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BAMBOOS OF THE INDIAN BOTANIC GARDEN

R.B. BOSE, H.S. PANDEY AND A.K. BANERJEE

Botanical Survey of India, Howrah

ABSTRACT

A census of bamboos under cultivation at Indian Botanic Garden has been made.Information on their introduction,cultivation and their availability in various parts of this garden is provided. Taxonomic account of each taxon together with usefulness of bamboos are furnished.

The Indian Botanic Garden, one of the oldest gardens of Asia, was established by Col. Robert Kyd, in July, 1787. It is situated by the side of the river Ganges and occupies an area of about 112hectares, having the approximate rainfall of 1500-1600 mm and temperature ranges from 20-32°C.

More than11,000plants comprising of different groups of Cryptogams and Phanerogams are available inside this garden. Among these groups, bamboos play a very important role in the maintenance of the garden and scientifically regarded for its unique germplasm collections having genera and species from all over the globe.

The purpose of bringing out an up-to-date list of various species of bamboos under cultivation at the Indian Botanic Garden, Howrah, a pioneer garden of South-East Asia during its 200th year from its establishment, is primarily for two reasons. Firstly, to give an idea about the existing species under cultivation in this garden at present and secondly, there is a pressing demand from inquiring scientists, horticulturists for a revised list updating the last list of Sen and Naskar (1965). A census made by us on the bamboos of this garden would help the readers to locate the plants occurring in different divisions of this garden and render interesting information and data in respect of their introduction, cultivation (Propagation),usefulness. A note on world wide distributions together with short taxonomic accounts pointing out the identifying characters is also included.

Considering the importance of bamboos in our daily life, the introduction and cultivation of various species of bamboos were started almost since the inception of this garden. Roxburgh (1814) reported the presence of 7 species of this group existing prior to 1794, when he took charge as the first Superintendent of this garden. During about last 200 years several species were introduced and many of them are still existing. Bamboos were also introduced and cultivated as wind brackers in various divisions with special reference to division no. 2 & 3 lying near the bank of river Ganges (Hoogly). Later on, the bamboos were introduced to build up a germplasm collection of different genera both Indian and foreign and only recently for maintaining soil fertility because of the fact that spp. of *Dendrocalamus* take up

rapidly potassium from the soil.

The bamboos with their tall culms have attracted attention of people from all walks of life since ancient times. So far botanical studies on Indian bamboos are concerned it is noticed that Van Rheede, the Dutch Governor of Malabar, was the first scientist who described 2 species of bamboos in his *Hortus Malabaricus* in 1678.

Roxburgh in *Hortus Bengalensis* (1814) named 7 species under cultivation in this garden at his time and described them in *Flora Indica* (1832). The first monograph of Indian Bamboos (consisting also of Bangladesh, Burma, Ceylon and Pakistan etc.) was published by Col. Munro, only in 1868 wherein he dealt with 21 genera and 95 species. Later on Kurz (1872 & 1876) and Brandis (1905) had contributed substantially to the knowledge of these specialised group of plants. However, most comprehensive work was done by Gamble (1896) in his work on *"Bambuseae of British India"* dealing with 16 genera and 115 species reducing some of the genera of Munro. During the last 80 years some remarkable contributions on studies of bamboos were made by Blatter (1928), Deogun (1937), Holttum (1958), Raizada and Chatterjee (1963), Bahadur (1979), Bahadur and Naithani (1976 & 1978), Soderstrom (1981), Ramkrishnan (1983), Verma and Bahadur (1983) etc.

Bamboos are found generally in all tropical and sub-tropical regions of the world especially in Asia and South America. No species grows wild in Europe. In Asia, bamboos are occurring in India, Bangladesh, Burma, Sri Lanka, Nepal, Bhutan and most of the countries of the South-East Asia, China and Japan. A few species are also found in tropical Africa and Australia.

The culms or stems of all bamboos are more or less cylindrical, hollow in the interior zone and separated by a nodal partition at regular intervals. They usually grow erect excepting a few species which show tendency to angularity (zig-zag type) as in *Dinochloa m'clellandii.* The lower nodes often bear root scars or rootlets. Some bamboos have rings of spines *e.g. Bambusa arundinacea.* Most of the bamboos are green in colour when young barring a few species which develop two or three colours striations near the nodal zones *e.g. B. vulgaris* var. *striata,* a few forms of *B. glaucescens* etc.

