CHAPTER - VII

TAXONOMIC DESCRIPTIONS OF CAPILLIPEDUM,
SACCHARUM, ISEILEMA &Themeda

(PROJECT WORK ALLOTTED BY BOTANICAL SURVEY OF INDIA)
TAXONOMIC DESCRIPTIONS OF CAPILLIPEDDUM, SACCHARUM, ISEILEMA AND THEMEDA

Hooker (1897) has not separated genus Themeda from Anthistiria and Capillipedium from Andropogon. Forskulli (1775) had already proposed separation of some species of Anthistiria forming a new genus Themeda. Capillipedium was separated from Andropogon by Stapf (1917). Hennard (1940) has discussed the dispute on this genera in details. Indian species of Capillipedium, were revised by Raizada & Jain (1951). The controversial position of species in genus Capillipedium is shown in the table.

Bor (1960) has described 7 species of Capillipedium, 5 species of Iseilema, 15 species of Saccharum and 13 species of Themeda. These species are reported from the regions constituting former British India. The species those are not found in present day in Indian territories are not considered in this account. These species are Iseilema argutum, Saccharum Wardii and S. williamsii which are endemic in Burma.

After 1960 onwards some new species have been investigated by various workers and they are included in present account. Two new species of Iseilema are added by Murty and Satyavathi (1968) are Iseilema hubbardii Murty Sp. nov. and I. venkateswarulli Satyavathi Sp. nov., reported from Ujjain (Madhya Pradesh) and Guntur (Andhra Pradesh) respectively. A new species Themeda decruzzii Birari, recently reported by Birari (1975), who separated it from Themeda anathera and collected at Mussorie. In present taxonomic work on these four genera, total species, included are 45. For consideration of species, priority has been given to
Bor (1960). Under disputed genus *Capillipedium* special attention has been paid in considering the Indian species. *Capillipedium planipedicellatum* is not considered in present work as it was shifted to new genus *Filipedium planipedicellatum* (Bor) Raizada et Jain (1951). *C. venustum* (Th. W.) Bor., considered in this account was not recognized by Raizada & Jain (1951). Bor (1960) considered it to be a species in *capillipedium* but also mentioned that this could also go with *Bothriochloa*, *Andropogon* and *Vetiveria*. This species has already harassed taxonomists earlier.

For compiling distributional details of plants it is necessary to refer various works on the study of local as well as consolidated accounts of large areas. The "Flora of British India" (1897) is more varied than of any other country of an equal area in the Eastern Hemisphere. Bews (1929) has presented a comprehensive account of the distribution of world grasses in details. Beetle (1955) has described four grass subfamilies regarding their systematics and distribution in world. But the detailed distributional account of a particular species can only be available in regional or local floras. In this connection following works have been consulted freely and frequently during present investigations. Bor (1938-1960), Duthie (1883, 86, 88 & 93), Fischer (1864, 1935), Hutchinson (1905, 1934), Stewart (1969), Burns, Kulkarni & Godbole (1925, 28), Camus (1920), Clouston (1920), Caius (1937), Grassl (1946), Janki Ammal (1936), Lisboa (1993, 96), Mooney (1950), Mukherjee (1949, 54), Narayanswami (1935), Pilger (1941), Raina (1959), Raizada & Jain (1951, 54), Stapf (1930), Stebbins (1955), Tateoka (1956, 57), Hubbard (1965, 58), Joseph (1963), Maheshwari (1960, 64), Panigrahi (1964-68), Raizada (1958),
Haizada, Bharadwaja and Jain (1961), Sebastine & Ramanurty (1966),
Tiwari (1954, 63), Uppulari and Satyavati (1963), Venkateswarlu &
Murty (1967), Whyte (1964).

Taxonomic descriptions, and distribution of these
genera and species are given in the text in accordance with the
guidelines provided by Botanical Survey of India for "Flora of
India" Project. Distribution of these genera in India is shown
in maps 2-5.
GUIDE FOR THE SEQUENCE OF PRESENTATION OF DISTRIBUTIONAL DATA

1. India (within India State-wise viz.: Jammu & Kashmir, Himachal Pradesh, Punjab, Harayana, Delhi, Bihar, West Bengal, Sikkim, Arunachal Pradesh, Assam, Nagaland, Mizoram, Manipur, Meghalaya, Tripura, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, Goa, Daman & Diu, Lakshadweep Islands, Andaman & Nicobar Islands, Dadra & Nagar Haveli).

1/2. Pakistan.
1/4. Bhutan.
1/5. Bangladesh.
1/7. Sri Lanka.

2. Eastern Asia. (China, Japan, Ryukyu Islands, Macau Islands & Korea).


4A. Malaya Peninsula (Malaysia)
(Malaysia, Perak, Singapore, etc.)

4B. Indo-China:
(Thailand (Siam), Cambodia, Laos, Vietnam, Tonkin, Cochinchina, Annam).

4C. Malesian Islands:
(Borneo, Kalimantan, Sarawak, Sabah, Indonesia, Sumatra, Java, Lesser Sunda Islands, Celebes, Molucces Timor, Cocos, Kelling).

4D. Philippines.

4E. New Guinea.

5. Australia & New Zealand.

6. Pacific Islands.

7. Malagasy (Madagascar) & Macarens Islands.

8A. North Africa: (Algeria, Libya, Tunisia, Morocco, Sahara etc.).

8B. Africa: (excluding North Africa).

9. Western Asia:
(Egypt, Turkey, Syria, Israel, Lebanon, Cyprus, Jordan, Iraq, Iran, Saudi Arabia, Yemen, Aden, Muscat, Oman, Quater, Bahrain, Kuwait, Afganistan).


11A. North America: (U.S.A. & Canada, Greenland).

11B. Central America & West Indies.

12. South America.
<table>
<thead>
<tr>
<th>Name in Hooker's Fl. Br. Ind. (1937)</th>
<th>Name used in later Indian floras. (1997 onwards)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andropogon micranthus Kunth</td>
<td>Capillipedium parriflorum (Fr. Pr.) Stapf.</td>
</tr>
<tr>
<td>A. micranthus Kunth var. villosulum Hack.</td>
<td></td>
</tr>
<tr>
<td>A. assimilis Steud.</td>
<td>C. assimile (Steud) Camus.</td>
</tr>
<tr>
<td></td>
<td>C. glaucopsis (Steud) Stapf.</td>
</tr>
<tr>
<td>A. hugelii Hack.</td>
<td>C. hugelii (Hack) Stapf.</td>
</tr>
<tr>
<td>A. schmidii Hook. f.</td>
<td></td>
</tr>
<tr>
<td>A. hugelii Hack. var. foetidus</td>
<td>Not given</td>
</tr>
<tr>
<td>Lisbona. (Not given in Fl. Br. Ind.)</td>
<td></td>
</tr>
<tr>
<td>A. filiculmis Hook. f.</td>
<td>C. filiculmis (Hook. f.) Stapf.</td>
</tr>
<tr>
<td>A. pteropechys Clarke.</td>
<td>C. pteropechys (Clarke.) Stapf.</td>
</tr>
<tr>
<td></td>
<td>C. planipedicellatum Bor.</td>
</tr>
<tr>
<td>Name proposed by Raizada &amp; Jain (1951)</td>
<td>Name given by Por. (1960)</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>C. subrepens (Steud) Henr.</td>
<td>C. assimile (Steud) A. camus.</td>
</tr>
<tr>
<td>and C. subrepens Henr. var. glaucophyllum</td>
<td>C. hugelii (Hack.) Camus.</td>
</tr>
<tr>
<td>C. hugelii (Hack.) Camus.</td>
<td>C. hugelii (Hack.) Stapf.</td>
</tr>
<tr>
<td>C. foetidum (Lisboa) Raizada and Jain</td>
<td>Not given</td>
</tr>
<tr>
<td>C. filiculme (Hook.f.) Stapf.</td>
<td>C. filiculme (Hook.f.) Stapf.</td>
</tr>
<tr>
<td>C. pteropechys (Clarke) Stapf.</td>
<td>C. pteropechys (Clarke) Stapf.</td>
</tr>
<tr>
<td>Transferred to the genus Filipedium Raizada &amp; Jain</td>
<td>C. planipedicellatum Por.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CAPILLIPEDUM


Annual or perennial slender grasses with simple or often copiously branched culms, frequently bearded at the nodes. Leaf-blade flat, with a conspicuous white mid-rib; sheaths, compressed, smooth, lanceolate, ciliate at the mouth, ligule a ring of hairs, 1-2 mm long.

Inflorescence a panicle rather delicate, usually much divided, the branchlets at length more or less divergent; main rachis and branches capillary; racemes 1-4, rarely up to 8- jointed; joints and pedicels slender filiform, longitudinally grooved or depressed, translucent at the centre, leaving a minute transverse, truncate or very shallowly cupular scar on the peduncle after falling. Spikelets 2- nate, one sessile and other pedicelled, similar in shape, differing in sex. Sessile spikelets dorsally compressed; callus short, rounded, shortly bearded; glumes subequal, thinly chartaceous to membranous; lower glume 2- keeled with narrow inflexed margins; keels usually bristly- ciliate; upper glume boat shaped, more or less grooved on each side of the keel, 3- nerved; lemmas dis-similar; lower lemma hyaline, empty nerverless or 0; upper lemma reduced to the linear hyaline base of a geniculate awn containing bisexual floret. Palea minute or absent. Lodicules 2 minute, glabrous. Stamens 3. Stigmas exerted laterally longer than the styles. Grain oblong- ellipsoid or oblong, slightly compressed. Pedicelled spikelets narrower than the sessile, deciduous; lower glume
Index to distribution of *Species* of Genus *Capillipedium* Map. No. 1.

1. *C. assimile*.
2. *C. filiculme*.
3. *C. foetidum*.
4. *C. huegelii*.
5. *C. parviflorum*.
6. *C. pteropechys*.
7. *C. venustum*.

...
MAP 2 DISTRIBUTION OF GENUS CAPILLIPEDUIM STAPF IN INDIA
dorsally flattened; upper glume usually rounded on back; lemma if present, nerveless, hyaline, stamens 3. Palea very narrow or 0.

**KEY TO THE SPECIES**

1. Pedicels opaque, without a translucent median furrow.
   
   **C. Venustum**

1. Pedicels with a definite translucent median furrow.

2. Culms weak, decumbent and trailing, much geniculately branched.
   
   **C. filiculme**

2. Culms erect, robust, simple or branched.

3. Peduncles of the racemes ciliate.
   
   **C. pteropechys**

3. Peduncles of the racemes glabrous.

4. Lower glume of the sessile spikelet channelled; leaves slightly narrowed or rounded at the base; panicle large diffuse of the small spikelets.
   
   **C. parvisflorum**

4. Lower glume of the sessile spikelet flat on the back; leaves conspicuously narrowed at the base; panicle often dense of many or few spikelets.

5. Nodes glabrous or shortly hairy; callus shortly bearded; panicle often somewhat open.
   
   **C. assimile**

5. Nodes densely bearded; callus villously bearded; panicle contracted.

6. Glume IV present in pedicelled spikelets, unscented grass.
   
   **C. huegeli**
6. Glume IV absent in pedicelled spikelet, sweet scented grass.

*C. foetidum*


An annual grass. Culms 60-120 cm long, strict, subsimple as thick as goose-quill below and clothed with short pubescent sheaths. Leaf-blade 30-40 cm long and 4-5 mm broad and prominent beneath; sheaths sub-compressed, smooth, lanceolate, ciliate at the mouth; ligule a ring of hairs.

Inflorescence a large panicle, 30-40 cm long, elongate interrupted rachis, spreading, opposite and alternate, branches capillary, glabrous, dull-purplish, much branched. Spikes narrow, small, lax-fid, 3-8 jointed, pedicels 1/3 of the sessile spikelets, terete, not channelled, acute. Sessile spikelets narrowly-lanceolate, acute, 1.2 cm long, slightly curved; callus small, stellately, bearded with white hairs; gl. I quite smooth, flat or rather convex dorsally, nerveless, tip two-toothed, keels scabrid above the middle; gl. II chartaceous, linear-lanceolate, acuminate, 3-nerved, keel acute, smooth or scabrid upwards; gl. III smaller, ovate-acuminate or aristulate, ciliate above, 1-3-nerved; gl. IV linear, bifid, awn very slender. Pedicelled spikelets longer than the sessile and more acuminate, nearly glabrous, male; gl. I
7-nerved, 3 towards the margin on each side; gl. II and gl. III similar to sessile spikelet; gl. IV narrow, glabrous, awn. 0.


Distribution in India: Southern W. Ghats; Tamil Nadu, above 1700 m contour. Central Provinces; Madhya Pradesh and Southern Uttar Pradesh.

World Distribution: India and Sri Lanka.

PLATE: 141.


An annual grass. Culms 60-90 cm long, elongate, filiform, flaccid, decumbent and interlaced, copiously geniculately branched throughout weak, quite glabrous, nodes shortly bearded, internodes long, pubescent. Leaf-blades 5-10 cm, long and 3-4 mm, broad linear-lanceolate, finely acuminate with filiform tip, glabrous above, sparsely hairy beneath, flaccid, pale green, margins smooth ciliate towards the very narrow base, midrib and nerves very slender; sheaths long, narrow, spreading at the remication, glabrous, bearded at the tip, lower sheath open below; ligule broad, membranous, ciliate.

Inflorescence a panicle 2.5 -5 cm long; branches few of extreme slender, filiform; spikelets 2 or 3, pale-green or white, callus densely or shortly villous. Sessile spikelet 3 mm long, oblong-lanceolate; lower glume obtuse, membranous, oblong-
lanceolate, 5-7-nerved, nerves very faint, villous below the middle or all over, keels ciliate; upper glume, oblong-lanceolate, thinly membranous, acute, shortly mucronate, truncate, glabrous, 3-nerved, lower floret barren; lemma very small, ovate-obtuse, hyaline nerveless; upper floret hermaphrodite, lemma .5-1 mm long, awn very slender, 13-18 mm long, column brown twisted, upper half portion yellowish white, base not dilated. Pedicelled spikelets narrow than sessile; lower glume ovate-lanceolate, tip truncate-mucronate, 7-9-nerved, ciliate with long hairs; upper glume as long, ovate-lanceolate, acute, strongly 5-7-nerved; lower floret barren; lemma broadly oblong, obtuse, hyaline nerveless; upper floret, lemma absent. Anthers 1-2 mm long. Stigma oblong, 2 mm long.


