoiba K. 134481* (CALI);

Mananthavady, Anjukunnu, 09 July 2014, *A.K. Pradeep 138083* (CALI); Pakramthalam, *A.K. Pradeep 138085* (CALI); Kalpetta, 22 Aug. 2015, *Thoiba K.* & *A.K. Pradeep 144143* (CALI); Amba–Sugandhagiri, 10 Oct. 2012, *Remya J. 73883* (TBGT); 20 Apr. 2015, *Thoiba K.* & *Pradeep A.K. 144117* (CALI). **Maharashtra,** Jalna Dist.: Masai, 05 Aug. 2004, *Aparna Watve A0054*; *Ibid.*, 06 Sept. 2004, *Aparna Watve A00235* (AHMA). Kolhapur Dist.: Ajara, 12 Nov. 2016, *Shinoj* & *Thoiba K. 146731* (CALI); Shivaji University Campus, 09 Nov. 2016, *Thoiba K. 146734* (CALI); *Ibid.*, 10 Nov. 2006, *K.V.C. Gosavi 2724* (SUK). Mumbai City Dist.: St. Xavier College Campus, *s.die.*, *C. Meccan 4294*; *Ibid.*, July 1917, *C. Meccan 4528*; *Ibid.*, Oct. 1917, *C. Meccan 4505* (BLAT); Sion Creek, Oct. 1916, *Sabnis 9982* (BLAT). Mumbai Suburban Dist.: Versova, Sept. 1917, *C. Meccan 4476* (BLAT); Peru, Kulala 14 Oct. 1910, *R.K. Bhide s.n.* (BLAT). Nagpur Dist.: Ratangarh-Ratanwadi River bed, 01 Oct. 1970, *B.W. Wadhwa 127971*(BSI). Nashik Dist.: Igatpuri, Jan. 2004, *C. Meccan 5192*; *Ibid.*, Jan. 1917, *Blatter* & *Hallberg 3930* (BLAT). Pune Dist.: Kukdeshwar, 07 Oct. 2001, *S.B. Nagarkar s.n.* (AHMA); Katraj Ghat, 19 Sept. 1902, *R.K. Bhide 926* (BLAT); Pune Dist.: Rajpur, 15. Oct. 1557, *J.A. Vasvada 29029* (BSI); Khandala, 02 Aug. 1960, *B.M. Wadhwa 64014* (BSI); Valvan Dam, Lonavle, 18 Aug. 1964, *B. Venkata Reddi 98632* (BSI); Ambavne–Zonavla, 21 May 1964, *B. Venkata Reddi 97851* (BSI); Kolwan, 22 Nov. 1956, *S.K. Jain 9537* (BSI); Bhimasankar Road, 08 Oct. 1962, *K.P. Janardhanan 81667* (CAL). Raigad Dist.: Matheran, Parai Point, 30. July 1966, *B.M. Wadhwa 109906* (BSI). Ratnagiri Dist.: Plateaus in MIDC, 15 Sept. 2003, *Malpure Nilesh Vijay s.n.* (AHMA); *s.loc.*, 14 September 2008, *K.V.C. Gosavi s.n.* (SUK); Lanja, 12 October 1994, *C.B. Salunkhe 7223* (SUK); Chiplun, 31 Oct. 1993, *C.B. Salunkhe 7180* (SUK); *s.loc.*, 11 Nov. 2005, A.S. Upadhya *s.n.* (AHMA). Sangli Dist.: Ashta, 26 Sept. 1993, *C.B. Salunkhe 849* (SUK); Khanapur, 01 Jan. 2007, *C.B. Arun N. Chandore 2053* (SUK). Satara Dist.: Kas, *s.die.*, *Aparna Watve A0347* (AHMA); Khubi, 26 Oct. 2007, *S.B. Nagarkar s.n.* (AHMA); Kas Plateau, 19 Mar. 2009, *M.M. Lekhak 246*; *Ibid.*, Dec. 1995, *M.P. Bachulkar-*

Chockkar 20084 (SUK); Koyna Nagar, 08 October 1989, *C.B. Salunkhe 8384*; *Ibid.*, 03 Oct. 1989, *S.R. Yadav 7950* (SUK). Sindhudurg Dist.: Aare, 24 June 2004, *Aparna Watve A0107* (AHMA); Devgad, 18 Sept. 1957, *G.S. Puri 27311*(BSI). Thane Dist.: Dolkamb Forest, Washala Range, 15 Oct. 1967, *K.V. Billore 111849* (BSI). **Tamil Nadu,** Coimbatore Dist.: Shaekalmudi, Mudiyankunnu, 12 Dec. 2013, *Thoiba K. 138028* (CALI); Myladumpara, 13 Dec. 2013, *Thoiba K. 138030* (CALI). Cuddalore Dist.: Kovalarithittu, Pichavaram R.F., 04 Mar. 1970, *K.N. Subramanian 3920* (FRC). Dindigul Dist.: Seerumalai, 25 Nov. 1958, *Pallithanam 4156* (RHT); Kodaikanal, 21 Mar. 1985, *K.M. Matthew 41152* (RHT); Law's Ghat road, 26 July 1986, *K.M. Matthew* & *N. Charles 45854* (RHT); Dindigal Rock, 20 Dec. 1968, *K.M. Matthew 10700* (RHT). Kanyakumari Dist.: Nagercoil, Kumaracoil, 29 Oct. 2015, *Thoiba K.* & *Mohammed Yoonus. 146652* (CALI); Nagercoil, Mambazhathuraiyar Reservoir, 29 Oct. 2015, *Thoiba K.* & *Mohammed Yoonus 146654* (CALI); Cape Comerin, 24 June 1980, *T. Usha 36084* (CALI). Madurai Dist.: *s.loc.*, May 1917, *Blatter* & *Hallberg 268* (BLAT). Nilgiri Dist.: Nadugani, *s.die.*, *Remya J. 75417* (TBGT). Thiruchirapalli Dist.: Puliyancholai, 06 Aug. 1958, *K.M. Sebastine 6192* (MH). Thoothukudi Dist.: Tuticorin, 11 July 1977, *M. Ramesh 9436* (CALI); 11 June 1977, *Majid 15574* (CALI). Tirunelveli Dist.: Courtallam, 10 June 1979, *s.coll. 30971*; *Ibid.*, 03 Sept.1981, *T. Beena Joseph 13* (CALI); Agricultural Estate above Five falls, 01 Oct. 1975, *K.K.N. Nair 1271*; *Ibid.,* 07 June 1977, *Rofhy David 14464* (CALI); Courtallam,Therkumalai, 24 July 1958, *K. Subramanyam 3787* (MH); Courtallam falls, 21 Apr. 1957, *K. Subramanyam 2793*; *Ibid.*, 25 Sept. 1919, *K.C. Jacob 16237* (MH); Ambasamudram, 13 May 1901, *C.A. Barber 2744* (MH); Mundanthurai, 16 May 1901, *C.A. Barber 2803* (MH); Kannikatti, 11 July 1959, *K.M. Sebastine 8486* (MH); Mancholai, 25 June 1959, *K.M. Sebastine 3635* (MH); Singampatti, 02 Mar. 1958, *K.M. Sebastine 5483* (MH); Kakachi, 15 Oct. 1957, *K.M. Sebastine 4502* (MH); Kodamudy, 04 Sept. 1969, *B.V. Shetty 32232* (MH); Sivalaperi, 12 Nov. 1962, *J. Joseph 15271* (MH). *s.loc.*, *s.die.*, *Fischer 176*, *Ibid.*, *s.loc.*, *28 Sept. 1910*, *Fischer*

2250 (FRC). **Telangana,** Warangal Dist.: Pakhal R.F., 28 Nov. 1960, *K.M. Sebastine 11662* (CAL). West Bengal, Dakshin Dinajpur Dist.: Balurghat, 25 Oct. 1983, *R.N. Banerjee 15958* (CAL).

Notes:—*E. unioloides* is an extremely variable species in the shape and structure of their panicles and spikelets, although it is easily recognized from the broad elliptic or slightly ovate, pinkish or purplish or sometimes pale spikelets. The size of the lemma too varies within rather wide limits. *E. jainii* is a new species recently described from Northern Kerala, India (Vivek *et al.*, 2013c). Authors compared the new species with *E. unioloides* and *E. mokensis*. The diagnostic characters of *E. unioloides* include sparsely villous leaf blades, highly variable effuse to lax, or sometimes contracted and interepted panicles, granular pinkish lemma and oblong or acutish palea apex with ellipsoid or ovoid caryopsis. According to authors, *E. jainii* is similar to *E. unioloides* and different from it mainly by having the presence of stiff leaves with villous hairs adaxially, panicles narrow linear and wider upto 2 cm with branches adpressed to the main axis; spikelets sharply acute with compact florets distinctly overlapping one another at base; palea distinctly curved on back, lateral nerves not prominent towards apex. The present authors thoroughly studied the holotype, paratypes (deposited at CAL & MH) and different live collections from type localities and other areas of Peninsular India, and was found the characters emphasised by the authors to differentiate *E. jainii* from *E. unioloides* overlap completely with those of *E. unioloides*. The panicle is highly variable, apex of palea may be oblong or acute, and it varies depending on the size of spikelets and number of florets in a single specimen. All these characters agree with the protologue of *E. unioloides*. Moreover, the caryopsis morphology of both the taxa does not support their segregation.

35. Eragrostis viscosa (Retz.) Trin., Mém. Acad. Sci. Pétersb. Sér. 6 (1): 397. 1831; C.E.C. Fisch. in Gamble, Fl. Madras 3: 1826. 1934; Bor, Grass. Burma Ceylon India Pakistan 515. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1859. 1983; Karth., S.K. Jain, M.P. Nair &

Sanjappa, Fl. Ind. Enum. Monocot. 218. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 393. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 227. 1994; S. Moulik, Grass. Bam. India 2: 611. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1200. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 155. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 549. 2012; Chaison., Chantar. & Hodk., ScienceAsia 39: 122. 2013. *Poa viscosa* Retz., Observ. Bot. 4: 20. 1786. *Eragrostis tenella* var. *viscosa* Retz. (Stapf), Hook.f., Fl. Brit. India 7: 315. 1896. **Type:—**India, Malabar, Deccan Peninsula? 1776, *Köenig s.n. in Herb. Retzius* (Holotype: LD, Isotypes: BM000578756, image!, fragm. in K000643369, image!). **Figs. 112, 113, 116**

Eragrostis mangalorica Hochst., Verh. Nederl. Inst. III 4: 38. 1851. Type:—India, Karnataka, Mangalor, *Metz 262* (Holotype: U, Isotype: LE, P00622498, image!, W18890067338, image!).

Teufted annuals or perennials, 15–70 cm high, roots fibrous. ***Culms*** 10–60 cm long, nodes glabrous. ***Leaf sheaths*** 3–7 cm long, terete to keeled, inrolled to the culm, sometimes viscous below mouth, fimbriate at apex. ***Leaf blades*** linear-lanceolate, 4–13 × 0.3–0.6 cm, base slightly cordate, apex acute-acuminate; surface glabrous, midrib prominent, margins entire and eglandular; ***ligules*** pilose, cilia 2–9 mm long. ***Panicles*** spiciform to effuse, open, 5–20 × 1–6 cm, branches alternate, basal ones whorled, axils pilose or not, viscous and yellow spotted; peduncles 3–22 cm long, glabrous, glandular, viscid, yellow spots with sticky grains. Primary pedicel *c.* 0.3 mm long, serrulate margins and glandular patches; secondary pedicel 0.2–0.4 mm long. ***Spikelets*** ovate-lanceolate, 2.5–5.3 × 1–1.7 mm, 4–11-flowered, olive green or greenish yellow to purple, disarticulation of florets from above downwards or entire florets falling or sometimes paleas persistent and falling later. Glumes deciduous, unequal. ***Lower glumes*** ovate-lanceolate, 0.6–1.2 × 0.3–0.4 mm, 1-nerved, 1-keeled, keels scabrid, membranous, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 1–1.3 × 0.3–0.4 mm, 1-nerved, 1-keeled, acute to acuminate at apex. ***Lemmas*** ovate-elliptic, 1–

1.2 × 0.4–0.8 mm, 3-nerved, lateral nerves prominent, deciduous, chartaceous, apex acute to obtuse. ***Paleas*** falcatus, 1–1.2 × 0.3–0.6 mm, winged, deciduous or not, 2-nerved, keels ciliate, acute-oblong at apex. ***Rachilla*** zigzag, *c.* 0.3 mm long. ***Lodicules*** 2, 0.2–0.3 mm long, dentate-triquadrate. ***Stamens*** 3; anthers 0.1–0.2 mm long, white. ***Ovary*** 0.2–0.5 mm long, globose; style 0.1–0.2 mm long, slender; stigma plumose, 0.2–0.3 mm long. ***Caryopses*** ovoid-ellipsoid, 0.3–0.5 × 0.2–0.3 mm, light brown.

Flowering & Fruiting:—May–March

Habitat & Ecology:—*E. viscosa* is a locally abundant species grows along the city sidewalks, moist places, open grounds, road sides, railway tracks sandy soils, and sea shores in association with *E. amabilis* (L.) Wight & Arn., *E. gangetica* (Roxb.) Steud., *E. unioloides* (Retz.) Nees *ex* Steud., *Lindernia caespitose* (Blume) Panigrahi, *Ischaemum ciliare* Retz., *Panicum repens* L., *Oldenlandia corymbosa* L., *Pilea microphylla* (L.) Liebm. and *Vinca minor* L.

Distribution:—North and South America, Africa and Asia, now pantropical. In India, it is reported from all states.

Specimens examined:—India, **Andhra Pradesh,** Nellore Dist.: *s.loc.*, Mar. 1985, *Fischer 4305* (FRC); Duttalur, Mar. 1918, *Fischer 4307* (FRC); Kavali, 21 Dec. 1917, *Fischer 4243* (FRC). **Goa,** North Goa Dist.: Taleigão, Goa University Campus, 18 Oct. 1997, *Vaishali C. Joshi* & *S. Rajkumar 1131* (Goa University Herbarium). **Karnataka,** Hassan Dist.: Belur, 13 Sept. 2014, *Thoiba K. CU 137520* (CALI). Raichur Dist.: Deodurga, 16 Nov. 1978, *S.R. Ramaesh* & *K.P. Sreenath 4406* (JCB). **Kerala,** Alappuzha Dist.: Pallathuruthy, 28 Jan. 2014, *Thoiba K. 138054* (CALI); Vandanam, 28 Jan. 2014, *Thoiba K. 138068* (CALI); Vandanam, Medical College Ground, 28

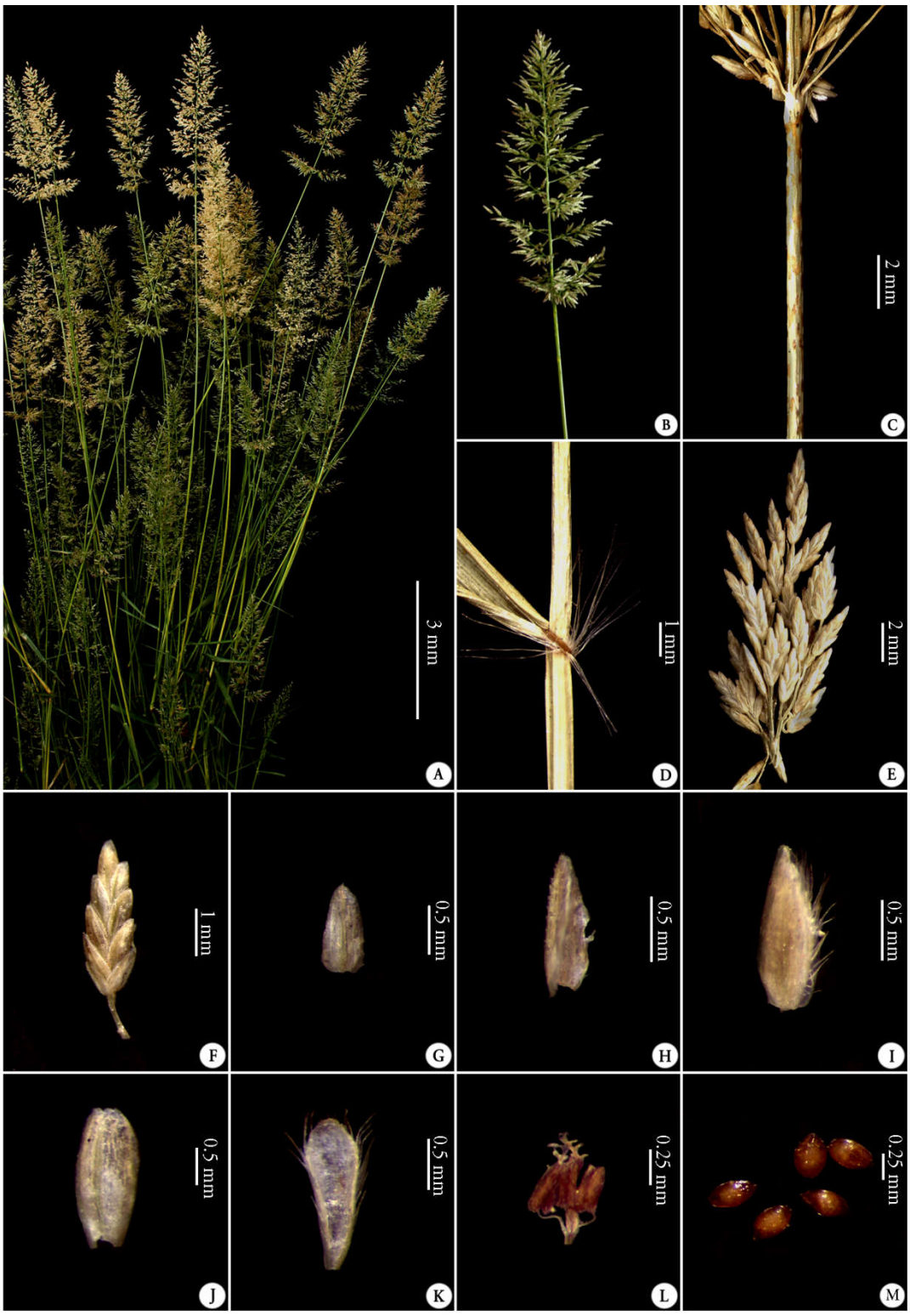


Fig. 112. ***Eragrostis viscosa*** (Retz.) Trin.: **A.** Habit; **B.** Panicle; **C.** Pedicel; **D.** Ligule; **E.** Primary pedicel with spikelets; **F.** Spikelets; **G.** Lower glume; **H.** Upper glume; **I.** Floret; **J.** Lemma; **K.** Palea; **L.** Stamens & pistil; **M.** Caryopsis.

Fig. 113. Type specimen of *Eragrostis viscosa* (Retz.) Trin. [*Köenig s.n.* (K000643369)] © The Board Trustees of the Royal Botanic Gardens, Kew.

Jan. 2014, *Thoiba K. 138070* (CALI); Valavanadu, 29 Jan. 2014, *Thoiba K. 138061* (CALI); Kayamkulam, Thamarakulam, Chethiyara, 30 Jan. 2014, *Thoiba K. 138065* (CALI); *s.loc.*, *s.die.*, *Sunil C.N. 1835* (CALI). Idukki Dist.: Thekkady, 16 Sept. 1993, *Jomy Augustine 12406* (CALI). Kannur Dist.: Muzhappilangad, 16 Dec. 1979, *V.S. Ramachandran 65262* (CAL). Kottayam Dist.: Kurishumala, 17 Mar. 1993, *N. Mohanan 11324* (TBGT). Kozhikode Dist.: Devagiri, 03 Sept. 1991, *Fr. K.M. Joseph 1098,* 07 Feb. 1986, *M.M. Matthew s.n.*; *Ibid.*, 14 Nov. 1983, *M.M. Matthew s.n.* (DEV). Malappuram Dist.: Calicut University Campus, 09 Mar. 1986, *Baby Jayalekha, K.C. 8097*; *Ibid.*, 14 Sept. 1981, *Rema, M. 183*; *Ibid.*, 08 Aug. 1985, *Neena, C. 8967* (CALI); Angadipuram, 12 Jan. 1996, *Shiji Sebastian 614* (DEV). Palakkad Dist.: Pattambi, Bharathapuzha River basin, 22 Jan. 2013, *Thoiba K. 138044* (CALI); Walayar, 09 Jan. 1911, *Fischer 2456* (FRC). Pathanamthitta Dist.: Chittoor, 30 Jan. 2013, *Mohammed Yoonus* & *Thoiba K. 1334411* (CALI); Kodumon, 02 Apr. 1978, *C.N.Mohanan 54959* (CAL). Thrissur Dist.: Parambikulam Tiger Reserve, Earth Dam, 26 Sept. 2013, *Thoiba K. 134461* (CALI); Kodungallur, Mathilakam, Koolimuttam, 27 Nov. 2015, *Thoiba K.* & *A.K. Pradeep 146682* (CALI). **Maharashtra,** Beed Dist.: Parli, Dec. 1995, *M.P. Bachulkar-Chockkar 20055* (SUK). Jalna Dist.: Jamwadi, 22 Sept. 1978, *S. Karthikeyan 156545* (BSI). Kolhapur Dist.: Amba, 14 Oct. 1990, *S.R. Yadav 7283* (SUK). Satara Dist.: Mayni, 25 Sept. 1993, *C.B. Salunkhe 7564* (SUK). Ratnagiri Dist.: Islampur, 26 Sept.

1993, *C.B. Salunkhe 7654* (SUK). *s.loc.*, 12 Oct. 2012, *Thoiba K. 138042* (CALI). **Tamil Nadu,** Cuddalore Dist.: Chidambaram, 04 Jan. 1980, *A. Diraviadoss 25460* (RHT). Madurai Dist.: Alagarkoil, 27 July 1965, *E. Vajravelu 25287* (MH); Nupura Ganga, 11 June 1957, *K. Subramanyam 3385* (MH). Nilgiri Dist.: Theppakadu R.F., 25 Nov. 1963, *K. Ramamurthy 17691* (MH). Ramanathapuram Dist.: Krishnathevarthoppu, Pallipuram, 09 Mar. 1980, *S. R. Srinivasan 63635* (MH). Theni Dist.: Cumbam–Theni Road, 10 Aug. 2017, *C.N. Sunil* & *Thoiba K. 146757* (CALI). Thiruchirappalli Dist.: Pettavaithalai, 26 Sept. 1967, *K.M. Matthew 7891* (RHT); Narthamalai, 30 Aug. 1970, *K.M. Matthew 12276* (RHT). Tirunelveli Dist.: Kanyakumari-Tirunelveli National Highway, 30 Oct. 2015, *Thoiba K. 146672* (CALI).

Notes:—*E. viscosa* is closely similar to *E. amabilis* but differs by having sticky glandular yellow spots below the panicles and sometimes the culm nodes. Veldkamp (2002) treated this name under the *E. amabilis*, which is treated here as a distinct species.

36. Eragrostis zeylanica (Retz.) Nees et Meyen, Gramineae: 72. 1841; Bor, Grass. Burma Ceylon India Pakistan 515. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 218. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 394. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 228. 1994; S. Moulik, Grass. Bam. India 2: 611. 1997. **Type:—**Sri Lanka, July 1829, *Macrae s.n. in Herb. Lindley*, *Herb. Arnott* (Holotype: CGE, photo in K, Isotype: BM000959607, image!). **Figs. 114–116**

Caespitose perennials, 20–90 cm high, roots fibrous. ***Culms*** 10–70 cm long, wiry, erect or trailing or decumbent, sparsely branched. ***Leaf sheaths*** 2–6 cm long, keeled, involute to the culm, ciliate towards apex. ***Leaf blades*** linear-lanceolate, 2.5–8 × 0.2–0.3 cm, base slightly cordate, apex acute-acuminate; surface sparsely villous adaxially and glabrous abaxially; margins entire; ligules a fringe of hairs, hairs 1–3 mm long. ***Panicles*** open, loose and interrupted, spreading, 5–25 × 3–12 cm long; branches alternate, 2–3 cm long, axils sparsely villous and scabrid, with 8–25 spikelets; peduncle 6–30 cm long,

Fig. 114. ***Eragrostis zeylanica*** Nees & Meyen: **A.** Panicle; **B.** Ligule; **C. & D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Lodicules, stamens & pistil; **K.** Lodicule; **L.** Caryopsis.

glabrous, ribbed; rachis 1–3 cm long, scaberulose. Primary pedicel 0.5–2 cm long, scaberulose; secondary pedicel 3–5 mm long, flat or quadrangular, glabrous. ***Spikelets*** linear-lanceolate, 15–25 × 1.5–2 mm, 10–60-flowered, olive green in colour, acute at apex; disarticulation of florets from below upwards. Glumes deciduous, unequal. ***Lower glumes*** ovate-lanceolate, 1–1.6 × 0.5–0.7 mm, 1-nerved, 1-keeled, keels scaberulose, acute to acuminate at apex. ***Upper glumes*** ovate-lanceolate, 1.5–2 × 0.5–0.8 mm, 1-nerved, 1-keeled, keels scaberulose, acute at apex. ***Lemmas*** oblong-lanceolate, 1.5–2 × 1–1.3 mm, 3-nerved, nerves slightly scabrid, minutely keeled, keels scabrid, lateral nerves not prominent towards apex, glandular, deciduous, chartaceous, acuminate at apex. ***Paleas*** oblanceolate, 1.2–1.5 × 0.3–0.5 mm, winged, persistant, 2-nerved, keeled; keels ciliate, obtuse at apex. ***Rachilla*** zigzag, 0.2–0.5 mm long, glabrous. ***Lodicules*** 2, 0.1–0.2 mm long, obovate. ***Stamens*** 3; anthers 0.3–0.4 mm long. ***Ovary*** 0.2–0.3 mm long, globose; style 0.2–0.3 mm long, slender; stigma plumose, 0.2–0.3 mm long. ***Caryopses*** ovoid to sub-globose, 0.3–0.5 × 0.2–0.3 mm long, narrowly compressed laterally, light brown.

Fig. 115. Isotype of *Eragrostis zeylanica* (Retz.) Nees et Meyen [*Macrae s.n.* (BM000959607)] © The Board Trustees of the British Museum of Natural History, London.

Flowering & Fruiting:—November–January

Habitat & Ecology:—*E. zeylanica* is grows in lowlands at about 300 m elevation, on moist places, open grounds, road sides, sandy soils, and seashores in association with *Alternanthera sessilis* (L.) R.Br. *ex* DC., *Chloris barbata* Sw., *Eragrostis amabilis* (L.) Wight & Arn., *E. brownii* (Kunth) Nees, *E. unioloides* (Retz.) Nees *ex* Steud., *E. cumingii* Steud., *Ischaemum ciliare* Retz. and *Oldenlandia corymbosa* L.

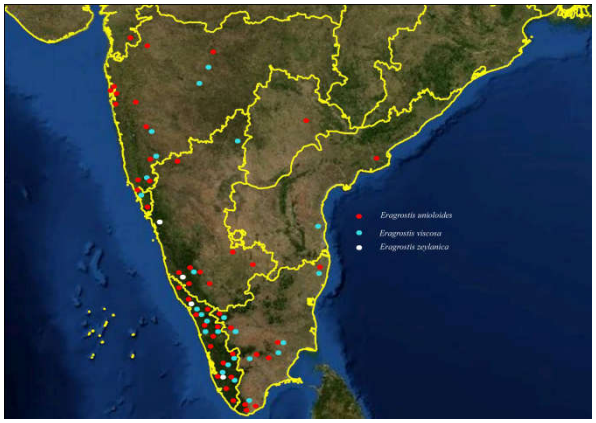


Fig. 116. Distribution of *Eragrostis unioloides* (Retz.) Nees *ex* Steud. (●), *E. viscosa* (Retz.) Trin. (●) and *E. zeylanica* (Retz.) Nees et Meyen (○)

Distribution:—Australia, Burma, S. China, Taiwan, India and Sri Lanka. In Peninsular India, it is known only from Kerala and Karnataka.

Specimens examined:—India, **Karnataka,** Dekshina Kannada Dist.: HBSS Kadaba, 15 Sept. 2014, *Thoiba K. 137524* (CALI). Uttara Kannada Dist.: Sirsi, Oct. 1919, *Hallberg* & *Meccan s.n.* (BLAT). **Kerala,** Alappuzha Dist.: Valavanadu, 29 Jan. 2014, *Thoiba K. 138061* (CALI). Kannur Dist.: Hosdurg, 29 Jan. 1979, *V.J. Nair 59997*; *Ibid.*, 29 Jan. 1979, *V.S. Ramachandran 60035* (CAL, MH).

Notes:—*E. zeylanica* is a variable species, especially in the size and shape of its panicle. It has been confused with the *E. brownii* and *E. cumingii*. Many authors (Eg. Veldkamp 2002, Chaisongkram *et al.,* 2013) considered *E. zeylanica* Nees & Meyen (1841c) as conspecific with *E. brownii* (Kunth) Nees. An examination of the protologue and type (*Macrae s.n.* BM, image!) of *E. zeylanica* showed it as a distinct species. *E. zeylanica* is characterized by its short spreading habit (*"ramis brevibus patentibus"*), more or less fascicled spikelets on the primary or secondary branches, very short (less than 3 mm) pedicels and up to 25 mm long spikelets with 10–60-florets.

Neyraudia Hook.f.

The genus *Neyraudia* was established by Hooker in 1896 to include a single species *N. madagascariensis* Hook.f. from Madagascar. Subsequently two more species, *N. curvipes* Ohwi, N. *montana* Keng, *N. reynaudiana* (Kunth) Keng *ex* Hitchc. were added to this genus. The genus, at present, is represented by four species in the world, and two in India. *Neyraudia* is remarkable for its tall stout perennial habit; long and wide leaf blades; large, lax panicles with silky spikelets.

Neyraudia Hook.f., Fl. Brit. Ind. 7: 305. 1896; C.E.C Fisch. in Gamble, Fl. Madras 3: 1806. 1934; Bor, Grass. Burma Ceylon India Pakistan 518. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 239. 1989; L. Watson & Dallwitz, Revis. Grass Gen. World: 648. 1994; S. Moulik, Grass. Bam. India 2: 614. 1997; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 631. 2012. **Type:—***Neyraudia medagascariensis* (Kunth) Hook.f., Fl. Brit. Ind. 7: 305. 1896.

Tall Perennials, leafy herbs or shrubs. ***Culms*** woody and persistent; 2–5 m high, nodes glabrous. ***Leaf sheaths*** glabrous. ***Leaf blades*** flat or sometimes convolute. ***Ligules*** a fringe of hairs. ***Panicles*** effuse, decompounds, often nodding. ***Spikelets*** laterally compressed, 4–8-flowered. ***Glumes*** 2, membranous, subequal or the upper slightly the longer, keeled, 1-nerved. ***Rachilla*** shortly bearded; persistent or not; jointed at the base or above the first lemma, in which case the latter is entire and empty, and between the lemmas. ***Lemmas*** elongate-subulate, often recurved, acuminate, entire or shortly 2-fid, with 2 setae and an often recurved arista from the tip of the sinus, strongly 3-nerved, sides long silky hairy. ***Paleas*** short, oblong, 2-keeled, keels scaberulous, all containing a bisexual floret or the lowest empty and glabrous. ***Lodicules*** 2. ***Stamens*** 1–3. Styles 2, free to base. ***Ovary*** glabrous. ***Caryopses*** linear-subulate, base acute, loose in the lemma.

Distribution:—The genus is distributed in Tropical Africa, Madagascar, China and Indo- malayan region. Two species are known to be distributed in India, of which one occurs in Peninsular India.

Habitat:—It is found growing in the edges of water bodies.

1. Neyraudia arundinacea (L.) Henrard, Meded. Rijks-Herb. 58: 8. 1929; Bor, Grass. Burma Ceylon India Pakistan 518. 1960; C.E.C Fisch. in Gamble, Fl. Madras 3: 1806. 1934. *Aristida arundinacea* L., Mant. Pl. 2: 186. 1771. **Lectotype** (designated by Hubbard, 1970)**:**—India, *Köenig s.n.* (LINN-98.8, image!).

Figs. 117

Neyraudia madagascariensis (Kunth) Hook.f., Fl. Brit. Ind. 7: 305. 1897; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 239. 1989; S. Moulik, Grass. Bam. India 2: 614. 1997; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 631. 2012; *Arundo madagascariensis* Kunth., Rev. Gram. 1: 273. t. 48. 1830. **Lectoype:—**Africa, Madagascar, Crescit in Madagascaria. *Du Petit-Thouars L.M.A. s.n.* (P00446272, image!, frag. US00156922, image!).

Tall Perennials, robust. ***Culms*** woody and persistent; 2–4 m high, nodes glabrous, solid, woody. ***Leaf sheaths*** glabrous. ***Leaf blades*** convolute, 30–60 × 0.5–1 cm, glabrous. ***Ligules*** a fringe of hairs. ***Panicles*** effuse, dense, 30–90 cm long. ***Spikelets*** 6–9 mm long, pale brown, 4–8-flowered. ***Lower glumes*** membranous, 2–3 mm long, acute at apex. ***Upper glumes*** 2–3 mm long, acute at apex. ***Lemmas*** membranous, 3–5 mm long, apex two lobed. ***Paleas*** membranous, 1.5–2.5 mm long, short, oblong, 2-keeled. ***Lodicules*** 2. ***Stamens*** 1–3. Styles 2, free to base. ***Ovary*** glabrous. ***Caryopses*** linear-subulate, base acute.

Fig. 117. Lectotype of *Neyraudia arundinacea* (L.) Henrard [*Köenig s.n.*, (LINN-98.8) designated by Hubbard, 1970] © The Board Trustees of the Linnean Society, London.

Distribution:—Seen in Tropical Africa, the Mascarenes. In Peninsular India, it was reported from Kerala and Maharashtra.

Specimens examined:—India, **Arunachal Pradesh,** *s.loc.*, 06 Nov. 1999, *M. Bhaumik 2536* (CAL). **Gujarat,** Ahmedabad Dist.: Dolka, 09 Dec. 1940, *Sharma s.n.*; *Ibid.*, *s.loc.*, 07 Dec. 1940 *Sharma s.n.* (FRC). **Meghalaya,** East Khasi Hills Dist.: Mount Khasia, *s.die.*, *J. D. Hayy s.n.* (MH). **Punjab,** *s.loc., s.die., s.coll., s.n.* (MH).

Trigonochloa P.M. Peterson & N. Snow

The generic boundaries of *Leptochloa* P. Beauv. have been contentious, since establishment of the genus in 1812 . The genus has been considered as a diverse assemblage of unrelated taxa, and is demonstrably polyphyletic when tested with molecular DNA markers (Snow & Peterson, 2012a). Recent molecular studies using the six DNA markers recognise five separate lineages in *Leptochloa s.l.* The molecular results support the dissolution of *Leptochloa s.l.* into the following five genera: *Dinebra* Jacq., *Diplachne* P. Beauv., *Disakisperma* Steud., *Leptochloa* P. Beauv. *s.s.* and *Trigonochloa* P.M. Peterson N. Snow (Peterson *et al.,* 2012; Snow & Peterson, 2012a). From these, genus *Trigonochloa* resolved as a strongly supported clade in the subtribe Perotidinae. The genus comprises only two species, *T. uniflora* (Hochst. *ex* A. Rich) P.M. Peterson & N.Snow and *T. rupestris* (C.E. Hubb.)P.M. Peterson & N.Snow.

Trigonochloa P.M. Peterson & N. Snow, Ann. Bot. 109: 1327. 2012; N. Snow & P.M. Peterson, Phytokeys 13: 29. 2012. **Type:—***Trigonochloa uniflora* (Chipp.) P.M. Peterson & N. Snow, Ann. Bot. (Oxford), n.s. 109(7): 1328. 2012.

Plants annuals to short lived-perennial, sometimes rhizomatous or stoloniferous. ***Culms*** (15–) 35–130 cm high, terete, documbent or clambering to erect; nodes glabrous. ***Leaf sheaths*** half as long as to slightly longer than internodes, glabrous or ciliate apically

along margins; ligules 1-3.5 mm long, membranous irregularly lacerate with age. ***Leaf blades*** 1–13(–17) cm long, 0.3–14(–19) mm wide, linear to broadly ovate, flat, typically thin and flaccid, apex acuminate to acute. ***Panicles*** 17–55 × 2–8 cm long, exerted at maturity, open narrowly oblong to narrowly elliptic, composed of several to numerous unilateral, second spikes or spicate racemes scattered along a central axis; rachis semi-terete; branches (1.5–)2–7 cm long, ascending, straight or slightly drooping. ***Spikelets*** 1.9–2.8 mm long, 1(rarely 2-flowered), laterally compressed, subsessile, overlapping; disarticulation above the glumes; ***glumes*** 1.8–3.1 mm long, subequal, as long or longer than the floret, subequal, linear to narrowly ovate, 1-nerved, apex acute to acuminate, mucronate or emucronate; ***lemmas*** 1.2–2.6 mm long, ovate, 3-nerved, thinly membranous to hyaline, minutely hairy along the nerves, apex acute, entire, awnless; ***plaleas*** 1.5–2.5 mm long, keels ciliolate. ***Stamens*** 3. ***Caryopses*** 1–1.2 mm long, narrowly elliptic, trigonous in cross section, narrowly but deeply sulcate on the hilar side; suface smooth to slightly rugose-striate, light brown, pericarp fused, tightly adherent to endosperm.

Distribution:—Scattered through the eastern and southern portions of sub-Saharan Africa, India, and most common in Sri Lanka. Only 2 species represented in the world; from these one in India.

Habitat:—In forests and shady areas on hill sides, well-drained and often sandy soils in disturbed and riparian areas and also known in adjacent to water logged areas, stream sides.

Etymology:—The name *Trigonochloa* is derived from Greek word *trigon*, triangle; *chloa*, grass; with the meaning of 'triangle-seed grass' (Clifford & Bostock, 2007).

1. Trigonochloa uniflora (Hochst. *ex* A. Rich.) P.M. Peterson & N. Snow, Ann. Bot. 109: 1328. 2012; N. Snow & P.M. Peterson, Phytokeys 13: 29. 2012. *Leptochloa uniflora* Hochst. *ex* A. Rich. Tent. Fl. Abyss. 2: 409. 1851; Hook.f., Fl. Brit. India 7: 297. 1896; C.E.C Fisch. in Gamble, Fl. Madras 3: 1820.

1934; Bor, Grass. Burma Ceylon India Pakistan 517. 1960; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 235. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 396. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 301. 1994; Moulik, Grass. Bam. India 2: 614. 1997; Sasidh., Biodiv. Doc. Kerala–Fl. Pl. 580. 2004; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 162. 2009. *Craspedorhachis uniflora* (Hochst. *ex* A. Rich) L. Chippendall in Meredith, Grass. and Past. South Africa 205. f. 182. 1955. **Type:**—Ethiopia, Abyssinia, In valle fluvi Tacaze, *G.W. Schimper 1707* (Holotype: P00439470, image!, Isotypes: B, BM000514983, image!, GH, K!, MO, PRE, S, W). **Figs. 118–121**

Cynodon gracilis Nees *ex* Steud., Syn. Pl. Glumac. 1: 213. 1854; Thw., Enum. Pl. Zeyl. 5: 371. 1864. *Leptochloa gracilis* Wight ex Steud. *nom. inval.*, Syn. Pl. Glumac. 1: 213. 1854. Lectotype (designated by N. Snow & P.M. Peterson, 2012):—India, Ab. loco. *Wight Herb. 8895* (K!, Isolectotype: K!).

Agrostis Montana Rottl. *ex* Hook.f. *nom. inval.*, Fl. Br. Ind. 7: 298. 1896. Lectotype (designated by N. Snow & P.M. Peterson 2012):—India, Tirunelveli Dist.: Palayamkottai, 28 Nov. 1895, *Rottler s.n.* (K!).

Tufted annuals or weakly perennial. ***Culms*** slender, creeping or geniculate, 10–65 cm high; nodes glabrous, slightly geniculate and 1–5-noded. ***Leaf blades*** 05–11.5 × 1.3–1.6 cm, ovate-acute or elliptic or elliptic-lanceolate, surfaces glabrous, midrib prominent, more or less membranous, margins cartilaginous, scabrid, acute or acuminate at apex. ***Leaf sheaths*** 2.3–7 cm long, keeled towards apex, more or less ribbed, glabrous; ***ligules*** ovate, acute, membranous, *c.* 2 mm long. ***Panicles*** terminal, 05–28 cm long, lax, central axis more or less ribbed, scabrid on ribs, especially towards apex; peduncle 6–11 cm long, glabrous, more or less ribbed. ***Racemes*** stout, many, alternate or sub whorled, 4.5–8 cm long; rachis flat, winged, scabrid. ***Spikelets*** subsessile, secund, oblong or lanceolate, 2–2.5 × *c.* 0.5 mm, oblong-lanceolate, distant, 1-flowered. Glumes longer

than the floret. ***Lower glumes*** oblong-lanceolate, 2–2.3 × 0.4–0.5 mm, acuminate, chartaceous, 1-veined, keeled, scabrid, margins finely serrulate towards apex. ***Upper glumes*** 2–2.3 × *c.* 0.4 mm, lanceolate, keeled, 1-veined. ***Lemmas*** 1.5–1.7 × *c.* 0.8 mm, ovate-oblong, membranous to chartaceous, greenish, more or less delicate, 3-nerved, 1-keeled, sparsely hairy along nerves, minutely ciliate towards apex, otherwise glabrous. ***Paleas*** elliptic or oblong-elliptic, 1–1.5 × 0.5–0.8 mm, hyaline, 2-keeled, 2-nerved, keels ciliolate. ***Lodicules*** 2, *c.* 0.2–0.4 mm long, hyaline, truncate with raised hook-like projections on one side. ***Stamens*** 3; anthers 0.5–1 mm long, yellowish; filaments 0.3–0.5 mm long, hyaline, glabrous. ***Ovary*** *c.* 0.3 mm long, obovate to elliptic; styles 2, slender, hyaline, 0.3 mm long; stigma 0.6 mm long, plumose. ***Caryopses*** oblong-lanceolate, 1–1.2 × 0.2–0.3 mm, acute, brownish, smooth, deeply grooved on one side.

Flowering & Fruiting:—Almost throughout the year when adequate moisture is available.

Habitat & Ecology:—From the lowlands of the dry, arid and wet zones to the lower highlands upto about 1200 m elevation. Apparently always in shade, in a wide range of habitats including shallow, rocky soils on hill sides in association with *Aponogeton* sp., *Cyrtococcum muricatum* (Retz.) Bor, *Digitaria ciliaris* (Retz.) Koeler, *Isachne globosa* (Thunb.) O. Ktze., *Nymbphaea* sp., *Pogostemon deccanensis* (Panigrahi) Press, *Rotala malapuzhensis* R.V. Nair *ex* Cook and *Utricularia* spp.

Distribution:—In India (Kerala, Tamil Nadu), Sri Lanka and Tropical Africa.

Specimens examined:—Kerala, Idukki Dist.: Vadanmedu-Theni Road, 11 Oct. 2017, *Thoiba K. 146787* (CALI). Kozhikode Dist.: *s.loc.*, 22 Oct. 1900, *s.coll.*, *s.n.* (MH). Palakkad Dist.: Malabar, 19 Oct. 1919, *s.coll. 105364* (MH). **Tamil Nadu,** Coimbatore Dist.: Kurudimalai, 21 Dec. 1956, *K. Subramanyam 1830a*; *Ibid.*, 21 Dec. 1956, *K. Subramanyam 1830b* (CAL, MH); Aliyar, 21 Nov. 1962, *K.M. Sebastine 15090* (CAL); Velliangiri, 23 Mar. 2012, *Remya J. 72267* (TBGT); Poonachi Ghat, 08 Oct. 1901, *C.A. Barber 3578* (MH); Aliyar, 21 Nov. 1962, *K.M. Sebastine 15090*

Fig. 118. ***Trigonochloa uniflora*** (Hochst. *ex* A. Rich.) P.M. Peterson & N. Snow: **A.** Habit; **B. & C.** Enlarged portion of raceme; **D. & E.** Ligule; **F.** Leaf blade - adaxial view; **G.** Lower glume; **H.** Upper glume; **I.** Floret; **J.** Lemma; **K.** Palea; **L.** Caryopsis.

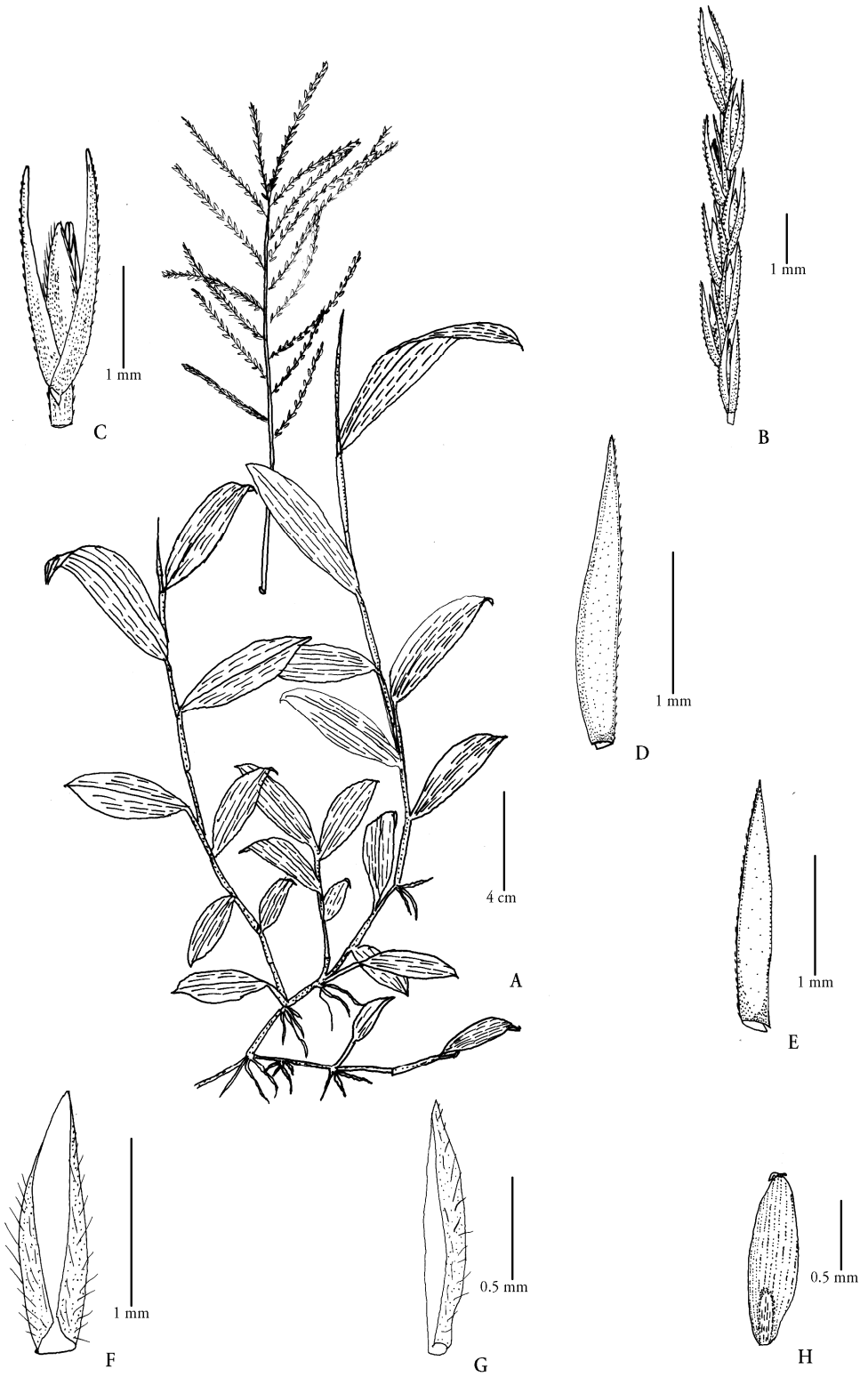


Fig. 119. ***Trigonochloa uniflora*** (Hochst. *ex* A. Rich.) P.M. Peterson & N. Snow: **A.** Habit; **B.** Enlarged portion of raceme; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Lemma; **G.** Palea; **H.** Caryopsis.

(MH). Dindigul Dist.: Kodaikanal, Palani Ghat Road, 13 Dec. 1989, *K.T. Mathew, S. Perianayagam* & *S. Sebastian 53791* (RHT). Dharmapuri Dist.: Pennagaram R.F., near Muthur Forest Bengalow, 01 Dec. 1964, *E. Vajravelu 796* (MH). Kanyakumari Dist.: Anaikkalpattai, Panagadu, 04 Dec. 1969, *B.V. Shetty 33026* (CAL). Madurai Dist.: Vannathiparai, 17 Oct. 1959, *K. Subramanyam 9411* (CAL); Vannathiparai, 17 Oct. 1959, *K. Subramanyam 9411* (MH); Uthamapalayam, Bodi foot hills, Valasa Road, 16 Nov. 1987, *K.M. Matthew* & *M. Charles 51246* (RHT); Periakulam, Vengayapparai, 18 Nov. 1987, *K.M. Matthew* & *M. Charles 51410* (RHT). Nilgiri Dist.: Mudumalai, 19 Jan. 2013, *Remya J.* & *Prasanna 72262* (TBGT). Salem Dist.: *s.loc.*, 01 Dec. 1964, *E. Vajravelu 21992* (CAL). Ramanathapuram Dist.: Rajapalayam, 17 Nov. 1953, *J. Satharam Rao 22207* (MH). Tirunelveli Dist.: Panagudi, Anaikkalpathai, 04 Dec. 1969, *B.V. Shetty 33026* (MH).

Fig. 120. Isotype of *Trigonochloa uniflora* (Hochst. *ex* A. Rich.) P.M. Peterson & N. Snow [*G.W. Schimper 1707* (BM000514983)] © The Board Trustees of the British Museum of Natural History, London.

Fig. 121. Distribution of *Trigonochloa uniflora* (Hochst. *ex* A. Rich.) P.M. Peterson & N. Snow ( )

Notes:—*Trigonochloa uniflora* individuals vary significantly in growth habit. Plants are relatively delicate, sprawling annuals, but some are more erect with relatively stout culms that appear to be weakly perennial. The more erect forms typically occurs in somewhat more open areas and have thicker leaves, whereas the more slender forms that frequently root at the lower nodes, typically occur in shade and have thinner leaves.

Tripogon Roth *ex* Roem. & Schult.

The name *Tripogon* is derived from the Greek word 'treis' (three) and 'pogon' (beard) referring to the fringe of hair located at the base of the lemma nerves of each floret (Watson & Dallwitz 1992; Clifford & Bostock, 2007). The genus comprises 51 species (Phillips & Chen, 2002; Rùgolo de Agrasar & Vega, 2004; Thoiba & Pradeep, 2016; The Plant List, 2018) distributed in tropical, subtropical and warm temperate regions of Africa, including the Arabian Peninsula (11 species), Asia, including the islands of New Guinea (36 species), Americas (3 species) and Australia (1 species). Out of these, *T. purpurascens* Duthie occurs in Africa and Asia, and also *T. loliformis* (F. Muell.) C.E. Hubb. is distributed in Australia and New Guinea (Fabillo, 2015). Despite, majority are represented in southern Asia, especially in India, where it is represented by 24 species including the recently described six taxa (*T. malabaricus* Thoiba & Pradeep, *T. idukkianus* Sunil & Pradeep, *T. bimucronatus* Thoiba & Sunil, *T. mahendragiriensis* Chorghe, Sang. Dey, K. Prasad, Prasanna, Y.V. Rao, *T. karnatakensis* Thoiba & Pradeep and *T. munnarensis* Thoiba & Manudev). In Peninsular India, the genus is represented by 22 species. Hence, Peninsular India is the center of diversity for this genus.

Species of *Tripogon* flourishes in a variety of habitats such as dry, seasonally moist, or moist mountains, hill tracts, and rock crevices and sometimes in lowlands. All taxa in the genus *Tripogon* occur as caespitose or tufts ranging in height from 4 to 120 cm and exhibit remarkable similarities in vegetative structure. Most Indian species of

Tripogon are helophytic to xerophytic, epiphytic, glycophytic, gregarious and occur in open habitats (Bor, 1960; Newmaster *et al.,* 2008). The present knowledge on the genus *Tripogon* is largely based on the informations available in revisionary studies (Phillips & Launert, 1971; Phillips & Chen, 2002; Veldkamp & Phillips, 2003; Rùgolo de Agrasar & Vega, 2004) and online databases (Watson & Dallwitz 1992; Clayton *et al.,* 2006; The Plant List, 2018).

The greater number of reports on *Tripogon* involve descriptions of new species and taxonomic revisions based on morphology. A few significant taxonomic contributions include the revision of the species of *Tripogon* in Africa (Phillips & Launert, 1971), China (Phillips & Chen, 2002), Thailand (Veldkamp & Phillips, 2003) and description of new species in America, India and Thailand (Sreekumar *et al.,* 1983a; Sreekumar *et al.,* 1983b; Pradeep & Sunil 1999; Sunil & Pradeep 2001; Murugaesan & Balasubramaniam, 2008; Teerawatananon & Sugkaew, 2012; Thoiba & Pradeep, 2014, 2015; Sunil *et al.,* 2015; Chorghe *et al.,* 2016; Thoiba *et al.,* 2016).

History

The genus *Tripogon* was originally established by J.J. Roemer and J.A. Schultes (1817) as "Calyx 2-valved, somewhat 8-flowered, somewhat awned. Corolla 2-valved, outer valve with a pilose base, below the apex with a straight awn, with margin at the middle on both sides provided with an outward bending awn. Stamens 3. Stigmas 2, feathery. Seed 1" with a reference to A.W. Roth's *Triathera* in an unpublished manuscript (*Novae Plantarum Species*). In the same work, Roemer and Schultes described a single species of *Tripogon*, *T. bromoides* with a reference to *Triathera bromoides* Roth in an unpublished manuscript (l.c.). The authors commented "*primo intuitu similis FESTUCAE myuro*" that their new species at first glance similar to *Festuca myuros* L. It is evident that Roemer and Schultz have considered *Festuca mysorensis* as synonymous to *T. bromoides* and has indicated "H. in Mysore". Since, *T. bromoides* was the only species included while establishing the genus, it constitute the type species

of the genus. However, no reference to a specimen was given in the protologue. The reference to "H. in Mysore" in the protologue indicates Heyne in Mysore. Benjamine Heyne, a German Missionary Served as Superintendent of Bangalore Garden in 1802 (Stafleu & Cowan, 1979) probably collected the specimen from Mysore in India. Both Heyne and A.W. Roth's types are at B and it seems Roth received Heyne's specimen for identification and it became part of Roth's Herbarium. Roth identified it as *Festuca mysorensis* (unpublished) and later Roemer & Schultz gave it a new name as *T. bromoides*. A well preserved specimen evidently collected by Heyne in 1814 from Mysore is available at Museum Botanico Berolinense (B100367364 image!), with a handwritten (presumably by Roth) note on *Festuca mysorensis* Heyne affixed on it. Since it being the only element that can be attributed with some certainty to the original collection of *Tripogon bromoides,* it is accepted as the holotype of *T. bromoides.*

The general characters of the genus include solitary unilateral racemes, laterally compressed spikelets with 3-nerved lemmas (Clayton & Renvoize, 1986). As per the recent world wide phylogenetic classification of Poaceae (Gramineae) by Soreng *et al.* (2015), this genus comes under the subfamily Chloridoideae Kunth *ex* Beilschm., tribe Cynodonteae Dumort., subtribe Tripogoninae Stapf.

Tripogon Roth *ex* Roem. & Schult., Syst. Veg. 2: 34. 1817; Hook.f., Fl. Brit. India 7: 285. 1896; C.E.C Fisch. in Gamble, Fl. Madras 3: 1832. 1934; Bor, Grass. Burma Ceylon India Pakistan 519. 1960; S.M. Phillips & E. Launert, Kew Bull. 25(2): 301. 1971; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1911. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 270. 1989; Sreek. & V.J. Nair, Fl. Kerala Grass. 398. 1991; Dassan., Fosberg & Clayton, Revis. Handb. Fl. Ceylon 8: 443. 1994; L. Watson & Dallwitz, Revis. Grass Gen. World: 973. 1994; S. Moulik, Grass. Bam. India 2: 618. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1268. 1997; S.M. Phillips & S.L. Chen, Kew Bull. 57(4): 912. 2002; Kabeer & V.J.

Nair, Fl. Tamil Nadu Grass. 178. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 555. 2012. **Type:—***Tripogon bromoides* Roth *ex* Roem. & Schult.

Plagiolytrum Nees in Proc. Lin. Soc. 1: 95. 1841.*nom. inval.*

Annual or perennial. ***Leaf blades*** narrow, often rigid (apex pungent in *T. pungens*); ***ligules*** a narrow membrane fringed with hairs or absent. ***Inflorescence*** a single unilateral raceme. ***Spikelets*** laterally compressed, broadside to the rachis, linear to elliptic, rachilla elongate between the florets, disarticulating above the glumes and tardily so between the florets; callus minute, obtuse, bearded. ***Glumes*** membranous, glabrous; lower glumes 1-nerved, acuminate, smooth; the upper glumes sometimes 3-nerved (the lowest lemma sterile and glume-like in *T. siamensis*, *T. wardii*); florets several, closely imbricate, perfect or the upper ones staminate or barren, or rarely the lower floret also barren. ***Lemmas*** lightly keeled or rounded, glabrous, bidentate (sometimes entire in *T. major*), mucronate or awned, the awn straight or rarely flexuous, often the teeth also awned. ***Paleas*** hyaline, entire, ciliolate on the keels upwards, otherwise glabrous,sometimes winged. ***Stamens*** 1–3, linear-oblong. ***Caryopses*** subterete, obtusely triquetrous, narrow, free within the lemma and palea.

Distribution:—Widely distributed in tropical and subtropical regions of Asia, Africa, Australia, and the Americas, from southern U.S.A. to Argentina and Sri Lanka. About 51 species in the world; 24 species in India of which and 22 occur in Peninsular India.

Habitat:—Taxa of *Tripogon* thrive in a variety of habitats of dry, seasonally moist or always mountain slopes of grasslands, ghat road sides, hilly tracts, rock crevices and outcrops from 500 m to 4000 m elevation. In the appropriate habitats, *Tripogon* is usually found in shallow brown to red soils that are usually sandy or clayey.

Etymology:—The name 'Tripogon' is derived from the Greek word *tries* (three) and *pogon* (beard), referring to the hair at the base of the three lemma veins (Watson & Dallwitz 1992; Clifford & Botstock 2007).

Key to the Indian species of *Tripogon*

1a. Culms thickened below by the persistent leaf sheaths; leaves equitant, rigid and pungent. ..... **16. *T. pungens***

1b. Culms and leaves not as above… **2**

2a. Lemmas cleft at the apex into 2 lobes, awned in the cleft; lobes awned or not…..... **3**

2b. Lemmas cleft at the apex into 4–6 lobes or not; with or without a definite lobe between each lateral awn and the median awn; outer lobes, if present awned or not **14**

3a. Median awn as long as or longer than the lemmas..... 4

3b. Median awn shorter than the lemma, occasionally almost absent **8**

4a. Awns straight or curved, not more than twice as long as the lemmas **5**

4b. Awns flexuous, capillary, several times as long as the lemmas. .....**4. *T. capillatus***

5a. Spikelets 1–4 cm long; paleas broadly winged **6**

5b. Spikelets not more than 1.5 cm long; paleas not broadly winged…..... 7

6a. Culms stoloniferous or not; leaves equitant, less than the size of racemes; spikelets up to 16-flowered, olive to dark green or yellowish; awns straight at young atage and recurved at maturity.…….. ..... **23. *T. wightii***

6b. Culms almost stoloniferous, leaves convolute or sometimes equitant, equal or more than the size of racemes; spikelets up to 9-flowered, olive to dark green with

or without purple tinge; awns almost straight but at maturity minutely bend…… .....**22.** ***T. velliangiriensis***

7a. Upper glumes 2-toothed with a short awn at the apex; lemmas bearded at base, 2 lobed at apex, awned in the sinus, the lobes awned or not athe apex, median awn twice as long as lemma; palea obtuse at apex… .....**20.** ***T. trifidus***

7b. Upper glumes never 2-toothed or awned at apex; lemmas glabrous at base, 2-lobed at apex, awned in the sinus, the lobes never awned at the apex, median awn as long as or shorter than lemmas; paleas acute or lobed at apex..... **19.** ***T. sivarajanii***

8a. Perennials with wiry roots forming tufts; leaves glabrous or sparsely hairy… **9**

8b. Perennials with fibrous roots, forming a close turf; leaves covered with a mass of matted hairs; whole plant with a purple tinge; racemes not ver stout; spikelets 2–4 or 4–8-flowered… .....**17.** ***T. purpurascens***

9a. Leaves and clums glaucous, convolute or involute; ligules very short but definite ciliate…..... **10**

9b. Leaves and culms green, not glaucous; leaves flat; ligules obsolete or indistinct ……..…..... **11**

10a. Leaves sub filiformis, involute; greater than or equal to racemes; spikelets 1–3 cm long, up to 25-flowered; more common on old walls.…..... 7.***T. jacquemontii***

10b. Leaves convolute, less than the racemes; spikelets 2–6.5 cm long, up to 60-flowered; more common in river bed rocks…..... **15.** ***T. polyanthus***

11a. Leaves and racemes almost equal in length; racemes straight or curved; glumes unawned…..... .**12**

11b. Racemes greater than the leaves, stout; glumes awned or not…..... **13**

12a. Leaves flat or sometimes rolled; ligule obsolete; upper glumes aristate; awn shorter than the lemmas; paleas acute at apex .....**9. *T. lisboae***

12b. Leaves flat; ligules indistinct; upper glumes acute; lemma awn equal or greater than the lemmas; paleas subulate at apex… .....**11. *T. malabaricus***

13a. Plants caespitose; lower glumes asymmetrical; upper glumes mucronate or narrowly awned at sinus; paleas bimucronate at apex… .....**1. *T. bimucronatus***

13b. Plants robust; lower glumes symmetrical; upper glumes acute to acuminate; paleas acute at apex…… .....**21. *T. vellarianus***

14a. Lemmas 3-awned with a definite lobes between the awns; stamens 3…..... **15**

14b. Lemmas 3-awned without a definite lobes between the awns; stamens 2…… .....**12. *T. mahendragiriensis***

15a. Lemmas 4-lobed…..... **16**

15b. Lemmas 6-lobed… **23**

16a. Median awn shorter than or nearly equal to the lemmas; stout grass..... **17**

16b. Median awn twice as long as the lemma or more; very slender grass..... **20**

17a. Leaves convolute or flat; lateral awns sub equal to median awns.. ..... **18**

17b. Leaves flat, linear-lanceolate, pilose; lateral and median awns are not as above..... .....**19**

18a. Spikelets 5–10 mm long, loosely spaced on the rachis, 4–6-flowered; lower glumes 2.3–3.5 mm long…..... **14. *T. narayanae***

18b. Spikelets 10–16 mm long, contracted on the rachis, 10–16-flowered; lower glumes 1– 2.7 mm long…..... **13. *T. munnarensis***

19a. Spikelets contracted or compactly arranged; olive green with purple tinge or dark green at fresh and yellowish in dry; size of lateral awns in lemma is highly variable; paleas acute or with a central notch at apex…..**3. *T. bromoides***

19b. Spikelets distant, olive green or yellowish; lateral awns almost subequal to the median awn; apex of paleas acute with a subapical setae…..**6. *T. idukkianus***

20a. Culms stout; spikelets contracted; median awn and lateral awns are almost equal in length… **21**

20b. Culms flexous or slender; spikelets loosely arranged; lateral awns shorter than the median awns…. **22**

21a. Spikelets 10–15 mm long; lower glumes 2-nerved and 2-lobed; lemma lobes acute to acuminate; paleas notched at apex… **8. *T. karnatakensis***

21b. Spikelets 10–25 mm long; lower glume 1-nerved; lemma lobes lanceolate to acuminate; palea 2-lobed… **18. *T. ravianus***

22a. Leaf blades filiform, densely pilose; racemes with closely imbricate spikelets; central awns flexuous, at mostly reflexed…..**5. *T. filiformis***

22b. Leaf blades convolute, sparsely pilose; racemes with widely spaced spikelets; central awns all strongly and stiffly reflexed…… **10. *T. longearistatus***

23a. Upper glumes 7–9 mm long, notched at apex with small awn between; keels of palea ciliate; stamens 1.3–2 mm long…. **24. *T. zeylanicus***

23b. Upper glumes up to 3 mm long, acute at apex, deeply 2-lobed with arista 0.5 mm long; keels of palea not ciliate; stamens upto 0.8 mm long….**2. *T. borii***

1. Tripogon bimucronatus Thoiba & Sunil in Gard. Bull. Singapore 67(1): 151. 2015.

Type:— India, Kerala, Palakkad Dist.: Nelliyampathy Hill Top, 1200 m, 16 Nov 2010, *C.N. Sunil 4477* (Holotype: SING, Isotypes: BRIT, CAL!, CALI!, K). **Figs. 122–124, 128**

Tufted perennial herb. ***Culms*** 30–60 cm tall, erect; nodes glabrous. ***Leaf blades*** 30–60 × 0.4–0.6 cm, linear, hispid towards base, apex acute-acuminate, scabrid adaxially, margins involute. ***Leaf sheaths*** closely involute to the culm, almost rigid, sparsely hairy; ***ligules*** a fringe of hairs 2–2.5 mm long. ***Racemes*** 30–40 cm long, spikelets arranged along both sides, 45–65 spikelet per raceme; peduncle glabrous, terete, 10–15 cm long; rachis stout, minutely scaberulous, triangular. ***Spikelets*** linear-lanceolate, 1.3–1.8 × 0.2–0.25 cm, 6–8-flowered; *callus* bearded. ***Rachilla*** not persistent, 1–2 mm long, slightly scabrid. ***Lower glumes*** 3–3.5 × *c.* 1mm, lanceolate, asymmetrical, notched on one-side below the middle, chartaceous, 1-nerved, apex acuminate. ***Upper glumes*** 5–6 × *c.* 1 mm, elliptic-lanceolate, prominentely 3-nerved, glabrous, apex mucronate or shortly awned; awns 0.5–1 mm long. ***Lemmas*** 5–5.5 × 1.5–2 mm (excluding awn), 3-nerved, 1-awned, the awn arising between lateral lobes, median awn 5–5.5 mm long, scabrid, straight or geniculate, lateral awns absent. ***Paleas*** 4–5 × 1–2 mm, hyaline, narrowly elliptic, keeled and winged, keels minutely puberulous, apex bimucronate, notched at the centre. ***Lodicules*** 2*, c.* 0.25 mm long, quadrate, apex coarsely 3-toothed. ***Stamens*** 3, anthers 1–1.5 mm long, oblong, filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** 0.25–0.5 mm long, obovate; style 2, slender, hyaline, 1mm long; stigma feathery, 1–1.5 mm long. ***Caryopses*** 1.1–1.3 × 0.4–0.5 mm, narrowly oblong-lanceolate, obtusely trigonous, pale brown, obtuse at apex, longitudinally ribbed abaxially.

Flowering & Fruiting:—September–November.

Habitat & Ecology:—It usually grows in the granitic grassy slopes of Nelliyampathy hills at an elevation between 1000–1200 m. It is found growing in association with

Fig. 122. ***Tripogon bimucronatus*** Thoiba & Sunil: **A.** Habit; **B.** Spikelet; **C.** Lower glume;Ligule; **D.** Upper glume; **E.** Palea; **F.** Lemma; **G.** Stamens & Pistil; **H.** Caryopsis.

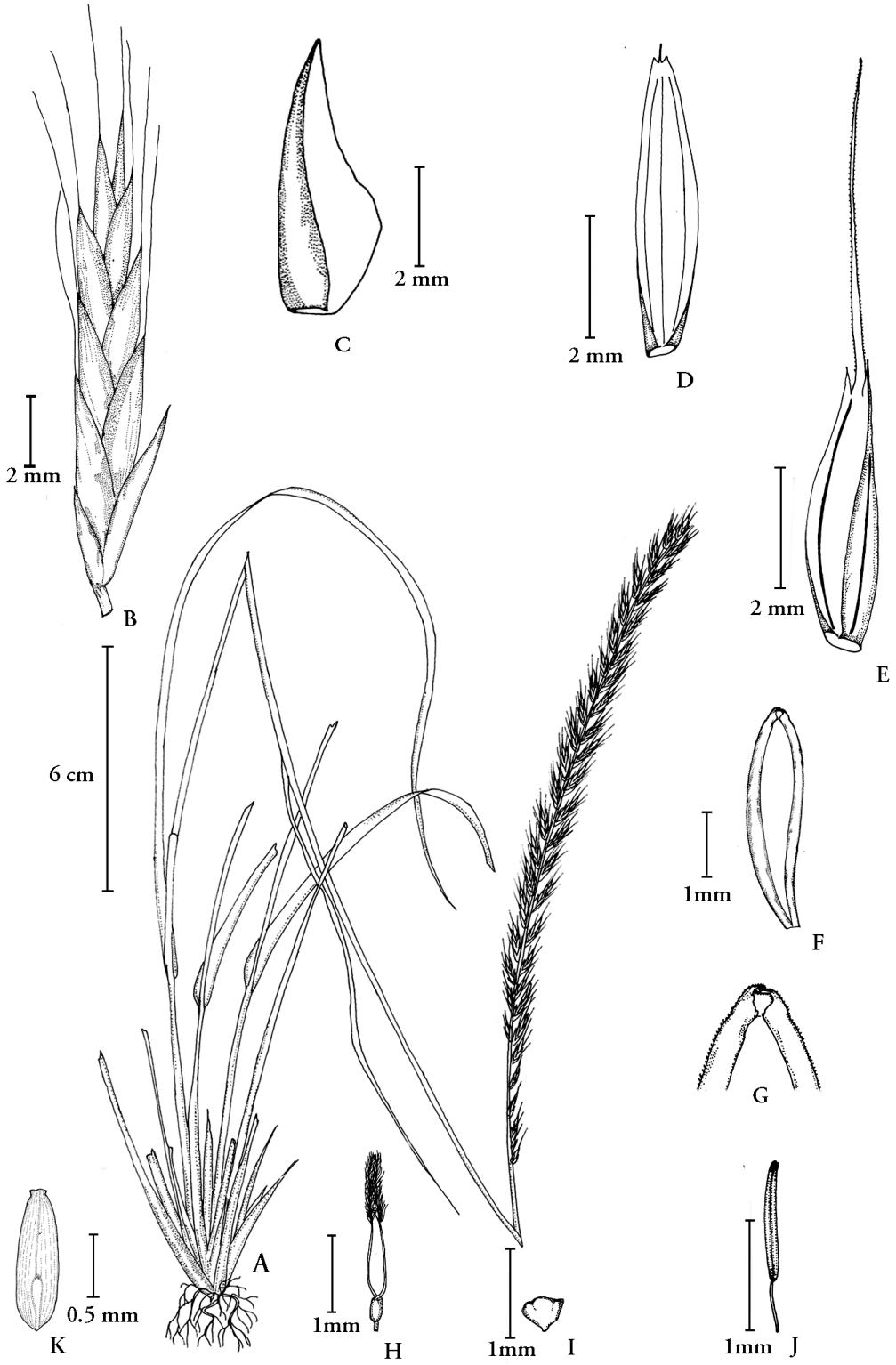


Fig. 123. ***Tripogon bimucronatus*** Thoiba & Sunil: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Enlarged portion of palea apex; Stamen & **H.** Pistil; **I.** Lodicule; **J.** Stamen; **K.** Caryopsis.

Arthraxon castratus Griff., *Cyanotis papilionacea* (Burm.f.) Schult. & Schult.f., *Chrysopogon nodulibarbis* (Hochst. *ex* Steud.) Henrard., *Cymbopogon commutatus* (Steud.) Stapf, *Eulalia trispicata* (Schult.) Henrard., *Garnotia elata* (Arn. *ex* Miq.) Janowsky., *Isachne bourneorum* C.E.C. Fisch., *Osbeckia* spp., *Sopubia trifidus* Buch.-Ham. *ex* D. Don, *Swertia angustifolia* Buch.- Ham. *ex* D. Don., *Tephrosia pulchella* Hook.f., *Tripogon wightii* Hook.f.

Fig. 124. Isotype of *Tripogon bimucronatus* Thoiba & Sunil [*C.N. Sunil 4477*] © University of Calicut, Kerala, India.

Distribution:—*Tripogon bimucronatus* currently known from two localities, Nelliyampathy Hills in Palakkad District and Meenuliyanpara in Idukki District of Kerala. It grows along granitic grassy slopes at an elevation between 1000–1200 m.

Specimens examined:—India, **Kerala,** Idukki Dist.: Meenuliyan Para, Vannappuram, 28 Nov. 2014, *Sunil 4910* (SNM College Herbarium, Kerala); *Ibid.*, 20 Dec. 2016, *Dani Francis s.n.* (CALI). Palakkad Dist.: Nelliyampathy Hill Top, 1200 m, 16 Nov 2010, *C.N. Sunil 4477* (CALI).

Notes:—*Tripogon bimucronatus* is similar to *T. malabaricus, T. vellarianus* and *T. lisboae* but differs from them in having adaxially scabrid, linear-acuminate leaves; ligules

a fringe of hairs to 2.5 mm long; spikelets with 6–8 closely packed florets; lower glume asymmetrical; upper glumes awned; lemma awn scabrid; palea elliptic-lanceolate with its apex bimucronate at the centre.

2. Tripogon borii Kabeer, V.J. Nair & G.V.S. Murthy in Bull. Bot. Surv. India 50(1–4): 115. 2009. **Type:—**India, Tamil Nadu, Kanyakumari Dist.: Nagerkoil, Marunthwamalai, ± 360 m, 30. 11. 2005, *K. Althaf Ahamed Kabeer 118632* (Holotype: CAL, Isotype: MH!). **Figs. 125–128**

Plants caespitose perennials. ***Culms*** terete, upto 60 cm high; 2–3-noded, nodes glabrous, slightly geniculate and 1-noded. ***Leaf blades*** 25–47 × 0.2–0.4 mm, linear, flat-inrolled, nerves prominent, adaxially glabrous to sparsely long hairy, abaxially finely scabrellate along ribs, attenuate at apex. ***Leaf sheaths*** 5–10 cm long, linear, glabrous or hairy, apex densely ciliate; ***ligules*** membranous, fimbriate rim with a tuft of 1–2.5 mm long hairs at both ends. ***Racemes*** terminal, 15–28 cm long, straight to curved; peduncle terete, 5–14 cm long, glabrous; spikelets arranged compactly on raceme, creamy yellow; rachis stout, glabrous, ribbed. ***Spikelets*** ovate-lanceolate, 10–16 × 0.1–0.2 mm long, linear, 6–14-flowered; callus bearded, hairs 0.5–1 mm long. ***Lower glumes*** 1.8–2.3 × 0.5–0.8 mm, oblong, deeply lobed below middle along one side, lobes acute to acuminate, 1-keeled, 1-nerved, keels slightly scabrid, with acute and mucronulate at apex. ***Upper glumes*** 2.3–4 × *c.* 0.8 mm, elliptic-oblong, 1-keeled, 1-nerved, apex bi-lobed, aristate, arista 0.5–2 mm long at sinus. ***Lemmas*** 2.8–4 × 0.8–1 mm (excluding awn), oblong-lanceolate, 6-lobed, 3-nerved, 3-awned, median awns 2.5–3.5 mm long, lobes on either side of central awns acute to acuminate, 0.4–1 mm long, lateral awns 1.5–2.5 mm long, lateral lobes on either side of the lateral awns conspicuous; slightly keeled. ***Paleas*** 2.3–2.8 × 0.8–1 mm, oblong-elliptic, hyaline, 2-nerved, 2-keeled, keels ciliate, subacute at apex. ***Rachilla*** upto 0.7 mm long, oblique at apex. ***Lodicules*** 2, *c.* 0.3–0.5 mm long, truncate. ***Stamens*** 3; anthers 0.7–1 mm long, oblong, purple tinged

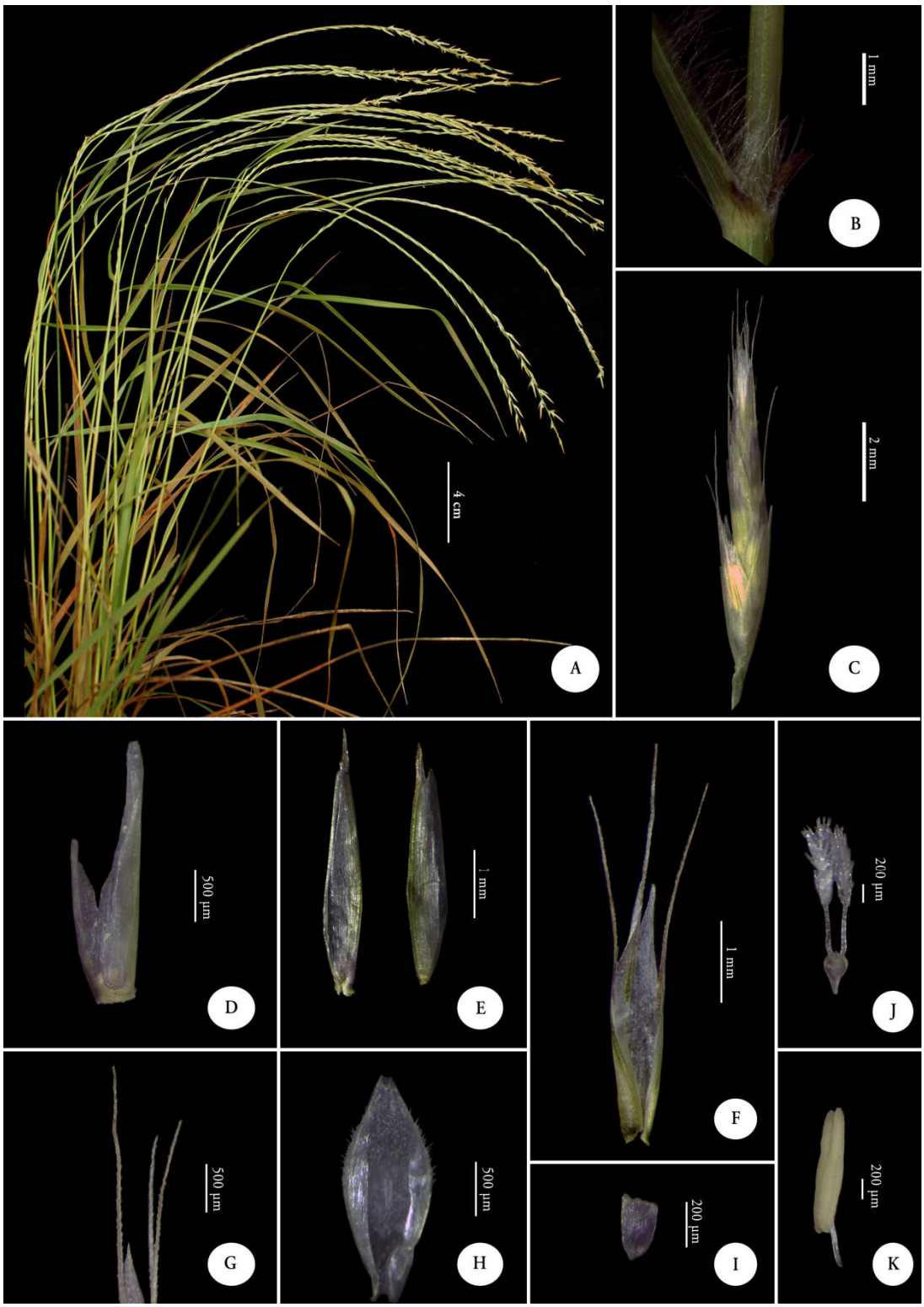


Fig. 125. ***Tripogon borii*** Kabeer, V.J. Nair & G.V.S. Murthy: **A.** Habit; **B.** Ligule; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Lemma; **G.** Lemma apex; **H.** Palea; **I.** Lodicule; **J.** Pistil; **K.** Stamen.