The rhizomes of bamboos are usually of two types :— (i) Some develop knotty thick short producing buds for growing culms from the knots, *e.g.* spp. of *Bambusa* and *Dendrocalamus* (ii) The others with long rhizome pushing their way underground and sending out rootlets or buds, from where the aerial culms grow *e.g. Melocanna.* When the young culm bud first begins to grow, covered with imbricating sheath, a conical growth is seen protruding from the ground, and are often tinged with bright colour. The new culms usually develop, during the beginning of rainy season. Most of the culms are reasonably fast growing *e.g. B. balcooa, B. tulda, Dendrocalamus giganteus* etc.

Culm-sheaths which surround the young shoots and nodes provide very important diagnostic characters to distinguish one species from the other. Since the flowering in most of the bamboos are not regular (flowering takes place after several years), taxonomists often identify the species of bamboos based on the characters of culm-sheaths and of the rhizome. This sheath has three main parts a) *Sheath proper* — corresponding to the petiole of the ordinary leaves which in bamboos forms a broad expansion with its base attached at the node of culm. Sometimes the sheath is thick and smooth, as in most of the species of *Bambusa* and *Dendrocalamus* but it is coriaceous in texture *e.g.* spp. of *Dinochloa.* Some species have dense felted hairs all over the outer surface of the sheath but nearly

glabrous on the inner surface *e.g. Dendrocalamus giganteus.* (b) The imperfect blade corresponds to the blade of a ordinary leaf and is inserted on the top of the sheath, there it develops many different shapes, sizes and forms and often becomes decurrent into fringed auricles. In most of species of the genera *Dendrocalamus, Melocanna, Phyllostachys, Thyrsostachys* etc., the inferfect blade is narrow more or less triangular and pointed, while its blade is comparatively broader in species of genera like *Bambusa, Gigantochloa, Cephalostachium* and *Dinochloa.* (c) The ligule is inserted like the leaves of grasses on the inner surface at the junction of the sheath and the imperfect blade. The character of this structure however is not very significant for identification of individual species.

The ordinary leaves of bamboos are usually petiolate, linear, lanceolate and green. The petiole is usually long and midrib is prominent. At the base of each leaf below the petiole lie the "leaf sheaths" and "ligules", both the structures some times provide diagnostic features for identification.

Great variations are noticed in respect of the inflorescences. Sometimes, the spikelets appear in leafy branches, in other they form gigantic panicles. The spikelets may be of a few or many flowers, varying from species to species. Flowering in bamboos is rather irregular and they may be classified according to their flowering behaviour into following groups: (i)Species flowering annually or nearly so *e.g. Gigantochloa ater* (ii) Flowering after 5-10 or more years *e.g. Ochlandra travancorica, Dendrocalamus strictus* (iii) Species flowering after a lapse of 10-50 years *e.g. Thyrsostachys oliveri.*

On the basis of vegetative characters as referred to above, the species listed in this paper are identified and where the vegetative characters are not found to be contrasting the characters of the inflorescences/spikelets were examined from herbarium materials *e.g. Bambusa tulda, B. nutans* and *Gigantochloa hasskarliana* etc.

Bamboos the "A Poorman's Timber" have age old relationships with the people. The strength of culm, their straightness, together with the easy way of handling made them suitable for various purposes. They provide materials for preparation of houses, bridges, ladders, mats, umbrella handles, sticks, fences, bows and arrows, scaffolding, handles for various agricultural implements and tools, toys and various other goods.

Bamboo leaves are used for thatching huts and houses and are also valued for fodder. Some of the bamboos possess medicinal properties. "tabashir or banslochan" largely used as a coolling tonic, is obtained from the nodal joints of *Bambusa arundinacea.*

Rhizomes of bamboos are used as handle of billhook and materials for manufacturing of 'Poloballs. It is understood that this ball is being manufactured in a large scale in Howrah district of West Bengal. The rhizomes, on account of interwoven root system, prevent soil erosion.

During the last few decades, the bamboos are also used in paper industry and in preparation of handicraft materials. It is calculated that more than two million tons of bamboos are used as raw materials in paper industry annually.