Distribution in India: Northern W. Ghats; Maharashtra. Southern W. Ghats; Karnataka, Tamil Nadu, Kerala.

World Distribution: Endemic in India

PLATE 142.

_Capillipedium pteropechys_ (Clarke) Stapf in Hook., _Ic. Pl._ (1922) sub. tab. 3085. _Andropogon pteropechys_ Clarke in J. Linn. Soc. (Bot.) 25, 88 (1899) t. 38.

A perennial grass. Culms very slender from a creeping root stock, stout, 40-60 cm high, sparsely branched, terete, glabrous and smooth, finely striate, leafy upwards, nodes thickly bearded. Leaf-blades 7.5 to 15 cm long, linear-lanceolate, finely acuminate, narrowed towards the base, glabrous above, sparsely hairy with tubercled bases beneath, upper surface and margins...
scaberulous, midrip definite above as a white line; sheaths closed, rather loose below, striate, smooth and glabrous, except for a few hairs at the collar and few at the mouth; ligule very short with stiff cilia.

Inflorescence a very open panicle 5-8 cm long, sparingly branched, branches filiform, smooth and glabrous except below the spike where they are villous with brown or white hairs. Racemes usually few, spiculate, about 1 cm long, joints and pedicels ciliate on the margins, channelled, usually about half the length of the spikelet. Spikelets oblong, somewhat obtuse, erect; callus hairs of 1/4th the length of the spikelet. Sessile spikelet 3.75-4.25 cm long, grooved, lower glume dorsally glabrous, oblong-obtuse more or less rounded on the back, keels pectinately ciliate, 9-nerved, nerves prominent; upper glume ovate-lanceolate, acute 3-nerved, sparingly ciliate, lower floret barren; lemma small, ovate, nerveless; palea absent; upper floret hermaphrodite lemma the linear base of an awn 1.5 cm long, base acute; palea very small or absent. Pedicelled spikelet male or barren; narrower than the sessile and more acute; lower glume 9-11-nerved; upper glume thin, membranous 3-nerved; lemma oblong, obtuse, glabrous and nerveless. Authers 2 mm long.

Fl. Sept.- Nov.

Distribution in India: Endemic in Naga hills; Nagaland on Jakhmo and Kohima, 2000-3000 m, Munnpore up to 3000 M alt.

World Distribution: Endemic in India.

PLATE: 143.


Anatherum parviflorum (R.Br.) Sprüngg., Syst. Veg. 1, 290 (1825).


A perennial grass. conspicuously branched with creeping rootstock. Culms woody, slender, polished, tufted, more than 1 m high, erect or shortly ascending at the base, simple or sparingly branched, terete, internodes sometimes channelled on the side facing towards the leaf, glabrous, nodes more or less bearded. Leaf-blades linear, often narrowed and slightly contracted base, long tapering to a fine point up to 30 cm long and 2-5 mm broad, flat, more or less hairy with tubercle based hairs, surface and margins scaberulous, base rounded, lateral nerves fine, 3-4 on each side; sheath tight; ligule short truncate.
Inflorescence a panicle. Panicle oblong or pyramidal, 10-25 cm long and 2.5 - 6 cm wide, erect; with capillary clustered primary branches, more or less decompound, primary branches sub-verticillate, 5-7 or more from the lowest nodes unequal, and divided from lower down and up to three degree, glabrous or hairy at the insertion, minutely puberulous all along, usually dark purple to almost black, peduncles 12-20 mm long. Racemes reduced to 1- sessile and 2-pedicelled spikelets, or 2-rarely 3-jointed; joints and pedicels 1-3 mm long, shortly ciliate or sometimes glabrous. Sessile spikelets oblong, 3-5 mm long, usually dark purplish or reddish to brown in colour; lower glume membranous, pale, oblong, narrowly truncate, 2-6 -nerved between the keels, scaberulous, margins narrowly inflexed; upper glume lanceolate, acuminate or mucronate, scaberulous, 1-3-nerved, lower floral glume short obtuse, ciliate, nerveless, upper floral glume an awn, 6-8 mm long. Pedicelled spikelets male similar to sessile or somewhat smaller, narrower and pale, callus naked, Glume I acute, keels, sparsely hispidulous, 3-6-nerved, margins hardly inflexed glume III oblong, hyaline, broadly-lanceolate, as long as gl. I glume IV narrow, awnless, anthers 1-2 mm long.


Distribution in India: Widely distributed throughout in India.

World Distribution: India, Pakistan, Nepal, Burma, Eastern Asia; Malesian Islands, New Guinea, Australia, and New Zealand, Africa (excluding North Africa) Indo-China.

PLATE: 14M.

A perennial grass. Culms 1.5 - 3.5 m tall, subfruticos, fastigiately branched from a decumbent base, rooting at the base, branches spreading internodes very glabrous, rounded but flattend on one side, nodes glabrous or more or less bearded. Leaf-blades flat, almost lanceolate, linear, setaceous, acuminate, rather flaccid, glabrous or sparsely hairy on both surface, 6-15 cm long, 3-6 mm broad, flat, soft, spreading, margins sub-serrulate; median nerve thick, prominent, whitish; sheaths somewhat compressed usually bearded at the mouth, upper sheath appressed, lower open, often divaricate; ligule short, obscure, truncate, ciliolate or hairy.

Inflorescence a decomposed panicle, 0.5-12 cm long slender erect, ovate, oblong or triangular, branched to the third degree, common axis slender, branches and branchlets capillary, spreading at the right angle after anthesis, bearded in the axils, naked at the base, the primary solitary, rarely exposed, the secondary numerous; racemes 7-10 mm long, peduncled, 2-3 -jointed, rhachis smooth, fragile; joints and pedicels 1.5-2.5 mm long, filiform, deeply channelled at the back, hyaline, margins ciliate
or glabrescent, hairs 75-1.25 mm long, often absent at the top; articulation without appendages. Sessile spikelets linear-oblong, 2-3.5 mm long, all hermaphrodite, dorsally compressed, pale-green or reddish, aristate; lower glume membranous, oblong or linear-oblong, margins narrowly incurved and long ciliate; 2-keeled, flat or concave towards the centre, somewhat depressed on the back, glabrescent towards the top, keels with stiff cilia delicately 2-6-nerved, callus small, shortly bearded, not pitted; upper glume acute, margins glabrous, 2-3.5 mm long, broadly lanceolate and ciliolate at the apex, keel flattened, ciliolate above, 3-nerved, lower floret barren; lemma 1-1.5 mm long, ovate obtuse, glabrous, linear, nerveless; upper floret hermaphrodite, lemma .75-1.2 mm long, narrow, glabrous,awn very slender 6-12 mm long; base acute; Palea absent; lodicules glabrous. Stigma oblong, broadly plumose. Pedicelled spikelets male or neuter, 3.5 mm long, longer than the sessile, linear-lanceolate, rusty, pedicels 2 mm long, sparsely ciliate; lower involucral glume linear-lanceolate, acute, margins incurved, keels ciliate at upper part, green or reddish, 5-7-nerved; upper involucral glume 3.5 mm long, acute, ciliolate, hyaline, 3-5-nerved; lower floret barren; lemma shorter, oblong-obtuse, nerveless, glabrous; upper floret male; lemma absent, anthers 1.2 mm long, stamens scarcely absent.


Distribution in India: Throughout in India, from plains to ascending upto 2000 M altitude.


PLATE: 145.

A perennial grass. Culms often suffrutescent below, frequently red, branching from the base, branches about 1 m long nodes bearded. Leaf-blades 10-20 cm long and 2-3 cm broad, linear-lanceolate, acuminate, flat, flaccid, green, narrowed at the base, puberulous beneath, margins saccate, sometimes ciliate with long hairs; sheaths slightly compressed, bearded at the mouth, otherwise glabrous; ligule short, membranous, ciliate.

Inflorescence a panicle; panicle 5-9 cm long shining, branches capillary with bearded axils; joints and pedicels ciliate. Sessile spikelet 3 mm long, pale green or purplish, callus densely villous; lower involucral glume truncate, chartaceous, ovate, villous below the middle or glabrous, dorsally polished, margins narrowly incurved, keels ciliate with long hairs; upper involucral glume equal to lower, glabrous, narrowly truncate, apiculate, ciliate, keel much thickened; lower floral glume minute 1.5 mm long, hyaline, ovate, obtuse, glabrous; upper floral glume represented by the slender, white, undilated base of the awn, awn up to 2.5 cm long. Pedicelled spikelets 4 mm long, lanceolate green or purple; lower glume subacute, 9-11-nerved, keels and back ciliate; upper glume as long as lower, acuminate, keels
minutely ciliate; 5-nerved, lower floral glume nearly as long, hyaline, oblong-obtuse, glabrous, nerveless; upper floral glume narrowly-linear or absent.


Distribution in India: Western Himalayas; Kashmir, Himachal Pradesh. Vindhyan and Satpura Ranges; Madhya Pradesh. Southern W. Ghats; Tamil Nadu, Andhra Pradesh, Kerala, Karnataka, up to 2300 meter high. Northern W. Ghats & Deccan; Maharashtra. Aravali Ranges; Mt. Abu, Rajasthan.

World Distribution: India and Burma.

PLATE 48.


A perennial sweet scented grass. Culms slender, decumbent and rooting at the base then ascending to 75-120 cm, high or more; grooved on the side of leaves and branches, glabrous, pale-purple; nodes bearded with white hairs. Leaf-blades 12-20 cm long and 1-2 cm wide, linear-lanceolate acute with few hairs on the lower surface, distinctly divided into two unequal parts by a white midrib, which is prominent on the lower surface; sheaths slightly compressed, bearded at the mouth, ligule 1 mm long, membranous ciliate.
Inflorescence a panicle 10-15 cm, long, oblong, much branched on a long peduncle. Rhachis pale- apple colour, smooth or scabrous, tubercles minute, 6-9-jointed, branches many at each joint (6-12 at lower joint), capillary, smooth or scaberous, unequal in length, articulations of the main rhachis and primary branches swollen and bearded with long soft white hairs; secondary branches 2-4 at each joint of primary branches, small tertiary branches two often present; the ultimate branches bearing a terminal triad of spikelets, one sessile between two pedicelled ones and generally 3 pairs below the triplet; joints and pedicels shortly hairy; spikelets yellowish-white or dingy-green; callus hairy sessile spikelet; gl. I. ovate, truncate, glabrous or sparsely hairy, 7-9-nerved; gl. II broader, glabrous, 5-nerved gl. III, absent; gl. IV represented by a slender twisted awn, bisexual; palea hyaline, 1.5 mm, long, 1 mm wide. Pedicelled spikelet; gl. I, ciliolate at the margins, many nerved; gl. II 3-nerved; gl. III broader than II, hyaline, gl. IV absent. Stamen 2-3 mm long.

Fl. Sept.- Nov.

**Distribution in India:** Vindhyan and Satpura Ranges: Madhya Pradesh. Northern Western Ghats. Maharashtra.

**World Distribution:** Endemic in India.

**PLATE:** 146.
SACCHARUM


A tall, robust, perennial grass. Culm usually solid. Leaves narrow, flat, sometimes rolled when dry. Inflorescence a large, silky and densely branched panicle, branches spreading or erect, capillary and fragile, spikelets usually surrounded by large silky hairs from their bases, minute, awned or awnless, 1-fid, 2-nate, a sessile bisexual and pedicelled female, rarely both pedicelled and bisexual, the pedicelled falling from their pedicels, the sessile deciduous together with the contiguous joints of rachis and pedicel. Callus bearded with very long hairs. Florets-2, the lower reduced to an empty lemma; upper hermaphrodite. Glumes 4, equal, lower involucral glume chartaceous, equal in length to the second, oblong-lanceolate, margins inflexed, usually 2-keeled, not winged, 1-2-nerved; upper involucral glume concave, dorsally rounded, obscurely keeled, 1-5-nerved; Lower floral glume hyaline, oblong, empty; upper floral glume shortest or 0, awnless; palea small, hyaline, nerveless or 0; lodicules cuneate. Stamens 3. Stigma laterally exerted. Grain oblong or subglobose.
Index to distribution of *Species of Genus Saccharum Map. No. 2.*

1. *S. arundinaceum.*
2. *S. bengalense.*
3. *S. filifolium.*
4. *S. griffithii.*
5. *S. longisetosum* var *longisetosum.*
6. *S. longisetosum* var *hookeri.*
7. *S. macratherum.*
8. *S. officinarum.*
9. *S. procerum.*
10. *S. ravennae.*
11. *S. rufipilum.*
12. *S. spontaneum.*

...
MAP 3 DISTRIBUTION OF GENUS SACCHARUM LINN IN INDIA
Key to the Species

1. Spikelets not awned.

2. Peduncle hairy below the panicle; rhachis very fragile; hairs very white, silvery.
   2. Peduncle not hairy below the panicle, rhachis less fragile, hairs greyish-brown.  
   \[S. spontaneum\]

3. Lower glume of sessile spikelet glabrous;
   \[S. officinarum\]

4. Upper glume of sessile spikelet with long hairs.

5. Spikelets 4-6 mm long, longer than the joints of the rhachis; leaves glaucous.
   \[S. bengalense\]

5. Spikelets 2.5-4 mm long, shorter than the joints of the rhachis, leaves green.

6. Sessile spikelet 2.5-4 mm long, joints 3.5-4 mm long, pedicels 2.5-3.5 mm long; leaves villous at the base only; strip of green blade broader than the midrib, panicle not very loose of silky.
   \[S. arundinaceum\]