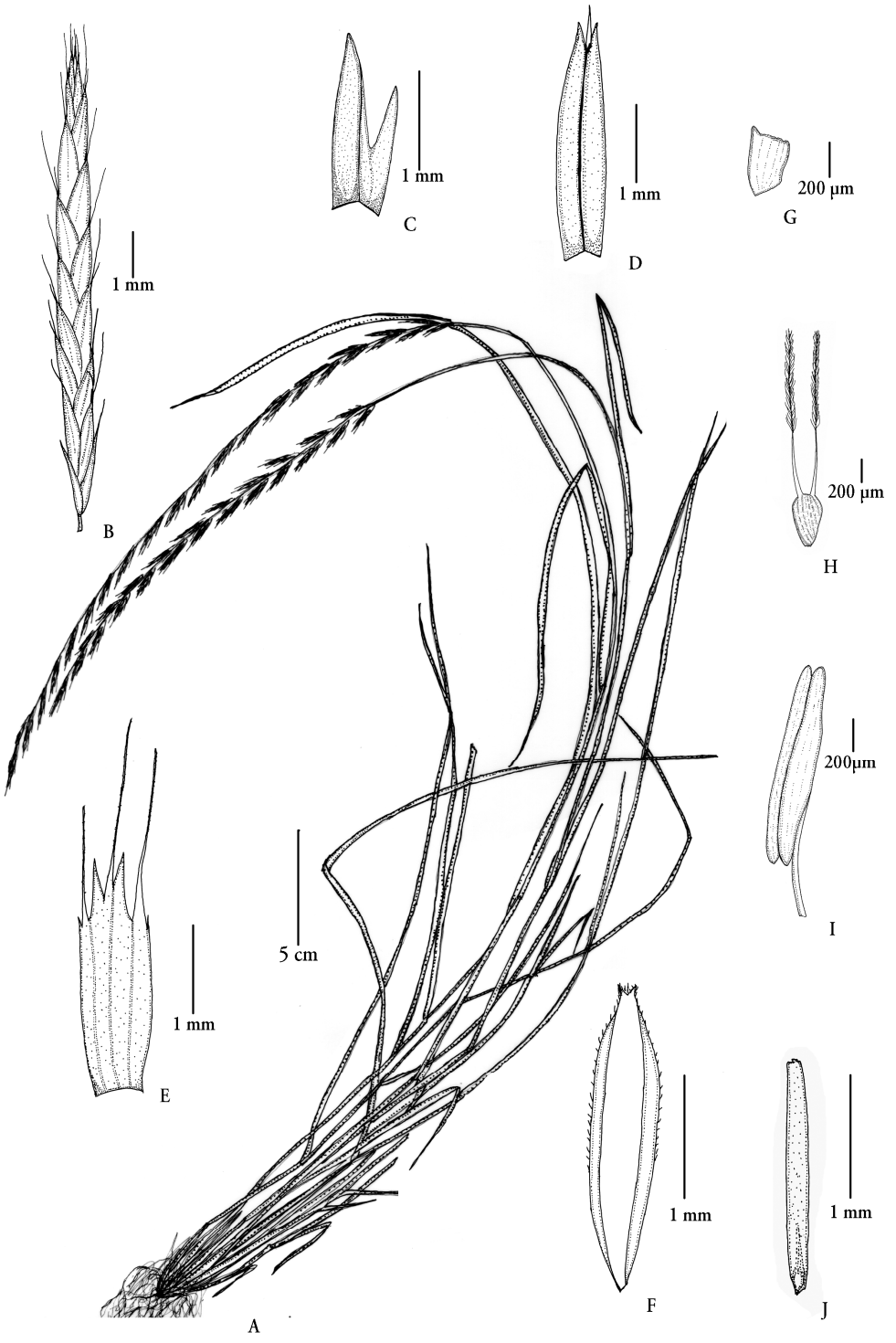


Fig. 126. ***Tripogon borii*** Kabeer, V.J. Nair & G.V.S. Murthy: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicule; **H.** Pistil; **I** Stamen; **J.** Caryopsis.

at fresh; filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** 0.3–0.4 mm, oblong-elliptic, styles 2, slender, hyaline, 1–1.2 mm long; stigma 0.7–1 mm long, plumose, creamy white. ***Caryopses*** narrowly oblong-lanceolate, 1.5–1.8 × 0.2–0.3 mm, light brown.

Fig. 127. Isotype of *Tripogon borii* Kabeer, V.J. Nair & G.V.S. Murthy [*K. Althaf Ahamed Kabeer 118632* (MH00003227)] © Botanical Survey of India, Coimbatore.

Flowering & Fruiting:—September–Early December.

Habitat & Ecology:—This species prefers to grow in rock crevices and bare rocks at high elevation grasslands in association with *Anisochilus carnosus* (L. f.) Wall. *ex* Benth., *Arundinella pumila* (Hochst. *ex* A. Rich.) Steud., *Cyanotis cristata* (L.) D. Don, *Cymbopogon citratus* (DC.) Stapf, *Didymocarpus incanus* Benth. & Hook.f. *ex* C.B. Clarke, *Eragrostiella bifaria* (Vahl) Bor, *Justicia* sp., *Leucas nepetifolia* Benth. and *Tripogon bromoides* Roth *ex* Roem. & Schult.

Distribution:—Endemic to Tamil Nadu, South India.

Specimens examined:—India, **Tamil Nadu,** Coimbatore Dist.: Velliangiri Hills, 30 Sept. 2016, *A.K. Pradeep*, *Nikhil Krishna* & *Thoiba K. 146727*; *Ibid.*, 30 Sept. 2016, *A.K. Pradeep*, *Nikhil Krishna* & *Thoiba K. 146728, 146729* (CALI). Kanyakumari Dist.: Marunthwamalai, 30 Nov. 2005, *K. Althaf Ahamed Kabeer 118632* (MH); *Ibid.*, 09 Aug. 2014, *Thoiba K. 138094*; *Ibid.*, 30 Oct. 2015, *Thoiba K.* & *M. Yoonus*

T. 146650, *146658*, *146660*, *146662*, *146665* (CALI); Nagercoil, Mambazhathuraiyar Reservoir, 29 Oct. 2015, *Thoiba K.* & *M. Yoonus T. 146648* (CALI).

Notes:—Closely similar to *Tripogon zeylanicus* and *T. bromoides*, but differs from them in having narrowly linear creamy yellow spikeltes with upto 14-florets; lower glumes deeply lobed below the middle, mucronulate at apex; upper glumes aristate; lemma upto 5 mm long.

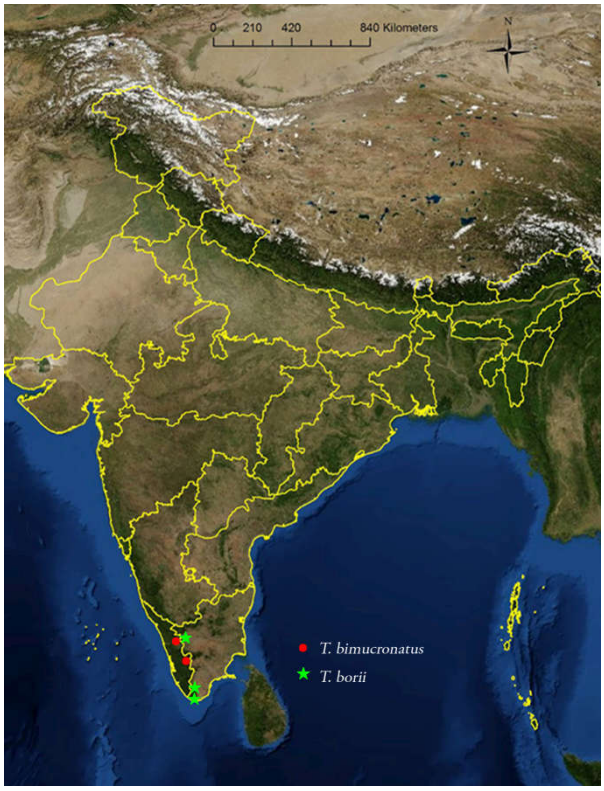


Fig. 128. Distribution of *Tripogon bimucronatus* Thoiba & Sunil (●) and *T. borii* Kabeer, V.J. Nair & G.V.S. Murthy (★)

3. Tripogon bromoides Roth *ex* Roem. & Schult., Syst. Veg. 2: 600. 1817; Hook.f. Fl. Brit. India 7: 287. 1896; C.E.C Fisch. in Gamble, Fl. Madras 3: 1834. 1934; Bor, Grass. Burma Ceylon India Pakistan 521. 1960; Britto & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 3(2): 1911. 1983; Karth., S.K. Jain, M.P. Nair & Sanjappa, Fl. Ind. Enum. Monocot. 622. 1989; P.V. Sreek. & V.J. Nair, Fl. Kerala-Grasses 399. 1991; M.D. Dassanayake, F.R. Fosberg & W.D. Clayton, Revis. Handb. Fl. Ceylon 8: 443. 1994; S. Moulik, Grass. Bam. India 2: 622. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1268. 1997; Sasidh., Biodiv. Doc. Kerala–Fl. Pl. 595. 2004; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 179. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 557. 2012. *Avena mysorensis* Spreng. Syst. Veg. 1, 337. 1825. **Holotype:**—India, Mysore, 1814, *Heyne, B. s.n.* (B10367364, image!). **Figs. 129–131, 135**

Notes:—Bor (1960) considererd *T. bromoides* as an "extremely variable grass" and the recognition of varieties under this taxon are "hardly worthkeeping". However, the present study based on large number of specimens from its range of distribution reveal, two of its varieties are worth keeping.

Key to the varieties

3a. Culms 30–68 cm high; leaves villous on both sides; racemes 10–30 cm long; upper glumes shortly aristate or awned, awns 0.3–0.5 mm long…….....
.....**3a. *T. bromoides* var. *bromoides***

3b. Culms 05–30 cm high; leaves sparsely villous adaxially and glabrous abaxially; racemes 05–10 cm long, upper glumes prominently awned, awns 1–2 mm long…….....**3b. *T. bromoides* var. *longifolius***

3a. T. bromoides var. bromoides

Caespitose perennials. ***Culms*** erect. 30–70 cm high; nodes glabrous, slightly geniculate and 1-noded. ***Leaf blades*** 15–50 × 0.3–0.5 mm, linear-lanceolate, acuminate to attenuate at apex, flat-convolute, more hairy towards collar, hairy along both sides of the blades. ***Leaf sheaths*** 04–10 cm long, linear, glabrous or hairy; ***ligules*** indistinct with a tuft of 1–2 mm long hairs at both ends. ***Racemes*** terminal, 10–30 cm long; peduncle 10–25 cm, glabrous; spikelets arranged alternately on both sides of the raceme, olive green or yellowish with purple tinge; ***rachis*** stout, glabrous or scabrid, 3–7 mm long; ***Spikelets*** 7–10 × 2–2.8 mm long, linear, distant, dorsiventrally flattened, 5–16-flowered; callus bearded, hairs 1–1.2 mm long. ***Lower glumes*** 1.6–3.5 × 0.75–1.2 mm, notched on oneside, ovate-lanceolate, 1-keeled, 1-nerved, keels slightly scabrid, with acuminate apex. ***Upper glumes*** 2.4–5.8 × 0.5–1 mm, elliptic-lanceolate, 1-keeled, 1-nerved, apex dentate, shortly awned, awns 0.3–0.8 mm long at sinus. ***Lemmas*** 02–4.4 × 1–2 mm (excluding awns), ovate-lanceolate, 4-lobed, lateral lobes and lateral awns are almost equal length or sometimes reduced, 3-nerved, slightly keeled, and 3-awned;

awns scabrid, apex straight or geniculate, median awns 1.5–3.6 mm long, lateral awns 0.5–2.3 mm long; lateral lobes 0.3–1 mm long, margins scabrid. ***Paleas*** 2–4 × 0.5–1.2 mm, elliptic-oblanceolate, hyaline, 2-keeled, ciliate above the half, purple dotted emarginate or 2-lobed with a minute central notch at the apex. ***Rachilla*** 1–1.2 mm long, glabrous to scabrid, almost straight, not persistent. ***Lodicules*** 2, c. 0.3–0.4 mm long, truncate. ***Stamens*** 3; anthers 1–1.2 mm long, oblong; filaments 0.4–0.75 mm long, slender, glabrous. ***Ovary*** 0.3–0.5 mm, obovate, styles 2, slender, hyaline, 0.5–0.75 mm long; stigma 0.75–1.2 mm long, plumose, creamy white. ***Caryopses*** narrowly oblong-lanceolate, 1–1.6 × 0.3–0.4 mm, dark brown.

Flowering & Fruiting:—Late July–December

Habitat & Ecology:—In grasslands, moist slopes and rock crevices, forest margins and Ghat road sides in medium to high elevations. It grows in association with *Anisochilus carnosus* (L.f.) Wall *ex* Benth., *Arundinella purpurea* Hochst. *ex* Steud., *Chrysopogon nodulibarbis* (Steud.) Henrard, *Cyanotis* sp., *Didymocarpus humboldtiana* Gard., *Eragrostiella bifaria* (Vahl) Bor, *Exacum tetragonum* Roxb., *Impatiens acaulis* Arn., *Justicia procumbens* L., *Leucas biflora* (Vahl) R.Br., *Pogostemon mollis* Benth., *Murdannia semiteres* (Dalz.) Sant., *Sonerila gamblei* Giri & M.P. Nayar, *Tripogon zeylanicus* Thwaites, *T. ravianus* Sunil & Pradeep, *T. sivarajanii* Sunil.

Distribution:—In India (Andhra Pradesh, Bihar, Goa, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Rajasthan, Tamil Nadu, Telangana and Sri Lanka.

Specimens examined:—India, **Andhra Pradesh,** Anantapur Dist.: Batrepalli, 14 Feb. 2009, *B. Raviprasad Rao* & *P. Priyadarsini 37069* (BSID). Nellore Dist.: Rapur Ghat, 09 Oct. 2016, *Thoiba K. 146783* (CALI). **Jammu & Kashmir,** Kathua Dist.: Bhullari, 20 Sept. 1963, *R.S. Rao 91938* (BSI). **Karnataka,** Bangalore Dist.: 10 June 1953, *He. Govinda CoA 200* (CAL); Bommanahalli, way to Tumkur, 29 Sept. 2015, *Thoiba K. 144166*; *Ibid.*, 29 Sept. 2015, *Thoiba K. 144177* (CALI). Chikmagalur Dist.: way to

Fig. 129. ***Tripogon bromoides*** Roth *ex* Roem. & Schult.: **A.** Habit; **B.** Enlarged portion of raceme; **C.** Ligule; **D.** Spikelet; **E.** Glumes; **F.** Lower glume; **G.** Upper glume; **H.** Lemma; **I.** Palea - dorsal & ventral view; **J.** Palea with flower; **K.** Lodicules; **L.** Caryopsis.

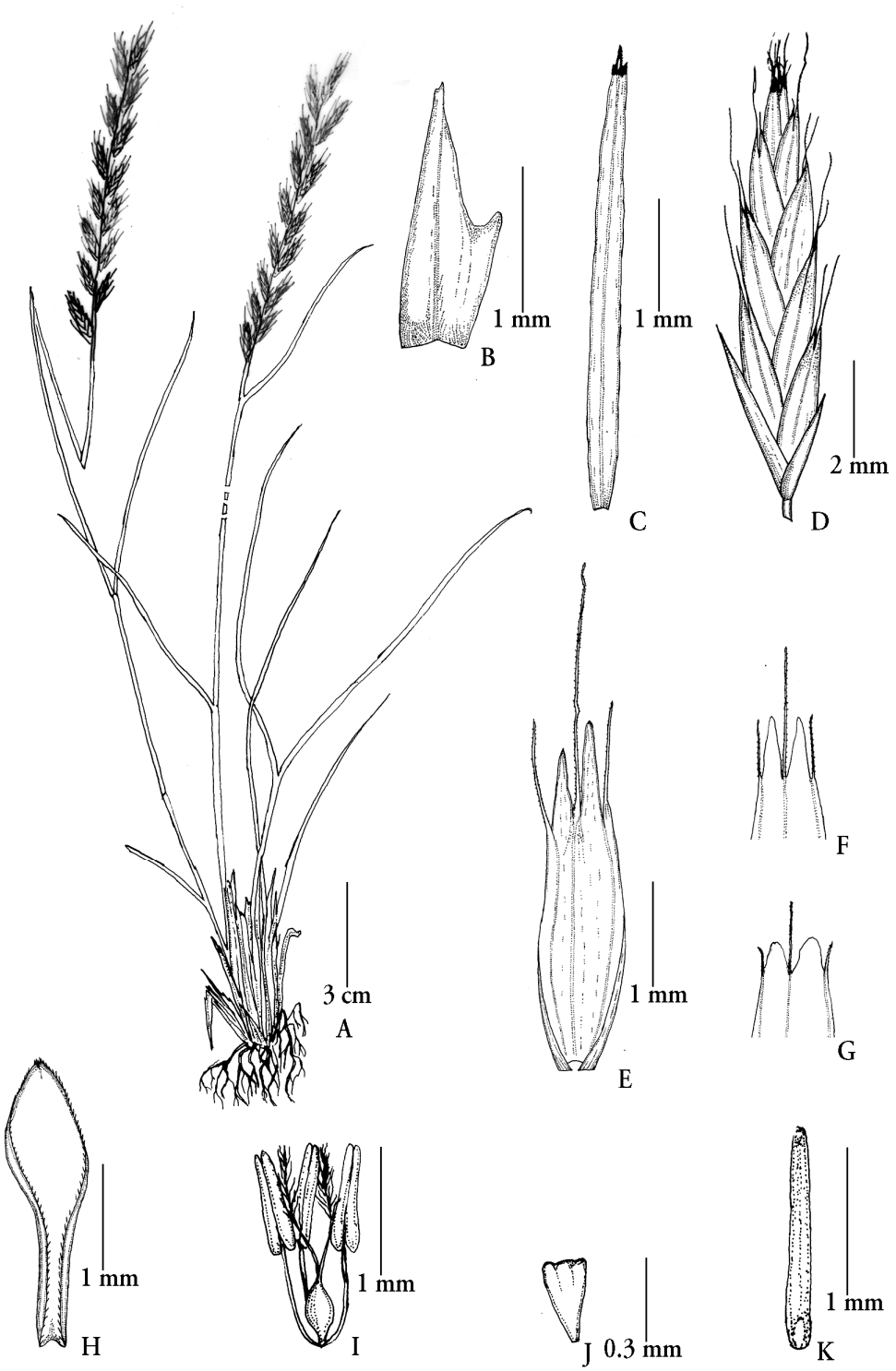


Fig. 130. ***Tripogon bromoides*** Roth *ex* Roem. & Schult.: **A.** Habit; **B.** Lower glume; **C.** Upper glume; **D.** Spikelet; **E.** Lemma; **F. & G.** Lemma apices; **H.** Palea **I.** Stamens & Pistil; **J.** Lodicule; **K.** Caryopsis.

Baba Budan Hills, 13 Sept. 2014, *Thoiba K. 137531a*; *Ibid.*, 13 Sept. 2014, *Thoiba K. 137531b*, *137531c* (CALI). Mysore Dist.: 06 Sept. 1893, *Talbot 3079* (CAL). Chamarajanagar Dist.: Himavad Gopalaswamy Hills, 30 Sept. 2015, *Thoiba K. 144169* (CALI). Kodagu Dist.: Tadiyandamol Hills, 26 Nov. 2014, *Thoiba K. 137555*; *Ibid.*, 26 Nov. 2014, *Thoiba K. 137558* (CALI). Tumkur Dist.: Devarayanadurga, 29 Aug. 1961, *A.R.K. Sashtry 73420* (BSI). **Kerala,** Ernakulam Dist.: Shoolamudi, Variyam, 14 Dec. 2016, *Nikhil Krishna* & *Thoiba K. 146740* (CALI). Idukki Dist.: Lockhart Gap, 12 Oct. 1963, *K.M. Sebastine 17530*; *Ibid.*, 12 Oct. 1963, *K.M. Sebastine 17527* (CAL); Vagamon, way to Pullikanam, 15 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146611* (CALI); Parunthupara, 15 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146618*; *Ibid.*, 15 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146620* (CALI); Kumaly Theni Road, 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146625* (CALI); Thrisangu Hills, Peerumedu, 17 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146637*; *Ibid.*, 17 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146638*, *Thoiba K.* & *A.K. Pradeep 146643* (CALI); Munnar, Mattupetty, 16 Dec. 2014, *A.K. Pradeep* & *Thoiba K. 144104* (CALI); Cheruthoni, Painavu, Thodupuzha-Kattapana Road, 17 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146633* (CALI); Munnar, Pallivasal, 14 Nov. 2014, *Thoiba K.* & *A.K. Pradeep 137565* (CALI); Devikulam, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137588*; *Ibid.*, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137589*; *Ibid.*, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137590*; *Ibid.*, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137591*; *Ibid.*, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep137593*; *Ibid.*, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137595* (CALI); Eravikulam National Park, 23 Aug. 1980, *P.V. Sreekumar 67772*; *Ibid.*, 24 Aug. 1980, *P.V. Sreekumar 67780* (BSID, CALI); Peermedu, 26 Sept. 1964, *K. Vivekananathan 21413* (MH); Poovanpara, 07 Sept. 1997, *S.D. Biju 36186* (TBGT); Mathikettan Shola National Park, 10 Jan. 2016, *Thoiba K. 146719* (CALI); Ramakkalmedu, 23 Oct. 2017, *A.K. Pradeep* & *Thoiba K. 146749* (CALI). Kollam Dist.: Ponnambalamedu, 04 July 1981, *P.V. Sreekumar 69495* (BSID). Kottayam Dist.: Anaimudi slopes, 19 Nov. 1965, *B.V. Shetty 26544*

Fig. 131. Holotype of *Tripogon bromoides* Roth *ex* Roem. & Schult. [*Heyne, B. s.n.* (B10367364)] © The Board Trustees of the Museum Botanicum Berolinense, Berlin, Germany.

(MH). Kozhikode Dist.: Kakkadampoyil, 21 Nov. 2009, *A.K. Pradeep 90074*; *Ibid.*, 19 Oct. 2016, *Drisya V.* & *Thoiba K. 146760* (CALI). Kakkadampoyil, Kozhipara Water fall, 09 Oct. 2013, *Thoiba K. 134471*; *Ibid.*, 09 Oct. 2013, *Thoiba K. 134472*; *Ibid.*, 13 Oct. 2017, *Nikhil Krishna* & *Thoiba K. 146754*; *Ibid.*, 21 Nov. 2009, *A.K. Pradeep 90074* (CALI). Palakkad Dist.: Sispara, 28 March 1983, *N.C. Nair 77216* (CAL, MH); Silent Valley Dam, near Hanging Bridge, 05 Oct. 1979, *N.C. Nair 64270* (CAL); Dhoni R.F., 23 Oct. 1963, *Joseph 17860* (CAL); Malampuzha Dam Site, 11 Dec. 2014, *Thoiba K. 144129* (CALI); Nelliyampathy, Seetharkundu, 17 Sept. 2013, *Thoiba K. 134435*; *Ibid.*, 19 Sept. 2013, *Thoiba K. 134439* (CALI); Nelliyampathy, Kaeshavan Para, 07 Nov. 2013, *Thoiba K.134493*; *Ibid.*, 07 Nov. 2015, *Thoiba K. 146680* (CALI); way to Silent Valley, near Gateway, 18 Sept. 1982, *Sathish Kumar 10754* (CALI); Silent Valley National Park 25 Sept. 2013, *Manudev K.M.* & *Thoiba K. 135106* (CALI); *s.loc.*, 21 April 1983, *Sathish Kumar SV11249* (CALI); Sirendhri, Nilgiri Biosphere Reserve, 03 Oct. 2008, *Remya J.* & *Prasanna 63175* (TBGT); Aruvampara, *s.die.*, *Remya J.* & *Prasanna 74584* (TBGT). Thiruvananthapuram Dist.: Agasthyamala, Pongalapara, 14 Oct. 1988, *N. Mohanan 4300*; *Ibid.*, 14 Oct. 1988, *N. Mohanan 4279* (CALI); *Ibid.*, 15 May 1988, *N. Mohanan 9835*; *Ibid.*, 14 Mar. 1988, *N. Mohanan 9750* (MH); *Ibid.*, 06 Oct. 1973, *J. Joseph 44631* (MH); Athirumala, 04 February 1988, *N. Mohanan 8922* (MH);

Thrissur Dist.: Parambikulam Tiger Reserve, View Point, 24 Sept 2013, *Thoiba K. 134465* (CALI); Earth Dam, 26 Sept. 2013, *Thoiba K. 134462* (CALI); Kariyamchola, 27 Sept. 2013, *Thoiba K. 134449* (CALI); Vengoli Hills, 25 Sept. 2013, *Thoiba K.134453*; *Ibid.*, 25 Sept. 2013, *Thoiba K.134460* (CALI). Wayanad Dist.: Myladi Para, 22 Aug. 2013, *Thoiba K. 134430* (CALI); Pakshipathalam, 09 Oct. 2012, *Remya J.* & *Prasanna 73837*; *Ibid.*, 06 Oct. 2010, *Remya J.* & *Prasanna 65492* (TBGT); Manikunnumala, 20 Aug. 2011, *Remya J.* & *Prasanna 67129* (TBGT); Meenangadi, 15 Sept. 2016, *Janeesha A.P.* & *Thoiba K. 146769* (CALI); Kurichyarmala, 24 Oct. 2000, *Ratheesh Narayanan 2278* (CALI). **Madhya Pradesh,** Jabalpur Dist.: 25 Nov. 1989, *J.F. Duthie 10038* (CAL). **Maharashtra,** Aurangabad Dist.: Ajanta Caves, 30 Sept. 1963, *R.S. Rao 92658* (BSI); Kolhapur Dist.: Radhanagari, 18 Oct. 2007, *K.V.C. Gosavi 2805* (SUK); Zenda, 26 Oct. 2004, *Aparna Watve A0476* (AHMA). Pune Dist.: Khandala, 07 Oct. 1956, *R. Fernandez 3001*(BLAT); Purandhar Vazirgarh Fort, 08 Oct. 1950, *H. Santapau 11362* (BLAT); Sinhagad, 1956, *s.coll. 7819*; *Ibid.*, 21 Oct. 1964, *M.Y. Ansari 101702*, *M.Y. Ansari 101676* (BSI); Chirka Farm, 30 Sept. 1902, *s.coll. s.n.* (BSI); Chatarshingi Hill, 02 Nov. 1904, *G.A. Gammie s.n.* (BSI); Katraj Ghat, 30 Sept. 1903, *G.A. Gammie s.n.*; *Ibid.*, 06 Oct. 1957, *G.S. Puri* & *Bheodi 25604* (BSI); Shivneri Fort, 10 Oct. 1962, *R.S. Rao 83517* (BSI); Ramling, 04 Jan. 1958, *S.K. Jain 30922* (BSI); Raigad Dist.: Matheran-Neral Road, Samson Tank, 17 Aug. 1963, *B.M. Wadhwa 67386* (BSI); Junnar, On the way to Kukadi River, 14 Oct. 1962, *M.Y. Ansari 81945* (BSI); Sindhudurg Dist.: Amboli, Savantwadi, 30 Sept. 1978, *S.M. Almedia SMA 1953* (BLAT); Bhuibavada Ghat, 07 Oct. 2007, *K.V.C. Gosavi 2791* (SUK); Amboli Ghat, 27 Nov. 2006, *K.V.C. Gosavi 274* (SUK). **Odisha,** Koraput Dist.: Pottangi, 25 Aug. 2013, *Alok Chorghe 10235* (BSID). **Rajasthan,** Julelia Mala Block, Mount Alice, 24 Oct. 1960, *B.C. Nanda 2091* (CAL). Chittorgarh Dist.: Sunna, 21 Aug. 1959, *S.K. Jain 58709* (BSI). Pali Dist.: Bheru Ghat, 15 Sept. 1957, *G.S. Puri 26566* (BSI). **Tamil Nadu,** Coimbatore Dist.: Anamalai Tiger Reserve, Nallamudi, Poonjolai, 13 Dec. 2013, *Thoiba K. 138016* (CALI); Malakkapara,

Shaekalmudi, Mudiyankunnu, 12 Dec. 2013, *Thoiba K. 138026* (CALI); Velliangiri hills, 13 Jan. 2016, *A.K. Pradeep 146718* (CALI). Dindigul Dist.: Kodaikanal, Pulney Hills, 02 July 1898, *Bourne 1973*; *Ibid.*, 04 July 1901, *Bourne 2100*, *2111* (CAL); Silver Cascade, 26 May 1898, *Bourne 3140* (CAL); Tandigudi-Lower Pulneys, 24 May 1899, *Bourne 3150* (CAL); Kodaikanal, Vadakavuchi, 14 Aug. 1967, *K.M. Matthew* & *K.T. Mathew 90188*; *Ibid.*, 27 Sept. 1956, *J. Pallithanam 2489* (RHT); Shembaganur, Periakulam Path, 15 May 1982, *K.M. Matthew 18067* (RHT); Berijam Slopes, 09 Aug. 1984, *K.M. Matthew 40784* (RHT); Palani Hills, Perumal Peak, 10 June 1986, *K.M. Matthew 45618* (RHT); Shembaganur, Kodai Levinge Path, 09 July 1986, *K.M. Matthew* & *N. Rajendren 45772* (RHT); Gundur-Vembadi slopes, 27 July 1982, *K.M. Matthew* & *M. Charles 45903*; *Ibid.*, 04 July 1987, *K.M. Matthew 49837*(RHT); Kukkal, 24 Aug. 1986*, K.M. Matthew, M. Charles* & *N. Rajendren 46597*(RHT); Combal's Cave, 15 June 1986, *Fieldman 49768* (RHT); Palani Ghat Road, Kombaikadu, Melpallam, *s.die.*, *K.M. Matthew* & *N. Rajendren 50325* (RHT); Gundar Pumbarai road, 04 Nov. 1987, *K.M. Matthew* & *K.T. Mathew 51083* (RHT); Konalar, 05 Nov. 1987, *K.M. Matthew* & *K.T. Mathew 51121* (RHT); Vandaravu-Marion Shola Levinge Path, 18 Dec. 1989, *K.M. Matthew* & *K.T. Mathew 54054* (RHT); Kodaikanal, Foot of Fire Tower, 15 June 1990, *K.T. Mathew 54304* (RHT); Periakulam Path, Joining Bridle Path, 15 June 1990*, K.M. Matthew* & *K.T. Mathew 54358* (RHT); Kodai-Berijam Road, before Fire Tower, 07 Sept. 1991, *K.T. Mathew 54549* (RHT); Kodai to Kukkal, 07 July 1920, *s.coll. 16522* (MH); Upper Palnis, 15 Sept. 1911, *Fisher 2998* (FRC). Madurai Dist.: Hospital Valley, *s.die.*, *V. Lakshmanan 87692* (BSID); Kuthanatchi R.F., 25 May 1989, *V. Lakshmanan 87692* (BSID). Nilgiri Dist.: *s.loc.*, September 1883, *J. S. Gamble 12477* (CAL); *s.loc.*, 30 Aug. 1983, *K.N. Subramanian 9538* (FRC); Upper Bhavani, *s.die.*, *Remya J.* & *Prasanna 73762* (TBGT); Doddabetta–Kotagiri Way, *s.die.*, *Remya J.* & *Prasanna 73808* (TBGT); Ootty, 22 Oct. 2015, *A.K. Pradeep 86960* (CALI). **Telangana,** Mehbubnagar Dist.: *s.loc.*, 05 Nov. 2008, *B. Raviprasad Rao* & *B. Sadasivaiah s.n.* (BSID).

3b. Tripogon bromoides Roth *ex* Roem. et Schult. var. **longifolius** Hook.f., Fl. Brit. India 7: 287. 1896. *Tripogon festucoides* Jaub. & Spach. Ill. Fl. Orient. 4, 49, t.333. 1851. **Type:—**India, Nelligherry, *G. Perrottet 1260* (K000907444, image !). **Figs. 132–134, 135**

Tripogon lanatus Hochst. *ex* Steud., Syn. Pl. Glum. 1, 301. 1854. Type:—India, montibus Niligiri, 1851, *R.F. Hohenacker 922* (P00740185, image !).

Caespitose perennials. ***Culms*** erect, 05–30 cm high; nodes glabrous, slightly geniculate and 1 or 2 noded. ***Leaf blades*** 03–14 × 0.15–0.2 cm, linear-lanceolate, acuminate at apex, flat-convolute, scabridulous, sparsely villous adaxially and glabrous abaxially; margins entire. ***Leaf sheaths*** 1–4 cm long, linear, fibrous, glabrous; ***ligules*** membranous with a tuft of 1–2 mm long villous hairs more at both ends. ***Racemes*** terminal, 05–10 cm long; peduncle 05–10 cm, glabrous; 10–15 spikelets on each racemes, spikelets arranged alternately on both sides of the raceme and leaden green coloured; ***rachis*** stout, triquetous, glabrous or scabrid; 2.5–3.5 mm long, scabridulous; ***Spikelets*** 4.8–12 × 2.5–3 mm long, ovate-lanceolate, distant, dorsiventrally flattened, 4–10-flowered; callus bearded, hairs 1–1.8 mm long. ***Lower glumes*** 3.3–04 × 0.5–0.75 mm, elliptic-lanceolate notched on onside, about 2–2.5 mm long from base, 1-keeled, 1-veined, coriaceous with acuminate apex. ***Upper glumes*** 2.9–05 × 0.5–0.75 mm, elliptic-lanceolate, coriaceous, 1-keeled, 1-veined, 1-awned, awn continous with apex, awns scabridulose, 1–2 mm long at sinus. ***Lemmas*** 3–4 × 1–1.5 mm, oblong-lanceolate, 4-lobed, 3-nerved, slightly keeled, 3-awned, straight, scabrid, median awns 3–4.2 mm long, lateral awns 2.5–3 mm long; lateral lobes 0.5–1 mm long, acute-acuminate, hyaline. ***Paleas*** 3–3.8 × 0.75–1 mm, elliptic-oblanceolate, hyaline, 2-keeled, ciliate above the half, coriaceous, acute or 2-lobed with a minute central notch at the apex. ***Rachilla*** 0.75–1.2 mm long, glabrous to scabrid, almost straight, not persistent.

Fig. 132. ***Tripogon bromoides*** Roth *ex* Roem. et Schult. var. ***longifolius*** Hook.f.: **A.** Habit; **B.** Ligule; **C.** Spikelet; **D.** Glumes; **E.** Lower glume; **F.** Lemma; **G.** Palea; **H.** Lodicule; **I.** Stamens & pistil; **J.** Caryopsis.

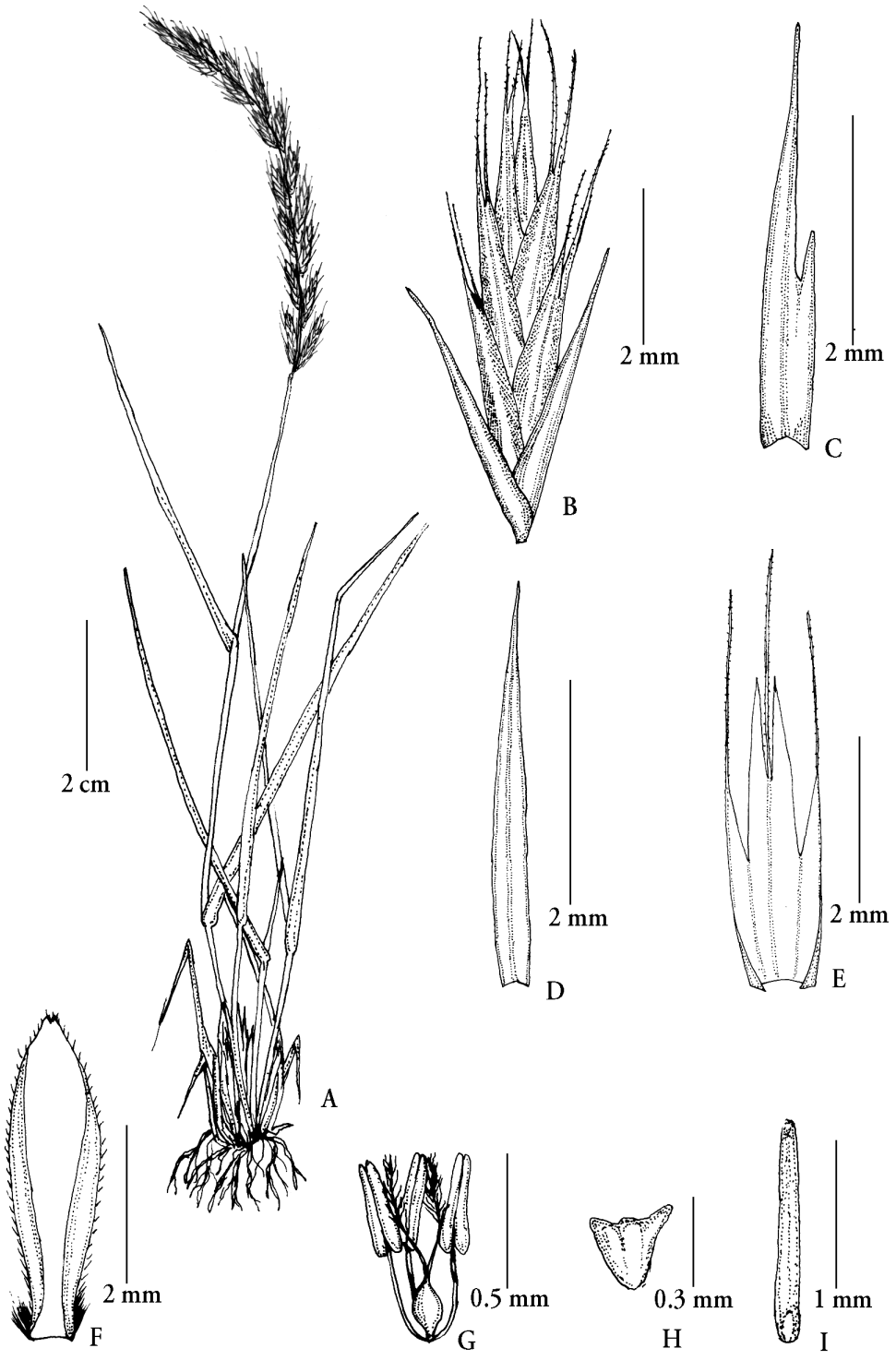


Fig. 133. ***Tripogon bromoides*** Roth *ex* Roem. et Schult. var. ***longifolius*** Hook.f.: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamens & pistil; **H.** Lodicule; **I.** Caryopsis.

Lodicules 2, *c.* 0.3–0.4 mm long, 3-toothed. ***Stamens*** 3; anthers 1–1.2 mm long, oblong; filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** 0.3–0.5 mm long, obovate, styles 2, slender, hyaline, 0.5–0.75 mm long; stigma 1–2 mm long, plumose, creamy white. ***Caryopses*** narrowly oblong-elliptic, 1.2–1.8 × 0.2–0.4 mm, dark brown.

Fig. 134. Type specimen of *Tripogon bromoides* var. *longifolius* Hook.f. [*G. Perrottet 1260* (K000907444)] © The Board Trustees of the Royal Botanic Gardens, Kew.

Flowering & Fruiting:—Late August–December.

Habitat & Ecology:—In grasslands, soil pockets and granitic rock crevices, Ghat road sides at high elevations. It grows in association with *Arundinella mesophylla* Nees *ex* Steud., *Chrysopogon nodulibarbis* (Steud.) Henrard, *Didymocarpus humboldtiana* Gard., *Drosera indica* L., *Exacum wightianum* Arn., *Impatiens acaulis* Arn., *Leucas ciliata* Benth *ex* Wall., *Sonerila rheedei* Wight & Arn.

Distribution:—India (Andhra Pradesh, Bihar, Goa, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Rajasthan, Tamil Nadu, Telangana) and Sri Lanka.

Specimens examined:—India, **Karnataka,** Bagalkot Dist.: Badami Fort, Sept. 1909, *R.U. Shidi s.n.* (BLAT). Chikmagalur Dist.: Bababudan Hills, 18 Oct. 1974, *R.S. Raghavan 132420* (BSI); Baba Budan Hills, 13 Sept. 2014, *Thoiba K. 137525* (CALI); Kavikal Gandi Hills, 13 Sept. 2014, *Thoiba K. 137503* (CALI); way to Mullayangiri

Hills, 13 Sept. 2014, *Thoiba K. 137516a*; *Ibid.*, 13 Sept. 2014, *Thoiba K. 137516b*, *137516c*, *137516d* (CALI). **Kerala,** Idukki Dist.: Anamudi slopes, 19 Nov. 1965, *B.V. Shetty 26544* (CAL); Devikulam, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137591* (CALI); Parunthpara, 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146616*; *Ibid.*, 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146619* (CALI); Peerumedu, 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146631* (CALI). Kozhikode Dist.: Vattappara, below Vellarimala, 15 Dec. 1998, *A.K. Pradeep 56232*; *Ibid.*, 15 Dec. 1998, *A.K. Pradeep 56423* (CALI). Thiruvananthapuram Dist.: Agasthyamala, near Agasthyarkoodam, 13 May 2018, *Nikhil Krishna, Manudev* & *Thoiba K. 146797* (CALI); *Ibid.*, 14 Oct. 1988, *N. Mohanan 4279, 4300* (TBGT); Pongalapara, 28 Aug. 1990, *N. Mohanan 10050* (TBGT). Wayanad Dist.: Chambra Hills, 22 Aug. 2013, *Thoiba K. 134431* (CALI!). **Maharashtra,** Kolhapur Dist.: Vishalgad, 26 Sept. 2008, *K.V.C. Gosavi 2915* (SUK); Gaganbawada, 03 Oct. 1989, *Salunkae C.B. 7409* (SUK); Halkarni College, 08 July 2001, *s.coll.*, *s.n.* (SUK). Pune Dist.: Purandar Fort, 07 Sept. 1907, *R.K. Bhide 2071183* (BSI); Raireshwar, 08 Nov. 1958, *V.D. Vartak 14633* (BSI). Ratnagiri Dist.: Durgawadi, 24 Sept. 2004, *Aparna Watve A0412* (AHMA). Satara Dist.: Mahavashi, 10 Sept. 2005, *Aparna Watve A0622* (AHMA); Kas, 09 Aug. 2004, *Aparna Watve A0211* (AHMA); Kas Plateau, 19 Sept. 2009, *M.M. Lekhak 238* (SUK). Yavatmal Dist.: Junnar, Ralegaon Hill Range, 23 Sept. 1965, *K. Hemadri 107267* (BSI). **Tamil Nadu,** Coimbatore Dist.: Valparai, 28 July 1978, *M. Chandrabose 57709* (CAL). Dindigul Dist.: Kodaikanal, 16 Sept. 1956, *J. Pallithanam 2210* (RHT); Shembaganur, *s.die.*, *K.M. Matthew 741*; *Ibid.*, 01 June

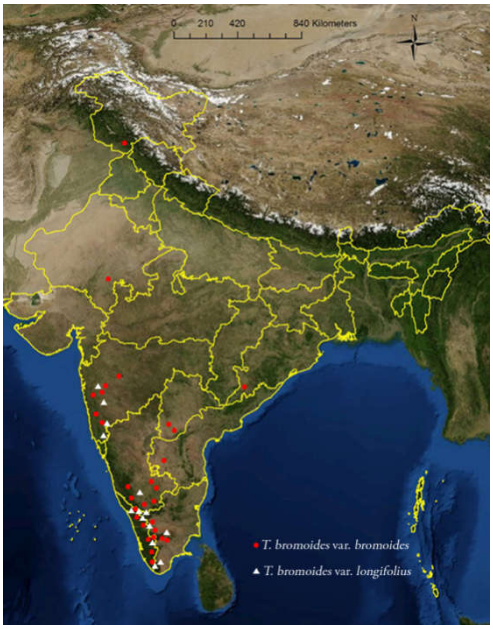


Fig. 135. Distribution of *Tripogon bromoides* Roth *ex* Roem. & Schult. (●) and *T. bromoides* var. *longifolius* Hook.f. (△)

1984, *K.M. Matthew* & *S.J. Britto 40231*(RHT); Silver Cascade Top, 31 July 1985, *S.J. Britto 41574* (RHT); Konalar, 09 Sept. 1985, *K.M. Matthew, S.J. Britto* & *A. Usha 42331*(RHT); Perumalmalai, 30 Oct. 1985, *K.M. Matthew* & *N. Rajendren 42442* (RHT); Mannavanur Lake Exit, 30 Aug. 1987, *K.M. Matthew* & *K.T. Mathew 50599* (RHT); Vembadi Peak, 04 Nov. 1987, *K.M. Matthew* & *K.T. Mathew 51039* (RHT); Vandaravu-Marion Shola Levinge Path, 25 Oct. 1988, *K.M. Matthew 53644* (RHT); Vadakavunchi-Perumal Peak, 14 Dec. 1989, *K.T. Mathew* & *S. Sebastian 53855* (RHT). Nilgiri Dist.: Udagamandalam, Coonor, 01 June 2014, *Thoiba K. 138077* (CALI); Sholur, Gudallur-Ootty Road, 22 Oct. 2015, *A.K. Pradeep* & *Thoiba K. 86964*; *Ibid.*, 22 Oct. 2015, *A.K. Pradeep* & *Thoiba K. 86965* (CALI); Valley View, Coonor-Ootty road, 22 Oct. 2015, *A.K. Pradeep* & *Thoiba K. 86961*(CALI); Otacamund, Ebbanad, 10 Sept. 1970, *G.V. Subba Rao 36627* (MH); Pykara, June 1883, *J.S. Gamble 11835* (RHT); Coonor Peak, June 1883, *J.S. Gamble 15319* (RHT); Kotagiri, Aravenu, 24 Oct. 1956, *K. Subramanyam 1109* (RHT). Tirunelveli Dist.: *s.loc.*, 01 Sept. 1964, *A.N. Henry 17411* (CAL); Naduvattam, 23 June 2016, *Nikhil Krishna* & *Thoiba K. 146773*; *Ibid.*, 23 June 2016, *Nikhil Krishna* & *Thoiba K. 146775* (CALI).

Notes:—*T. bromoides* var. *festucoides* is fairly common in hill top, in seasonally wet rocky outcrops, plants upto 30 cm high; spikelets leaden green in colour, lemma awns almost equal and lateral lobes acute to acuminate in shape.

4. Tripogon capillatus Jaub. & Spach, Illustr. Pl. Orient. 4: 47, t. 332. 1851; Hook.f. Fl. Brit. India 7: 285. 1896; C.E.C Fisch. in Gamble, Fl. Madras 3: 1834. 1934; Bor, Grass. Burma Ceylon India Pakistan 521. 1960; P.V. Sreek. & V.J. Nair, Fl. Kerala Grass. 401. t. 83. 1991; S. Moulik, Grass. Bam. India 2: 622. 1997; Sasidh., Biodiv. Doc. Kerala–Fl. Pl. 595. 2004; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 557. 2012. **Type:—**Western Ghats; from the Concan to the Nilghiri Hills, *Jacquemont s.n.* (Isotypes: K000245009, image!, P00740179, image!). **Figs. 136–138, 142**

Caespitose annuals, sometimes epiphytic. ***Culms*** erect, 15–45 cm high; nodes glabrous. ***Leaf blades*** 05–30 × 0.1–0.2 cm, linear-lanceolate, acuminate to attenuate at apex, flat-convolute, midrib prominent. ***Leaf sheaths*** 2–10 cm long, linear, glabrous; ***ligules*** membranous with a tuft of ciliate hairs, 1–2 mm long hairs at the ends of leaf sheath. ***Racemes*** terminal, 10–30 cm long, filiform and flexuous spikelets arranged distantly and alternately; peduncle 5–10 cm long, glabrous; ***rachis*** flexuous, triquetrous, 0.5–1.2 cm long, smooth. ***Spikelets*** 5–8 × 1.3–1.6 mm long, linear-lanceolate, distant, dorsiventrally flattened, 3–5-flowered; callus bearded, hairs 1–1.2 mm long. ***Lower glumes*** 1.3–3.5 × 0.5–0.75 mm, notched on oneside, elliptic-lanceolate, 1-keeled, 1-nerved, attenuate or shortly awned at apex, awns 0.5–1.5 mm long, scabrid. ***Upper glumes*** 3–3.5 × 0.4–0.75 mm, elliptic- lanceolate, 1-keeled, 1-nerved, apex awned, awns 5–6 mm long, scabrid, bristle like. ***Lemmas*** 2.8–4.5 × 0.4–1.2 mm (excluding awn), oblong-lanceolate, 3-veined, 3-awned, awns scabrid, straight-geniculate, flexous or filiform; lateral awns 2–8 mm long, median awns 15–35 mm long. ***Paleas*** 2–2.8 × 0.4–1 mm, elliptic-oblanceolate, hyaline, 2-keeled, ciliate along the margins, 2-lobed at the apex. ***Rachilla*** 1.2–1.6 mm long, not persistent, disrticulating with florets, glabrous. ***Lodicules*** 2, *c.* 0.4–0.5 × 0.25–0.3 mm long, truncate. ***Stamens*** 3; anthers 1–1.5 mm long, oblong; filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** 0.3–0.5 mm, obovate, styles 2, slender, hyaline, 0.5–0.75 mm long; stigma 0.75–1.2 mm long, plumose, creamy white. ***Caryopses*** elliptic-oblong, 1.3–1.6 × 0.2–0.3 mm, dark brown.

Flowering & Fruiting:—Late August–Early December.

Habitat & Ecology:—Occasional at higher elevation on tree trunks, rocks and on dilapidated walls. It grows in association with *Aeschynanthus perrottetii* A.DC., *Arthraxon lancifolius* (Trin.) Hochst., *Eriocaulon* sp., *Impatiens theuerkaufiana* Ratheesh & Sivad., *Indopoa Paupercula* (Stapf) Bor, *Porella* sp. and some mosses and ferns.

Fig. 136. ***Tripogon capillatus*** Jaub. & Spach: **A.** Habit; **B.** Enlarged portion of raceme; **C.** Ligule; **D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Lemma; **H.** Palea; **I.** Lodicules; **J.** Caryopsis.

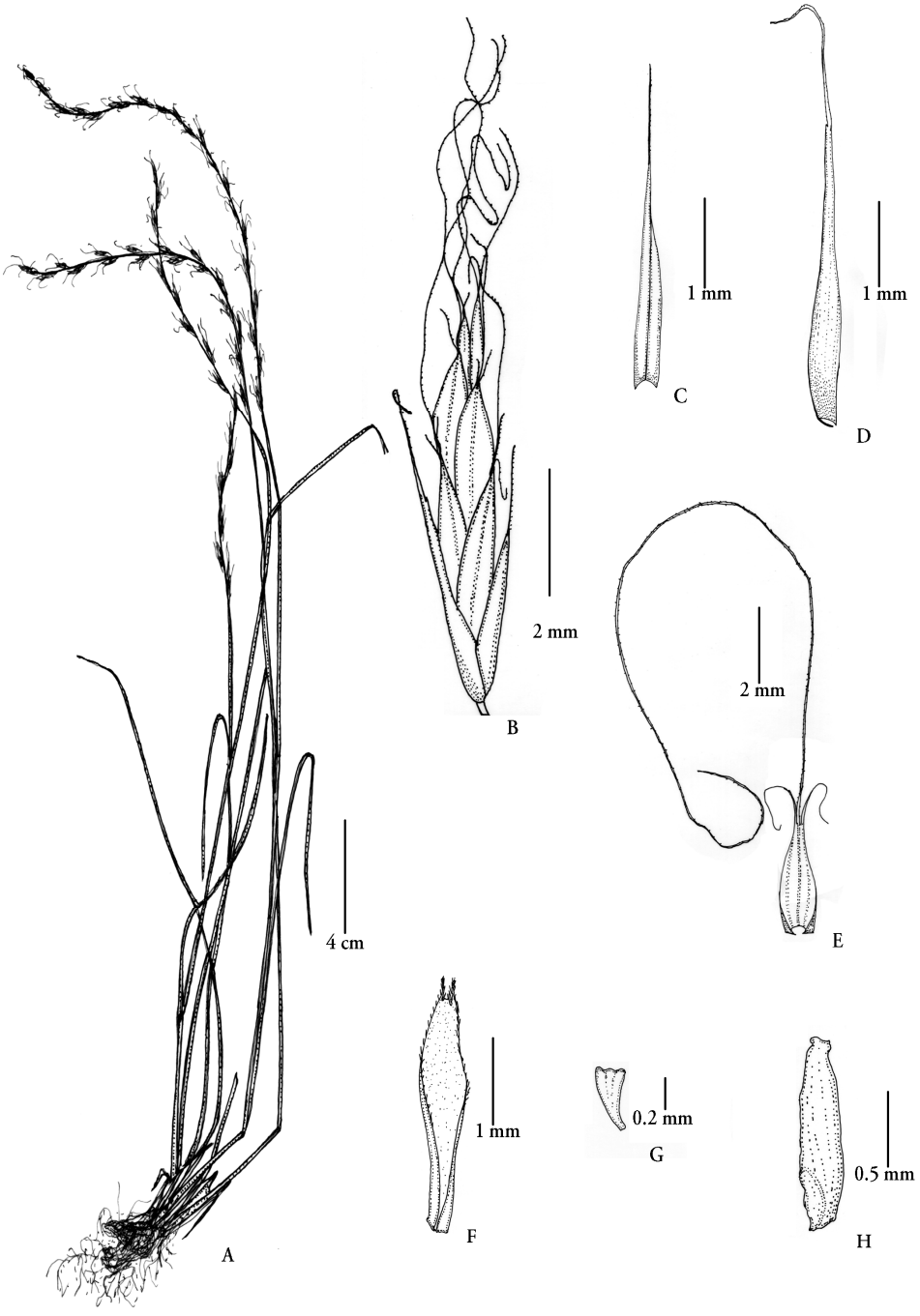


Fig. 137. ***Tripogon capillatus*** Jaub. & Spach: **A.** Habit; **B.** Spikelet; **C.** Lower glume; Ligule; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicule; **H.** Caryopsis.

Distribution:—In India (Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu) and Sri Lanka.

Fig. 138. Isotype of *Tripogon capillatus* Jaub. & Spach [*Jacquemont s.n.* (P00740179)] © The Board Trustees of the Muséum National d'Histoire Naturelle, Paris.

Specimens examined:—India, **Goa,** North Goa Dist.: Surla Plateau, Salan, 02 Oct. 2005, *Harshala Gad* & *M.K. Janarthanam 243* (Goa University Herbarium). **Karnataka,** Chikmagalur Dist.: Kalhatti Falls, 19 Oct. 1974, *R.S. Raghavan 132501* (BSI); *s.loc.*, Sept. 1915, *W.A. Talbot 2621* (BSI); *s.loc.*, *s.die.*, *Hooker CNH 539250* (CAL); *s.loc.*, *s.die.*, *W.M. Munro 866* (CAL); Hazari, 1883, *s.coll. 33677* (CAL). Kodagu Dist.: Virajpet, 07 Oct. 2010, *Remya J.* & *Prasanna 69556* (TBGT); Irippu falls, 01 Jan. 2017, *Nikhil Krishna* & *Thoiba K. 146766* (CALI). **Kerala,** Kasargod Dist.: Ranipuram, 20 Sept. 2015, *Thoiba K.144164* (CALI). Palakkad Dist.: Sirendhri, Nilgiri Biosphere Reserve, 06 Nov. 2012, *Remya J.* & *Prasanna 74586* (TBGT). Wayanad Dist.: Thirunelli, 09 Oct. 2012, *Remya J. 73861* (TBGT). **Jharkhand,** Giridih Dist.: Parasnath, 01 Oct. 1873, *s.coll. 20777* (CAL). **Maharashtra,** Kolhapur Dist.: Panhala, 08 Nov. 2016, *Nikhil Krishna* & *Thoiba K. 146732* (CALI); Panhala, 10 Oct. 2001, *s.coll.*, *s.n.* (SUK); Amboli Ghat, 13 Sept. 2008, *K.V.C. Gosavi 2895* (SUK). Mumbai Dist.: Lisbon, 04 Oct. 2013, *Thoiba K.* & *K.M. Manudev 134467* (CALI). Mumbai Suburban Dist.: Trombay, Sept. 1907, *A. Meebold 8847* (CAL); Borivali National Park, 28 Aug. 1952, *Fernandez R330* (BLAT). Nashik Dist.: Igatpuri, Mahalunga Hills, 13 Sept. 1962, *R.S. Rao*

81381 (BSI, CAL). Pune Dist.: Rajgad, 25 Sept. 1956, *V.D. Vartak 5999* (AHMA); Khubi, 16 Sept. 2005, *S.B. Nagarkar s.n.* (AHMA); Dhak Hill Range, Junnar, 29 Sept. 1965, *K. Hemadri 107454* (BSI, CAL); Durga Khilla, 06 Nov. 1969, *K. Hemadri 117916* (BSI); Way to INS Shivaji-Lonavle, 27 Apr. 1964, *B. Venkata Reddi 98739* (BSI); Muhshi, Ambawane, 07 Sept. 1964, *B. Venkata Reddi 99093* (BSI); Lonavala–Bridgeon Dam, 05 Sept. 1956, *S.K. Jain 5996* (BSI); Dukar Ghat, Panchai, A.L. Nager, 24 Sept. 1970, *B.M. Wadhwa 127525* (BSI); Totk Range, 19 Nov. 1968, *K. Hemadri 115773* (BSI); Hari Chandnagarh, 25 Sept. 1970, *B.M. Wadhwa 127621* (BSI); Khandala, 20 Sept. 1902, *G.A. Gammie 15413*; *Ibid.*, Sept. 1910, *L.D. Earade s.n.* (BSI); Raireshwar, 18 Aug. 1958, *V.D. Vartak 8* (CAL). Raigad Dist.: Dhak, July 2007, *S.S. Rahangdale s.n.* (AHMA). Ratnagiri Dist.: Amboli Ghat, 11 Oct. 1970, *B.G. Kulkerni 121622* (BSI); *Ibid.*, 30 Apr. 2001, *s.coll.*, *s.n.* (SUK). Satara Dist.: Yawateshwar, 01 Sept. 1991, *C.B. Salunkhe 8223* (SUK). Thanae Dist.: Durgadi Killa, 20 Sept. 1968, *K. Hemadri 117916* (CAL); Panecnai Plateau, Taroda Range, 19 Nov. 1968, *K.V. Billore 115773* (CAL); Near Kirouli School, 16 Sept. 1962, *R.S. Rao 81563* (CAL); Cactle Rock, Oct. 1908, *A. Meebold 10501*(CAL).

Notes:—This taxon is frequently growing in tree trunks, old walls and bare rocky soil above 700 m. Lemmas awn are flexous, upto 35 mm in length.

5. Tripogon filiformis Nees *ex* Steud. Pl. Glum. 1: 301. 1854; Hook.f. Fl. Brit. India 7: 288. 1896; Bor, Grass. Burma Ceylon India Pakistan 521. 1960; S. Moulik, Grass. Bam. India 2: 622. 1997; S.M. Phillips & S. L. Chen, Kew Bull. 57 (4): 919. 2002; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 560. 2012. **Type:—**India, Ind. Or., *Herb. Royle s.n.* (Holotype: *Herb. Royle*, Isotype: K000245038, image!). **Figs. 139–142**

Tripogon semitruncatus Nees ex Steud., Pl. Glum. 1: 301. 1854. Type:—Indonesia, Monte Laeou Javae.

T. unidentatus Nees ex Steud., loc. cit. 301. 1854.

Plagiolytrum filiforme Nees, *nom. nud.*, Proc. Linn. Soc. London 1: 95. 1841.

P. unidentatum Nees, *nom. nud.*, loc. cit. 95. 1841.

Catapodium filiforme Nees ex Duthie, *nom. inval.*, Grass 1: 95. 1841. N.W. Ind. 33. 1883.

Tripogon filiformis Steud. var. *tenuispicus* Hook. f., Fl. Brit. India 7: 288. 1896. Type:— Northeast India, *Wallich 8892* (Holotype: K000245041, image!).

Tripogon nanus Keng *ex* Keng f. & L. Liou, Acta. Bot. Sin. 9: 71. 1960. Type:— China, Sikang, Miao-niu, July 1940, *K.L. Chu 7683* (Holotype: NJU).

Caespitose perennials. ***Culms*** erect. 10–50 cm high; slender, nodes glabrous. ***Leaf blades*** 5–17 × 0.2–2.5 cm, linear-lanceolate, filiform, convolute, acuminate to attenuate at apex, more hairy towards collar, dense hairy along margins and both sides of the blade. ***Leaf sheaths*** 2–10 cm long, linear, ribbed and hairy; ***ligules*** obsolete, ciliate with a tuft of 1–2 mm long hairs at both ends. ***Racemes*** terminal, 5–25 × 0.3–0.5 cm, 25–35 spikelets arranged closely and alternately; peduncle 3–10 cm long, glabrous; rachis 3–5 mm long, stout and slightly scabrid. ***Spikelets*** 6–8 × 1–2 mm long, linear, dorsiventrally flattened, 4–10-flowered; callus bearded, hairs 0.5–1mm long. ***Lower glumes*** 1.5–2.5 × 0.5–1 mm, ovate-lanceolate, asymmetrical, notched on oneside, 1-keeled, 1-nerved, keels slightly scabrid, margins serrulate, obtuse at apex. ***Upper glumes*** 2.5–4 × 0.5–1 mm, elliptic- lanceolate, 1-keeled, 1-nerved, apex dentate, 1-awned, awns 1–1.2 mm long at sinus. ***Lemmas*** 5–5.5 × 1–1.5 mm, oblong-lanceolate, 4-lobed, 3-awned, 3-nerved, slightly keeled, 3-awned; awns scabrid, straight or flexuous, median awns 2.5–5 mm long, lateral awns 1–2 mm long; lateral lobes 1–1.2 mm long, lanceolate, apex acute, margins serrulate. ***Paleas*** 2–3 × 0.5–0.75 mm, elliptic-lanceolate, slightly winged, 2-nerved, 2-keeled, hyaline, keels ciliate more at the tip, apex obtuse or minutely bimucronate. ***Rachilla*** 0.5–0.75 mm long, glabrous,

Fig. 139. ***Tripogon filiformis*** Nees *ex* Steud.: **A.** Habit; **B.** Ligule; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Lemma; **G.** Palea; **H.** Stamens & pistil; **I.** Lodicules; **J.** Caryopsis.

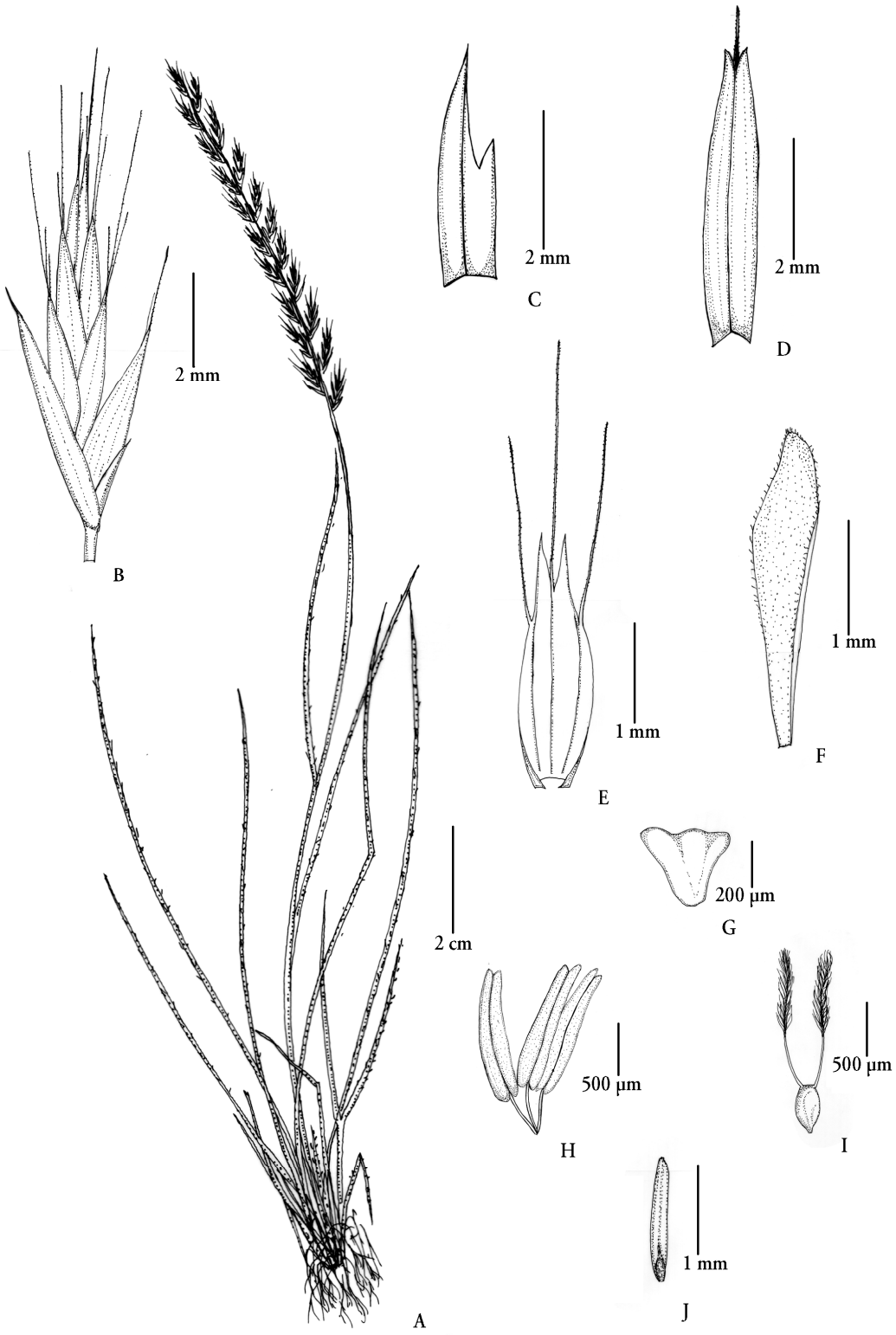


Fig. 140. ***Tripogon filiformis*** Nees *ex* Steud.: **A.** Habit; **B.** Spikelet; Ligule; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicule; **H.** Stamens; **I.** Pistil; **J.** Caryopsis.

slightly zig-zag. ***Lodicules*** 2, c. 0.3–0.4 mm long, truncate. ***Stamens*** 3; anthers 1–1.5 mm long, oblong; filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** 0.3–0.5 mm, obovate, styles 2, slender, hyaline, 0.5–0.75 mm long; stigma 0.75–1.2 mm long, plumose, creamy white. ***Caryopses*** narrowly oblong-elliptic, 1.5–2.5 × 0.3–0.5 mm, light brown.

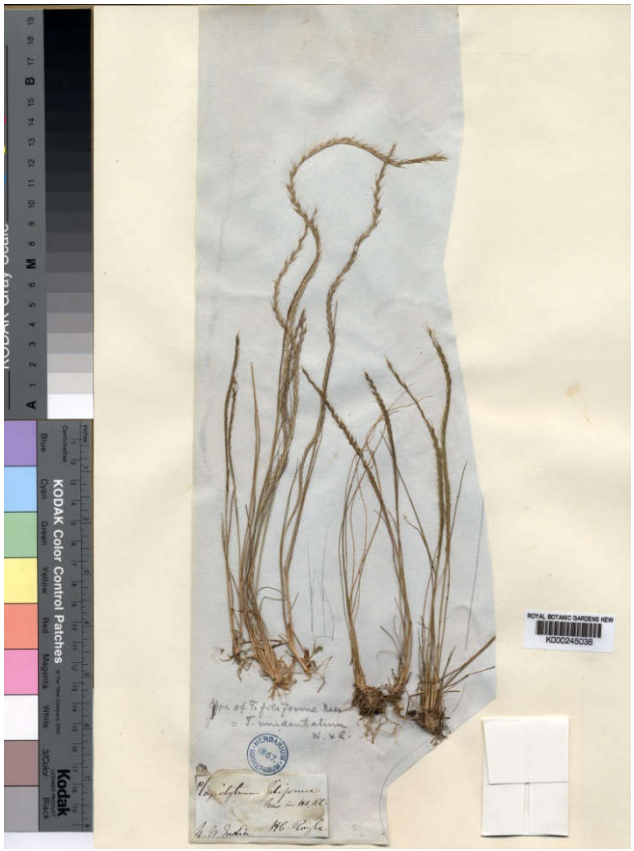


Fig. 141. Isotype of *Tripogon filiformis* Nees *ex* Steud. [*Herb. Royle s.n.* (K000245038)] © The Board Trustees of the Royal Botanic Gardens, Kew.

Flowering & Fruiting:—August–November.

Habitat & Ecology:—Rare on moist rocky outcrops at higher elevation grasslands. It grows in association with *Cyanotis* sp., *Eriocaulon* sp., *Impatiens goughii* Wight, *Tripogon bromoides* Roth *ex* Roem. & Schult., *T. karnatakensis* Thoiba & Pradeep Bryophytes and some other mosses.

Distribution:— In India it is fairly common in Himalayan regions but rare in Peninsular India.

Specimens examined:—India, **Karnataka,** Belgaum Dist.: *s.loc.*, Oct. 1897, *W.A. Talbot s.n.* (BSI). Chamarajanagar Dist.: Biligirirangan Betta, 28 Apr. 1962, *A.S. Rao 80409* (CAL). Chikmagalur Dist.: Kavikal Gandi Hills, 13 Sept. 2014, *Thoiba K. 137504* (CALI). Kodagu Dist.: Tadiyandamol Hills, 26 Nov. 2014, *Thoiba K. 137555* (CALI). **Himachal Pradesh,** Lahaul & Spiti Dist.: Shell Village Site, 13 Feb. 1957, *S.C. Agarwal 1145* (CAL). **Maharashtra,** Pune Dist.: Khandala, Paoli Hill, 17 Sept. 1951,

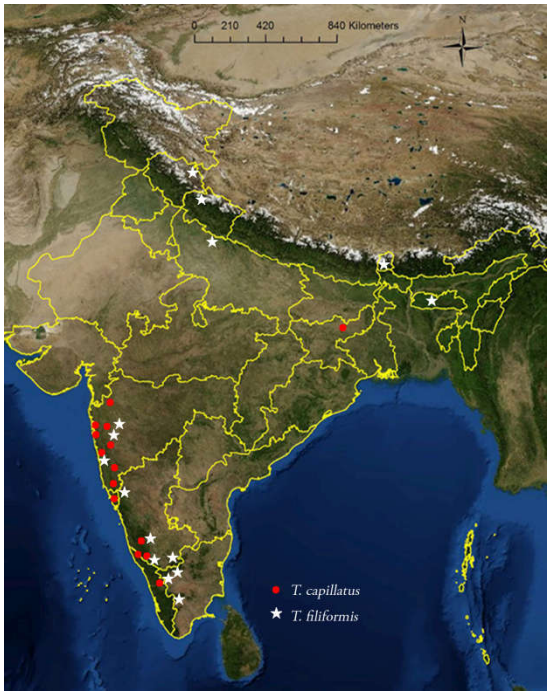


Fig. 142. Distribution of *T. capillatus* Jaub. & Spach (●) and *T. filiformis* Nees *ex* Steud.(☆)

H. Santapau 13409; *Ibid.*, 17 Sept. 1951, *H. Santapau 13415* (BLAT); Khed Taluk, near Gayimukh, 07. Oct. 1962, *K.P. Janardhanan 81643* (BSI); Junnar, Ambe Plateau, 04 Oct. 1965, *K. Hemadri 107590* (BSI). Raigad Dist.: Matheran, Hart Point, 17 Oct. 1960, *N.A. Irani 5567* (BLAT). **Meghalaya,** East Khasi Hills Dist.: K & J Hills, 75 Sept. 1956, *G. Panigrahi 3498* (CAL); Mawsynram, 26 Aug. 2018, *Nikhil Krishna* & *Thoiba K. 159873* (CALI). **Sikkim,** East Sikkim Dist.: Bakthang Water falls, Gangtok, 27 July 2018, *Nikhil Krishna* & *Thoiba K. 59804* (CALI). North Sikkim Dist.: Lachung, 01 Sept. 1892, *G.A. Gammie 1095* (CAL); *s.loc.*, 16 Oct. 1875, *s.coll. 25326* (CAL); *s.loc.*, Aug. 1866, *Wight s.n.* (CAL). **Tamil Nadu**, Coimbatore Dist.: Velliangiri Hills, 30 Sept. 2016, *A.K. Pradeep, Nikhil Krishna* & *Thoiba K. 146721*; *Ibid.*, 30 Sept. 2016, *A.K. Pradeep*, *Nikhil Krishna* & *Thoiba K. 146724*, *146730* (CALI). Dindigul Dist.: Kodaikanal, Mannavanur, Sheep farm, 28 Aug. 1987, *K.M. Mathew 5044* (RHT); Kukkal, 19 Oct. 1987, *K.M. Mathew 50798* (RHT); Vembadi Peak, 17 Dec. 1989, *K.M. Mathew* & *K.T. Mathew 53998* (RHT). Salem Dist.: Shevaroy Hills, 10 Aug. 2004, *A.K. Pradeep 93156a*; *Ibid.*, 10 Aug. 2004, *A.K. Pradeep 93156b*, *93156c*, 10 *93156d*, *93156e* (CALI). **Uttarakhand,** Pauri Garhwal Dist.: Chopra, 21 Sept. 1975, *A.S. Rao 56419* (CAL). **Uttar Pradesh,** *s.loc.*, Oct. 1890, *J.F. Duthie 10774* (CAL). 'Himalayas', *s.die.*, *s.coll.*, *s.n.* (MH).

Notes:—*T. filiformis* is an upland and high altitude species, often confused *T. bromoides*. It can be distinguished by its densely villous, the densely villous leaves, with dense feathery racemes of long awned spikelets with 3 anthers.