Recently, a new use of bamboo "Bamboo Reinforced Cement Concrete Construction" has been evolved at Forest Research Institute, Dehra Dun. In this method, bamboos are used as reinforcing materials, replacing steel in the construction of roof slabs, beams, electric poles etc. (Vermah and Bahadur, 1983). Besides, the above bamboos are also used in several other ways in our daily life. They are also used for various ornamental decorations.

Cultivation and management of bamboos are based on the developments of the culms. During the rainy season the new culms produced from the rhizomes are to be reared up carefully (after transplantation). In respect of gregariously flowering species the whole culm including the rhizome die out after flowering. As such, the collections of buds, bulbils producing new plants are to be done transplanted and reared up in the nursery until the individual green culms is strong enough for final transplantation (it takes usually 1-2 years). For management of the bamboo population (which varies from species to species), harvesting is usually done keeping the age of the culm. While harvesting not all the culms of a groove should be chopped down and about 4-10 culms should be left, as it is. The culms are to be cut preferably after the second node, leaving the basal height of 10-20 cm of the culm from the ground level. The felling of bamboos also should be done during rainy season since that is a growing season.

The bamboos occurring in the premises of Indian Botanic Garden, Howrah are identified and enumerated below along with short taxonomic description, availability of various species in different divisions of I.B.G., world-wide distribution and notes on their introduction, propagation and special uses are also provided (Figs. 1-5).

(D.N. = Division Nos. of the Garden)

ENUMERATION

1. **Bambusa arundinacea** Willd. in Sp. Pl. ii : 245, 1799. *B. spinosa* Roxb. in *Cor. Pl.* : t. 79. 1798.

Specimens examined : Hort. Bot Calc., Dec. 1888, *Gamble s. n.*, Acc. no. 11101-11161(CAL); *Ibid.*, Dec. 1919, *N.C. Mondal s.n.*, Acc. no. 549445 (CAL).

Local names: Thorny bamboo (Eng.) Katwa (Hindi).

A small thorny bamboo with *culms* 10-12 m × 8-10 cm ; having many branches with short recurved spines (usually 3, middle one larger in size), *Culm-sheaths*- thick, 12-15 × 7-12 cm, striate, covered below with long stiff bristles *Imperfect-blade* — triangular, slightly rounded at base. D.N. 3.

Distributed in Eastern, Western and Southern India ; SriLanka, Burma and to its adjoining states of S.E. Asia.

This species was introduced by Robert Kyd between 1787 and 1793 as Roxburgh reported the existence of this species prior to taking over the charge of this garden in 1793. Seeds of this species were collected by Dr. A.S. Rao in 1980 and from them a few plants were also grown in this garden.

Propagation is done usually with the half of offset. Culms are used in building construction and yields a valuable substance known as 'Banslochan