6. Sessile spikelets 3-4 mm long; joints 6-7 mm long; pedicels 2.5-3.5 mm long; leaves villous in lowest 10 cm; strip of green blade narrower than midrib; panicle looser and more silky.
   \[S. procerum\]

4. Upper glume of sessile spikelet villous; panicles creamy-white, often interrupted.

S. griffithii

1. Spikelets awned.

7. Panicle decompound, ultimate branches very short or 3-4 joints.
   \[S. reventae\]

7. Panicle of long simple branches, sparingly, divided.

8. Awns 3.5-4 mm long, spikelets 2-3 mm long; upper lemmas 7 mm long, bifid, with long very narrow lobes.
   \[S. macrotherum\]

8. Awns not more than 2 cm long.
9. Upper lemmas entire at the apex, very narrow; leaf-blades almost all midrib.

10. Spikelets 3-3.5 mm long, twice as long as the joints, surrounded by mauve-coloured long hairs.

\[ \text{S. rufipilum} \]

10. Spikelets 4-5 mm long, as long as the joints, surrounded by silvery-golden or golden hairs.

\[ \text{S. sikkimensc} \]

9. Upper lemmas 2-fid at the apex, awned in the sinus; leaf-blades broad to very broad or filiform.

11. Blades broad; stems glabrous below the nodding inflorescence.

12. Stem glabrous below the panicle; spikelets 4-5.5 mm long, equal to or usually longer than the raceme-joints; glumes sparsely hairy in the lower third; paleae of the upper floret 2 mm long.

\[ \text{Var. longisetosum} \]

12. Stem pubescent below the panicle; spikelets 5.5-6.5 mm long, usually longer than the joints of the racemes; glumes densely hairy in the lower half; paleae of the upper floret very short.

\[ \text{Var. hookeri} \]

11. Blades narrow, stem pubescent below the nodding inflorescence.

\[ \text{S. filifolium} \]

A tall perennial, coarse grass with creeping rootstock; stems erect, occasionally decumbent or prostrate stolens, rhizome thick. Culms 1-5 m long with several nodes, solid, smooth, polished, glabrous, with silky appressed hairs below the panicle, slender. Leaf-blade erect, very long 45-130 cm, 4-5 mm broad, narrow, margins convolute or incurved, rigid, coriaceous, glaucous, narrowly linear acuminate, capillary at the tip, glabrous, margins scabrid and involute; sheath smooth, glabrous, wooly at the mouth, ligule ovate membranous.

Inflorescence a lanceolate panicle, 20-60 cm long, dense silky, somewhat contracted, rhachis slender, fragile, branches capillary, joints filiform, dorsally long ciliate, primary branches slender, 5-10 cm long, the lower 4-5 node, upper 1-2 node; secondary branches from the base, simple or branched, filiform, silkily hairy, the upper spiculate to the base, lower naked; pedicels ciliate, 1-5-3 mm long. Spikelets 3-6 mm long, lanceolate, rusty-red, base often sub-glabrous, binate, one sessile and other pedicelled, both bisexual and alike; callus small and bearded with long spreading silky hairs. Glumes 4; lower involucral glume 3-6 mm long, lanceolate-acuminate or subulate membranous hyaline, villous with white hairs, margins inflexed above the middle, 2-toothed, glabrous on the back,
2-nerved; upper involueral glume concave, dorsally rounded or obscurely keeled, acuminate, often mucronate, 1-nerved; lower floral glume hyaline oblong, ovate-lanceolate, acute or somewhat obtuse, ciliate, nerveless; upper floral glume smaller, hyaline linear, ciliate or c.; palea small hyaline, nerveless; lodicules 2., ciliate on the margin, cuneate or irregular Stamens 3. linear, 1.5-2 mm long. Stigma oblong, laterally exserted, longer than the style.

Fl. Aug-Sept.

Local names: Kans, Munj, Sentha, Patavar (N.Kheri)

Distribution in India. Throughout in India.


PLATE: 21.


A gigantic grass with solid leafy stem. Culms 2-6 m tall, erect, glabrous or appressed hairy below the panicle, waxy below the nodes; internodes shining polished, yellow or purple-violet. Leaf-blade rigid, linear-lanceolate, acuminate base narrow, spreading, glaucous beneath, margins scabrid, about 2 m. long by 6-8 cm wide, median-nerve very thick. White; sheaths pubescent or appressed hairy below, ligule very short, membranous, ciliate.
Inflorescence a very short panicle, ovate-pyramidal, densely spreading, axis glabrous, nodes bearded, channelled, primary branches slender, 5-10 cm long, verticillate, filiform, pubescent at the base, glabrous, scaberulous at the top, bearded towards the nodes, secondary branches simple, distant, internode fragile, thickened at the top, glabrous between the angles; pedicels glabrous. Spikelets linear-oblong, pale or brownish, 4-5 mm long, surrounded by dense silky hairs 7-12 mm long. Glumes uniform, whitish throughout; lower glume 4-5 mm long, membranous, papery, acute, entire margins broadly and laxly inserted, 2-keeled; upper glume 3.4-5 mm long, membranous, lanceolate, acute, equal, narrowly-cymbiform, 1-3-nerved, keels scaberous above, glabrous or ciliate; lower floret empty, lemma almost as long as spikelet, lanceolate, acute, hyaline, membranous, nerveless; upper floret hermaproditic, lemma very reduced, palea lanceolate, acute, ciliate at the apex.

Besides the Noble Cane, two other canes recognized as 'species' *S. sinense* and *S. barberi* are cultivated. They are both similar to *S. spontaneum* in that the axis and branches of the panicle are long-haired, but they differ from that species in having glabrous lodicules and being cultivated, not wild, species. They can be separated by the following key:

Leaves up to 5 cm broad; tall robust grass; joints greenish brown.

*S. sinense*

Leaves much narrower; culms slender and shorter; joints whitish or ivory-coloured.

*S. barberi*
S. sinense Roxb., Pl. Coromond 3 (1819), t. 232.
Cultivated to a limited extent in subtropical India.
2n = 116 - 118.

Cultivated in Northern parts of India mostly.
2n = 90 - 92.

Fl. Sept. - Nov.

Distribution in India - Cultivated throughout warmer regions.

World Distribution: India, Pakistan, Bangladesh, Burma,
Eastern Asia, Malasian Islands, Philippines, New Guinea,
Australia and New Zealand, Pacific Islands, Madagascar and
Macarens Islands; North Africa, Africa, Western Asia, North
America, Central America and West Indies, South America.

PICTURE- 22.
Saccharum bengalense Retz., obs. Bot. 5, 16 (1789). S. munja
Roxb., Fl. Ind. 1, 250 (1820). S. sara Roxb., loc. cit. 249.
in part, non Retz. Brijanthus munja (Roxb.) Jeswiet in Arch.
Suikerind. Ned. - Ind. 399 (1925). E. Sara (Roxb.) Rumke in Arch.
Suikerind. Ned. - Ind. 223 (1934). E. ciliaris (Anderss.) Jeswiet
in loc. cit. 399.

A very large tufted perennial grass. Culms about 6 m
in height; terete, smooth and glabrous, striate, solid. Leaf-blade
glaucescent, tapering from the base, upper 20-60 cm long, 5-10 mm
wide; lower up to 2 m long, 20 mm wide, long, acuminate, scabrid
on the margins, densely white- villous hair near the ligule;
sheath shortly silky at the base, otherwise smooth, striate,
villous on the margins above, ligule truncate, membranous, ciliate.
Inflorescence a large plumose panicle, 30-90 cm tall, thyrsoid, more or less lanceolate to somewhat cylindrical in shape, branches spreads at flowering season, purple-cream or white-greyish colour, angular or sulcate, rhachis and sub-verticillate compound branches glabrous, scabrid on the angles, branches whorled, compound, more or less villous with long white hairs on the corners; rhachis of the spike, pedicels of spikelets and back portion of lower glume with long dense silvery hairs. Spikelets mostly exceeding the internodes of rhachis, in pairs, one sessile and other pedicelled; pedicelled with capillary jointed branches, awnless, up to 5 mm long, lanceolate, similar to sessile in shape and structure, glumes dorsally villous; lodicules 2, cuneate; Anthers 3, pale-yellow, 2-3 mm long. Sessile spikelet with 4 glumes. Lower glume 5 mm long, lanceolate, chartaceous, 2-nerved, nerves lateral, dorsally villous at the base, keels scabrid, margins inflexed; upper glume similar to lower in length, lanceolate cymbiform, chartaceous, keeled, glabrous or obscurely hispid on keel, 3-4-nerved, central nerve strong, other less distant, ciliate at the tip, apex mucronate; lower floret barren; lemma oblong-lanceolate hyaline, 1-3-nerved, ciliate, acute apex; palea absent upper; floret hermaphrodite; lemma lanceolate, elliptic hyaline, 1-3-nerved, ciliate, mucronate, 1-5 mm long; Palea ovate, hyaline.


Local names: Munja, Sentha, Patawar.

World Distribution: India; Pakistan, Bangladesh; Eastern Asia; Malagasy and Macarens Islands; Western Asia; Central America and West Indies.

Plate: 13.


A perennial, gigantic large tufted grass, growing in clumps. Culms 4-6 m tall and 12-13 cm in diameter, glabrous, smooth long internodes, nodes smooth and glabrous. Leaf-blade 1-2 long by 5-8 cm wide, mid-rib white and prominent tapering to a slender point; folded, filiform; sheathes glabrous, bearded at mouth, ligule short, membranous truncate with silky hairy ring.

Inflorescence a large silky panicle 60-120 cm long pink, white or silvery, erect, ovoid-oblong; axis smooth and glabrous, branches tufted on the axis, tufts alternate or sub-verticillate. Spikes 3-8 cm long; rhachis capillary; spikelets 2.5-4 mm long, much shorter than the internodes of the spike, lanceolate; pale-green or violet or brownish, pedicel shorter, both white villous; callus with hairs, not dense, as long as the spikelet; sessile spikelet; lower glume chartaceous,
dorsally villous, flat or depressed, nerveless, keeled; upper glume lanceolate, shortly acuminate, boat shaped; lower floret oblong- lanceolate, male or barren; lemma hyaline as long as spikelet, epaleate; upper floret mucronate, ciliate, hermaproditic, lemma hyaline, half the length of the spikelet; palea shorter, ciliate. Pedicelled spikelet, similar to sessile; glumes dorsally villous. Anthers 3, brownish-yellow, 2-3 mm long.

Fl. Sept. - Nov.

Local name: Munj.

Distribution in India: Upper Gangetic plains; Uttar Pradesh, Bengal Eastern Himalayas; Sikkim, North Bengal; Assam, Malaya Platau; Madhya Pradesh, Southern Western Ghats; Tamil Nadu, Karnataka, Kerala. Northern western Ghats; Maharashtra.

World Distribution: India; Nepal; Burma; Sri Lanka; Eastern Asia, Malaya Peninsula, Indo-China; Malesian Islands.

PLATE: 147.

Sacccharum procerum Bxb., Fl. Ind. 1, 243 (1820).

A very tall gigantic, perennial grass. Culms up to 4-5 m long, solid, terete, glabrous, and smooth. Leaf-blade 1.5-2 m long and 5 cm wide, linear-lanceolate, tapering in a fine point, sebroid on the margins, mid-rib half of the width of blade at the base and covered with dense villae from the ligule 10 cm up the length of blade; sheath glabrous smooth,
lanceolate, bearded at mouth, ligule membranous 1-2 mm long.

Inflorescence large, silvery-grey, lanceolate and loose panicle, axis smooth and glabrous; rhachis joints 6-7 mm long, pedicels 2-4 mm long; callus with hairs, not dense, as long as the spikelet. Sessile spikelet; lower glume chartaceous, dorsally villous, flat or depressed, nerveless, keeled; upper glume lanceolate, shortly acuminate, boat shaped; lower floret oblong-lanceolate male or barren; lemma hyaline as long as spikelet, epaleate; upper floret mucronate, ciliate, hermaphrodite; lemma hyaline, half the length of the spikelet; palea shorter, ciliate; Pedicelled spikelet similar to sessile; glumes dorsally villous. Anthers 3, brownish-yellow, 2-3 mm long.

Fl. Sept. - Dec.

Distribution in India - Southern W. Ghats; Tamil Nadu, Northern W. Ghats; Maharashtra, Eastern Himalaya; Assam.

World Distribution - India, Nepal; Bhutan; Burma; Indo-China; Malayan Islands.

PLATE : 148.


Saccharum ciliare var. griffithii Hack. in DC., Monogr. Phan. 6, 119 (1889).

A perennial grass. Culms very tall, tufted, glabrous, solid, thick, pale-yellow, polished. Leaf-blade 60-30 cm long.
and 2.5-5 mm wide, thickened, coriaceous, rigid, very smooth, dorsally rounded, concave on upper surface, margins of the leaf scaberulous; sheath smooth, polished shining; ligule long ciliate, hairs very long.

Inflorescence is a large panicle, 15-30 cm long, effuse, contracted, thyrsiform, creamy-white, pale-yellow when dry; rachis glabrous, less fragile, lower branches 2.5-5 cm long; joints of the rachis and pedicels about half the length of spikelet, pedicels villous with long pale hairs. Spikelets pale, purple at the tip, callus hair as long as spikelets, white or brownish, unawned, peduncle glabrous, Sessile spikelet linear-lanceolate; lower glume long hairy, 3-nerved, margins narrowly incurved, scabrid; upper glume villous; rather longer, acuminate, 3-nerved; lower floret lanceolate, 1-nerved, hyaline, margins long ciliate; upper floret as long as lower, 3-nerved, narrowed into a short exerted awn may be reduced; palea much shorter, more or less ciliate.


Distribution in India - Northern W. Chats; Maharashtra. Indus Valley; Punjab and Himanchal Pradesh. Western Himalayas; Jammu & Kashmir.

World Distribution - India, Pakistan, Western Asia;

PLATE : 149.