6. Tripogon idukkianus Sunil & Pradeep in Phytotaxa 202(4): 295. 2015. **Type:**—India, Kerala, Idukki Dist.: Ramakkalmedu 1500 m, 10 Nov. 2002, *C.N. Sunil 2267* (Holotype: K, Isotypes: CAL!, CALI!, MH!). **Figs. 143–145, 152**

Caespitose perennials. ***Culms*** up to 55 cm high, slender, nodes glabrous. ***Leaf sheaths*** 5–9 cm long, coriaceous, sparsely hispid, ***ligules*** with a tuft of hairs, hairs 1–2 mm long, basal leaf sheaths papery. ***Leaf blades*** 20–62 × 0.2–0.3 cm, flat or involute, linear-lanceolate, acuminate, glabrous or sparsely hairy, midrib inconspicuous, margins entire. ***Racemes*** 15–45 cm long, with 20–58 spikelets, terminal; rachis smooth, angular, glabrous. ***Spikelets*** 5–13 × 1.5–2.5 mm long, 6–14-flowered, secund, pale-green or yellow coloured, distant, laterally compressed, florets loosely imbricate. ***Lower glumes*** 2–3 × 1–1.5 mm, 1-veined, membranous, asymmetrical, and broadened on one-side below the middle, apex subacute, sometimes lobed. ***Upper glumes*** 4–5 × 1–1.5 mm, lanceolate-oblong, 1-veined, membranous, apex acute, notched, mucronate, the mucro 0.5 mm long, scabrous, the lateral lobes as long or shorter than the mucro. ***Lemmas*** 3–3.5 × 2–2.5 mm, membranous, gray-green, 3-veined, 3-awned, central awn 2–2.5 mm long, straight, rigid, scabridulous, lateral awns up to 2 mm long, apex acute, 4-lobed, each lobe, 0.5–1 × 0.25 mm, ovate-lanceolate. ***Paleas*** 2.5–3 × *c.* 1 mm, hyaline, obovate, apex obtuse or acute, bisetaceous subapically, setae 0.25 mm long, curved, ciliolate. ***Rachilla*** usually not visible; callus bearded. ***Stamens*** 3, anthers 1–1.5 mm long; ***Ovary*** *c.* 0.25 mm long, globose with 2 styles, stigmas 0.75 mm long, purplish, feathery. ***Caryopses*** 1.5–1.6 × 0.25–0.3 mm, oblong-lanceolate, cylindric, light brown.

Flowering & Fruiting:—October–Late December.

Fig. 143. ***Tripogon idukkianus*** Sunil & Pradeep: **A.** Habit; **B.** Enlarged portion of raceme; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Enlarged portion of upper glume apex; **G.** Lemma; **H.** Palea; **I.** Enlarged portion of palea apex; **J.** Stamens & pistil; **K.** Caryopsis.

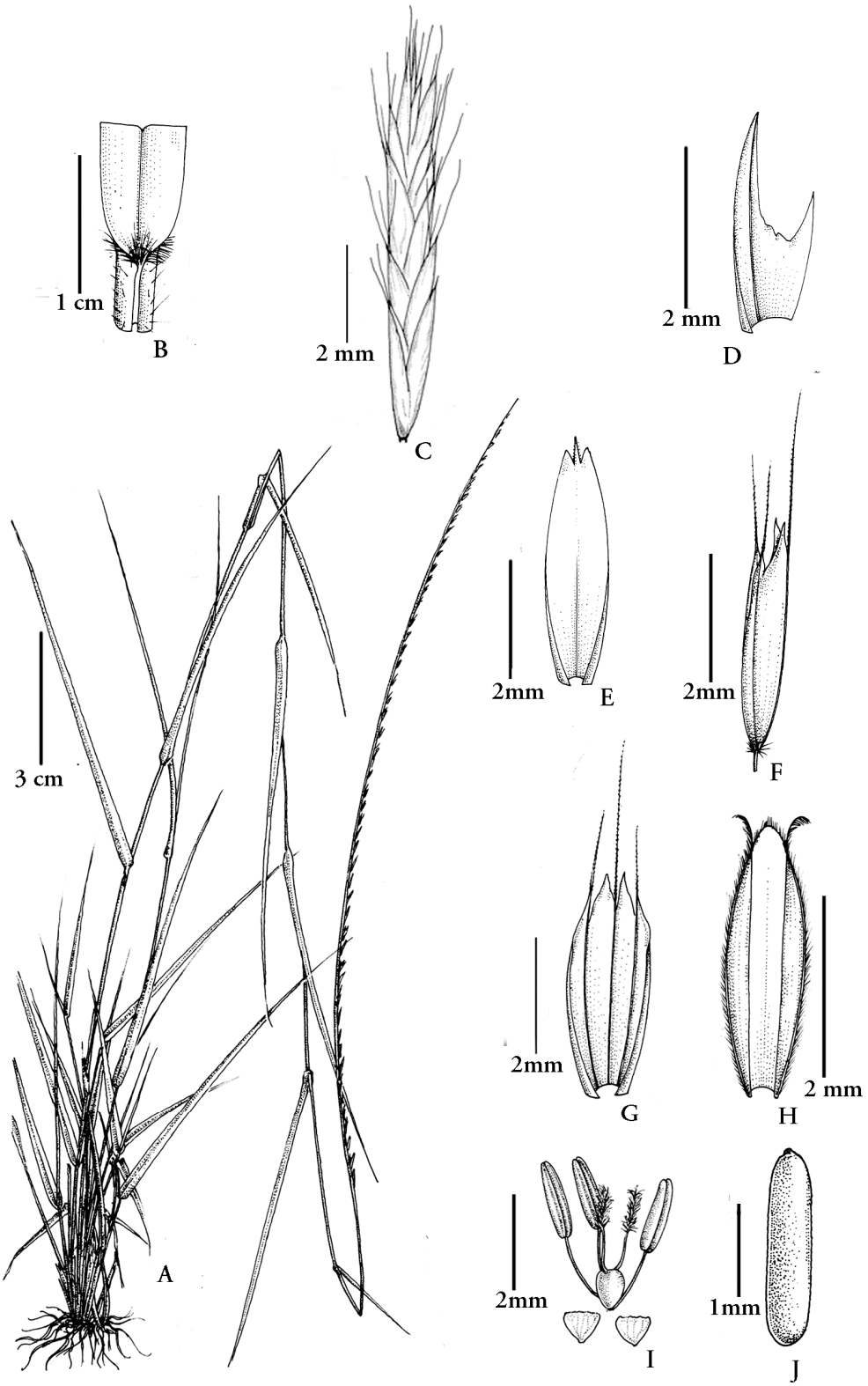


Fig. 144. ***Tripogon idukkianus*** Sunil & Pradeep: **A.** Habit; **B.** Ligule; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Floret; **G.** Lemma; **H.** Palea; **I.** Lodicules, stamens & pistil; **J.** Caryopsis.

Habitat & Ecology:—This species grows from 1000–1500 m elevation on seasonally wet rocky hill sides. It is seen in association with *Apluda mutica* L., *Crotalaria beddomeana* Thoth. & A.A. Ansari, *Didymocarpus tomentosa* Wight, *Eragrostiella bifaria* (Vahl) Bor, *Leucas ciliata* Benth. *ex* Wall., *Themeda tremula* (Nees *ex* Steud.) Hack. and *Tripogon bromides* Roth *ex* Roem. & Schult.

Fig. 145. Isotype of *Tripogon idukkianus* Sunil & Pradeep [*C.N. Sunil 2267*] © Botanical Survey of India, Coimbatore.

Distribution:—*Tripogon idukkianus* is endemic to South India and is hitherto known only from the Idukki District of Kerala, Peninsular India.

Specimens examined:—India, **Kerala,** Idukki Dist.: Ramakkalmedu 1500 m, 10 Nov 2002, *C.N. Sunil 2267* (CAL, CALI, K, MH); *Ibid.*, 13 Nov. 2014, *Thoiba K.* & *A.K. Pradeep 137546*; *Ibid.,* 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137584* (CALI).

Notes:—Similar to *Tripogon bromoides* and *T. zeylanicus* but it distinguished by having 5–13 mm long, acuminate, glabrous leaves, 6–14-flowered spikelets with secund florets, 4-lobed scabrid lemmas with 3 awns each, and 2-keeled ciliate paleas with anobtuse or acute apex with two subapical setae.

7. **Tripogon jacquemontii** Stapf in Kew Bull. 64: 85. 1892; Hook. f. Fl. Brit. India 7: 286. 1896; Bor, Grass. Burma Ceylon India Pakistan 522. 1960; S. Moulik, Grass. Bam. India 2: 622. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1268. 1997; Sasidh., Biodiv. Doc. Kerala–Fl. Pl. 595. 2004; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 560. 2012. **Lectotype** (designated by Thoiba & Pradeep, 2018):—Poona, 09 Feb. 1892, *Jacquemont 320* (K000245018, image!). **Figs. 146–148, 152**

Caespitose perennials. ***Culms*** terete, erect, 10–70 cm high; nodes glabrous. ***Leaf blades*** 04–30 × 0.1–0.3 cm, linear, sub filiform, involute, glabrous, setaceous, acuminate to attenuate at apex. ***Leaf sheaths*** 2–10 cm long, terete, glabrous; ***ligules*** ciliate membranous, with a tuft of 1–2 mm long hairs at both ends. ***Racemes*** terminal, 10–30 cm long, long erect or curved towards apex, 15–35 spikelets; peduncle 8–15 cm, glabrous; spikelets arranged alternately on both sides of the raceme and leaden grey coloured; rachis stout, glabrous or scabrid, 3–12 mm long; ***Spikelets*** 7.5–16 × 1–1.5 mm narrowly elliptic, linear, distant, 4–25-flowered; callus bearded, hairs c. 0.5 mm long. ***Lower glumes*** 2.8–3.5 × 0.3–0.5 mm, notched on oneside, ovate-lanceolate, 1-keeled, 1-nerved, keels slightly scabrid, with acute apex. ***Upper glumes*** 3–4 × 0.5–0.8 mm, elliptic-ovate, 1-keeled, 1-nerved, apex apiculate. ***Lemmas*** 3–4 × 0.6–1 mm, broadly ovate, 2-lobed, 3-nerved, slightly keeled, and 1-awned, awns 1–1.5 mm long, scaberulous, lateral lobes membranous. ***Paleas*** 2.3–3 × 0.5–0.8 mm, elliptic, narrowly winged, hyaline, 2-keeled, keels scabrid, obtuse or emarginated at apex. ***Rachilla*** 0.3–0.4 mm long, glabrous, straight or zig zag, not persistent. ***Lodicules*** 2, c. 0.3 mm long, slightly cordate . ***Stamens*** 3; anthers 1–1.6 mm long, oblong; filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** 0.3–0.5 mm, obovate, styles 2, slender, hyaline, 0.5–0.75 mm long; stigma 0.75–1.2 mm long, plumose, creamy white. ***Caryopses*** linear-oblong, 1.4–1.6 × 0.3–0.5 mm, light brown.

Flowering & Fruiting:—August–Early November.

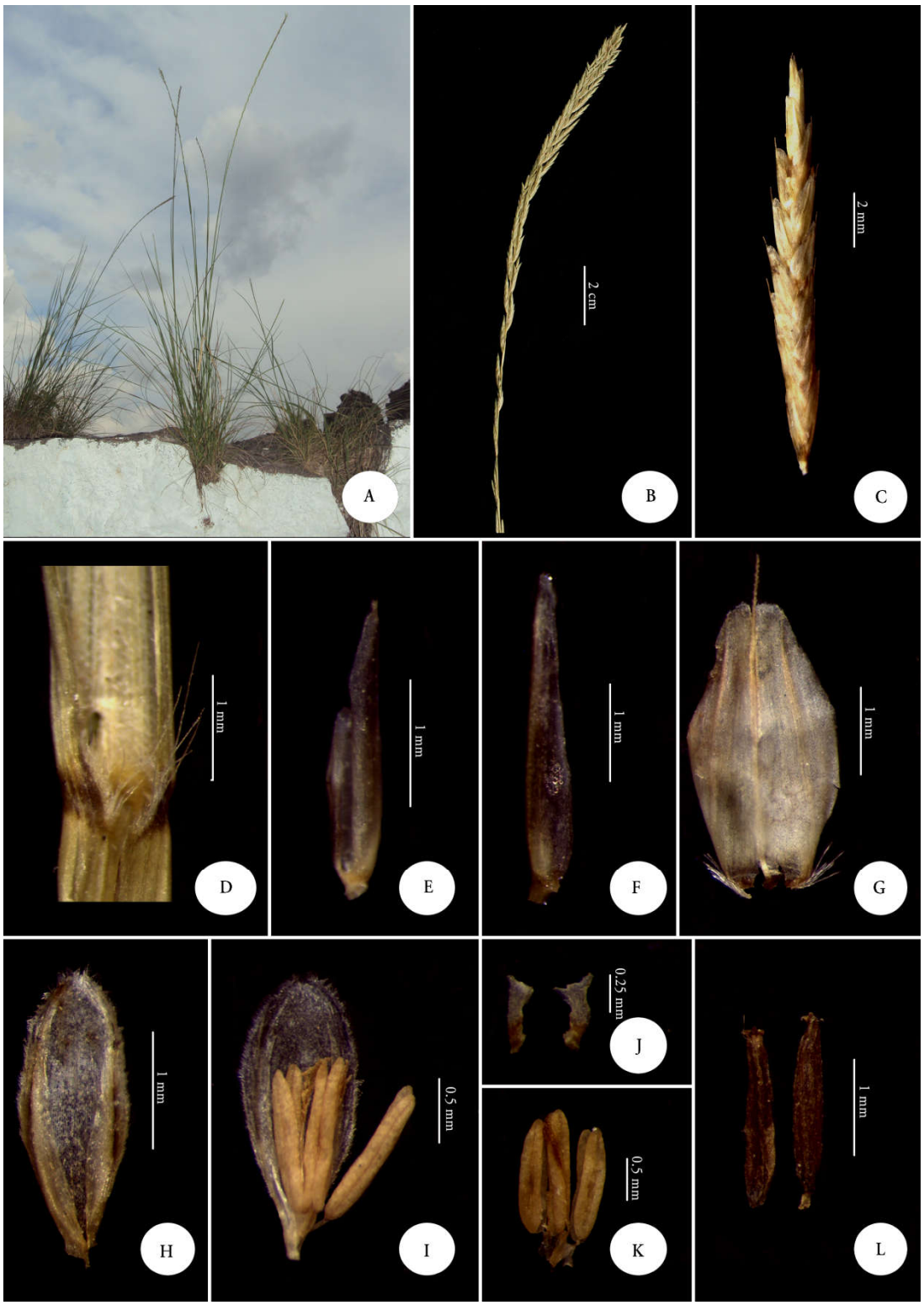


Fig. 146. ***Tripogon jacquemontii*** Stapf: **A.** Habit; **B.** Enlarged portion of raceme; **C.** Spikelet; **D.** Ligule; **E.** Lower glume; **F.** Upper glume; **G.** Lemma; **H.** Palea; **I.** Palea with flower; **J.** Lodicules; **K.** Stamens & pistil; **L.** Caryopsis.

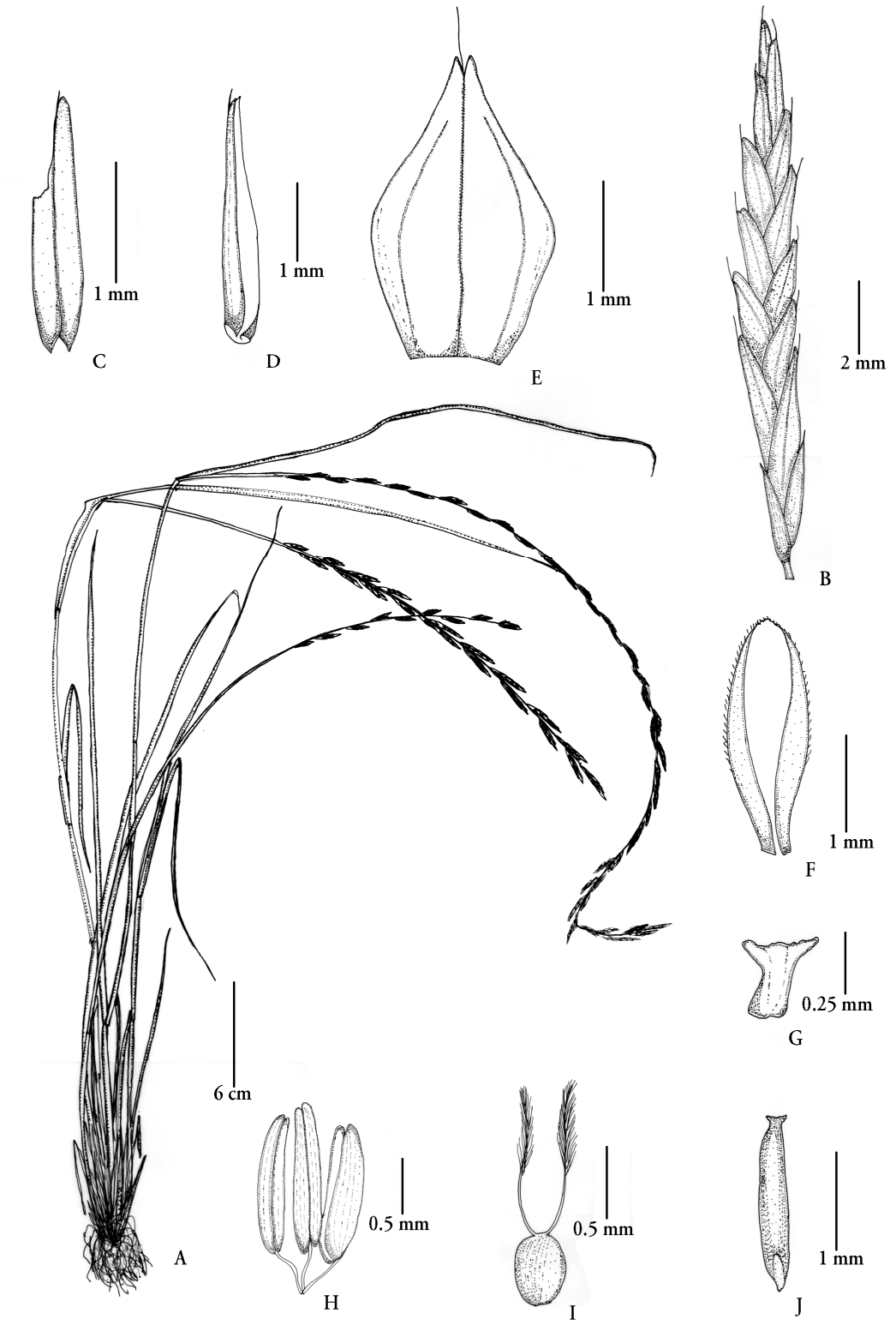


Fig. 147. ***Tripogon jacquemontii*** Stapf: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicule; **H.** Stamens; **I.** Pistil; **J.** Caryopsis.

Habitat & Ecology:—Gregarious, usually found in tussocks on open grasslands, around along boulders, road sides and on old walls. It grows in association with *Apluda mutica* L., *Dimeria deccanensis* Bor, *Eragrostis maderaspatana* Bor, *E. minor* Host, *Eragrostiella bifaria* (Vahl) Bor, *Pouzolzia zeylanica* (L.) Bennett and *Tripogon bromoides* Roth *ex* Roem. & Schult.

Distribution:—In India, fairly common in barren uplands of the Carnatic and Central India.

Specimens examined:—India, **Karnataka,** Belgaum Dist.: *s.loc.*, 1897, *Talbot 9782* (BLAT). Dharwad Dist.: Fort Walls, 10 Sept. 1890, *W.A. Talbot 2301* (BLAT). **Gujarat,** Dhahod Dist.: Devgadh, *s.die.*, *G.S. Puri 27303* (BSI). **Jammu & Kashmir,** Kathua Dist.: Bhullari, 20 Sept. 1963, *Seshangiri Rao Rolla 91987* (BSI). **Madhya Pradesh,** Indore Dist.: Manpur in Mordu Road, 18 Oct. 1982, *A.S. Rao 83808* (BSI). **Maharashtra,** Akola Dist.: Narnala Fort, 25 Feb. 1978, *S.Y. Kamble 152866* (BSI). Amravati Dist.: Chikhladara, Melghat, 23 Aug. 1976, *M.Y. Ansari 143769* (BSI). Aurangabad Dist.: Ajanta Caves, 06 Nov. 1961, *R.S. Rao 71440* (BSI). Buldhana Dist.: Lodi Forest, 25 Sept. 1982, *P.G. Diwaker 164171* (BSI). Jalna Dist.: Shelgaon, 31 Oct. 1961, *K.P. Janardhanan 72827* (CAL). Nagpur Dist.: Amravati Road–39/3 Mile Point, 17 Sept. 1963, *R.S. Rao* & *U.R. Deshpande 91718a*; *Ibid.*, 17 Sept. 1963, *R.S. Rao* & *U.R. Deshpande 91718b* (BSI). Nashik Dist.: Peth Ghat, 08 Aug. 1961, *K.P. Janardhanam 71983* (CAL); Saptashrungi Hill, 15 Aug. 1983, *P.L. Narasimhan 165257* (BSI). Osmanabad Dist.: Ramling Hill, 06 Oct. 2001, *s.coll.*, *s.n.* (SUK). Pune Dist.: Shivneri, 19 Oct. 2001, *s.coll.*, *s.n.* (SUK); Ganeshkhind, Aug. 1951, *B.A. Razi 6276*(AHMA); Aie, Aug. 2007, *S.S. Rahangdale s.n.* (AHMA); Katraj Hill, 21 July 1956, *V.D. Vartak 5249* (AHMA); Vetal Hill, 08 Oct. 1987, *V.N. Jhoshi VH333* (AHMA); Taleran, Sept. 2006, *S.S. Rahangdale s.n.* (AHMA); Bopodi, 13 Feb. 1902, *s.coll. 15309* (BSI); On the way from Awhat to Shorewadi, Khed Taluk, 10. Aug. 1961, *K.P. Janardhanan 72406* (BSI); Top of Kharpudi Hill, 05 Aug. 1961, *K.P. Janardhanan 71835* (BSI); Camp Canal Cantt., 29 July 1960, *K.C. Kanodia 64410*

Fig. 148. Lectotype of *Tripogon jacquemontii* Stapf [*Jacquemont 320* (K000245018) designated by Thoiba & Pradeep, 2018] © The Board Trustees of the Royal Botanic Gardens, Kew.

(BSI); Gargatwadi, 19 Sept. 1960, *K.P. Janardhanan 66276* (BSI); Sinhagad, *s.die.*, *G.S. Puri s.n.* (BSI); Between Mental Hospital & Vishrantwadi, 23 Sept. 1960, *M.Y. Ansari 64727* (BSI); Shivneri Hills, On way to top Junnar, 25 July 1963, *M.Y. Ansari 88706* (BSI); Khed, Mahalunge, 02. Nov. 1961, *K.P. Janardhanan 72911A* (BSI); Shivneri Fort, 10 Oct. 1962, *Hemadri* & *R.S. Rao 83545* (BSI); Khed, Top of Peth Ghat, 08. Aug. 1961, *K.P. Janardhanan 71983* (BSI); Junnar, Shivneri Hill, 14 Aug. 1964, *K. Hemadri 99655* (BSI); Markandey Top, 16. Sept. 1966, *R.D. Pataskar 108889* (BSI); Barshinge Hills 11 Sept. 1966, *R.D. Pataskar 101263* (BSI); Khed, Chakan-Talegaon Road, 4th Mile Point, 19 Sept. 1960, *K.P. Janardhanan 66417* (BSI); Shivneri Fort, 15 Aug. 1964, *K. Hemadri 99685* (BSI); Shivneri Eastern Exposure, 13 Oct. 1962, *s.coll. 83793* (BSI); Sinhagad, 09 Aug. 1956, *G.S. Puri 5675* (BSI); Bawjhan, 10 Oct. 1956, *Jain 7535* (BSI); Junnar, Narayangaon, 23 Oct. 1967, *K. Hemadri 107055* (BSI); Parvathi Hills, 22 July 1960, *M.Y. Ansari 64368* (BSI); Katraj Ghat, 30 Sept. 1956, *S.K. Jain 4076* (BSI); Manchar, Ghodegoan, 09 Sept. 1956, *G.S. Puri 7302* (BSI); Donaje, 07 Aug. 1964, *M.Y. Ansari 97569* (BSI); *s.loc.*, 18 June 1902, *L.D. Garade 486* (BSI); Khed, Shelgaon, 31 Oct. 1961, *K.P. Janardhanan*

72827 (BSI); Shivneri Fort, 10 Oct. 1962, *Seshagiri Rao 83545* (BSI); Junnar, Shivneri Hill, 14 Aug. 1964, *K. Hemadri 99655* (BSI); Chakan-Talegaon Road, 19 Sept. *1960, K.P. Janardhanan 66417* (BSI); Barshingi Hills, 11 Sept. 1966, *R.D. Pataskar 101263* (CAL). Raigad Dist.: Shelu Budruk, 29 Aug. 1977, *S.Y. Kamble 150213* (BSI). **Rajasthan,** Banswara Dist.: *s.loc.*, 20 Mar. 1976, *V. Singh 2913* (CAL). Chittorgarh Dist.: *s.loc.*, 17 Aug. 1979, *V. Singh* & *R.P. Pandey 7249* (CAL). **Tamil Nadu,** Coimbatore Dist.: Poonachi, 10 Oct. 1901, *C.A. Barber 3726* (MH).**Telangana,** Hyderabad Dist.: Golconda Fort, 13 Sept. 2014, *A.K. Pradeep* & *Thoiba K. 144128a*; *Ibid.*, 13 Sept. 2014, *A.K. Pradeep* & *Thoiba K. 144128b*, *144128 c*, *144128 d*; *Ibid.*, 07 Feb. 2018, *Thoiba K. 146795* (CALI).

Notes:—*T. jacquemontii* is a gregarious species found in tussocks on rocks or on the barren upland, old walls of forts. It is distinguished by its glaucous leaves and culms, awn shorter than the lemma or occasionally almost absent.

8. Tripogon karnatakensis Thoiba & Pradeep in Phytotaxa 272(2): 126. 2016. **Type:**––India, Karnataka, Chikmagalur Dist.: Kavikal Gandi Hills, 1450 m, 13 Nov 2014, *T. Kottekkattu* & *M. Yoonus T. 137510* (Holotype: CAL!, Isotypes: CALI!, MH!, K). **Figs. 149–152**

Perennial; caespitose. ***Culms*** 40–60 cm tall, erect, unbranched; nodes glabrous, slightly geniculate. ***Leaf blades*** 12–23 × 0.4–0.5 cm, flat to convolute, apex acute-acuminate, scabrid and sparsely villous adaxially and glabrous abaxially, margins entire. ***Leaf sheaths*** 3–8 cm, closely involute to the culm, persistent, fibrous; ligules narrow, membrane fringed with long hairs at the ends of leaf sheath, hairs 3–7 mm long. ***Raceme*** 15–28 × 0.5–0.7 cm, leaden green coloured, spikelets laterally compressed, arranged along both sides alternately, 50–60 spikelets per raceme; peduncle stout, glabrous, 5–10 cm long; rachis 3–5 mm long, stout, triangular, minutely scaberulose. ***Spikelets*** linear-lanceolate, 10–30 × 3–4 mm long, 7–10-flowered; callus bearded, barbate in front at the base of the rachilla internode, hairs 1–1.5 mm long. ***Rachilla*** not

Fig. 149. ***Tripogon karnatakensis*** Thoiba & Pradeep: **A.** Habit; **B.** Enlarged portion of raceme; **C.** Spikelet; **D.** Ligule; **E. & F.** Lower glume; **G.** Upper glume; **H.** Lemma; **I.** Palea; **J.** Lodicules; **K.** Stamens & pistil.

Fig. 150. ***Tripogon karnatakensis*** Thoiba & Pradeep: **A.** Habit; **B.** Spikelet; **C. & D.** Lower glume; **E.** Upper glume; **F.** Lemma; **G. & H.** Palea – ventral & dorsal view; **I.** Lodicule; **J.** Stamens & pistil.

persistent, 1–1.2 mm long, glabrous, slightly zig-zag. ***Lower glumes*** 5–7 × 1 mm, oblong-lanceolate, asymmetrical, 2-keeled, bilobed, chartaceous, 2-nerved, awned at the apex; awn 1 mm long. ***Upper glumes*** 6–8 × 0.5–1 mm, symmetrical, elliptic-lanceolate, 1-keeled, prominentely 1-nerved, scabrid, apex 2-fid, shortly awned from the summit, awns 2.5–3 mm long, scabrid. ***Lemmas*** 3–3.5 × 1.5–2 mm (excluding awn), narrowly elliptic to ovate-lanceolate, 4-lobed, 3-nerved, 3-awned, lobes acute-acuminate, 1–1.5 mm long; median awn 3.7–4.2 mm long, scabrid, straight or curved; lateral awns 2.5–3 mm long. ***Paleas*** 2.8–3 × 1.7–2 mm, hyaline, elliptic-lanceolate, keeled and slightly winged, keels minutely ciliolate along the margins, apex varying from subacute to deeply notched at the centre. ***Lodicules*** 2, *c.* 0.5 mm long, wedge-shaped, apex coarsely 3-toothed. Stamens 3; anthers 1.5–2 mm long, oblong; filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** 0.25–0.5 mm long, obovate; style 2, slender, hyaline, 0.75–1mm long; stigma 0.75–1mm long, plumose. ***Caryopses*** not seen.

Fig. 151. Holotype of *Tripogon karnatakensis* Thoiba & Pradeep [*T. Kottekkattu* & *M. Yoonus T. 137510*] © Botanical Survey of India, Kolkata.

Flowering & Fruiting:—September–December.

Habitat & Ecology:—It grows on hill tracts among boulders and also along the Ghat road sides at elevation between 1000–1950 m, in association with *Cyanotis papilionacea* (Burm.f.) Schult. f., *Eriocaulon* spp., *Impatiens* spp., *Indopoa paupercula*

(Stapf) Bor., *Murdannia dimorpha* (Dalz.)Brueck., *Tripogon bromoides* Roth *ex* Roem. & Schult. and *T. filiformis* Nees ex Steud.

Distribution:—*Tripogon karnatakensis* is currently known from two localities, Kavikalgandi Hills in Muthodi Range and Baba Budan Hills in Chikmagalur in Karnataka, South India.

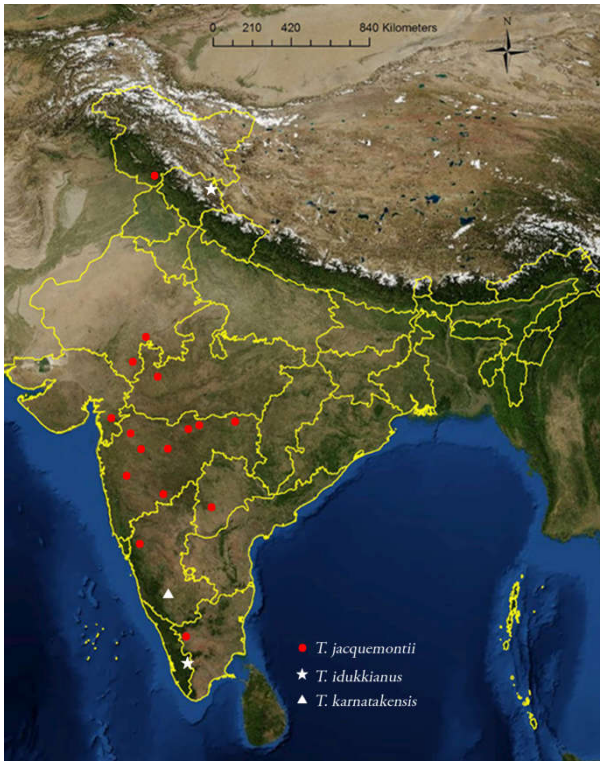


Fig. 152. Distribution of *Tripogon jacquemontii* Stapf (●), *T. idukkianus* Sunil & Pradeep (☆) and *T. karnatakensis* Thoiba & Pradeep (△)

Specimens examined:—India, **Karnataka,** Chikmagalur Dist.: Baba Budan Hills, 13 Sept. 2014, *Thoiba K.* & *M. Yoonus T. 137501*; *Ibid.*, *Thoiba K.* & *M. Yoonus T. 137530* (CALI); Kavikalgandi Hills, 13 Sept. 2014, *Thoiba K.* & *M. Yoonus T. 137510* (CAL,CALI, K, MH).

Notes:—*T. karnatakensis* shows resemblance with *T. fliformis*, but differs in having flat to convolute, sparsely villous and adaxially scabrid leaves; 15–28 cm long stout leaden green racemes; spikelets with 7–10-florets, 2-keeled lower glumes; ciliate paleas with a deep apical notch.

9. Tripogon lisboae Stapf in Kew Bull. 1892: 84. 1892; Hook. f. Fl. Brit. India 7:286. 1896; Bor, Grass. Burma Ceylon India Pakistan 522. 1960; S. Moulik, Grass. Bam. India 2: 622. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 180. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 563. 2012. **Lectotype** (designated by Thoiba & Pradeep, 2018):—Rajputana, Mt. Abu, on rocks, 3500 ft, 12 Oct 1987, *J.F. Duthie 6788* (K000245015, image!).

Figs. 153–155, 160

Caespitose perennials. ***Culms*** terete, erect, 10–120 cm high; nodes glabrous. ***Leaf blades*** 20–60 × 0.4–0.7 cm, linear, lanceolate, glaucous, flat-convolute, sparsely villous adaxially, scabridulous on veins acuminate at apex. ***Leaf sheaths*** 6–12 cm long, terete, glabrous; ***ligules*** obsolete. ***Racemes*** terminal, 10–30 cm long, erect or curved, 15–35 spikelets; peduncle 8–15 cm, glabrous; spikelets arranged alternately on both sides of the raceme, olive green coloured, flattened; rachis stout, glabrous or scabrid, 3–12 mm long; ***Spikelets*** 5–13 × 1–2 mm narrowly elliptic, linear, distant, 5–10-flowered; callus bearded, hairs c. 0.3 mm long. ***Lower glumes*** 2.5–4 × 0.5–0.8 mm, notched on one side, ovate-lanceolate, 1-keeled, 1-nerved, glabrous, with acute apex. ***Upper glumes*** 3–5.3 × 0.5–0.8 mm, elliptic-ovate, 1-keeled, 1–3-nerved, lateral nerves not prominent, apex 2-toothed, shortly aristate. ***Lemmas*** 2.8–3.2 × 0.6–0.8 mm, narrowly ovate, 2-lobed, 3-nerved, slightly keeled, and 1-awned, awns 1–2.2 mm long, scaberulous, lateral lobes membranous. ***Paleas*** 2.8–3.2 × 0.5–1 mm, elliptic-lanceolate, narrowly winged, hyaline, 2-keeled, keels ciliate, acute at apex. ***Rachilla*** 0.1–0.2 mm long, glabrous, straight or zig zag, not persistent. ***Lodicules*** 2, *c.* 0.3 mm long, slightly cordate, 3-toothed . ***Stamens*** 3; anthers 1–1.8 mm long, oblong; filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** 0.3–0.5 mm long, obovate, styles 2, slender, hyaline, 0.5–0.75 mm long; stigma 0.75–1.2 mm long, plumose, creamy white. ***Caryopses*** narrowly oblong, 1.4–2.2 × c. 0.5 mm, terete, light brown.

Flowering & Fruiting:— September–November.

Habitat & Ecology:—This species is found growing on the cliffs of moist rocks along Ghat road sides and also at high elevation grasslands. Occasionally seen in association with *Begonia malabarica* Lam., *Cholorophytum heynei* Rottl. *ex* Baker, *Chrysopogon hackelii* (Hook.f.) C.E.C. Fisch., *Eragrostis collinensis* Vivek, G.V.S. Murthy & V.J. Nair, *Impatiens* sp., *Tripogon bromoides* Roth *ex* Roem. & Schult.

Fig. 153. ***Tripogon lisboae*** Stapf: **A.** Habit; **B.** Enlarged portion of raceme; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Lemma; **G.** Palea; **H.** Stamens & pistil.

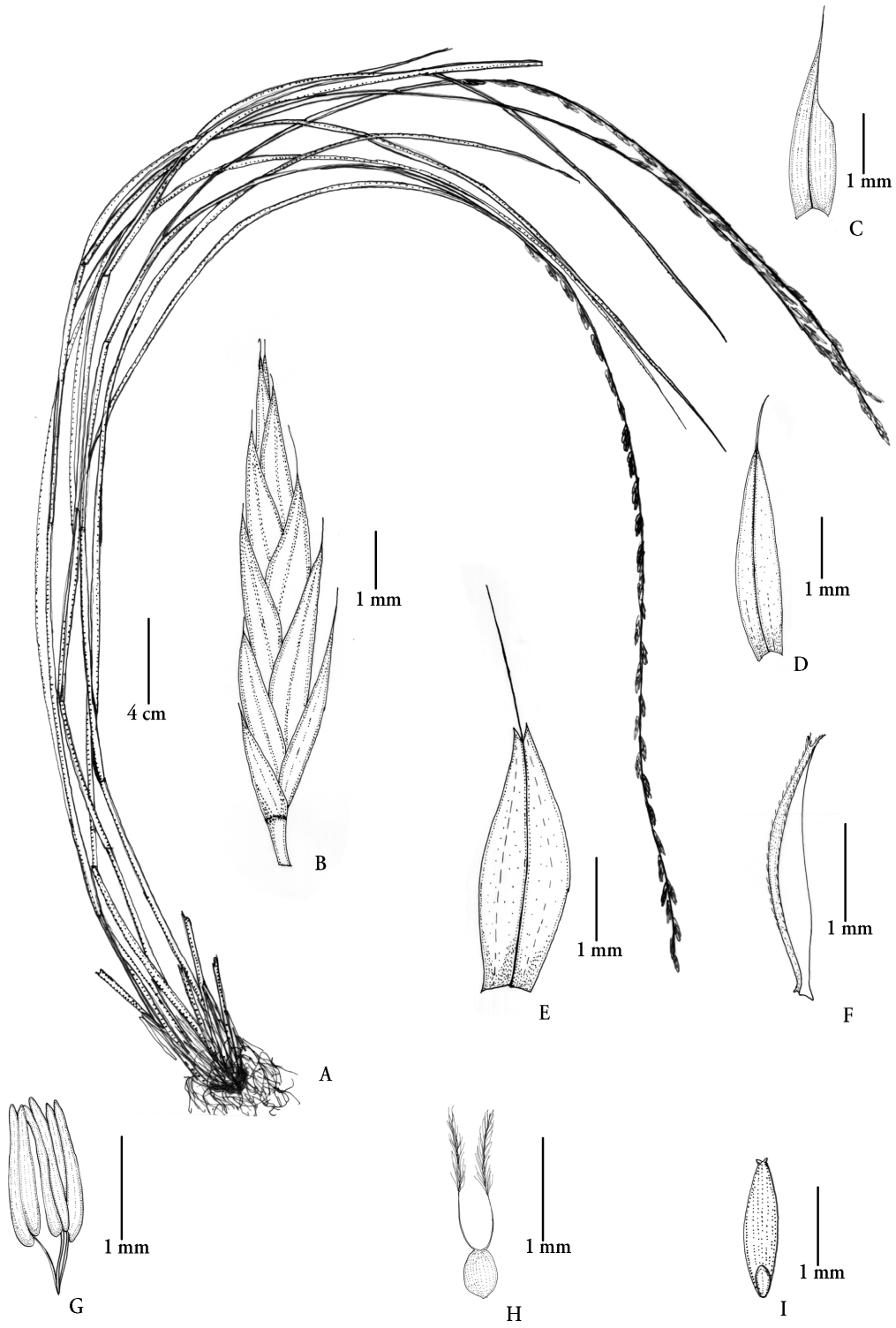


Fig. 154. ***Tripogon lisboae*** Stapf: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamens; **H.** Pistil; **I.** Caryopsis.

Distribution:—In India, fairly common in southwest region of the Peninsula.

Fig. 155. Lectotype of *Tripogon lisboae* Stapf [*J.F. Duthie 6788* (K000245015) designated by Thoiba & Pradeep, 2018] © The Board Trustees of the Royal Botanic Gardens, Kew.

Specimens examined:—India, **Goa,** North Goa Dist.: Naruja, Table land Keyna, 29 Nov. 1978, *R.K. Kochhar 157977* (BSI); Dicholi, 12 Sept. 1970, *R.K. Kochhar 154177* (BSI); Surla, Satari, 02 Oct. 2005, *Harshala Gad* & *M.K. Janarthanam 244* (Goa University Herbarium). South Goa Dist.: *s.loc.*, 11 Sept. 2016, *Syam Radh S.* & *Thoiba K. 146739* (CALI). **Karnataka,** Chikmagalur Dist.: Kudremukh National Park, 18 Sept. 2015, *Thoiba K.* & *A.K. Pradeep 144145* (CALI). Shimoga Dist.: Mookambika Wildlife Sanctuary, Park Khodachadri, 09 Sept. 2015, *Thoiba K. 144163* (CALI). **Kerala,** Idukki Dist.: way to Vagamon, 10 Oct. 2015, *Thoiba K.* & *C. Pramod 146606* (CALI). Wayanad Dist.: Periya, Gurukula Botanical Sanctuary, 22 Aug. 2015, *Thoiba K.* & *A.K. Pradeep 144144* (CALI). **Madhya Pradesh,** Hoshangabad Dist.: Pachmaxi road, Bori R.F., 06 Oct. 1960, *J. Joseph 11254* (MH). **Maharashtra,** Kolhapur Dist.: Amba Ghat, 06 Nov. 2016, *Thoiba K. 146733* (CALI); Tillari, 16 Sept. 2001, *s.coll.*, *s.n.* (SUK). Mumbai Dist.: Mumbai Hills, Thanae Range, 09 Sept. 1968, *K.V. Billore 116607* (CAL). Pune Dist.: Khandala, 20 Sept. 1902, *G.A. Gammie 15442* (BSI); Meroli, 15 Sept. 1957, *S.D.*

Mahajan 17184 (BSI); Lonavla, Ravine above Bashi Lake, 28 Sept. 1964, *B. Venkata Reddi 98796* (BSI); Bhimashankar, 30 Mar. 1957, *G.S. Puri 12598* (BSI); Kukdeshwar, 07 Oct. 2001, *S.B. Nagarkar s.n.* (AHMA); Junnar, Aie, Aug. 2007, *S.B. Nagarkar J11526* (AHMA); Vazirgarh Fort, 29 Dec. 1945, *H. Santapau 8335*; *Ibid*., 26 Dec. 1944, *H. Santapau 5648* (BLAT); Bhimashankar, 09 Oct. 1962, *K.P. Janardhanan 81740* (CAL); Rairashwar, 17 Sept. 1958, *V.D. Vartak 13860* (CAL); Sinhagad, 05 Sept. 2010, *s.coll. 3422* (CALI). Raigad Dist.: Karnala, 29 Sept. 1976, *V.D. Vartak 1126* (AHMA); Matheran, Hart Point, 08 Oct. 2003, *R.K. Singh 188778* (BSI). Ratnagiri Dist.: Amboli Ghat, Nanapuri, 31 Oct. 1969, *B.G. Kulkerni 119234* (BSI); Amboli, Mahadeogad, 09 Oct. 1970, *B.G. Kulkerni 121545* (BSI); *s.loc.*, 30 Sept. 2001, *s.coll.*, *s.n.* (SUK); *s.loc.*, *s.die.*, *M.M. Sardesai s.n.* (SUK). Sangli Dist.: Dongarwadi, 26 Jan. 2005, *Aparna Watve A00511* (AHMA). Satara Dist.: Panchgani, Oct. 1908, *E. Blatter A338* (BLAT); Mahabalaeshwar, 14 Sept. 1958, *H. Santapau 22737* (BLAT); Mahableshwar, Koyna, Tadorhi, 24 Nov. 1978, *R.K. Kochhar 157834*; *Ibid*., 05 Oct. 1957, *G.S. Puri 25639* (BSI); Carnac Point, 12 Oct. 1960, *M.Y. Ansari 67659* (BSI); On the top of Fort, Muhshi, Ambawane, 06 Sept. 1964, *B. Venkata Reddi 99051*(BSI); Mahabalaeshwar, 05 Oct. 1957, *G.S. Puri 25639* (BSI); Khandala, Sept. 1907, *A.Meebold 9121* (CAL). **Rajasthan,** Banswara Dist.: *s.loc.*, 20 Mar. 1976, *V. Singh 2913* (CAL). Churu Dist.: Ratangarh, 04 Oct. 1970, *B.M. Wadhwa 128120* (BSI). Jaipur Dist.: Devaliya, 29 Sept. 1960, *R.S. Rao 6606* (BSI). Jhalawar Dist.: s.*loc.*, 17 Sept. 1964, *B.M. Wadhwa 5405* (CAL). Jhunjhunu Dist.: Khola Hill, Sirohi, 24 Oct. 1960, *P.C. Nanda 2086* (CAL). Jodpur Dist.: Mahalkari, Manar, 17 Oct. 1906, *s.coll. 2* (BSI). Sirohi Dist.: Mount Abu, Guru Shikhar Road, 10 Nov. 1959, *S.K. Jain 660177* (BSI); On way to Devaliya, 29 Sept. 1960, *R.S. Rao 66643* (BSI). **Tamil Nadu,** Coimbatore Dist.: Lambden's Peak, 03 June 1954, *D. Daniel Sundararaj s.n.* (MH). Dindigul Dist.: Kodaikanal, Law's Ghat Road, 08 Sept. 1985, *K.M. Mathew 42249* (RHT).

Notes:—*T. lisboae* is a tough wiry species, leaves and culms green, not glaucous; blades usually flat, sometimes rolled; ligule obsolete; racemes straight or curved; awn equal or less than the lemma.

10. Tripogon longearistatus Hack. *ex* Honda, Bot. Mag. Tokyo 41:11.1927, as "*longe-aristatus*"; Lee, Manual Korean Grass. 244: 1966; Koyama, Grass. Japan & Neighbour Regions 271: 1987; Osada, Illustr. Grass. Japan 1: 466. 1989; S.L. Chen, Fl. Reipubl. Popul. Sin. 10(1): 61. 1990; S.M. Philips & S.L. Chen, Kew. Bull. 57: 920; Wu, Z.Y., P.H. Raven & D.Y. Hong, Fl. China (Poaceae) In: S.L. Chen & S.M. Philips (Eds.), Fl. China 22: 466. 2006. Enum. Pl. Corea 56: 1922. *Tripogon chinensis* (Franch.) Hack. var. *longearistatus* Hack. *ex* Honda, Bot. Mag. (Tokyo) 41: 11. 1927. **Lectotype** (designated here):—Korea, Cheju-do, Quelpaert, 1908, *Taquet 3425* (TI 00016318, image!). **Figs. 156– 158, 160**

Tripogon longearistatus Nakai, Veg. Isl. Quelpaert: 19: 147. 1914, *nom. nud.*

Tripogon coreensis (Hack.) Ohwi var. *longearistatus* Hack. *ex* T. Mori, *nom. nud.*

Tripogon longearistatus Honda var. *japonicas* Honda, Bot. Mag. (Tokyo) 41: 12. 1927. Type:— Japan, Hondo, *Ando 69* (Holotype:TI!); *Tripogon longearistatus* Honda subsp. *japonicas* (Honda) T. Koyama, Grass. Japan & Neighbour. Regions 271: 532. f. 103. 1987; *Tripogon japonicas* (Honda) Ohwi, Acta Phytotax. Geobot. 4: 63. 1935.

Tripogon panxianensis H. Peng, Acta Bot. Yunnan. 13 (2): 147. 1991. Type:—China, Guizhou, Panxian, Gesuo, Dang Cheng-Zhong 1010 (Holotype: HGAS, Isotype: YUNU).

Caespitose perennials. ***Culms*** erect, 15–30 cm high; nodes glabrous. ***Leaf blades*** 4–17 × c. 0.1 cm, linear, convolute, adaxial surface glabrous or loosely pilose, abaxial surface glabrous, acuminate or attenuate at apex. ***Leaf sheaths*** 4–10 cm long, papery, ribbed,

glabrous; ***ligules*** ciliolate membranous. ***Racemes*** terminal, 8–30 cm long, usually slightly flexous, spikelets loosely erect, distant by about their own length along the slender rachis; peduncle 5–8 cm long, glabrous. ***Spikelets*** 4.5–10.5 × 1–1.3 mm, linear-lanceolate, pale green-dark grey; 4–7(–12)-flowered, loosely arranged; callus bearded, hairs 0.5–1 mm long. ***Lower glumes*** 2.5–3 × 0.5–0.7 mm, linear-lanceolate, asymmetrical, broadened or toothed on one side, 1-keeled, 1-nerved, keels slightly scabrid, subacute or acuminate apex. ***Upper glumes*** 3.5–4.5 × 0.5–0.7 mm, lanceolate-oblong, 1-keeled, 1-nerved, apex acuminate-rostrate or emarginated and mucronate. ***Lemmas*** 2.3–3.3 × 0.5–0.8 mm (excluding awns), elliptic-lanceolate, 3-nerved, bi-dentate, central awn 3.6–8 mm long, stiff, scabrid, strongly reflexed, teeth acute, lateral veins extended into 0.2–0.4 mm long awns arising free from lemma tooth or from its outer margins, lateral awn size may be equal or not. ***Paleas*** 2–2.5 × 0.4–0.6 mm, lanceolate, hyaline, 2-keeled, narrowly winged, keels ciliolate, apex acute or bi-lobed . ***Rachilla*** 0.4–0.5 mm long, glabrous, straight or zig zag, not persistent. ***Lodicules*** 2, 0.2–0.3 mm long, dentate at apex . ***Stamens*** 1; anthers 1–1.5 mm long. ***Ovary*** 0.2–0.3 mm long; styles 2, slender, 0.2–0.3, hyaline; stigma 0.4–0.5 mm, feathery. ***Caryopses*** 1–1.6 × 0.1–0.2 mm, linear-lanceolate, cylindric, light brown.

Flowering and Fruiting:— September–December.

Habitat and Ecology:— In rocky slopes and also in river beds between 300–1500 m elevation.

Distribution:— China, India (Meghalaya), Japan and Korea.

Specimens examined:—India, **Meghalaya,** East Khasi Hills Dist.: Mawlynnong, 1496 m, 11 Oct. 2017, *Santhosh Nampy* & *Vishnu Mohan 156870a*; *Ibid.*, 11 Oct. 2017, *Santhosh Nampy* & *Vishnu Mohan 156870b,156870c, 156870d, 156870e* (CALI). **Sikkim**, West Sikkim Dist.: Tashiding, on the way to Phamerong Water falls, 29 July 2018, *Nikhil Krishna* & *Thoiba K. 159815* (CALI).

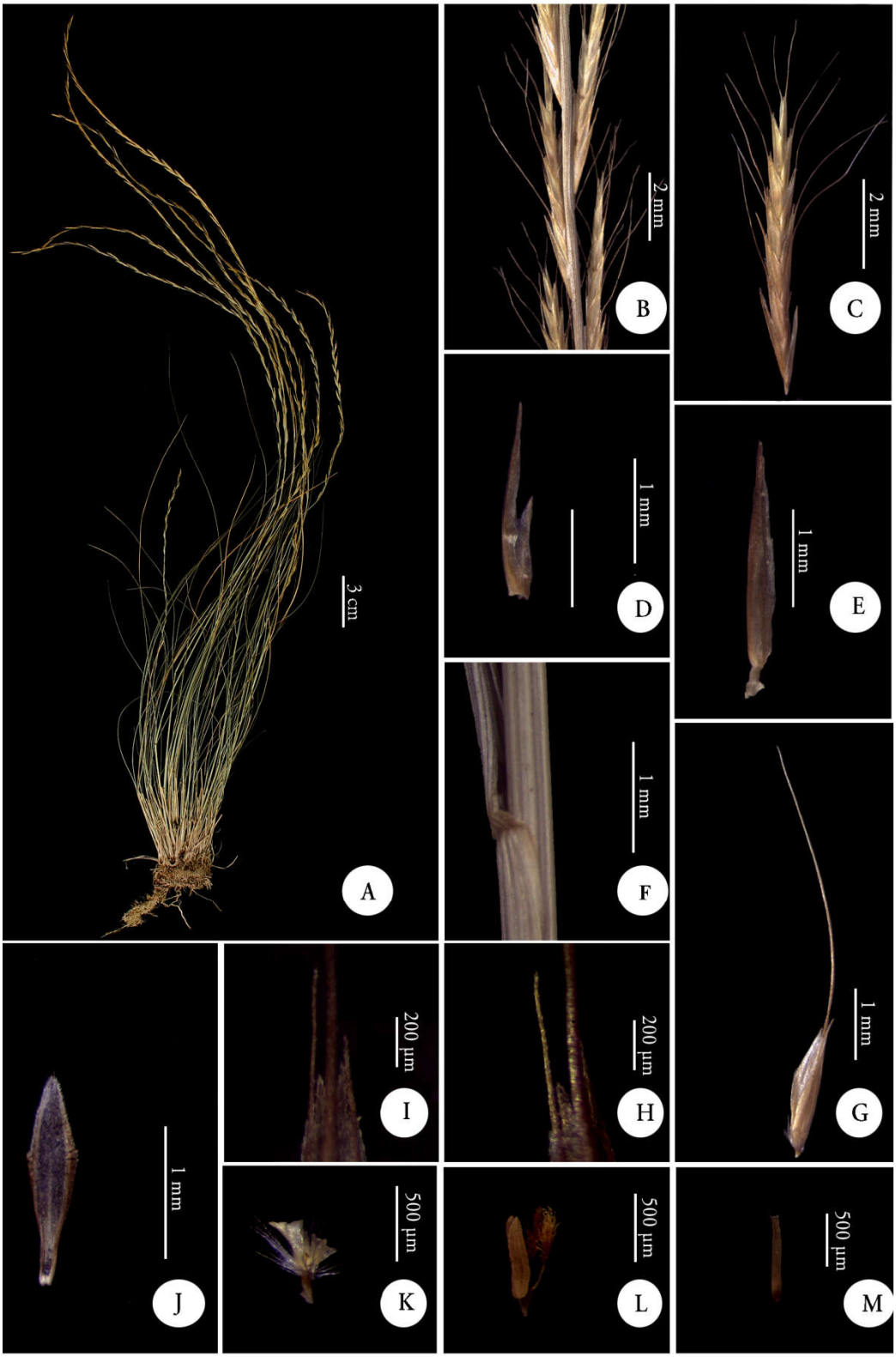


Fig. 156. ***Tripogon longearistatus*** Hack. *ex* Honda: **A.** Habit; **B.** Enlarged portion of raceme; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Ligule; **G.** Lemma; **H. & I.** Enlarged portion of lemma apex; **J.** Palea; **K.** Callus with lodicules; **L.** Stamen & pistil; **M.** Caryopsis.

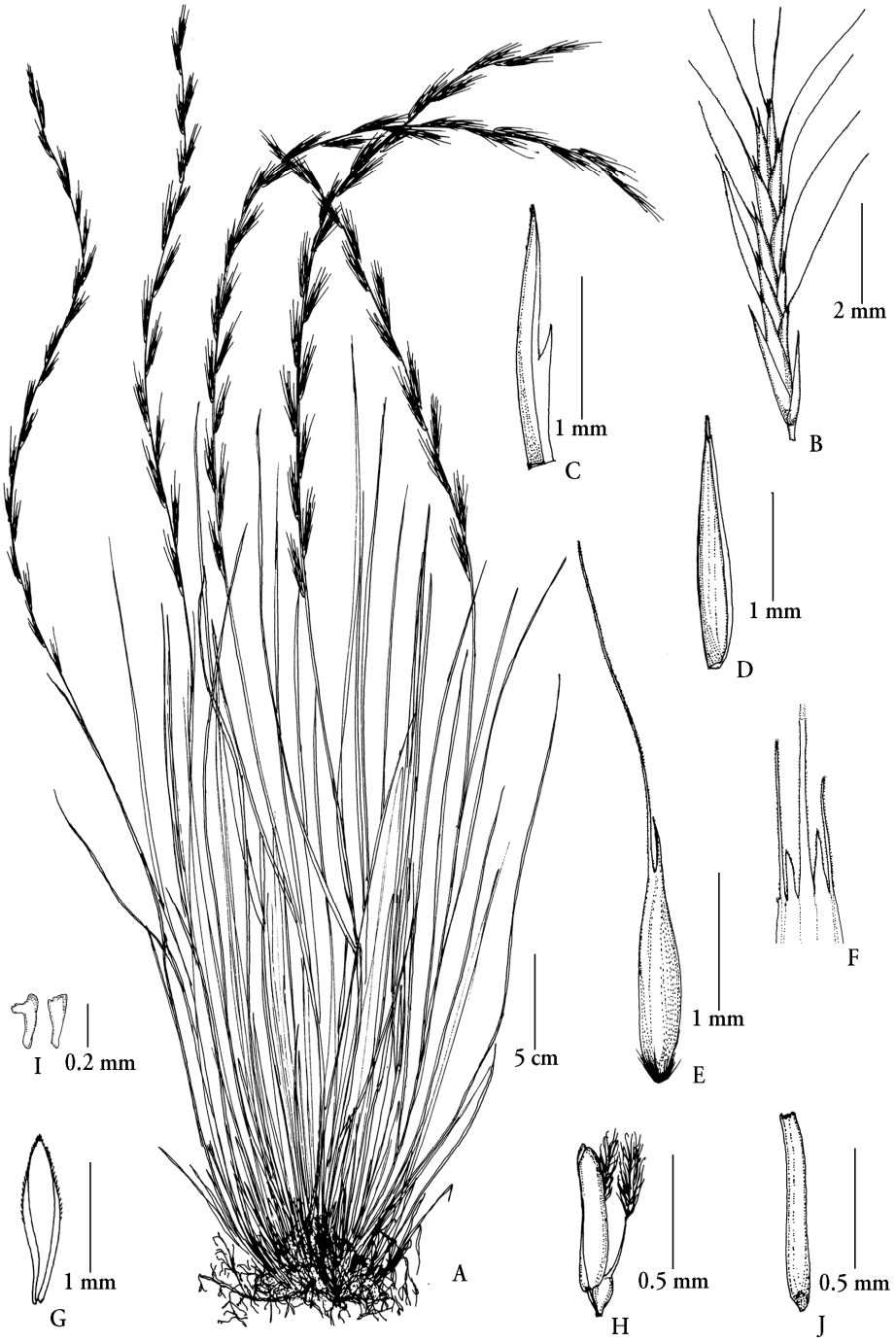


Fig. 157. ***Tripogon longearistatus*** Hack. *ex* Honda: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Enlarged portion of lemma apex; **G.** Palea; **H.** Stamen & pistil; **I.** Lodicules; **J.** Caryopsis.

Notes:—Honda (1927) described *T. longearistatus* based on specimens collected from Quelpeart (Japan, Corea). He cited three specimens "Corea: ins. Quelpaert (TAQUET, no. 1882, anno 1908); ibidem (TAQUET, no. 3425, anno 1909); ibidem (T. NAKAI, no. 4845, anno 1917). Plants endemica" simultaneously without designating the type in the protologue. According to Phillips and Chen (2002), the above mentioned syntypes are available at TI Herbarium Tokyo. While searching for the original specimens at TI, We traced two sheets consulted by Honda, while describing *T. longearistatus*. However, *Taquet 1882* was not traceable at TI. From the available materials, the sheet *Taquet 3425* with Barcode TI00016318 has the type label, and also a determination slip of M. Honda in 1925. The other sheet *Nakai 4845* with Barcode TI00016317 determined by Honda in 1925 with three specimens mounted on a single sheet without any type labels. Therefore, among these original materials from TI Herbarium, the sheet *Taquet 3425* (TI00016318!) is a well preserved specimen matching exactly with the protologue and is designated here as the lectotype of *T. longearistatus*.

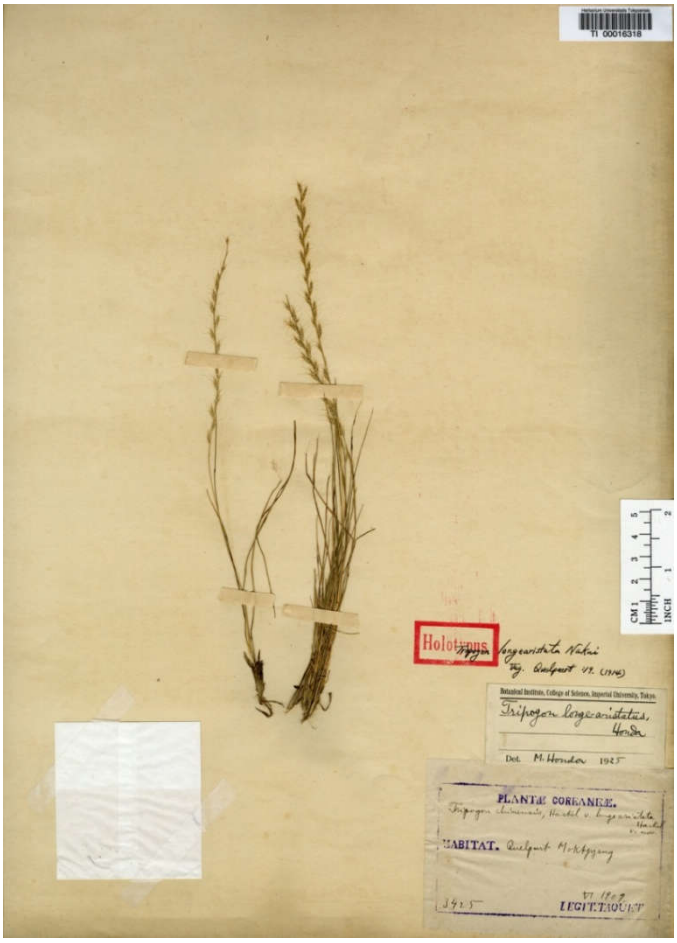


Fig. 158. Lectotype of *Tripogon longearistatus* Hack. *ex* Honda [*Taquet 3425* (TI 00016318) designated here] © University of Tokyo, Japan.

Tripogon longearistatus is closely resembles to *Tripogon filiformis* Nees *ex* Steud., but can easily be distinguished from it by its widely spaced spikelets with stiff strongly reflexed awns, lateral awns arising free from lemma tooth or from its outer margin, and a single anther. However, specimens of *T. filiformis* with laxer racemes than usual or with a tendency for the awns to reflex, and also young specimens of *T. longearistatus* with straight awns, can cause difficulty. There is little overlap in their geographical range. *Tripogon filiformis* is an upland and high altitude species, whilst *T. longearistatus* is confined to the eastern lowlands (Phillips & Chen, 2002; Chen & Phillips, 2006). Thorough examination of the protologue and type (*Royle s.n.*, K000245038 image!) of *T. filiformis* showed it as a distinct species. *T. filiformis* is characterized by its filiform, lax and villous leaves, upper glumes 2-toothed below the apex, lemmas 4-lobed, 3-awned, median awns twice as long as the lemma or more.

11. Tripogon mahendragiriensis Chorge, Sangita Dey, K. Prasad, Prasanna & Y.V. Rao in Nord. J. Bot. 33(6): 655. 2015. **Type:—**India, Odisha (Orissa) state, Gajapati Dist.: Mahendragiri Hill, 18^0 58′04.3′′N, 084^0 21′57.4′′E), 1478 m.a.s.l., 17 Sept. 2014, *Chorghe* & *Prasad 4210* (Holotype: BSID!, Isotype: CAL!). **Figs. 159, 160**

Caespitose perennials. ***Culms*** erect, 15–20 cm high; nodes glabrous. ***Leaf blades*** 4–10 × 0.05 cm, linear, filiform, sparsely covered with white hairs. ***Leaf sheaths*** 3–5 cm long, linear, glabrous; ***ligules*** ciliate, cilia 0.5 mm long. ***Racemes*** terminal, 5–10 cm long, spiciform; peduncle 7–12 cm long; spikelets arranged alternately on both sides of the raceme; rachis flat, glabrous; ***Spikelets*** 4.5–5.2 × 1 mm, linear-lanceolate, laterally compressed, 4–5-flowered with reduced florets near apex. ***Lower glumes*** 2–2.25 × *c.* 0.50 mm, linear-lanceolate, shallowly lobed on one side, 1-keeled, 1-nerved, with acuminate apex. ***Upper glumes*** 3.5–3.7 × *c.* 0.5 mm, linear-lanceolate, 1-keeled, 1-nerved, acuminate at apex. ***Lemmas*** 2.8–3.1 × 0.7–0.9 mm, lanceolate, bearded at base, 3-nerved, 1-keeled, unlobed, and 3-awned; median awn 1.8–2.2 mm long, shorter than the lemma, arising from the median nerve, lateral awns 0.5 mm long. ***Paleas*** 2.6–2.8 ×

0.6 mm, oblanceolate, hyaline, 2-keeled, keels ciliate, acute at apex. ***Stamens*** 2; anthers 1.3 mm long. Ovary 0.4 mm long, styles 2, slender, hyaline; stigma feathery. ***Caryopses*** 1.5–1.6 × 0.5–0.6 mm long, oblanceolate or oblong-elliptic, light brown.

Flowering & Fruiting:—September.

Habitat & Ecology:—It was found growing on rocks above 1400 m elevation associated with *Arundinella setosa* Trin., *Garnotia tenella* (Arn. ex Miq.) Janowski, and *Jansenella griffithiana* (C. Muell.) Bor.

Distribution:—*Tripogon mahendragiriensis* is presently known only from the Mahendragiri Hills in the Gajapati District of Odisha State.

Specimens examined:—India, **Odisha,** Gajapati Dist.: Mahendragiri Hill, 17 Sep 2014, *Chorghe* & *Prasad 4210* (BSID, CAL).

Notes:—Similar to *Tripogon humilis* and *T. purpurascens*, but differs mainly by having longer culms, leaf blades and racemes; unlobed and 3-awned lemmas with 2 anthers.

Fig. 159. Isotype of *Tripogon mahendragiriensis* Chorge, Sangita Dey, K. Prasad, Prasanna & Y.V. Rao [*Chorghe* & *Prasad 4210* (CAL0000025360)] © Botanical Survey of India, Kolkata.

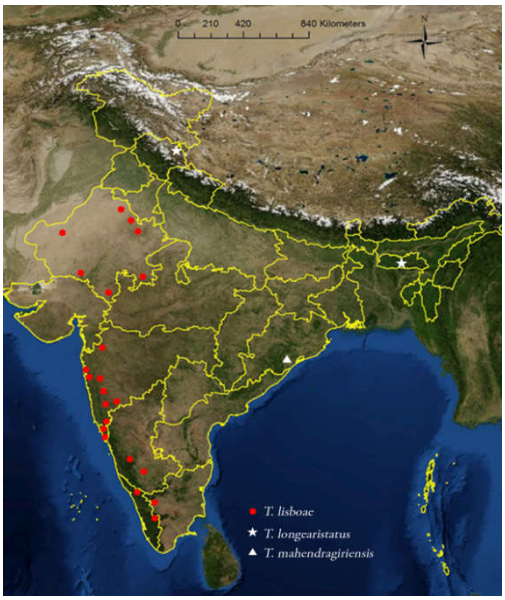


Fig. 160. Distribution of *Tripogon lisboae* Stapf (●), *T. longearistatus* Hack. *ex* Honda (☆) and *T. mahendragiriensis* Chorge, Sangita Dey, K. Prasad, Prasanna & Y.V. Rao (△)

12. Tripogon malabaricus Thoiba & Pradeep in J. Bot. Res. Inst. Texas 8(2): 523. 2014, as *"malabarica"*. **Type:—**India, Kerala, Kozhikode Dist.: Malabar Wildlife Sanctuary, Kakkayam, 990 m elev., 11^0 33.037′ N, 075^0 55.024′ E, 19 Sept. 2013, *Thoiba Kottekkattu 134436* (Holotype: BRIT, Isotypes: CAL!, CALI!, K, MH!). **Figs. 161–163, 170**

Tufted perennial herb. ***Culms*** 25–65 cm high; nodes glabrous. ***Leaf blades*** 30–70 × 0.2–0.8 cm, linear-lanceolate, flat, margins slightly scabridulous or scabrid, upper surface pubescent with short white papillose hairs, glabrous abaxially. ***Leaf sheaths*** linear-lanceolate, coriaceous, villous adaxially, 10–18 cm long, apex pubescent with a tuft of 2.5–3.5 mm long hairs at both ends; ***ligules*** indistinct. ***Racemes*** terminal, 15–40 cm long, with 30–55 spikelets; rachis stout, glabrous. ***Spikelets*** 13–14 × 1.5–2 mm long, linear, distant, dorsiventrally flattened, 4–7-flowered; callus bearded. ***Lower glumes*** 2.5–4 × 1–1.5 mm, coriaceous, ovate-lanceolate, 1-keeled, 1-nerved, keels slightly scabrid, with acuminate apex. ***Upper glumes*** 4.5–6 × 1–1.5 mm, lanceolate, coriaceous, 1-keeled, scabrid, 1–3-nerved, acute at apex. ***Lemmas*** *c.* 5 × 1.5–2 mm, ovate-lanceolate, 3-nerved, slightly keeled, scabrid; 1-awned, 3 mm long, scabrid, sometimes slightly geniculate towards apex. ***Paleas*** 3–5 × 1–1.5 mm, obovate, hyaline, 2-keeled, ciliate, apex subulate. ***Rachilla*** 1mm long, glabrous. ***Lodicules*** 2, c. 0.25–0.5 mm long, truncate apex coarsely 3-toothed. ***Stamens*** 3; anthers 1.5–2 mm long, oblong; filaments 1mm long, slender, glabrous. ***Ovary*** 0.5–0.75 × 0.25–0.5 mm, obovate, styles 2, slender, hyaline, 0.5–0.75 mm long; stigma 0.75 mm long, plumose, creamy white. ***Caryopses*** not seen.

Flowering & Fruiting:—Late July–Early November.

Habitat & Ecology:—This species grows from 950–1500 m elevation on steep granitic cliffs, road cuts and wet rocky hillsides and found growing in association with

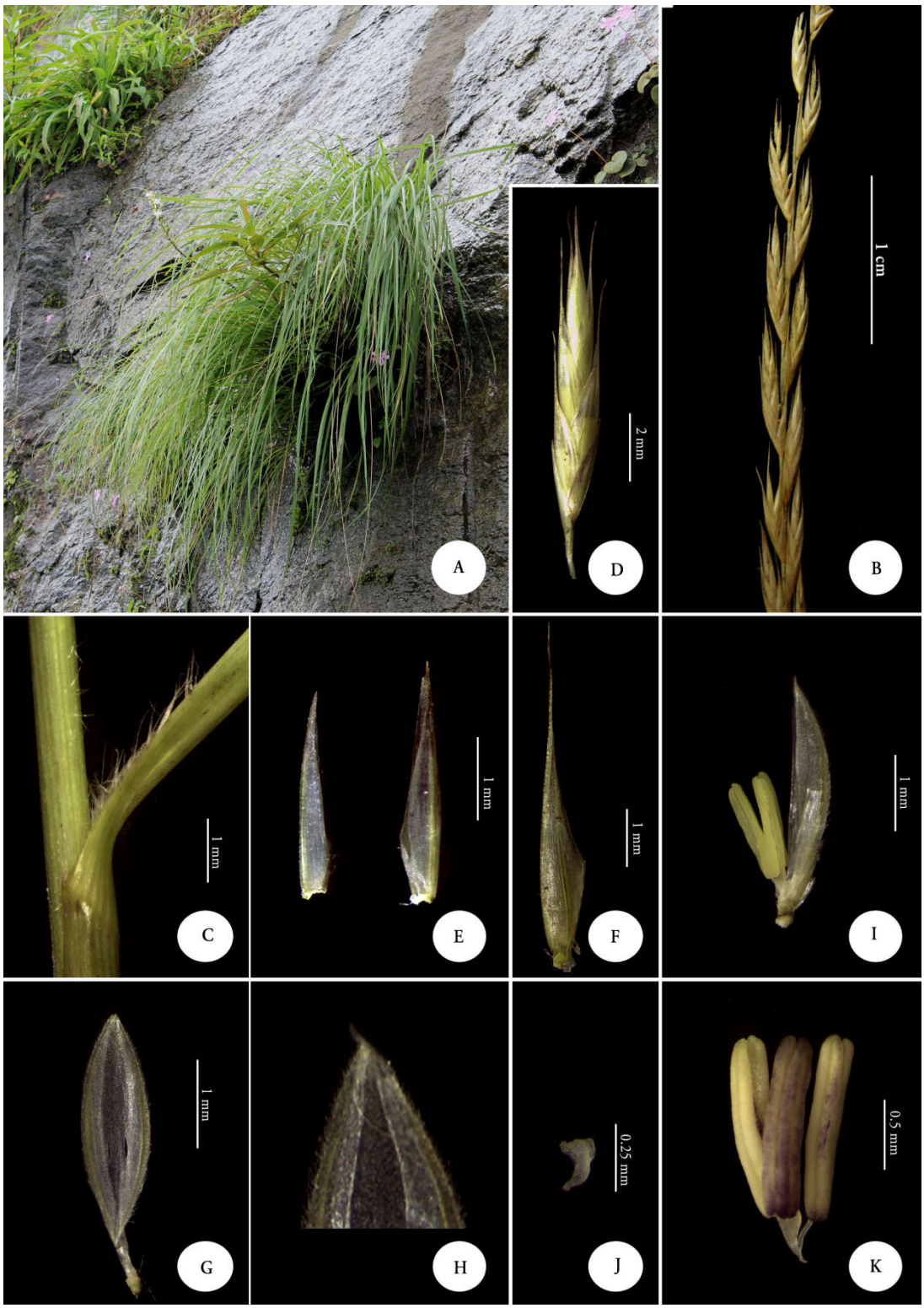


Fig. 161. ***Tripogon malabaricus*** Thoiba & Pradeep: **A.** Habit; **B.** Enlarged portion of raceme; **C.** Ligule; **D.** Spikelet; **E.** Glumes; **F.** Lemma; **G.** Palea; **H.** Enlarged portion of palea apex; **I.** Palea with flower; **J.** Lodicules; **K.** Stamen & pistil.

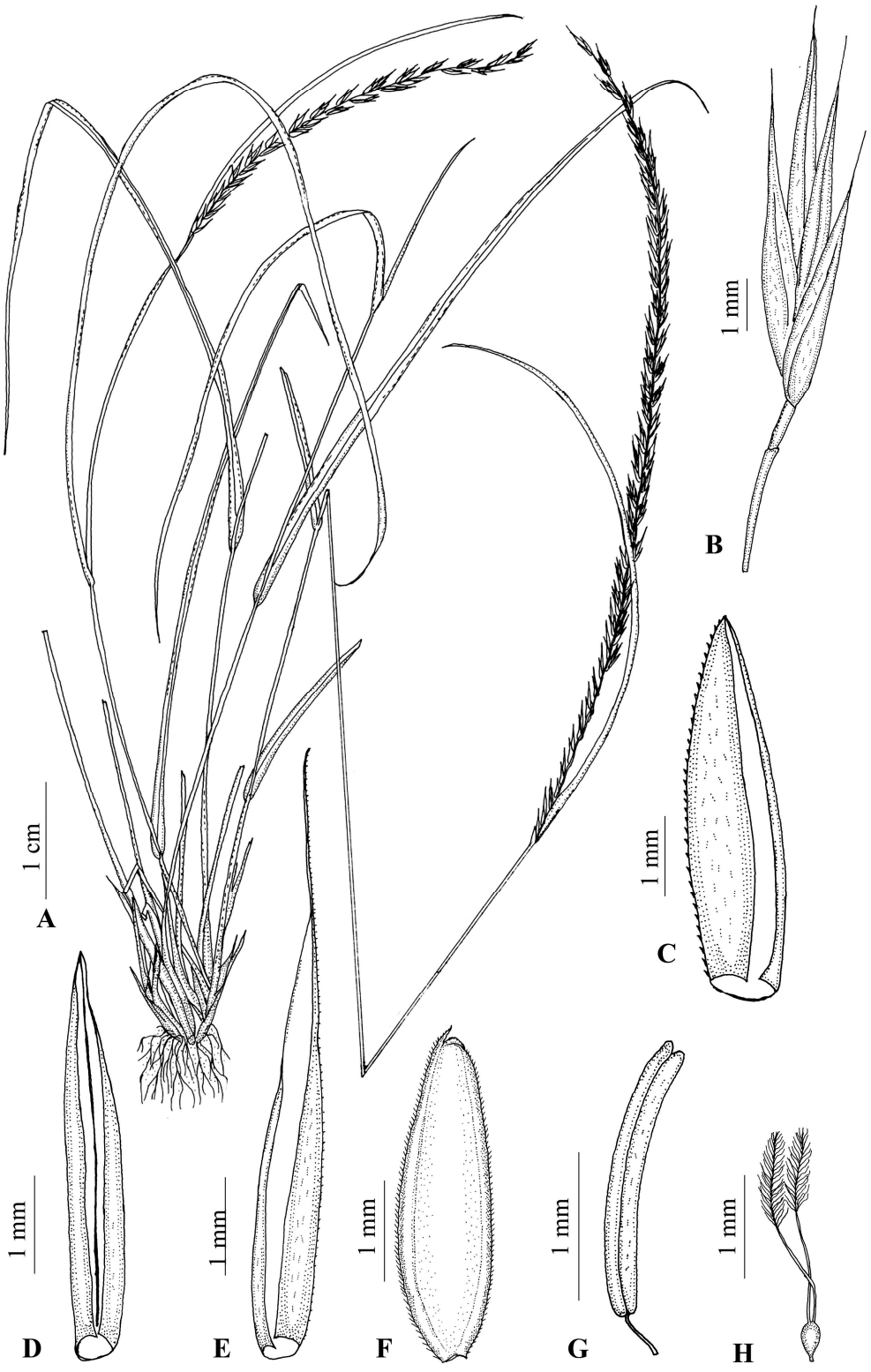


Fig. 162. ***Tripogon malabaricus*** Thoiba & Pradeep: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamen; **H.** Pistil.

Chlorophytum malabaricum Baker, *Impatiens scapiflora* Heyne *ex* Roxb., *I. gardneriana* Wight, *Kleinia grandiflora* (Wall. *ex* DC.) Rani, *Pouzolzia auriculata* Wight, *P. bennetiana* Wight, *Themeda triandra* Forssk. and *Panicum* spp.