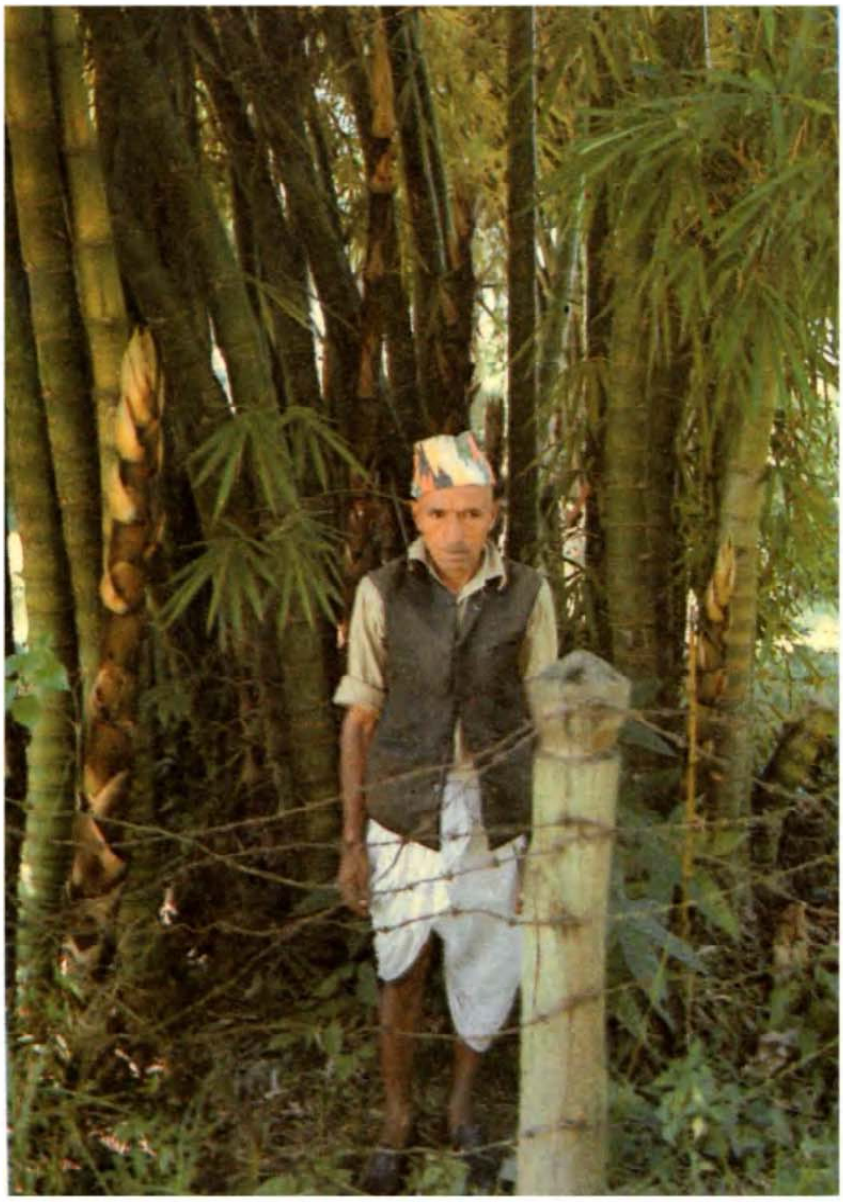
2. **B. burmanica** Gamble in Ann. Roy. Bot. Gard. Calcutta 7 : 35, pl. 35, 1896.

A large handsome bamboo, *culms* 2-14 m × 10-12 cm. Nodes not much swollen possessing rings of hairs on either side. *Culm-sheaths*—greenish, turning to yellow at the edges covered with golden hairs and glabrous inside, boarder in the middle, auricles spreading beyond the sides of the sheath possessing bristles 6-8 mm long. *Imperfect-blade*—caudately rounded, D.N. 3 & 6.

The species is a native of Burma. Cultivated in Trop. Gardens. One old plant is growing in Divi. no. 3, which was probably grown from the seeds sent by Oliver, Conservator of Forests, Burma during 1876. Two plants were brought by Pandey from Forest Research Institute, Dehra Dun in 1983 and successfully introduced.

3. **B. balcooa** Roxb. in (Hort. Beng. 25 1814 *nom.nud.*) Fl. Ind. 2 : 196, 1824; Gamble in Ann. Roy. Bot. Gard. Calcutta 7 : 42, 1896; Prain, Beng, Pl.

Bambusa balcua



Bambusa ventricosa

Bambusa polymorpha

Bambusa vulgaris var striata

Dendrocalamus gigantea

1232, 1903; Deb, Fl. Tripura: 2 : 494-95, 1983.

Specimen examined : Hort. Bot. Calc., Dec. 1888, *Gamble s.n.*, Acc. no. 111000 (CAL).

A tall bamboo, *Culms*—greyish green, 14-16 m × 10-15 cm. Nodes swollen with whitish hairy ring. *Culm-sheaths*—of two descriptions (a) lower ones — short and broad densely hairy on the upper surface, with rounded top. *Imperfect-blade*—short, triangular with fringed auricles, (b) upper ones 30-35 × 20-24 cm blade almost glabrous. *Imperfect-blade* — 15-20 × 7-10 cm sharp at the apex. D.N. -3, 4 & 10.

Distributed in Arunachal Pradesh, Assam, W. Bengal, Bihar, U.P. and elsewhere in India.

Roxburgh described this species which was existing in the garden prior to 1794.

Vegetative propagation is effected through rhizomes, buds, offsets.

Used for scaffolding, as building material and in the manufacture of papers.

4. **B. glaucescens** (Willd.) Sieb. ex Munro in Trans. Linn. Soc. 26 : 89, 1868; Holttum in Kew Bull. 2 : 207-11, 1956. *B. nana* Roxb. Fl. Ind. 2 : 199, 1824.