Saccharum ravennae (Linn.) Murray, Syst. Veg. 38 (1774).

Ravennae (Linn.) Trin., Fund. Agrost. 169 (1820). Erianthus

A large tufted perennial grass, closely resembles
with S. bengalense. Culms 1.5 m to 3 m in height, nodes glabrous.
Leaf-blade 60-90 cm long by 2.5-4 cm broad, linear, flat,
scabrous on both surface, bearded at the base with golden
hairs, margins scabrid, mid rib broad; sheath hirsute with
bulbous-based subappressed hairs, ligule very short, silkly
hairless narrow band.

Inflorescence a long panicle, 40-60 cm long and 15 cm
broad., oblong, erect or inclined, silky-hairy, very thick with
crowded spikelets, grey or purple, rachis glabrous, branches
solitary or subverticillate, tufted. Spikes about 2 cm long,
joints and pedicel filiform, as long as spikelets, ciliate, with
long hairs. Spikelets pale, 3-4 mm long, awned; callus short with
long silky hairs. Sessile spikelet with 4 glumes; lower glume
3-4 mm long, 2-keeled, margins incurved, 1-3-nerved, membranous
lanceolate-acuminate; upper glume slightly longer than the lower
glume, acuminate or aristate, lanceolate, obscurely 3-nerved; lower
floral glume 2-3 mm long, narrowly lanceolate acute, with incurved
margins, hyaline, 1-nerved; upper floral glume 2-3 mm long,
lanceolate glabrous or ciliate, 3-nerved. Pedicelled spikelet
with few or sparse hairs; gl. I 2-3-nerved, villous below, rest
similar to sessile.

Distribution in India: Western Himalaya; Jammu and Kashmir; Upper Gangetic plains; Uttar Pradesh; Indus Valley Delhi and Punjab, Plains of Assam, Western Peninsula, Karnataka and Tamil Nadu, Maharashtra.


PLATE: 156.


Perennial with a much branched rhizome. Culms up to 2 m. high, provided with numerous intravaginal branches: nodes with white shining hairs. Leaf-blades' narrowly linear, folded, glabrous; ligules membranous, sufficiently long. Panicle long exserted, dense, up to 20 cm. long, spikelets and joints densely pilose with long, white or brown silky hairs; joints and pedicels about 4 mm. long, pilose along the margins, the hairs twice as long. Sessile spikelets 3–9 mm. long, straw coloured; callus hairs longer than the spikelet. Lower glume coriaceous membranous, dorsally flattened, margins narrowly inflexed, broadly ovate-lanceolate, obtuse, apex slightly toothed, 2-keeled, the nerves of the keels percurrent; besides these there are 4 other nerves which anastamose with the nerves of the keels. Upper glume membranous, cymbiform, keeled, margins hyaline and shortly villose, ovate lanceolate, 5-nerved, the lateral nerves not per-current. Lower lemma barren, thinly hyaline, narrowly ovate, 7 mm. long, ciliolate, inconspicuously 2-nerved. Upper lemma bisexual, thinly hyaline, narrowly lanceolate, ciliolate, 7 mm. long, narrowly 2-lobed,
awned from the sinus; awn rigid, scabrid, erect, neither geniculate nor twisted, exerted from 3 to 4 cm. beyond the apex of the spikelet; palea short, narrow, hyaline, nerveless. Stamens 3; anthers yellowish, 5 mm. long.


Distribution in India: Northern Western Himalaya, Gilgit and Astor region Jammu and Kashmir up to 3000 malrtitude, Chitral, Punjab.

World Distribution: India, Pakistan.

PLATE: 151.


A perennial grass. Culms 1-2 m tall, many noded nodes glabrous or with silky appressed hairs below the panicle. Leaf-blade linear from a slightly narrow base, glaucous and scaberulous beneath and on the margins, 3.0-7.0 cm long, 8-16 mm broad, rigid, median-nerve prominent; sheath striate, glabrous margins hairy, ligule rounded, ciliate, 1-2 mm long, membranous.

Inflorescence a large panicle, erect, short, oblong, 20-25 cm, rhachis villous, primary branches solitary up to 7 cm long pedicel filiform, villous, half as long as length of spikelet. Sessile spikelet 2.5-3 mm long, lanceolate, brownish, callus
hairy, hairs 1 cm long, pale above; lower glume chartaceous below, tip acute, entire, margins inflexed below the apex, dorsally flat, glabrous, ciliate above, 1-3-nerved, 2.5 mm long; upper glume rather longer 2.5-3 mm long, acute or 2-mucronate, glabrous, margins ciliate; lower floret empty, lanceolate, ciliate, acuminate, shortly awned; palea absent; upper floret hermaphrodite, much shorter, ovate-lanceolate, glabrous, 1-nerved; lemma 2 mm long, awn 6-8 mm long; palea as long as the glume or shorter or absent. Pedicelled spikelets similar to sessile but lower glume sometimes with spinulose hairs. Caryopsis obovate; ellipsoid, brown to golden in colour, 1.5 mm long.

Fl. Sept.–Nov.

Distribution in India: North W. Himalaya; Jammu and Kashmir, Himachal Pradesh. 1500 m to 2200 m alt. North E. Himalaya; Sikkim, Khasi and Naga Hills Assam and Manipur. 1500 m to 2000 m alt.

World Distribution: India, Pakistan, Nepal, Burma, Eastern Asia.

PLATE: 152.


A perennial grass. Culms 30-60 cm, as thick as a dove's quill. Leaf-blade narrow, rigid, flat, hairy towards the base, margins scabrous; sheaths glabrous or sparsely pubescent above; ligule rounded ciliate.

Inflorescence a panicle, 10-15 cm long, sparingly branched; spikes strict, erect, appressed to the villous rhachis,
joints and pedicels nearly as long as the spikelet, glabrous. Spikelets erect; lower glume oblong-lanceolate, coriaceous below the middle, dorsally glabrous, sides with long silky hairs, tip bifid with a broad sinus, margins inflexed, keels scabrid, nerves 5 between the scabrid keels vanishing upwards, tips often anastomosing; upper glume chartaceous below the upper hyaline third, keeled, 3-nerved, margins ciliate; lower floral glume as long as upper glume, thinly chartaceous, 3-nerved, margins incurved, ciliate; upper floral glume very narrow nearly as long as lower, linear-lanceolate 1-nerved, subciliate, narrowed into a short straight awn; palea nearly equal the glume, subulate-ciliolate.

Fl. Sept.-Nov.

Distribution: Eastern Himalaya alt. 2000 m: Sikkim
World Distribution: India, only.

PLATE: 153.

Saccharum longisetosum (Anderss.) Narayanaswami ex Bor, Fl. Assam 5, 461 (1940) .Erianthus longisetosus Anderss. ex Benth. in J. Linn. Soc. (Bot.) 19, 67 (1881).

Var. Longisetosum

A perennial grass. Culms 2-2.5 tall, stout, solid, terete, reedlike, simple or branched from a stout rhizome, almost woody below, smooth and glabrous, naked below the panicle, nodes glabrous. Leaf-blade 30-100 cm long and 1.5 cm wide, glabrous except at the base, many-nerved, flat, quite smooth, lanceolate, tapering to a fine point, base, often much narrowed, margins scabrid, sheath smooth, rather loose, strongly striate, covered with
appressed tubercle-based hairs margins hyaline smooth and glabrous; ligule rounded and shortly ciliate, 1-2 mm long.

Inflorescence a panicle, 15-45 cm long. Spikes long, densely packed solitary or binate, long divided, soft drooping clothed with pale-reddish or golden-brown hairs; rachis glabrous, joints and pedicel slender, about as long as the spikelets, densely ciliate with long hairs of unequal length, 3-8 mm long pedicels slightly thickened upwards, cupped. Spikelets 4.5-5 mm long ablong lanceolate, golden brown below, pale above, bearded on the callus, disarticulating from the pedicels. Pedicelled spikelets with long hairs from the lower portion of the dorsal surface of the glumes. Sessile spikelets has 4 glumes, glumes usually glabrous; lower glume ablong-lanceolate, with broadly inflexed margins, rest of the portion chartaceous, 4.5-5 mm long, glabrous, 2-6-nerved, apex truncate or toothed; upper glume ablong-lanceolate, chartaceous, spiculate or aristulate from a notched tip, apex and margins hyaline, ciliate, glabrous, 1-3-nerved, keels smooth, shortly awned; lower floret ablong, hyaline, copiously ciliate, empty; upper floret hermaphrodite; lemma very variable in length about 3-5 mm long, very narrow, awn up to 2 cm long; palea small, hyaline, oblong-truncate.


Distribution in India : Eastern Himalayas: Khasi and Naga Hills, Assam Manipur and Tripura, north Bengal.

World Distribution : India, Bhutan, Burma, Indo-China ;

PLATE : 154.
Saccharum longisetosum Var. hookeri (Hack.) Bor, Comb. Nov. 
Erianthus hookeri Hack in DC., Monogr. Phan. 6, 143 (1839). 
Saccharum hookeri (Hack.) Narayanswami ex Bor, Fl. Assam 5, 461 (1940).

A perennial grass up to 2 m tall. Culms pubescent below, stout, smooth and glabrous, villous below the penicle, often branched below. Leaf-blade rather flaccid, 30-50 cm long up to 2.5 cm wide, linear-lanceolate, median nerve strongly marked, white, smooth and glabrous on both surfaces, margins very rough; sheath close fitted, puberulous, villous at the top; ligule rounded, ciliate, membranous.

Inflorescence a silky panicle made up of silky racemes of spikelets, 25-45 cm long, rhachis pubescent, pedicels and joints of the rhachis 3-4 mm long, ciliate on the angles, callus long bearded with long hairs. Spikes unequal; spikelets in pairs, one sessile the other pedicelled, rusty-red in colour. Sessile spikelets 5-6 mm long, oblong-lanceolate in shape, rather longer than the reddish hairs of callus; lower glume chartaceous, tip acute, two-toothed at the apex, dorsally flat, 2-keeled, keels scabrid, villous with white hairs margins inflexed above the middle, 1-2-nerved between the keels, nerves often anastomosing; upper glume oblong, chartaceous, 3-nerved, sparsally villous on the back, keel scabrid above, margins broadly inflexed above, ciliate; lower floret empty; lemma 4 mm long, oblong, hyaline, 2-lobed, margins ciliate, awned, awn brownish in colour, sub-dorsally inserted in the sinus, up to 2.5 cm long, scaberulous, filiform, palea minute, oblong-obtuse, hyaline, long ciliate, 1-2 mm long. Stamens 3, anthers 2-2.5 mm long.

Distribution in India: Upper Gangetic plains; Uttar Pradesh.
Eastern Himalaya; Sikkim, Assam and Arunachal Pradesh.

World Distribution: India, Bhutan, Burma, Eastern Asia.

PLATE: 155.

Brianthus filifolius Nees ex Steud., loc. cit. 409.

A perennial grass. Culms 60-90 cm long, rootstock woody, pubescent below the narrow panicle, nodes pubescent. Leaf-blade 20-30 cm long, rigid, narrow, glabrous, subulate or filiform, convolute below, tip capillary; sheath glabrous, ligule very short, obtuse, ciliolate, 1-2 mm long.

Inflorescence a panicle of racemes, erect, panicle 15-20 cm long, red-purple in colour, joints and pedicels about half the length of the spikelet, covered with purple-reddish hairs. Spikelets surrounded with dense white hairs, lanceolate, 4-6 mm long; lower glume of sessile spikelet membranous, acute, keels scabrid, dorsally glabrous, minutely two-toothed, margins broadly inflexed, 2-4 nerved; upper glume alike to lower glume, 3-nerved, keels smooth; lower floret lanceolate, 2-mucronulate, 2-nerved, margins inflexed, ciliate; upper floret entire or minutely two-toothed, shorter, linear-lanceolate, 1-nerved, glabrous; palea short, lanceolate, glabrous, awn much longer than the spikelet, pedicelled spikelet similar to sessile but lower glume of pedicelled spikelet 6-7 nerved.


World Distribution: India and Pakistan.

PLATE: 156.

IKELEMA


Annual or perennial, Culms slender, compressed many noded, freely branched, nodes may be glabrous or bearded. Leaf-blades narrow or very narrow; sheaths compressed, keeled, shorter than the internodes; ligules membranous or ciliate.

Inflorescence is a large panicle, about half the length of the stem, branches usually fascicled and interspersed with scarious spathe like bracts; spathe boat shaped, acute, compressed, more or less herbaecous on the back, many nerved with scarious margins, racemes fasciculiform, solitary at the apex of the stem and branches, articulate with the peduncle below the lowest spikelets. Spikelets dimorphous, sessile and pedicelled; each peduncle bears 4 pedicelled male or neuter in a regular whorl forming an involucre, around 1 or 2 sessile bisexual spikelets and 2 or 3 pedicelled male spikelets. Involuval spikelets have 3 glumes, first 2 glumes are almost similar, gl. I 3-5-nerved; gl. II 3-nerved; gl. III 1-nerved, hyaline. Lodicules cuneate, retuse. Anthers yellow, violet or red in colour. Pedicelled spikelets inside the involucre similar to those of involuval. Sessile spikelet lanceolate, bisexual or female, glumes 4, awned, gl. I narrow truncate, gl. II keeled, gl. III hyaline; gl. IV reduced to membranous base of its awn.
Index to distribution of Species of Genus Iseilema Map No. 3.

1. *I. antheboroides.*
2. *I. holei.*
3. *I. hubbardii.*
4. *I. laxum.*
5. *I. prostratum.*

...
MAP 4. DISTRIBUTION OF GENUS ISEILEMA ANDERSS IN INDIA
Key to the species

A. Tubercles present on spatheoles, keels or on the margins of involucral spikelets.

B. Perennials, nodes bearded, beak shorter than the lower elliptic portion.

C. Panicle long, leafy, leaves linear-oblanceolate, clusters of spikelets not in dense fascicle of spathe and spatheoles a slender grass, 40-100 cm tall.