Distribution:—Presently *Tripogon malabaricus* is known to occur only from the type locality, Malabar Wildlife Sanctuary, Kakkayam and also from adjacent hills in Kozhikode district of Kerala.

Fig. 163. Isotype of *Tripogon malabaricus* Thoiba & Pradeep [*Thoiba Kottekkattu 134436*] © Botanical Survey of India, Coimbatore.

Specimens examined:—India, **Kerala,** Kozhikode Dist.: Malabar Wildlife Sanctuary, Kakkayam, 19 Sept. 2013, *Thoiba Kottekkattu 134436* (BRIT, CAL, CALI, K, MH); *Ibid.*, 09 Nov. 2014, *Thoiba K. 137545* (CALI); Vayalada, Thalayad, Kakkayam, 16 Sept. 2017, *Nikhil Krishna* & *Thoiba K. 146746* (CALI). Malappuram Dist.: Thamburankolli, Kudaranji, 30 Oct. 2013, *Thoiba K. 134480* (CALI).

Notes:—Allied to *T. vellarianus* and *T. lisboae* but differs in having linear, coriaceous, villous leaves, 13–14 mm long spikelets with 4–7-florets; lemma with straight or geniculate, scabrid awn and keeled palea with a subulate apex.

13. Tripogon munnarensis Thoiba & Manudev, Phytotaxa 272(2): 130. 2016. **Type:**––India, Kerala, Idukki Dist.: Munnar, Udumbanchola, near Mundiyaruma, 1430 m, 16 Dec. 2014, *T. Kottekkattu* & *A.K. Pradeep 144105* (Holotype: CAL!, Isotypes: CALI!, MH!, K). **Figs. 164–166, 170**

Caespitose perennials. ***Culms*** 5–15 cm tall, erect, unbranched; nodes glabrous, slightly geniculate. ***Leaf blades*** 5–15 cm long, 1.8–2.5 mm wide, lanceolate, flat to convolute, apex minutely pungent, sparsely villous hairs on both sides, but more hairs on adaxially, margins entire. ***Leaf Sheaths*** 2–5.5 cm long, closely involute to the culm, persistent, fibrous; ***ligules*** obscure, fringed with long hairs at the ends of leaf sheath, hairs 1–2 mm long. ***Racemes*** 7–15 cm, contracted, spikelets laterally compressed, alternately arranged along both sides alternately, 14–35 spikelets per raceme; peduncle stout, glabrous, 5–10 cm long; rachis 0.5–1 cm long, stout, quadrate, glabrous. ***Spikelets*** linear-lanceolate, 10–16 × 1–2.5 mm long, 10–16-flowered, younger florets with pinkish dots; callus bearded, barbate in front at the base of the rachilla internode, hairs 1–1.5 mm long. ***Rachilla*** not persistent, 1–1.2 mm long, glabrous, slightly zig-zag. ***Lower glumes*** 1–2.7 × 0.5–1 mm, oblong-lanceolate, asymmetrical, chartaceous, 1-nerved, acute at the apex. ***Upper glumes*** 3–4.5 × 0.5–1 mm, symmetrical, elliptic-lanceolate, 1-keeled, prominentely 1-nerved, scabrid, apex 2-fid, shortly awned from the summit, awns 0.3–0.5 mm long, scabrid. ***Lemmas*** 3–3.5 × 1–1.5 mm (including awn), narrowly elliptic to ovate-lanceolate, 4-lobed, 3-nerved, 3-awned, lobes acute-acuminate, 0.3–0.5 mm long, aristate; median awn 1–1.5 mm long, scabrid, almost straight or curved; lateral awns 0.5–0.8 mm long. ***Paleas*** 1.5–3 × 0.6–2 mm, hyaline, elliptic-lanceolate, keeled and slightly winged, keels minutely ciliolate along the margins above the half, apex varying from subacute to deeply notched at the centre. ***Lodicules*** 2*, c.* 0.5–0.8 mm long, wedge-shaped, apex coarsely 3-toothed. ***Stamens*** 3; anthers 1–1.5 mm long, oblong; filaments 0.4–0.5 mm long, slender, glabrous. ***Ovary*** 0.3–0.5 mm long, obovate; style 2, slender, hyaline, 0.5–0.75 mm long; stigma 0.5–0.75 mm long, plumose. ***Caryopses*** not seen.

Flowering & Fruiting:— September–Early December.

Habitat & Ecology:—It grows on hill sides among boulders and also along the Ghat road sides at an elevation between 1000–1430 m, in association with *Chrysopogon nodulibarbis* (Steud.) Henrard, *Didymocarpus tomentosa* Wight, *Eriocaulon* spp., *Tripogon bromoides* Roth *ex* Roem. & Schult., *Tripogon sivarajanii* Sunil and mosses.

Fig. 164. ***Tripogon munnarensis*** Thoiba & Manudev: **A.** Habit; **B.** Enlarged portion of raceme; **C.** Ligule; **D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Lemma; **H.** Palea; **I.** Lodicule; **J.** Lodicules, stamens & pistil.

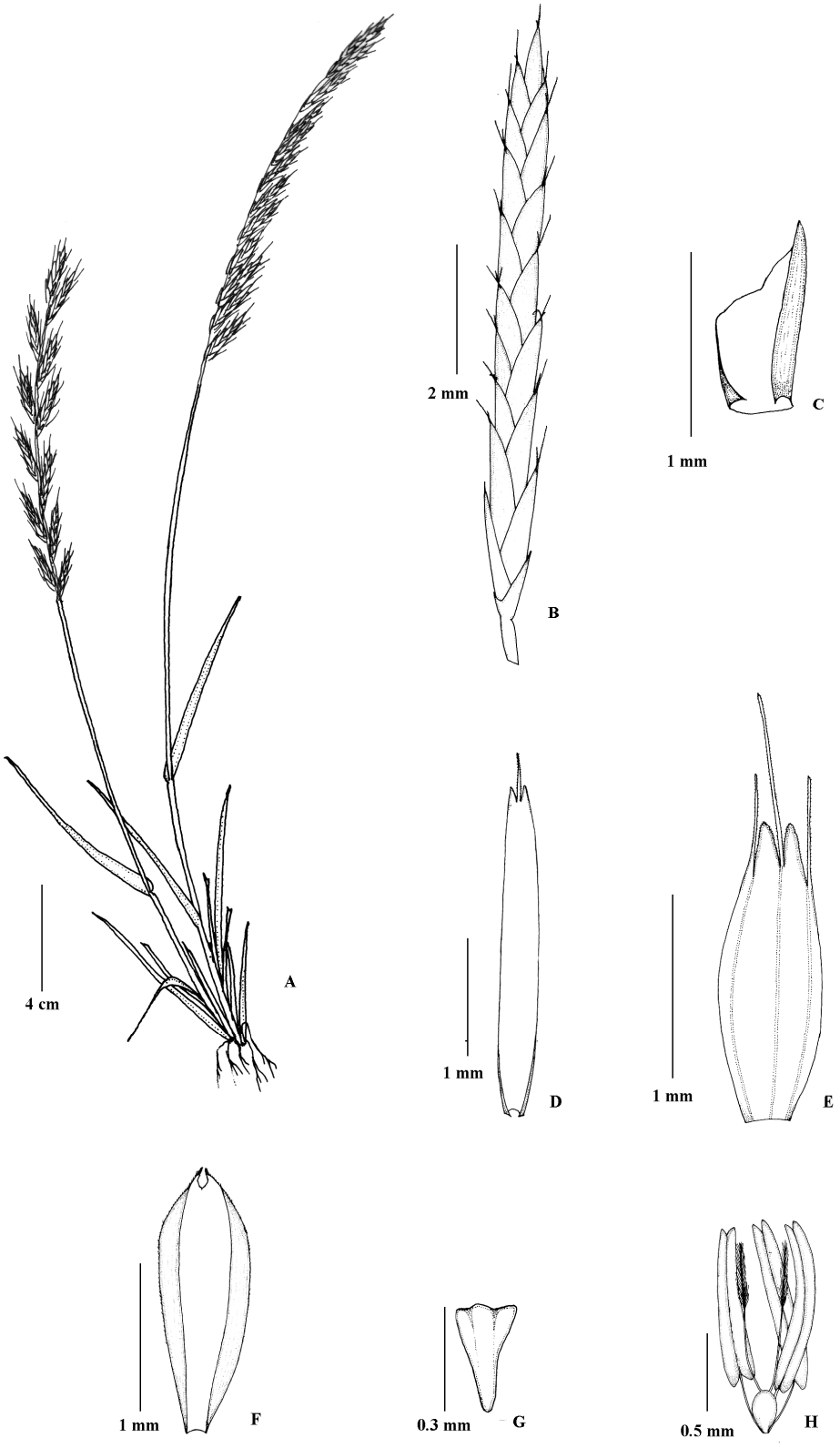


Fig. 165. ***Tripogon munnarensis*** Thoiba & Manudev: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicule; **H.** Stamens & pistil.

Distribution:—*Tripogon munnarensis* is currently known from Idukki District of Kerala, Peninsular India.

Specimens examined:—India, **Kerala,** Idukki Dist.: Kambakal Medu, Munnar, 26 Sept. 2014, *K.M. Manudev 138906* (CALI!); Munnar, Udumbanchola, near Mundiyaruma, 16 Dec. 2014, *Thoiba K., A.K. Pradeep* & *M. Yoonus T. 144105* (CAL,CALI, K, MH); Ramakkalmedu, 23 Oct. 2017, *A.K. Pradeep* & *Thoiba K. 146752* (CALI).

Fig. 166. Holotype of *Tripogon munnarensis* Thoiba & Manudev [*T. Kottekkattu* & *A.K. Pradeep 144105*] © Botanical Survey of India, Kolkata.

Notes:—*T. munnarensis* is similar to *T. narayanae*, but it differs from it is having 10–16 mm long spikelets with 10–16 florets; rachilla 0.5–0.8 mm long; apically acute asymmetrical lower glumes; 4-lobed and 3-awned lemmas with 1–1.5 mm long median awns, lateral awns 0.5–0.8 mm long, almost straight or curved.

14. Tripogon narayanae Sreek., V.J. Nair & N.C. Nair in J. Bombay Nat. Hist. Soc. 80(1): 196. 1983, as *"narayanii"*; P.V. Sreek. & V.J. Nair, Fl. Kerala Grass. 401. t. 84. 1991; S. Moulik, Grass. Bamb. India 2: 622. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 181. 2009; Sasidh., Biodiv. Doc. Kerala–Fl. Pl. 595. 2004. **Type:—**India, Kerala, Idukki Dist.: Eravikulam National Park, 2000 m, 28 Aug 1980, *P.V. Sreekumar 68412* (Holotype: CAL!, Isotypes: K, MH!). **Figs. 167–170**

Fig. 167. ***Tripogon narayanae*** Sreek., V.J. Nair & N.C. Nair: **A.** Habit; **B.** Enlarged portion of leaf blade; **C.** Ligule; **D.** Enlarged portion of raceme; **E.** Spikelet; **F. & G.** Lower glume; **H.** Upper glume; **I.** Lemma; **J. & K.** Palea; **L.** Lodicules; **M.** Stamens & pistil; **N.** Caryopsis.

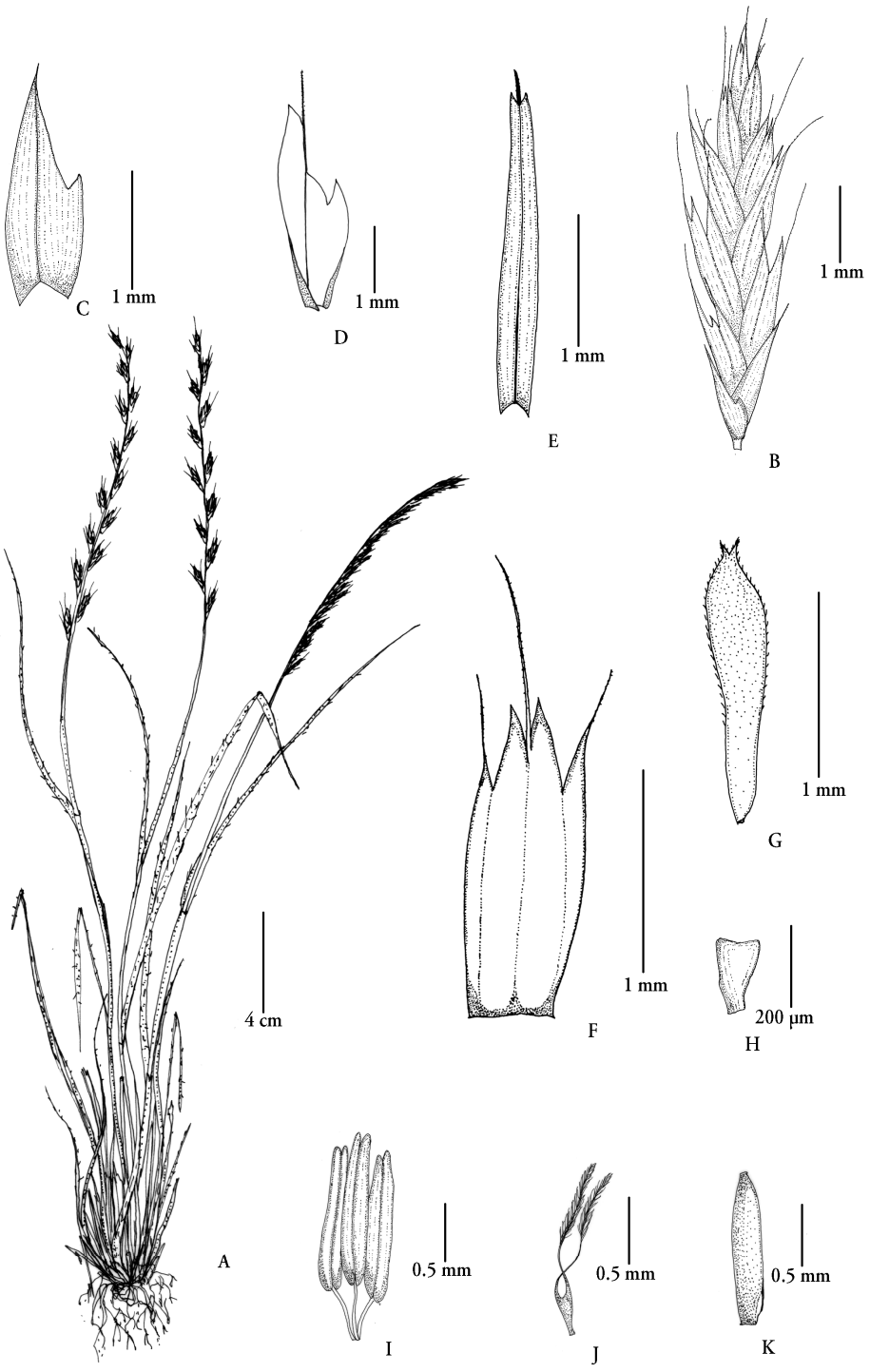


Fig. 168. ***Tripogon narayanae*** Sreek., V.J. Nair & N.C. Nair: **A.** Habit; **B.** Spikelet; **C. & D.** Lower glume; **E.** Upper glume; **F.** Lemma; **G.** Palea; **H.** Lodicule; **I.** Stamens; **J.** Pistil; **K.** Caryopsis.

Fig. 169. Isotype of *Tripogon narayanae* Sreek., V.J. Nair & N.C. Nair [*P.V. Sreekumar 68412* (MH00001654)] © Botanical Survey of India, Coimbatore.

Caespitose perennials. ***Culms*** erect, 10–25 cm high; nodes glabrous, slightly geniculate and 1 or 2 noded. ***Leaf blades*** 10–25 × 0.15–0.25 cm, linear-lanceolate, acuminate to attenuate at apex, flat-convolute, hairy along margins and both sides of the blade. ***Leaf sheaths*** 4–10 cm long, linear, hairy; ***ligules*** thin, membranous, with a ciliate rim on both ends of leaf sheaths, cilia 1–2 mm long. ***Racemes*** terminal, 6–12 cm long; peduncle 05–10 cm, glabrous; spikelets arranged alternately on both sides of the raceme and leaden grey coloured; rachis triquadrate, stout, scabrid, 2–3 mm long; ***Spikelets*** 5–10 × 2–2.8 mm long, linear-lanceolate, distant, dorsiventrally flattened, 4–6-flowered; callus bearded, hairs 1–1.2 mm long. ***Lower glumes*** 2.3–3.5 × 0.5–1 mm, notched on oneside, ovate-lanceolate, 1-keeled, 1-nerved, keels slightly scabrid, with acuminate or mucronate apex, mucro 0.3 mm long, scabrid. ***Upper glumes*** 4–5.5 × 0.5–0.75 mm, elliptic- lanceolate, 1-keeled, 1-nerved, apex dentate or shortly awned, awns 0.5–0.8 mm long at sinus. ***Lemmas*** 3.5–4 × 1–1.2 mm, ovate-lanceolate, coriaceous, 3-nerved, slightly keeled, 4-lobed and 3-awned; awns scabrid, apex straight or geniculate, median awns 1.5–3.6 mm long; lateral awns almost half the length of median, awns 0.5–2.3 mm long; lateral lobes ovate-acute, 0.3–1 mm long, margins scabrid or aristate. ***Paleas*** 2–3 × 0.5–0.75 mm, elliptic -oblanceolate, hyaline,

2-nerved, 2-keeled, keels ciliate above the halves, emarginate or 2-lobed with a minute central notch at the apex. ***Rachilla*** 2 mm long, glabrous, almost straight, and not persistent. ***Lodicules*** 2, c. 0.3–0.4 mm long, obovate, 3-lobed at apex. ***Stamens*** 3; anthers 1.3–1.5 mm long, oblong, purple tinged; filaments 1.5–2.5 mm long, slender, glabrous. ***Ovary*** 0.3–0.5 mm long, obovate, styles 2, slender, hyaline, c.4 mm long; stigma 2, *c.* 0.6 mm long, plumose, creamy white. ***Caryopses*** 1.2–1.6 × 0.3–0.4 mm, narrowly oblong, light brown.

Flowering & Fruiting:—August–October.

Habitat & Ecology:—This species is usually found growing along soil filled rock crevices, and wet areas along Ghat road sides and high elevation grasslands in association with *Arundinella ciliata* (Roxb.) Nees *ex* Miq., *Arundinella pumila* (Hochst. *ex* A. Rich) Steud., *Cyanotis tuberosa* (Roxb.) Schult.f., *Didymocarpus innominatus* Burtt, *Garnotia tenella* (Arn. ex Miq.), *Tripogon bromoides* Roth *ex* Roem. & Schult., *T. munnarensis* Thoiba & Manudev.

Distribution:—Endemic to Peninsular India.

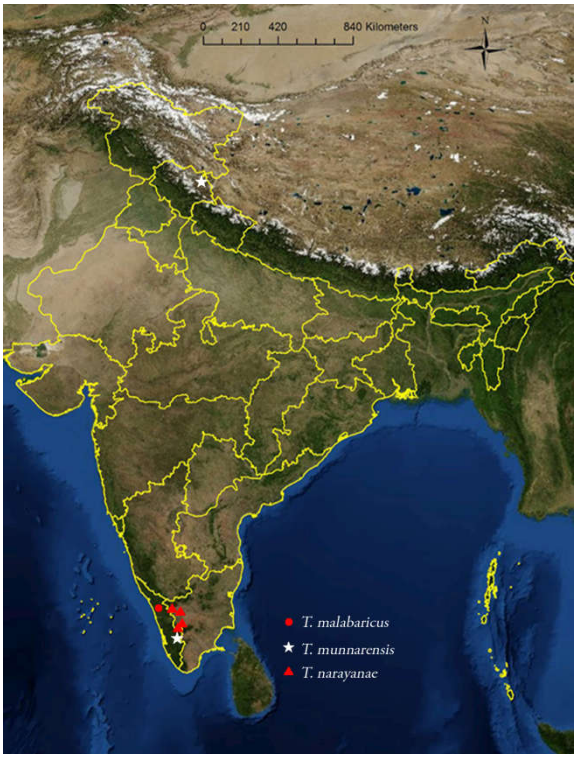


Fig. 170. Distribution of *Tripogon malabaricus* Thoiba & Pradeep (●), *T. munnarensis* Thoiba & Manudev (☆) and *T. narayanae* Sreek., V.J. Nair & N.C. Nair (▲)

Specimens examined:—India, **Kerala,** Idukki Dist.: Kanthalloor, Pius Nager, 13 Nov. 2012, *A.K. Pradeep* & *Thoiba K. 134401a*; *Ibid.*, 13 Nov. 2012, *A.K. Pradeep* & *Thoiba K. 134401b*, *134401c*, *134401d* (CALI); Kanthallur, 22 Nov. 2013, *A.K. Pradeep* & *Thoiba K.138008a*; *Ibid.*, 22 Nov. 2013, *A.K. Pradeep* & *Thoiba K.*

138008b, 138008c, *138008d* (CALI); Udumbanchola, Mundiyeruma, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 144103a*; *Ibid.*, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 144103b*, *144103c*, *144103d* (CALI); Chinnar Wildlife Sanctuary, 09 Dec. 2016, *A.K. Pradeep* & *Thoiba K. 146764* (CALI). **Tamil Nadu,** Coimbatore Dist.: Velliangiri Hills, 30 Sept. 2016, *A.K. Pradeep*, *Nikhil Krishna* & *Thoiba K. 146722*; *Ibid.*, 30 Sept. 2016, *A.K. Pradeep*, *Nikhil Krishna* & *Thoiba K. 146723* (CALI). Nilgiri Dist.: Gudallur, Suicide Point, 12 Dec. 2015, *Thoiba K. 146708* (CALI). Salem Dist.: Yercaud, Rosegarden View point, 10 Dec. 2017, *Nikhil Krishna* & *Thoiba K. 146788* (CALI).

Notes:—It resembles *Tripogon bromoides* but differs in having densely tufted villous leaves; florets 4–6; lemma 4-lobed, lateral awns half of the median awns and palea ciliate above the middle.

15. Tripogon polyanthus Naik & Patunkar in Bull. Bot. Surv. India 15: 158. 1973; S. Moulik, Grass. Bam. India 2: 623. 1997; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 563. 2012. **Type:—**India, Maharashtra, Aurangabad Dist.: Daulatabad, 18 Oct. 1973, *Patunkar 1859A* (Holotype: Marathwada University, Isotypes: BSI!, CAL!). **Figs. 171–173, 179**

Caespitose perennials. ***Culms*** terete, erect, 30–80 cm high; nodes glabrous. ***Leaf blades*** 03–10 cm long, 1–2 mm wide, linear, convolute, surface adaxially hairy and abaxially glabrous, acuminate to attenuate at apex. ***Leaf sheaths*** 1.5–6 cm long, ribbed, margins long ciliate; ***ligules*** ciliate or membranous. ***Racemes*** terminal, 10–30 cm long, spiciform; peduncle 5–13 cm, glabrous; spikelets arranged alternately on both sides of the raceme and yellowish or purple tinged in colour; rachis stout, glabrous or scabridulose, 0.5–1.5 cm long; ***Spikelets*** 2–6.5 × 0.1–0.2 cm, linear, 20–60-flowered; callus bearded, hairs 0.5–1mm long. ***Lower glumes*** 3–3.5 × 0.5–0.75 mm, notched on oneside, ovate-lanceolate, 1-keeled, 1-nerved, keels slightly scabrid, apex mucronulate.

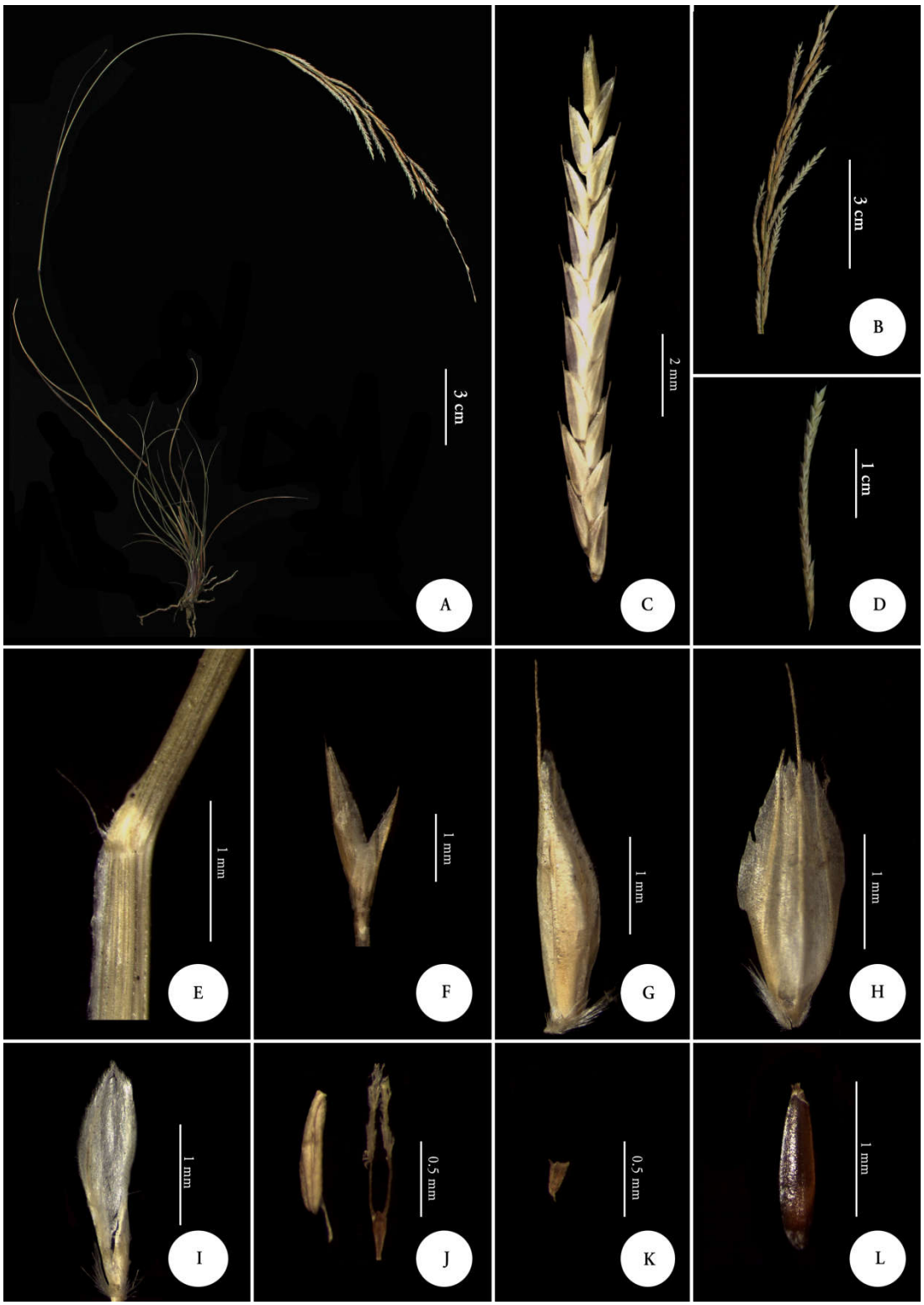


Fig. 171. ***Tripogon polyanthus*** Naik & Patunkar: **A.** Habit; **B.** Enlarged portion of raceme; **C. & D.** Spikelet; **E.** Ligule; **F.** Glumes; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Stamen & pistil; **& K.** Lodicule; **L.** Caryopsis.

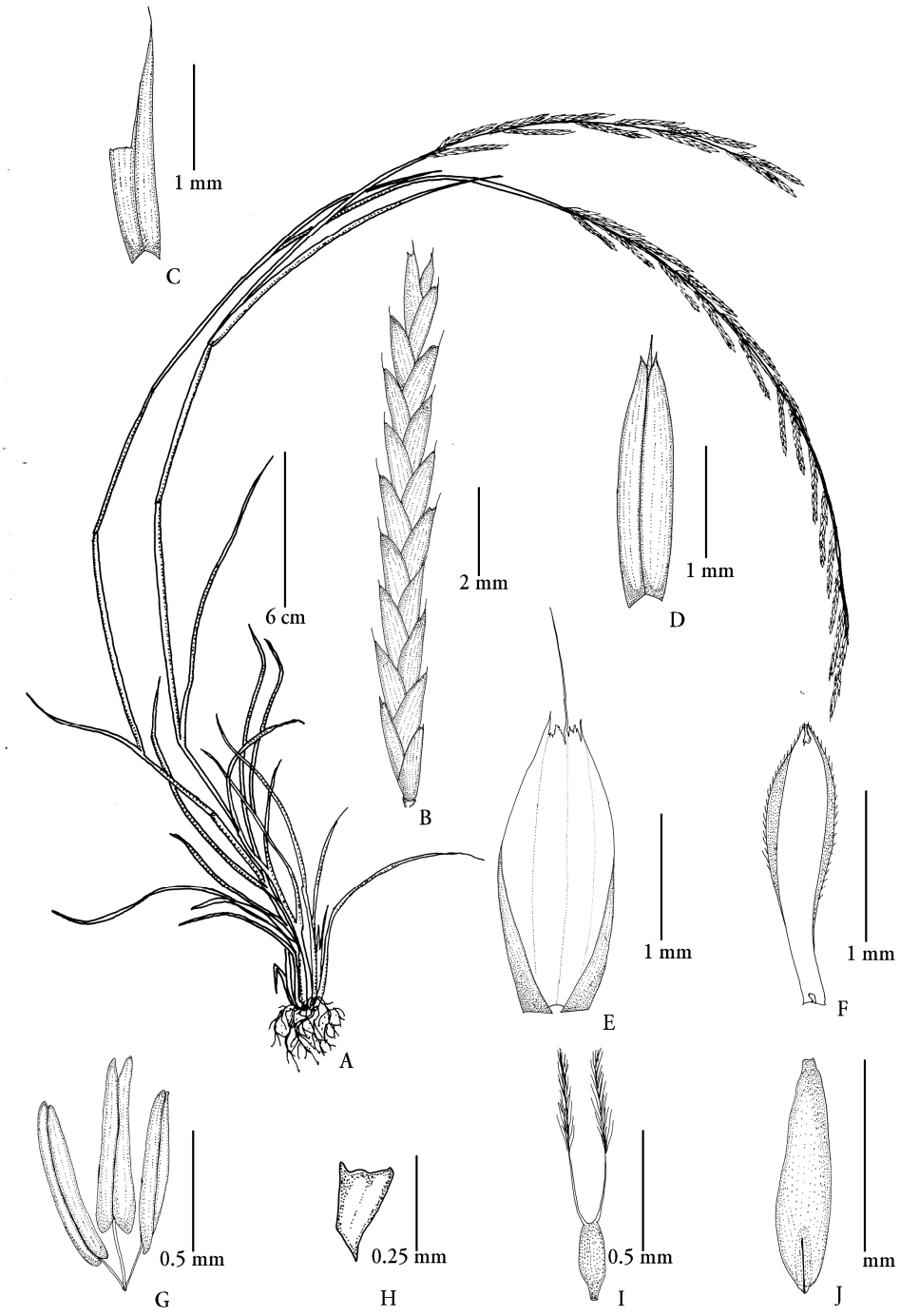


Fig. 172. ***Tripogon polyanthus*** Naik & Patunkar: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamens; **H.** Lodicule; **I.** Pistil; **J.** Caryopsis.

Upper glumes 3.5–4.5 × 0.75–1 mm, linear-lanceolate, 1-keeled, 1-nerved, apex mucronate, mucro 0.5 mm long. ***Lemmas*** 3.5–4 × 0.6–1 mm (excluding awn), ovate-lanceolate, 3-nerved, 1-awned, 2-lobed, lobes ciliate or sometimes minutely awned, median awns 1–2 mm long, scabrid. ***Paleas*** 3–4.25 × 0.8–1.25 mm, obovate-lanceolate narrowly winged, hyaline, 2-keeled, keels ciliate, acute at apex. ***Rachilla*** 1–1.2 mm long, scabridulose. ***Lodicules*** 2, 0.5–0.7 mm long, slightly cordate . ***Stamens*** 3; anthers 1–1.6 mm long, oblong; filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** 0.3–0.5 mm, obovate, styles 2, slender, hyaline, 0.5–0.75 mm long; stigma 0.75–1 mm long, plumose, creamy white. ***Caryopses*** narrowly oblong-lanceolate, 1.4–1.8 × 0.2–0.3 mm, light brown.

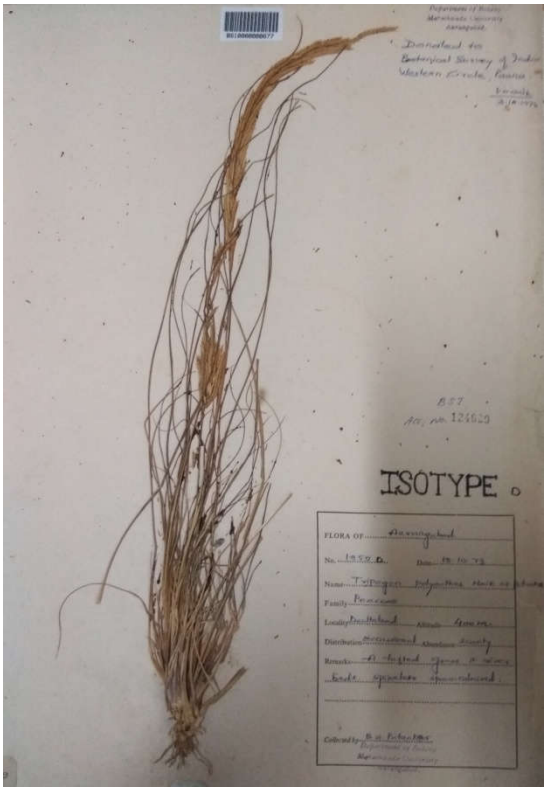


Fig. 173. Isotype of *Tripogon polyanthus* Naik & Patunkar [*Patunkar 1859A* (BSI0000 000677)] © Botanical Survey of India, Pune.

Flowering & Fruiting:—August –October.

Habitat & Ecology:—This species is generally found growing in open situations along dry river banks in association with *Aristida funiculata* Trin. & Rupr., *Cynodon dactylon* (L.) Pers., *Chrysopogon polyphyllus* (Hack.) Blatt. & McCann, *Digitaria annua* Van der Veken, *Eragrostis amabilis* (L.) Wight & Arn., *Tridax procumbens* L.

Distribution:—*Tripogon polyanthus* shows a narrow distribution. It is hitherto known only from a few localities in Maharashtra State.

Specimens examined:—India, **Maharashtra,** Aurangabad Dist.: Daulatabad, 400 m, 18 October 1973, *B.W. Patunkar 1857a* (BSI, CAL). Nandurbar Dist.: Tapi River Bed, Prakasha, Shahada, 15 Nov. 2016, *K.V.C. Gosavi* & *Thoiba K. 146747a*; *Ibid.,* 15 Nov. 2016, *K.V.C. Gosavi* & *Thoiba K. 146747b*, *146747c* (CALI). Pune Dist.: Sinhagad, *s.die.*, *Manudev* & *Santhosh Nampy 3429* (CALI).

Notes:—Closely similar to *T. jacquemontii,* but differs in having much longer many-flowered spikelets which are rather divaricate, more loose and straw-coloured and the lemmas being 2-fid at apex.

16. Tripogon pungens C.E.C. Fisch. in Bull. Misc. Inform. Kew 1934 (4): 170. 1934 & in Gamble, Fl. Madras 3: 1834: 1934; Bor, Grass. Burma Ceylon India Pakistan 522. 1960; S. Moulik, Grass. Bam. India 2: 623. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 180. 2009; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 564. 2012. **Type:—**S. Coimbatore Dist.: Punachi, Anaimalais Hills, 3500 ft, 10 Oct. 1901, *C.A. Barber 3717* (Holotype: K000245044, image!), Isotype: MH!). **Figs. 174–176, 179**

Tripogon paramjitianus Murugesan, Arum., & Kabeer **syn. nov.**, Indian J. Forest. 40 (3): 285. 2017. Type:—India, Tamil Nadu, Velliangiri Hills, Western Ghats, 22 Nov. 2014, *Murugesan 302 A* (Holotype & Isotype: MH!).

Densely tufted perennials. ***Culms*** branching, upto 20 cm high; thickened with the imbricating old leaf sheaths, slender, wiry and usually long exerted above; nodes concealed by the sheaths. Leaves mostly near the base, equitant, coriaceous; ***Leaf blades*** 1–5 cm, convolute or involute, rigid, pungent, often curved, glabrous abaxially, 6–8 ribbed and minutely hispidulous adaxially. ***Leaf sheaths*** 5–10 mm long, imbricate, striate; ***ligules*** represented by a minutely hairy ridges. ***Racemes*** numerous, terminal, 3–8 cm long, erect or curved, 15–35 spikelets; peduncle 5–15 cm long, glabrous; spikelets arranged alternately on both sides of the raceme; rachis narrow; ***Spikelets*** 2–6 × 1–1.5 mm, narrowly ellipsoid, 3–9-flowered. ***Lower glumes*** 2–3 × 0.5–1 mm, membranous,

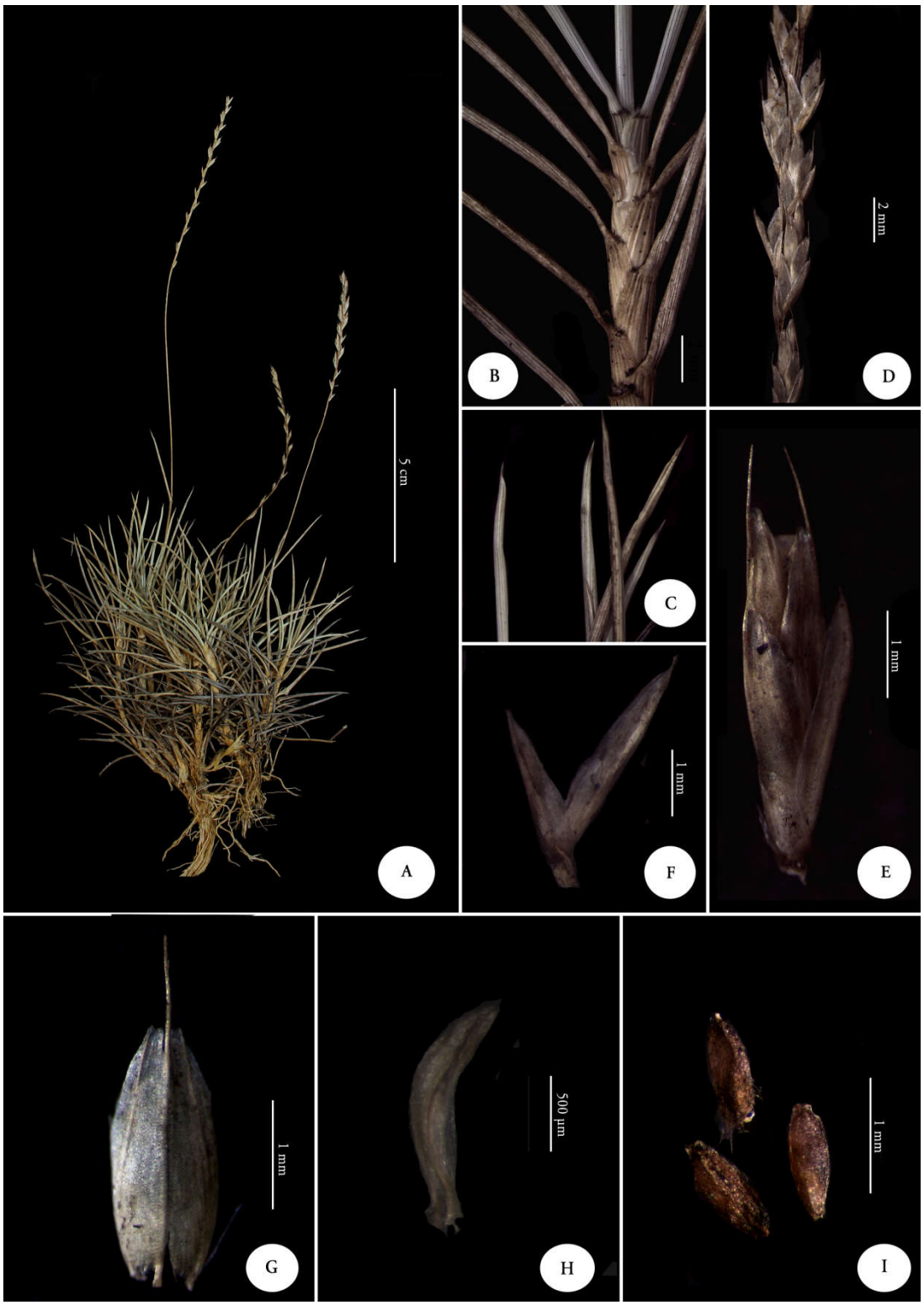


Fig. 174. ***Tripogon pungens*** C.E.C. Fisch.: **A.** Habit; **B.** Enlarged portion of leaf sheath; **C.** Enlarged portion of leaf blade apex; **D.** Enlarged portion of raceme; **E.** Spikelet; **F.** Glumes; **G.** Lemma; **H.** Palea; **I.** Caryopsis.

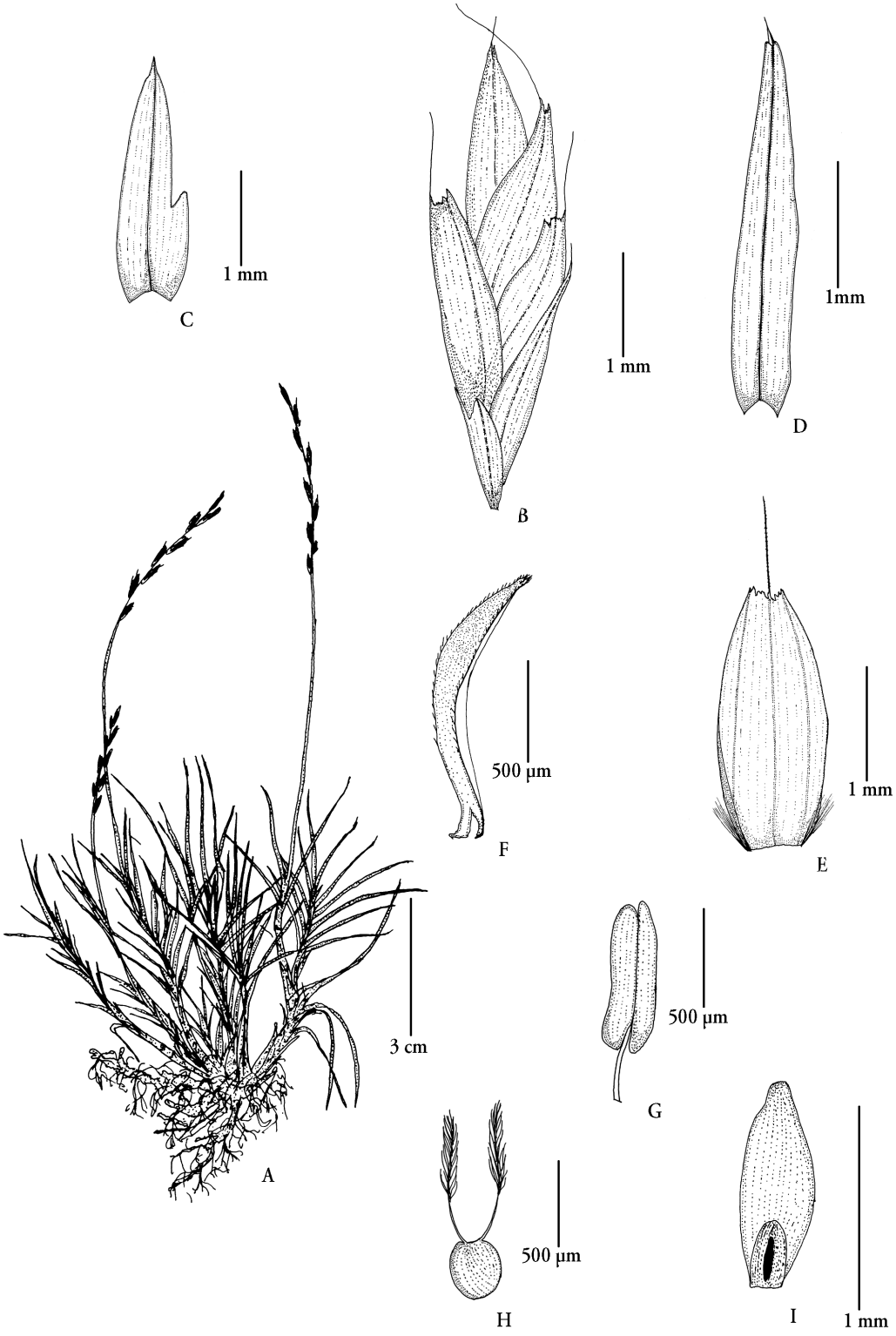


Fig. 175. ***Tripogon pungens*** C.E.C. Fisch.: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamen; **H.** Pistil; **I.** Caryopsis.

with a large lobe on one side, each lobe with a single nerve, obtuse (sometimesthe glume completely divided into two sub equal parts). ***Upper glumes*** 2.8–4 × 0.5–1 mm long, oblong, acute or notched, strongly 1-ribbed, back rounded or more or less keeled. ***Lemmas*** 1.5–2.5 × 0.8–1.5 mm (excluding awn), upper lemmas gradually smaller, broadly ovate, obtuse, 3-nerved, base bearded, apex shortly 2-lobed, lobes obtuse, bearing an arista or awn from the sinus, arista 0.6–1.2 mm long. ***Paleas*** 2–2.2 × 0.5–0.8 mm, oblanceolate, 2-keeled, keels ciliolate, obtuse, complicate at apex.

Fig. 176. Isotype of *Tripogon pungens* C.E.C. Fisch. [*C.A. Barber 3717* (MH00002624)] © Botanical Survey of India, Coimbatore.

Rachilla 0.6–1 mm long, terete, more or less hairy, disarticulating at the base of each floret. ***Lodicules*** 2, narrowly obcuneate, 0.1–0.2 mm long, truncate. ***Stamens*** 3; anthers 1 mm long, oblong; filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** minute, subglobose, styles 2, distant at the base. ***Caryopses*** 0.2–0.5 × 0.5–1 mm, oblong, cylindrical, light brown.

Flowering & Fruiting:—September–November.

Habitat & Ecology:—This species grow among rocks with the lower part of the stem in rock crevices of high elevation grasslands. It is found in association with *Aeschynanthus perrottetii* A.D.C., *Arundinella mesophylla* Nees ex steud., *Eriocaulon* sp., *Desmodium styracifolium* (Osbeck) Merr., *Jansenella grifithiana* (C. Muell.) Bor, *Tripogon bromoides* Roth *ex* Roem. & Schult. and *Utricularia praeterita* P. Taylor.

Distribution:—Rare, endemic to to South India.

Specimens examined:—Kerala, Idukki Dist.: Pothadi, Marayoor, 26 Jan. 2018, *Dani Francis* & *Thoiba K. 146796*; *Ibid.*, 26 Jan. 2018, *Dani Francis* & *Thoiba K. 158302* (CALI). **Tamil Nadu,** Coimbatore Dist.: Punachi, Anaimalais Hills, 10 Oct. 1901, *C.A. Barber 3717* (MH). Dindigul Dist.: *s.loc.*, *s.die., s.coll. 50215* (RHT).

Notes:—*T. paramjitianus* was described by Murugesan *et al.* (2017) from Velliangiri Hills in Tamil Nadu. The authors distinguished their new species from *T. pungens* based on its size of leaf blades; lobes of glumes and number of florets in the spikelets. *T. pungens* is unique in having thickened culms by persistent leaf sheaths and leaves being equitant, rigid and pungent. An examination of *T. pungens* in the field also shows its leaves not as much pungent in the young stage and racemes not much more extended from the leaves, while characters such as size of spikelets, shape and number of lobes in glumes, size of awns in lemma and size of anthers appears variable and cannot be taken for distinguishing species.

The present authors have thoroughly studied the type of *T. paramjitianus* (*Murugesan 302A* MH!) and other specimens from Kerala and Tamil Nadu, and prefer to consider it as conspecific with *T. pungens,* hence the former is treated in the synonymy of *T. pungens*.

17. Tripogon purpurascens Duthie in Ann. Roy. Bot. Gard. (Calcutta) 9: 74. t. 92. 1901; Bor, Grass. Burma Ceylon India Pakistan 522. 1960; S. Moulik, Grass. Bam. India 2: 623. 1997; S.M. Philips & S.L. Chen, Kew Bull. 57(4): 913. 2002; Veldkamp & S.M. Phillips, Blumea 48: 493. 2003. **Holotype:—**Western Himalaya, Tehri-Garhwal Dist.: Tons valley, 4–5000 ft, 5 May 1927, *Duthie 23532* (B100279879, image!). **Figs. 177–179**

Festuca filiformis Nees ex Steud., Syn. Pl. Glumac. 1: 302. 1854. *non* Pourr. 1788.

Tripogon abyssinicus Hook.f., Fl. Brit. Ind. 7: 287. 1896. *non* Nees 1854.

Tripogon jacquemontii var. *submuticus* Hook.f., Fl. Brit. Ind. 7: 287. 1896. Type:—India, Simla, Aug. 1889, *Duthie 10149* (K000245021, image!).

Tripogon hookerianus Bor *nom. inval.*, Grass. Burma Ceylon India Pakistan 522. 1960. Lectotype (designated by Teerawatananon & Sungkaew 2012):—N.W. Himalaya, Hazara Dist.: Kagan Valley, 8000 ft, 24 July 1896, *Duthie 20364* (K000245025, image!).

Caespitose perennials, purple tinged. ***Culms*** 4–18 cm high, erect, sub-erect or ascending, slender, purplish, reddish-brown to green; nodes glabrous. ***Leaf blades*** 1.7–8 × 0.07–0.2 cm, filiform, convolute, margins entire, densely pilose adaxially and glabrous abaxially, acuminate at apex. ***Leaf sheaths*** 2–4 cm long, linear, persistent with remnants of culm bases of previous years, inrolled to the culm; ***ligules*** membranous, ciliate. ***Racemes*** solitary spike like raceme, 3–15 cm long, straight or arcuate, spikelets arranged alternately on both sides of the racemes, purplish coloured; peduncle 7–11 cm, glabrous; rachis angular; ***Spikelets*** 2.5–7 × 0.4–0.5 mm long, oblong-elliptic, distant, laterally compressed, 2–4(-5–8)-flowered, with diminished sterile floret at the apex, disarticulation of florets from above glumes and in between florets; callus bearded. ***Lower glumes*** oblong-lanceolate, 1.5–3 × 0.5–0.7 mm, notched on oneside, 1-keeled, 1-nerved, keels slightly scabrid, with acute apex. ***Upper glumes*** elliptic-lanceolate, (2–)2.6–4.5 × 0.5–1mm, 1-keeled, 1-nerved. ***Lemmas*** elliptic, 2–4.5 × 1–1.2 mm, membranous, keeled, bi-fid, 3-nerved, median nerve reaching upper as a small point. ***Paleas*** 2–4 × 0.8–1 mm, obovate to elliptic, winged, surface pubescent, 2-keeled, ciliate along the margins, obtuse or emarginated at apex. ***Rachilla*** glabrous, almost straight, not persistent. ***Lodicules*** 2, c. 0.3–0.4 mm long, truncate. ***Stamens*** 3; anthers 1–1.2 mm long, oblong; filaments 0.3–0.5 mm long, slender, glabrous. ***Ovary*** 0.3–0.4 × c. 0.25 mm, obovate; styles 0.7–1.2 mm long, slender, hyaline; stigma 1.2–1.3 mm long, plumose, creamy white. ***Caryopses*** 0.5–1.2 × 0.2–0.3, linear-lanceolate, light brown.

Fig. 177. ***Tripogon purpurascens*** Duthie: **A.** Enlarged portion of raceme; **B.** Ligule; **C.** Spikelet; **D.** Lower glume; **E.** Upper glume; **F.** Lemma; **G.** Palea; **H.** Lodicule; **I.** Stamen; **J.** Pistil.

Flowering & Fruiting:—June– September.

Habitat & Ecology:—This species restricted to open moist, rocky areas and open grassy slopes between 3150–3200 m.

Specimens examined:—India, **Andhra Pradesh,** Nellore Dist.: Veligonda, July 1914, *M.S. Ramaswami 1417* (CAL). **Kashmir,** Ganderbal Dist.: Sind Valley, 24 June 1892, *J.F. Duthie 11457* (CAL); *s.loc.*, *s.die.*, *R.B. Majumder 670* (CAL). **Madhya Pradesh,** Rewa Dist.: Nawagaon, 21 Aug. 1954, *K. Subramanyam 8565* (CAL). **Maharashtra,** Chandrapur Dist.: Devada Forest Camp, 20 Aug. 1970, *B.M. Wadhwa 137425* (BSI). **Rajasthan,** Jaipur Dist.: Gopalpura, 17 July 1976, *G.P. Roy 2679* (CAL); University Campus, *s.die.*, *Y.D. Tiagi 9* (CAL). *s.loc.*, *s.die.*, *Griffith 6644* (CAL). *s.loc.*, Sept. 1964, *Braun 3138* (CAL).

Notes:—*T. purpurascens* unique in having all parts with a purplish tinge; racemes slender; spikelets (2–)4 –6(–8)-flowered; lemma 2-lobed, mucronate, mucro arising from the midrib sinus and lateral lobes unawned.

Fig. 178. Holotype of *Tripogon purpurascens* Duthie [*Duthie 23532* (B100279879)] © The Board Trustees of the Museum Botanicum Berolinense, Berlin, Germany.

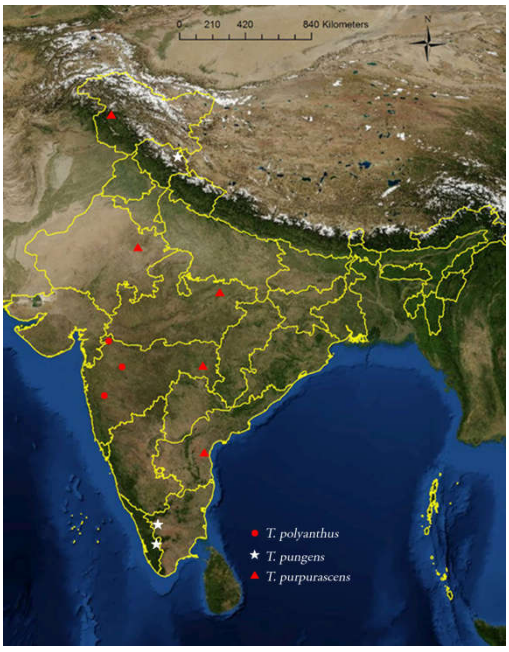


Fig. 179. Distribution of *Tripogon polyanthus* Naik & Patunkar (●), *T. pungens* C.E.C. Fisch. (☆) and *T. purpurascens* Duthie (▲)

18. Tripogon ravianus Sunil & Pradeep in Sida 19 (4): 803. 2001; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 182. 2009. **Type:—**India, Tamil Nadu, Nilgiri Dist.: Pykara near Udagamandalam, 1990 m, 3 Dec. 2000, *Sunil 2176* (Holotype: BRIT, Isotypes: CAL!, CALI!, K, L, NY). **Figs. 180–182, 189**

Tripogon bromoides Roth *ex* Roem. & Schult. var. *major* Stapf *ex* Hook.f., **syn. nov.**, Fl. Brit. India 7: 288. 1896, non *T. major* Hook.f., J. Proc. Linn. Society VI: 230. 1864. (**Lectotype** designated here)**:—**India, Nilgiri Hills, Naduvattum, 6000 ft, Nov. 1888, *Lawson 35*, (K, K000907448!).

Plants caespitose perennials. ***Culms*** erect. 24–70 cm high; nodes glabrous, slightly geniculate. ***Leaf blades*** 3–35 × 0.2–0.4 cm, linear-lanceolate, flat-convolute, sparsely hairy and scabrid adaxially, glabrous abaxially, margins scabrid especially towards base, acuminate to attenuate at apex. ***Leaf sheaths*** 3–10 cm long, linear, glabrous or hairy, ribbed, persistent; ***ligules*** a fine membrane with tuft of 1–4 mm long hairs. ***Racemes*** terminal, 15–35 cm long, with 18–48 spikelets, leaden green in colour; peduncle 4–12 cm long, glabrous; spikelets arranged alternately on the rachis; rachis stout, smooth, glabrous and 4–7 mm long. ***Spikelets*** 10–25 × 2.5–3.5 mm long, linear, distant, dorsiventrally flattened, 6–14-flowered; callus bearded, hairs c. 1 mm long. ***Lower glumes*** 3–4 × 1–2 mm, notched on oneside, ovate-lanceolate, 1-keeled, 1-nerved, keels slightly scabrid, unequally 2-lobed with acuminate apex. ***Upper glumes*** 5–6 × 1.5–2 mm, elliptic- lanceolate, 1-keeled, 1-nerved, coriaceous, lobed and awned at sinus; awns 1–1.5 mm long, scabrid; lobes 0.5–1 mm long. ***Lemmas*** 3–4 × 2–3 mm (excluding awn), elliptic-lanceolate, coriaceous, 4-lobed, 3-nerved, slightly keeled, and 3-awned; awns scabrid, straight, median awns 4–5 mm long, lateral awns 3–3.5 mm long; lateral lobes 2 mm long. ***Paleas*** 2.5–3.5 × 1–1.5 mm long, elliptic-oblanceolate, hyaline, winged, 2-keeled, keels ciliate or 2-lobed, acute with a minute central notch at the apex. ***Rachilla*** 1–1.5 mm long, glabrous, almost straight, not persistent. ***Lodicules*** 2, *c.* 0.5–0.75 mm long, wedge shaped. ***Stamens*** 3; anthers 1.5–2 mm long, oblong; filaments 1–1.5 mm long, slender, glabrous. ***Ovary*** 0.75–1 × 0.5 mm, obovate; styles 2, slender, hyaline, c. 1 mm long; stigma 1–1.5 mm long, plumose, creamy white. ***Caryopses*** 1.8–2.3 × 0.4–0.7 mm, oblong-cylindric, light brown.

Fig. 180. ***Tripogon ravianus*** Sunil & Pradeep: **A.** Habit; **B.** Ligule; **C.** Enlarged portion of raceme; **D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Lemma; **H.** Palea; **I.** Lodicule; **J.** Callus with stamen & pistil; **K.** Caryopsis.

Fig. 181. ***Tripogon ravianus*** Sunil & Pradeep: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicule; **H.** Stamen & pistil; **I.** Caryopsis.

Flowering & Fruiting:—September–Late December.

Habitat & Ecology:—This species grows from 1500–2200 m elevation on road cuts and seasonally wet rocky hillsides. It is seen in association with *Anaphalis leptophylla* (DC.) DC., *Eragrostis collinensis* Vivek, G.V.S. Murthy & V.J. Nair, *Eragrostis nigra* Nees ex Steud., *Eragrostis schweinfurthii* Chiov., *Hypericum mysurense* Wall *ex* Wight & Arn., *Spermacoce articularis* L. f. and *Tripogon bromoides* Roth *ex* Roem. & Schult.

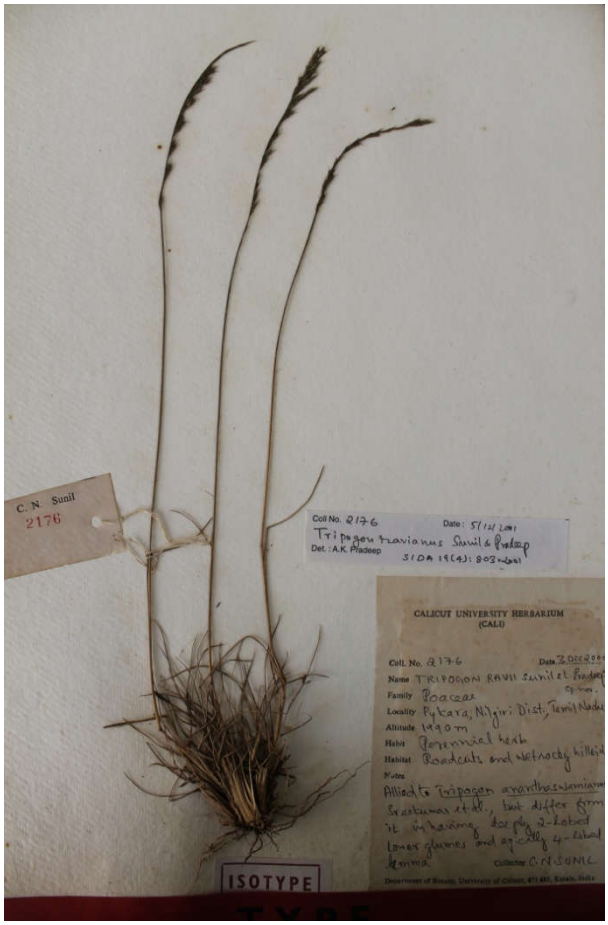


Fig. 182. Isotype of *Tripogon ravianus* Sunil & Pradeep [*C.N. Sunil 2176*] © University of Calicut, Kerala, India.

Distribution:—Endemic to South India.

Specimens examined:—India, **Kerala**, Idukki Dist.: Valakettimala, Moolamattam, 09 Sept. 1998, *C.N. Sunil 2115a*; *Ibid.*, 09 Sept. 1998, *C.N. Sunil 2115b* (CALI). Palakkad Dist.: Silent Valley National Park, 25 Sept. 2013, *Thoiba K.* & *K.M. Manudev 135132* (CALI); Nelliyampathy, Kurishumudi, *s.die.*, *C.N. Sunil 4478* (CALI). **Tamil Nadu**, Coimbatore Dist.: Velliangiri Hills, 22 Feb. 1932, *S.R. Raju* & *Ratnavelu 250* (MH); *Ibid.*, 30 Sept. 2016, *A.K. Pradeep, Nikhil Krishna* & *Thoiba K. 146768* (CALI). Nilgiri Dist.: Gudallur, Shooting Point, 12 Dec. 2015, *Thoiba K. 146704* (CALI); Gudallur, Suicide Point, 12 Dec. 2015, *Thoiba K. 146707* (CALI); Nilgiri Hills, Coonor, 20 March 1870, *s.coll. 11125a*; *Ibid.*, 20 March 1870, *s.coll. 11125b* (CAL); Udagamandalam, Pykara, 03 Dec. 2000, *C.N. Sunil 2176*; *Ibid.*, 03

Dec. 2000, *C.N. Sunil 2163* (CALI); *Ibid.,* 23 Dec. 2017, *Nikhil Krishna* & *Thoiba K. 146794* (CALI); *Ibid.,* 09 Jan. 1902, *C.A. Barber 4161a*, *4161b* (MH); Naduvattam, Oct. 1910, *Bor 11562* (CAL); *Ibid.,* 23 Feb. 2010, *Santhosh Nampy 2778* (CALI); *Ibid., s.die.*, *s.coll. 56* (MH); Pykara, 12 Sept. 1930, *N. Narayanaswami 4190* (MH); *Ibid.*, 12 Sept. 1930, *N. Narayanaswami 4273*(MH); Emerald, 09 Nov. 2012, *Remya J.* & *Prasanna 75485* (TBGT).

Notes:—*Tripogon ravianus* closely resembles to *T. zeylanicus* Thwaites but can be distinguished by its 15–40 cm long racemes, 10–25 mm long spikelets with 6–14-florets, deeply 2-lobed lower glumes and apically 4-lobed lemma.

19. Tripogon sivarajanii Sunil in Sida 18 (3): 809. 1999; Sasidh., Biodiv. Doc. Kerala–Fl. Pl. 595. 2004. **Type:—**India, Kerala, Idukki Dist.: Valakettimala near Moolamattam, 1020 m, 2 Sept. 1997, *C.N. Sunil 2117* (Holotype: MH!, Isotypes: BRIT, CALI!, K, L, PBL). **Figs. 183–185, 189**

Tripogon jayachandranii Arum. & Murugan **syn. nov.**, Indian J. Forest. 40 (2): 159. 2017. Type: —India, Tamil Nadu, Theni Dist.: Meghamalai Wildlife Sanctuary, 1450 m, 04 Oct. 2016, *Arumugam, S.* & *C. Murugan 134462* (Holotype: CAL!, Isotypes MH!).

Tufted perennial herb. ***Culms*** erect, 30–70 cm high; nodes glabrous. ***Leaf blades*** 10–40 × 0.2–0.3 mm, linear-lanceolate, flat-convolute, villous adaxially with short dense hairs intermingled with long scattered shaggy hairs, glabrous abaxially, acuminate to attenuate at apex. ***Leaf sheaths*** 6–10 cm long, linear, glabrous; ***ligules*** a fine glabrous membrane. ***Racemes*** terminal, 20–45 cm long, 25–60 spikelets; peduncle 3–9 cm, glabrous; spikelets arranged alternately on both sides of the raceme; rachis stout, glabrous, 3–7 mm long. ***Spikelets*** 7–10.5 × 1.5–2 mm long, linear, distant, dorsiventrally flattened, 5–8-flowered; callus hairy, hairs c. 0.5 mm long. ***Lower glumes*** 2–2.5 × 0.5–1 mm, notched on oneside, oblong-lanceolate, 1-keeled, 1-nerved, keels slightly scabrid, with acuminate apex. ***Upper glumes*** 3–4.2 × 0.5–1 mm, elliptic-

lanceolate, 1-keeled, 1-nerved, acuminate or mucronulate at apex. ***Lemmas*** 3–4 × 1.5–2 mm, oblanceolate, 2-lobed, 3-nerved, slightly keeled, and 1-awned; awns scabrid, straight, 3–3.5 mm long, lateral lobes 0.8–1.5 mm long. ***Paleas*** 2–3 × 1–1.5 mm, elliptic, winged, hyaline, 2-keeled, keels ciliolate, acute or 2-lobed with a minute central notch at the apex. ***Rachilla*** 0.5–1 mm long, glabrous, straight or zig zag, not persistent. ***Lodicules*** 2, *c.* 0.5 mm long, slightly cordate . ***Stamens*** 3; anthers 1–1.5 mm long, oblong; filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** 0.25—0.4 mm, obovate, styles 2, slender, hyaline, 0.5–0.75 mm long; stigma 0.75–1.2 mm long, plumose, creamy white. ***Caryopses*** 1.2–1.6 × 0.3–0.4 mm, narrowly oblong, cylindric, light brown.

Flowering & Fruiting:—September–Early December.

Habitat & Ecology:—This species is usually found growing along grassy hill slopes at high elevations in association with *Arundinella mesophylla* Nees *ex* Steud., *Crotalaria grahamiana* Wight & Arn., *Chrysopogon hackelii* (Hook.f.) C.E.C. Fisch., *Eragrostis atrovirens* (Desf.) Trin. *ex* Steud., *Didymocarpus fischeri* Gamble, *Didymocarpus tomentosa* Wight, *Eragrostis collinensis* Vivek, G.V.S. Murthy & V.J. Nair, *Eragrostiella bifaria* (Vahl) Bor, *Impatiens acaulis* Arn., *Justicia latispica* (Clarke) Gamble, *Murdania semiteres* (Dalz.) Sant., *Swertia corymbosa* (Griseb.) Wight *ex* Clarke, *Tripogon bromoides* Roth *ex* Roem. & Schult., and some Bryophytes and Pteridophytes.

Distribution:—Endemic to South India.

Specimens examined:—India, **Kerala,** Ernakulam Dist.: Shoolamudi, Variyam, 14 Dec. 2016, *Nikhil Krishna* & *Thoiba K. 146741*; *Ibid.*, 14 Dec. 2016, *Nikhil Krishna* & *Thoiba K. 146743* (CALI). Idukki Dist.: Periyakanal Water Falls, 14 Nov. 2014, *Thoiba K.* & *A.K. Pradeep 137547* (CALI); Munnar, Devikulam, 16 Dec. 2014, *Thoiba K 137583* (CALI); Kattapana, 16 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 144101* (CALI); Kuttikanam Mundakayam Road, 15 Oct. 2015, *Thoiba K.* & *A.K.*

Fig. 183. ***Tripogon sivarajanii*** Sunil: **A.** Habit; **B. & C.** Enlarged portion of raceme; **D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Lemma; **H.** Palea; **I.** Callus with Lodicules, stamens & pistil; **J.** Caryopsis.

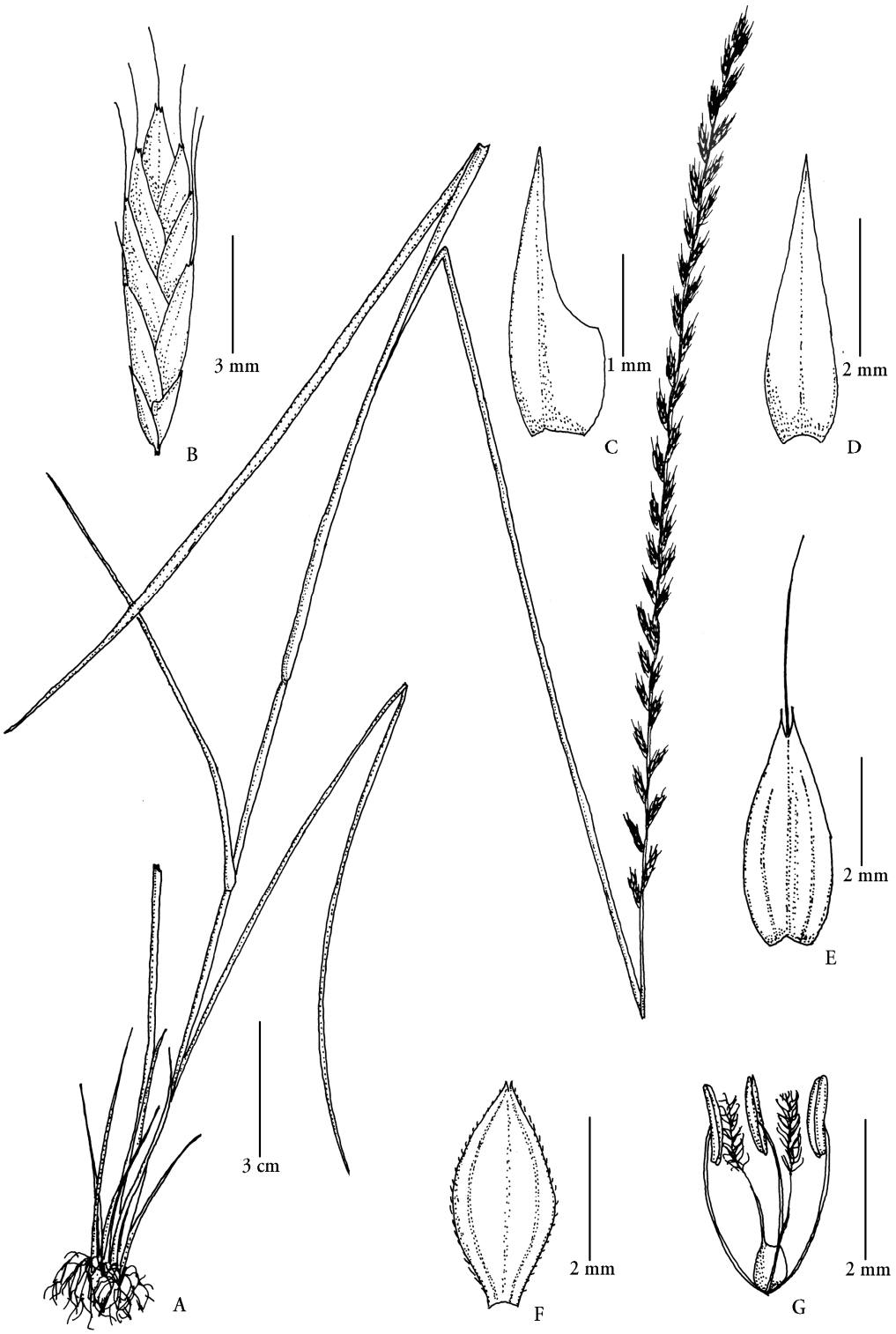


Fig. 184. ***Tripogon sivarajanii*** Sunil: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamens & pistil.

Pradeep 146607 (CALI); Vagamon, way to Pullikanam, 15 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146610*; *Ibid.,* 15 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146612* (CALI); Peerumedu, 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146614* (CALI); Parunthpara, *Thoiba K.* & *A.K. Pradeep 146632* (CALI); Kattapana, Kalvari Mount, 17 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146634* (CALI); Marayoor, 24 May 2016, *Shaju T. 66748* (CALI); Valakettimala near Moolamattam, 2 Sep 1997, *C.N. Sunil* 2117 (CALI); Meenuliyampara, 23 Dec. 2009, *Santhosh Nampy 2735* (CALI).

Fig. 185. Isotype of *Tripogon sivarajanii* Sunil [*C.N. Sunil 2117* (00658706)] © The Board Trustees of the New York Botanical Garden, USA.

Kollam Dist.: Varkala, Sivagiri, Jadayupara, 10 Oct. 2015, *Thoiba K.* & *P. Soumya 146602* (CALI). Kottayam Dist.: *s.loc.*, 05 Nov. 1956, *S.C. Agarwal 881* (CAL). Palakkad Dist.: Nelliyampathy, Kaeshavan Para, 07 Nov. 2015, *Thoiba K. 146678* (CALI); *Ibid.*, 07 Nov. 2013, *Thoiba K. 134485* (CALI). Thiruvananthapuram Dist.: Bonacaud, *s.die.*, *N. Mohanan 11389* (TBGT); Ponmudi, 05 Sept. 2017, *Nikhil Krishna* & *Thoiba K. 146755* (CALI). Thrissur Dist.: Parambikulam Tiger Reseve, Karimala Hills, 26 Sept. 2013, *Thoiba K. 134447*; *Ibid.*, 26 Sept. 2013, *Thoiba K. 134451*(CALI). **Tamil Nadu,** Coimbatore Dist.: Valparai, Shivamalai, 13 Dec. 2013, *Thoiba K. 138010* (CALI); Malakkapara, Shaekalmudi, Mudiyankunnu, 12 Dec. 2013, *Thoiba K. 138027* (CALI).

Notes:—*T. jayachandranii* is a new species described by Arumugam and Murugan (2017) from Meghamalai Wildlife Sanctuary in Tamil Nadu, India. The authors compared the species with *T. jacquemontii*, *T. pungens*, *T. copei* and *T. wightii*. According to the authors, these four species of *Tripogon* are allied to *T. jachandranii.* During the course of present investigation, the authors have examined the types and protologues of all the five taxa involved and found that, *T. jayachandranii* is conspecific with *T. sivarajanii* and not at all similar to any one of the species the authors are compared with, and hence it is reduced in to the synonymy of *T. sivarajanii*.

20. Tripogon trifidus Munro *ex* Hook.f., Fl. Brit. India 7:286. 1896; Bor, Grass. Burma Ceylon India Pakistan 524. 1960; S. Moulik, Grass. Bam. India 2: 623. 1997; G.G. Potdar, C.B. Salunkhe & S.R. Yadav, Grass. Maharashtra 564. 2012. **Lectotype** (designated by H.J. Noltie, 1999)**:**—Sikkim Himalaya, Khasia Hills, alt. 4–5500 ft., *Griffith 6634* (Lectotype: K000245010, image!; Syntype: W0030660, image!). **Figs. 186–189**

Tripogon tirumalae Chorghe, Rasingam, Prasanna & Sankara Rao **syn. nov.**, Phytotaxa 131 (1): 17. 2013. Type:—India, Andhra Pradesh, Tirumala Hills, near Kumaradara Pusupudara Dam, 13^0 43.509′ N, 79^0 19.345′ E, 990 m elevation, 4 Sept. 2012, *L. Rasingam, M.S. Rao* & *Alok Chorghe 2914* (Holotype: CAL!, Isotype: BSID!).

Tripogon uma-ganeshii B.R.P. Rao & M. Anilkumar **syn. nov.**, Indian J. Forest. 41 (1): 97. 2018. Type:—India, Andhra Pradesh, Horsely Hills, 13^0 38'.44.0'' N, 78^0 24'50.1''E, 1195 m elevation, 19 Sept. 2016, *B. Ravi Prasad Rao* & *Midigesi Anilkumar 51980* (Holotype: SKU!, Isotype: BSID!).

Tripogon nallamalayanus Rasingam & J. Swamy **syn. nov.**, Phytotaxa 351 (4): 296. 2018. Type:—India, Telangana, Mahbubnagar district, Umamaheshwaram, 16.36989 N / 78.73168 E, 700 m elevation, 22 Oct. 2016, *L. Rasingam* & *J. Swamy 7396* (Holotype: CAL!, Isotype: BSID!).

Caespitose perennials. ***Culms*** 20–45 cm high; nodes glabrous. ***Leaf blades*** 10–70 × 0.1–0.25 cm, linear-lanceolate, filiform, involute, ribbed, tough adaxially and glabrous abaxially, margins scabrid, acuminate to attenuate at apex. ***Leaf sheaths*** 4–12 cm long, linear, glabrous, persistent, inrolled to the culm; ***ligules*** a ciliate membrane, cilia 0.3–1.2 mm long or glabrous at maturity. ***Racemes*** solitary spike like raceme, 5–35 cm long, spikelets arranged alternately on both sides of the racemes, greenish to yellow; peduncle 7–25 cm long, glabrous; rachis angular; ***Spikelets*** elliptic, 4–16 × 0.7–2 mm long, 5–20-flowered, disarticulation of florets from above glumes and in between florets; callus bearded. ***Lower glumes*** lanceolate, 2–4 × 0.5–0.7 mm, notched on oneside, 1-keeled, 1-nerved, with acuminate, attenuate or mucronulate apex, un-lobed at maturity. ***Upper glumes*** lanceolate, 3–5 × 1–1.2 mm, 1-keeled, 1-nerved, apex 2-toothed, mucronate or minutely awned at sinus. ***Lemmas*** 3–4.5 × 1–1.3 mm (excluding awn), elliptic-lanceolate, 2-lobed, 3-nerved, 3-awned or not; median awns 2.8–4.5 mm long, scabrid, sparsely geniculate, flexous or recurved; lateral lobes acute to acuminate or sometimes lateral veins extended to lateral awns, awns 0.2–0.5 mm long. ***Paleas*** 2–2.6 × 0.5–0.6 mm, obovate to elliptic, winged, hyaline, 2-keeled, 2-nerved, ciliate along the margins, apex 2-lobed or bidentate. ***Rachilla*** 0.3–0.5 mm long. ***Lodicules*** 2, *c.* 0.1–0.2 mm long, 2-toothed at apex. ***Stamens*** 3; anthers 0.5–0.7 mm long, oblong; filaments 0.3–0.4 mm long, slender. ***Ovary*** 0.2–0.3 × *c.* 0.25 mm, obovate; styles 0.3–0.4 mm long, slender, hyaline; stigma *c.* 0.5 mm long, plumose, creamy white. ***Caryopses*** 1.6–2.5 × 0.25–0.3 mm, elliptic-lanceolate, dark brown coloured.

Flowering & Fruiting:—September –October.

Habitat & Ecology:—Rare on rocky hill slopes, it grows on rocks at elevations between 800 and 900m, in association with *Apluda mutica* L., *Chamaecrista mimosoides* (L.) Greene., *Digitaria longiflora* (Retz.) Pers., *Eragrostiella bifaria* (Vahl) Bor, *Eragrostiella brachyphylla* (Stapf) Bor, *Heteropogon contortus* (L.) P. Beauv. *ex* Roem. & Schult., *Ischaemum* sp., *Lophopogon tridentatus* (Roxb.) Hack., *Sopubia delphinifolia* G.Don, *Tripogon bromoides* Roth *ex* Roem. & Schult. and *T. wightii* Hook.f.

Fig. 186. ***Tripogon trifidus*** Munro *ex* Hook.f.: **A.** Habit; **B. & C.** Ligule; **D. & E.** Enlarged portion of raceme; **F. & G.** Spikelet; **H.** Lower glume **I.** Upper glume; **J.** Lemma; **K.** Palea.

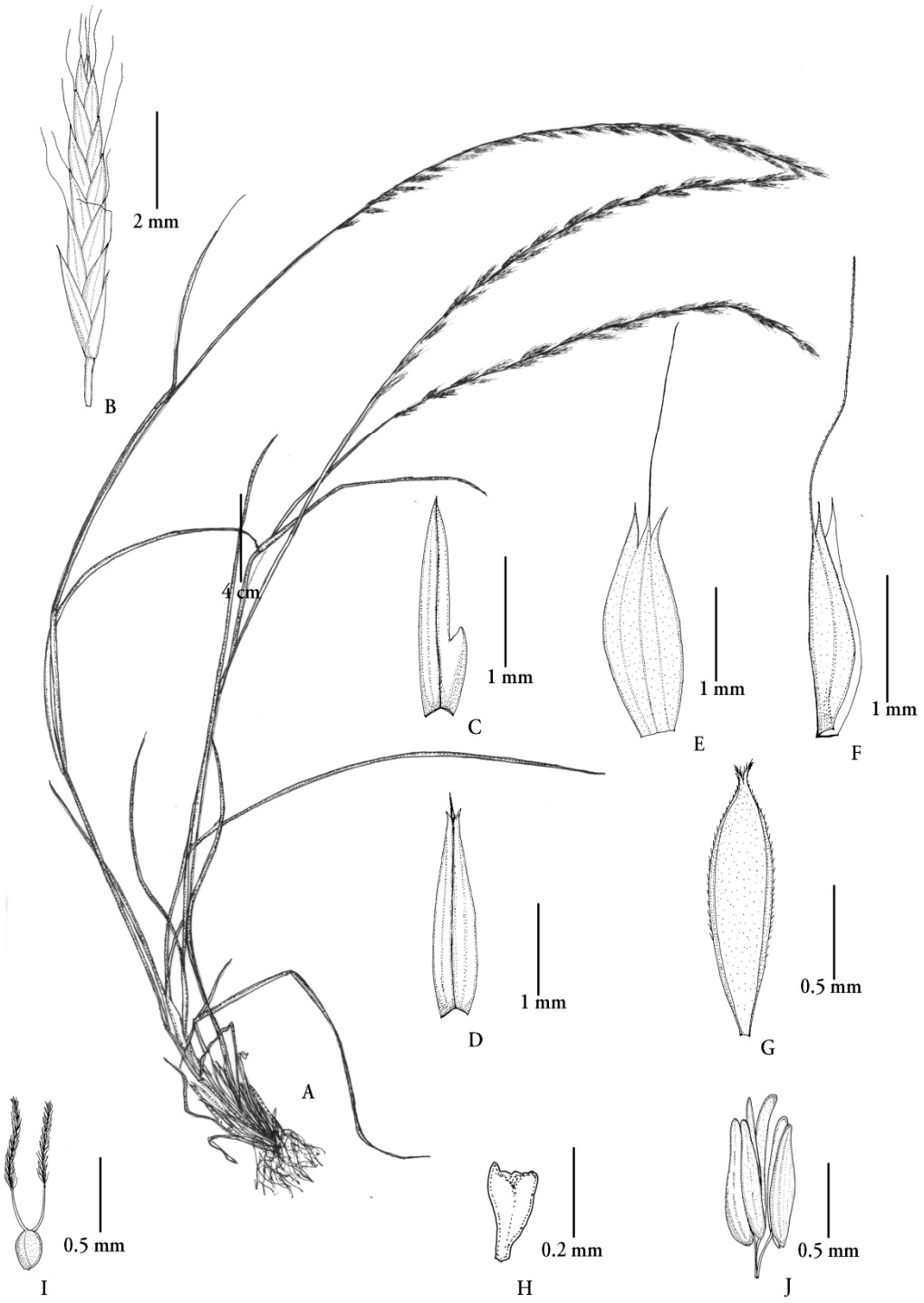


Fig. 187. ***Tripogon trifidus*** Munro *ex* Hook.f.: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E. & F.** Lemma; **G.** Palea; **H.** Lodicule; **I.** Pistil; **J.** Stamen.

Distribution:—*Tripogon trifidus* was known from Hills of Eastern India extending into South-east Asia. Currently it is reported from two states of Peninsular India, Andhra Pradesh and Maharastra.

Fig. 188. Lectotype of *Tripogon trifidus* Munro *ex* Hook.f. [*Griffith 6634* (K000245010) designated by H.J. Noltie, 1999] © The Board Trustees of the Royal Botanic Gardens, Kew.

Specimens examined:—Andhra Pradesh, Chittor Dist.: Arai, Nagalakona, 23 Feb. 2017, *Thoiba K.* & *M. Yoonus T. 146781* (CALI); Penchalakona Hills, 08 Sept. 2016, *M. Yoonus T.*, *Nikhil Krishna* & *Thoiba K. 146782* (CALI); Talakona Watch House, 09 Dec. 2017, *Soumya, Geethika* & *Thoiba K. 146791* (CALI); Tirumala Hills, near Kumaradara Pusupudara Dam, 4 Sept. 2012, *L. Rasingam, M.S. Rao* & *Alok Chorghe 2914* (BSID, CAL); Penchalakona Hills, *s.die.*, *s.coll. 146782* (CALI). Nellore Dist.: Rapur Ghat, 09 Oct. 2016, *B.R.P. Rao* & *M. Anil Kumar 52148* (SUK). **Maharashtra,** Dhule Dist.: Tarad, near Shirpur, 17 Sept. 2015, *K.V.C. Gosavi* & *Thoiba K. 146784* (CALI). **Meghalaya,** East Khasi Hills Dist.: Khasia, 25 Sept. 1886, *C.B. Clarke 45671A*; *Ibid.*, K Hills, Sept. 1856, *s.coll. s.n.* (CAL); K & J Hills, 22 Dec. 1959, *G. Panigrahi 19282*; *Ibid.*, 24 Sept. 1886, *C.B. Clarke 45089* (CAL); Khasia, Kullong, 23 Aug. 1885, *C.B. Clarke 40028*; *Ibid.*, 29 Aug. 1886, *C.B. Clarke 45092* (CAL); Mawphlang, 11 Sept. 1886, *C.B. Clarke 44707A* (CAL); Cherrapunjee, July 1878, *G. Gallatly 476* (CAL); Shillong, Bishop Falls, 26 Sept. 1885, *C.B. Clarke 40543* (CAL); *s.loc.*, Aug. 1919, *P.W. Meekinnon s.n.* (CAL).

Notes:—*T. trifidus* is extremely variable. Specimens from northeast and southern India often look different. The height of the plant varies from 30–95 cm ; ligules very short

and ciliate at maturity, but at flowering stage, long pilose hairs may present at the throat, it falls down by reaching maturity; both awned and unawned types of lemmas are seen in a single collection.

Tripogon tirumalae was described by Chorghe *et al.* in 2013 based on collections from Tirumala Hills in Andhra Pradesh. The authors distinguished *T. tirumalae* from *T. trifidus* by its height (60–75 cm), glabrous leaf sheaths near the summit, unawned lemma lobes, median awns being 1.5 times longer than lemma. An examination of large number of specimens of *T. trifidus* available in Indian herbaria, along with live collections from Tirumala and adjacent hill ranges in Chittor district of Andhra Pradesh revealed *T. trifidus* as a highly variable taxon. An examination of the type specimens (*L. Rasingam, M.S. Rao & Alok Chorghe 2914*) available at CAL and BSID and a number of collection from the type locality also revealed the characters used to distinguish *T. tirumalae* from *T. trifidus* is rather variable and cannot be relied upon. Hooker (1896) had also observed that the lobes of lemma "awned or irregularly toothed" in *T. trifidus*. The length of median awn of lemma also ranges from 2.8 mm to 4.5 mm. Examinations of the type of both the taxa also support merging of *Tripogon tirumalae* under *T. trifidus*. The two new species recently described *T. nallamalayanus* Rasingam & J. Swamy and *T. uma-ganeshii* B.R.P. Rao & M. Anilkumar also belongs to *T.*

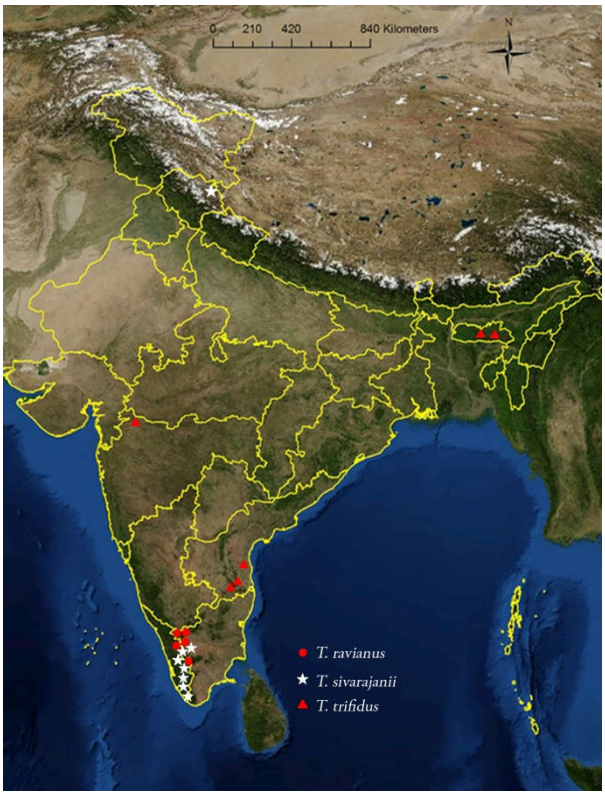


Fig. 189. Distribution of *Tripogon ravianus* Sunil & Pradeep (●), *T. sivarajanii* Sunil (☆) and *T. trifidus* Munro *ex* Hook.f. (▲)

trifidus Munro *ex* Hook.f. the authors (Rasingam & Swamy, 2018) distinguished *T. nallamalayanus* from *T. trifidus* in "having glabrous leaf sheaths, longer spikelets and geniculate awn on lemma". An examination of large number of collection reveals that these characters cannot be relied upon for their segregation. The leaf sheath of *T. trifidus* is always pubescent when young, later the hairs fall off and the sheath appears glabrous. The length of the spikelets varies from 4 to 16 mm, and the awn may be straight, wavy or shortly geniculate. While *T. uma-ganaeshii* is differentiated from *T. trifidus* in having longer (30–70 cm) leaf blades, glabrous leaf sheath, larger number of florets (13–20) in spikelets. All these characters are also shared by *T. trifidus*, and hence both the names, *T. nallamalayanus* and *T. uma-ganaeshii* are treated as conspecific and treated under the synonymy of *T. trifidus.*

21. Tripogon vellarianus Pradeep, Sida 18 (3): 811. 1999; Sasidh., Biodiv. Doc. Kerala –Fl. Pl. 595. 2004. **Type:—**India, Kerala, Kozhikode Dist.: Vellarimala, 11^0 25.877′ N, 76^0 06.765′ E, 1300 m, 17 Oct. 1997, *A.K. Pradeep 56110* (Holotype: MH!, Isotypes: BRIT, CAL!,CALI!, K, L, PBL). **Figs. 190–192, 202**

Tufted perennial herb.***Culms*** erect; 30–150 cm high; nodes glabrous. ***Leaf blades*** 30–60 × 8–15 mm, linear-lanceolate, acuminate to attenuate at apex, flat, sparsely hairy at adaxially and glabrous abaxially. ***Leaf sheaths*** 4–10 cm long, linear, glabrous; ***ligules*** indistinct with a tuft of 1–4 mm long hairs at both ends at young stage. ***Racemes*** terminal, 30–40 cm long; peduncle 10–25 cm long, glabrous; spikelets 2-rowed, packing broadside to rachis; rachis stout, glabrous, 2.5–3 cm long; ***Spikelets*** 10–17 × 3–3.6 mm long, linear, distant, dorsiventrally flattened, 6–12-flowered; callus bearded, hairs 1–1.2 mm long. ***Lower glumes*** 4–5.2 × 0.9–1.1 mm, lanceolate, 1-keeled, 1-nerved, glabrous, purplish tinged dorsally acuminate at the apex. ***Upper glumes*** 5–7.5 × 1–1.5 mm, elliptic-lanceolate, 1-keeled, 1–3-nerved, acute to acuminate at apex,

Fig. 190. ***Tripogon vellarianus*** Pradeep: **A.** Habit; **B. & C.** Enlarged portion of raceme; **D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Callus with lodicules.

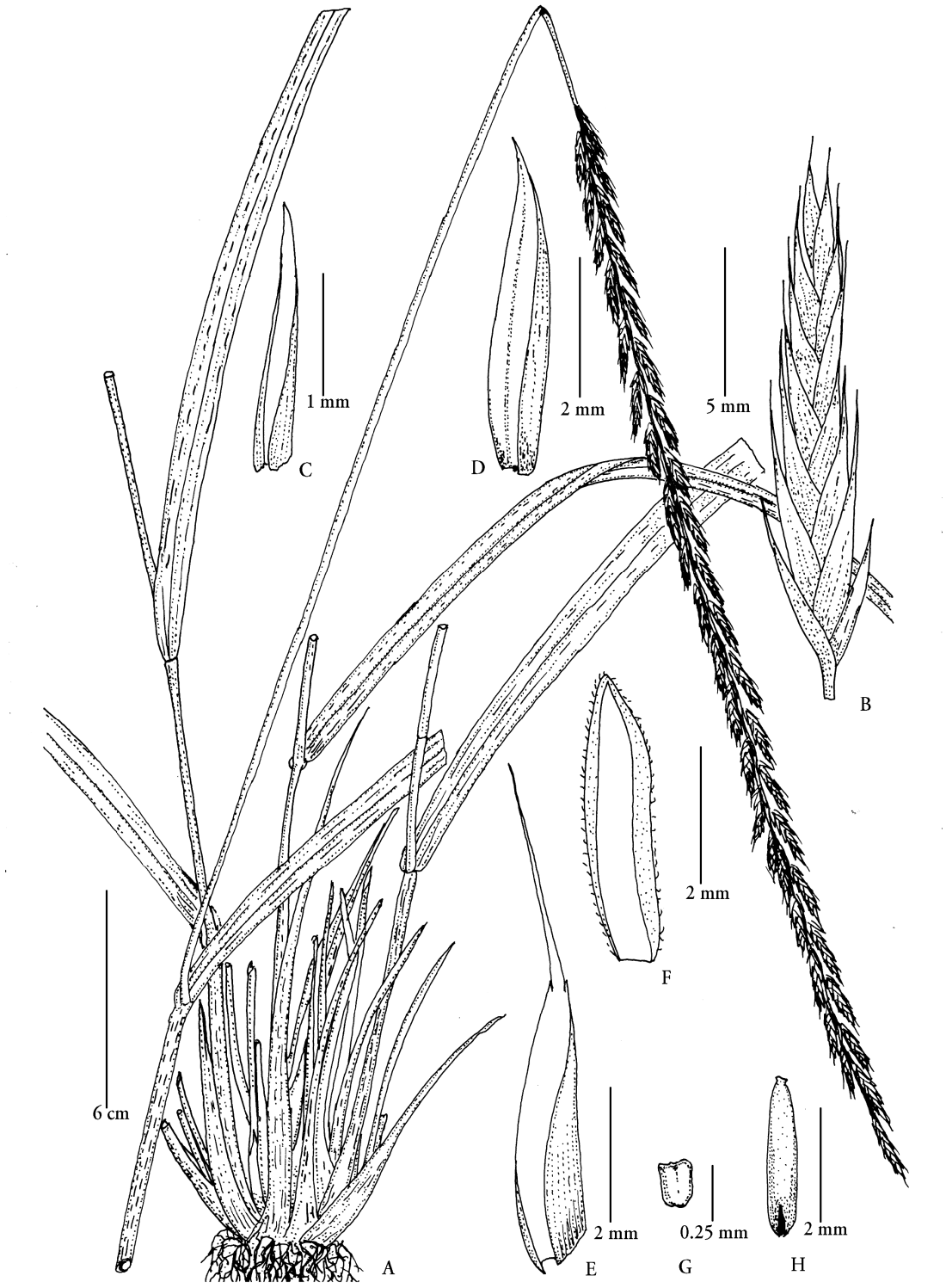


Fig. 191. ***Tripogon vellarianus*** Pradeep: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicule; **H.** Caryopsis.

prominently 3-nerved, glabrous. ***Lemmas*** (excluding the awn) 5–10 × 1–2 mm, ovate-lanceolate, 3-nerved, slightly keeled, and 1-awned; awns scabrid, apex straight or geniculate, median awns 3 mm long, awns scabrid, lateral awns absent or closely adpressed to the median awn. ***Paleas*** 4–8 × 0.8–1 mm, narrowly elliptic, hyaline, 2-keeled and winged, keels minutely puberulous, with an acute apex. ***Rachilla*** 0.5 mm long, glabrous, almost straight, not persistent. ***Lodicules*** 2, *c.* 0.25–0.5 mm long, quadrate, apex coarsely 3-toothed. ***Stamens*** 3; anthers 1.5–2 mm long, oblong; filaments 0.5 mm long, slender, glabrous. ***Ovary*** 0.25 mm long, obovate, styles 2, slender, hyaline, 0.8 mm long; stigmas 0.6–0.8 mm long, plumose, creamy white to purplish in colour. ***Caryopses*** oblong-cylindric, 2.5–3.5 × 0.5–0.7 mm, light brown.

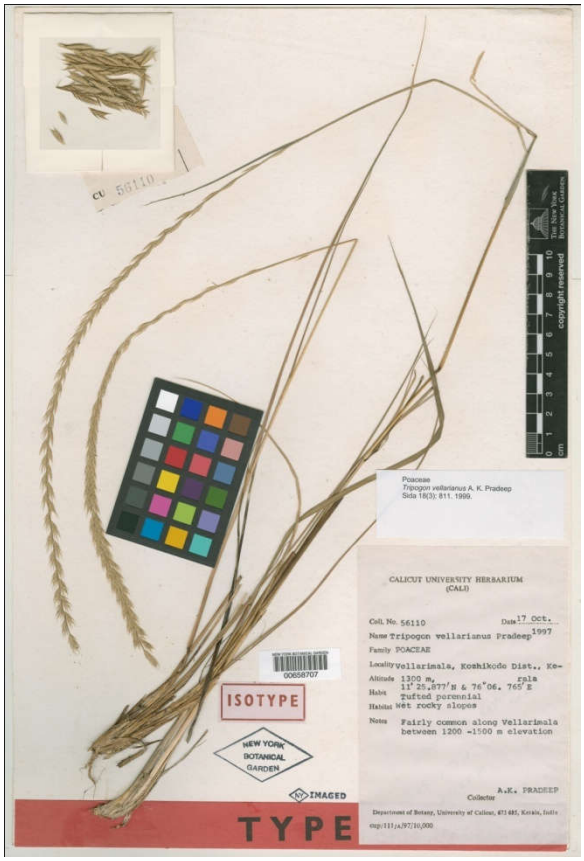


Fig. 192. Isotype of *Tripogon vellarianus* Pradeep [*A.K. Pradeep 56110* (00658707)] © The Board Trustees of the New York Botanical Garden, USA.

Flowering & Fruiting:—September–January.

Habitat & Ecology:—This species is rather rare and occurs from 1000–1500 m in seasonally wet rocky hill sides in association with *Arthraxon lancifolius* (Trin.) Hochst., *Arundinella pumila* (Hochst. *ex* A. Rich) Steud., *Chrysopogon nodulibarbis* (Steud.) Henrard, *Cynotis arachnoidea* Clarke, *Didymocarpus humboldtiana* Gard., *Ipsea malabarica* (Rchb.f.) Hook.f., *Murdania semiteres* (Dalz.) Sant., *Themeda tremula* (Nees *ex* Steud.) Hack., *Tripogon bromoides* Roth *ex* Roem. & Schult.

Distribution:—Endemic to northern Kerala, South India.

Specimens examined:—India, **Kerala,** Kozhikode Dist.: Kakkadampoyil, 09 Oct. 2013, *Thoiba K. 134468a*; *Ibid.*, 09 Oct. 2013, *Thoiba K. 134468b*, *Thoiba K. 134468c* (CALI); Vellarimala, 17 Oct. 1997, *A.K. Pradeep 56110* (CALI, MH).

Notes:—*T. vellarianus* is a distinct species characterised by its strongly tussock-forming habit, broad leaves and large spikelets. It is perhaps the tallest species of *Tripogon* in the world.

22. Tripogon velliangiriensis Murug. & V. Balas.*,* Indian J. Forest. 31 (1): 109. 2008; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 182. 2009. **Type:—**India, Tamil Nadu, Coimbatore Dist.: Velliangiri hills, 1850 m, 12.09.2003, *Murugesan KASCH 1181* (Holotype: KASCH, Isotype: MH!). **Figs. 193–195, 202**

Tripogon copei Newmaster, V. Balas., Murug. & Ragup. **syn. nov.**, Syst. Bot. 33 (4): 698. 2008, as *"cope"*. Type:—India, Tamil Nadu,Velliangiri hills, 1840 m, 18 Dec. 2006, *Ragu* & *Newmast 55277* (Holotype OAC; Isotype KASCH).

Tripogon wightii Hook.f. var. *kanyakumarensis* Kabeer & V.J. Nair*,* **syn. nov.**, Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 183. 2009. Type:—India, Tamil Nadu, Kanyakumari Dist.: Mothiramalai, Thomarai, near Peechiparai, ± 630 m, 16 Dec. 2005, *K. Althaf Ahamed Kabeer 118769* (Holotype & Isotype: MH!).

Caespitose perennials. ***Culms*** erect or stoloniferous, 10–25 cm high; nodes glabrous. ***Leaf blades*** 5–18 × 0.2–0.25 cm, linear-lanceolate, convolute or sometimes equitant, surfaces ciliate at adaxially and glabrous, ribbed abaxially, acuminate to attenuate at apex. ***Leaf sheaths*** 3–5 cm long, linear, glabrous and persistent; ligules membranous with a 0.4–0.6 mm long hairs at the apex of leaf sheath. ***Racemes*** terminal, solitary spike like raceme, 6–13 cm long, 6–12 spikelets, leaden green, arranged alternately on both sides of the raceme; peduncle 3–11 cm long, glabrous, ribbed; rachis stout, flat, scabridulous, 4–6 mm long; ***Spikelets*** 10–25 × 2–3 mm long, linear, distant, dorsiventrally flattened, 6–9-flowered, acute at apex; disarticulation of florets from

above glumes and in between florets; callus bearded, hairs *c.* 1.5–1.8 mm long. ***Lower glumes*** 4–4.5 × 0.7–1 mm, notched on oneside, ovate-lanceolate, 1-keeled, 1-nerved, keels slightly scabrid, with acuminate and mucronulate apex. ***Upper glumes*** 4.5–5.5 × 1.5–2 mm, elliptic-lanceolate, 1-keeled, 1-nerved, apex dentate, mucronate; mucro 0.3–0.4 mm long. ***Lemmas*** 8–9.5 × 1.5–2 mm, elliptic-lanceolate, 2-lobed, 3-nerved, slightly keeled, and 1-awned; awns scabrid, straight, slightly bend when mature, 3–6 mm long, lateral lobes sharply acuminate or sometimes look like a minute awn, lobes 1–1.5 mm long. ***Paleas*** 3–3.5(–4–5) × 1.4–1.6 mm, elliptic-oblanceolate, broadly winged, hyaline, 2-keeled, keels ciliate, emarginate or 2-lobed with a minute central notch at the apex. ***Rachilla*** 0.5–1 mm long, glabrous, straight or zig zag, not persistent. ***Lodicules*** 2, *c.* 0.4 mm long, slightly cordate. ***Stamens*** 3; anthers 1.5–2 mm long, oblong; filaments *c.* 0.3 mm long, slender, glabrous. ***Ovary*** *c.* 0.5 mm long, obovate, styles 2, slender, hyaline, 0.8–1mm long; stigma 0.7–1 mm long, plumose, creamy white to purple violet. ***Caryopses*** 0.45–0.7 × 0.2–0.3 mm, narrowly oblong, brown.

Flowering & Fruiting:—August–October.

Habitat & Ecology:—This species grows from 1200–2200 m elevation on rocks and wet rocky hillsides in association with *Cyanotis concanensis* Hassk., *Cyanotis cristata* (L.) D. Don, *Cymbopogon martinii* (Roxb.) Wats., *Didymocarpus humboldtiana* Gard., *Didymocarpus wightii* (Clarke) Gamble, *Impatiens* sp., *Tripogon bromoides* Roth *ex* Roem. & Schult., *T. filiformis* Nees *ex* Steud., *T. sivarajanii* Sunil, and some Bryophytes and Pteridophytes.

Distribution:—Endemic South India.

Specimens examined:—India, **Kerala,** Idukki Dist.: Peerumedu, Parunthpara, 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146621*; *Ibid.*, 16 Oct. 2015, *Thoiba K.* & *A.K. Pradeep 146628*, *146629* (CALI). Palakkad Dist.: Nelliyampathy, Keshavan Para, 07 Nov. 2013, *Thoiba K. 134492* (CALI). Thrissur Dist.: Parambikulam Tiger Reserve, Karimala Hills, 26 Sept.2013, *Thoiba K. 134454*; *Ibid.*, 23 Oct. 1990, *Sasidharan s.n.*

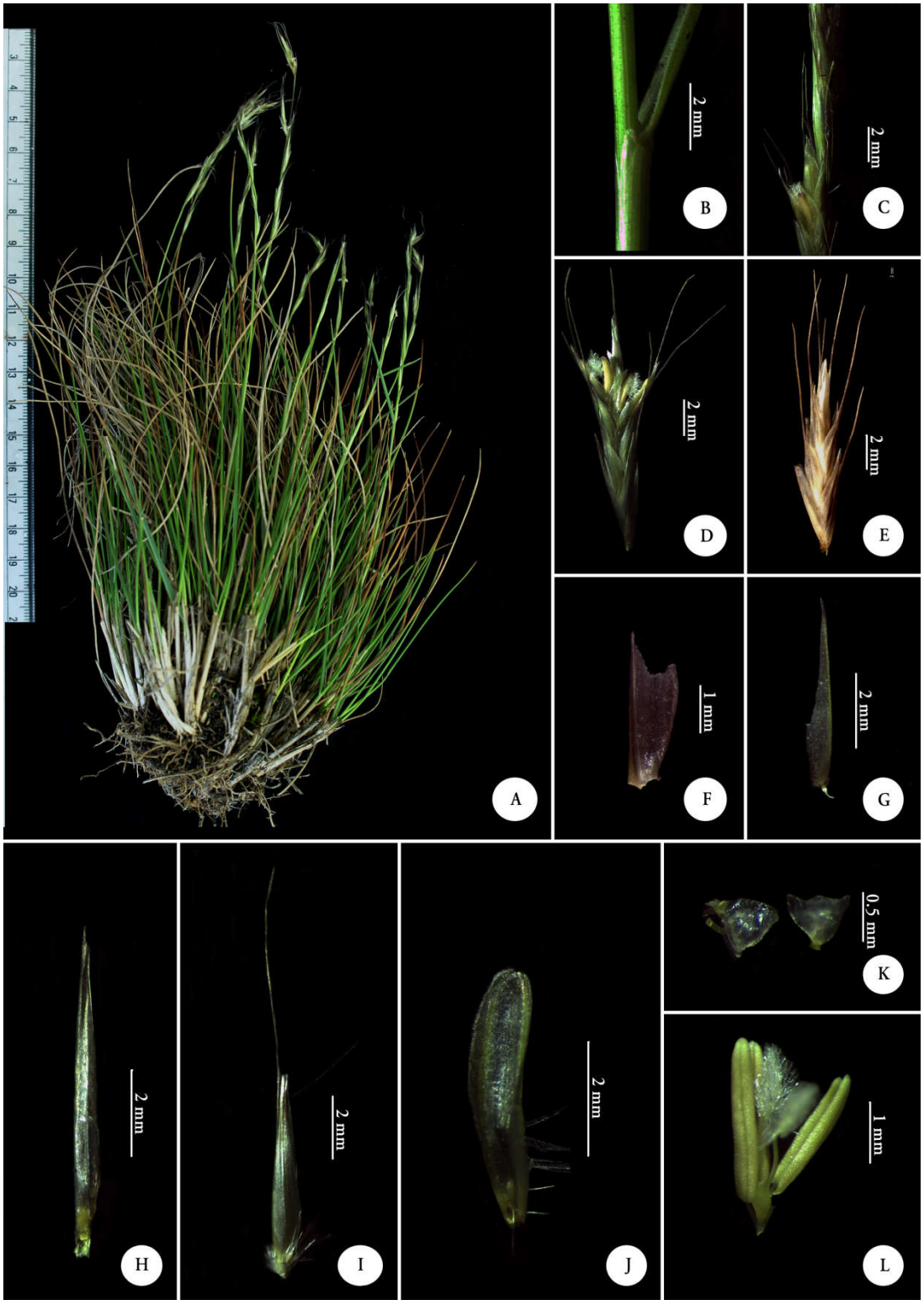


Fig. 193. ***Tripogon velliangiriensis*** Murug. & V. Balas.: **A.** Habit; **B.** Ligule; **C.** Enlarged portion of raceme; **D. & E.** Spikelet; **F. & G.** Lower glume; **H.** Upper glume; **I.** Lemma; **J.** Palea; **K.** Lodicules; **L.** Stamens and pistil.

Fig. 194. ***Tripogon velliangiriensis*** Murug. & V. Balas.: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Stamens & pistil.

(CALI). Tamil Nadu, Coimbatore Dist.: Velliangiri Hills, 30 Sept. 2016, *A.K. Pradeep*, *Nikhil Krishna* & *Thoiba K. 146725*; *Ibid.*, 30 Sept. 2016, *A.K. Pradeep, Nikhil Krishna* & *Thoiba K. 146700* (CALI).

Fig. 195. Isotype of *Tripogon velliangiriensis* Murug. & V. Balas. [*Murugesan 1181* (MH00003233)] © Botanical Survey of India, Coimbatore.

Notes:—*T. velliangiriensis* was first described from the Velliangiri Hills in Coimbatore District of Tamil Nadu by Murugaesan and Balasubramaniam (2008). They distinguished it from *T. wightii* by its "leaves being longer than inflorescence, 15–20 cm long; lower glume not toothed, linear-lanceolate, 6–6.5 mm long, awned, awns 1.5–2.5 mm long; upper glume 2-toothed, linear-lanceolate, 8–9.5 mm long, awned, awns 2–2.5 mm long; median awn of lemma 10.5–12 mm long; straight, lobes of lemma acuminate, awned, awn 1.5–2 mm long". Subsequently, Newmaster *et al.* (2008) published *T. copei* from the same hills of Velliangiri in Coimbatore District of Tamil Nadu. The type of this species was reportedly located at OAC and KASCH (*Ragupathy* & *Newmaster 55277*). The authors tried in vain to locate the isotype of this taxon at KASCH, and no holotype was also available at OAC (Regupathy, personal communication dated 14 July 2016).

During the course of botanical exploration in different parts of south India, the authors have also collected a good number of specimens from different areas of Velliangiri and adjoining hill ranges. A critical examination of protologue and available materials from the type locality shows, the floral characters used to delimit *T. copei* from *T. velliangiriensis* is variable. The authors have observed populations of *T.*

velliangiriensis with longer leaves, asymmetrical lower glumes, exceptionally symmetrical at the apical spikelets; almost straight median awn; palea clefted at apex. Eventhough the type specimens were unavailable for our studies, judging from the description and illustrations of *T. copei* provided in the protologue and a number of specimens collected from the type locality, we prefer to reduce *T. copei* in the synonymy of *T. velliangiriensis*.

23. Tripogon wightii Hook.f., Fl. Brit. India 7:286. 1896; C.E.C Fisch. in Gamble, Fl. Madras 3: 1833. 1934; Bor, Grass. Burma Ceylon India Pakistan 524. 1960; S. Moulik, Grass. Bam. India 2: 623. 1997; Pullaiah, Fl. Andhra Pradesh 3: 1269. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu Grass. 182. 2009; Sasidh., Biodiv. Doc. Kerala – Fl. Pl. 595. 2004. **Lectotype** (designated by Thoiba & Pradeep, 2018)**:—**India, Mysore, Bellary Dist.: 1834. *Wight 1793* (K000245012, image!). **Figs. 196–198, 202**

Caespitose perennials. ***Culms*** 20–35 cm high; stoloniferous or not, nodes glabrous. ***Leaf blades*** 5–15 × 0.2–0.3 cm, equitant, convolute, margins smooth, minutely ciliate adaxially and glabrous abaxially, margins minutely serrulate towards apex, acuminate to attenuate at apex. ***Leaf sheaths*** 2.3 –4 cm long, linear, ribbed, persistent, inrolled to the culm; ***ligules*** indistinct with a tuft of 4–6 mm long hairs at both ends. ***Racemes*** solitary spike-like raceme, 06–15 cm long with 08–12 spikelets olive to dark green or yellowish, arranged alternately on both sides of the racemes; peduncle 7–11 cm, glabrous; rachis stout, flat to triquetrous and serrulate, 3–7 mm long. ***Spikelets*** 13–30 × 0.5–0.7 mm long (without awns), oblong, distant, dorsiventrally flattened, 5–16-flowered, disarticulation of florets from above glumes and in between florets; callus bearded, hairs 1–1.2 mm long. ***Lower glumes*** oblong-lanceolate, 3.6–4.8 × 0.5–0.7 mm, notched on oneside, 1-keeled, 1-nerved, keels slightly scabrid, with acuminate apex, uppermost one with c. 1–1.3 mm long arista at apex. ***Upper glumes*** elliptic-lanceolate, 5–7 × 1–1.2 mm, 1-keeled, 1-nerved, apex dentate, 1-awned, awns 1–1.5 mm long, aristate at sinus. ***Lemmas*** ovate-lanceolate, 4.8–6.2 × 1.4–2 mm, 2-lobed,

Fig. 196. ***Tripogon wightii*** Hook.f.: **A.** Habit; **B. & C.** Enlarged portion of raceme; **D.** Spikelet; **E.** Lower glume; **F.** Upper glume; **& G.** Floret; **H.** Lemma; **I.** Palea.

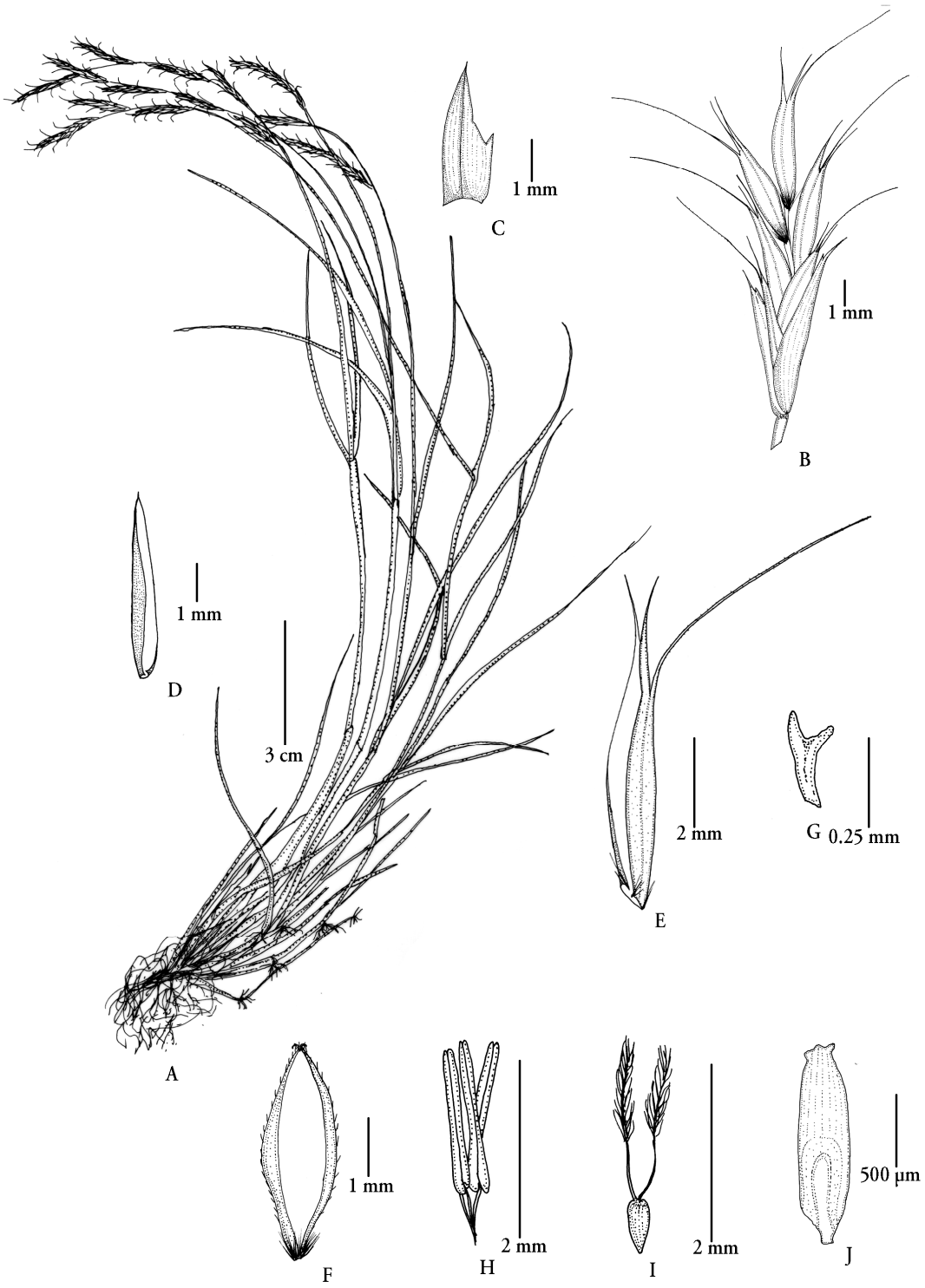


Fig. 197. ***Tripogon wightii*** Hook.f.: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicule; **H.** Stamens; **I.** Pistil; **J.** Caryopsis.

acute-acuminate,1.2–1.5 mm long, 3-nerved, slightly keeled, and 1-awned; median awns 6–8 mm long, scabrid, straight or curved. ***Paleas*** obovate to elliptic, 2.3–4.2 × 1–1.5 mm, broadly winged, surface pubescent, 2-keeled, ciliate along the margins, sharply 2-lobed with a central notch at the apex. ***Rachilla*** 1–1.2 mm long, glabrous to scabrid, almost straight, not persistent. ***Lodicules*** 2, *c.* 0.3–0.4 mm long, truncate. ***Stamens*** 3; anthers 1–2 mm long, oblong; filaments 0.3–0.5 mm long, slender, glabrous. ***Ovary*** 0.3–0.5 × c. 0.25 mm, obovate; styles 0.7–1.2 mm long, slender, hyaline; stigma 1.2–1.3 mm long, plumose, creamy white. ***Caryopses*** oblong-elliptic, 1.4–2.2 × 0.5 mm, light brown.

Fig. 198. Lectotype of *Tripogon wightii* Hook.f. [*Wight 1793?* (K000245012) designated by Thoiba & Pradeep, 2018] © The Board Trustees of the Royal Botanic Gardens, Kew.

Flowering & Fruiting:—August–January.

Habitat & Ecology:—Occuring in seasonally wet hill slopes in association with *Arundinella ciliata* (Roxb.) Nees *ex* Miq., *Cyanotis tuberosa* (Roxb.) Schult. f., *Didymocarpus tomentosa* Wight, *Murdannia semiteres* (Dalz.) Sant., *Tripogon bromoides* Roth *ex* Roem. & Schult. and *Tripogon sivarajanii* Sunil.

Specimens examined:—India, **Andhra Pradesh,** Chittoor Dist.: Horsleykonda, Aug. 1989, *J.S. Gamble 20920* (CAL). **Kerala,** Ernakulam Dist.: Shoolamudi, Variyam, 14 Dec. 2016, *Nikhil Krishna* & *Thoiba K. 146741* (CALI). Palakkad Dist.: Nelliyampathy, 07 Nov. 2013, *Thoiba K. 134490*; *Ibid.,* 07 Nov. 2015, *Thoiba K. 146679* (CALI). Thrissur Dist.: Sholayar, Valve House, 11 Dec. 2013, *Thoiba K.*

138031 (CALI). **Tamil Nadu,** Coimbatore Dist.: Valparai, Shivamalai, 13 Dec. 2013, *Thoiba K. 138011* (CALI). Nilgiri Dist.: Pakasuramalai, 29 Aug. 1957, *K.M. Sebastine 3944* (CAL).

Notes:—*T. wightii* difffers from other species in having, shorter leaves than racemes; leaf blades equitant; spikelets being large sized (upto 20 mm long); awns in lemma straight when young and recurved at maturity; awns never more than twice as long as the lemma and palea notched at apex.

24. Tripogon zeylanicus Thwaites, Enum. Pl. Zeyl. 374. 1864. **Lectotype** (designated by here):—Ceylon, *Thwaites C.P. 281* (K000245028, image!). **Figs. 199–202**

Tripogon anantaswamianus Sreek., V.J. Nair & N.C. Nair **syn. nov.**, Bull. Bot. Surv. India 25(1–4): 185. 1983; P.V. Sreek. & V.J. Nair, Fl. Kerala Grass. 399. t. 82 1991; S. Moulik, Grass. Bamb. India 2: 620. t. 137. 1997; Kabeer & V.J. Nair, Fl. Tamil Nadu-Grass. 179. 2009; Sasidh., Biodiv. Doc. Kerala–Fl. Pl. 595. 2004. Type: India, Kerala, Idukki Dist.: Eravikulam Sanctuary, 15 Nov 1980, *P.V. Sreekumar 69432* (Holotype: CAL!, Isotypes: K!, MH!).

Caespitose perennials. ***Culms*** erect. 30–50 cm high; nodes glabrous, slightly geniculate and 1-noded. ***Leaf blades*** 25–40 × 0.3–0.5 mm, linear-lanceolate, acuminate to attenuate at apex, flat-convolute, more hairy towards collar, sparsely hairy along margins and both sides of the blade. ***Leaf sheaths*** 4–10 cm long, linear, glabrous or hairy; ***ligules*** small fine membrane with a tuft of 1–2 mm long hairs at both ends. ***Racemes*** terminal, 10–30 cm long; peduncle 10–15 cm long, glabrous; spikelets leaden green, arranged alternately on both sides of the raceme; rachis stout, glabrous or scabrid, 3–7 mm long; ***Spikelets*** ovate-lanceolate, 08–15.5 × 3–3.5 mm long, linear, dorsiventrally flattened, 7–13-flowered; callus bearded, hairs 0.5–1 mm long. ***Lower glumes*** 4–5 × 0.75–1mm, notched on one-side, ovate-lanceolate, 1-keeled, 1-nerved, keels slightly scabrid, awned at apex, awns 1–1.5 mm long. ***Upper glumes*** 7–9 × 0.5–1

Fig. 199. ***Tripogon zeylanicus*** Thwaites: **A.** Habit; **B.** Enlarged portion of raceme; **C.** Adaxial side of leaf blade; **D.** Ligule; **E.** Spikelet; **F.** Glumes; **G.** Floret; **H.** Lemma; **I.** Palea; **J.** Lodicules, stamens & pistil.

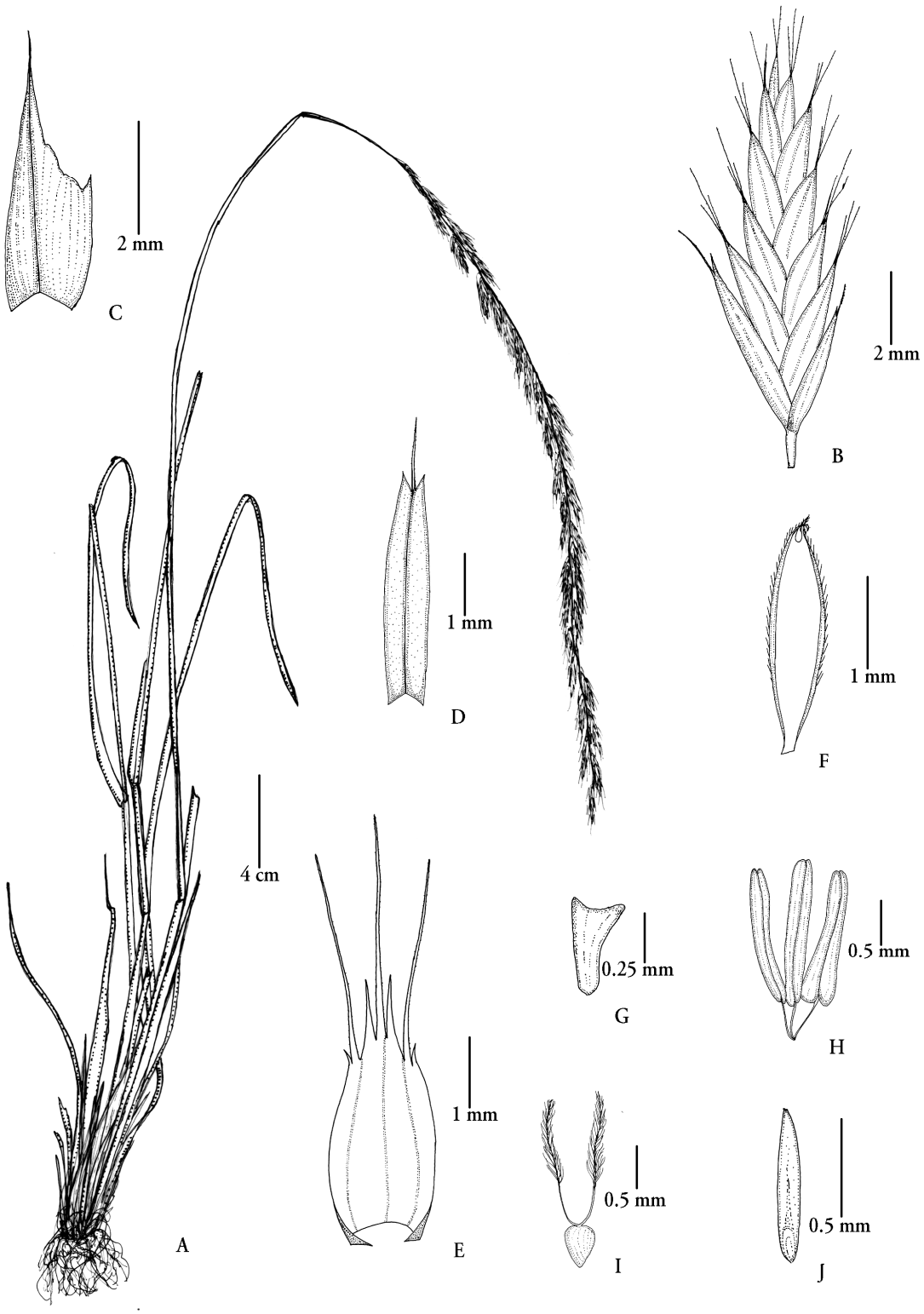


Fig. 200. ***Tripogon zeylanicus*** Thwaites: **A.** Habit; **B.** Spikelet; **C.** Lower glume; **D.** Upper glume; **E.** Lemma; **F.** Palea; **G.** Lodicule; **H.** Stamens; **I.** Pistil; **J.** Caryopsis.

mm, elliptic- lanceolate, 1-keeled, 1-nerved, apex 2-lobed, 1-awned, awns scabrid, 1–2 mm long. ***Lemmas*** 7–8 × 1.5–2.5 mm (including awn), oblong-lanceolate, 6-lobed, lateral awns and median awns subequal or sometimes reduced, lateral lobes on either side of each lateral awn 0.25–0.5 mm long; 3-nerved, slightly keeled, and 3-awned; awns scabrid, apex straight or geniculate, median awns *c.* 4 mm long, lateral awns 0.5–3 mm long; lateral lobes 1–1.5 mm long, acuminate, margins scabrid, apex sometimes bi-liped. ***Paleas*** elliptic-oblanceolate, 3–4 × 1–1.4 mm, hyaline, 2-keeled, ciliate, acuminate at the apex. ***Rachilla*** 1–1.3 mm long, glabrous, almost straight, not persistent. Lodicules 2, *c.* 0.3–0.5 mm long, truncate. ***Stamens*** 3; anthers 1.3–2 mm long, oblong; filaments 0.5–0.75 mm long, slender, glabrous. ***Ovary*** 0.3–0.6 mm, obovate, styles 2, slender, hyaline, 1–1.2 mm long; stigma 0.7–1.2 mm long, plumose, creamy white. ***Caryopses*** 1.2–1.8 × 0.3–0.4 mm, narrowly oblong, cylindrical, brown.

Fig. 201. Lectotype of *Tripogon zeylanicus* Thwaites [*Thwaites C.P. 281* (K000245028) designated by here] © The Board Trustees of the Royal Botanic Gardens, Kew.

Flowering & Fruiting:—September–Early December.

Habitat & Ecology:—This species is usually found growing in rock crevices and Ghat road sides at 7 m 00–1890 m elevation in association with *Arundinella pumila* (Hochst. *ex* A. Rich.) Steud., *Cyanotis tuberosa* (Roxb.) Schult. f., *Cyanotis villosa* (Spreng.) Schult.f., *Eragrostis collinensis* Vivek, G.V.S. Murthy & V.J. Nair, *Tripogon bromoides* Roth *ex* Roem. & Schult., *T. ravianus* Sunil & Pradeep, *T. sivarajanii* Sunil.

Distribution:—Endemic to South India.

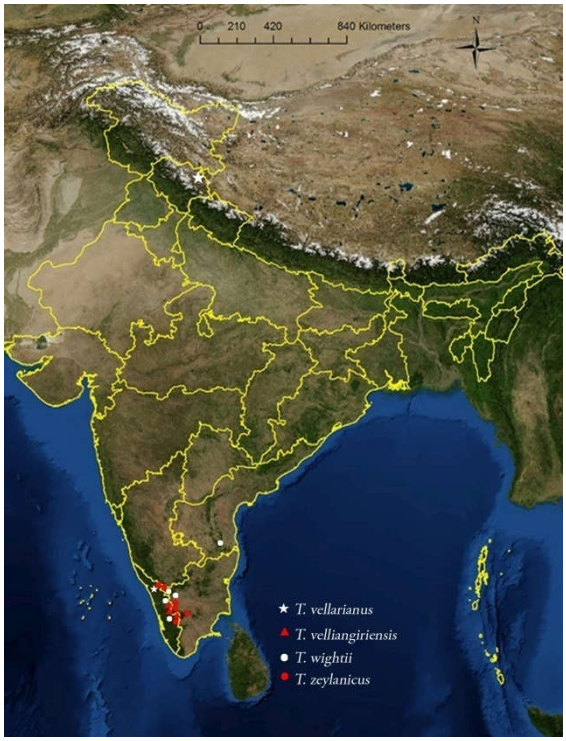


Fig. 202. Distribution of *Tripogon vellarianus* Pradeep (☆) *T. velliangiriensis* Murug. & V. Balas. (▲), *T. wightii* Hook.f. (○) and *T. zeylanicus* Thwaites (●)

Specimens examined:—India, **Kerala**, Idukki Dist.: Eravikulam Sanctuary, 15 Nov. 1980, *P.V. Sreekumar 69432* (CAL); *Ibid.*, 27 Aug. 1980, *P.V. Sreekumar 68403* (MH); 15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137571a*; *Ibid.*, 15 Dec. 2014, *Thoiba K.* & *A.K. Pradeep 137571b*; *Ibid.*, 12 Dec. 2015, *Thoiba K.* & *A.K. Pradeep 146697* (CALI); *Ibid.*, 27 Aug. 1980, *P.V. Sreekumar 68403*; *Ibid.*, 16 Nov. 1980, *P.V. Sreekumar 69429* (BSID). *s.loc.*, *s.die.*, *C.N. Sunil 1775* (CALI); Poovanpara, 07 Sept. 1997, *S.D. Biju 36185* (TBGT); Alampetty, Marayoor–Chinnar Road, 26 Oct. 2017, *A.K. Pradeep* & *Thoiba K. 146753* (CALI); Munnar, 14 Nov. 1980, *P.V. Sreekumar 68460* (BSID). Wayanad Dist.: Chembra, 12 Oct. 2012, *Remya J.* & *Prasanna 74507* (TBGT). **Tamil Nadu**, Coimbatore Dist.: Valparai, 28 Jan. 1978, *M. Chandrabose 57709* (MH). Dindigul Dist.: Kodaikanal, Shevaroy Hills, Sept. 1905, *C.A. Barber 7254* (MH); Observatory Hills, Sept. 1905, *C.A. Barber 7254a* (MH); Pulney Hills, Poombarai Road, 04 July 1901, *Bourne 2111* (MH); Kodaikanal, Palani Hills, Berijam Road, 06 Dec. 1986, *K.M. Matthew* & *M. Charles 47756* (RHT); Kukkal, Boothanachiammankoil Hill, 19 Oct. 1987, *K.M. Matthew 50803* (RHT); Kodai-Berijam road, 16th km, 17 Dec. 1989, *S. Perianayagam 53973* (RHT); Vandaravu, 18 Dec. 1989, *K.M. Matthew* & *K.T. Mathew 54018* (RHT); Berijam slopes,09 Aug. 1984, *K.M. Matthew 40785* (RHT). Nilgiri Dist.: Ootacamund, Wenlock Downs, 11 Nov. 1956, *B.D. Patil 945* (CAL); Avalanche, 14

Oct. 1972, *K. Vivekananthan 42950* (MH); Bison Swamp, 11 June 1970, *B.V. Shetty 34196a* (MH); Otacamund, 05 Aug. 1900, *C.A. Barber 2652* (MH); Mukurthi National Park, 16 May 1971, *J.L. Ellis 38476* (MH); *s.loc.*, *s.die.*, *Wight 1871* (CAL); *s.loc.*, s.*die.*, *s.coll. 56* (MH). *s.loc.*, 24 May 2016, *C.N. Sunil 1775* (CALI). **Sri Lanka,** *s.die.*, *Thwaites C.P. 281* (CAL).

Notes:—Similar to *Tripogon bromoides* and sometimes growing along with it in the type locality, but it differs in having leaden green coloured spikelets; florets upto 15; lemma 6-lobed, awns almost equal in size.

Chapter 7

Discussion on Comparative Morphology

Chapter 7 Discussion on Comparative Morphology

A first detailed account on the study of morphology and taxonomy on the subtribe *Eragrostidinae* in Peninsular India is presented here. The work is based on extensive field studies and consultation of large number of specimens housed in major Indian herbaria. A comprehensive study on the subtribal classification, morphology, SEM analysis, and taxonomy of Peninsular Indian *Eragrostidinae* is discussed here.

In the present treatment, subtribal classification of Peterson *et al. (*1995, 1997) was followed. However, generic delimitation by Soreng *et al. (*2017) was accepted with some minor modifications. All the segregate genera of *Leptochloa s.l.* was accepted in the present treatment and included in a more inclusive *Eragrostidinae*. Hence the current treatment (modified from Peterson *et al.,* 1995) includes seven genera (*Dinebra* Jacq., *Disakisperma* Steud., *Eragrostis* Wolf, *Eragrostiella* Bor, *Neyraudia* Hook.f., *Trigonochloa* P.M. Peterson & N. Snow and *Tripogon* Roth *ex* Roem. & Schult.) under five different subtribes. Among seven genera, all of them were reported from Peninsular India. In general, vegetative morphology is homogeneous among the species of different genera of *Eragrostidinae*. The major taxonomic characters used in the present study are discussed below.

Habit

Clayton and Renvoize (1986) pointed out the importance of the life cycle of most grasses is strongly seasonal in grass taxonomy. The habit of the grass plant whether annual or perennial is extremely important for diagnosis. Most flowering grass-culms, whether the species be annual or perennial, die down to the base after the lapse of a year, but some persists for several years if perchance they are spread from grass fires

(Bor, 1960). In Peninsular India, the true annuals or perennials of the subtribe *Eragrostidinae* have more or less erect or geniculate culm with fibrous or wiry root system. The perennials have cataphylls, erect or stoloniferous culms with prominent rootstock. It grows along mostly in lateritic soil, rocky substrata, or sandy soils near river banks. Of the 69 taxa of *Eragrostidinae* (under seven genera) treated here, 17 are annuals and 52 species are more or less perennials.

The genus *Eragrostis* is notorious for its troublesome infrageneric and specific delimitation (Veldkamp, 2002; Ingram, 2010). *Eragrostis* exhibits wide variety of altitudinal gradients from sea level to high altitudes. The majority of Peninsular Indian *Eragrostis* (35 species) are caespitose, sometimes slender, or geniculate annuals (12 species), perennials (11 species), or neither true perennials nor annuals (12). Whereas *E. aspera*, *E. atrovirens, E. curvula,* and *E. paniciformis* develop long, vigorous ones. *E. unioloides* is the only species that are pantropical, sometimes stoloniferous, but the flowering culms of *E. amabilis, E. brownii, E. cumingii, E. riparia,* and *E. zeylanica* can be sprawling or prostrate to erect. *E. japonica* is noteworthy due their size as annuals or short-lived perennials.

Stapf (1892) commented that, the habit of *Tripogon* is especially apt, most of them are delimited within specific geographic areas remarkably constant, and concur with a certain similarity in the habit which is not easy to convey in a short description. Most generally, the genus *Tripogon* thrives in a vriety of habitats like high altitude rocky outcrops (inselbergs), grasslands, and forest margins. The majority of Indian Tripogons are caespitose, slender, erect annuals or perennials, of which about three species (*T. vellarianus, T. bimucronatus* and *T. malabaricus*) may develop long racemes with well developed rootstocks. Whereas the species like *T. velliangiriensis* and *T. wightii* are sometimes stoloniferous, but the flowering culms of *T. filiformis* have mass of wolly pilose hairs all over the plant. While, *T. pungens* (pungent leaves) and *T. purpurascens* (purple coloured) are readily distinguished from others by their peculiar habit. Moreover, the species like, *T. capillatus* (tree trunks), *T. jaquemontii* (boulders),

and *T. polyanthus* (river bed granitic rocky outcrops) shows an unusual habitat preference.

The segregated genera of *Leptochloa s.l.*, *Dinebra, Disakisperma* and *Trigonochloa*, are tufted annuals or perennials. Among these, the Peninsular Indian taxa of the genus *Dinebra* are perennials except *D. paniceae* (annuals), of which *D. chinensis* may produce the stoloniferous roots from lower nodes. While the genera like *Disakisperma* (*D. obtusiflorum*) and *Trigonochloa* (*T. uniflora*) represents single species from Peninsular India. Besides, *T. uniflora* is strictly follows the annual habit with stloloniferous roots from lower nodes, sometimes sprawling to erect with short rhizomes. The genus *Eragrostiella* may have gregarious or sporadic habitat. Both species of *Eragrostiella* from Peninsular India (*E. bifaria* and *E. brachyphylla*) are caespitose annuals or perennials with wide altitudinal gradient for distribution.

Culms and Foliage

Broadly, culms are terete, unbranched or rarely branched (*Dinebra chinensis*), few noded, glabrous and smooth. Culm nodes vary in number from 1–4 in *Eragrostiella bifaria, Tripogon bromoides,* and *T. sivarajanii;* but 2–8 in *Dinebra chinensis*. While the remaining taxa of the subtribe *Eragrostidinae* may have 1–6-nodes in their culms. Predominantly, leaves are arranged all along the culm or grouped at the base of the culms. The leaf blades in all species of *Eragrostidinae* found in Peninsular India are usually linear-lanceolate, flat, rolled (involute or convolute), and folded (conduplicate).

Leaf sheath

In the genus *Eragrostis,* leaf characters are of limited taxonomic value. Mainly, the sheaths are shorter than their culm internodes, tight on the culms, and mostly glabrous. Only in *E. amabilis, E. ciliaris, E. ciliata, E. deccanensis* and *E. schweinfurthii* bears the tubercle based, hirsute or ciliate hairs on the leaf sheaths. In texture, the sheath may be chartaceous (*E. collinensis* and *E. unioloides*), keeled or complicate (*E. tenuifolia*). Similarly, in some species of *Tripogon* the sheath is densely hairy all over (*T. filiformis),* tough, imbricate and striate (*T. pungens*). Frequently the basal sheath of

Tripogon breaks up into fibrous threads which persist for a very long time. While in the genus *Eragrostiella* leaf sheath is much shorter than the internodes. Unusually, in the species of *Dinebra, Disakisperma* and *Trigonochloa* the culm may slip away from the sheaths.

Ligule

At the junction of the sheath and blade, on the inside, closely adpressed to the culm is a structure called the ligule. It exhibits great variation in shape and texture, but experience has shown that, treated as a specific character they are fairly reliable, i.e. they vary very little in shape and size for a species. Predominantly, the ligules of the genus *Eragrostis* may be ciliate (eg. *E. amabilis, E. coarctata, E. deccanensis),* sometimes with a narrow membranous base (*E. aspera* and *E. japonica*), fringe of hairs (eg. *E. brownii, E. ciliaris, E. cumingii, E. nilgiriensis*) or ciliate rim (eg. *E. atrovirens, E. collinensis),* but in *E. paniciformis* ligules may be fimbriate membrane with tubercle based hairs. Whereas in *Eragrostiella* and *Tripogon*, the ligules may be ciliate or long pilose hairy (*E. bifaria, E. brachyphylla, T. trifidus, T. narayanae* and *T. bromoides*), or inconspicuous (*T. lisboae* and *T. vellarianus*). Similarly, the genus *Dinebra* has the membranous (*Dinebra chinensis*), lacerate (*D. neesii*) or fimbriate ligules.

Leaf blade

Among the species of the subtribe *Eragrostidinae*, leaf blade features rarely applicable for species delimitations. Especially, in the genus *Eragrostis*, leaf blades often occur in various combinations on the same plant or change from flat to folded or rolled during their life cycle. However, the apex, indumentum of the leaf blades is more crucial and sometimes diagnostic in combination with other characters. It may be long acuminate (eg. *E. henryii, E. minor, E. curvula*), or flat-lanceolate (*E. paniciformis, E. atrovirens* and *E. nutans*), folded or keeled (*E. tenuifolia*) and others follow the linear-lanceolate to acute-acuminate apex. Whilst, leaf blade features in the genus *Tripogon* may impressive for taxonomic delineation. It may have linear-lanceolate (*T. bromoides, T. capillatus, T. idukkianus, T. narayanae, T. ravianus* and *T. zeylanicus*), flat (*T. bimucronatus, T. lisboae, T. malabaricus* and *T. vellarianus*), convolute (*T.*

jaquemontii and *T. polyanthus*), or flat-convolute (*T. sivarajanii*). Whereas the pungent apex of *T. pungens* are very conspicuous and help in species identification. In *Eragrostiella* there is also variation in absolute leaf size, from short leaves of *E. brachyphylla* to the clustered (*E. bifaria* var. *bifaria*) or scattered long leaves of *E. bifaria* var. *secunda* and *E. bifaria* var. *walkeri*. Similarly, the species of *Trigonochloa uniflora* shows a broad thin lanceolate flat leaves, but it shows more disparity from other members of the *Leptochloa s.l.*

Indumentum

The indumentum on blades is variable in different taxa of the *Eragrostidinae*. Succinctly, terms like ciliate, bearded, scabrid, pilose, tuberculate, pubescent, hirsute etc. have been here refered under indumentum. Commonly, among the species of *Eragrostis,* the adaxial sides and margins may have scaberulous, but abaxial sides are smooth and glabrous. Despite, exceptions include *E. collinensis, E. maderaspatana, E. minor* and *E. unioloides* (sparsely pilose adaxially), and *E. schweinfurthii* (hirsute on both surfaces). Predominantly, the nature of indumentums on the members of *Tripogon* is important for delimitation of taxa with other relevant key characters. Majority of the taxa in *Tripogon* have scabrid, sparsely pilose (adaxially) and glabrous (abaxially) leaf lamina, exceptionally they may be densely pilose (*T. filiformis*), or sparsely pilose (*T. narayanae*) on both surfaces.

Inflorescence

As in every other organ of this subtribe the diversification of inflorescence is much elaborate. It may be a spike (*Eragrostiella*), spike-like raceme (*Tripogon*), or true panicle (*Dinebra, Disakisperma, Trigonochloa* and *Eragrostis*) with wide variations. Some inflorescences barely emerge from the topmost spathe-like sheath as in *Dinebra chinensis.* In the genus *Eragrostis,* the panicle may be spiciform *(E. ciliata, E. ciliaris, E.riparia* and *E.deccanensis)*, spiciform-contracted (eg. *E. nutans, E. tef, E. viscosa*), interrupted and spiciform (*E. japonica*), effuse (eg. *E. amabilis, E. rottleri, E. minor, E. maderaspatana, E. henryi, E. nilgiriensis*), open-effuse (*E. pilosa, E. tenuifolia* and

Fig. 203. Panicles of ***Eragrostis*** **Wolf: A.** *Eragrostis amabilis*; **B.** *E. amabilis* var. *insularis*; **C.** *E. aspera*; **D.** *E. brownii*; **E.** *E. cilianensis*; **F.** *E. ciliaris*; **G.** *E. cumingii*; **H.** *E. henryi* **I.** *E. japonica*; **J.** *E. macilenta*; **K.** *E. maderaspatana*; **L.** *E. minor*.

Fig. 204. Panicles of ***Eragrostis*** **Wolf: M.** *Eragrostis nigra*; **N.** *E. nilgiriensis*; **O.** *E. nutans*; **P.** *E. paniciformis*; **Q.** *E. riparia*;**R.** *E. rottleri*; **S.** *E. schweinfurthii*; **T.** *E. tef*; **U.** *E. tremula*; **V.** *E. unioloides*; **W.** *E. viscosa*; **X.** *E. zeylanica.*

Fig. 205. Panicles of ***Eragrostis*** **Wolf: A.** *Eragrostis atrovirens*; **B.** *E. collinensis*; **C.** *E. deccanensis*; **D.** *E. gangetica*; **E.** *E. pilosa*; **F.** *E. tenuifolia*.

E. schweinfurthii), effuse and widely spreading (eg. *E. cumingii, E. brownii, E. superba, E. zeylanica*), lax (*E. atrovirens, E. gangetica, E. paniciformis, E. curvula, E. nigra, E. subsecunda* and *E. tremula*), effuse to lax (eg. *E. collinensis, E. cilianensis, E. macilenta, E. unioloides*), thyrsiform (*E. aspera*). Whereas in *Tripogon,* inflorescence is invariably a spike-like raceme, but the number and size of florets may vary from species to species. Sometimes the racemes may be stout (*T. lisboae, T. malabaricus, T. bimucronatus* and *T. vellarianus*), slender (*T. bromoides, T. jacquemontii* and *T. sivarajanii*), and flexuous (*T. capillatus, T. filiformis, T. longearistatus* and *T. purpurasensce*). While the genus *Leptochloa s.l.* have the true panicle with numerous racemes on the central axis (**Figs. 203–205**).

Spikelet

Spikelet is the basic unit of inflorescence in Poaceae. In *Eragrostidinae*, the spikelet is indeterminate in growth and the number of florets developed varies from few to numerous, sometimes considerably in the same species, example 4–70 in *Eragrostiella bifaria, Eragrostis collinensis, E. tremula, E. unioloides,* and *E. zeylanica.* Generally all the florets in a spikelet are bisexual, despite they become gradually smaller distantly. In a relatively few taxa, the apical floret is vestigial or reduced to a naked rachilla internode. The length: width ratio of the spikelet, correlated with outline shape and the number of florets present, are the general diagnostic characters for the *Eragrostidinae.* Largely, the spikeltes of the many *Eragrostis* species are pedicelled in a long primary or secondary pedicels on the panicles (*E. aspera, E. paniciformis, E. collinensis,* and *E. tremula*). The shape of spikelets on *Eragrostis* may have oblong-lanceolate or crescent shaped (*E. cumingii, E. tremula* and *E. zeylanica*), ovate or oblong (*E. amabilis, E. minor* and *E. riparia*), linear or linear-lanceolate (*E. japonica* and *E. gangetica*), ovate-lanceolate or oblong-lanceolate (*E. collinensis* and *E. unioloides*), ovate or ovate-oblong (eg. *E. atrovirens, E. nutans, E. cilianensis*), broadly ovate to oblong-lanceolate (*E. superba*). Occasionally, coloration is a supporting feature that can aid in identification, *E. nigra* and *E. nilgiriensis* (dark or dark greenish), *E. pilosa* and *E. japonica* (light green), *E. atrovirens* and *E. gangetica* (ash or grey), *E. collinensis* and *E. unioloides* (purplish with chocolate tinge), *E. amabilis, E. cilianensis, E. pilosa* and *E. tremula* (olive green with purple tinge). Whereas in the genus *Tripogon,* number of florets and awns is a characteristic feature for the delimitation of species. While in *genera such as Dinebra, Disakisperma,* and *Trigonochloa* the number of florets on the spikelets in each racemes is the one of the delimiting character for species identification (**Figs. 206–209; Table 3,** 4).

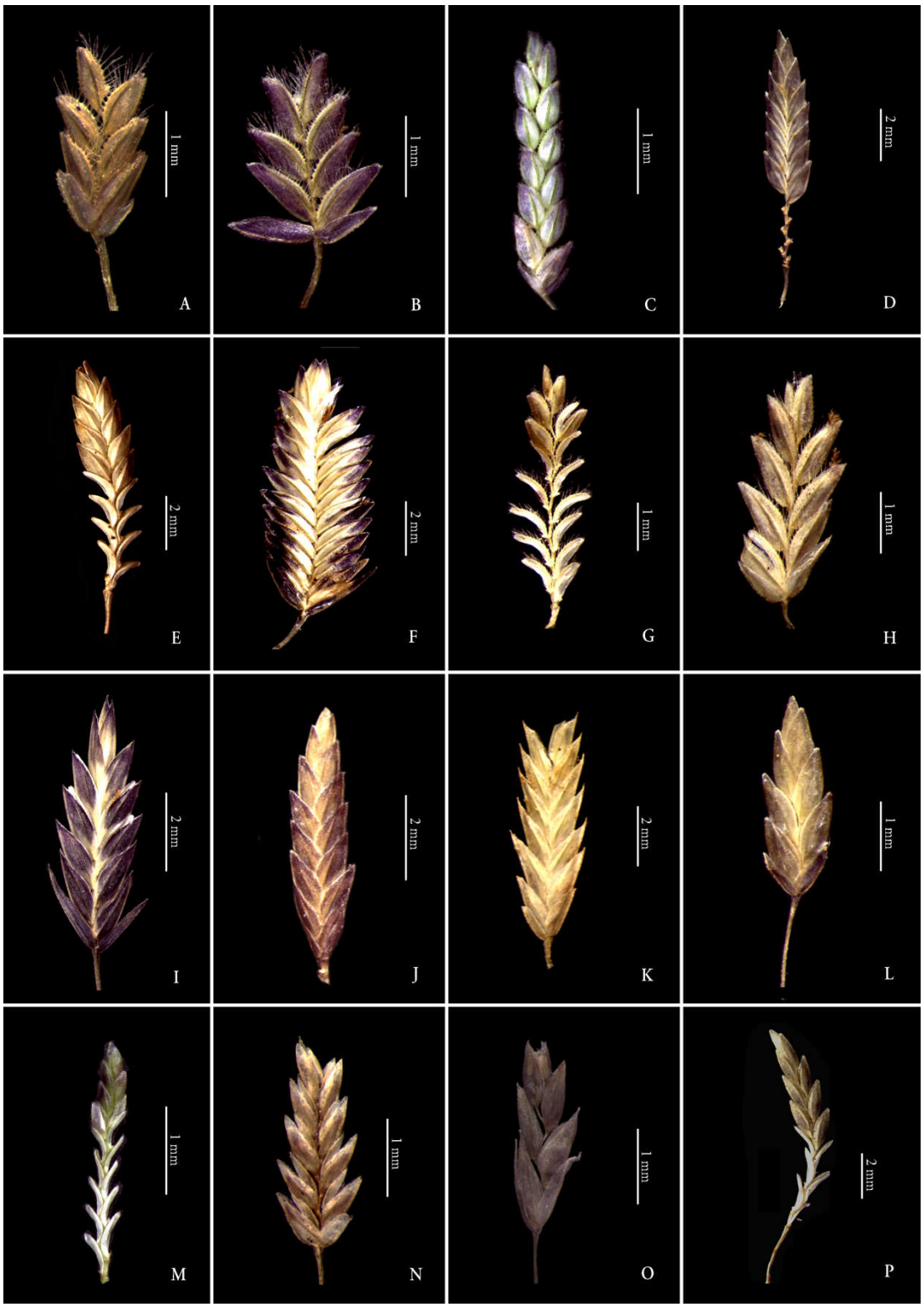
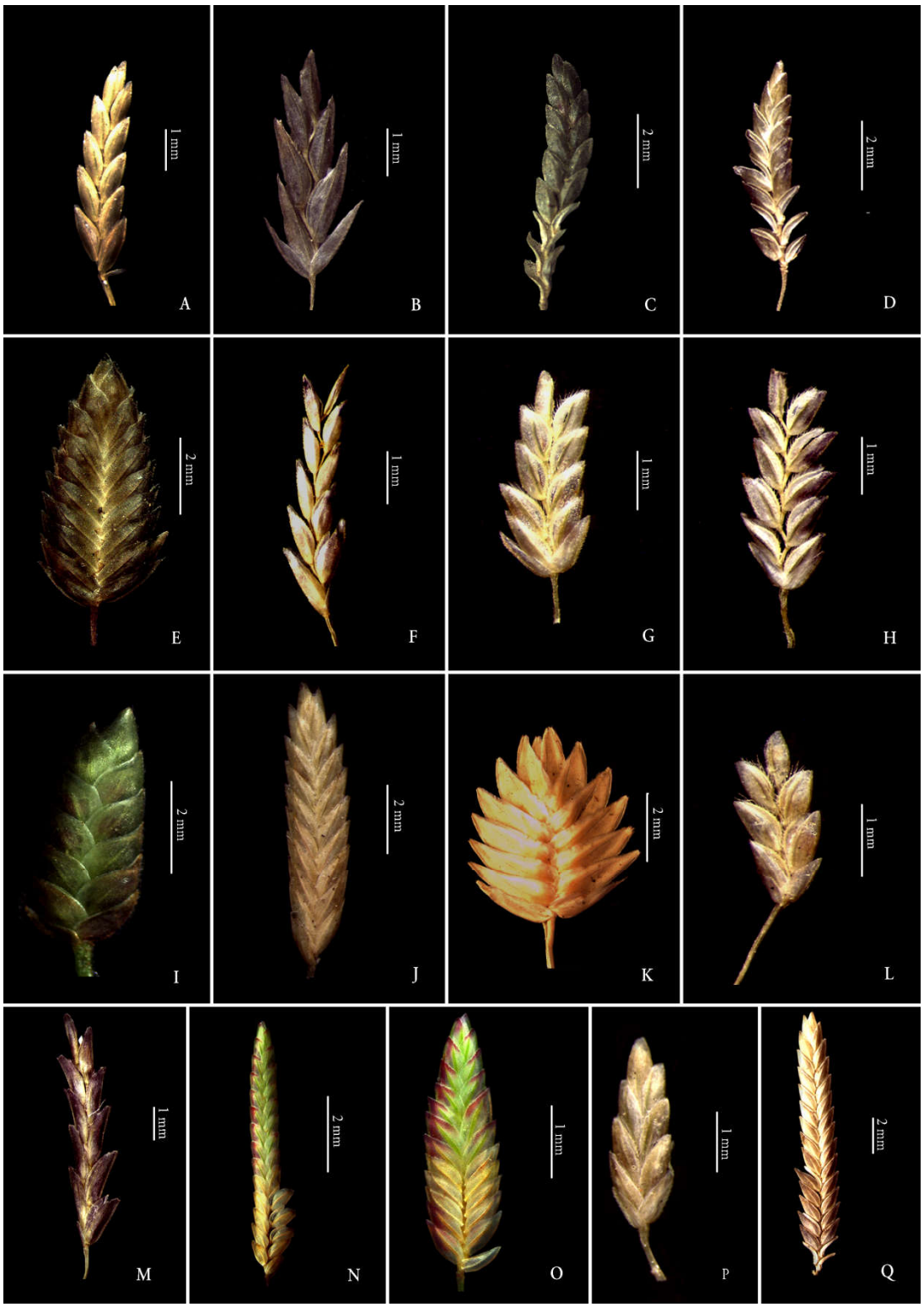


Fig. 206. Spikelets of ***Eragrostis*** **Wolf: A.** *Eragrostis amabilis*; **B.** *E. amabilis* var. *insularis*; **C.** *E. aspera*; **D.** *E. atrovirens*; **E.** *E. brownii*; **F.** *E. cilianensis*; **G.** *E. ciliaris*; **H.** *E. ciliata*; **I.** *E. collinensis*; **J.** *E. cumingii*; **K.** *E. deccanensis*; **L.** *E. gangetica*; **M.** *E. henryi;* **N.** *E. japonica*; **O.** *E. macilenta*; **P.** *E. maderaspatana*.