1. *I. prostratum*

CC. Panicle short, without leaves, leaves linear-lanceolate clusters of spikelets in dense fascicle of spathe and spatheoles, a robust grass, 60-120 cm tall.

2. *I. holei*

BB. Annuals, nodes glabrous, beak longer than the lower elliptic portion.

D. Pedicelled spikelets present, lower floret empty.

3. *I. venketeswarulii*

DD. Pedicelled spikelets absent or much reduced, lower floret absent.

4. *I. hubbardii*

AA. Tubercles not present on spatheoles, keels or on the margins of involucral spikelets.

E. Panicle slender, lax; involucral spikelets 4-6 mm long, weakly nerved, pedicel slender, terete.

5. *I. laxum*
EE. Panicle not slender, crowded, leafy; involucral spikelets 5-6.5 mm long, strongly nerved, pedicel harder, firmer and flattened.

6. I. anthephoroides


A perennial grass, tufted, very leafy. Culms prostrate, red in colour, rooting at the base ascending 40-120 cm long, nodes bearded. Leaf-blades very slender, 5.5-8.2 cm long 5-6 mm wide, linear, acute, margins scabrid; sheaths lax with tubercle based hairs; ligule short, truncate, membranous or ciliate.

Inflorescence a panicle, long, occupying half the stem or more, very leafy, linear-oblanceolate, more or less compound, erect, branches crowded, rachis bearded at the nodes; spathes and spatheoles tubercled on keels and margins, spatheoles divergent, 6-8 mm long, linear-lanceolate, keels and margins tubercled. Involucral spikelets male or neuter, 2-3 mm long, pedicellate, oblong-lanceolate, green or violet, glumes 2, lower involucral glume sub-acute, 5-nerved, scaberulous on the back; upper involucral glume glabrous, margins infolded, 1-nerved, anthers 1-2 mm long. Sessile spikelets sometimes 2, callus bearded;
lower glume flat, 2-nerved; upper glume scaberulous on keel;
lower floral glume linear, hyaline, truncate, elliptic-lanceolate,
glabrous, male or barren; upper floral glume an awn, awn 6-8 mm
long, glabrous. Pedicelled spikelets 2-6 mm long, pedicel 4-6 mm
long, bisexual; lower glume acute; obscurely 4-nerved; upper
glume elliptic-lanceolate, acute or sub-obtuse, keeled on the
back, 3-nerved, glabrous; lower floral glume 0, upper floral
glume an awn, 6-8 mm long, glabrous.


Distribution in India: Gangetic plain, Siwalik ranges of
Himalayas, Vindhyan and Satpura ranges, plains of Punjab,
Rajasthan, Gujrat and South Penninsular region, Western Ghats and
Nilgiri hills ascending up to 1,300 m. Throughout in India.

World Distribution: India and Sri Lanka.

PLATE: G


A robust plant, 100-120 cm high. Culms compressed,
polished, devicely bearded at the nodes. Leaf-blades erect, 15-20
cm X 2-3 mm in size, glaucous beneath, glabrous or villous near
the base, margins scabrid; sheaths with prominent keels, mouth
ciliate; ligule short, truncate, hairy. The inflorescence a
panicle, panicle without leaves, branches erect, with fascicle of
spathe, spatheoles and small subsessile clusters, spatheoles
5-7 mm long, red in colour, tubercled on keel, peduncle about 2 mm
long, smooth, tip saucer shaped, clusters villous at the base, red
in colour. Involucral spikelets narrow, elliptic-oblone, 2-4 mm
long, pedicel slender, 1-2 mm long, acute, glumes-2; lower invol.
glume 3-nerved, margins broadly inflexed; upper invol. glume about 9-nerved, keels granulate, margins inflexed. Sessile spikelets 3-4 mm long lanceolate or linear lanceolate, callus bearded, gl. I narrowly lanceolate, keels scabrid, 4-nerved, margins inflexed, gl. II polished, acuminate, 3-nerved, gl. III linear, hyaline, truncate, minutely denticulate, gl. IV bifid, 1 - 2 mm long, awn very slender, pores near the base, 4-8 mm long, smooth. Stigma feathery. Grain ellipsoid brown, 2 mm long.

Fl. Oct.-Nov.

Distribution in India: Vindhyan and Siwalik ranges, found in forests of Palamau hills, Bihar, Forests of Balaghat and Bastar, Madhya Pradesh.

World Distribution: India (endemic).

PLATE 157.


Annual, prostrate, rooting at the nodes, 30-40 cm tall, Culms round, purple or white. Leaf-blades narrowly broad with prominent mid rib, base eciliate, 2 - 4 cm long and 3-4 mm broad, Sheaths crowded, glabrous, ligule membranous, truncate, 1 mm long.

Inflorescence a panicle. Involutural spikelets 6.5 - 7.5 mm long X 1.25 - 1.5 mm wide, oblong-acute, markedly umbonate at the base, pedicels 1.25 mm long and 1 - 1.25 mm wide at the apex, densely ciliate on the outer margins. Stamin 3 mm long, Central spikelets almost sessile, 5.5 mm long of which 3.5 mm are elliptic and remainder beak, in some racemes, beak longer than lower elliptic portion; lower and upper glumes similar in nervatio
and indumentum to those of *I. hubbardii*, lower floret empty; upper floret female; lemma 4 mm long, very narrow; produced into a perfect awn, palea a hyaline scale; 4 mm long. Pedicelled spikelet present; glumes 5.5 mm long, anthers present, pedicel 4 - 4.5 mm long.

Related to *I. anthophoroides* and *I. hubbardii* but differs in the relative lengths of involucral spikelets and the central hermaphrodite spikelet.

Fl. Sept.- Nov.

Distribution in India: Penninsular region of Andhra Pradesh. Reported from Guntur district.

Fl. Oct.- Nov.

World distribution: Endemic in Andhra Pradesh, India.

PLATE: 158.


Annual, prostrate, rooting at the nodes, 25- 40 cm tall. Culms rounded, purple or white. Leaf-blades narrow, broad at the base, prominent mid-rib, base eciliate, 2-4 cm long and 3.4 mm broad; sheaths crowded, glabrous, ligule membranous, truncate, 1 mm long.

Inflorescence a panicle involucral spikelets 7 mm long, 1.5 mm wide, oblong- lanceolate, somewhat acuminate, pedicel 1.25- 1.5 mm wide below the spikelet, ciliate on the margins; stamens 3,
anthers 3 mm long. Central spikelet stipitate, 7-8 mm long of which 3 - 5 mm from the beak, stipe 1 mm long, pilose at the tip; lower glume elliptic-oblong in the lower half, rigid on the dorsal surface, rounded on the margins, appressed hairy towards the base of the beak, pilose on the margins, 7-nerved; upper glume similar in shape, 3-nerved, both narrowed into the beak; lower floret absent; upper floret female, lemma 4 mm long, very narrow, produced into a perfect awn, palea a hyaline scale, 4 mm long. Grain elliptic in nature, dorsally compressed, embryo 3/4 the length of the grain, awn 13 mm long, column twisted, chestnut 9 mm long, bristle straight, scabrid, pedicelled spikelets consists of reduced scales seated on very slender pedicels.

Allied to *Iseilema antheporoides* Hack. but differs in the length of involucral spikelets and their pedicels and in the extreme reduction of the inner pedicelled spikelets to rudimentary scales.

Fl. Sept.- Nov.

**Distribution in India**: Vindhyan and Malwa regions, Madhya Pradesh, upto 1000 m

**World Distribution**: Endemic in India

**PLATE**: 62.

*Iseilema laxum* Hack. in DC., Monogr. Phan. 6, 682 (1889).

Perennial grass. Culms tufted, branched at the base, erect, slender, glabrous, 32-90 cm long, nodes glabrous. Leaf-blades linear, obtuse, glabrous, ciliate at the base, 2.5 - 9 cm
long, 3 - 4 mm broad, green in colour sheaths glabrous, shorter than the internode, ligule short, membranous, ciliate, 1 mm long.

Inflorescence a narrow panicle, slender, lax, long bearing clusters of spikelets covered by spathes. The outer spathe narrow-lanceolate, glabrous; inner spathe smaller than outer, lanceolate with membranous margins, not tubercled.

Spikelets dissimilar, each cluster of spikelets having involucral of 4-pedicelled spikelets forming a true whorl around 2 involucral spikelets are male, pedicelled and sessile, narrow, 3 pedicelled and 2 sessile spikelets, oblong-lanceolate, acute, pedicels short, flattened, bearded at the base. Glumes 3, gl. I oblong-lanceolate acute, 5 - 7-nerved, keeled, ciliate, gl. II sub-chartaceous, equal or shorter than gl. I acute, glabrous, 3-nerved, gl. III hyaline, narrow or linear, toothed at the apex. Sessile spikelets are female, rarely bisexual, narrowly-lanceolate, 8 mm long, glabrous; glumes 4, gl. I lanceolate, chartaceous or bifid at the apex, 5-nerved, with long hairs or glabrous, margins scaberulous at the tip about one third the length of the glume, gl. II lanceolate, acuminate, chartaceous, glabrous, 3-nerved, gl. III hyaline, nerveless, sometimes wanting, gl. IV an awn about 2 cm long. Pedicelled spikelets found inside similar to involucral spikelets, 2 - 4 mm long, slender, acuminate, gl. III is very narrow, linear 3-nerved and scaberulous.

Fl. Aug.- Nov.

Distribution in India: Gangetic plains; Vindhyan and Satpura ranges; South Penninsular region, Western Ghats, Plains of Bengal and Assam.

World Distribution: India, Burma, Sri Lanka, Australia and New Zealand.

PLATE: 60.
**Iseilema anthephoroides** Hack. in DC., Monogr. Phan. 6, 683 (1889).

A perennial grass. Culms slender, tufted, ascending, freely branched, nodes glabous, Leaf-blades narrowly broad with conspicuous mid rib, base not ciliate, 6-10 cm long, 3-4 mm broad; sheaths crowded, glabrous; ligule membranous, truncate, 1 mm long.

The inflorescence is a panicle, crowded, leafy, racemes divergent. Spikelets dissimilar, compressed with boat shaped spathes covering the peduncle, spathes and spatheoles with or without tubercles. Spikelets are of two kinds, sessile and pedicelled, each peduncle bears 4-pedicelled male or neuter spikelets with an involucre around it one or two sessile bisexual spikelets and 2 or 3-pedicelled male spikelets are present. Involucral spikelets 2.4 cm long and 4 mm broad; glumes 3 or 2, lower involucral glume oblong-lanceolate, 3-5-nerved, upper involucral glume lanceolate, thin, 3-nerved, glabrous having hard pedicel thickly bearded, lodicules cuneate, anthers violet in colour. Pedicelled spikelets similar to involucral spikelets, hermaphrodite. Sessile spikelets lanceolate or linear-lanceolate.

Glumes 4, gl. I elliptic-lanceolate, apex long narrow strips, truncate sparsely ciliate at the margins, 3-nerved; gl. II shorter, lanceolate, acuminate at the apex, hairy on the back, gl. III hyaline, short, oblong, apex broad and irregularly toothed, nerveless. gl. IV is an awn, 2 cm long.


**Distribution in India**: Gangetic plain, Siwalik ranges of Himalayas, Vindhyan and Satpura ranges, plains of South and Western Ghats, ascending up to 1000 m. Throughout in India.

**World Distribution**: India only.

**PLATE**: 59.

The tall robust grasses with polished culms and node, with large inflorescence. Leaves long, narrow. The racemes are supported by spathes, at the top of the peduncle is a whorl involucral spikelets which may be on the same level or on the different levels. Inside the whorl of involucral spikelets which incidentally are male or neuter, are the sessile fertile spikelet or spikelets accompanied by 1 or 2 pedicelled spikelets. Spikes many, short, crowded in spatheous panicle fascicles each in proper spathe, very shortly peduncled, inarticulate at the base. Spikelets 6-11, 4 lowest male or neuter, involucriform, awnless in superposed pairs or whorled around a jointed rachis which bears one or more sessile bisexual or female, usually awned, each with one or if more than one, then the uppermost with pedicelled male or neuter awnless spikelets inserted on its callus. Bisexual spikelets linear-oblong; callus long or short gl. I terete or dorsally compressed or channelled, coriaceous, at length hardened, margins incurved, not keeled; gl. II as long coriaceous, 3-nerved, 1-broad keeled, margins thin, incurved; gl. III oblong, hyaline, 1-nerved; gl. IV the very slender, sometimes narrowly hyaline base of an awn, rarely awnless; palea 0. Lodicules cuneate. Stamens 3. Styles free, stigma long. Grain oblong. Pedicelled spikelets lanceolate, dorsally compressed, pedicel slender, compressed; glumes 3. gl. I many nerved, margins
Index to distribution of Species of Genus Themeda Map No. 4

1. T. anathera.
2. T. arguensis.
3. T. arundinacea.
4. T. caudata.
5. T. cymbaria.
6. T. hookeri.
7. T. huttonensis.
8. T. x intermedia.
10. T. longispathae.
11. T. mooneyi.
12. T. quadrivalvis var. quadrivalvis.
13. T. quadrivalvis var. helberi.
15. T. strigosa.
16. T. x subsericans.
17. T. tremula.
18. T. triandra.
19. T. villosa.
20. T. decruzii.

...
MAP 5. DISTRIBUTION OF GENUS THEMEDA FORSSK IN INDIA
Key to the Species

1. Pairs of involucral spikelets inserted at different levels.

2. Involutural spikelets entirely glabrous or puberulous but without tuberole-based hairs.

3. Involutural spikelets puberulous with very short hairs on the lower glume.

4. Fertile spikelets with an imperfect awn or awnless.

T. villosa

4. Fertile spikelets with a well developed awn.

5. Involutural spikelets 10-15 mm long; false racemes 2-3 together.

T. caudata

5. Involutural spikelets 20-22 mm long; false racemes solitary.

T. longifolia

6. Involutural spikelets entirely glabrous.

6. Inflorescence of a solitary compound raceme terminating the unbranched culm.

T. samblica

6. Inflorescence of few to many compound racemes.

7. Inflorescence usually very large; involucral spikelets 4-6 mm long.

T. cyperina

7. Inflorescence simple of few racemes; involucral spikelets 12-19 mm long.

T. hookeri

2. Involutural spikelets covered on the lower glume with numerous or sparse tuberole-based bristles.

8. Sessile spikelets not awned.

9. Robust tall grass; involucral spikelets 10-12 mm long, covered with golden hairs; sessile spikelets dark brown, 0 mm long.