Figs 207. Spikelets of ***Eragrostis*** **Wolf: A.** *Eragrostis minor*; **B.** *E. nigra*; **C.** *E. nilgiriensis*; **D.** *E. nutans*; **E.** *E. paniciformis*; **F.** *E. pilosa*; **G.** *E. riparia*; **H.** *E. rottleri*; **I.** *E. schweinfurthii*; **J.** *E. subsecunda*; **K.** *E. superba*; **L.** *E. tef*; **M.** *E. tenuifolia*; **N.** *E. tremula;* **O.** *E. unioloides*; **P.** *E. viscosa*; **Q.** *E. zeylanica.*

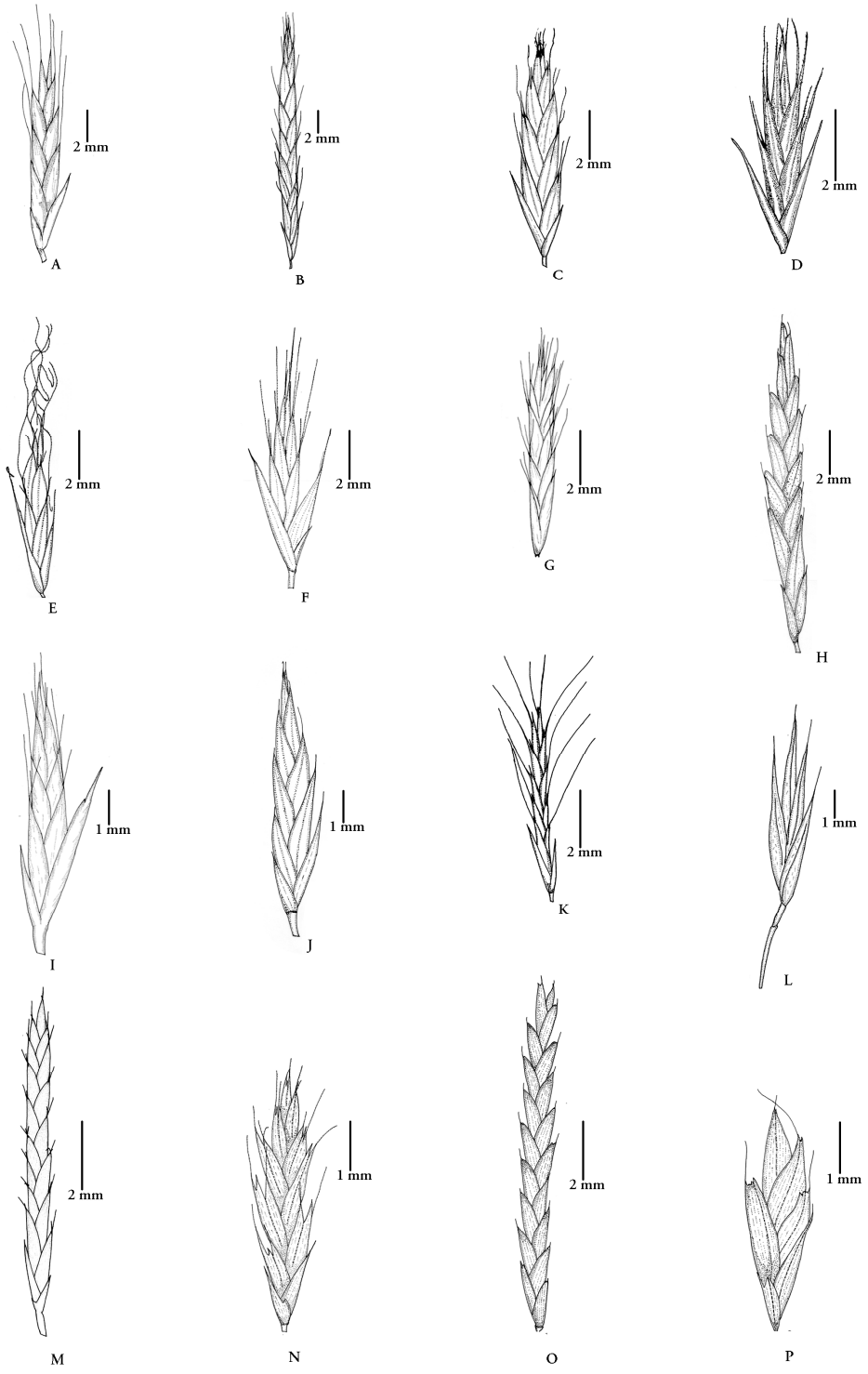


Fig. 208. Spikelets of ***Tripogon* Roth *ex* Roem. & Schult.: A.** *Tripogon bimucronatus*; **B.** *T. borii*; **C.** *T. bromoides*; **D.** *T. bromoides* var. *longifolius*; **E.** *T. capillatus*; **F.** *T. filiformis*; **G.** *T. idukkianus*; **H.** *T. jacquemontii*; **I.** *T. karnatakensis;* **J.** *T. lisboae*; **K.** *T. longearistatus;* **L.** *T. malabaricus*; **M.** *T. munnarensis;* **N.** *T. narayanae*; **O.** *T. polyanthus*; **P.** *T. pungens*.

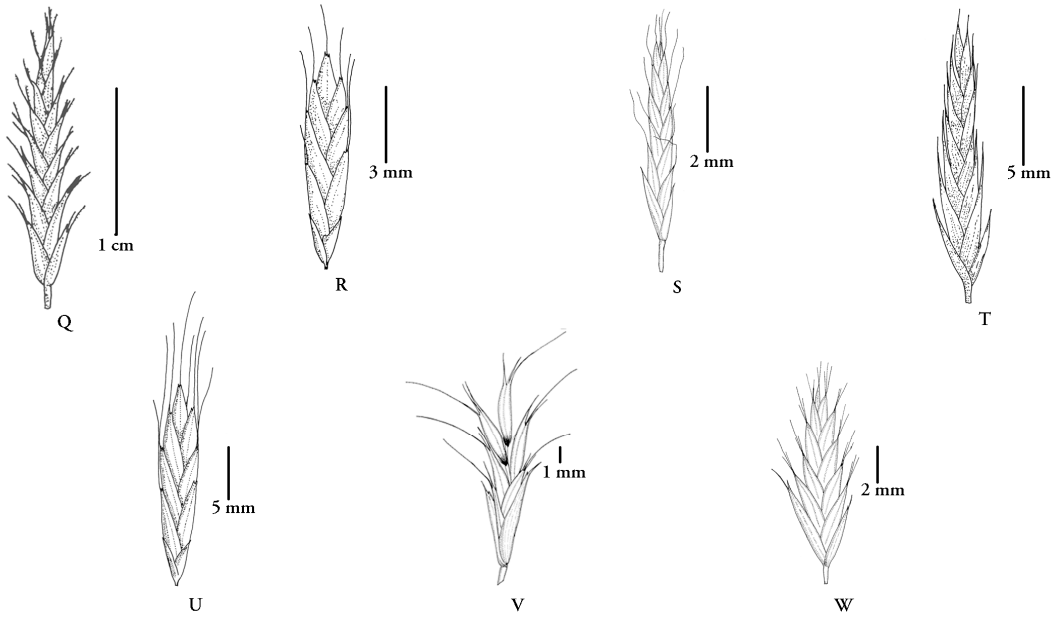


Fig. 209. Spikelets of ***Tripogon* Roth *ex* Roem. & Schult.: Q.** *Tripogon ravianus*; ***R.*** *T. sivarajanii*; **S.** *T. trifidus*; **T.** *T. vellarianus*; **U.** *T. velliangiriensis*; **V.** *T. wightii*; **W.** *T. zeylanica.*

Table. 3. Spikelet characters of the species of *Eragrostis* Wolf in Peninsular India

Taxa	Spikelet length (mm)	Spikelet shape	Disarticulation	No. florets	No. stamens
E.amabilis (L.) Wight & Arn.	2–3.4	Ovate to oblong-lanceolate	Basipetal, on the rachilla above the glumes, glumes sub-persistent	4-8	3
E. aspera (Jacq.) Nees	2.5–7	Oblong, acute	Basipetal, on the rachilla above or below the glumes	6–12	3
E. atrovirens (Desv.) Trin *ex* Steud.	4–6	Ovate-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous at first	5–20	3
E. brownii (Kunth) Nees	5–10	Ovate-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous at first	5–25	3
E. cilianensis(All.) Vignolo *ex* Janch.	5–20	Ovate-oblong	Acropetal, on the rachilla below the florets, glumes deciduous at first	5–40	3
E. ciliaris (L.) R.Br.	1.8–3.2	Ovate-oblong or lanceolate	Basipetal, on the rachilla above or below the glumes	5–11	2
E. ciliata (Roxb.) Nees	3.8–5.5	Oblong	Basipetal, on the rachilla above or below the glumes	7–12	3

Taxa	Spikelet length (mm)	Spikelet shape	Disarticulation	No. florets	No. stamens
E. coarctata Stapf	2–4.5	Oblong	Basipetal, on the rachilla above or below the glumes	3–12	3
E. collinensis Vivek, G.V.S. Murthy & V.J. Nair	4–10	Ovate-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous at first	5–40	3
E. cumingii Steud.	2–10	Oblong-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous at first	5–20	3
E. curvula (Schrad.) Nees	4–10	Oblong	Acropetal, on the rachilla below the florets, glumes deciduous	4–13	3
E. deccanensis Bor	4–5.5	Oblong-lanceolate	Basipetal, on the rachilla above or below the glumes	5–12	3
E. gangetica (Roxb.) Steud.	3–8	lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous at first	5–20	2
E. henryi Vivek, G.V.S. Murthy & V.J. Nair	5–25	Ovate-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous at first	5–55	3
E. japonica (Thunb.) Trin.	2–4.5	Ovate-lanceolate	Basipetal, on the rachilla above or below the glumes	4–13	2
E. macilenta (A.Rich.) Steud.	3–6	oblong	Basipetal, with rachilla above or below the glumes	4–12	3
E. maderaspatana Bor	5–17	Linear-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous	10–35	3
E. minor Host	5–15	Linear-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous	10–45	3
E. multicaulis Steud.	2–4.75	Linear-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous	4–8	3
E. nigra Nees ex Steud.	3–7	Ovate to oblong-lanceolate	Acropetal, on the rachilla below or between the florets, glumes deciduous	3–14	3
E. nilgiriensis Vivek, G.V.S. Murthy & V.J. Nair	4–13	Ovate to linear-lanceolate	Acropetal, on the rachilla below or between the florets, glumes deciduous	3–28	3

Taxa	Spikelet length (mm)	Spikelet shape	Disarticulation	No. florets	No. stamens
E. nutans (Retz.) Nees *ex* Steud.	4–5	Ovate-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous at first	7–12	3
E. paniciformis (A. Braun) Steud.	2.5–14	Ovate-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous at first	10–30	3
E. papposa (Duf.) Steud.	3.5–11	Elliptic-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous	8–18	3
E. pilosa (L.) P.Beauv.	3–8	Ovate-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous at first	8–10	3
E. riparia (Willd.) P. Beauv.	2–2.5	Ovate-lanceolate	Basipetal, with rachilla above or below the glumes	3–6	3
E. rottleri Stapf	4–6	Linear-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous	5–12	3
E. schweinfurthii Chiov.	4–8	Ovate-oblong	Occasionally in between the florets	5–15	2
E. subsecunda (Lam.) E. Fourn.	3–10	Oblong or oblong-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous	10–24	3
E. superba Peyr.	9–11	Broadly oblong-lanceolate	Usually entire spikelets disarticulating from pedicel apex	6–16	3
E. tef (Zucc.) Trotter	2.5–4	Ovate-lanceolate	Basipetal, with rachilla above or below the glumes	4–12	3
E. tenuifolia (A. Rich.) Hochst. *ex* Steud.	4–12	Linear-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous	4–15	3
E. tremula Hochst. *ex* Steud.	1.5–8 or 5–25	Ovate-oblong	Acropetal, on the rachilla below the florets, glumes deciduous at first	10–70	3
E. unioloides (Retz.) Nees *ex* Steud.	4–12	Ovate or ovate-oblong	Acropetal, on the rachilla below the florets, glumes deciduous at first	5–80	2
E. viscosa (Retz.) Trin.	2.5–5.3	Ovate-lanceolate	Acropetal or basipetal, sometimes in between florets.	4–11	3
E. zeylanica (Retz.) Nees et Meyen	15–25	Linear-lanceolate	Acropetal, on the rachilla below the florets, glumes deciduous at first	10–60	3

Table 4. Spikelet characters of *Tripogon* Roth *ex* Roem. & Schult. in India

Species	Spikelet length (mm)	No. florets	No. lemma lobes	No. lemma awns	Texture of awns	Palea apex	No. stamens
T. bimucronatus Thoiba & Sunil	1.3–1.8	6–8	2	1	Straight	Bimucronate	3
T. borii Kabeer, V.J. Nair & G.V.S. Murthy	10–16	6–14	6	3	Straight	Sub-acute	3
T. bromoides Roth *ex* Roem. & Schult.	4.8–12	4–10	4	3	Straight	Acute or minutely bi-lobed	3
T. capillatus Jaub. & Spach	5–8	3–5	2	3	Flexuous	Bi-lobed	3
T. filiformis Nees ex Steud.	6–8	4–10	4	3	Straight or flexuous	Obtuse or narrowly bimucronate	1 or 3
T. idukkianus Sunil & Pradeep	5–13	6–14	4	3	Straight	Bisetaceous subapically	3
T. jacquemontii Stapf	7.5–16	4–25	2	1	Straight	Obtuse or emarginate	3
T. karnatakensis Thoiba & Pradeep	10–30	7–10	4	3	Straight	Sub-acut to deeply notched	3
T. lisboae Stapf	5–13	5–10	2	1	straight	Acute	3
T. longearistatus Hack. ex Honda	4.5–10.5	4-12	4	3	Straight or flexuous	Acute or bi-lobed	1
T.mahendragiriensis Chorge, Sangita Dey, K. Prasad, Prasanna & Y.V. Rao	4.5–5.2	4–5	–	3	Straight	Acute	2
T. malabaricus Thoiba & Pradeep	13–14	4–7	None or 2	1	Straight	Subulate	3
T. munnarensis Thoiba & Manudev	10–16	10–16	4	3	Straight	Sub-acute to deeply notched	3
T. narayanae Sreek., V.J. Nair & N.C. Nair	5–10	4–6	4	3	Straight	Emarginate or 2-lobed	3
T. polyanthus Naik & Patunkar	20–65	20–60	2	1	Straight	Acute	3
T. pungens C.E.C. Fisch.	2–6	3-9	2	1	Straight	Obtuse or complicate	3
T. purpurascens Duthie	2.5–7	2–8	2	0 or 1	Straight	Obtuse or emarginate	3
T. ravianus Sunil & Pradeep	10–25	6–14	4	3	Straight	Acute with a central notch	3
T. sivarajanii Sunil	7–10.5	5–8	2	1	Straight	Acute or lobed with a a central notch	3
T. trifidus Munro *ex* Hook.f.	4–16	5–20	2	1or 3	Straight	Bi-lobed or dentate	3

Species	Spikelet length (mm)	No. florets	No. lemma lobes	No. lemma awns	Texture of awns	Palea apex	No. stamens
T. vellarianus Pradeep	10–17	6–12	2	1	Straight	Acute	3
T. velliangiriensis Murug. & V. Balas.	10–25	6–9	2	1	Almost Straight	Emarginate or 2-lobed with a minute central notch	3
T. wightii Hook.f.	13–30	5–16	2	1 or 3	Straight to curved	Sharply bi-lobed with a central notch	3
T. zeylanicus Thwaites	8–15.5	7–13	6	3	Straight	Acuminate	3

In *Eragrostis,* the mode of spikelet disarticulation is remarkably diverse. Here, majority of the spikeletes disarticulates from below the fertile florets, or sometimes below the glumes (*E. superba*). Disarticulation may be acropetal or basipetal manner. In most native Old world taxa, the lemma disarticulates acropetally from persistent rachilla, while palea is persistent or sub-persistent on the rachilla. Since then, spikelets disarticulation characters have been used as a basis for infrageneric classifications.

Glumes

In *Eragrostidinae,* the glumes provide useful characteristics, and they vary in texture, indumentum, shape and relative quantitative characters. They are shorter than the neighbouring lemmas (except *Dinebra, Disakisperma* and *Trigonochloa*), mostly 1–3-nerved, with or without lobes, and have obtuse to acute apices that are usually awned or unawned. Among *Eragrostiella* and *Eragrostis*, glumes are usually deciduous, subequal to unequal, always shorter than the each spikelet. The usual conditions for the genus are 1-nerved, muticous and glabrous glumes, however some species are anomalous in being nerveless (*E. tenuifolia* and *E. maderaspatana*). At the sametime, the shape of the glumes in *Tripogon* is taxonomically relevant and it may vary from species to species. Lower glume of *Tripogon* has a lobe or tooth on one side, and upper glumes represented by bi-lobed teeth with mucronate or miniature awn at the apex (*T. bromoides, T. ravianus, T. sivarajanii, T. velliangiriensis, T. wightii* and *T. zeylanicus*).

In *Leptochloa s.l. (Dinebra, Disakisperma* and *Trigonochloa),* the glumes are keeled and finely serrulate towards apex.

Lemma

Lemmas of almost all species are generically 3-nerved, acute or acuminate (*Eragrostiella, Eragrostis* and *Leptochloa s.l.*), muticous (*Eragrostis*), and glabrous or chartaceous, lobed with 1–3 awns (*Tripogon*). In *Eragrostis,* lateral nerves are frequently closer to the midnerve, almost as long as the lemma itself. However, sometimes they are submarginal (eg. *E. ciliaris, E. japonica, E. maderaspatana, E. pilosa, E. riparia, E. schweinfurthii, E. unioloides*), much shorter than the lemma and/or obscure (*E. macilenta*). The mode of disarticulation of lemma may be sub-persistent (*E. atrovirens*, *E. nutans* and *E. gangetica*), or caducous (*E. schweinfurthii, E. tenuifolia, E. tremula,* and *E. unioloides*). While in *Tripogons,* lemma apex may be 2-lobed (*T. bimucronatus, T. lisboae, T. jacquemontii, T. polyanthus, T. malabaricus, T. sivarajanii, T. wightii* and *T. velliangiriensis)*, 4-lobed (*T. bromoides, T. filiformis, T. trifidus, T. narayanae, T. munnarensis, T. karnatakensis* and *T. idukkianus*) or 6-lobed (*T. borii* and *T. zeylanicus*) with 1 or 3 awns (**Figs. 210, 211**)

Palea

In *Eragrostidinae,* shape, texture and indumentum of the palea furnish a significant number of differentiating characters. Other relevant features encompass the length of the palea relative to that of its lemma, which is frequently subequal, but sometimes conspicuously smaller (eg. *Eragrostis japonica, Trogonochloa uniflora*). In *Eragrostis,* the palea keels may be minutely scaberulous, ciliate, but occasionally ciliate with long hirsute hairs (*E. amabilis, E. viscosa, E. ciliate* and *E. ciliaris*), which are visible to eyes without using a magnifying glass. In *Eragrostis*, the palea may be persistent (*E. minor*) sub persistent (*E. riparia, E. atrovirens, E. rottleri, E. gangetica* and *E. nigra*) or deciduous (eg. *E. amabilis, E. cilianenesis, E. unioloides*) with its

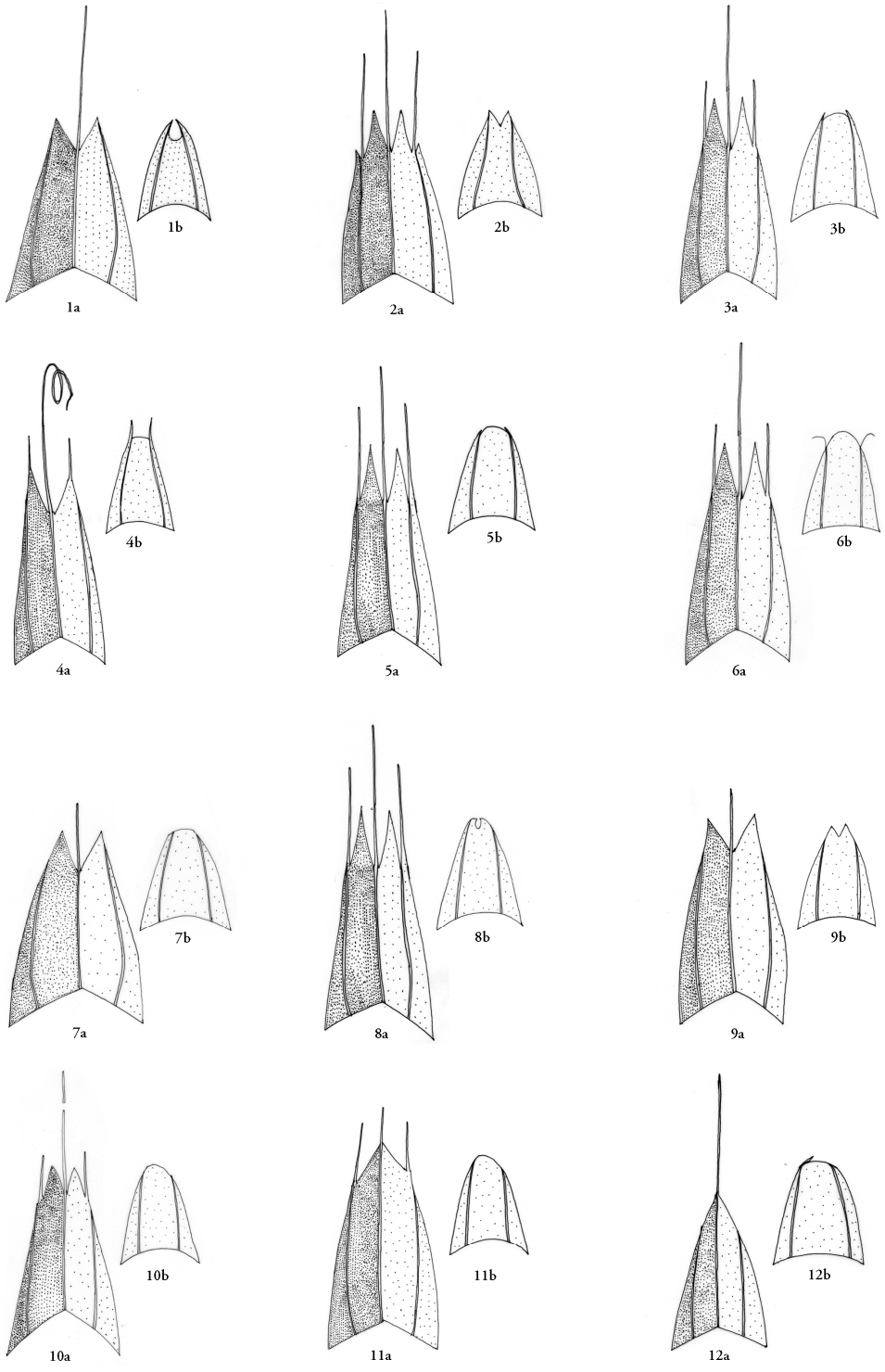


Fig. 210. Diagrammatic representation of the variation in lemma (**a**) and palea (**b**) apices in ***Tripogon*** **Roth *ex* Roem. & Schult.** throughtout India**: 1.** *Tripogon bimucronatus*; **2.** *T. borii*; **3.** *T. bromoides*; **4.** *T. capillatus*; **5.** *T. filiformis*; **6.** *T. idukkianus*; **7.** *T. jacquemontii*; **8.** *T. karnatakensis;* **9.** *T. lisboae*; **10.** *T. longearistatus;* **11.** *T. mahendragiriensis*; **12.** *T. malabaricus*.

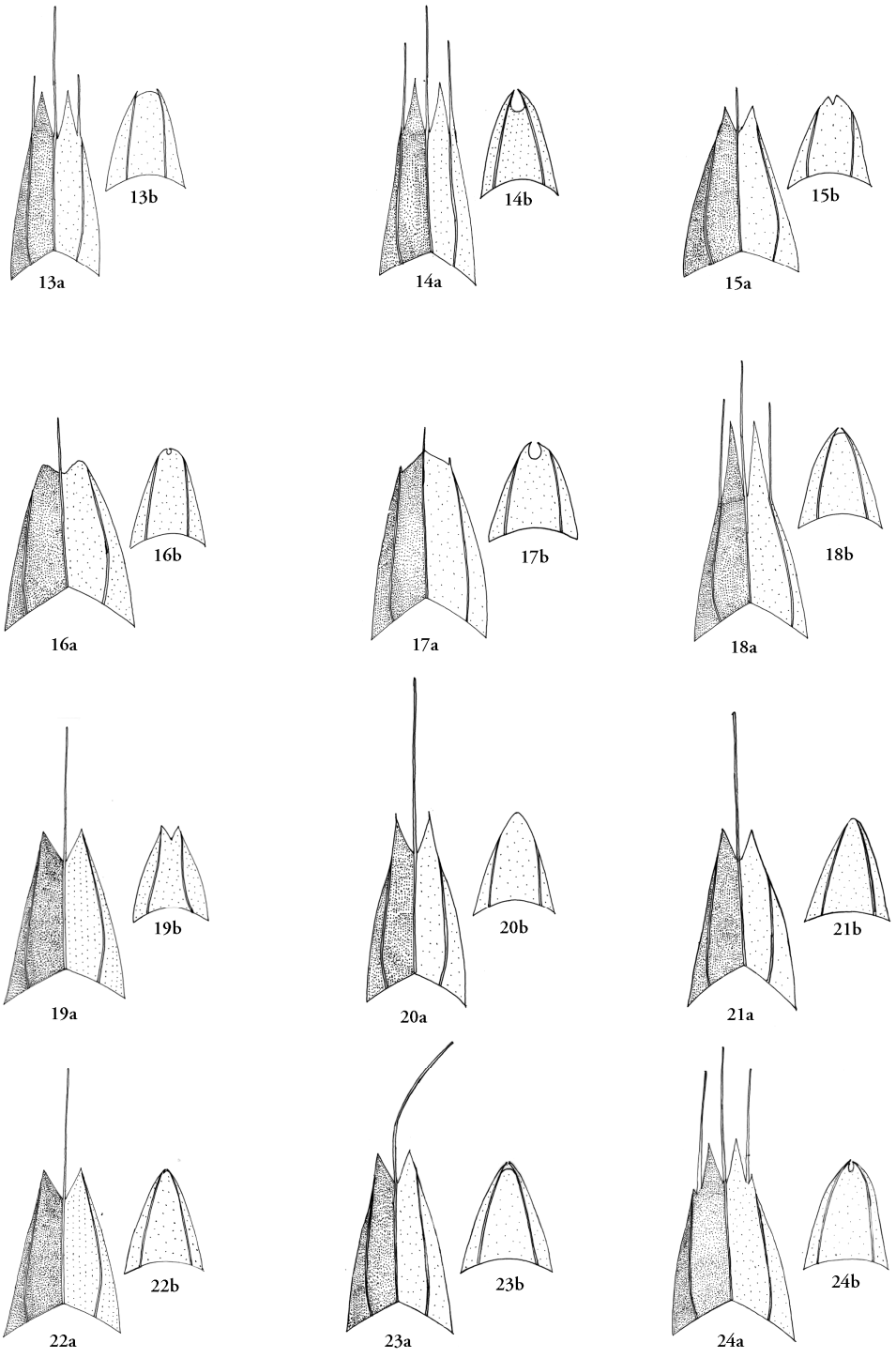


Fig. 211. Diagrammatic representation of the variation in lemma (**a**) and palea (**b**) apices in ***Tripogon*** **Roth *ex* Roem. & Schult.** throughtout India: **13.** *T. munnarensis*; **14.** *T. narayanae*; **15.** *T. polyanthus*; **16.** *T. pungens*; **17.** *T. purpurascens*; **18.** *T. ravianus*; **19.** *T. sivarajanii*; **20.** *T. trifidus;* **21.** *T. vellarianus*; **22.** *T. velliangiriensis*; **23.** *T. wightii*; **24.** *T. zeylanica.*

lemma. While in *Tripogon* and *Eragrostiella,* the keels may be narrowly winged or rarely broadly winged (*E. bifaria, Tripogon wightii* and *T. velliangiriensis*). In massive species, the flaps of the palea are narrow and wholly encircle the caryopsis; however, in *E. paniciformis* have much reduced keels and with auricle-like flaps.

Lodicules

Lodicules are rarely discussed in the literature on *Eragrostidinae*, presumably because they are rather invariant and uniform in generic and specific levels. This is legitimate for all Indian species in which the lodicules are two in number, delicate, glabrous, cuneate (*Eragrostiella* and *Eragrostis*) or truncate (*Tripogon*).

Stamens

In *Eragrostidinae*, the convenient number of anthers is a diagnostic feature of the taxa. Commonly in *Eragrostidinae*, anthers are consistent to 1–3 in number. In *Eragrostis,* some species have inconsistent number of stamens *viz.,* two or three (*E. brownii* and *E. cumingii*), or only two (*E. ciliaris, E. ciliata, E. gangetica, E. deccanensis* and *E. unioloides*). Whereas in the genus *Tripogon,* almost all of them have 3 anthers, infrequently some of them are with one *(T. longearistatus)* or two anthers *(T. mahendragiriensis)* in their florets.

Caryopses

The caryopses comprise many morphological features that are relevant aid in the identification of taxa. This data can be used to analyze hypothetical relationship among the species. Caryopses are the one of the most useful organs for taxonomic delineation in *Eragrostidinae.* It may be compressed either dorsally or laterally, or turgid to semi-turgid (oblong, terete or trigonous). The shape of caryopsis varies from each genera, such as oblong (*Tripogon*), oblong or oblanceolate with convex or deeply grooved surfaces (*Dinebra, Disakisperma* and *Trigonochloa*). Furthermore, *Eragrostiella* and *Eragrostis* have globoid or ellipsoid to much longer than wide grains, with diverse variations within these extremes. Caryopsis micromorphology (including SEM studies) are discussed in some details in chapter 8.

Chapter 8

Caryopsis Morphology

Chapter 8 Caryopsis Morphology

In recent times, Scanning Electron Microscope (SEM) is being used extensively to study seed-coat characters. The use of SEM in morphological studies has opened up new vistas for morphologists and taxonomists because of its ability to reveal new dimensions of plant surface details (Heywood & Dakshini, 1971; Sivarajan, 1991). Davis and Heywood (1963) observed that seed morphological studies may provide many systematically significant characters in plant taxonomy which are reliable and unique within a taxon. Seed morphology has been used as a potential character to explain taxonomic problems, and to establish the evolutionary relationships between different groups of plants because of its great range of variability and remarkable specificity and consistency in their features (Takhtajan, 1991).

The caryopsis encompasses many morphological features that are important tool in the identification of species, and this information can be used to infer hypothetical relationships among the grasses (Colbry, 1957; Terell & Peterson, 1993; Boechat & Longhi-Wagner, 2003; Peterson *et al.,* 2007). The caryopsis morphology of Poaceae, especially shape, size and testa ornamentation pattern, have been well utilized by different workers, to classify and delimit different genera, species and infra-specific categories (Terrel & Peterson, 1993). However, a number of papers have already been published on the caryopsis morphology of the genus *Eragrostis* in Australia (Lazarides, 1997), Brazil (Boechat & Longhi-Wagner, 2003), Peru (Peterson & Sanchez Vega, 2007), northwestern South America (Giraldo-Canas *et al.,* 2012), and India (Gandhi *et al.,* 2013; Vivek *et al.,* 2015).

Notwithstanding, majority of the floristic and revisionary studies have a tendency of neglecting this significant morphological feature even today, though it attempt wide range of characters with appropriate systematic value. Here, in the

subtribe *Eragrostidinae* caryopses of (58 out of 69 species within 7 genera) as many species as possible have been studied using both Stereo Microscope and SEM. Hither for the best expression of ornamentations, adequate sampling of caryopsis for various taxa has been done before scanning. Besides, to get the complete range of variation patterns of their testa microsculpture mature caryopses were used. Caryopsis size, shape, colour and nature of ornamentation are used for the diagnostic analysis.

Eragrostis Wolf is the largest, morphologically diverse and complicated genus of the subfamily Chloridoideae. Due to its notorious troublesome infrageneric delimitation, *Eragrostis* is taxonomically significant genus of the family Poaceae. Consequently, caryopsis morphology has a crucial role in determining taxa at species and infraspecific levels also. In the present study the surface features of the caryopses of 33 out of the 36 species of Peninsular Indian *Eragrostis* were examined by using Stereo Microscope and Scanning Electron Microscope (SEM) (**Fig. 212; Table 5**). From these, 3 of the caryopses studied were extremely from herbaria (*E. curvula, E. subsecunda* and *E. superba*), and all others (30 species) were from the live specimens collected from the field itself. Caryopses of the *Eragrostis* are dry, one-seeded indehiscent fruit. The pericarp is always adnate to seed; however in *E. japonica* the pericarp is loose, i.e. it may shed if the grain is moistened (Giraldo-Canas *et al.,* 2012). Size of grain varies from miniature (*c.* 0.2 mm in *E. japonica*) up to 2 mm long (*E. superba*) in Peninsular Indian taxa. Shape varies from angled, globose, subglobose, ovoid, obovoid, ellipsoid, oblong, prism-like, with truncate or obtuse edges. The ornamentations of caryopsis vary primarily in the thickness of reticulations as well as shape and length of the cells (**Figs. 213–219**). The caryopsis surface is varyingly reticulate *viz.,* prominently reticulate (*E. atrovirens, E. cilianensis, E. collinenesis, E. cumingii, E. macilenta, E. minor, E. nigra, E. nutans, E. paniciformis, E. schweinfurthii, E.superba, E. tenuifolia, E. tremula* and *E. unioloides*), medianly reticulate (*E. amabilis, E. aspera, E. brownii, E. ciliata, E. henryi, E. maderaspatana, E. nilgiriensis, E. pilosa, E. tef* and *E. zeylanica*), finely reticulate or almost smooth (*E. ciliaris, E. coarctata, E. curvula, E. deccanensis, E.*

japonica, E. gangetica, E. riparia and *E. viscosa*). The cells are rectangular to polygonal, narrower or broader in outline. Similarly, thickness of the cells also fluctuates among various species. Recently, in Peninsular India, the ambiguous descriptions in literature due to the confusion in the identity of 2-closely allied species viz., *E. jainii* Vivek, G.V.S. Murthy & V.J. Nair and *E. unioloides* (Retz.) Nees ex Steud. have been resolved mainly by studying its substantive similarity between the morphology of their caryopsis testa ornamentations. Succinctly, both have the prominently reticulate/isodiametric thick walled broader cells in testa. Therefore, present study based on morphological characteristics support merging of *E. janii* with *E. unioloides*.

Table 5. Caryopsis morphology of the species of *Eragrostis* Wolf in Peninsular India

Name of taxa	Grain shape	Length (in mm)	Colour	Surface cell ornamentation
E. amabilis var. *amabilis* (L.) Wight & Arn.	Ovoid to ellipsoid	0.3–0.5	Light brown	Medianly reticulate/ Rectangular thin walled narrow cells
E. amabilis var. *insularis* (C.E.Hubb.) P.Umam. & P.Daniel	Ovoid to ellipsoid	0.3–0.5	Light brown	Finely reticulate/ Rectangular thin walled narrow cells
E. aspera (Jacq.) Nees	Ovoid to sub globose	0.4–0.5	Deep brown	Medianly reticulate/ Rectangular thin walled narrow cells
E. atrovirens (Desv.) Trin *ex* Steud.	Ellipsoid to oblong	0.3–0.5/ 0.6–0.9	Deep brown	Prominently reticulate/ Rectangular thick walled narrow cells
E. brownii (Kunth) Nees	Ellipsoid, laterally flattened	0.4–0.75	Dark brown	Prominently reticulate/ Isodiametric thick walled broader cells
E. cilianensis (All.) Vignolo *ex* Janch.	Globose to orbicular	0.4–0.75	Reddish brown	Prominently reticulate/ Isodiametric thick walled narrow cells
E. ciliaris (L.) R.Br.	Ovoid to ellipsod	0.3–0.5	Light brown	Finely reticulate or almost smooth/ Rectangular thin walled narrow cells

Name of taxa	Grain shape	Length (in mm)	Colour	Surface cell ornamentation
E. ciliata (Roxb.) Nees	Ovoid to ellipsoid	0.4–0.5	Deep brown	Medianly or finely reticulate/ Rectangular thin walled narrow cells
E. coarctata Stapf	Ovoid to ellipsoid	0.3–0.5	Deep brown	Finely reticulate/ Rectangular thin walled narrow cells
E. collinensis Vivek, G.V.S. Murthy & V.J. Nair	Obovoid to ellipsoid	0.5–0.8	Reddish brown	Prominently reticulate/ Isodiametric thick walled broader cells
E. cumingii Steud.	Ovoid to globose	0.5–0.75	Deep brown	Prominently reticulate/ Isodiametric thick walled broader cells
E. curvula (Schrad.) Nees	Ellipsoid to prismatic; ventrally grooved	0.7–1	Light brown	Medianly reticulate/ Rectangular thin walled narrow cells
E. deccanensis Bor	Ovoid to ellipsoid	0.4–0.9	Yellowish brown	Medianly reticulate/ Rectangular thin walled narrow cells
E. gangetica (Roxb.) Steud.	Ovoid to ellipsoid	0.3–0.5	Deep brown	Prominently reticulate/ Rectangular thick walled narrow cells
E. henryi Vivek, G.V.S. Murthy & V.J. Nair	Ovoid; ventrally grooved	0.5–0.6	Yellowish brown	Medianly reticulate/ Rectangular thin walled narrow cells
E. japonica (Thunb.) Trin.	Obovoid	0.2–0.25	Light brown	Finely reticulate or almost smooth / Rectangular thin walled narrow cells
E. macilenta (A.Rich.) Steud.	Oblong; ventrally grooved	0.3–0.5	Dark brown	Prominently reticulate or undulate/ Rectangular thick walled narrow cells
E. maderaspatana Bor	Oblong to ellipsoid; ventrally grooved	0.5–0.9	Yellowish brown	Medianly reticulate / Rectangular thin walled narrow cells
E. minor Host	Globose to oblong; narrowly flattened ventrally	0.6–0.8	Reddish brown	Finely reticulate / Rectangular thin walled narrow cells

Name of taxa	Grain shape	Length (in mm)	Colour	Surface cell ornamentation
E. nigra Nees ex Steud.	Oblong or quadrangular; ventrally grooved	0.4–0.8	Dark brown	Prominently reticulate/ Rectangular thick walled narrow cells
E. nilgiriensis Vivek, G.V.S. Murthy & V.J. Nair	Ellipsoid to oblong, narrowly flattened ventrally	0.4–0.7	Yellowish brown	Medianly reticulate/ Rectangular thin walled narrow cells
E. nutans (Retz.) Nees *ex* Steud.	Ellipsoid to globose	0.3–0.6	Deep brown	Prominently reticulate/ Rectangular thin walled narrow cells
E. paniciformis (A. Braun) Steud.	Obovoid to ellipsoid	1–1.3	Deep brown	Prominently reticulate/ Rectangular thick walled narrow cells
E. pilosa (L.) P.Beauv.	Ellipsoid to oblong	0.3–0.5	Light brown	Medianly reticulate/ Rectangular thin walled cells
E. riparia (Willd.) P. Beauv.	Ellipsoid to ovoid	0.3–0.6	Light brown	Finely reticulate or almost smooth / Rectangular thin walled narrow cells
E. rottleri Stapf	Ovoid to sub-globose	0.4–0.6	Deep brown	Medianly reticulate/ Rectangular thin walled cells, somewhat undulate in texture
E. schweinfurthii Chiov.	Globose to orbicular	0.4–0.8	Deep brown	Prominently reticulate/ Rectangular thick walled broader cells
E. subsecunda (Lam.) E.Fourn.	Ovoid to globose	0.5–1	Deep brown	Prominently reticulate/ Isodiametric thick walled broader cells
E. superba Peyr.	Ellipsoid or ovate	1–2	Deep brown	Prominently reticulate/ Rectangular thick walled narrow cells
E. tef (Zucc.) Trotter	Ovoid oblong or oblong ellipsoid	0.5–0.6 or 1–1.2	Yellowish brown	Medianlly reticulate/ Rectangualr thin walled narrow cells

Name of taxa	Grain shape	Length (in mm)	Colour	Surface cell ornamentation
E. tenuifolia (A. Rich.) Hochst. *ex* Steud.	Ellipsoid to oblong	0.6–1	Deep brown	Prominently reticulate/ Rectangular thick walled narrow cells
E. tremula Hochst. *ex* Steud.	Sub-globose to orbicular	0.4–0.75	Yellowish brown	Prominently reticulate/ Isodiametric thick walled broader cells
E. unioloides (Retz.) Nees *ex* Steud.	Obovoid to ellipsoid	0.4–1	Reddish brown	Prominently reticulate/ Isodiametric thick walled broader cells
E. viscosa (Retz.) Trin.	Ovoid to ellipsoid	0.3–0.5	Light brown	Finely reticulate or almost smooth/ longitudinal thin walled cells
E. zeylanica (Retz.) Nees et Meyen	Ovoid to sub-globose; laterally compressed	0.3–0.5	Light brown	Medianly reticulate/ Isodiametric thick walled broader cells

Recent floristic expeditions revealed sizable diversity in the genus *Tripogon* in India, while best part of its diversity harbours in Peninsular India. The only significant Scanning Electron Microscopic study on this genus was taken up in single species (*T. loliformis*) in Australia. Consistently the caryopses of *Tripogon* are narrow, subterete to trigonous in shape (**Fig. 220**). Genuinely, seed setting of *Tripogon* is higly limited or very less and poor. In the present revisionary study, among the 24 species of *Tripogon* reported from India, 20 species had the matured caryopses. All the caryopses were collected from the field trips in different parts of India (except *T. mahendragiriensis* and *T. purpurascens*). The colour of mature caryopsis may vary from golden yellow to brownish, shining with finely to prominently reticulate surface cells. The length of the caryopses starts from 0.2 mm (*T. pungens*) to 3.5 mm long (*T. vellarianus*). The shape of the caryopses varies from narrowly oblong, elliptic-ovate, linear-oblong, oblong to elliptic, oblong cylindrical. The surface ornamentation study reveals a number of important micromorphological characters such as thickness of reticulations as well as shape and length of cells in the caryopses (**Figs. 221–224;Table 6**). The ornamentation

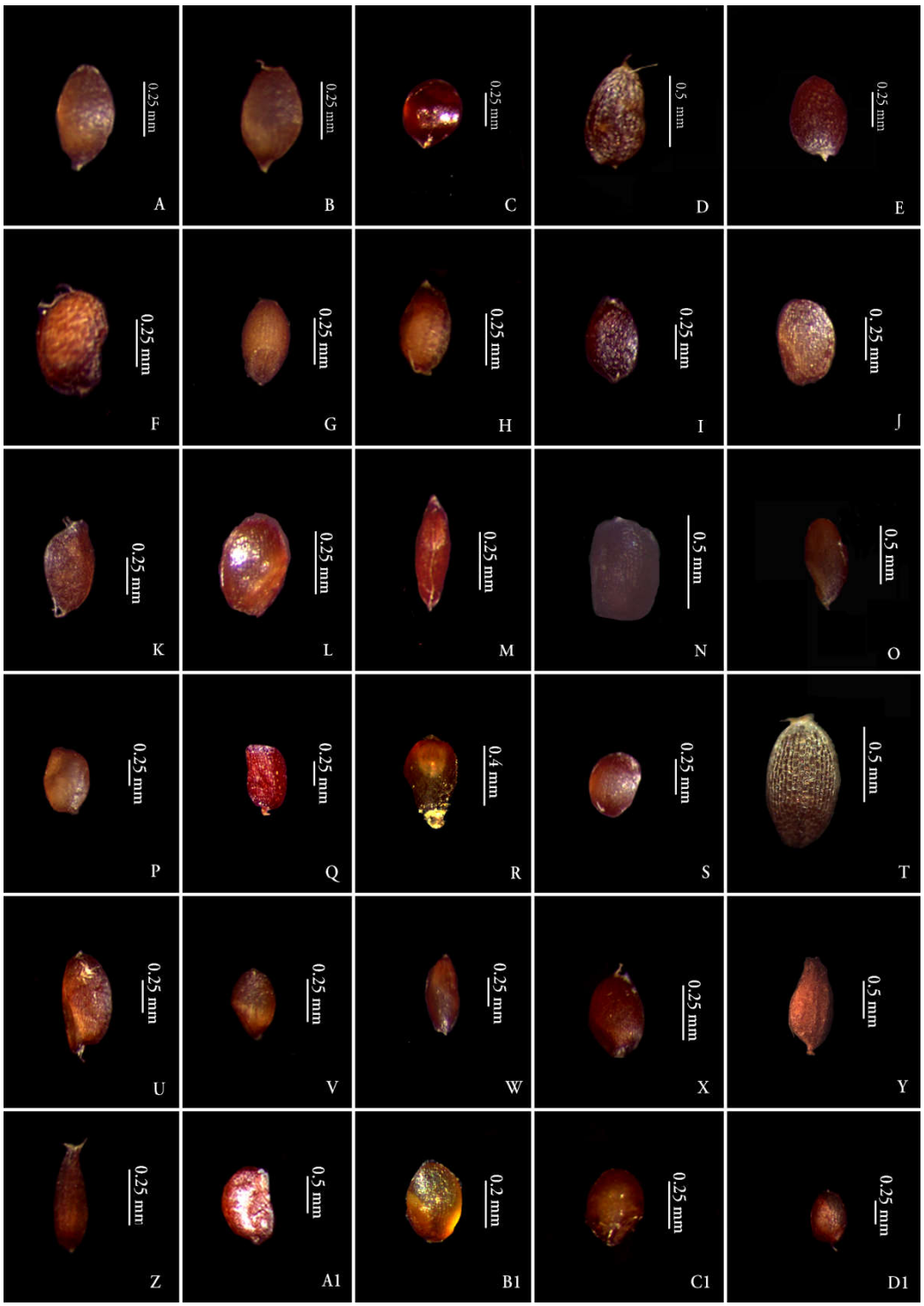


Fig. 212. Caryopsis morphology of ***Eragrostis*** **Wolf: A.** *Eragrostis amabilis*; **B.** *E. amabilis* var. *insularis*; **C.** *E. aspera*; **D.** *E. atrovirens*; **E.** *E. brownii*; **F.** *E. cilianensis*; **G.** *E. ciliaris*; **H.** *E. ciliata*; **I.** *E. collinensis*; **J.** *E. cumingii*; **K.** *E. deccanensis*; **L.** *E. gangetica*; **M.** *E. japonica*; **N.** *E. macilenta*; **O.** *E. maderaspatana*; **P.** *E. minor*; **Q.** *E. nigra*; **R.** *E. nilgiriensis*; **S.** *E. nutans*; **T.** *E. paniciformis*; **U.** *E. pilosa*; **V.** *E. riparia*; **W.** *E. rottleri*; **X.** *E. subsecunda*; **Y.** *E. superba*; **Z.** *E. tef*; **A1.** *E. tenuifolia*; **B1.** *E. unioloides*; **CI.** *E. viscosa*; **D1.** *E. zeylanica.*

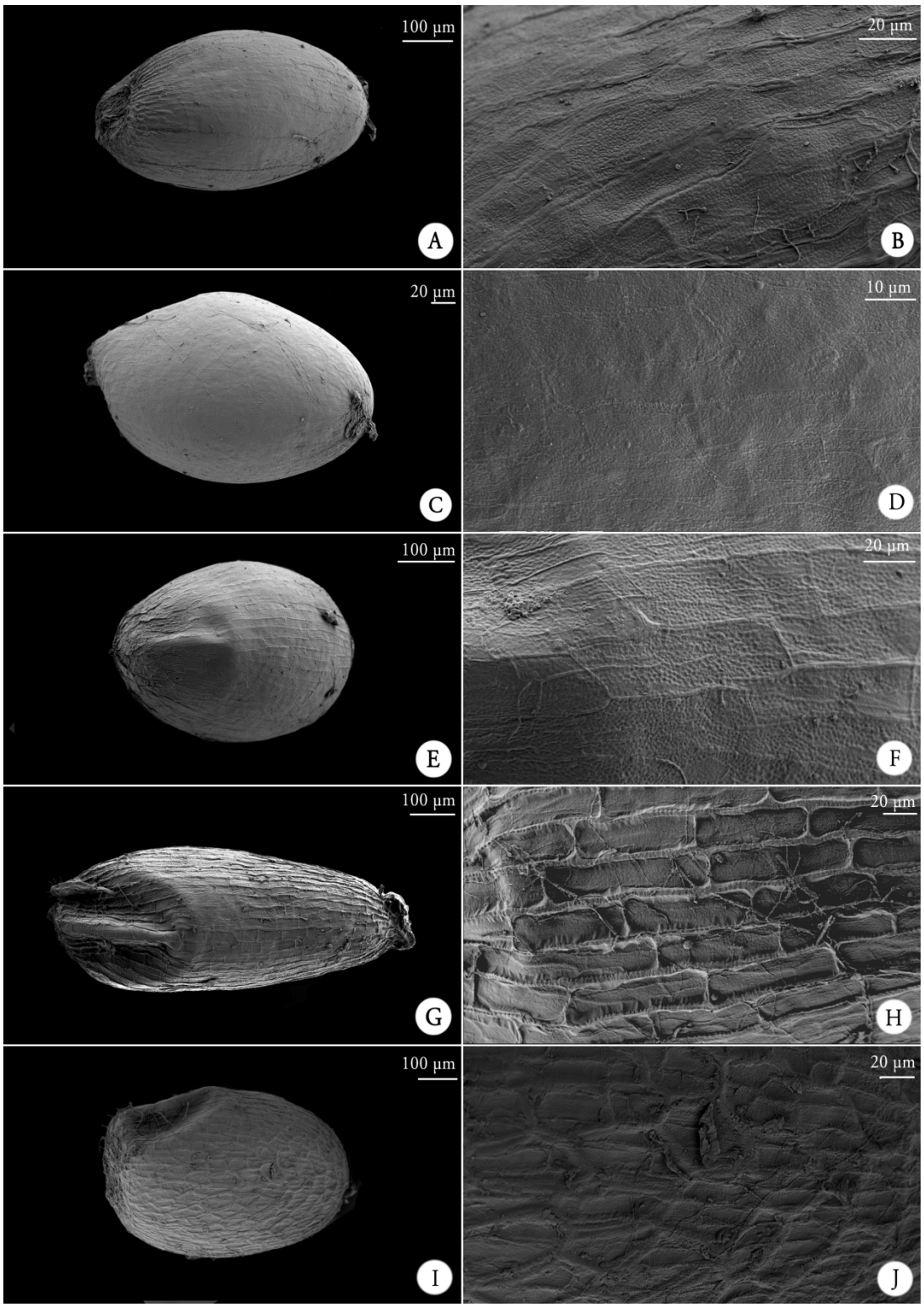


Fig. 213. Caryopsis testa ornamentation of ***Eragrostis*** Wolf: **A. & B.** *Eragrostis amabilis* (L.) Wight & Arn.; **C. & D.** *Eragrostis amabilis* var. *insularis* (C.E. Hubb.) P. Umam. & P. Daniel; **E. & F.** *Eragrostis aspera* (Jacq.) Nees; **G. & H.** *Eragrostis atrovirens* (Desf.) Trin ex Steud.; **I. & J.** *Eragrostis brownii* (Kunth) Nees.

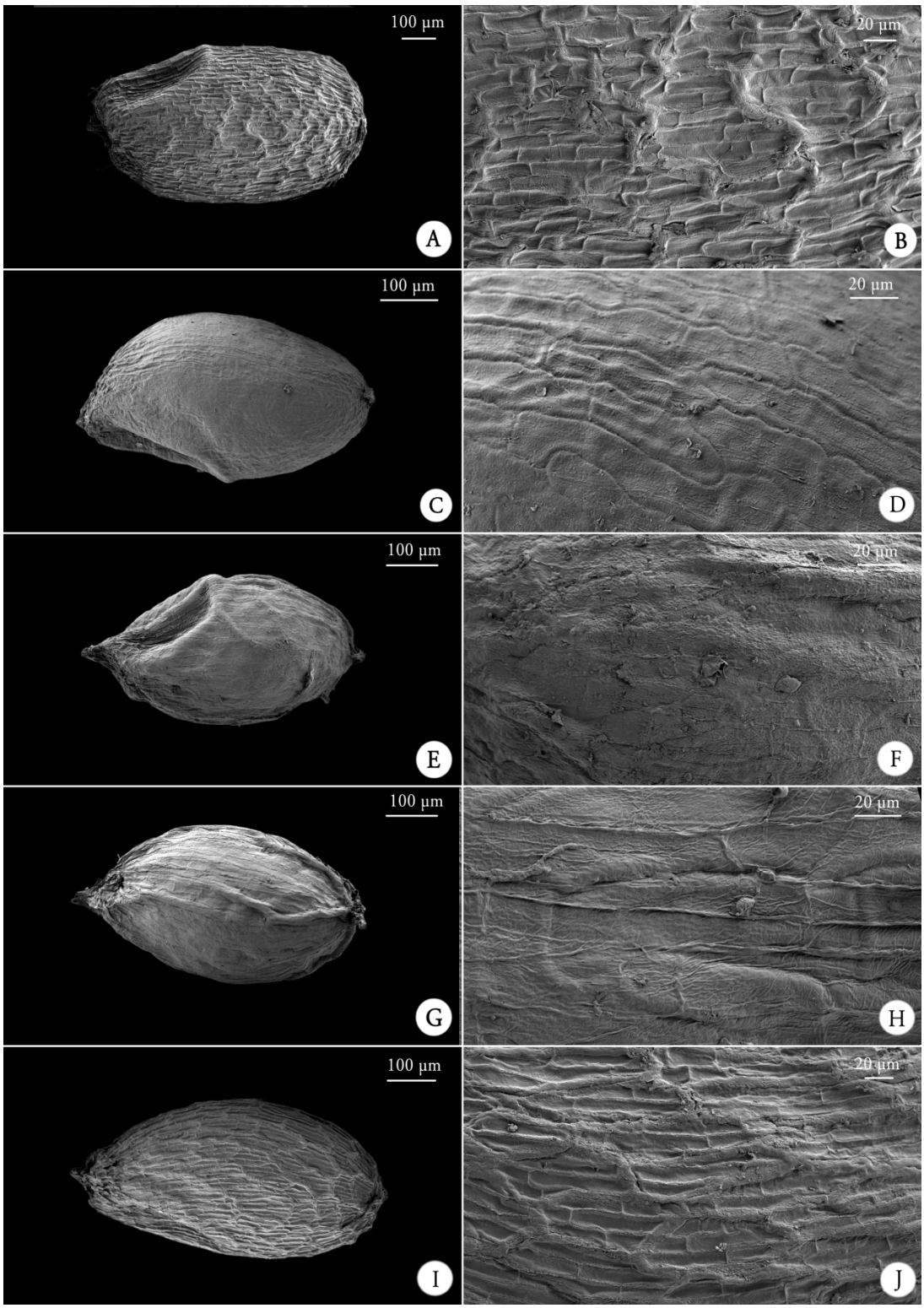


Fig. 214. Caryopsis testa ornamentation of ***Eragrostis*** Wolf: **A. & B.** *Eragrostis cilianensis* (All.) Vignolo ex Janch.; **C. & D.** *Eragrostis ciliaris* (L.) R.Br.; **E. & F.** *Eragrostis ciliata* (Roxb.) Steud.; **G. & H.** *Eragrostis coarctata* Stapf; **I. & J.** *Eragrostis collinensis* Vivek, G.V.S. Murthy & V.J. Nair.

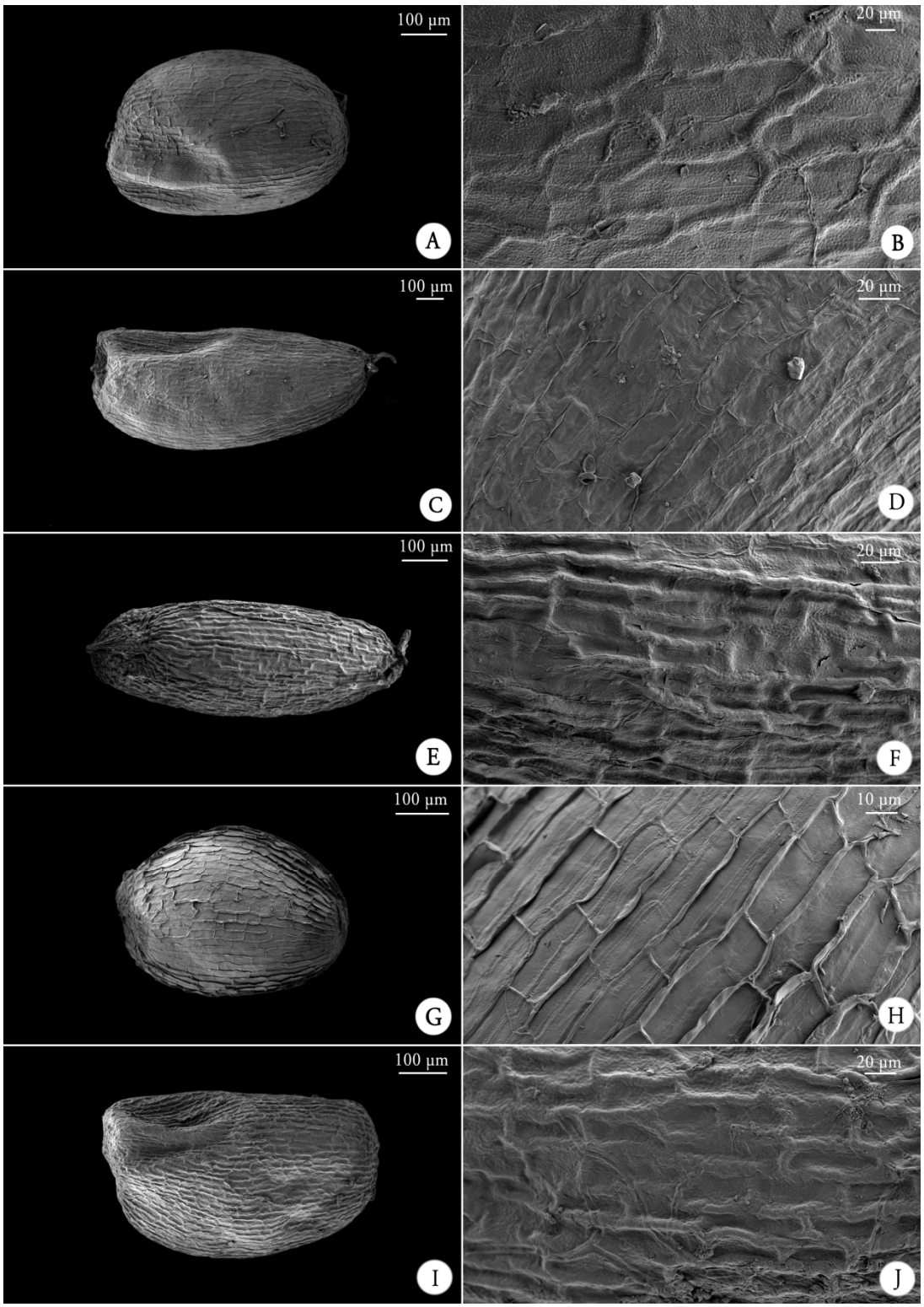


Fig. 215. Caryopsis testa ornamentation of ***Eragrostis*** Wolf: **A. & B.** *Eragrostis cumingii* Steud.; **C. & D.** *Eragrostis curvula* (Schrad.) Nees; **E. & F.** *Eragrostis deccanensis* Bor; **G. & H.** *Eragrostis gangetica* (Roxb.) Steud.; **I. & J.** *Eragrostis henryi* Vivek, G.V.S. Murthy & V.J. Nair.

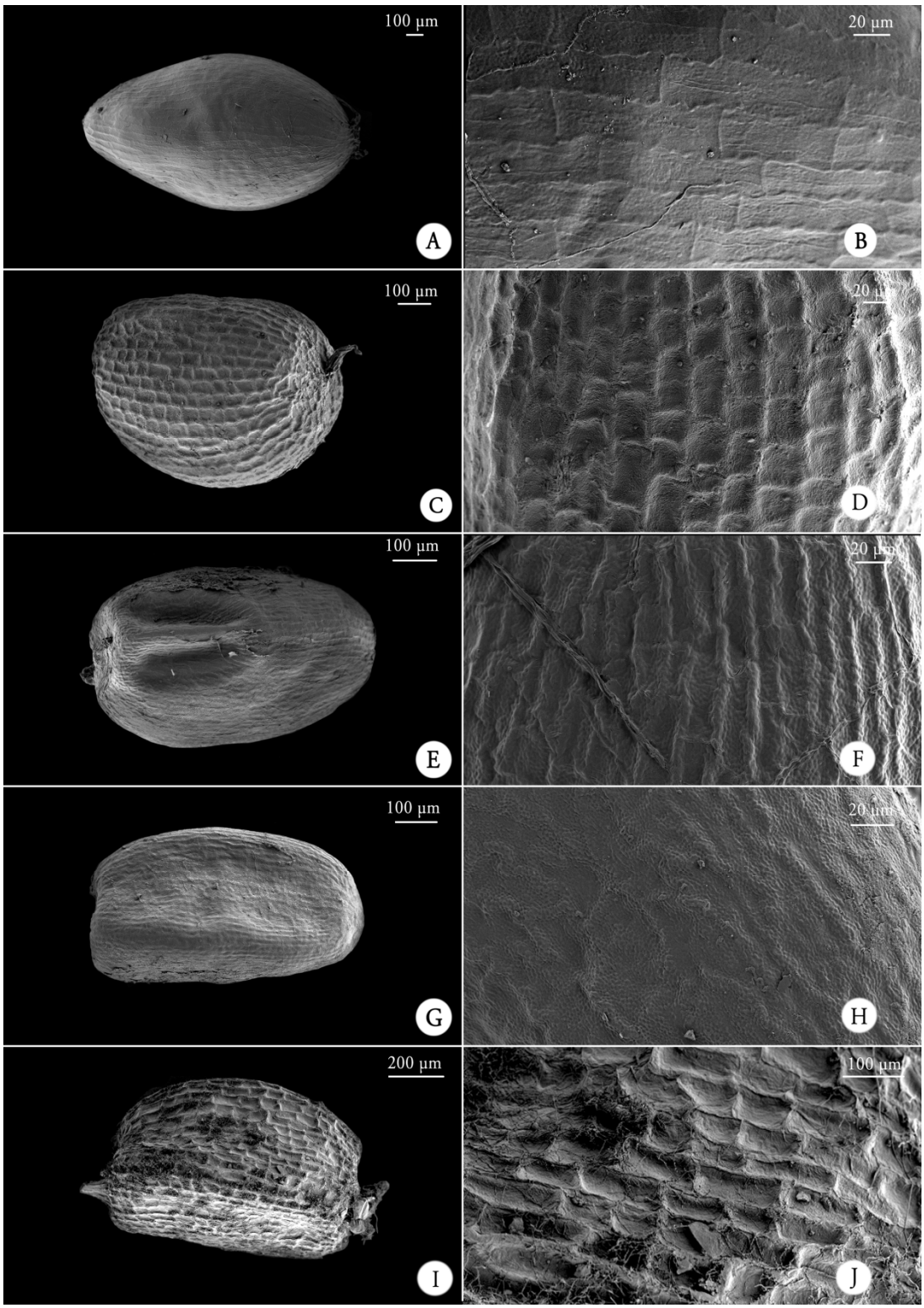


Fig. 216. Caryopsis testa ornamentation of ***Eragrostis*** Wolf: **A. & B.** *Eragrostis japonica* (Thunb.) Trin.; **C. & D.** *Eragrostis macilenta* (A. Rich.) Steud.; **E. & F.** *Eragrostis maderaspatana* Bor; **G. & H.** *Eragrostis minor* Host; **I. & J.** *Eragrostis nigra* Nees ex Steud.

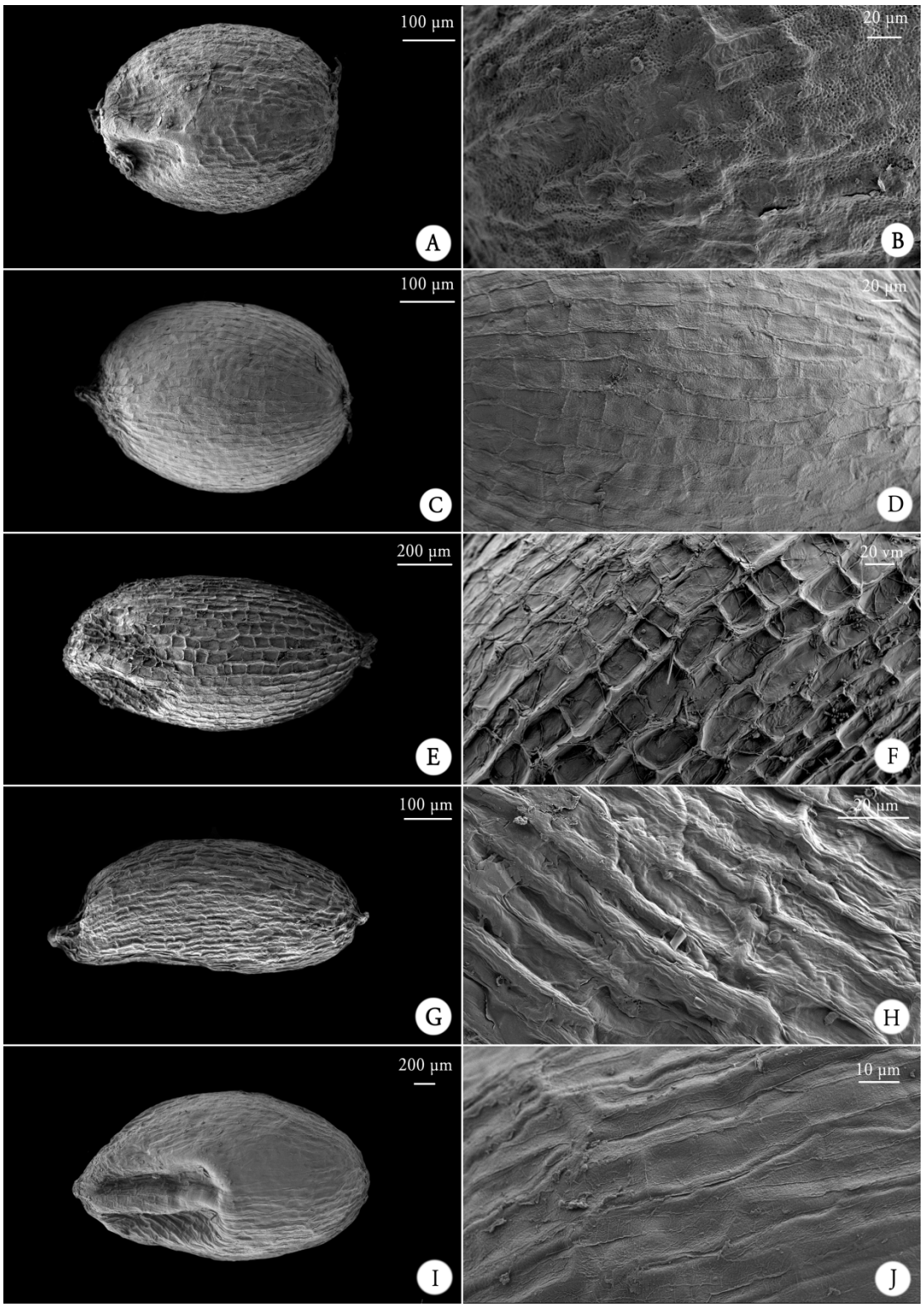


Fig. 217. Caryopsis testa ornamentation of ***Eragrostis*** Wolf: **A. & B.** *Eragrostis nilgiriensis* Vivek, G.V.S. Murthy & V.J. Nair; **C. & D.** *Eragrostis nutans* (Retz.) Nees *ex* Steud.; **E. & F.** *Eragrostis paniciformis* (A. Braun) Steud.; **G. & H.** *Eragrostis pilosa* (L.) P. Beauv.; **I. & J.** *Eragrostis riparia* (Willd.) P. Beauv.

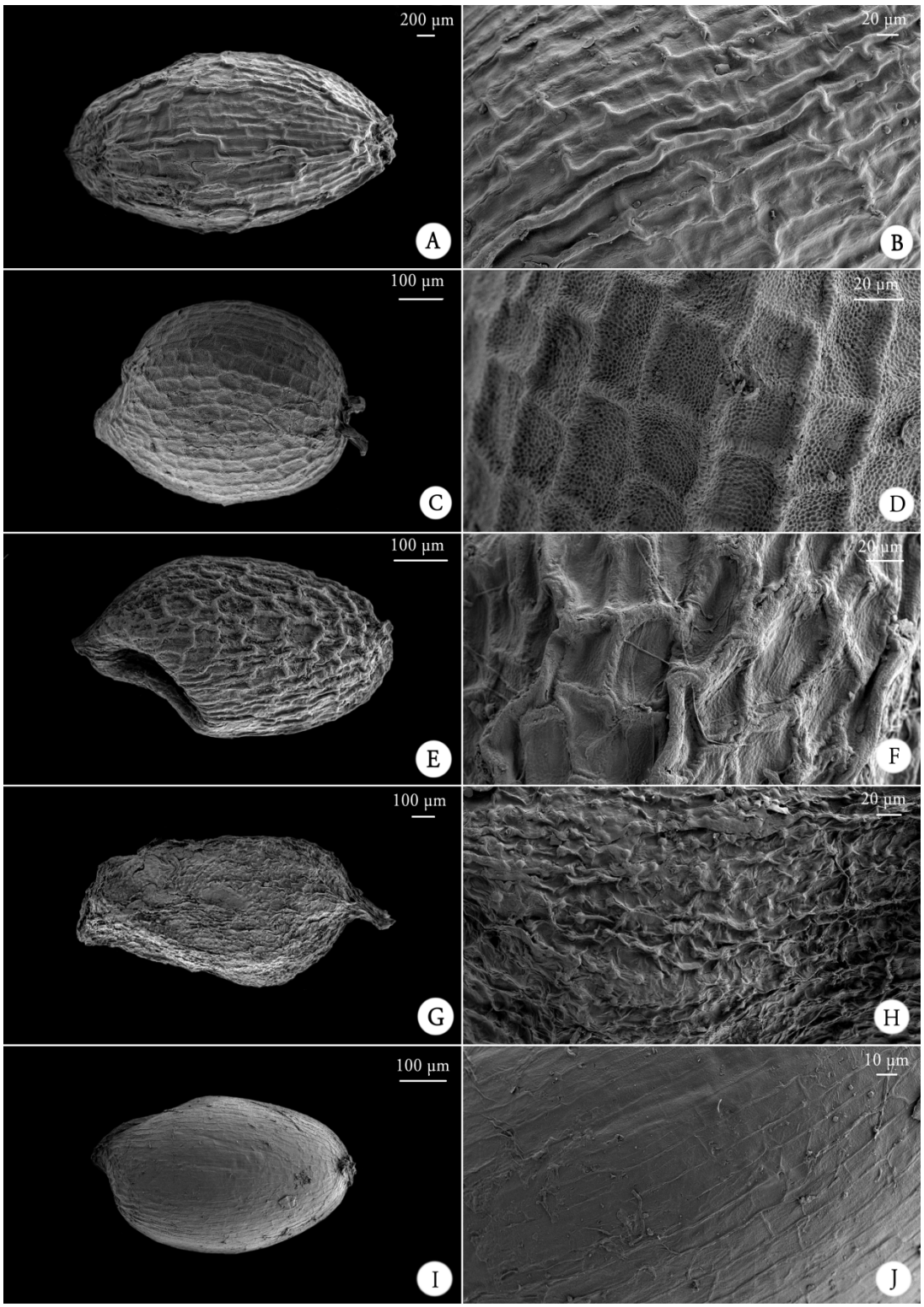


Fig. 218. Caryopsis testa ornamentation of ***Eragrostis*** Wolf: **A. & B.** *Eragrostis rottleri* Stapf; **C. & D.** *Eragrostis schweinfurthii* Choiv.; **E. & F.** *Eragrostis subsecunda* (Lam.) E. Fourn.; **G. & H.** *Eragrostis superba* Peyr.; **I. & J.** *Eragrostis tef* (Zucc.) Trott.

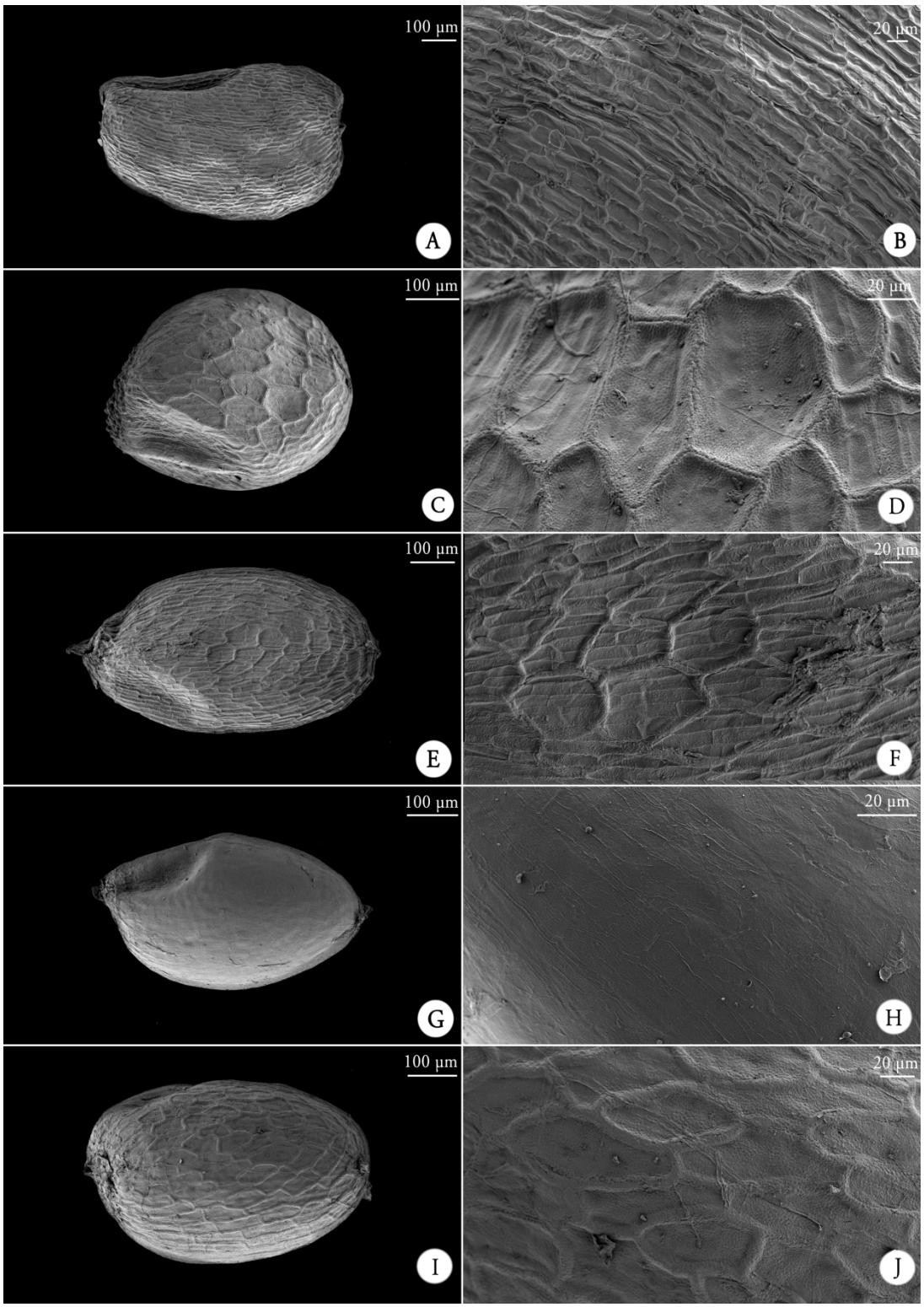


Fig. 219. Caryopsis testa ornamentation of ***Eragrostis*** Wolf: **A. & B.** *Eragrostis tenuifolia* (A. Rich.) Hochst. ex Steud.; **C. & D.** *Eragrostis tremula* Hochst. *ex* Steud.; **E. & F.** *Eragrostis unioloides* (Retz.) Nees *ex* Steud.; **G. & H.** *Eragrostis viscosa* (Retz.) Trin.; **I. & J.** *Eragrostis zeylanica* Nees & Meyen.

of the surface may be prominently reticulate (*T. bromoides, T. capillatus, T. sivarajanii* and *T. zeylanicus*), medianly reticulate (*T. borii, T. filiformis* and *T. pungens*), medianly or finely reticulate (*T. idukkianus* and *T. lisboae*), finely reticulate (*T. polyanthus, T. ravianus* and *T. trifidus*), prominently reticulate or undulate (*T. mahendragiriensis* and *T. wightii*), and prominently undulate (*T. jacquemontii, T. longearistatus, T. narayanae, T. purpurascens,* and *T. vellarianus*). This cell ornamentation supports the morphology at interspecific levels is also useful for taxonomic delimitation.

Table 6. Caryopsis morphology of species of *Tripogon* Roth *ex* Roem. & Schult. in India

Name of taxa	Grain shape	Length (in mm)	Colour	Surface cell ornamentation
T. borii Kabeer, V.J. Nair & G.V.S. Murthy	Oblong-lanceolate	1.5–1.8	Light brown	Medianly reticulate/ Rectangular thin walled longitudinal cells
T. bromoides Roth *ex* Roem. & Schult.	Oblong-lanceolate	1–1.6	Dark brown	Prominently reticulate/ Rectangular thick walled longitudinal cells
T. bromoides var. *longifolius* Hook.f.	Oblong-elliptic	1.2–1.8	Dark brown	Prominently reticulate/ Rectangular thin walled narrow cells
T. capillatus Jaub. & Spach	Elliptic-oblong	1.3–1.6	Deep brown	Prominently reticulate/ Rectangular thick walled longitudinal cells
T. filiformis Nees ex Steud.	Oblong-elliptic	1.5–2.5	Light brown	Medianly reticulate/ Rectangular thin walled longitudinal cells
T. idukkianus Sunil & Pradeep	Oblong-lanceolate	1.5–1.6	Light brown	Medianly or faintly reticulate/ Rectangular thin walled longitudinal cells
T. jacquemontii Stapf	Linear-oblong	1.4–1.6	Light brown	Prominently undulate/ Unevenly thick walled irregular cells
T. lisboae Stapf	Narrowly Oblong, terete	1.4–2.2	Light brown	Medianly or faintly reticulate/ Rectangular thin walled longitudinal cells
T. longearistatus Hack. ex Honda	Linear-lanceolate	1–1.6	Light brown	Prominently undulate/ Unevenly thick walled irregular cells
T. mahendragiriensis Chorge, Sangita Dey, K. Prasad, Prasanna & Y.V. Rao	Oblanceolate or oblong-elliptic	1.5–1.6	Light Brown	Prominently reticulate or undulate/ Rectangular thick walled narrow cells

Name of taxa	Grain shape	Length (in mm)	Colour	Surface cell ornamentation
T. narayanae Sreek., V.J. Nair & N.C. Nair	Narrowly oblong-lanceolate	1.2–1.6	Light brown	Prominently undulate/ Unevenly thick walled irregular cells
T. polyanthus Naik & Patunkar	Narrowly oblong-lanceolate	1.4–1.8	Light brown	Faintly reticulate or almost smooth/ Rectangular thin walled longitudinal cells
T. pungens C.E.C. Fisch.	Oblong cylindrical	0.2–0.5	Light brown	Medianly reticulate/ Rectangular thick walled narrow cells
T. purpuresence Duthie	Linear-lanceolate	0.5–1.2	Light brown	Prominently undulate/ Irregular thin walled longitudinal cells
T. ravianus Sunil & Pradeep	Oblong-cylindric	1.8–2.3	Light brown	Medianly or almost faintly reticulate/ Rectangular thin walled narrow cells
T. sivarajanii Sunil	Narrowly oblong, cylindric	1.2–1.6	Light brown	Prominently reticulate/ Rectangular thick walled narrow cells
T. trifidus Munro *ex* Hook.f.	Elliptic lanceolate	1.6–2.5	Dark brown	Faintly reticulate/ Rectangular thin walled longitudinal cells
T. vellarianus Pradeep	Oblong-cylindric	2.5–3.5	Light brown	Prominently undulate/ Unevenly irregular longitudinal cells
T. wightii Hook.f.	Oblong-elliptic	1.4–2.2	Light brown	Prominently reticulate or undulate/ Rectangular thick walled irregular cells
T. zeylanicus Thwaites	Narrowly oblong, cylindrical	1.2–1.8	Light brown	Prominently reticulate/ Rectangular thin walled, longitudinal cells

Fig. 220. Caryopsis morphology of ***Tripogon*** **Roth *ex* Roem. & Schult.: A.** *Tripogon bimucronatus*; **B.** *T. bromoides*; **C.** *T. bromoides* var. *longifolius*; **D.** *T. capillatus*; **E.** *T. filiformis*; **F.** *T. idukkianus*; **G.** *T. jacquemontii*; **H.** *T. narayanae*; **I.** *T. polyanthus*; **J.** *T. pungens*; **K.** *T. ravianus*; **L.** *T. sivarajanii*.

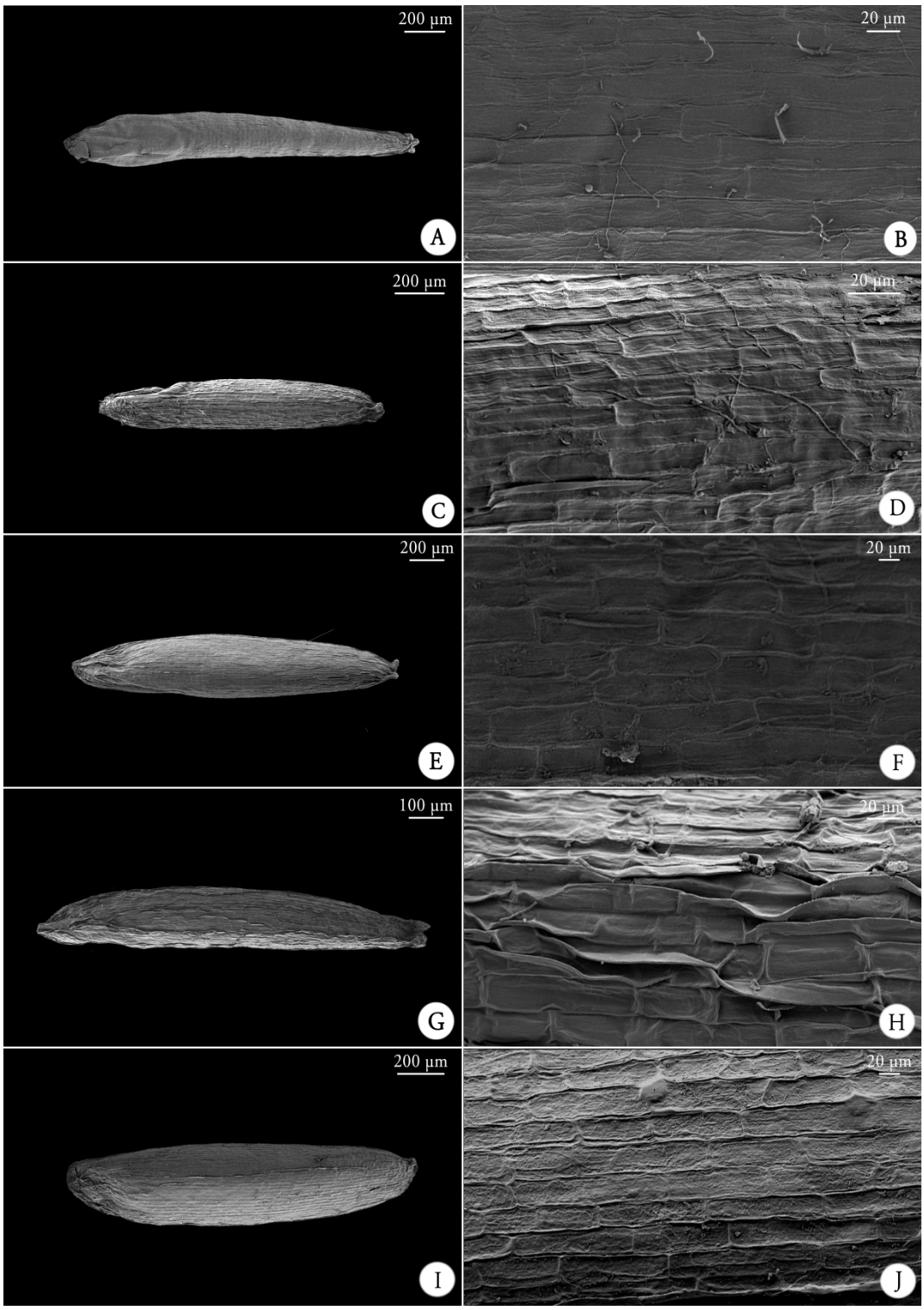


Fig. 221. Caryopsis testa ornamentation of ***Tripogon*** Roth *ex* Roem. & Schult.: **A. & B.** *Tripogon borii* Kabeer, V.J. Nair & G.V.S. Murthy; **C. & D.** *Tripogon bromoides* Roth *ex* Roem. & Schult.; **E. & F.** *Tripogon bromoides* Roth *ex* Roem. et Schult. var. ***longifolius*** Hook.f.; **G. & H.** *Tripogon capillatus* Jaub. & Spach; **I. & J.** *Tripogon filiformis* Nees *ex* Steud.

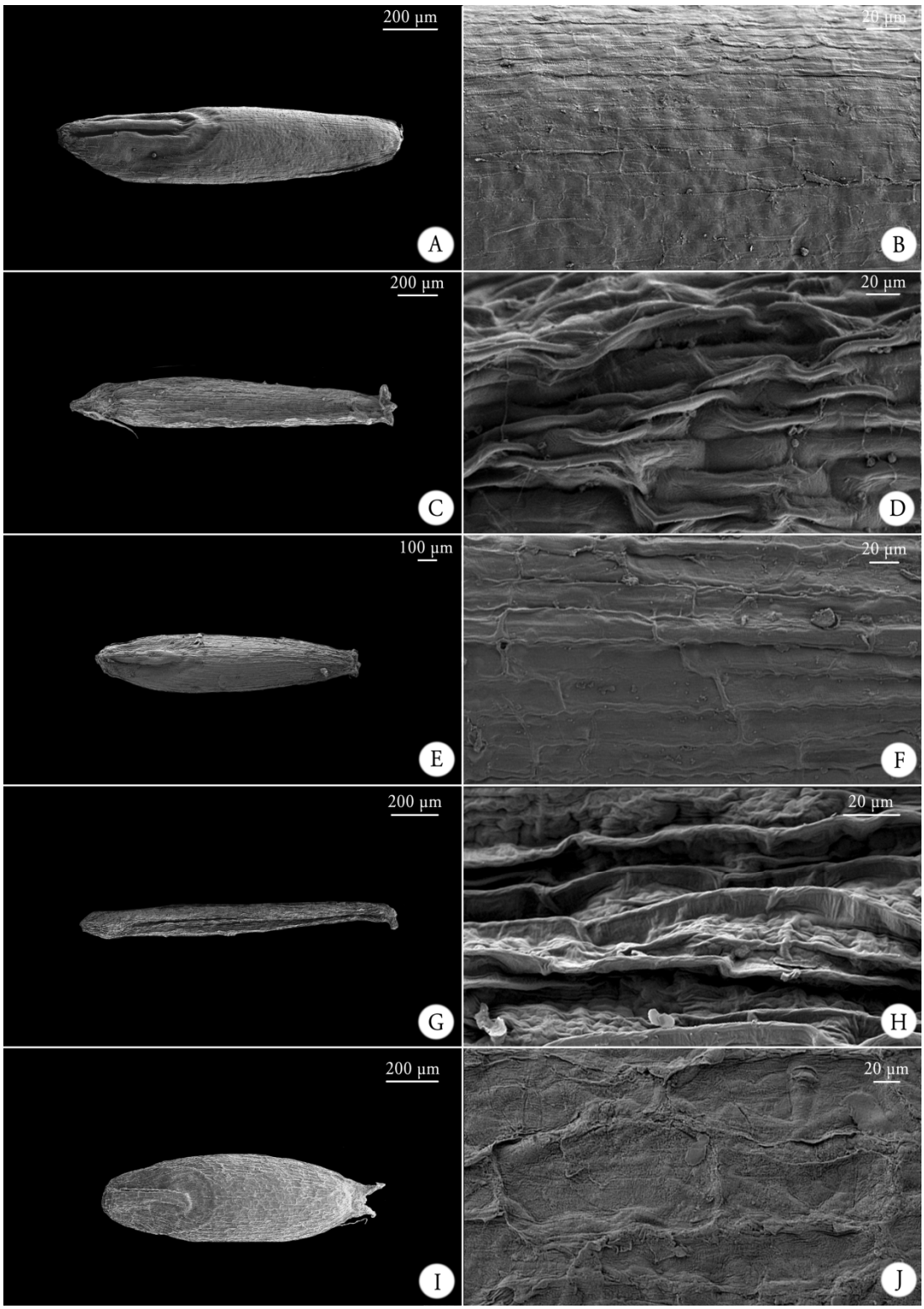


Fig. 222. Caryopsis testa ornamentation of ***Tripogon*** Roth *ex* Roem. & Schult.: **A. & B.** *Tripogon idukkianus* Sunil & Pradeep; **C. & D.** *Tripogon jacquemontii* Stapf; **E. & F.** *Tripogon lisboae* Stapf; **G. & H.** *Tripogon longearistatus* Hack. *ex* Honda; **I. & J.** *Tripogon mahendragiriensis* Chorge, Sangita Dey, K. Prasad, Prasanna & Y.V. Rao.

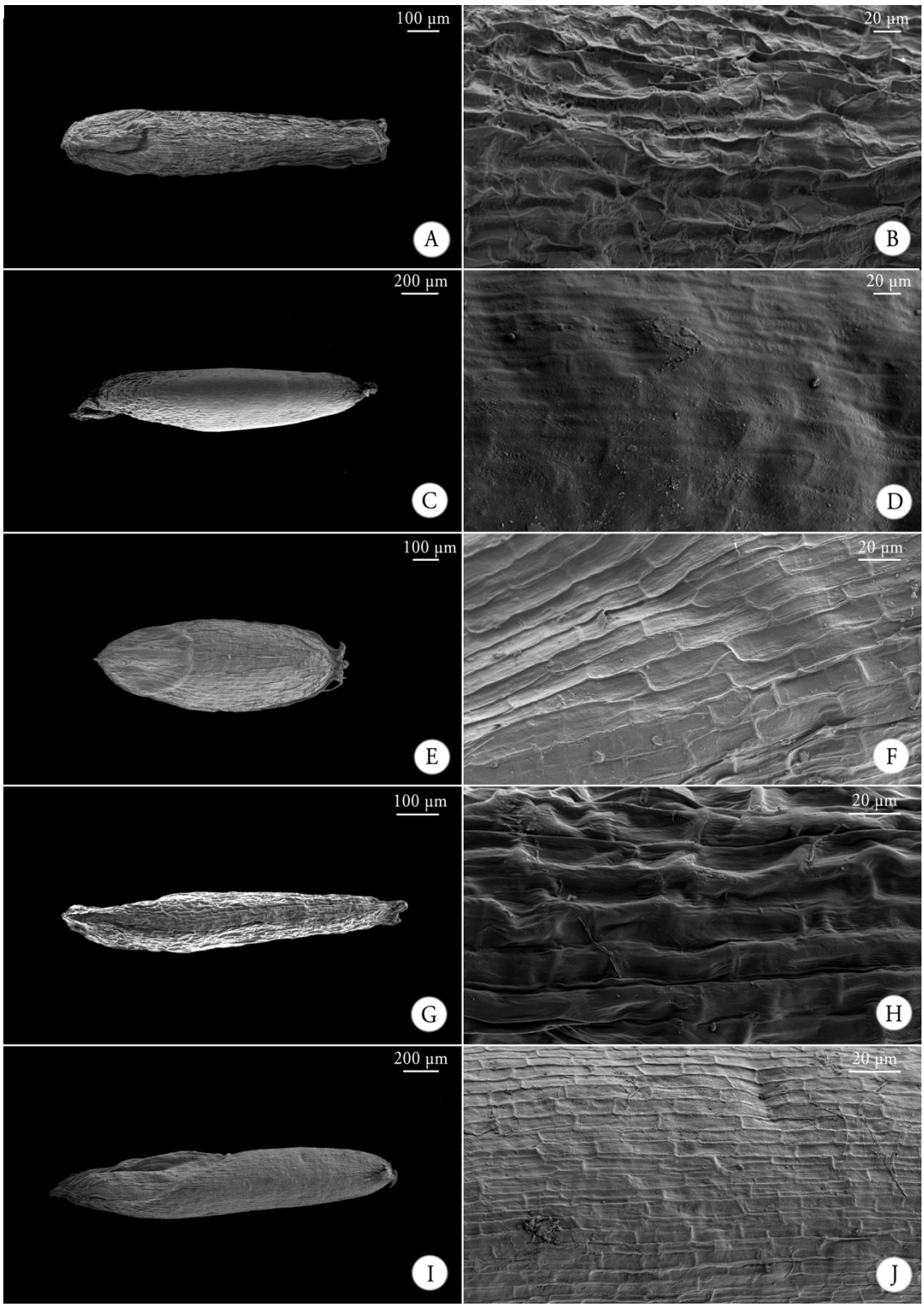


Fig. 223. Caryopsis testa ornamentation of ***Tripogon*** Roth *ex* Roem. & Schult.: **A. & B.** *Tripogon narayanae* Sreek., V.J. Nair & N.C. Nair; **C. & D.** *Tripogon polyanthus* Naik & Patunkar; **E. & F.** *Tripogon pungens* C.E.C. Fisch.; **G. & H.** *Tripogon purpurascens* Duthie; **I. & J.** *Tripogon ravianus* Sunil & Pradeep.

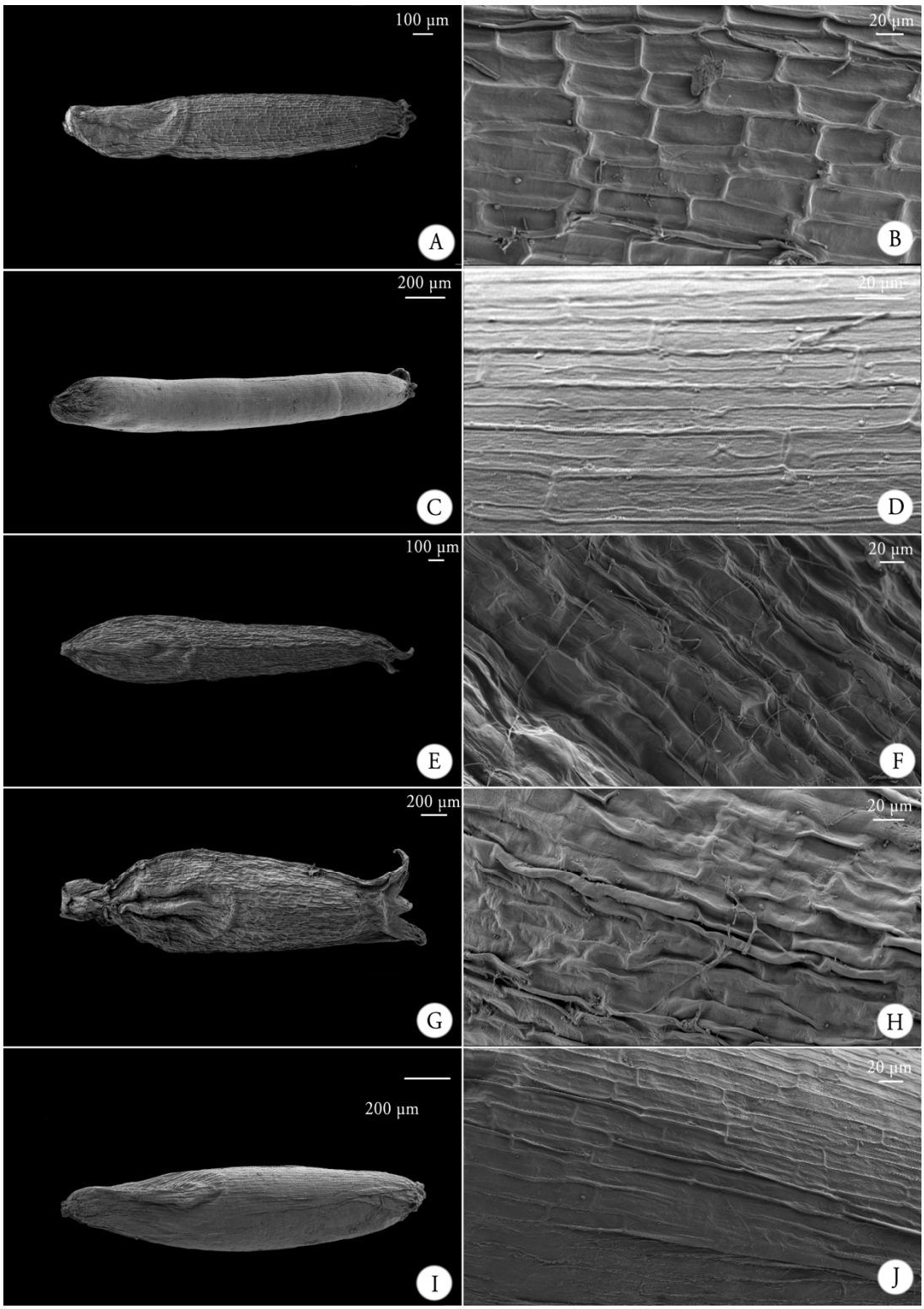


Fig. 224. Caryopsis testa ornamentation of ***Tripogon*** Roth *ex* Roem. & Schult.: **A. & B.** *Tripogon sivarajanii* Sunil; **C. & D.** *Tripogon trifidus* Munro *ex* Hook.f.; **E. & F.** *Tripogon vellarianus* Pradeep; **G. & H.** *Tripogon wightii* Hook.f.; **I. & J.** *Tripogon zeylanicus* Thwaites.

The genus *Eragrostiella* is the one of the segregated genera from *Eragrostis*. It consists of six species distributed in the tropics and subtropics of the world, of which about five species and three varieties occur in India. Out of these, two species (*E. bifaria* and *E. brachyphylla*) and two varieties (*E. bifaria* var. *secunda* and *E. bifaria* var. *walkeri*) are known from Peninsular India. Usually the caryopses are globose to elliptic, rounded or truncate at apex. The testa ornamentation of the caryopses may be prominently or medianly reticulate (*E. bifaria*), and medianly reticulate (*E. brachyphylla*) (**Table 7**). The thickness and depth of the cells may vary from the primitive genus *Eragrostis,* therefore the results substantiated the prevailing status of a taxon within the genus *Eragrostiella* (**Fig. 227**).

Table 7. Caryopsis morphology of the species of *Eragrostiella* Bor in Peninsular India

Name of species	Grain shape	Length (in mm)	Colour	Surface cell ornamentation
E. bifaria (Vahl) Bor	Ovoid to globose	0.3–0.5	Light brown	Medianly reticulate/ Rectangular thin walled narrow cells
E. bifaria var. *secunda* (Nees ex Steud.) Lazarides	Ovoid to ellipsoid	0.3–0.5	Light brown	Prominently reticulate/ Rectangular thin walled narrow cells
E. bifaria var. *walkeri* (Stapf) Lazarides	Ovoid to elliptic	0.3–0.6	Light brown	Prominently reticulate/ Rectangular thin walled long narrow longitudinal cells
E. brachyphylla (Stapf) Bor	Ellipsoid to oblong	0.4–0.6	Light brown	Medianly or finely reticulate/ Rectangular thin walled narrow cells

In *Dinebra, Disakisperma* and *Trigonochloa (Leptochloa s.l.),* shape of the grain may be oblong-elliptic, compressed or trigonous, concave or grooved. In the present investigation, out of the five species reported from Peninsular India, SEM of three species were studied (**Figs. 225, 226**). The testa sculpture of *Dinebra* (*D. chinensis* and

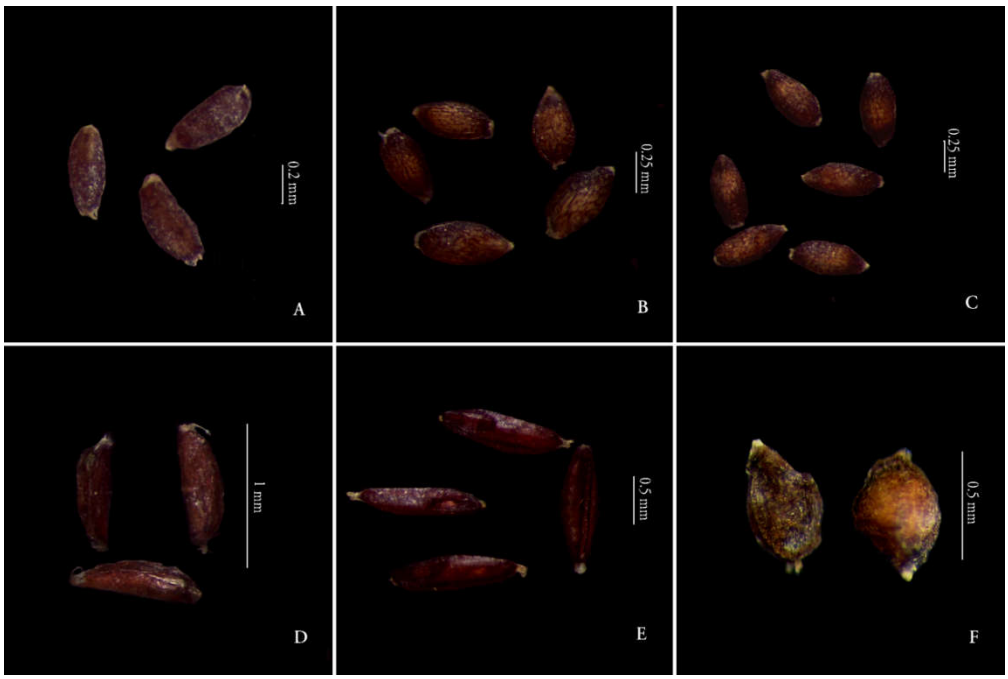


Fig. 225. Caryopsis morphology: **A.** *Dinebra chinensis*; **B.** *D. neesii*; **C.** *D. panicea*; **D.** *Disakisperma obtusiflorum*; **E.** *Trigonochloa uniflora*; **F.** *Eragrostiella bifaria* var. *secunda.*

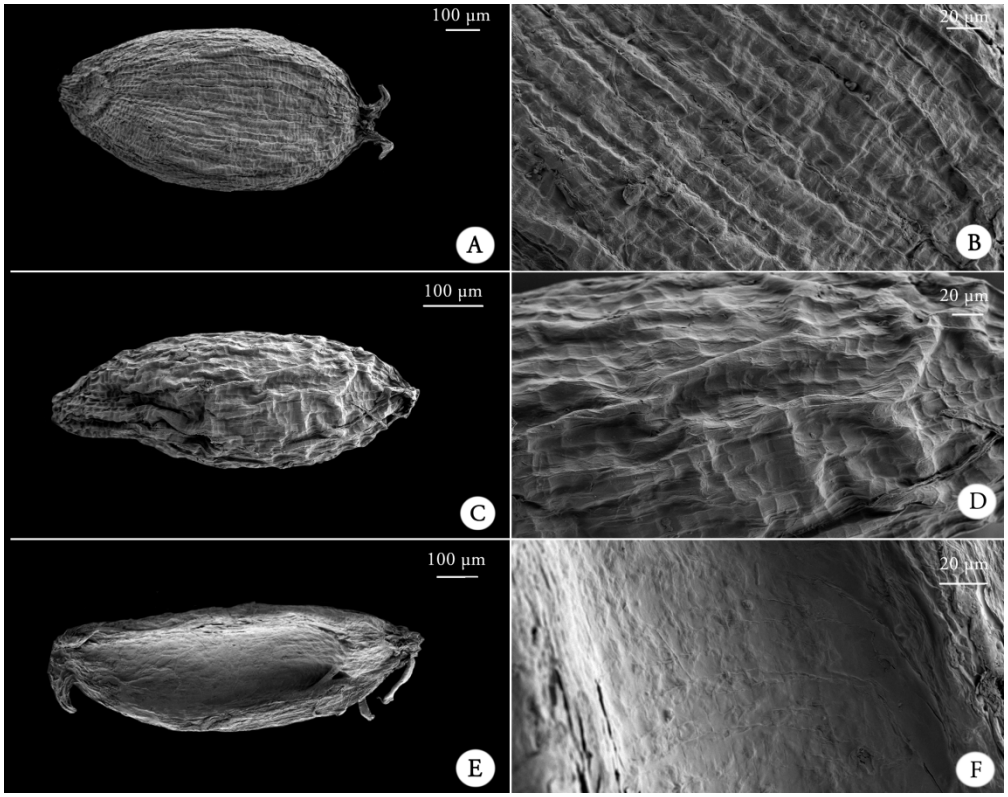


Fig. 226. Caryopsis testa ornamentation of ***Dinebra, Disakisperma*** & ***Trigonochloa*** (***Leptochloa s.l.***): **A. & B.** *Dinebra chinensis* (L.) P.M. Peterson & N. Snow; **C. & D.** *Dinebra neesii* (Thwaites) P.M. Peterson & N. Snow; **E. & F.** *Disakisperma obtusiflorum* (Hochst.) P.M. Peterson & N. Snow.

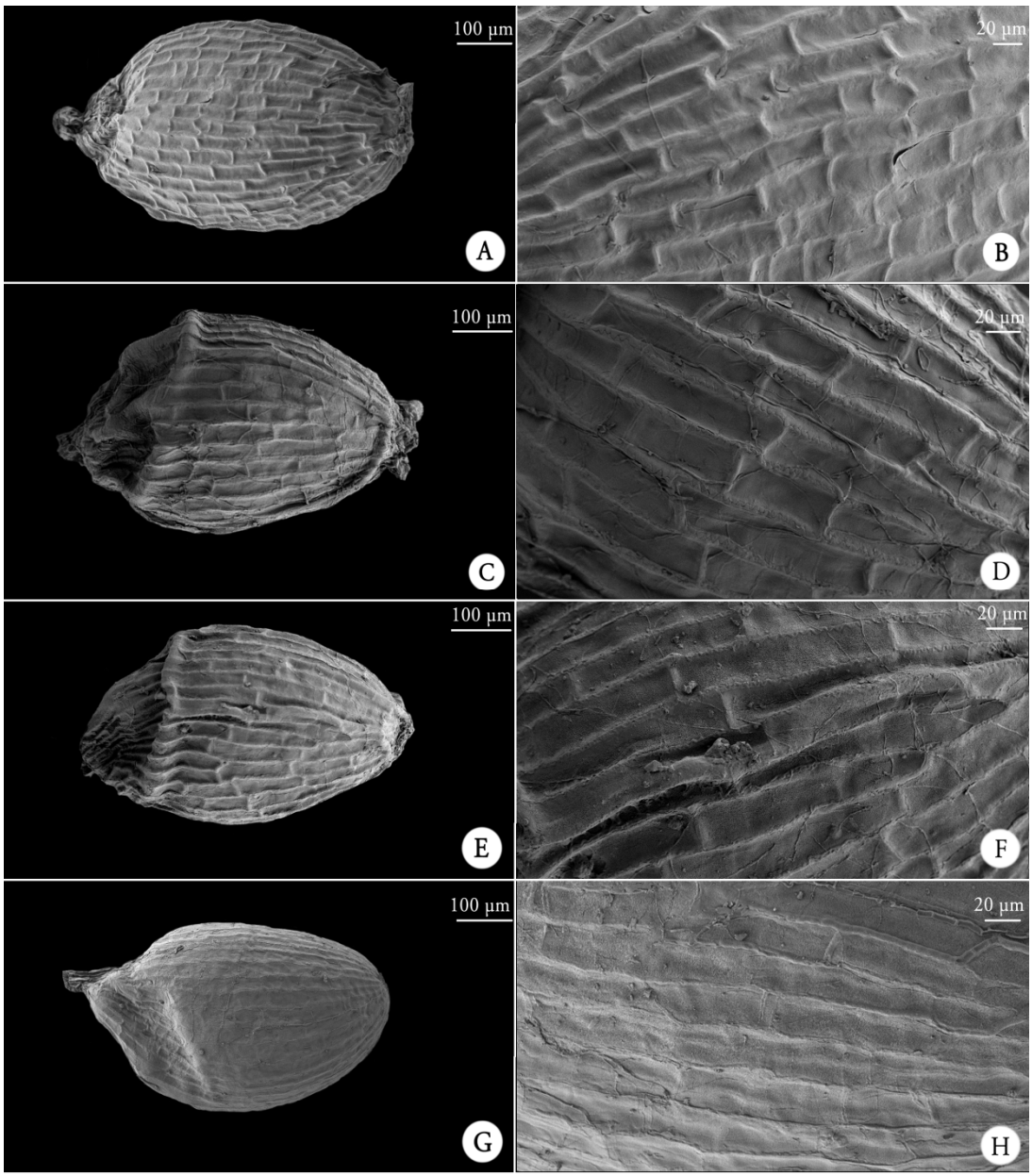


Fig. 227. Caryopsis testa ornamentation of ***Eragrostiella*** Bor: **A. & B.** *Eragrostiella bifaria* (Vahl) Bor; **C. & D.** *Eragrostiella bifaria* (Vahl) Bor var. *secunda* (Nees ex Steud.) Lazarides; **E. & F.** *Eragrostiella bifaria* (Vahl) Bor var. *walkeri* (Stapf) Lazarides; **G. & H.** *Eragrostiella brachyphylla* (Stapf) Bor.

D. neesii) shows distinct rectangular or hexagonal, undulated cells arranged very close together with finely reticulate cell boundaries raised to form a ridged surface. Occasionally, *Disakisperma obtusiflorum* have testa with longitudinal rows of striations of oblong rectangular cells in dorsal side and deeply grooved in ventral surface. In the light of various morphological features, it is evidenced that, the segregate genera of

Leptochloa s.l. are very distinct from each other. However, *Dinebra,* and *Disakisperma* share many features in common, often posing problems in generic delimitation. Even though, the present investigations of caryopses morphology provide useful support to prevailing status of segregate *Dinebra* and *Disakisperma* (**Table 8**).

Table 8. Caryopsis morphology of the species of *Dinebra* Jacq. & *Disakisperma* (*Leptochloa s.l.* Steud.) in Peninsular India

Name of species	Grain shape	Length (in mm)	Colour	Surface cell ornamentation
Dinebra chinensis (L.) P.M. Peterson & N. Snow	Oblong or elliptic-oblong; deeply convex ventrally	0.8–1	Light brown	Prominently reticulate/ Rectangular thin walled broad cells with numerous undulations
Dinebra neesii (Thwaites) P.M. Peterson & N. Snow	Oblanceolate to ovoid; deeply grooved or convex ventrally	0.4–0.6	Light brown	Prominently reticulate/ Rectangular thin walled broad cells with undulations
Disakisperma obtusiflorum (Hochst.) P.M. Peterson & N. Snow	Oblong or elliptic-oblong	1–1.2	Light brown	Finely reticulate or almost smooth/ Rectangular thin walled long narrow cells

Chapter 9

Phytogeography and Endemism

Chapter 9 Phytogeography and Endemism

Eragrostidinae is the largest subtribe of the subfamily Chloridoideae. It comprises about 562 taxa which are distributed in Old and New Worlds tropics and subtropics (Plant List, 2018). About 90% of the known world taxa can be established in the following four continents, *viz.,* Africa, America, Asia, and Australia (Giraldo-Canas *et al.,* 2012). Remarkably, most of the taxa are having delimited distribution in one of these four regions. The distributional markings inferred from the literature and herbarium data indicate that subtribe *Eragrostidinae* was naturally distributed in the southern erstwhile Gondwanaland region. It is an area comprising of Australia, India, Madagascar, Sri Lanka, and South East Asia chiefly Malesian region (**Fig. 228**).

Chatterjee (1939), Razzi (1955), and Takthajan (1986) recognized different phytogeographical regions in the country. Moreover, various authors opined that Peninsular India is an ancient tableland of Indian subcontinent and a compact natural unit of geomorphological and biogeographical evolution (Krishnan, 1968; Nayar, 1996). In Peninsular India, *Eragrostidinae* is predominantly distributed from Maharashtra to Kerala (along Western Ghats) in the west to eastern side of Tamil Nadu, to Odisha (along Eastern Ghats) in the north-east. Hardly, scattered populations are observed in Deccan region. Generally, enormous diversity and maximum species representations are found in western Peninsular India and low altitude areas of Western Ghats along Maharashtra, Goa, Karnataka, and Kerala. Bor (1960) treated five genera (*Eragrostiella, Eragrostis, Leptochloa s.l., Neyraudia,* and *Tripogon*) and 63 species under the subtribe *Eragrostidinae s.l.* from Indian subcontinent. Out of the two species described as new by Bor (1960), both are from Peninsular India. In the present investigation, an additional species from the genus *Tripogon*, *viz., Tripogon malabaricus* Thoiba & Pradeep, *T. idukkianus* Sunil & Pradeep, *T. bimucronatus* Thoiba & Sunil, *T. karnatakensis* Thoiba & Pradeep, *T. munnarensis* Thoiba & Manudev, and *T. mahedragiriensis* Chorghe, Sangita Dey, K. Prasad, Prasanna & Y.V. Rao have been

recognized as new taxa from Peninsular India. Moreover, two new records *viz., Eragrostis paniciformis* and *E. brownii* are also reported from the present study area. Hence, a total of 69 species and 7 varieties have been recognized from Peninsular India alone (**Fig. 229**).

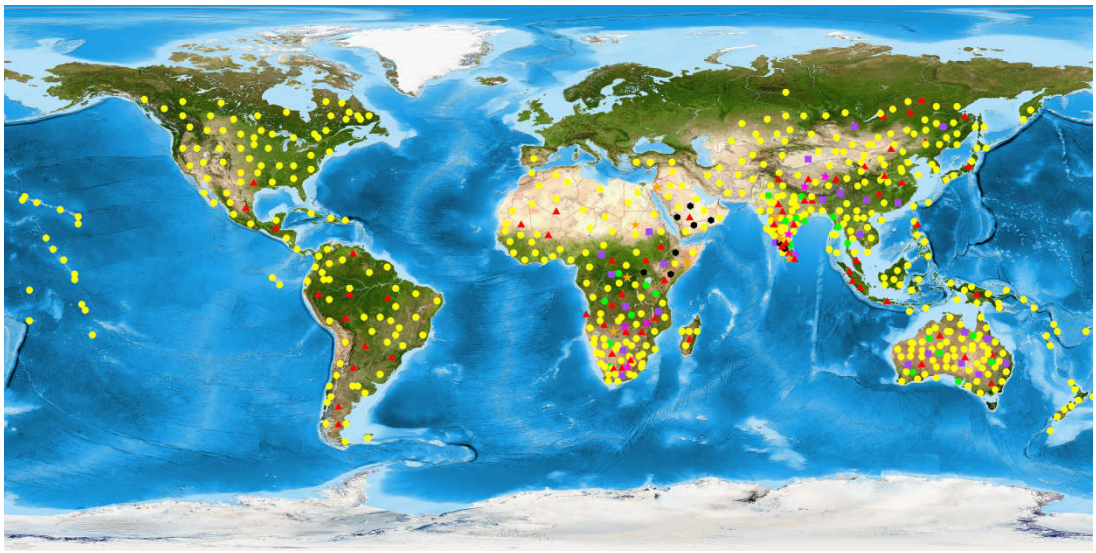


Fig. 228. Global distribution of the subtribe Eragrostidinae: *Dinebra* Jacq. (■), *Disakisperma* Steud. (●), *Eragrostiella* Bor (●), *Eragrostis* Wolf (●), *Neyraudia* Hook.f. (★), *Trigonochloa* P.M. Peterson & N. Snow (★) and *Tripogon* Roth *ex* Roem. & Schult. (▲).

Markedly Peninsular India harbours greatest species diversity of *Eragrostidinae* and high percentage of endemism (especially in the genus *Tripogon*). Out of the 80 recognized taxa in India, 69 species are reported from Peninsular India. Based on our field observations, major taxa are distributed in Southern Western Ghats and West Coast (46), Eastern Ghats and Coramandal Coast (44), northern Western Ghats (34), and Deccan region (27) of Peninsular India. The species diversity of *Eragrostidinae* represented by genera on different phytogeographic regions of Peninsular India is graphically shown in **Figure 230**. The highest assemblage of taxa is concentrated in southern Western Ghats and least in Deccan region.

Likewise, the subtribe indicates a high degree of endemism within Peninsular India with 22 species and 1 variety (under seven genera), which are solely known from this region. Indeed, 15 of the 69 Peninsular Indian taxa including 5 new taxa described here (*Tripogon malabaricus* Thoiba & Pradeep, *T. idukkianus* Sunil & Pradeep,

can be exclusively found in the southern Western Ghats, a small province from the south of Goa, Karnataka, and Kerala to Tamil Nadu. Moreover, *T. mahendragiriensis* Chorghe, Sangita Dey, K. Prasad, Prasanna & Y.V. Rao and *Eragrostis decanensis* Bor are extremely restricted to Eastern Ghats and Deccan region of the Indian Peninsula (**Table 9**).

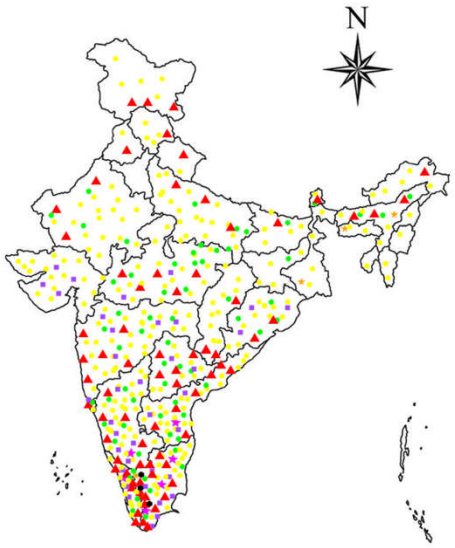


Fig. 229. Distribution of the subtribe Eragrostidinae in India: *Dinebra* Jacq. (■), *Disakisperma* Steud. (⬟), *Eragrostiella* Bor (●), *Eragrostis* Wolf (●), *Neyraudia* Hook.f. (★), *Trigonochloa* P.M. Peterson & N. Snow (★) and *Tripogon* Roth *ex* Roem. & Schult. (▲).

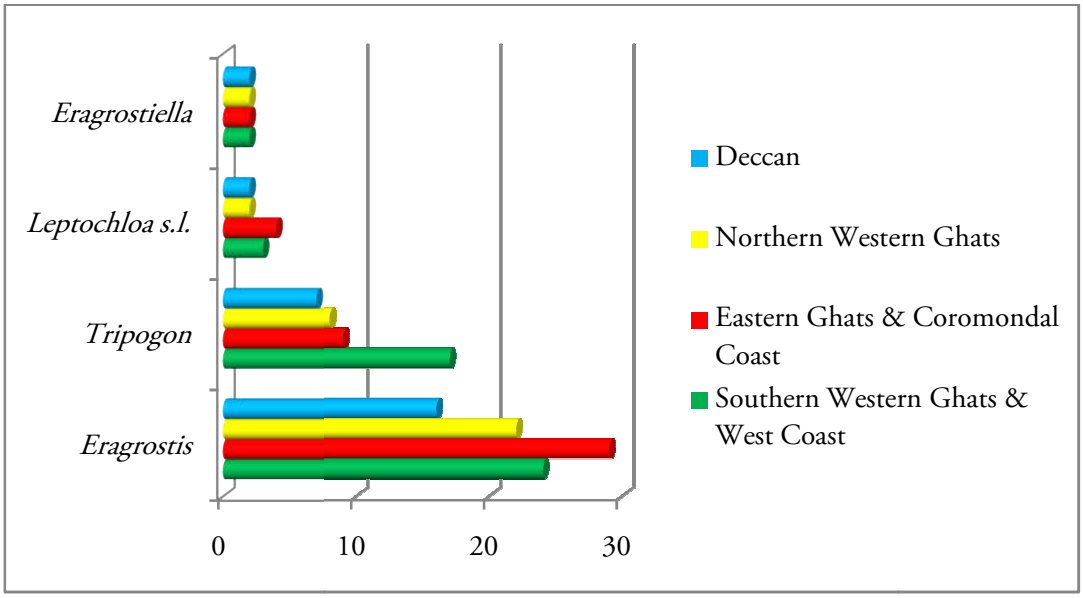


Fig. 230. Distribution of species in *Eragrostidinae* along different phytogeographical regions of Peninsular India

Table 9. Endemic species of subtribe *Eragrostidinae* in Peninsular India

Sl. No.	Genus	Species	State	Country
1	*Eragrostis*	*E. collinensis*	Kerala, Tamil Nadu	India
2		*E. deccanensis*	AndhraPradesh, Karnataka,	India
3		*E. henryi*	Tamil Nadu	India
4		*E. maderaspatana*	Tamil Nadu	India
5		*E. nilgiriensis*	Tamil Nadu	India
6		*E. paniciformis*	Kerala	Africa, India
7		*E. rottleri*	Tamil Nadu	India, Pakistan
8	*Tripogon*	*T. borii*	Tamil Nadu	India
9		*T. bimucronatus*	Kerala	India
10		*T. idukkianus*	Kerala, Tamil Nadu	India
11		*T. karnatakensis*	Karnataka	India
12		*T. malabaricus*	Kerala	India
13		*T. mahendragiriensis*	Odisha	India
14		*T. munnarensis*	Kerala	India
15		*T. narayanae*	Kerala, Tamil Nadu	India
16		*T. polyanthus*	Maharashtra	India
17		*T. ravianus*	Kerala, Tamil Nadu	India
18		*T. sivarajanii*	Kerala, Tamil Nadu	India
19		*T. vellarianus*	Kerala	India
20		*T. velliangiriensis*	Kerala, Tamil Nadu	India
21		*T. wightii*	Andhra Pradesh, Kerala, Tamil Nadu, Maharashtra	India
22		*T. zeylanicus*	Kerala, Tamil Nadu	India, Sri Lanka
23	*Eragrostiella*	*E. bifaria* var. *secunda*	Kerala	India, Sri Lanka

Awfully, the prime centre of diversity of *Eragrostidinae* in Peninsular India is the states of southern Western Ghats region in Karnataka, Kerala, and Tamil Nadu. Especially the states of Kerala and Tamil Nadu having the maximum diversity of the subtribe *Eragrostidinae viz.,* 37 and 47 taxa respectively. In the subtribe, two genera (*Eragrostis, Tripogon*) show the maximum representation in Peninsular India. The genus *Eragrostis* shine greater amount of species (36) diversity with less amount of endemism (19.44%).

Remarkably climate plays a crucial role in the existence and diversity of *Tripogon* in Peninsular India. Tripogons enjoy monsoon climate in general, and are confined along the tropical wet region of western Peninsular India. Hence, the genus *Tripogon* manifests a maximum percentage (62.5%) of endemism in Peninsular India (47.05 % in India). The species of *Tripogon* frequently found in humid as well as wet areas of high altitude mountain ranges. Few species are found in areas with an altitude below 600 m (*T. bromoides, T. trifidus*) in Peninsular India. The benign zone for greater species is the granitic or lateritic red-soil grasslands and margins along evergreen forests, or associative habitats adjacent to these regions.

The annual Tripogons are usually adapted to the high altitude dry grassy plains or wet rocky meadows in association with cryptogams. Despite, a few taxa adopt more discrepant habitats like steep granitic cliffs (*T. malabaricus*), bare rocky outcrops, tree trunks, boulders (*T. capillatus*), high altitude rocky river beds (*T. polyanthus*), and old walls (*T. jacquemontii*). In Eastern Ghats and Deccan region, few taxa (*T. capillatus, T. jaquemontii*) may be inhabited in isolated granitic rocky outcrops (inselbergs). Inselbergs also support edaphically and climatically for the growth of specialized plant communities (Porembski & Barthlott, 2000). The highly specialized stoloniferous and creeping rootstock with thick elongated fibrous roots of Tripogons aid for effective anchorage in the steep granitic outcrops. Due to these microclimatic types of habitat preference and minimum seed-setting, *Tripogon* serve maximum percent for endemism in Peninsular India.

Chapter 10

Summary

Chapter 10 Summary

The present revision of the subtribe *Eragrostidinae* J. Presl (Chloridoideae: Poaceae) in Peninsular India deals with 7 genera, 69 species, and 7 varieties. *Eragrostis* is the largest genera (36 species) of this subtribe followed by *Tripogon* (24 species). 5 new species have been described new to science during the course of this work, and 3 species, one variety were newly recorded for India. 23 species were found to be endemic to Peninsular India. The treatment provide correct name of each taxa with their updated nomenclatural citation, with reference to respective type materials (also type designations), detailed descriptions, colour photographs and illustrations (wherever necessary), details of phenology and distribution, phytogeography and endemism, comparative morphology with caryopses (including SEM studies), and taxonomic key for genera and all the species and varieties are provided for easy identification (additionally for the genus *Tripogon* a key for all Indian taxa are also provided). This is the first comprehensive study on the taxonomy and morphology of the subtribe *Eragrostidinae* in Peninsular India. The new and significant findings and contributions of the prevailing study are summarized below.

Field exploration

Two hundred and sixty five field trips were conducted during 01.11.2012 to 31.05.2018 spending 358 days in the field, ranging from sea level to high altitudes. The states of Andhra Pradesh, Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu, and Telangana were visited for collecting live specimens, and for observing the habitat diversity of each taxa. The type localities of various taxa were visited for their collection, the distributional status of the species and varieties of each genus in the subtribe were assessed. Different accessions of each species have been collected for studying infraspecific variations. Phenology and ecological features were recorded directly from

the field. Almost all taxa were collected from the field except 9 species, i.e. four species from (*Eragrostis*), two each from (*Tripogon* and *Dinebra*), and one from (*Neyraudia*).

Nomenclature

All the specimens collected were identified in consultation with protologue, types and authentic collections and literature. Detailed morphological descriptions, colour photographs, illustrations (wherever necessary), relevant types, and distribution maps were provided for each taxa for easy identification. The nomenclature of all taxa is updated with latest authentic literature and in consultation with types and protologues. The specimens housed at 15 Indian herbaria (AHMA, BLAT, BSI, BSID, CAL, CALI, DEV, FRC, JCB, KFRI, MH, RHT, SUK, TBGT, and Goa University Herbarium) and the virtual database of the 25 following herbaria (B, BM, BR, B-W, C, CORD, E, FI, G, G-DC, HAL, JE, K, K-W, L, LD, LINN, MICH, MPU, P, S, S-G, TI, U, US, W, WAG, WU) were also consulted.

New taxa discovered

Five new species, *Tripogon malabaricus* Thoiba & Pradeep (2014), *T. idukkianus* Pradeep & Sunil (2015), *T. bimucronatus* Thoiba & Sunil (2015), *T. karnatakensis* Thoiba & Manudev (2016), *T. munnarensis* Thoiba & Pradeep (2016) were discovered and described during this study.

New report to Asia

Eragrostis paniciformis (A. Braun) Steud. collected from southern Western Ghats (Munnar, Kerala) was reported new to Asia; while it was formerly recorded from Africa and Australia.

New report to India

Eragrostis brownii (Kunth) Nees collected from southern Karnataka (Dekshina Kannada District) was reported new to India; already it was recorded from Sri Lanka,

Malesia, Thailand and Australia. Similarly, *Tripogon longearistatus* Hack. ex Honda collected from Mawlynnong, Meghalaya was reported new to India. Previously, it was recorded from China, Japan and Korea. *Eragrostiella bifaria* var. *secunda* (Nees ex Steud.) Lazarides from southern Western Ghats (Ramakkalmedu, Kerala) formerly recorded only from Sri Lanka is also reported for the first time.

Rediscovery

Eragrostis rottleri Stapf is rediscovered after a lapse of 183 years from the lowlands of Thiruchirappalli District of Tamil Nadu. Fresh collections of recently described taxa *E. henryi* Vivek, G.V.S. Murthy & V.J. Nair (from herbaria) is also collected after 35 years.

Species complex

Tripogon bromoides species complex is extensively discussed, and two varieties *T. bromoides* Roth ex Roem. & Schult. var. *bromoides* and *T. bromoides* Roth ex Roem. & Schult. var. *longifolius* Hook.f. have been recognized. The status of *Tripogon bromoides* Roth ex Roem. & Schult. var. *major* Hook.f. is treated as conspecific with *T. ravianus* Sunil & Pradeep.

Reinstatement of taxa

Eragrostis schweinfurthii Chiov. var. *kiwuensis* (Jedwabn.) S.M. Phillips is reinstated. Similarly, *Tripogon anantaswamianus* Sreek., V.J. Nair & N.C. Nair from southern Western Ghats (Kerala) was found to be conspecific with *T. zeylanicus* Thwaites, from Sri Lanka and hence, the later is reinstated.

New synonyms recognized

In the genus *Eragrostis*, three names, *E. jainii* Vivek, G.V.S. Murthy & V.J. Nair and *E. unioloides* var. *tremula* K.C. Jacob are reduced to the synonymy of *E. uniolodes* (Retz.) Nees ex Steud., while *E. santapaui* K.G. Bhat & C.R. Nagendran is

synonymised under *Eragrostis brownii* (Kunth) Nees respectively. Similarly, in *Tripogon,* including the recently described species, namely, *T. nallamalayanus* Rasingam & J. Swamy, *T. uma-ganeshii* B.R.P. Rao & M. Anil Kumar, *T. tirumalae* Chorghe, Rasingam, Prasanna & Sankara Rao are synonymised under the species *T. trifidus* Munro ex Hook.f; while, *T. paramjitianus* Murugesan, Arum., & Kabeer, *T. copei* Newmaster, V. Balas., Murug. & Ragup. and *T. jayachandranii* Arum. & Murugan are synonymised under *T. pungens* C.E.C. Fisch., *T. velliangiriensis* Murug. & V. Balas., and *T. sivarajanii* Sunil. While *T. wightii* Hook.f. var. *kanyakumarensis* Kabeer & V.J. Nair and *T. bromoides* var. *major* Stapf *ex* Hook.f. are also synonymised under *T. velliangiriensis* Murug. & V. Balas. and *T. ravianus* Sunil & Pradeep respectively.

Amended description

The protologue of *T. vellarianus* Pradeep was amended by adding the descriptions on their caryopsis morphology.

Lectotypification

The following six names *Eragrostiella brachyphylla* (Stapf) Bor, *Tripogon Jacquemontii* Stapf, *T. lisboae* Stapf, *Tripogon longearistatus* Hack. *ex* Honda, *T. wightii* Hook.f. and *Tripogon zeylanicus* Thwaites are lectotypified.

Caryopses morphology

The caryopses morphology of 58 taxa was studied using both optic and Scanning Electron Microscope (SEM). In the genus *Eragrostis,* caryopses morphology plays a crucial role in determining species identity. The merging of *E. jainii* Vivek, G.V.S. Murthy & V.J. Nair under *E. unioloides* is also supported by caryopsis morphology. Correspondingly species of *Tripogon* shows almost uniform caryopses morphology compared to other genera under the subtribe *Eragrostidinae,* yet it is much useful for taxonomy.

Endemism

In the subtribe *Eragrostidinae*, the genus *Tripogon* manifests maximum percentage (62.5%) of endemism, 15 out of 24 Indian taxa are endemic. Greater diversity of Tripogons occurs in the Peninsular India where 22 species were found. Western Ghats harbours 17 species, one species is endemic to the Eastern Ghats, another species is endemic to North West India and 10 species are endemic to the Western Ghats. The species of *Tripogon* frequently found in humid as well as wet areas of high altitude mountain ranges.

References

References

Achariar, R.B.K.R. & C.T. Mudaliyar 1921. *A handbook of South Indian grasses.* Bishen Singh Mahendra Pal Singh, Dehra Dun.

Adanson, M. 1763. *Familles des plantes.* Vol. **2.** Vincent, Paris.

Ahemedullah, M. 2000. Endemism in Indian Flora. In: Singh, N.P., Singh, D.K., Hajra, P.K. & B.D. Sharma (Eds.), *Flora of India, Introductory Volume* **1(2).** Botanical Survey of India, Kolkata. pp. 246–263.

Ahemedullah, M. & M.P. Nayar 1987. *Endemic plants of Indian region.* Botanical Survey of India, Kolkata.

Ahmad, F., Khan, M.A., Ahmad, M., Hameed, R.B., Tareen, M.Z. & A. Jabeen 2011. Taxonomic application of foliar anatomy in grasses of tribe Eragrostideae (Poaceae) from Salt Range of Pakistan. *Pak. J. Bot.* **43**: 2277–2284.

Aidar, S.T., Chaves, A.R.M., Junior, P.I.F., Oliveira, M.S., Neto, B.P.C., Junior, T.C. & C.V. Morgante 2017. Vegetative desiccation tolerance of *Tripogon spicatus* (Poaceae) from the Tropical semiarid region of Northeastern Brazil. *Funct. Plant Biol.* **44(11)**: 1124–1133.

Akhtar, T. 1986. *The cytology of Eragrostis with special reference to E. tef and its relatives.* Ph.D. Thesis (unpublished). University of London, UK.

Allred, K.W. & J.T. Columbus 1988. The grass spikelet formula: an aid in teaching and identification. *J. Range Managem.* **41**: 350–351.

Almeida, M.R. 1970. Three new grasses from the former Bombay Presidency. *J. Bombay Nat. Hist. Soc.* **66**: 510–513.

Amarasinghe, V. & L. Watson 1990. Taxonomic significance of microhair morphology in the genus *Eragrostis* Beauv. (Poaceae). *Taxon* **39**: 59–65.

Anonymous 1961. *Handbook of agriculture.* Indian Council of Agricultural Research, New Delhi.

Arumugam, S. & C. Murugan 2017. A new species of *Tripogon* (Poaceae: Chloridoideae: Tripogoninae) from India. *Indian J. Forest.* **40(2)**: 159–162.

Avdulov, N.P. 1931. Karyo-systematische untersuchung der familie gramineen. *Bull. Appl. Bot. Suppl.* **44**: 1–428.

Babu, R.H. & N. Savithramma 2014. Studies on stomata of some selected grass species of Poaceae and Cyperaceae. *World J. Pharm. Pharm. Sci.* **3**(7): 1268–1279.

Balakrishnan, N.P. 1996. Phytogeographical divisions: general considerations. In: Hajra, P.K., Sharma, B.D., Sanjappa, M. & A.R.K. Sastry (Eds.), *Flora of India, Introductory Volume* **1(2).** Botanical Surey of India, Kolkata. pp. 197–205.

Balsamo, R.A., Willigen, C.V., Bauer, A.M. & J. Farrant 2006. Drought tolerance of selected *Eragrostis* species correlates with leaf tensile properties. *Ann. Bot.* **97(6)**: 985–991.

Banerjee, S.K. & K.P.S. Chauhan 1981. Studies on the evolution of seed coat pattern in wheat by scanning electron microscopy identification. *Seed Sci. Technol.* **9**: 819–822.

Barnhart, J.H. 1895. Family nomenclature. *Bull. Torrey Bot. Club* **22**: 1–24.

Basak, R.K. 1981. Robert Wight and his botanical studies in India. *Taxon* **30(4)**: 784–793.

Basel, E.H. & H.S. Berlin 1981. *Grass weeds.* Vol. **2.** Ciba-Geigy Ltd., Switzerland.

Beauvois, A.M.F.J. Palisot de 1812. *Essai d'une nouvelle agrostographie; ou nouveaux genres des Graminées, avec figures représentant les caractères de tous les genres.* Fain, Paris.

Beetle, A.A. 1955. The four subfamilies of the Gramineae. *Bull. Torrey Bot. Club* **85**: 196–197.

Beetle, A.A., Forceck, E.M., Sanchez, J.A.M., Luque, V.J., Hernandez, A.C. & A.M.R. Rodriguez 1991. *Eragrostis* Wolf. In: *Las Gramineas de Mexico*. Vol. **3.** COTECOCA, S.A.R.H., Mexico, D.F. pp. 50–97.

Beilschmied, C.T. 1833. Chloridoideae. *Flora* **16(52)**: 105.

Bentham, G. 1881. Notes on Gramineae. *J. Linn. Soc., Bot.* **19(115–116)**: 14–134.

Bentham, G. & J.D. Hooker 1883. *Genera plantarum.* Vol. **3.** L. Reeve & Co., London.

Bews, J.W. 1929. *The World's grasses.* Longmans, Green & Co., London.

Bharucha, F.R. **& K.A. Sankarnarayanan 1958.** Studies on the grasslands of the Western Ghats, India. *J. Ecol.* **46(3)**: 681–705.

Bhat, K.G. & C.R. Nagendran 1985. Two new species of Poaceae from India. *Rainwardtia* **10**: 127–130.

Bhat, K.G. & C.R. Nagendran 2001. *Sedges and grasses (Dakishna Kannada & Uduppi District).* Bishen Singh Mahendra Pal Singh, Dehra Dun.

Bhide, R.K. 1906. New and revised species of Gramineae from Bombay. *J. Asiat. Soc. Bengal* 7**(8)**: 515.

Bing, C.L. 2005. *Tripogon debilis* (Poaceae) a new species from Western China. *Novon* **15:** 390–392.

Bir, S.S. & M. Sahni 1988. Cytomorphological studies on members of genus *Eragrostis* V.Wolf from Punjab plain (North India). *J. Cytol. Genet.* **23**: 118–131.

Blackmore, S. 1984. Pollen features and plant systematics. In: Heywood, V.H. & D.M. Moore (Eds.), *Current concepts in plant taxonomy.* Academic Press, London. pp. 135–154.

Blake, S.T. 1969. Taxonomic and nomemclatural studies in the Gramineae, 2. *Proc. Roy. Soc. Queensland* **81:** 20–21.

Blatter, E.J. & C. McCann 1935. *The Bombay grasses.* Indian Council of Agricultural Research, Delhi.

Boechat, S.C. & H.M. Longhi-Wagner 2000. Padrõs de distribuicão geográfica dos táxons brasileiros de *Eragrostis* (Poaceae, Chloridoideae). *Revista Brasil. Bot., São Paulo* **23**: 177–194.

Boechat, S.C. & H.M. Longhi-Wagner 2001. O gênero *Eragrostis* (Poaceae) no Brasil. *Iheringia* **55**: 23–169.

Boechat, S.C. & H.M. Longhi-Wagner 2003. Análise do fruto em espécies de *Eragrostis* Wolf (Poaceae). *Iheringia* **58**: 131–166.

Bogdan, A.V. 1966. Seed morphology of some cultivated African grasses. *Int. Seed Test. Assoc. Proc.* **31**: 789–799.

Boissier, E. 1881. *Flora Orientalis*. Vol. **5.** Basel, Genève.

Bor, N.L. 1940. *The Flora of Assam.* Vol. **5** (Gramineae). Assam Government Press, Kolkata.

Bor, N.L. 1941. Some common U.P. grasses. *Indian Forest. Rec.* **2(1)**: 1–220.

Bor, N. L. 1957. Notes on Asiatic grasses: XXIX. New Species from Burma. *Kew Bull.* **12(3):** 414–418.

Bor, N. L. 1958a. Notes on Asiatic grasses: XXXII: *Indopoa* Bor, a new genus of Indian grasses. *Kew Bull.* **13 (2):** 225–226.

Bor, N.L. 1958b. Notes on Asiatic grasses: XXIX. New species from Burma. *Kew Bull.* **12(3)**: 417–418.

Bor, N.L. 1960. *The grasses of Burma, Ceylon, India & Pakistan.* Pergamon Press, London.

Bor, N.L. 1963. *Tripogon siamensis*. *J. Indian Bot. Soc.* **42**: 14.t.3.

Bor, N.L. 1968. *Tripogon larsenii*. *Dansk Botanisk Arkiv.* **23**: 470.

Bouchenak-Khelladi, Y., Verboom, G.A., Savolinen, V. & T.R. Hodkinson 2010. Biogeography of the grasses (Poaceae): a phylogenetic approach to reveal evolutionary history in geographical space and geological time. *Bot. J. Linn. Soc.* **162**: 543–557.

Bremer, K. 2000. Early cretaceous lineages of monocot flowering plants. *Proc. Natl. Acad. Sci. U.S.A.* **97**: 4704–4711.

Bridson, D. & L. Forman. 1998. *The herbarium handbook.* (Ed. 3). Royal Botanic Garden, Kew, London.

Britto, S.J. & K.M. Matthew 1983. Poaceae. In: Matthew, K. M (Ed.), *Flora of the Tamil Nadu Carnatic.* Vol. **3** (1–2). The Rapinat Herbarium, Thiruchirappalli. pp. 1788–1915.

Brown, R. 1810. *Prodromus florae Novae Hollandiae.* Vol. **1.** R. Taylor, London.

Brown, R. 1814. *General remarks, geographical and systematical notes on the Botany of Terra Australis.* Vol. **2.** G. & W. Nichol., London.

Brown, W.V. 1958. Leaf anatomy in grass systematics. *Bot. Gaz.* **119**: 170–178.

Brown, W.V. 1977. The Kranz syndrome and its subtypes in grass systematics. *Mem. Torrey Bot. Club.* **23(3)**: 1–97.

Brummit, R.K. & C.E. Powell 1992. *Authors of plant names.* Royal Botanic Gardens, Kew.

Burbidge, N.T. 1970. *Australian grasses.* Vol. **3.** Angus & Robertson Ltd., Melbourne.

Burns, W. 1923. Grassland ecology. *Agr. Res. Inst. Pusa Bull.* **150**: 18–21.

Bush, B.F. 1903. A new genus of grass. *Trans. Acad. Sci. St. Louis* **13**: 175–183.

Butzin, F. 1965. *Neue untersuchungen über die Blüte der Gramineae.* Ph.D. Thesis (unpublished). Freie Universität, Berlin.

Campbell, S.C. 1985. The subfamilies and tribes of Gramineae (Poaceae) in the South eastern United States. *J. Arnold Arbor.* **66**: 123–199.

Camus, A.A. 1920. *Tripogon thorelii* A.Camus. *Notul. Syst.* (Paris) **4**: 14.

Cardone, S., Polci, P., Selva, J.P., Mecchia, M., Pessino, S., Hermann, P., Cambi, V., Voigt, P., Spangenberg, G. & V. Echenique 2006. Novel genotypes of the subtropical grass *Eragrostis curvula* for the study of apomixis (diplospory). *Euphytica* **151**: 263–272.

Caro, J.A. 1982. Sinopsis taxonómica de las gramíneas argentinas. *Dominguezia* **4**: 1–51.

Celakovsk, L. 1889. Über den ärchenbau der Brasilianschen Grasgatung Streptochaeta Schrader. Sitzungsberichte der Königlichen Böhmischen Gesellschaftder Wissenschaften. *Math.-naturwiss. Kl.* **3**: 14–42.

Chaisongkram, W., Chantaranothai, P. & T.R. Hoodkinson 2013. A taxonomic revision of the genus *Eragrostis* in Thailand. *ScienceAsia* **39:** 111–123.

Champian, H.G. & S.K. Seth 1968. *A revised survey of forest types in India.* Manager of publications, Delhi.

Chatterjee, D. 1939. Studies on the endemic flora of India & Burma. *J. Roy Asia Soc. Beng. Sci.* **5**:19–67.

Chen, S.L. & S.M. Phillips 2006. *Tripogon* Roem. & Schult. In: Wu, Z.Y., Raven, P.H. & D.Y. Hong. (Eds.), *Flora of China (Poaceae).* Vol. **22**. Science Press, Beijing and Missouri Botanical Garden Press, St. Louis. pp. 466–469.

Chen, S.L., Wu, Z.I., Lu, S.L., Sun, B.X., Phillips. S.M. & P.M. Peterson 2006. Tribe Eragrostideae. In: Wu, Z.Y., Raven, P.H. & D.Y. Hong. (Eds.). *Flora of China (Poaceae).* Vol. **22**. Science Press, Beijing and

Missouri Botanical Garden Press, St. Louis. pp. 457–487.

Cherian, P.T. 2001. Deccan Peninsula. In: Alfred, J.R.B., Das, A.K. & A.K. Sanyal (Eds.), *Ecosystems of India*. ENVIS Centre, Zoological Survey of India, Kolkata. pp. 387–410.

Chorghe, A., Dey, S., Prasad, K., Prasanna, P.V. & Y.V. Rao 2015. *Tripogon mahendragiriensis* sp. nov. (Poaceae) from the Eastern Ghats of Odisha (Orissa) state, India. *Nordic J. Bot.* **33**: 655–658.

Chorghe, A., Rasingam, L., Prasanna, P.V. & M.S. Rao 2013. *Tripogon tirumalae* (Poaceae), a new species from the Seshachalam Hills of Andhra Pradesh, India. *Phytotaxa* **131(1):** 17–22.

Christopher, J. & A. Abraham 1974. Studies of the cytology and phylogeny of South Indian grasses I. Subfamily Eragrostoideae. *Cytologia* **39**: 561–571.

Christopher, J. & A. Abraham 1976. Studies of the cytology and phylogeny of South Indian grasses III. Subfamily VI: Panicoideae, tribe (i) the Paniceae. *Cytologia* **41**: 621–637.

Clark, L.G. 2004. The grasses (Poaceae): Robert Brown and now. *Telopea* **10(2)**: 505.

Clark, L.G., Zhang, W. & J.F. Wendel 1995. A phylogeny of the grass family (Poaceae) based on *ndhF* sequences. *Syst. Bot.* **20**: 436–460.

Clayton, W.D. 1972. The awned genera of the Andropogoneae. Studies in the Gramineae 31. *Kew Bull.* **27**: 457–474.

Clayton, W.D. 1973. The awnless genera of the Andropogoneae. Studies in the Gramineae 33. *Kew Bull.* **28**: 49–58.

Clayton, W.D. 1981. Evolution and distribution of grasses. *Ann. Missouri Bot. Gard.* **68**: 5–14.

Clayton, W.D. & T.A. Cope. 1980. The chorology of Old World species of Gramineae. *Kew Bull.* **35**: 135–170.

Clayton, W.D. & S.A. Renvoize 1986. *Genera Graminum. Grass genera of the World.* Kew Bulletin Add. Ser. XIII. Royal Botanic Gardens, Kew.

Clayton, W.D., Phillips, S.M. & S.A. Renvoize. 1974. *Flora of tropical East Africa, Gramineae (Part 2).* Crown Agents, London.

Clayton, W.D., Vorontsova, M.S., Harman, K.T. & H. Williamson 2006. *Grass Base-The online World grass flora.* Royal Botanical Gardens, Kew. Available at http://www.kew.org/data/grass.db.html. (Accessed on 10 Sept 2013).

Clifford, H.T. 1965. The classification of the Poaceae: a statistical study. *Pap. Dept. Bot. Univ. Qld.* **4**: 243–253.

Clifford, H.T. 1996. *Etymological dictionary of grasses, Version 1.0 (CD-ROM).* Expert Center for Taxonomic Identification, Amsterdam.

Clifford, H.T. & L. Watson. 1977. *Identifying grasses: data, methods and illustrations.* Queensland University Press, Brisbane.

Clifford, H.T. & P.D. Bostock 2007. *Etymological dictionary of grasses.* Springer-Verlag, Berlin.

Clifford, H.T., Williams, W.T. & G.N. Lance 1969. A further numerical contribution to the classification of the *Poaceae. Aust. J. Bot.* **17**: 119–131.

Colbry, V.L. 1957. Diagnostic characteristics of the fruits and florets of economic species of North American *Sporobolus. Contr. U.S. Natl. Herb.* **34**: 1–24.

Coldstream, W. 1889. *Illustrations of some of the grasses of the southern Punjab: with short descriptive letterpress.* Thacker, Edinburgh.

Connar, H.E. 1981. Evolution of reproductive systems in the Gramineae. *Ann. Missouri Bot. Gard.* **68**: 48–74.

Cooke, T. 1901–1908. *The Flora of the Presidency of Bombay.* Vol. **1–3**. Botanical Survey of India, Kolkata.

Cooke, T. 1958. *Flora of the Presidency of Bombay.* Vol. **3.** Botanical Survey of India, Kolkata.

Cope, T.A. 1982. Poaceae. In: Nasir, E. & S.I. Ali (Eds.) *Flora of Pakistan.* Agricultural Research Council and University of Karachi, Islamabad. pp. 40–678.

Cope, T.A. 1998. A synopsis of *Eragrostis* Wolf (Poaceae) in the flora of Zambesiaca area. *Kew. Bull.* **53**: 129–164.

Cvelev, N.N. 1976. *Zlaki SSSR.* Leningrad, Nauka.

Dabadghao, P.M. & K.A. Sankaranarayanan 1973. *The grass cover of India.* Indian Council of Agricultural Research, New Delhi.

Dahlgren, R.M.T., Clifford, H.T. & P.F. Yeo 1985. *The families of Monocotyledons – structure evolution and taxonomy.* Springer-Verlag, Berlin.

Daniels, R.J.R. 1997. Taxonomic uncertainities and conservation assessment of the Western Ghats. *Curr. Sci.* **73**(**2**): 169–170.

Dassanayake, M.D., Fosberg, F.R. & W.D. Clayton 1994. *A revised hand Book to the flora of Ceylon.* Vol. **8**. Amerind publishing Co., New Delhi.

Davidse, G. 1987. Fruit dispersal in the Poaceae. In: Soderstrom, T.R., Hilu, K.W., Campbell, C.S. & M.E. Barkworth (Eds.). *Grass Syst. Evol.* Smithsonian press, Washington D.C. pp. 143–155.

Davidse, G. 1994. *Eragrostis* Wolf. *Flora Mesoamericana.* Vol. **6**: 263–272.

Davis, J.I. & R.L. Soreng 1993. Phylogenetic structure of the grass family (Poaceae) as inferred from chloroplast DNA restriction site variations. *Amer. J. Bot.* **80**: 1444–1454.

Davis, P.H. & V.H. Heywood 1963. *Principles of Angiosperm taxonomy.* Van Nostrand. Princeton.

Deshpande, U.R. & N.P. Singh 1986. *Grasses of Maharashtra*. Mittal Publications, New Delhi.

De Winter, B. 1960. A new genus of Gramineae. *Bothalia* 7: 387–390.

Dinda, S. & A.K. Mondal 2018. The morphometric and numerical analysis of five species of *Eragrostis* sp. Wolf based on silica bodies in leaf epidermal cells. *Ann. Plant Sci.* 7(**5**): 2213–2219.

Döll, J.C. 1878. *Eragrostis.* In: Martius, C.P.F. von (Ed.), *Flora Brasiliensis* **2(3).** Munich & Leipzig, Oldenbourg. pp. 135–158.

Domin, K. 1915. Beiträge zur flora und pflanzengeographie Australiens I. Pteridophyta, Gymnospermae, Monocotyledonae. *Biblioth. Bot.* **85(1)**: 133–146.

Dumortier, B.C.J. 1824. *Observations sur les Graminees de la Flore Belgique*. J. Casterman aîné: Tournay.

Duthie, J.F. 1883. *A list of the grasses of North-western India, indegenous and cultivated*. Department of Agriculture North-West Province, Roorkee.

Duthie, J.F. 1888. *The fodder grasses of the northern India.* Reprint, Scientific Publishers, Jodphur.

Duthie, J.F. 1901. *Tripogon purpurascens* Duthie. *Ann. Roy. Bot. Gard.* (Kolkata) **9**: 74–75.

Duthie, J.F. 1903. *Flora of upper Gangetic Plain. Botanical Survey of India,* Kolkata.

Duvall, M.R. & B.R. Morton. 1996. Molecular phylogenetics of Poaceae: an expanded analysis of *rbcL* sequence data. *Mol. Phylogen. Evol.* **5**: 352–358.

Duvall, M.R., Peterson, P.M. & A.H. Christenesen 1994. Alliances of *Muhlenbergia* (Poaceae) within New World Eragrostideae are identified by phylogenetic analysis of mapped restriction sites from plastid DNAs. *Amer. J. Bot.* **81(5)**: 622–629

Duvall, M.R., Davis, J.I., Clark, L.G., Noll, J.D., Goldman, D.H. & J.G. Sanchez-Ken 2007. Phylogeny of the grasses (Poaceae) revisited. *Aliso* **23**: 237–247.