T. x intermediaria

9. Weak erect grass with small spikelets.

10. Involutural spikelets 4.5-8 mm long, peduncles 1.5 cm long, covered with grey hairs; sessile spikelets 5 mm long.

T. aesthosa

10. Involutural spikelets 6-8 mm long, peduncles 17-30 cm long, glabrous; sessile spikelets 6.5-7 mm long.

T. decrustata
2. Sessile spikelets awned.

11. Racemes less than 1.5 or long.
12. A wiry, bushy, low grass; involucral spikelets 10-11 mm long; hermaphrodite spikelets usually two. *T. huttonensis*

13. An erect unbranched grass; involucral spikelets 8 mm long; hermaphrodite spikelets only one. *T. triandra*

11. Racemes much more than 1.5 cm long.
13. Tall robust grasses with nodding panicles and tule-style-based golden hairs on the lower glumes of the involucral spikelets; awns stout.
14. Awns with a column 3.75-7 cm long; involucral spikelets 13-20 mm long. *T. sournicas*

14. Awns with a column 2.5 cm or less long; involucral spikelets 11-12 mm long. *T. subserricans*

13. Weak but not wiry, bushy grasses or if robust the hairs on the lower glumes of the involucral spikelets always grey; awns slender.
15. Pedicels of the racemes up to 5 cm long; racemes solitary; inflorescence simple. *T. moneyi*

15. Pedicels of the racemes less than 1 cm long; racemes more or less glomerulate; inflorescence compound. *T. treula*

1. Pairs of involucral spikelets inserted at the same level.

16. Spikelets arranged in large flabelliform clusters, 4-5 cm long excluding awns; awns 5-7 cm long. *T. arguens*

16. Spikelets arranged in much smaller clusters; awns much shorter. *T. triandra*
17. Panicle very loose, leafy; awn about 3.5 cm long.  

\[ T. laxa \]

17. Panicle more or less densely congested, not leafy.

18. Lower glumes of involucral spikelets very densely strigose all over.  

\[ T. strigosa \]

18. Lower glumes of involucral spikelets not densely strigose but with tubercle-based hairs mostly towards the tip.  

\[ T. quadrivalvis \]

19.a. Robust grass; lower glume of the hermaphrodite spikelet glabrous along the middle line.  

\[ \text{var. quadrivalvis} \]

19.b. Dwarf grass; 30-45 cm tall, lower glume of the hermaphrodite spikelet strigulose on the back.  

\[ \text{var. helferi} \]

...
inflexed, keels winged; gl. II as long as gl. I, 1-3-nerved, hyaline; gl. III smaller or absent.


A perennial grass. Culms tall, tufted, very stout; up to 20 cm tall, smooth glabrous, polished, solid, very leafy. Leaf-blades 25-40 cm long, linear-lanceolate, tip narrow, glabrous or scaberulous on both surface, mid-rib white with prominent nerves on lateral side, margins somewhat thickened and scabrid; sheath strongly keeled below, auricled at the mouth, glabrous, ligule membranous, short 1-2 mm long, shortly ciliate.

Inflorescence very large, leafy decompound panicle, branches and branchlets glabrous or scaberulous, spathes and spatheoles boat shaped, keeled, 2.5-4 cm long, many-nerved, scabrid on the keel. Spikes erect or divaricate, peduncles terete, 1-1.5 cm long, villous at the top. Involucral spikelet 1-1.5 cm long, glabrous smooth or scaberulous, four paired, male inserted at different levels; lower glume lanceolate, 1-1.5 cm long, many-nerved, 2-keeled, keels scabrid, narrowly winged, margins inflexed, hirsipid, ciliate on the margins; upper glume shorter than the lower glume, hyaline, 3-nerved, margins ciliate, nerves scaberulous or
shortly hairy; lemma 1 cm long, lanceolate, ciliate on the margins; palea narrow, ciliate., stamens 3, anthers 4-5 mm long. Sessile spikelets 2, 7-8 mm long; callus densely hispid with short brown hairs; lower glume 6-7 mm long, oblong-lanceolate; truncate, margins inflexed, keels rounded, densely covered with short brown hairs, 7-8-nerved; upper glume 7-9 mm long narrowly lanceolate, 3-nerved, tip obtuse, densely hairy on the dorsal surface; lower floret barren; lemma 5-6 long, lanceolate hyaline; palea minute; upper floret bisexual; lemma lanceolate, acute 6-8 mm long, hispid on the keel, awn a stout, 7 mm long or may be absent. Pedicelled spikelets male, 3 mm long, ciliate hispid with brown hairs; lower glume narrowly lanceolate, acuminate, 10-15 mm long, 12-13-nerved, nerves scabrid, sparsely hairy on the dorsal surface; upper glume 5-nerved, ciliate on the margins in upper half, 8-10 mm long, aristate; lemma 7-8 mm long, hyaline, ciliate on the margins, palea short hyaline obtuse stamens 3, anthers 4-5 mm long.


Distribution in India: Plains of Western Himalayas; Uttar Pradesh, Eastern Himalayas; Bengal (north), Assam, Manipur, Tripura, Arunachal Pradesh, Nagaland, Meghalaya, Mizoram.


PLATE: 159.

Themedia caudata (Nees) A. Camus in Lecomte, Fl. Gen. de l'Indo-chine 7, 364 (1922). Androscopia gigantea. Var. armata Anderss. in

A tall grass about 2-4 m high. Culms flattened, greenish yellow. Leaf-blades linear, tapering to a fine point, very long about 1.6 m long and 3-16 mm broad, midrib broad, flat, surface glabrous, rough, glaucous below, margins scabrid; sheaths smooth, striate, glabrous; ligule narrow of ciliate ring, convex upwards.

Inflorescence a panicle, lax-fid, leafy, subsimple, branches and branchlets decompound, glabrous. Spikes with very large spatheoles on slender peduncles, half as long as the spatheole, slender, long, pilose upwards, spatheoles 3.5-6 cm long, acuminate, many-nerved, glabrous. Involucral spikelets 4-6 mm long in unequal pairs, one pair with long callus than the others, one empty the other staminate; lower glume long, subulate, sub-aristate, margin of one side inflexed, keel scantily ciliate and scabrid, flat, scaberulous on back, about 9-nerved; upper glume about 3/4 of the length of the lower glume, 3-nerved with an additional nerve on the margin, scaberulous, gl. III and gl. IV sub-similar, ciliate, hyaline; anthers 3-5 mm long. Sessile spikelets 2, densely-brown, bearded, ultimate pungent callus falling with its joint. Pedicelled spikelets; lower glume coriaceous, nearly covering the upper glume, 4- nerved upper glume with hirsute keel, margins involute, coriaceous, gl. III and IV as long, thin, brownish-hairy; lodicules very large, oblong-lanceolate, 2-cuspidate. Grain free oblong brown 3-4 mm long.
Fl. Sept.-Nov.

**Distribution in India**: North West Himalayas; Himanchal Pradesh, Uttar Pradesh, North East Himalayas; Sikkim, North Bengal. Plains of Assam. Chota Nagpur; Bihar and Orissa up to 1250 m.

**World Distribution**: India, Nepal, Bhutan, Eastern Asia, Malaya Peninsula, Indochina, Malesian Islands, Africa.

**PLATE**: 63.


A perennial grass. Culms, 2-4 mm long, nearly 2.5 cm in diameter below, erect solid, terete, glabrous, simple below branching above, leafy. Leaf-blade, 1.2 m-2.4 m long by 1.5-2.5 cm broad, linear setaceously acuminate, glaucous beneath, smooth, margins scabrid, base narrowed, madrib broad; sheaths compressed, glabrous, ligule short, membranous, ciliolate.

Inflorescence a broad, compressed panicle, branches scaberulous, spikes often pendulous; spathes narrowly cymbiform, keel and nerves scabrid. Spike as long as the proper spathe or shorter; peduncle much shorter than the spathe, filiform, erect or divaricate. Involutrcl spikelets about 2 cm long, lower involucral glume linear-lanceolate, setaceous acuminate, glabrous or hirsute with fulvous hairs, keels scabrid; upper involucral glume shorter, acuminate ciliate; lemma and palea still shorter, linear-oblong or lanceolate, ciliate. Bisexual spikelets 1-1.5 cm long, linear-lanceolate; callus 4-5 mm long with long brown hairs; lower
glume coriaceous, acute or acuminata, dorsally 1-3-nerved, more or less villously hirsute all over or below the middle with brown hairs, acute in the awnless spikelets obtuse in the awned; lower floral glume; lemma oblong-lanceolate; palea similar to lemma in length, linear-lanceolate in awnless spikelets, acute, 1-nerved in the awned; upper floral glume hyaline base of the awn.


Distribution in India: Himalayas, from Jammu & Kashmir to Assam.

World Distribution: India only. No material at kew.

PLATE: 16B.


Perennial grass, slender, root woody. Culms up to 30 cm high, slender, terete, smooth and glabrous, simple not branched, at the base covered by the tall slender pilose sheaths, leaves mostly dustered at the base. Lower leaf-blades linear-acuminate, narrowed to a strong apex, up to 6 cm long, 2.5 - 3 mm wide, glabrous below, above beset with long white hairs arising from tubercules especially at the margins, very minutely scabrous on side; upper leaf-blades short or vestiginal, erect; sheaths closely embracing the culm, shorter at the nodes, keeled, glabrous, smooth; the lower sheath very short, pilose between the nerves; ligule very short, 1 mm long, membranous, ciliate on the upper margin.

Inflorescence a raceme, solitary; spikelets in two pairs, lower homogenous; upper heterogenous, with male terminal spikelet forming a trio; peduncle 5 cm long, glabrous, very slender coming out of the spatheiform sheath. Involutural spikelets arranged in alternate pairs, one pair of unequal length, 1.3 - 1.5 cm long, other is 1.1 cm long; lower glume 1.1 - 1.5 mm long, obliquely
elliptic- acute, flat or slightly convex on the back, many-nerved, 2-keeled, narrowly winged by the keels, very glabrous, smooth, purplish or green; upper glume shorter than lower by three times, hyaline, 3-nerved, smooth, ciliate on the margins; lower spikelet male; lemma hyaline, ciliate on the margins, palea of equal length but narrower; stamens 3-anthers 3.5 -4 mm long. sessile spikelet with callus 2 mm long, very sharp ,pointed, somewhat curved, glabrous in front, bearded on side and behind densely, 7.5- 8 mm long ,terete, slightly compressed; lower glume flattened, oblong-truncate, covered with short brown dense hairs, coriaceous, 5- nerved, minutely scabrous on the back, margins scabrous at the apex, green then dark brown; upper glume oblong- truncate membranous; lower spikelet empty; lemma triangular. hyaline, 4 mm long; palea absent; upper spikelet female; lemma aristate at the base with very strong bristles, hyaline, 3 cm long, column 2 cm long, brown, twisted, scabrous; styles 2; stigmas plumose; anthers absent. Pedicelled spikelets; pedicel 2.5 mm long, slender compressed; lower glume 1 cm long, elliptic, acute, many-nerved, rounded on the sides, ciliate on the margins; upper glume about 9 mm long, 3-nerved, rounded on the back, ciliate on the margins; lower lemma hyaline; palea 0; upper lemma hyaline, short; stamens 3; anthers 3.5 -4 mm long.

To be compared with Themeda hookeri (Griseb) A.Camus, but easily distinguished from it and all other species by the single raceme and the unbranched culms.


Exsicc. Type at kew (Mooney 4241).
Distribution in India: Endemic in Koraput district, Orissa. Found growing in shallow pockets of soil overlying granite-gneiss.

World Distribution: Endemic in India

PLATE: [61]

Themeda cymbaria Hack. in DC., Monogr. Phan. 6, 663 (1839).

Anthistina cymbaria Roxb. in Fl. Ind. 1, 255 (1820). Syn.

Andropogon cymbarius Linn.

A perennial grass. Culms 1-3 m high, as thick as a swan's quill below, puberulous beneath the nodes, internode long, erect, branched, smooth. Leaf-blades 100-120 cm long and 10-15 mm wide. Linear, finely pointed, scaberulous above, glaucous beneath, margins scabrid; sheath 3-4 cm long, compressed, keeled, smooth, usually bearded at the mouth, ligule very short, reddish, membranous glabrous.

Inflorescence a large panicle, 40-90 cm tall, decompound, thyrsiform, branches smooth or scaberulous. Spikes in oblong fascicles, 4-8 mm long, proper spathe 10 mm long, linear-lanceolate, boat shaped, acuminate, pointed, glabrous or with hairy margins. Involucral spikelets red or blueish, keels scabrid, glabrous; lower glume 2-4 mm long, glabrous with minute tubercles, apex hispidulous, awn 2-3 cm long. Pedicelled spikelets with glabrous pedicel. Bisexual spikelets solitary, sub-sessile linear-oblong, callus short, bearded with white hairs, lower glume 6-8 mm long, dorsally convex awn 6 mm long, slender, smooth.

Fl. Oct.-Nov.
Distribution in India: Western Peninsular region; Tamil Nadu, Kerala, Karnataka, Maharashtra up to 2000 m. Plains of Gujrat and Rajasthan.

World Distribution: India and Sri Lanka.

PLATE: 162.


An annual or perennial grass. Culms slender, simple or sparingly branched above, 30-60 cm long, creeping at the base, erect or geniculately ascending as thick as crow-quill. Leaf-blade very narrow, smooth, subglaucescent beneath, tips filiform; sheath smooth; ligule short, ciliate 1 mm long.