Ehleringer, J.R., Sage, R.F., Flanagan, L.B. & R.W. Pearcy 1991. Climate change and the evolution of C4 photosynthesis. *Trends Ecol. Evol.* **6**: 95–99.

Ellis, R.P. 1984. *Eragrostis walteri* – a first record of non Kranz leaf anatomy in the sub-family Chloridoideae (Poaceae). *S. Afr. Bot.* **3**: 380–386.

Fabillo, M. 2015. *Leaf and inflorescence structure and phylogenetics of Tripogon and affiliated genera (Poaceae: Chloridoideae).* Ph.D. Thesis (unpublished). Queensland University of Technology (QUT), Queensland.

FAOSTAT 1999. Database online, http//:appas.fao.org/

Favaretto, A., Santos, J., Carneiro, C.M., & S.M. Scheffer-Basso 2015. The first anatomical and histochemical study of tough lovegrass (*Eragrostis plana* Nees, Poaceae). *Afr. J. Agri. Res.* **10(30)**: 2940–2947.

Finot, V.L., Barrera, J.A., Marticorena, C. & G. Rojas 2011. Systematic diversity of the family Poaceae (Gramineae) in Chile. In: Grillo, O. & G. Venora (Eds.). *The dynamical processes of the biodiversity – case studies of evolution and spatial distribution.* In Tech, Croatia. pp. 71–108.

Fischer, C.E.C. 1934. New or little known plants from South India: III. *Bull. Misc. Inform. (Royal Gardens, Kew).* **1934(4)**: 170–172.

Fischer, C.E.C. 1934. Gramineae. In: Gamble, J.S. (Ed.), *Flora of Presidency of Madras.* Vol. **3.**, Part X. Adlard & Sons Ltd., London.

Fosberg, F.R. & M.H. Sachet 1965. *Manual of tropical herbaria. Regnum Vegetabile.* Vol. **39**. International Bureau for Plant Taxonomy and Nomenclature, Utrecht.

Fyson, P.F. 1915. *The flora of the Nilgiri and Pulney hill-tops.* Government Press, Madras.

Fyson, P.F. 1932. *Flora of South Indian hill stations.* Vol. **1** & **2.** Today and Tomorrow Printers & Publishers, New Delhi.

Gad, H.S. 2008. *A taxonomic study of the family Poaceae in Goa.* Ph.D. Thesis (unpublished). Goa University, Goa.

Gaff, D.F. & P.V. Bole 1986. Resurrection grasses in India. *Oecologia* **71**: 159–160.

Gandhi, D., Albert, S. & N. Pandya 2013. Morphometric analysis of caryopses in nine species of *Eragrostis* (Poaceae) from India using SEM and light microscopy. *Telopea* **15**: 87–97.

Ghosh, A. & P. Karmakar 2017. Monocot pollen flora of Paschil Medinipur District, West Bengal, with a note on pollen dispersal mechanism. *Curr. Bot.* **8**: 41–54.

Gilliland, H.B. 1969. *A revised flora of Malaya,* Vol. **3**: *Grasses of Malaya.* Botanic Garden, Singapore.

Ginbot, Z.G. 2002. Physiological response of selected *Eragrostis* species to water-deficit stress. Msc. Dissertation (unpublished), University of Cape Town, South Africa.

Ginbot, Z.G. & J.M. Farrant 2011. Physiological response of selected *Eragrostis* species to water-deficit stress. *Afr. J. Biotechnol.* **10**: 10405–10417.

Giraldo-Cañas, D., Peterson, P.M. & I.S. Vega 2012. The genus *Eragrostis* (Poaceae: Chloridoideae) in Northwestern South America (Columbia, Ecuador, and Peru): morphological and taxonomic studies. *Bible. Jose. Jeron. Trian.* **23**: 1–180.

Goebel, K. 1895. Ein beitrag zur morphologie der gräser. *Flora* **81**: 17–19.

Good, R. 1953. *The geography of the flowering plants.* (Ed. 2). Longmans, Green & Co. Ltd., London.

Good, R. 1956. *Features of evolution in the flowering plants.* Longmans, Green & Co. Ltd., London.

Good, R. 1974. *The geography of the flowering plants.* Longmans, Green & Co. Ltd., London.

Gould, F.W. 1958. Chromosome numbers in Southwestern grasses. *Amer. J. Bot.* **45:** 757–767.

Gould, F.W. 1968. *Grass systematics.* McGraw-Hill Book Company, New York.

Gould, F.W. & R.B. Shaw1983. *Grass systematics.* (Ed. 2). Texas A & M

University Press, New York.

GPWG (Grass Phylogeny Working Group) 2000. A phylogeny of the grass family (Poaceae), as inferred from eight character sets. In: Jacobs, S.W.L. & J. Everett (Eds.). *Grasses: systematics and evolution.* CSIRO Publishing, Melbourne. pp. 3–7.

GPWG I 2001. Phylogeny and subfamilial classification of the grasses (Poaceae). *Ann. Missouri Bot. Gard.* **88**: 373–457.

GPWG II 2012. New grass phylogeny resolves deep evolutionary relationships and discovers C4 origins. *New Phytol.* **193**: 304–312.

Griffith, W. 1834. Grasses of Jheels of Sylhet. *J. Asiat. Soc. Beng.* **5**: 570.

Grisebach, A.H.R. 1859–1864. *Flora of the British West Indian Islands.* Lovell Reev & Co., London. pp. 531–533.

Gutierrez, M., Gracen, V.E. & G.E. Edwards 1974. Biochemical and cytological relationships in C_4 plants. *Planta* **119**(**4**): 279–300.

Hackel, E. 1887. Gramineae. In: A. Englar & K. Prantl (Eds.), *Die Natürlichen Pflanzenfamilien.* Wilhelm Engelman, Leipzig. pp. 1–97.

Hackel, E. 1889. Andropogoneae. In: de Candolle, A. & C. de Candolle (Eds.). *Monographiae phanerogamarum prodromi nunc continuation, nunc revisio editoribus et pro parte auctoribus Alphonso et Casimir de Candolle.* Vol. **6**. G. Masson, Paris. pp. 1–716.

Harris, J.G. & M.W. Harris 1995. *Plant identification terminology, an illustrated glossary* (Ed. 2). Spring Lake Publishing, Payson UT.

Hartely, W. 1950. The global distribution of the tribes of Gramineae. *Austr. J. Agr. Res.* **1**: 355–373.

Hartely, W. 1958. Studies on the origin, evolution and distribution of the Gramineae 1. The tribe Andropogoneae. *Austr. J. Bot.* **6**: 116–128.

Hartely, W. & C. Slater 1960. Studies on the origin, evolution, and distribution of the Gramineae III. The tribes of the subfamily Eragrostoideae. *Austr. J. Bot.* **8:** 256–276.

Hatch, M.D. 1971. Mechanism and fuction of C_4 photosynthesis. In: Hatch, M.D., Osmond, C.B. & R.O. Slater (Eds.), *Photosynthesis and Photorespiration*. Wiley Interscience, New York. pp. 139–152.

Henry, A.N. 1967. Nomenclatural changes in Indian plants. *Bull. Bot. Surv. India* **9**: 290.

Henry, A.N. Chithra, V. & N.P. Balakrishnan 1989. *Flora of Tamil Nadu Analysis.* Vol. **3(1).** Botanical Survey of India, Kolkata.

Henry, A.N. Rathakrishnan, N.C. & T. Ravisankar 1996. Deccan. In: Hajra, P.K., Sharma, B.D., Sanjappa, M. & A.R.K. Sastry (Eds.), *Flora of India, Introductory Volume* **1(2)**. Botanical Survey of India, Kolkata. pp. 456–476.

Henry, A.N. Vivekananthan, K. & N.C. Nair 1978. Rare and threatened

flowering plants of South India. *J. Bombay Nat. Hist. Soc.* **75(3)**: 684–697.

Heywood, V.H. & K.M.M. Dakshini 1971. Fruit structre in the Umbelliferae-Caucalideae. In: Heywood, V.H. (Ed.) *The biology and chemistry of the Umbelliferae.* Academic Press, London. pp. 215–232.

Heywood, V.H., Brummitt, R.K., Culham, A. & O. Seberg 2007. *Flowering plant families of the World.* Royal Botanic Gardens, Kew.

Hillman, F.H. 1916. Distinguishing characters of the seeds of Sudan grass and Johnson grass. *Bull. U.S. Dept. Agr.* **406**. U.S. Department of Agriculture, Washington D.C. pp. 1–5.

Hilu, K.W. 2007. A century of progress in grass systematics. *Kew Bull.* **62**: 355–373.

Hilu, K.W. & K. Wright 1982. Systematics of Gramineae: a cluster analysis study. *Taxon* **31**: 9–36.

Hilu, K.W. & J.L. Jhonson 1991. Chloroplast DNA re-association and grass phylogeny. *Pl. Syst. and Evol.* **176**: 21–31.

Hilu, K.W. & L.A. Alice 1999. Evolutionary implications of *matK* indels in Poaceae. *Amer. J. Bot.* **86**: 1735–1741.

Hilu, K.W. & L.A. Alice 2000. Phylogenetic relationships in subfamily Chloridoideae (Poaceae) based on *matK* sequences: a preliminary assessment. In: Jacobs, S.W.L. & J. Everett (Eds.), *Grassses: systematics and evolution.* CSIRO publishing, Australia. pp. 173–179.

Hilu, K.W. & L.A. Alice 2001. A phylogeny of Chloridoideae (Poaceae) based on *matK* sequences. *Syst. Bot.* **26**(2): 386–405.

Hitchcock, A.S. 1908. Agrostis genus novis speciebus Americae septentrionalis auctorum. *J. Bot. Taxonomy and Geobotany* **5 (21–25):** 356–359.

Hitchcock, A.S. 1914. *A text book of grasses.* The Macmillan Co., New York.

Hitchcock, A.S. 1920. The genera of grasses of the United States, with special reference to the economic species. *U.S. Dept. Agr. Bull.* **772**. pp. 1–288.

Hitchcock, A.S. 1935. *Manual of the grasses of the United States.* U.S. Department of Agriculture **200**. p. 993.

Hitchcock, A.S. & A. Chase 1950 & 1951. *Manual of the grasses of the United States.* Government Printing Office, Washington D.C.

Hochstetter, C.F. 1855. Plantas novas Africanas proponit et describit. 1. Gramina. *Flora* **38**: 193–206.

Honda, M. 1927. *Tripogon longiaristatus. Bot. Mag.* **41**: 12.

Hooker, J.D. 1864. *Tripogon major* Hook.f. *J. Proc. Linn. Soc., Bot.* 7: 230.

Hooker, J.D. 1896. *Flora of British India.* Vol. 7. L. Reeve & Co., London.

Hubbard, C.E. 1948. The genera of British grasses. In: Hutchinson, J. (Ed.), *British flowering plants.* Gawthorn, P.R. Ltd., London. pp. 284–348.

Hubbard, C.E. 1954. *Grasses.* Penguin Books, London.

Ingram, A.L. 2010. Evolution of leaf blade anatomy in *Eragrostis* (Poaceae). *Syst. Bot.* **35**: 755–325.

Ingram, A.L. & J.J. Doyle 2003. The origin and evolution of *Eragrostis tef* (Poaceae) and related polyploids: evidence from nuclear waxy and plastid *rps16. Amer. J. Bot.* **90**: 116–122.

Ingram, A.L. & J.J. Doyle 2004. Is *Eragrostis* (Poaceae) monophyletic? Insight from nuclear and plastid sequence data. *Syst. Bot.* **29**: 545–552.

Ingram, A.L. & J.J. Doyle 2007. *Eragrostis* (Poaceae): Monophyly and infrageneric classification. *Aliso* **23**(**1**): 595–604.

IPNI 2018. International Plant Name Index – Published on the internet. http://www.ipni.org/index.html

Jackson, B.D 1893. *Index Kewensis: an enumeration of the genera and species of flowering plants from the time of Linnaeus to the year 1885 inclusive together with their authors name, the works in which they were first published, their native countries and their synonyms.* Calrendon Press, Oxford.

Jacob, K.C. 1947. Some new species of South Indian plants. *J. Bombay Nat. Hist. Soc.* **47**(**1**): 47–51.

Jacobs, F.B., Kingston & L.L. Jacobs 1999. The origin of grass dominated ecosystems. *Ann. Missouri Bot. Gard.* **86**(**2**): 590–643.

Jacqes-Felix, H. 1955. Notes sur les Graminees d'Afrique tropicale. VIII. Les tribus de la serie Oryzoide. *J. Agr. Trop. Bot. Appl.* **2**: 600–619.

Jacqes-Felix, H. 1962. *Les Graminées d'Afrique tropicale.* Vol. **1.** Institut de Recherches Agronomiques Tropicales, Paris. p. 345.

Jain, S.K. 1967. Notes on Indian grasses. VII. The genus *Oropetium* Trin. in India. *Bull. Bot. Surv. India* **9**: 284–285.

Jain, S.K. 1986. The grass genera of India – a synoptic account of uses and phytogeography. *Bull. Bot. Surv. India* **28**: 229–240.

Jaubert, H.F. & É. Spach 1851. *Illustrationes plantarum orientalium auctoribus* Vol. 4. Apud Roret Bibliopolam, Parisiis. pp. 332–333.

Jensen, L.A. 1957. Seed characteristics of certain wild barley, *Horedeum* spp. *Proc. Inter. Seed Test. Assoc.* 7: 87–91.

Jettisha, P.I. & M. Sabu 2012. Phytoliths as a tool for the identification of some Chloridoideae grasses in Kerala. *ISRN Botany* **12.** Article ID 246057, pp.1–9.

Jettisha, P.I. & M. Sabu 2014. Foliar phytoliths as an aid to the identification of Paniceae (Panicoideae: Poaceae) grasses in South India. *Webbia: J. Plant Taxonomy and Geography* **70(1)**: 115–133.

Johnson, A.T. & H.A. Smith 1931. *Plant names simplified; their pronounciation, derivation and meaning.* Landsmans Bookshop Ltd., Herefordshire.

Johnston, C.R. & L. Watson 1976. Microhairs: a universal characteristic of non-festucoid grass genera. *Phytomorphology* **26**: 297–301.

Jussieu, A.L. de. 1789. *Genera plantarum.* Herissant & Theophilum Barrois, Paris.

Judd, W.S., Campbell, C.S., Kellogg, E.A. & P.F. Stevens 2002. *Plant systematics – a phylogenetic approach.* (Ed. 2). Sinaur Associates, Sunderland.

Judziewics, E.J. 1991. Poaceae (Gramineae). In: A. Görts-Van Rijn, (Ed.), *Flora of the Guianas.* Koeltz Scientific Books, Köenigstein.

Jung, M.J., Veldkamp, J.F. & C.S. Kuoh 2008. Notes on *Eragrostis* (Poaceae) for the flora of Taiwan. *Taiwania* **53(1)**: 96–102.

Kabeer K.A.A. 2017. *Scanning electron microscopic studies of caryopsis in Eragrostis, Sporobolus and Tripogon Genera of Poaceae.* Botanical Survey of India. Southern Regional Center, Coimbatore.

Kabeer K.A.A. & V.J. Nair 2009. *Flora of Tamil Nadu – grasses.* Botanical Survey of India, Kolkata.

Kabeer, K.A.A., Nair, V.J. & G.V.S. Murthy 2009. *Tripogon borii* – a grass species new to science from India. *Bull. Bot. Surv. India* **50:** 115–118.

Karbaschi, M.R., Williams, B., Taji, A. & S.G. Mundree 2016. *Tripogon loliformis* elicits a rapid physiological and structural response to dehydration for desiccation tolerance. *Funct. Plant Biol.* **43**(7): 643–655.

Karthikeyan, S. 1975. A synopsis of the awned grasses of former Madras Presidency. *Bull. Bot. Surv. India* **14**: 83–91.

Karthikeyan, S. 1980. A synopsis of the unawned grasses of former Madras Presidency. *Bull. Bot. Surv. India* **22**: 91–95.

Karthikeyan, S. 1984. Grasses of Shevaroys. *Bull. Bot. Surv. India* **26(1–2)**: 7–19.

Karthikeyan, S. 2005. Common tropical and subtropical sedges and grasses: an illustrated account: review. *Rheedea* **15(2)**: 141–142.

Karthikeyan, S., Jain, S.K., Nayar, M.P. & M. Sanjappa 1989. *Florae Indicae Enumeratio: Monocotyledonae.* Botanical Survey of India, Kolkata.

Kaur, H., Mubarak, N., Kumari, S. & R.C. Gupta 2014. Chromosome numbers and basic chromosome numbers in monocotyledonous genera of the western Himalayas (India). *Acta Biol. Cracov., Ser. Bot.* **56/2**: 9–19.

Kellog, E.A. 2001. Evolutionary history of the Grasses. *Plant physiol.* **125**: 1198–1205.

Kellogg, E.A. 2006. Beyond taxonomy: prospects for understanding morphological diversity in the grasses (Poaceae). *Darwiniana* **44(1)**: 7–17.

Kellogg, E.A. 2015. Chloridoideae Kunth ex Beilschm. In: Kubitzhi, K. (Ed.), *The families and genera of vascular plants.* Vol. **13**, Flowering Plants-Monocots (Poaceae). Springer. United Kingdom. pp. 357–393.

Kellogg, E.A. & C.S. Campbell 1987. Phylogenetic analysis of the Gramineae. In: Soderstorm, T.R., Hilu, K.W., Campbell, C.S. & M.E. Barkworth (Eds.), *Grass systematics and evolution.* Smithsonian Institution Press, Washington D.C.

Kiranraj, M.S. 2008. *Taxonomic revision of the subtribe Dimeriinae Hack. of Andropogoneae in Peninsular India.* Ph.D. Thesis (unpublished). Calicut University, Kerala.

Kiranraj, M.S., Sivadasan, M. & N. Ravi 2003. Grass diversity of Kerala – endemism and its phytogeographical significance. In: Janarthanam, M.K. & D. Narasimhan (Eds.), *Plant diversity, Human welfare and conservation.* Goa University, Goa.

Koch, K. 1848. Beiträge zu einer Flora des Orientes. *Linnaea* **21**: 289–443.

Kreitschitz, A., Tadele, Z. & E.M. Gola 2009. Slime cells on the surface of *Eragrostis* seeds maintain a level of moisture around the grain to enhance germination. *Seed Sci. Res.* **19**: 27–35.

Krishnan, M.S. 1968. *Geology of India and Burma.* Higginbothams Pvt. Ltd., Madras.

Kumar, N. & S. Nautiyal 2017. Leaf anatomy of two genera of tribe Eragrostideae (Poaceae) from Mandal forest of Kedarnath wildlife sanctuary, Uttarakhand, India. *Int J. Botany Stud.* **2**(5): 50–55.

Kunth, C.S. 1815. *Considerations generales sur les Graminees.* Vol. **2**. Memoires du MuScum Histoire Naturelle, Paris. p. 62–75.

Kunth, C.S. 1816. *Nova genera et species plantarum* (Ed. 4). Librarie-Gide, Paris.

Kunth, C.S. 1833. *Enumeratio Plantarum. Agrostographia Synoptica.* Vol. **1**. J.G. Cottae, Tubingen.

Lawrence, G.H.M. 1951. *Taxonomy of vascular plants.* The Mcmillan Co., New York.

Lazarides, M. 1976. The genus *Eragrostiella* Bor (Poaceae, Eragrostideae). *Contr. Herb. Austr.* **22**: 1–7.

Lazarides, M. 1980. The genus *Leptochloa* Beauv. (Poaceae, Eragrostideae) in Australia and Papua New Guinea. *Brunonia* **3**: 247–69.

Lazarides, M. 1994. *Eragrostiella* Bor, *Eragrostis* Wolf*, Leptochloa* P. Beauv., *Tripogon* Roem. & Schult. In: Dassanayake, M.D., Fosberg, F.R. & W.D. Clayton

(Eds.), *A revised handbook to the flora of Ceylon.* Vol. **8.** Amerind publishing Co. Pvt. Ltd., New Delhi. pp. 199–229.

Lazarides, M. 1997. A revision of *Eragrostis* (Eragrostidinae, Eleusininae, Poaceae) in Australia. *Aust. Syst. Bot.* **10:** 77–187.

Linnaeus, C. 1753. *Species plantarum.* Laurentii Salvii, Stockholm.

Lisboa, J.C. 1896. *List of Bombay grasses and their uses.* Government Central Press, Bombay.

Liu, Q., Zhang, D.X. & P.M. Peterson 2010. Lemma micromorphological characters in the Chloridoideae (Poaceae) optimized on a molecular phylo-geny. *S. African J. Bot.* **76**: 196–209.

Liu, Q., Zhao, N.X. & G. Hao 2004. Pollen morphology of the Chloridoideae. *Grana* **43**: 238–248.

Liu, Q., Zhao, N.X., Hao, G., Hu, X.Y. & Y.X. Liu 2005. Caryopsis morphology of the Chloridoideae (Gramineae) and its systematic implications. *Bot. J. Linn. Soc.* **148**: 57–72.

Löve, Á. 1966. IOPB Chromosome Number Reports. XII. *Taxon* **14**(**4**): 341–350.

Löve, Á. 1967. IOPB Chromosome Number Reports. XIII. *Taxon* **16**(**5**): 445–461.

Löve, Á. 1970. IOPB Chromosome Number Reports. XXVII. *Taxon* **19**(**3**): 437–442.

Löve, Á. 1971. IOPB Chromosome Number Reports. XXXII. *Taxon* **20**(**2/3**): 349–356.

Löve, Á. 1972a. IOPB Chromosome Number Reports. XXXVI. *Taxon* **21**(**2/3**): 333–346.

Löve, Á. 1972b. IOPB Chromosome Number Reports. XXXVIII. *Taxon* **21**(**5/6**): 679–684.

Löve, Á. 1973a. IOPB Chromosome Number Reports. XXXIX. *Taxon* **22**(**1**): 115–118.

Löve, Á. 1973b. IOPB Chromosome Number Reports. XLII. *Taxon* **22(5/6)**: 647–654.

Löve, Á. 1975. IOPB Chromosome Number Reports. XLVIII. *Taxon* **24(2/3)**: 367–372.

Löve, Á. 1976a. IOPB Chromosome Number Reports. LI. *Taxon* **25(1)**: 155–164.

Löve, Á. 1976b. IOPB Chromosome Number Reports. LIV. *Taxon* **25(5/6)**: 631–649.

Mabberly, D.J. 2017. *The plant book: a portable dictionary of the higher plants.* (Ed. 4). Cambridge University Press, London.

Mander, L., Li, M., Mio, W., Fowlkes, C.C. & S.W. Punyasena 2013. Classification of grass pollen through the quantitative analysis of surface ornamentation and texture. *Proc. Royal Soc. Lond.* **280(1770)**: 1–7.

Mani, M.S. 1974. *Ecology and biogeography of India.* The Hague, The Netherlands.

Manilal, K.S. & V.V. Sivarajan 1982. *Flora of Calicut.* Bishen Singh Mahendra Pal Singh, Dehra Dun.

Martin, A.C. & W.D. Barkley 1961. *Seed identification manual.* University of California Press, Berkley and Los Angeles.

Mattei, G.E. 1909. Richerche sul genere Eragrostis. In: A. Borzi (Ed.), *Contribuzioni alla biologia vegtale.* Instituto Botanico de Palermo, Stockholm.

Matthew, K.M. 1982. *Illustrations on the flora of the Tamil Nadu Carnatic*. The Rapinet Herbarium, Thiruchirappalli.

Matthew, K.M. 1988. *Further illustrations on the flora of the Tamil Nadu Carnatic*. The Rapinet Herbarium, Thiruchirappalli.

Matthew, K.M. 1996. *Illustrations on the flora of the Palni Hills.* The Rapinet Herbarium, St. Joseph's College, Thiruchirappalli.

Matthew, K.M. 1998. *Supplements* to *illustrations on the flora of the Palni Hills, South India.* The Rapinat Herbarium, Thiruchirappalli.

Matthew, K.M. 1999. *Flora of the Palni hills, South India.* Part **2**. The Rapinat Herbarium, Thiruchirappalli.

Mathew, S., Augustine, J. & S.J. Britto 2014. The grass diversity of Vagamon Hills in Kerala. *Res. Plant Biol.* **4(3)**: 10–15.

McNeill, J. 1979. *Diplachne* and *Leptochloa* (Poaceae) in North America. *Brittonia* **31**: 399–404.

Meher Homji, V.M. 2001. *Bioclimatology and plant geography of Peninsular India.* Scientific Publishers, Jodhpur.

Mehra, P.N. & M.L. Sharma 1975. Cytological studies in some central and eastern Himalayan grasses IV. Arundinelleae, Eragrosteae, Isachneae, Chlorideae, Sporoboleae, Meliceae, Stipeae, Arundineae and Garnotieae. *Cytologia* **40**: 453–462.

Metcalfe, C.R. 1960. *Anatomy of the Monocotyledons. I. Gramineae.* Clarendon Press, Oxford.

Mohanan, M. & A.N. Henry 1994. *Flora of Thiruvananthapuram.* Botanical Survey of India, Kolkata.

Mohanan, M. & P.V. Sreekumar 1982. On the occurrence of *Eragrostis cumingii* Steud. (Poaceae) in India. *J. Econ. Tax. Bot.* **3(1982)**: 447–448.

Moore, A.C. 1960. *The grasses – Earth's green wealth.* McMillan Company, New York.

Moulik, S. 1997. *The grasses and bamboos of India.* Vol. **1**. Scientific Publishers, Jodhpur.

Munro, W. 1862. On the identification of the grasses of Linnaeus's herbarium, now in the possession of the Linnean Society London. *J. Proc. Linn. Soc., Bot.* **6:** 33–55.

Munro, W. 1892. *Tripogon trifidus. Bull. Misc. Inform. Kew* **1892**: 85

Murthy, G.V.S., Venu, P. & M. Sanjappa 1996. Physiography. In: Hajra P.K., Sharma, B.D., Sanjappa, M. & A.R.K. Sastry (Eds.), *Flora of India, Introductory Volume.* Part **1**. Botanical Survey of India, Kolkata. pp. 1–16.

Murugesan, M. & V. Balasubramaniam 2008. *Tripogon velliangiriensis* (Poaceae) – a new species from Tamil Nadu, India. *Indian J. Forest.* **31(1):** 109–111.

Murugesan, M., S. Arumugam & K.A.A. Kabeer 2017. *Tripogon paramjitianus* (Poaceae: Chloridoideae) a new species from the Western Ghats of Tamil Nadu, India. *Indian J. Forest.* **40(3):** 285–287.

Myers, N., Mittermeier, R.A., Mittermeier, C.G. Fonseca, G.A.B. da & J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* **463**: 853–858.

Naik, V.N. & B.W. Patunkar. 1976. Two new grasses from Marathwada. *Bull. Bot. Surv. India* **15(1–2)**: 158–160.

Nair, N.C. & P. Daniel. 1986. The floristic diversity of Western Ghats and its conservation: a review. *Proc. Indian Acad. Sci. (Animal Sciences/Plant Sciences) Suppl.* 127–163.

Nayar, M.P. 1980a. Endemic flora of Peninsular India and its significance. *Bull. Bot. Surv. India* **22**: 12–23.

Nayar, M.P. 1980b. Endemism and patterns of distribution of endemic genera (Angiosperms) in India. *J. Econ. Taxon. Bot.* **1**: 99–110.

Nayar, M.P. 1996. *Hotspots of endemic plants of India, Nepal, and Bhutan.* Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Thiruvananthapurm.

Nayar, M.P. 1997. Hotspots of Plant diversity in India – Srategies. In: Pushpangadan, P., Santhosh, K.V. & K. Ravi (Eds.), *Conservation and economic evaluation of biodiversity.* Vol. **1**. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. pp. 59–80.

Nayar, M.P. & M. Ahmed. 1984. Phytogeographical significance of endemic genera (Angiosperms) in Peninsular India and Sri Lanka. *Bull. Bot. Surv. India* **26(1 &2)**: 65–70.

Nayar, T.S., Rasiya Beegam, A. & M. Sibi. 2014. *Flowering plants of the Western Ghats, India,* Vol. **2**. Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Thiruvananthapuram.

Newmaster, S.G. & S. Ragupathy 2010. Ethnobotany genomics-discovery and innovation in a new era of exploratory research. *J. Ethnobiol. Ethnomed.* **6:** 1–11.

Newmaster, S.G., Balasubramaniam, V., Murugesan, M. & S. Ragupathy 2008. *Tripogon cope* (Poaceae: Chloridoideae), a new species supported by morphometric analysis and a synopsis of *Tripogon* in India. *Syst. Bot.* **33:** 695–701.

Nees Von Esenbeck, C.G. V.E. 1829. Agrostologia Brasiliensis. In: Martius, C.F.P. (Ed.), *Flora Brasiliensis.* Vol. **2.** Sumptibus J.G. Cottae, Stuttgart.

Nees Von Esenbeck, C.G. 1841a. *Florae Africae Australioris, illustrationes monographicae.* Vol. **1.** Gramineae. Sumptibus Prausnitzianis, Glogau.

Nees Von Esenbeck, C.G. 1841b. *Plagiolytrum* Nees. *Proc. Linn. Soc. Lond.* **1(11)**: 95.

Nees Von Esenbeck, C.G. & C.G. Daniel 1854. *Synopsis plantarum Glumacearum* Vol. **1.** J.B. Metzler, Stuttgart. pp. 301.

Nees Von Esenbeck, C.G. & Meyen, F.J.F. 1841c. *Eragrostis zeylanica* Nees & Meyen. *Gramineae* **1:** 72–73.

Nicolson, D.H., Suresh, C.R. & K.S. Manilal 1988. *An interpretation of Van Rheede's Hortus Malabaricus* Regnum Veg. **119**. Koeltz Scientific Books, Königstein. pp. 309.

Nicora, E.G. 1941. Contribución al studio histológico de las glándulas epidérmicas de algunas species de *Eragrostis*. *Darwiniana* **5:** 316–321.

Nicora, E.G. 1998. Révision del generó *Eragrostis* Wolf (Gramineae: Eragrostideae) para Argentina y países limítrofes. *Boissiera* **54:** 8–109.

Northam, F.E., R.R. Old & R.H. Callihan 1993. Little lovegrass (*Eragrostis minor*) Distribution in Idaho and Washington. *Weed Technol.* **7**: 771–775.

Nowack, R. 1994. Revision of *Leptochloa* Beauv. (incl. *Diplachne* P. Beauv.) (Poaceae) in Malesia. *Rheedea* **4(2)**: 79–92.

Ogie-odia, E.A., Eseigbe, D., Ilechie, M.N., Erhabor, J. & E. Ogbebor 2010. Foliar epidermal and phytochemical studies of the grasses *Cymbopogon citratus* (Stapf), *Axonopus compressus* (P. Beauv.) and *Eragrostis tremula* (S.W. Beauv) in Ekpoma, Edo State, Nigeria. *Sci. World J.* **5(1)**: 20–25.

Osca, J.M. 2013. Expansion of *Leptochloa fusca* subsp. *uninervia* and *Leptochloa fusca* subsp. *fascicularis* in rice fields in Valencia, eastern Spain. *European Weed Res. Soc.* **53**: 479–488.

Palmer, J. & C.M. Weiller 2005. *Tripogon* Roem. & Schult. In: Orchard & A.J.G. Wilson (Eds.), *Flora of Australia,* Vol. **44b**. CSIRO Publishing, Australia. pp. 422–423.

Panarello, H.O. & E. Sanchez 1985. The Kranz syndrome in the Eragrostideae (Chloridoideae, Poaceae) as indicated by carbon isotopic ratios. *Bothalia* **15(3 & 4)**: 587–590.

Parodi, L.R. 1961. La taxonomia de las Gramineae Argentinas a la luz de las investigaciones más recentes. *Recent Adv. Bot.* **1**: 125–129.

Parrotta, J.A. 2001. *Healing plants of Peninsular India.* CABI Publishing, Wallingford.

Perveen, A. & M. Qaiser 2012. Pollen flora of Pakistan – LXIX. Poaceae. *Pak. J. Bot.* **44(2)**: 747–756.

Peterson, P.M. 2001. *Eragrostis* Wolf. In: Laegaard, S. & P.M. Peterson (Eds.), *Flora of Ecuador*, Vol. **68** (Part 2). Gramineae. Botanical Institute, Goteborg University. pp. 25–55.

Peterson, P.M. 2003. *Eragrostis* Wolf. In: Barkworth, M.E., Carpels, K.M., Long, S. & M.B. Piep (Eds.), Magnoliophyta: Commelinidae (in part): Poaceae (Part 2), *Flora of North America North of Mexico.* Vol. **25**. Oxford University Press, New York. pp. 65–105.

Peterson, P.M. & D. Giraldo-Cañas 2008. *Eragrostis* (Poaceae: Chloridoideae: Eragrostideae) in Colombia. *J. Bot. Res. Inst. Texas* **2**(**2**): 875–916.

Peterson, P.M. & J. Valdés-Reyna 2005. *Eragrostis* (Poaceae: Chloridoideae: Eragrostideae: Eragrostidinae) from Northeastern Mexico. *Sida* **21**: 1365–1420.

Peterson, P.M. & I.S. Vega 2007. *Eragrostis* (Poaceae: Chloridoideae: Eragrostideae: Ergrostidinae) of Peru. *Ann. Missouri Bot. Gard.* **94**: 745–790.

Peterson, P.M. & S.C. Boechat 2001. *Eragrostis* Wolf. In: Peterson, P.M., Soreng, R.J., Davidse, G., Filgueiras, T.S., Zuloaga, F.O. & E.J. Judziewicz (Eds.), Catalogue of New World grasses (Poaceae: Chloridoideae). *Contr. U.S. Natl. Herb.* **41**: 81–115.

Peterson, P.M., Columbus, J.T. & S.J. Pennington 2007. Classification and biogeography of New World grasses: Chloridoideae. *Aliso* **23**: 580–594.

Peterson, P.M., Romaschenko, K., & G. Johnson 2010. A classification of the Chloridoideae (Poaceae) based on multi-gene phylogenetic trees. *Mol. Phyl. Evol.* **55:** 580–598.

Peterson, P.M. Romaschenko, K. & R.J. Soreng 2014. A laboratory guide for generating DNA barcodes in grasses: a case study of *Leptochloa s.l.* (Poaceae: Chloridoideae). *Webbia: J. Plant Taxonomy and Geography* **69**(**1**): 1–12.

Peterson, P.M., Romaschenko, K. & Y.H. Arrieta 2014. A molecular phylogeny and classification of the Cteniinae, Farragininae, Gouiniinae, Gymnopogoninae, Perotidinae, and Trichoneurinae (Poaceae: Chloridoideae: Cynodonteae). *Taxon* **63:** 275–286.

Peterson, P.M., Romaschenko, K., Barker, N.P. & H.P. Linder 2011. Centropodieae and *Ellisochloa*, a new tribe and genus in Chloridoideae (Poaceae). *Taxon* **60**: 1113–1122.

Peterson, P.M., Romaschenko, K., Snow, N. & G. Johnson 2012. A molecular phylogeny and classification of *Leptochloa* (Poaceae: Chloridoideae: Chlorideae) *s.l.* and related genera. *Ann. Bot.* **109**: 1317–1329.

Peterson, P.M., Soreng, R.J., Davidse, G., Filgueiras, T.S., Zuloaga, F.O. & E.J. Judziewicz 2001. Catalogue of New World grasses (Poaceae): II. Subfamily Chloridoideae. *Contr. U.S. Natl. Herb.* **41**: 1–255.

Peterson, P.M., Webster, R.D. & J. Valdés-Reyna 1995. Subtribal classification of the New World Eragrostideae (Poaceae: Chloridoideae). *Sida* **16(3)**: 529–544.

Peterson, P.M., Webster, R.D. & J. Valdés-Reyna 1997. Genera of the New World Eragrostideae (Poaceae: Chloridoideae). *Smithsonian Contr. Bot.* **87**: 1–50.

Pfeiffer, L.G.K. 1873. *Nomenclator botanicus.* Sumptibus Theodori Fischeri, Cassellis.

Phillips, S.M. 1973. The genus *Dinebra* Jacq. (Gramineae). *Kew Bull.* **28(3)**: 411–418.

Phillips, S.M. 1975. A review of the genus *Oropetium* (Gramineae). *Kew Bull.* **30(3)**: 467–470.

Phillips, S.M. 1982. A numerical analysis of Eragrostideae (Gramineae). *Kew Bull.* **37**: 133–162.

Phillips, S.M. 1995. Poaceae (Gramineae). In: Hedberg, I & S. Edwards (Eds.), *Flora of Ethiopia and Eritrea*, Vol. 7. National Herbarium, Uppsala.

Phillips, S.M. & E. Launert 1971. A revision of the African species of *Tripogon* Roem. & Schult. *Kew Bull.* **25(2):** 301–322.

Phillips, S.M. & S.L. Chen 2002. The genus *Tripogon* (Poaceae) in China. *Kew Bull.* **57(4):** 911–924.

Pilger, R. 1954. Das system der Gramineae. *Bot. Jahrb.* **76**: 281–384.

Pilger, R. 1956. Gramineae III. In: Engler, A. & K. Prantl (Eds.), *Die Naturlichen Pflanzenfamilien.* Vol. **14e**., Leipzig, Berlin. pp. 1–168.

Pipermo, D.R. & H.D. Sues 2005. Dinosaurs dined on grass. *Science* **310(5751)**: 1126–1128.

Pohl, R.W. 1987. Man and Grasses: a history. In: Soderstrom, T.R., Hilu, K.W., Campbell, C.S. & M.E. Barkworth (Eds.), *Grass systematics and evolution.* Smithsonian Institution Press, Washington D.C.

Porembski, S. & W. Barthlott 2000. Granitic and gneissic outcrops (inselbergs) as centers of diversity for desiccation-tolerant vascular plants. *Pl. Ecol.* **151**: 19–28.

Potdar, G.G., Salunkhe, B. & S.R. Yadav. 2012. *Grasses of Maharashtra.* Shivaji University Press. Kolhapur.

Pradeep, A.K. & C.N. Sunil 1999. Two new species of *Tripogon* (Poaceae) from India. *Sida* **18(3):** 809–814.

Prat, H. 1960. Vers une classification naturelle des Graminees. *Bull. Soc. Bot. Fr.* **107**: 32–79.

Presl, C.B. 1830. Eragrostidinae. *Reliq. Haenk.* **1**: 273.

Pullaiah, T. 1997. *Flora of Andhra Pradesh (India).* Vol. **3.** Monocotyledons. Scientific Publishers, Jodhpur.

Radford, A.E., Dickson, W.C., Massey, J.R. & C.R. Bell 1974. *Vascular plant systematics*. Harper & Row, New York.

Ragupathy, S., Newmaster, S.G., Murugesan, M. & V. Balasubramaniam 2009. DNA barcoding discriminates a new cryptic grass species revealed in an ethnobotany study by the hill tribes of the Western Ghats in southern India. *Mol. Ecol. Resour.* **9**: 164–171.

Rao, A.S. & D.M. Verma 1976. Material towards a Monocot flora of Assam-V. *Bull. Bot. Surv. India* **18**: 9–18.

Rao, B.R.P. & M. Anilkumar 2018. *Tripogon uma-ganeshii* (Poaceae: Chloridoideae: Tripogoninae), a new species from India. *Indian J. Forest.* **41**(**1**): 97–101.

Rao, B.R.P., Redddy, A.M., Priyadarshini, P., Sadasivaiah, B. & S.K. Basha 2012. *Themeda villosa* (Poiret) A. Camus, *Tripogon trifidus* Munro ex Stapf (Poaceae): New distributional records for South India. *J. Econ. Taxon. Bot.* **36**(**2**): 383–386.

Rao, B.R.P., Redddy, A.M., Sadasivaiah, B., Subaiah, K.V. & S. Sunitha 2009. Two new distributional records of Poaceae for Peninsular India. *J. Econ. Taxon. Bot.* **33**(**2**): 434–436.

Rao, R.R. 1984. *Biodiversity of India – floristic Approach.* Bishen Singh Mahendra Pal Singh, Dehra Dun.

Rao, R.R. 1997. Diversity of Indian flora. *Proc. Indian Nat. Sci. Acad.* **B63**: 127–138.

Rao, R.S. 1986. *Flora of Goa, Diu, Daman, Dadra & Nagarhaveli.* Vol. **2.** Botanical Survey of India, Kolkata.

Rao, A.S. & D.M. Verma 1972. Materials towards a monocot flora of Assam (Zingiberaceae and Marantaceae). *Bull. Bot. Surv. India* **14**: 114–143.

Rasingam, L. & J. Swamy 2018. A new species of *Tripogon* (Poaceae: Chloridoideae: Tripogoninae) from Nallamala forests, Telangana, India. *Phytotaxa* **351**(**4**): 296–300.

Raunkaiaer, C. 1934. *The life forms of plants and statistical plant geography.* Clarendon press, Oxford.

Raven, P.H. 1975. The bases of Angiosperm phylogeny: cytology. *Ann. Miss. Bot. Gard.* **64**: 746.

Ravi, N. & N. Mohanan. 2002. *Common tropical and sub-tropical sedges and grasses – an illustrated account.* Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Ravichandran, P., Krishnan, S., Samson, N.P., Subbaiah, V.R., Azhakanandam, K. & D. Narasimhan 1996. *Eragrostis dayanandanii* – a new grass from Tamil Nadu, India. *Kew Bull.* **51(1)**: 155–157.

Ray, J. 1703. *Methodus Graminum, Juncorum et Cyperorum specialis.* Impensis S. Smith & B. Walford typographorum Regiae Societatis, London.

Raychaudhuri, S.P. 1963. *Black soils of India.* National Institute of Sciences of India, New Delhi.

Razzi, B.A. 1955. The phytogeography of the Mysore hilltops. *J. Mysore Univ. Sect. B.* **14(10)**: 87–107.

Reeder, J.R. 1957. The embryo in grass systematics. *Amer. J. Bot.* **44**: 756–768.

Reeder, J.R. 1962. The bambusoid embryo: A reappraisal. *Amer. J. Bot.* **49**: 639–641.

Rheede, V. 1693. *Hortus Indicus Malabaricus.* Vol. **12**. Sumptibus Johannis Van Someren & Joannis Van Dyxk, Amsterdam. p. 75, t. 41.

Rheeder, J.R. 1957. The embryo in grass systematics. *Amer. J. Bot.* **44**: 756–768.

Renvoize, S.A. 1981. The sub-family Arundinoideae and its position in relation to a general classification of the Gramineae. *Kew Bull.* **35**: 86–102.

Renvoize, S.A. 1998. *Gramineas de Bolivia.* Royal Botanic Gardens, Kew.

Ridd, M.F. 1971. South-east Asia as part of Gondwanaland. *Nature* **234**: 531–533.

Ridley, H.N. 1925. *The flora of Malay Peninsula*, Vol. **5**. L. Reev & Co. Ltd., London.

Ridley, H.N. 1930. *The dispersal of plants throughout the World.* L. Reev & Co. Ltd., London.

Rodgers, W.A. & S.H. Panwar 1988. *Biogeographical classification of India.* New Forest, Dehra Dun.

Roemer, J. & J. Schultes 1817. *Systema Vegetabilium.* Vol. **2**. (Ed. 15). J.G. Cottae, Stuttgart.

Roodt, R. & J.J. Spies 2003. Chromosome studies in the grass subfamily Chloridoideae. I. Basic chromosome numbers. *Taxon* **52**: 557–566.

Ross, R. 1966. The generic names published by N.M. von Wolf. *Acta Bot. Neerl.* **15**: 157.

Roxburgh, W. & W. Carey 1832. *Flora Indica or descriptions of Indian plants.* W. Thacker, Serampore.

Roy, G.P. 1976. The genus *Eragrostis* P. Beauv. in Rajasthan. *Bull. Bot. Surv. India* **18**(**1–4**): 102–108.

Roy, G.P. 1984. *Grasses of Madhya Pradesh.* Botanical Survey of India, Kolkata.

Roy, G.P. & B.K. Shukla 1983. A contribution to the grass flora of Madhya Pradesh. *J. Econ. Taxon. Bot.* **4**: 567–586.

Roy, K.K. 1964. Anatomical studies of some species of *Eragrostis* P.Beauv. *Bot. Bull. Acad. Sinica* **5**: 54–62.

Roy, K.K. 1965. Basic chromosome number in *Eragrostis. Curr. Sci.* **34**: 384.

Rúgolo de Agrasar, Z.E. & A.S. Vega 2004. *Tripogon nicorae*, a new species and synopsis of *Tripogon* (Poaceae: Chloridoideae) in America. *Syst. Bot.* **29** (**4**)**:** 874–882.

Saldanha, C.J. & D.H. Nicolson. 1976. *Flora of Hassan district, Karnataka, India.* Amerind Publishing Co. Pvt. Ltd., New Delhi.

Sasidharan, N. 2004. *Biodiversity documentation of Kerala, Part 6. Flowering plants.* KFRI Handbook No. 17. Kerala Forest Research Institute, Peechi.

Saxena, H.O. & M. Brahmam. 1996. *Flora of Orissa,* Vol. 4. Orissa Forest Department, Bhuvaneswar.

Schantz, H.L. 1954. The place of grass-lands in the earth's cover of vegetation. *Ecology* **35**: 143–147.

Scheffer-Basso, S.M. & Cecchin, K. & A. Favaretto 2016. Dynamic of dominance, growth and bromatology of *Eragrostis plana* Nees in secondary vegetation area. *Rev. Ciênc. Agron.* **47**(**3**): 582–588.

Scheuchzer, J. 1708. *Agrostographiae helvetica prodromus sistens binas Graminum.* Sumtibus auctoris, Tigurino.

Schuster, J. 1910. Über die morphologie der grasblüte. *Flora* **100**: 213–266.

Schweinfurth, G.A. 1894. Sammlung arabisch-athiopischer pflanzen. Ergebnisse von Reisen in den jhren 1881, 88, 91, 92 und 94. *Bull. I'Herbier Boissier* **2**: 1–113.

Senaratna, S.D.J.E. 1956. *The grasses of Ceylon.* Government Press, Ceylon.

Shantz, H.L. 1954. The place of grasslands in the earth's cover of vegetation. *Ecology* **35**(**2**)*:* 143–145.

Sharma, M.L. 1979. Some considerations on the phylogeny and chromosomal evolution in grasses. *Cytologia* **44**: 679–685.

Sharma, B.D., Karthikeyan, S. & N.P. Singh 1996. *Monocotyledons.* Botanical Survey of India, Kolkata.

Sharma, B.D., Singh, N.P., Raghavan, R.S. & U.R. Despande 1984. *Flora of Karnataka Analysis.* Series 2. Botanical Survey of India, Kolkata.

Sharma, C.B.S.R., Behera, B.N. & S.K. Dash 1978. A cytological study of some grasses from Orissa, an eastern coastal belt of India. *Proc. Indian Acad. Sci.* **87B** (**11**): 355–360.

Sharp, D. & B.K. Simon 2002. *AusGrass: grasses of Australia.* ABRS Identification, Brisbane. https://trov.nla.gov.au/version/46557423

Simon, B.K., Clayton, W.D., Harman, K.T., Vorontsova, M., Brake, I., Healy, D. & Y. Alfonso 2011. *Grass World.* http://grassworld.myspecies.info/

Simpson, M.G. 2010. *Plant Systematics.* Academic Press, Burlington.

Simpson, B.B. & M.M. Ogorzaly 2001. *Economic botany.* McGraw-Hill Inc., New York.

Singh, G. 1986. Some recent additions and name changes concerning Indian *Poaceae. J. Econ. Taxon. Bot.* **8(2)**: 493–503.

Singh, N.P., Deshpande, U.R. & R.S. Raghavan 1976. Poaceae of Karnataka State. *Bull. Bot. Surv. India* **18(1–4)**: 109–143.

Sivarajan, V.V. 1991. *Introduction to the principles of plant taxonomy.* Cambridge University Press. Cambridge.

Sivarajan, V.V. & A.K. Pradeep 1996. *Malvaceae of southern Peninsular India. A taxonomic monograph*. Daya Publishing House, Delhi.

Skerman, P.J. & F. Riveros 1990. *Tropical grasses.* Scientifc Publishers, Jodhpur.

Smith, B.N. & W.V. Brown 1973. The Kranz syndrome in the Gramineae as indicated by carbon isotopic ratios. *Amer. J. Bot.* **60(6)**: 505–513

Snow, N. 1996. The phylogenetic utility of lemmatal micromorphology in *Leptochloa s.l.* and related genera in subtribe Eleusininae (Poaceae, Chloridoideae, Eragrostideae). *Ann. Missouri Bot. Gard.* **83**: 504–529.

Snow, N. 1997. *Phylogeny and systematics of Leptochloa P. Beauv. s.l. (Poaceae, Chloridoideae, Eragrostideae).* Ph.D. Thesis (unpublished), Washington University, St. Louis.

Snow, N. 1998a. A new species of *Leptochloa* (Poaceae, Chloridoideae) from Sri Lanka. *Novon* **8**: 183–186.

Snow, N. 1998b. Caryopsis morphology of *Leptochloa s.l.* (Poaceae, Chloridoideae). *Sida* **18**: 271–282.

Snow, N. & G. Davidse 1993. *Leptochloa mucronata* (Michx.) Kunth is the correct name for *Leptochloa filiformis* (Poaceae). *Taxon* **42**: 413–417.

Snow, N. & B.K. Simon 1997. *Leptochloa southwoodii* (Poaceae: Chloridoideae), a new species from south-east Queensland. *Austrobaileya* **5(1)**: 137–143.

Snow, N., Peterson, P.M. & D. Giraldo-Cañas 2008. *Leptochloa* (Poaceae: Chloridoideae) in Colombia. *J. Bot. Res. Inst. Texas* **2**(**2**): 861–874.

Snow, N. & P.M. Peterson 2012a. Systematics of *Trigonochloa* (Poaceae: Chloridoideae: Chlorideae). *Phytokeys* **13**: 25–38.

Snow, N. & P.M. Peterson 2012b. Nomenclatural notes on *Dinebra, Diplachne, Disakisperma* and *Leptochloa* (Poaceae: Chloridoideae). *Phytoneuron* **71**: 1–2.

Snow, N., Peterson, P.M. & K. Romaschenko 2013. Systematics of *Disakisperma* (Poaceae: Chloridoideae: Chlorideae). *Phytokeys* **26**: 21–70.

Soderstrom, T.R. & R.P. Ellis 1987. The position of Bamboo genera and allies in a system of grass classification. In: Soderstrom, T.R., Hilu, K.W., Campbell, C.S. & M.E. Barkworth (Eds.). *Grasss systematics and Evolution.* Smithsonian Institution Press, Washington, D.C. pp. 235–238.

Soreng, R.J. & J.I. Davis 1998. Phylogenetics and character evolution in the grass family (Poaceae): simultaneous analysis of morphological and chloroplast DNA restriction site character sets. *Bot. Rev.* **64**: 1–85.

Soreng, R.J., Davis, J.I. & M.A. Voionmaa 2007. A phylogenetic analysis of Poaceae tribe Poeae *s.l.* based on morphological characters and sequence data from three plastid-encoded genes: evidence for reticulation, and a new classification for the tribe. *Kew Bull.* **62**: 425–454.

Soreng, R.J., Gillespie, L.J., Koba, H., Boudko & R.D. Bull 2015a. Molecular and morphological evidence for a new grass genus, *Dupontiopsis* (Poaceae tribe Poeae subtribe Poinae s.*l.*), endemic to alpine Japan, and implications for the reticulate origin of *Dupontia* and *Arctophila* within Poinae *s.l. J. Syst. Evol.* **53**: 138–162.

Soreng, R.J., Peterson, P.M., Romaschenko, K., Davidse, G., Teisher, J.K., Clark, L.G., Barbera, P., Gillespie, L.J. & O. Zuloaga 2017. A world-wide phylogenetic classification of Poaceae (Graminae) II: an update and a comparison of two 2015 classifications. *J. Syst. Evol.* **55** (**4**): 259–290.

Soreng, R.J., Peterson, P.M., Romaschenko, K., Davidse, G., Zuloaga, O.F., Judziewicz, J.E., Filgueiras, T.S., Davis, J.I., & O. Morrone 2015b. A World-wide phylogenetic classification of Poaceae (Graminae). *J. Syst. Evol.* **53** (**2**): 117–137.

Sprengel, C. 1825. *Systema Vegetabilium, (*Ed. 6). Vol. **1**. Sumtibus Librariae Dieterichianae, Gottingae.

Sreekumar, P.V. 1990. *Eragrostis subsecunda* (Lam.) Fourn. (Poaceae) – a new record for India. *J. Econ. Taxon. Bot.* **14(3)**: 626–628.

Sreekumar, P.V. & V.J. Nair, 1991. *Flora of Kerala – grasses.* Botanical Survey of India. Kolkata.

Sreekumar, P.V., Nair, V.J. & N.C. Nair. 1983a. *Tripogon anantaswamianus* Sreek., V.J. Nair *et* N.C. Nair – a new grass from Kerala, India. *Bull. Bot. Surv. India.* **25(14):** 185–187.

Sreekumar, P.V., Nair, V.J. & N.C. Nair. 1983b. *Tripogon narayanii*—a new species of Poaceae from Kerala, India. *J. Bombay Nat. Hist. Soc.* **80(1):** 196–198.

Stace, C.A. 1991. *Plant taxonomy and biosystematics.* Cambridge University Press, Cambridge.

Stafleu, F.A. & R.S. Cowan 1979. *Taxonomic Literature,* Vol. **2**: H–Le. Utrecht, The Hague.

Stanley, K.E. 1999. Evolutionary trends in the grasses (Poaceae): a review. *J. North Amer. Bot.* **38(1)**: 3–12.

Stapf, O. 1892. Decades Kewenses. Plantarum Novarum in Herbario Horti Regii Conservatarum. *Bull. Misc. Inform.* (*Royal Bot. Gard., Kew)* **64:** 84–85.

Stapf, O. 1896a. *Eragrostis* Beauv. In: Hooker, J.D. (Ed.), *Flora of British India,* Vol. **7**. L. Reeve & Co., London. pp. 312–327.

Stapf, O. 1896b. *Tripogon pauperculus* Stapf. In: Hooker, W.J. (Ed.), *Icones Plantarum.* Vol. **5**, Part 2, Dulau & Co., London. p. 25. t. 2442.

Stapf, O. 1898. Gramineae. In: Thiselton-Dyer, R. (Ed.), *Flora Capensis,* Vol. 7 (**2–4**). L. Reev, London. pp. 310–791.

Stapf, O. 1900. *Eragrostis* Beauv. In: Thiselton-Dyer, R. (Ed.), *Flora Capensis*, Vol. 7 (**2–4**). L. Reev, London. pp. 594–631.

Stapf, O. 1917–1934. Gramineae. In: Prain, D. (Ed.), *Flora of tropical Africa.* Vol. **9.** L. Reev & Co. Ltd., London. pp. 1–1100.

Stearn, W.T. 1983. *Botanical Latin-History*, *Grammar, Syntax, Terminology and Vocabulary.* David & Charles, London.

Stebbins, G.L. 1956. Cytogenetics and the evolution of the grass family. *Amer. J. Bot.* **43**: 890–905.

Stebbins, G.L. 1972. The evolution of the grass family. In: Younger, V.B. & C.M. Mckell (Eds.), *The biology and utilization of grasses.* Academic press, New York & London. pp. 1–17.

Stebbins, G.L. 1981. Co-evolution of grasses and herbivores. *Ann. Missouri Bot. Gard.* **68**: 75–84.

Stebbins, G.L. 1982. Major trends of evolution in the Poaceae and their possible significance. In: Estes, J.R., Tyrl, R.J. & J.N. Brunken, (Eds.), *Grasses and grasslands: Systematics and evolution.* University of Oklahoma Press, Norman. pp. 3–36.

Stebbins, G.L. 1985. Polyploidy, hybridization, and the invasion of new habitats. *Ann. Missouri Bot. Gard.* **72**: 824–832.

Stebbins, G.L. & B. Crampton 1961. A suggested revision of the grass genera of temperate North America. *Recent Adv. Bot.* 1: 133–145.

Steudel, E.G. 1854. *Synopsis plantarum glumacearum,* Vol. **1** – Gramineae, J.B. Metzler, Stuttgart.

Steussy, T.F. 1990. Plant taxonomy – the systematic evaluation of comparative data. Columbia University Press, New York.

Subramanyam, V.P., Subba Rao, B. & A.K. Subramaniam. 1965. Koppen and Thornthwaite system of climate classification as applied to India. *Ann. Arid Zone* **4**: 46–55.

Sunil, C.N. & A.K. Pradeep 2001. Another new species of *Tripogon* (Poaceae) from India. *Sida* **19**(4)**:** 803–806.

Sunil, C.N. & M. Sivadasan 2009. *Flora of Alappuzha district, Kerala, India.* Bishen Singh Mahendra Pal Singh, Dehra Dun.

Sunil, C.N., Pradeep, A.K. & K. Thoiba 2014. *Tripogon idukkianus* (Poaceae: Chloridoideae), a new species from India. *Phytotaxa* **202**(4)**:** 294–297.

Symonds, T.J. 1886. *Indian grasses*. Higginbotham & Co., Madras.

Takhtajan, A. 1986. *Floristcs regions of the World.* University of California Press, Berkeley.

Takhtajan, A. 1991. *Evolutionary trends in flowering plants.* Columbia

University Press, New York.

Tateoka, T. 1957. Miscellaneous papers on the phylogeny of Poaceae (10). Proposition of a new phylogenetic system of Poaceae. *J. Jap. Bot.* **32**: 275–287.

Tateoka, T. 1960. Cytology in grass systematics: A critical review. *Nucleus* **3**: 81–110.

Teerawatananon, A. & S. Sungkaew. 2012. *Tripogon purpurascens* (Chloridoideae: Poaceae): a native Thai grass recently recognized. *Thai For. Bull. (Bot)* **40:** 130–133.

Terrell, E.E. & P.M. Peterson 1993. Caryopsis morphology and classification in the Triticeae (Pooideae: Poaceae). *Smithsonian Contr. Bot.* **83**: 1–25.

The Plant List 2018. Version1.1. Published on the internet;

http://www.theplantlist.org/. (Accessed on 15 August 2018).

Theirs, B. 2011. *Index herbariorum: a global direction of public herbaria and associated staff (online)*. New York Botanical Garden's Virtual Herbarium available from http:// sweetgum.nybg.org/ih/ (Accessed 30 August 2016).

Thoiba, K. & A.K. Pradeep 2014. *Chrysopogon festucoides* (Poaceae), A new record for South India, Kerala. *Rheedea* **24(1):** 56–59.

Thoiba, K. & A.K. Pradeep 2014. *Tripogon malabarica* (Poaceae: Chloridoideae: Tripogoninae), A new species from India, Kerala. *J. Bot. Res. Inst. Texas* **8(2):** 523–527.

Thoiba, K. & A.K. Pradeep 2017. *Eragrostis brownii* (Poaceae: Eragrostidinae), a new record for India. *Taiwania* **63(1):** 84–88.

Thoiba, K. & A.K. Pradeep 2018. Lectotypification of three names in the genus *Tripogon* (Poaceae). *Phytotaxa* **350(2):** 177–181.

Thoiba, K., Pradeep, A.K. & C.N., Sunil 2015. *Tripogon bimucronatus* (Poaceae: Chloridoideae: Tripogoninae), a new species from India. *Gard. Bull., Singapore* **67(1):** 151–157.

Thoiba, K., Pradeep, A.K. & K.M. Manudev 2016. Two new species of *Tripogon* (Poaceae: Chloridoideae: Tripogoninae): from India. *Phytotaxa* **272(2)**: 125–133.

Thwaites, G.H.K. 1864. *Enumeratio Plantarum Zeylaniae: an enumeration of Ceylon plants.* Dulau & Co., London.

Trinius, C.B. Von 1830. Graminum genera quaedam speciesque complures definitionbus novis illustravit. *Mém. Acad. Sci. St. Pétersb.* **1**: 353–416.

Trinius, C.B. Von 1840. Agrostidea I, Vilfea. *Mém. Acad. Sci. St. Pétersb.* **6(2)**: 23–134.

Tsvelev, N.N. 1977. [On the origin and evolution of feathergrasses (*Stipa* L.)] In: *Problemi Ekologii, Geobotaniki, Botanicheskoi Geografii i Floristiki.* Leningrad, Nauka. pp. 139–150.

Tsvelev, N.N. 1989. The system of grasses (Poaceae) and their evolution. *Bot. Rev.* **55**: 141–204.

Turland, N.J., Wiersema, J.H., Barrie, F.R., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Kusber, W.-H., Li, D.-Z., Marhold, K., May, T.W., McNeill, J., Monro, A.M., Prado, J., Price, M.J. & G.F. Smith 2018. *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017.* [Regnum Vegetabile 154]. Koeltz Scientific Books, Königstein.

DOI https://doi.org/10.12705/Code.2018.

Umamaheswari, P. & P. Daniel 1998. *Eragrostis amabilis* (L.) Wight & Arn. (Poaceae) and its varieties. *J. Econ. Tax. Bot.* **22**(**1**): 211–216.

Valls, J.F.M. 1978. *A biosystematic study of Leptochloa with special emphasis on Leptochloa dubia (Gramineae: Chloridoideae).* Ph.D. Thesis (unpublished), Texas A & M University, Texas.

Vajravelu, E. & K. Vivekananthan 1996. Southern Western Ghats – South of Goa. In: Hajra, P.K., Sharma, B.D., Sanjappa, M. & A.R.K. Sastry (Eds.), *Flora of India, Introductory Volume.* Part **1**. Botanical Survey of India, Kolkata.

Van Den Borre, A. & L. Watson 1994. The infrageneric classification of *Eragrostis* (Poaceae). *Taxon* **43**(**3**): 383–422.

Van Den Borre, A. & L. Watson 1997. On the classification of the Chloridoideae (Poaceae). *Austral. Syst. Bot.* **10**: 491–531.

Van Den Borre, A. & L. Watson 2000. On the classification of the Chloridoideae: results from morphological and leaf anatomical data analyses. In: Jacobs, S.W.L. & J. Everett (Eds.), *Grassses: Systematics and Evolution.* CSIRO publishing, Australia. pp. 180–181.

Veldkamp, J.F. 1971. Notes on Malesian Grasses V, New species and combinations in *Pheidichloa, Hyparthenia* and *Leptochloa. Blumea* **19**: 61–64.

Veldkamp, J.F. 1994. Miscellaneous notes on Southeast Asian Gramineae. IX. *Blumea* **39(1&2)**: 373–384.

Veldkamp, J.F. 1999. A revision of *Chrysopogon* Trin. including *Vetiveria* Bory (Poaceae) in Thailand and Malesia with notes on some other species from Africa and Australia. *Austrobaileya* **5(3)**: 503–533.

Veldkamp, J.F. 2000. *Eragrostis amabilis* (L.) Wight & Arn. In: Cafferty, S., Jarvis, C.E. & N.J. Turland (Eds.), Typification of Linnaean plant names in the Poaceae (Gramineae). *Taxon* **49:** 254.

Veldkamp, J.F. 2002. Revision of *Eragrostis*. *Blumea* **47(1)**: 157–204.

Veldkamp, J.F. & S.M. Phillips 2003. *Tripogon* (Gramineae) in Thailand. *Blumea* **48:** 491–494.

Veldkamp, J.F., Thoiba, K. & A.K. Pradeep 2017. *Eragrostis paniciformis* (Poaceae): a new record for Asia from Kerala, India. *Rheedea* **27(1)**: 46–49.

Venu, P., Murthy, G.V.S. & M. Sanjappa 1996. Geology. In: Hajra, P.K., Sharma, B.D., Sanjappa, M. & A.R.K. Sastry (Eds.), *Flora of India, Introductory Volume.* Part **1**. Botanical Survey of India, Kolkata.

Vignolo, F. 1904. Sul valore sistematica della *Poa cilianensis* (All.). (1785). *Malpighia* **18:** 386.

Vivek, C.P., Murthy, G.V.S. & V.J. Nair 2012. A new species *Eragrostis henryi* (Poaceae: Eragrostideae) from Tamil Nadu, India. *Nelumbo* **54:** 9–12.

Vivek, C.P., Murth,y G.V.S. & V.J. Nair 2013a. *Eragrostis nilgiriensis* sp.nov. (Poaceae) from Nilgiri district, Tamil Nadu, India. *Nord. J. Bot.* **31:** 700–703.

Vivek, C.P., Murthy, G.V.S. & V.J. Nair 2013b. A note on *Eragrostis rottleri* (Poaceae) and its lectotypification. *Nelumbo* **55:** 109–112.

Vivek, C.P., Murthy, G.V.S. & V.J. Nair 2013c. *Eragrostis jainii* (Poaceae: Eragrostideae) A new species from Kerala, India. *Nelumbo* **55:** 1–5.

Vivek, C.P., Murthy, G.V.S. & V.J. Nair 2013d. On the confusion in the identity of *Eragrostis atrovirens, E. gangetica* and *E. nutans. Nelumbo* **55:** 94–101.

Vivek, C.P., Murthy, G.V.S. & V.J. Nair 2013e. *Eragrostis collinensis* (Poaceae: Eragrostideae): a new species from the hills of Kerala and Tamil Nadu, India. *Indian J. Forest.* **36(3):** 401–404.

Vivek, C.P., Murthy, G.V.S. & V.J. Nair 2013f. *Eragrostis minor* Host var. *rajasthanensis* (Poaceae: Eragrostideae) – a new variety from Rajasthan, India. *J. Econ. Taxon. Bot.* **37(4):** 717–719.

Vivek, C.P., Murthy, G.V.S. & V.J. Nair 2015a. Lectotypification of *Eragrostis maderaspatana*. *Nelumbo* **57:** 40–42.

Vivek, C.P., Murthy, G.V.S. & V.J. Nair 2015b. On the identity of *Eragrostis dayanandanii* (Poaceae) described from Tamil Nadu, India. *Nelumbo* **57:** 43–45.

Vivek, C.P., Gnanasekaran, G., Murthy, G.V.S. & V.J. Nair 2016. Microhairs of Indian *Eragrostis* Wolf (Poaceae) and their taxonomic significance. *Nelumbo* **58:** 48–56.

Vivek, C.P., Murthy, G.V.S., Gnanasekaran, G., Kabeer, K.A.A. & V.J. Nair 2015. A study on the caryopses morphology of the grass genus *Eragrostis* in India. *Nelumbo* **57:** 1–10.

Vogel de, E.F. 1987. *Mannual of Herbarium Taxonomy.* UNESCO, Indonesia.

Watson, L. & M.J. Dalwitz 1992. *Grass Genera of the World*. Flora online version 18. http://biodiversity.uno.edu/delta/grass/www/tripogon.htm.

Watson, L. & M.J. Dalwitz 1994. *Grass Genera of the World*. Cambridge International, Wallingford.

Watson, L. & M.J. Dalwitz 2008. *Grass Genera of the World: descriptions, illustrations, identification, and information retrieval; including synonyms, morphology, anatomy, physiology, phytochemistry, cytology, classification,*

pathogens, World and local distribution, and references. http://delta-intkey.com (Accessed 20 June 2018).

Watson, L., Clifford, H.T. & M.J. Dallwitz 1985. The classification of the Poaceae: subfamilies and supertribes. *Aust. J. Bot.* **33**: 433–484.

Wight, R. 1853. *Icones plantarum Indiae orientalis or figures of Indian plants.* Vol. **6.** Messrs Franck & Co., Madras.

Wolf, N.M. Von. 1776. *Genera plantarum vocabulis characteristicis definita.* Danzig, Königsberg. p. 326.

Wróbel, A., Nobis, M. & A. Nowak 2017. Pattern of the lemma micromorphology: a useful tool in taxonomy of the Middle Asian *Eragrostis* species (Poaceae). *Bot. Let.* **164(3)**: 253–262.

Yadav, S.R. 2010. *Know your grass genera through hand lens*. Shivaji University, Kolhapur.

Zhang, W. 2000. Phylogeny of the grass family (Poaceae) from *rpl16* intron sequence data. *Mol. Phyl. Evol.* **15**: 135–146.

Appendices

Appendix - I **Excluded names**

1. Eragrostis burmanica Bor, Kew Bull. 166. 1951; Bor, Grass. Burma Ceylon India Pakistan 495. 1960; Sunil, C.N. & Sivad. Fl. Alappuzha Dist., Kerala, India. 849. 2009. **Type:—**Burma, *U. Thein Lwin 582 (*K000245112, image!).

Eragrostis burmanica was originally described by Bor (1951) based on his collections from Burma. Later, Sunil & Sivadasan (2009) reported this species from South India, based on specimens collected by C.N. Sunil from Thottapally in Alappuzha District, Kerala. After an exhaustive search in herbaria, I couldn't find these specimens in any Indian Herbaria except Bor's collection deposited at CAL (*N.L. Bor 15438*) from Manipur, Assam, India. In the absence of any authentic specimens in any of the Indian Herbaria, the taxon is excluded from this study. However, Bor had not included this species in his monumental work *'Grasses of Burma, Ceylon, India and Pakistan'*. Yet, this specimen is corroborating the original description of *E. burmanica* Bor. Therefore it can be considered as a new record for India.

Appendix – II List of Publications

I. Papers published in International Journals:

1. **Thoiba, K.** & A.K. Pradeep **2018**. Lectotypification of three names in the genus *Tripogon* (Poaceae). *Phytotaxa* **350**(**2**): 177–181.

2. **Thoiba, K.** & A.K. Pradeep **2018.** *Eragrostis brownii* (Kunth) Nees (Poaceae)–A new Record for India. *Taiwania* **63**(**1**): 84–87**.**

3. Veldkamp, J.F., **Thoiba, K.** & A.K. Pradeep **2017**. *Eragrostis paniciformis* (Gramineae) in Kerala, India, A New Record for Asia. *Rheedea* **27**(**1**): 46–49.

4. **Thoiba, K.**, Manudev, K.M. & A.K. Pradeep **2016**. Two new species of *Tripogon* (Poaceae: Chloridoideae: Tripogoninae) from India. *Phytotaxa* **272**(**2**): 125–133.

5. Sunil, C.N., Pradeep, A.K. & **K. Thoiba 2015**. *Tripogon idukkianus* (Poaceae: Chloridoideae), a new species from India. *Phytotaxa* **202**(**4**): 294–297.

6. **Thoiba, K.**, Pradeep, A.K. & C.N. Sunil **2015**. *Tripogon bimucronatus* (Poaceae: Chloridoideae: Tripogoninae), a new species from India. *Garden's Bulletin Singapore* **67**(**1**): 151–157.

7. **Thoiba, K.** & A.K. Pradeep **2014**. *Tripogon malabarica* (Poaceae: Chloridoideae: Tripogoninae), A new species from India, Kerala. *J. Bot. Inst. Texas* **8**(**2**): 525–529.

8. **Thoiba, K.** & A.K. Pradeep **2014**. *Chrysopogon festucoides* (Poaceae): A new record for south India. *Rheedea* **24**(**1**): 56–59.

II. Papers presented in National/ International Seminars:

1. **Thoiba K.** & A.K. Pradeep **2017**. **Taxonomic Account on the Genus *Eragrostis* Wolf and *Tripogon* Roth (Poaceae: Eragrostidinae) in Southern Peninsular India (Oral).** National Seminar on Basics in Angiosperm Taxonomy. 22nd–23rd November 2017, PG and Research Department of Botany, M.E.S. Asmabi College, P.Vemballur, Kodungallur, Kerala. (Received **Best Paper Presentation Award**).

2. **Thoiba K.** & A.K. Pradeep **2016**. **The Genus *Eragrostis* Wolf in Peninsular India (Oral).** 26th Annual Conference of IAAT & International Seminar on Conservation and sustainable Utilization of Biodiversity. 07th–09th November 2016, Department of Botany, Shivaji University, Kolhapur, India.

3. **Thoiba, K.** & A.K. Pradeep **2015**. **Diversity & Endemism of the Genus *Tripogon* Roem. & Schult. (Poaceae) in Peninsular India (Oral).** National Seminar on

Patents, Plant Breeding, Biotechnology & Conservation. 3rd–5th December 2015, Malabar Botanical Garden and Institute for Plant Sciences, Kozhikode, Kerala.

4. **Thoiba, K.** & A.K. Pradeep **2015**. **An update to the subtribe Eragrostidinae *s.l.* (Poaceae: Chloridoideae: Eragrostidinae) in South India (Oral).** Silver Jubilee Conference of IAAT and Council Meeting of IAPT & International Seminar on Advancements in Angiosperm Systematics and Conservation. 19th –21st November 2015, Department of Botany, University of Calicut, Kerala.

5. **Thoiba, K.** & A.K. Pradeep **2015**. **The Genus *Tripogon* Roem. & Schult. (Poaceae) in Kerala (Oral).** National Seminar on Advancement of Biosysmatics on Biodiversity Conservation. 8th–9th October 2015, Sree Narayana College, Sivagiri, Varkala. (Received **Best Paper Presentation Award**).

6. **Thoiba, K.** & A.K. Pradeep **2014**. **The Genus *Tripogon* Roem. & Schult. (Poaceae) in South India (Oral).** 24th Annual Conference of Indian Association for Angiosperm Taxonomy (IAAT) and International Conference on Trends in Plant Systematics (TIPS). Department of Plant Science, Bharathidasan University, Tiruchirappalli, Tamil Nadu.

7. **Thoiba, K.** & A.K. Pradeep **2014**. **Preliminary report of subtribe Eragrostidinae *s.l.* (Poaceae) in South India (Oral).** UGC Sponsered National Seminar on Green Living for Sustainable Deveopment. 15th–17th October 2014, Department of Botany, Govt. Brennen College, Thalassery, Kerala.

Appendix – III List of Herbaria Cited

1. Agharkar Research Institute, Pune, India (AHMA).
2. Blatter Herbarium, St. Xavier's College, Mumbai, India (BLAT).
3. Botanic Garden and Botanical Museum, Berlin-Dahlem Herbarium, Berlin, Germany (B)*.
4. Botanical Survey of India, Deccan Regional Centre, Hyderabad, India (BSID).
5. Botanical Survey of India, Southern Regional Centre, Coimbatore, India (MH).
6. Botanical Survey of India, Western Regional Centre, Pune, India (BSI).
7. Calicut University Herbarium, Department of Botany, University of Calicut, India (CALI).
8. Central National Herbarium, Kolkata, India (CAL).
9. Herbarium Senckenbergianum Frankfurt/M, Germany (FR)*.
10. Institute of Forest Genetics and Tree Breeding, Coimbatore, India (FRC).
11. Kerala Forest Research Institute Herbarium, Peechi, India (KFRI).
12. Lund University, Lund, Sweden (LD)*.
13. Martin-Luther Universitat, Halle, Germany (HAL)*.
14. Museo di Storia Naturale dell'Università, Firenze, Italy (FI)*.
15. Museum National d'Histoire Naturelle, Paris. France (P)*.
16. Museum of Natural History, Vienna, Austria (W)*.
17. National Botanical Garden, Meise, Belgium (BR)*.
18. National Herbarium, Leiden University, Leiden, Netherlands (L)*.
19. National Herbarium of the Netherlands, Herbarium Utrecht, Leiden, Netherlands (U)*.
20. Naturalis Biodiversity Center, Leiden, Netherland (WAG)*.
21. Natural History Museum, London, England (BM)*.

22. National Museum of Natural History, Smithsonian Institution, Washington, USA (US)*.

23. National History Museum of Denmark, Copenhagen, Denmark (C)*.

24 . Rapinat Herbarium, St. Joseph's College, Thiruchirappalli (RHT).

25. Royal Botanic Gardens, Kew (K)*.

26. Shivaji University, Kolhapur, India (SUK).

27. Sri Krishnadevaraya University, Anantapur, India (SKU).

28. St. Joseph's College Herbarium, Bangluru (JCB).

29. St. Joseph's College Herbarium, Devagiri, India (DEV).

30. Swedish Museum of Natural History, Sweden, Stockholm (S)*.

31. The conservatory and Botanical Garden, Geneva, Switzerland (G)*.

32. The Linnean Society of London, England, U.K. (LINN)*.

33. Tropical Botanical Garden Herbarium, Thiruvananthapuram (TBGT).

*Herbarium not personally visited

Appendix – IV List of abbreviations used

Details of the main abbreviations used in the text are given below.

Acc. No.	:	Accession Number
auct. non.	:	*auctorum* (used for a misapplied name)
c.	:	*circa* (about)
cm	:	centimetre
comb. nov.	:	*combination nova* (new combination)
det.	:	*determinavit* (he/she has determined)
et al.	:	*et aliorum* (and of others)
f. nov.	:	*forma nova* (new form)
Ibid.	:	*Ibidem* (in the same place)
l.c.	:	*loco citato* (at the place cited)
mm	:	millimetre
m.s.l.	:	mean sea level
nom. illeg.	:	*nomen illegitimum* (illegitimate name)
nom. inval.	:	*nomen invalidum* (invalid name)
nom. nud.	:	*nomen nudum* (naked name)
p.p.	:	*pro parte* (in part)
s.coll.	:	*sine collector* (without collector's name)
s. die.	:	Undated
s.n.	:	*sine numero* (without collection number)
s.l.	:	*sensu lato* (in broader sense)
s.s.	:	*sensu strict* (in strict sense)
sensu	:	in the sense
sp. nov.	:	*species nova* (new species)
stat. nov.	:	*status novus* (name at new rank)
syn. nov.	:	*synonymum novum* (new synonym)

Index to Scientific Names