Inflorescence simple of few racemes. Spikes erect, spathes laterally compressed, peduncle 2.5-5 cm long, filiform, proper spathe linear-lanceolate, acuminate, rhachis of the spikes usually exceeding the involucral spikelets and proper spathe, rarely glabrous. Involutural spikelets in pairs, inserted at different levels, 13-19 mm long, glabrous, keels smooth, narrowly winged. Bisexual spikelets solitary, pungent, lower glume densely villous with brownish hairs, upper glume scabrid towards the tip; awn geniculate, narrowed below; lodicules membranous. Pedicelled spikelets longer than the bisexual spikelets, narrowly-lanceolate, acuminate, glabrous, keels scaberulous, pedicels slender, glabrous except at the base.

Fl. Aug.-Nov.

Distribution in India: Eastern Himalayas; Sikkim alt. 2000 - 3000 m.

World distribution: Endemic in India.

PLATE: 63.
Themeda × intermedia (Hack.) Börn in Indian For. Res. (Bot.) 1, 3, 96 (1936). Th. gigantea subsp. intermedia var. intermedia Hack. in DC., Monogr. Phan. 6, 675 (1889).

A very tall grass up to 5 m high. Culms smooth and polished, glabrous, solid, about 1.5 cm thick, Leaf-blades almost petiolated, mid rib very broad and grooved on the upper surface at the base, up to 1 m long, by 1.5 cm wide, scabrid on the margins and on both surfaces, glabrous; sheaths strongly keeled in the upper half, rather loose, striate, smooth and glabrous, ligule membranous.

Inflorescence a long panicle, racemes peduncled, spikelets arising from spatheoles. Involucral spikelets inserted at different levels, oblong-lanceolate, acuminate, tip oblique; lower glume about 13 mm long with slightly inturned margins, many-nerved, numerous tubercle-based hairs on the back; upper glume 10-14 mm long, 3-nerved, membranous, scabrid on the dorsal surface in the upper half; lower lemma hyaline, 1-nerved, 10 mm long, epaleate; upper lemma similar to lower lemma. Stamens 3. Sessile spikelets 1 cm long including callus bearded with brown hairs, oblong-acute; upper glume glabrous on the margins, almost similar to lower glume; lower lemma hyaline, upper lemma with a short bristle or awnless. Pedicelled spikelets like the involucral, pedicel 2-3 mm long.

This "species" is a putative hybrid between Themeda arundinacea (Roxb.) Kidley and Th. villosa (Poir) A.Camus. in which the awn is missing.

Fl. Sept.-Nov.
Distribution in India: Eastern Himalayas; Khasi and Jaintia Hills, Tripura, Manipur and Assam up to 1,200 m.

World Distribution: India, Burma, Malesian Islands, Philippines, New Guinea, Pacific Islands.

PLATE 164.

Themeda anathera (Nees) Hack. in DC., Monogr. Phan. 6, 669 (1839).


A perennial, tufted grass. Culms erect, 40-120 cm tall usually decumbent at the base, slender, subcompressed glabrous, smooth and polished. Leaf-blades very narrow, 20-30 cm long, 2-4 mm broad, rigid, erect, glaucous, margins and upper and lower surface scaberulous; sheaths glabrous, subcompressed, keeled; ligule oblong, obtuse, 2 mm long membranous.

Inflorescence a panicle, lax, 60-80 cm long, narrow, glabrous, branches solitary or in pairs, the primary branches elongated, sub-erect, many noded, nodes distant; spathe 2 cm long, linear-lanceolate, acute, compressed, keels scabrid, margins scariosus, green shorter than the racemes, peduncle of the racemes 1.5 cm long capillary racemes 1-2 cm long, oblong, much imbricate hairy, green or reddish, joints 1 mm long, spikes glabrous. Involucral spikelets in pairs, inserted at different levels, 1 mm long; lower glume scabrous above, keels with long tubercle based hairs, upper glume as long as the lower, 3-nerved, ciliate on the margins; lemma
shorter, hyaline, palea 3 mm long, ciliolate. Sessile spikelets 6-7 mm long, linear-lanceolate, yellowish-white below, reddish-purple above; lower glume acute, entire, margins narrowly inturned below the apex, ciliate on the keels, involute below, scabrid above, smooth below, 5-nerved; upper glume lanceolate, acute, 3-nerved, scabrid on the keel, margins hyaline, ciliolate, 6-7 mm long; lower floret empty; lemma 4 mm long, hyaline; upper floret bisexual, upper lemma shorter than the lower lemma, linear, obtuse, muticus, awnless. Pedicelled spikelets similar to the involucral but without tubercle-based hairs on the keels.

Fl. Sept.-Nov.

Distribution in India: Western Himalayas up to 2500 m high; Jammu and Kashmir, Himachal Pradesh, Plains of Punjab, Delhi, Uttar Pradesh.

World Distribution: India, Pakistan, Nepal, Western Asia.

PLATE: 165.


A perennial grass. Culms up to 120 to 130 cm, very slender, completely glabrous and smooth, polished geniculately ascending, branching at every node, branches erect, nodes- tumid and pruinose; internodes solid, glabrous, polished and completely round; leaf blade 35-40 cm long, 0.4-0.6 cm wide, leaves linear acuminate, ciliated at the base; ligule membranous or chartaceous, 0.2 cm long; sheath compressed, smooth, glabrous and clasping on the culm halfway.

Panicle elongate, very narrow, occupying about half the culm with sparse racemes of spikelets issuing from the spatheole which turns brownish at maturity; racemes consisting of the usual four homogamous involucral spikelets surrounding a sessile and
pedicelled spikelet. The involucral spikelets are in pairs and situated at different level, involucral spikelets completely glabrous; peduncle 1.7 to 2.0 cm long, capillary; raceme 1.6 to 2.0 cm long, oblong, imbricate, glabrous, green, brownish, joints between the hermaphrodite spikelets 0.15 to 0.20 cm long.

Involucral spikelets 6.3 mm long, lower glume scabrous above, 7-9-nerved, upper glume boat shaped, papery and 1-nerved, 6-8 mm long; lemma hyaline and 7 mm long while palea 6 mm long; sessile spikelet 6.5 to 7 mm long, linear, lanceolate, lower glume, acute, entire, ciliated on the keel, distinct 7-nerved, 7 mm long; upper glume lanceolate, acute, one nerved, smooth on the keel, margins hyaline 7 mm long. Upper floret bisexual, lemma lanceolate and ciliated on the upper half and 5.5 mm long; palea very narrow, chartaceous, 4.5 mm long; pistil usually one and sometimes two in the hermaphrodite spikelet. Stigma plumose, bifid; ovary superior; lodicules two.

Pl. Sept.-Nov.

Distribution in India: Western Himalayas up to 2500 m alt. Mussorie (UP)

World Distribution: Endemic in India only.

Themeda huttonensis Bor in Indian For. Rec. (Bot.) 1, 3, 95 (1933).

A perennial grass, 60-100 cm tall. Culms slender, sub-terete or compressed, 2-keeled, smooth and glabrous, much branched, branching from each node in upper part. Leaf-blades linear, acuminate, rounded at the base, 20 cm long and 8-10 mm broad, glabrous on the lower surface, scabrid on the margins with tuberole-based bristles; sheaths loose, strongly compressed and keeled, contracted towards the top; ligule membranous, convex upwards, very narrow, 1.5 mm long.

Inflorescence a panicle, very leafy, very lax and loose, ultimate spatheoles 2.5-3 cm long with a minute limb, scabrid on the margins, compressed, cymbiform, glabrous, lanceolate-acuminate;
racemes solitary peduncle 1 cm long, glabrous, usually with
2- fertile florets, seated in an involucre of 4-homogamous spikelets
and with 2-pedicelled spikelets to each sessile. Fertile spikelet
with callus 5-6 mm long, callus acute, densely bearded, pedicel
2 mm long, glabrous, obliquely articulated; lower glume chartaceous,
oblong-truncate, 11-merged, smooth and shining in the lower quarter,
scabrid on the top, margins strongly involute, upper glume chartaceous,
margins involute, linear-oblong, tip truncate, 4-nerved,
one central and three marginal glabrous; lower floret empty; lemma
linear-lanceolate, 4-5 mm long, margins slightly involute, ciliate
on the margins, hyaline-nerveless; upper floret hermaphrodite;
lemma 1-nerved, hyaline, forming the base of a stout, scabrid awn
about 2.5 cm long; palea absent or minute hyaline scale; lodicules
2, large, oblong, scaley-ever glabrous. Involucral spikelets
11-12 mm long, inserted at different levels, oblong-lanceolate to
linear-lanceolate, persistent; glume, subequal in length; lower
glume convex on the back with a few tubercle-based hairs, 2-keeled
near the margin, narrowly winged on the keel, margins narrowly
involute, many nerved; upper glume membranous, narrowly ovate-
lanceolate, acuminate, 3-nerved, margins involute and ciliate in
the upper half. Pedicelled spikelets falling from the pedicels with
a shortly bearded callus, similar to the involucral spikelets but
glabrous and narrow, lower floret; lemma 6.5 mm long, hyaline,
1-nerved, margins involute, ciliate on the upper half; upper
floret; lemma linear-ob lanceolate, contracted in to a very short
bristle.

Distribution in India: Endemic in the Naga Hills, Assam, where it occurs in tufts on the slopes above the Tizu river.

Exsicc - N.L. Bor 6704, 6717, Naga Hills.

Note: Original specimen not seen

World Distribution: Endemic in India only.

**Themeda triandra** Forssk., Fl. Aegypt.-Arab. cxii et 173 (1775).


A perennial grass. Culms robust, erect or geniculately ascending 140-160 cm long, rounded or slightly compressed, glabrous, leafy, branching basically. Leaf-blades linear, rounded at the base, acuminate or slightly obtuse, rigid sheaths compressed, keeled, 6-7 cm long covering 1/4 length of the culm, ligule 1-1.5 mm long, rounded, truncate, membranous ciliate, brown.

Inflorescence a leafy panicle, narrow, nodding at the top, branching strict, clusters of inflorescence in numerous fascicles, sub-globose, racemes crowded, spiciform, 12-15 mm long; spatheoles lanceolate, long, boat shaped, keeled, compressed,
margins scarious, many-nerved. Involuter al spikelets sessile, lanceolate, 5-10 mm long, acute or acuminate, rarely cuspidate, persistant, callus very short, glabrous or with tubercle-based bristles; lower glume keeled with scarious margins on one side 9-11-nerved, glabrous or with rigid tubercle-based hairs, 3-4 mm long upper glume lanceolate, acute; lemma oblong acute or obtuse. Sessile spikelets hermaphrodite, enclosed in an involucre, oblong, linear, cylindrical, 7-10 mm long, callus acute, curved 2-3 mm long, hairy on the side, red in color glabrous above; lower glume 7-10 mm long, coriaceous, obtuse, margins broadly involute, shiny, tubercolated at the top 7-nerved; upper glume 7-10 mm long, linear-oblong, obtuse, glabrous, scabrid above, 1-nerved; lower floret, lemma 4-5 mm long, lanceolate, acute, glabrous; nerveless; upper floret; lemma 1-nerved, awn 3-7 mm long brownish, hispid. Pedicelled spikelets similar to the involucral.


Distribution in India: Throughout in India except North West Himalayas Jammu and Kashmir.


PLATE: 64.

A tall tufted perennial grass about 6 m high. Culms solid 1.5 cm in diameter, smooth polished, yellowish, compressed. Leaf-blades linear, tip subacute, rough on both surface, scabrid on the margins, about 1 m long and 15 cm broad; sheaths strongly keeled, smooth and glabrous, yellowish in colour, auricle striate; ligule a membranous ring.

Inflorescence erect with nodding tip, very large, racemes compound, numerous, spatheoles 4-8 mm long; lanceolate, acuminate, peduncle about 10 mm long, shortly hairy or pubescent at the tip. Involucral spikelets inserted at different levels, 10 mm long, staminate covered with golden or deep-yellow spreading bristles with tubercled bases; lower glume 14-16 mm long lanceolate, spinulosely acuminate, 2-keeled, many-nerved; upper glume short, 3-nerved, chartaceous-acuminate lemma 2, male or not. Sessile spikelets 6-8 mm long, with long pungent callus, bearded with dark-brown hairs; lower glume oblong-acute thinly hairy below, 2-toothed, scabrid on the sides and back; upper glume as long as lower, of same texture; lower floret empty; lemma hyaline; upper floret hermaphrodite, lemma a hyaline base of stout awn, awn 5-6 cm long. Pedicelled spikelets seated on 3 mm long pedicel, similar to involucral but much more slender and delicate, densely tubercled-hairy.

Fl. Sept.-Nov.

Distribution in India: Plains of Assam, Khasia and Naga Hills; Nagaland, Manipur and Tripura; Upper Gangetic Plain; Uttar Pradesh and Bengal. Plains of Western Himalayas; Himanchal Pradesh up to 800 m alt.

World Distribution: India, Nepal, Burma, Indo-China, Maleesian Islands and Philippines.

PLATE: 166.
**Themeda subsericans** (Nees ex Steud.) Ridley., *Flor. Malay.*


Glum. 1, 401 (1855).

A perennial grass about 1 m tall. Culms leafy, more or less hairy below the upper nodes. Leaf-blade linear, acuminate, tapering to a fine point, rough on both the surface, margins scabrid, hairy on lower surface towards the base; sheaths scabrid and hairy; ligule short, membranous.

Inflorescence a panicle of compound racemes, seated on peduncles closely in spatheoles. Involutional spikelets male or neuter, 10-12 mm long, covered with numerous long golden hairs on the back side; lower glume narrow, elliptic-acuminate, margins incurved, 2-keeled; upper glume more delicate, 3-nerved, lemmas², male or neuter. Sessile spikelet 10 mm long densely brownish hairy, awn 2-3 cm long, hispid column. Pedicelled spikelets similar to the involucral but rather narrower and more delicate.

This "species" is assumed to be a hybrid between *Th. arundinacea* and *Th. villosa* in which the spikelets are awned.


**Distribution in India**: Eastern Himalayas up to 1-2000 m; Assam, Manipur, Arunachal Pradesh and Nagaland.

**World Distribution**: India, Eastern Asia, Malaya Peninsula, Indo-China, Malesian Islands.

**PLATE**: 167.


A perennial grass, slender erect. Culms up to 40 cm high, terete hard, smooth and glabrous, branched at almost all
nodes; branches erect, leafy. Leaf-blades linear, narrowed to a long bristle-like apex, up to 30 cm long, 4 mm wide, very scabrous on both sides, slightly narrowed at the base, glabrous below, white tubercle-based hairs covered above to base; sheaths stout, closely embracing the culm, compressed, keeled, striate, smooth and glabrous or slightly scabrous above; ligules membranous, 1.5 cm long, white, lacerate, scabrous.

Inflorescence a panicle, suberect; racemes solitary with the glabrous peduncle arise from proper spathes 5 cm long, filiform. Involutural spikelets disposed in alternate pairs; lower glume 11 mm long, those of one pair 2 mm wide, other narrower, elliptic-acute, flat or slightly convex, 2-keeled, keels narrowly winged, margins involute, many-nerved, scabrous at the margins of the wings, back entirely, densely or sparsely covered with white tuberculate hairs; upper glume shorter, oblong-elliptic, acute, 3-nerved, hyaline, ciliate on the margins; lower spikelet male; lemma elliptic-oblong, acute, hyaline, 7.5 mm long; palea oblong-obtuse, hyaline, 7 mm long, ciliate on the margins; lodicules two, oblong-truncate; Stamens 3; anthers 3-3.5 mm long; upper spikelet heterogamous, 2, the highest forming a trio with the male terminal spikelets. Sessile spikelets terete, slightly darseo-ventrally compressed, brownish, becoming dark brown, callus 1.5 mm long, obtuse, covered with dense hairs, 6.5 mm long; lower glume 5 mm long, flattened, 2 mm wide, oblong-truncate in outline, coriaceous, slightly depressed on the back, scabrous on the sides and back towards the apex; upper glume of equal length with the lower coriaceous, brownish, narrowly involute on the margins; lower spikelet empty; lemma hyaline, triangular; palea absent; upper
spikelet female; lemma hyaline, produced into a strong bristle 2.5 -4.5 cm long; column 1.5 - 2.5 cm long, dark brown, twisted; palea absent. Pedicelled spikelets; pedicel 2 mm long, flat; lower glume 3.5 mm long, lanceolate- acuminate flattened, 1 mm, wide, many- nerved, rounded on the sides, keeled above, glabrous on the back, scabrous towards the apex on the keels; upper glume lanceolate-acute, 3-nerved, smooth , glabrous, ciliate on the margins; lower spikelet male; lemma hyaline, 6 mm long; palea equal in length but narrower; stamens 3; anthers 3.5 mm long; lodicules 2, large, truncate.

To be compared with *T. tremula* Nees., but differ from it in the much longer peduncles.


Exsiccate. Type at Kew (Mooney 4064).

**Distribution in India**: Endemic in Orissa, near pottangi, Koraput District. According to Mooney, this grass grows gregariously on granite cliffs.

**World Distribution**: Endemic in India

**PLATE**: 168.

*Themeda tremula* (Nees ex Steud.) Hack. in DC., Monogr. Phan.


Annual or perennial grass. Culms erect, 100-140 cm, tall, slender, leafy, glabrous, branched, smooth and polished,
brownish in colour. Leaf-blades 10-40 cm long 3-4 mm broad, acuminata rigid, suberect, green, glabrous, margins scabrid; sheaths compressed smooth; ligule membranous few hairs on the margin.

Inflorescence a panicle, 30-60 cm long. Spikes arranged racemose fascicles of spikelets distant on capillary flexuose peduncles 3-9 cm long, subglobose, lower branches elongate and panicked; spatheate, outer spathe longer than the fascicles, hairy on margins with tubercles at the base, proper spathe 4.6 mm long, lanceolate, acute, compressed, sides and keels ciliate with bulbous-based hairs at the margins. Involucral spikelets 7-8 mm long, reddish green, sessile, glumes 3; lower glume linear- lanceolate, acuminate, margins with narrow scarious wings covered with tubercle-based hairs, many-nervedi upper glume oblong- lanceolate, acuminate, membranous 1-3 nerved, ciliate above; lower floral glume hyaline, linear- lanceolate, acuminate, 1-2 nerved, lodicules cuneate. Bisexual spikelets 2; sessile, 2-4 mm long lower glume linear- oblong, obtuse, lanceolate, nervedless, dorsally ciliate, channelled, narrowly truncate,awn 2-3 cm long. Pedicelled spikelets like the involucral, lanceolate, glumes 3; gl. I lanceolate, winged at one side on the margin, nervedless, hairy on the back with bulbous based hairs; gl. II and III similar to involucral spikelet.


Distribution in India: Northern and Southern Western Ghats; Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu and Kerala, Central India; Madhya Pradesh, Rajasthan (East) and South Uttar Pradesh.

World Distribution: India and Sri Lanka

PLATE 65.


An annual or perennial grass. Culms tall about 3-3.5 m stout or slender. Leaf-blade 20-40 cm long, 4-6 mm broad or narrow; sheaths glabrous or sparsely hairy, keels scabrid, ligule rounded, 1-2 mm long.

Inflorescence a large panicle. Spikes flabelliform, long peduncled, with imperfect, scattered, linear, hyaline spikelets on the peduncle, spikelets arranged in large flabelliform clusters, 4-5 cm long excluding awns. Involutural spikelets 2-4 in number, 4-8 mm long, irregular, pairs of involucral spikelets inserted at the same level, linear lanceolate, hyaline unequal. Bisexual spikelets 6-8 mm long, solitary, cylindric, with a long pungent dorsally brown-bearded callus, obscurely nerved, smooth and dotted below, scabrid and hispid towards the tip; gl. I terete, dorsally compressed, coriaceous, margins incurved, not keeled; gl. II as long, coriaceous, 3-nerved, keeled, keel broad, margins thin, incurved; gl. III oblong, hyaline, 1-nerved; gl. IV very slender, sometimes narrowly hyaline base of an awn; palea 0. Lodicules cuneate. Stamens 3. Styles free, stigmas long. Grain oblong. Pedicelled spikelets lanceolate, dorsally compressed; pedicels slender, glumes 3; gl. I many-nerved; gl. II as long as I, 1-3-nerved, hyaline or 0; gl. III smaller or 0.

Fl. Sept.-Nov.

**Distribution in India:** Andaman Islands.
World Distribution: India, Malaysia, Southeast Asia, West Indies, Madeira Islands.

PLATE: 169.


A perennial grass. Culms tufted, slender, profusely branched, leafy, 60-120 cm tall, smooth and glabrous. Leaf-blade narrowly linear up to 15 cm long and 5 cm broad, smooth and glabrous on the upper surface, less hairy on lower surface, margins scabrid with few long cilia 4-5 mm long; sheaths loose and compressed, keeled, reddish-brown; ligule absent.

Inflorescence a panicle, slender, leafy, small, spikelets few, clusters of racemes about 1.5 cm in diameter, shortly peduncled spatheoles long-acuminate, very narrowly cymbiform, 2.5-4 cm long, hispid, scabrid on the margins. Involucral spikelets homogamous, male or neuter, 5-5 mm long, reddish; callus green and glabrous; lower glume narrowly-oblong, tip spinulose, acute, 9-11-nerved, tubercled on the back scattered with long white hairs on the upper half; upper glume 5 mm long, fine median-nerve and 2-3-nerves on each margins, narrowly inflexed, ciliate; lemma as long, hyaline; lodicules cuneate, short, ciliate on the tubercle base; palea a rudimentary scale. Sessile spikelet 1, 4-5 mm long (including bearded callus); lower glume truncate, obscurely 9-nerved, upper part scabrid-hispid; upper glume narrow, longer, margins incurved, keels rounded which lies the awn of upper lemma. Lower floret hyaline, linear, 3 mm long. Upper floret reduced to the hyaline base or
nearly smooth awn, 3-4 cm long. Lodicules very large, oblong-obcuneate. Ovary linear-oblong. Pedicelled spikelets 2, very narrow, sharply acute; lower glume many-nerved; upper glume scaberulous on the keel, margins ciliate, inflexed.


Distribution in India: Eastern Himalayas up to 2000 m; Assam; Arunachal Pradesh, Manipur, Meghalaya. Upper Gangetic Plains; Uttar Pradesh, North Bengal. Central India; Madhya Pradesh, and Rajasthan, Western Peninsula; Tamil Nadu, Karnataka Andhra Pradesh, Maharashtra. Plains of Gujrat.

World Distribution: India, Nepal, Bhutan.

PLATE: 170.


A perennial leafy grass. Culms tufted, very stout, up to 1.5 m tall, polished, smooth, glabrous. Leaf-blades linear-lanceolate, up to 30 cm long, tips filiform, 3-4 mm wide, smooth and glabrous margins scabrid; sheaths smooth, polished, terete, keeled; ligule a narrow ciliate membrane.

Inflorescence a compound panicle, about 60 cm long, with long slender upright branches, 2 or 3 branches from leaf axil, leaf-lets arise from 2.5-8 cm, fascicles of spikes triangular, spatheoles hardly longer than the fascicles, cymbiform with very slender tips, glabrous, strongly nerved, 1-1.5 cm long, ciliate on the keel, subaristate geniculate, bearded on the
peduncle. Racemes of 4 involucral spikelets and 2 or more sessile hermaphrodite spikelets. Involucral spikelets; lower glume of involucral spikelet 3.5 mm long, oblong-lanceolate, closely covered with tuberose-based bristles, many-nerved; upper glume subaristate, acuminate 3-nerved 3.5 mm long, lemma empty, lanceolate, hyaline, narrow, 1-nerved; Sessile spikelets 2, hermaphrodite, terete, pale-green in colour, callus bearded with white hairs; lower glume hispidulous; upper glume coriaceous, notched, awn about 1 cm long; lower lemma hyaline, 1-nerved; upper lemma very narrow, bifid, margins hyaline; palea minute. Pedicelled spikelets usually 1 to the lower sessile and 2 to the upper sessile spikelets, pedicels 1-2.5 mm long, glabrous, lower glume 3.5 mm long, lanceolate, acuminate, bristly. Stamens 3.


World Distribution: India (endemic).

PLATE: 17/1.

in DC., Monogr Phan. 6, 664 (1839).

Var. quadrivalvis

An annual robust grass. Culms sub-erect, rooting from the nodes, very slender, 1-2 m high, stout, glabrous, simple
or branched. Leaf-blades 20-40 cm long and 6-8 mm broad, linear-acuminate, glabrous or sometimes hairy; sheath compressed hairy with tubercle-based on the upper side or at the mouth; ligule membranous, 1-2 mm long, hairy or glabrous.

Inflorescence a panicle, dense, sub-erect with the leaves; spathe linear-lanceolate with bulbous-based hairs on the back and on the margins of keels. Racemes 1-2 cm long, erect. Involucral spikelets sessile, whorled, linear-lanceolate, 6-8 mm long, reddish, barren or male, acute or acuminate, winged; lower involucral glume with tubercle-based bristles at the tip about 9-nerved oblong-lanceolate. Pedicelled spikelets 2-3 mm long, narrow, not winged glabrous, with 1 glume which is narrow, linear and flattened. Bisexual spikelets solitary, 2 mm long, narrow, linear-lanceolate; callus very short bearded with long brown hairs, lower glume obtuse hairy, shiny, 6-7 nerved; upper glume glabrous, sub-acute, lower floral glume shorter than invol,glume, glabrous; upper floral glume awned, awn 3.5 cm long, slender. Anthers 1-2 mm long.


Distribution in India: Throughout in India, from plains to hills ascending up to 1000 m alt.

World Distribution: India, Nepal, Bangladesh, Burma, Indo-China, Malayan Islands, Australia and New Zealand, Pacific Islands, Malagasy and Macarens Islands, Africa, Western Asia, Central America and West Indies, South America.

PLATE: 66.
Var-helferi (Hack.) Bor.Comb. Nov. Th. helferi Hack in DC, Monogr. Phan. 6, 665 (1839).

Dwarf plant, 5-30 cm long. Culms glabrous, thin, shining brown, cylindrical, prostrate, leaf-blade green, glabrous, acute, sheath compressed, glabrous, ligule 1 mm long, membranous, bracts shining brown.

Inflorescence a dense spike-like, compact, suberect, racemes with spathes, linear, lanceolate, tubercled on the inner margin, involucral spikelets 1.5 - 2 cm long, sessile, whorled, acute, lanceolate, glumes -4, gl. I (lower glume) lanceolate, 7-nerved, hairy at the upper half portion, tubercle based bristles on the margin of upper half portion, 4-5 mm long, gl. II (upper glume) glabrous, acute, 3-nerved, 3-4 mm long. Pedicelled spikelets narrow, not winged hairy on the upper half, 4-6 mm long, glumes 2, lower glume 4 mm long, tubercle based bristles on the upper half portion, 5-nerved, upper glume, shiny, glabrous, 4 mm long 3-nerved. Bisexual spikelets solitary, 3-4 mm long, narrow, linear-lanceolate, callus short, bearded with brown hairs, lower involucral glume obtuse, strigulose on the back with hairs, 5-6 mm long, 4-5-nerved; upper involucral glume glabrous, subacute, 1-nerved, lower floral glume oblong-lanceolate, shorter than invol. glume, 4 mm long, 5-nerved; upper floral glume 3-nerved, awned, awn single, 3-4 cm long, slender, overy bifid. Stigma hairy. Anthers bilobed, 1-2 mm long.


Distribution in India: Andaman Islands, Sagar, Madhya Pradesh.

World Distribution: Endemic in India

PLATE: 67.