Specimens examined : Hort. Bot. Calc., Dec. 1888 . *Gamble s.n.*, Acc. no. 111050 (CAL) 1898 ; *Ibid*, Jan. 1968, *Banerjee* 4881 (CAL). Eng. name — Chinese bamboo.

A dwarf thickly growing shrubby bamboo. *Culms*—2-3.5 m × 1.5-2.5 cm smooth, branched from the base. Nodes thickened. *Culm-sheaths* — green at first become yellow on maturity, more or less glabrous, 10-12 × 5-6 cm rounded at the top. *Imperfect-blade* — linear about 5 cm acuminate, somewhat rounded at the base, hirsute. D.N. 1,2,3,5,6,11,17 & 20.

A native of China and Japan; cultivated in the tropical and sub-tropical gardens.

This species was available at the Indian Botanic Garden prior to 1794 when Roxburgh took charge of this garden. A biotype of this species was introduced in 1983 from F.R.I., Dehra Dun.

Propagation is effected through the divisions of offsets.

It is an ornamental species — makes the good hardy hedge.

A distinct form of *B. glaucescens* having variegated leaves was introduced from F.R.I. Dehra Dun, in 1983 and growing in division no.6 of this garden.

5. **B. nutans** Wall. Gamble in Ann. Roy. Bot. Gard. Calcutta 7 : 32, 1896.

Specimen examined : Hort. Bot. Calc., Dec. 1888 *Gamble s.n.* Acc. no. 111057-61 (CAL).

A moderate sized bamboo with culms arising singly from a creeping rhizome, much branched above, green, smooth having white ringed below the nodes-8-10 m × 4-8 cm straight. *Culm-sheaths* — 15-20 cm, covered with scattered black hairs beneath. *Imperfect-blade* — broader in the middle with large recurved auricles. Spikelets long; stamens 6, free; anthers-obtuse. D.N. 3.

Distributed in lower strata of the Himalayas from Punjab to Sikkim 1200-1500 m, Assam, Bangladesh, W. Bengal, U.P. etc.

Perhaps introduced in this garden during the earlier part of present century. Gage (1913) reported this species in this garden while Gamble (1896) did not report this species. Biotype of this bamboo was successfully introduced during 1983 from the Forest Research Institute (F. R. I.), Dehra Dun.

Used for mat making, building purpose, scaffolding, for making baskets and in paper industry.

6. **B. tulda** Roxb. Hort. Beng.: 25, 1814 *nom. nud.* Fl. Ind. 2: 193, 1824; Prain, Beng. Pl. 1232, 1903; Fischer, Rec. Bot. Surv. India 12(2) : 150, 1938; Deb, Fl. Tripura 2 : 497, 1983;

Balakrishnan, Fl. Jowai 2 : 598, 1983.

Specimen examined : Hort. Bot. Calc., Dec. 1888 *Gamble's.n.*, Acc.no.111063-111131 (CAL).

More or less similar in morphological characters as possessed by *B. nutans* excepting culms—gray, green, nodes with white calcarious band on one side and sometimes streaked with yellow. *Culm-sheaths* —slightly attenuated upwards and rounded at top. *Imperfect-blade* — possessing fringed auricles, spikelets moderate long, stamens 6, free, anthers apiculate. D.N. 3 & 6 of I.B.G.

Distributed in W. Bengal, Assam, Eastern, Central and Northern regions of India.

Roxburgh reported the existence of this species in this garden prior to his assumption of charge in 1794. A few clumps of this bamboo were introduced in 1983 from F.R.I., Drhra Dun.

Used as building materials, for making baskets and in paper industry.

7. **B. cliveriana** Gamble in Ann. Roy. Bot. Gard. Calcutta 7 : 130-31, 1896.

Culms 10-12 m × 4-6 cm glossy green. *Culm-sheaths* — thin 20-25 × 5-8 cm glabrous. *Imperfect-blade* — 10-14 cm triangular, slightly hairy on both surfaces ; auricles-unequal, long fringed. D.N. 3.

Distributed in Eastern India to Burma.

Propagation through rhizome.

Used as building materials, preparation of baskets etc.

8. **B. ventricosa** McClure in Lingnen. Sci. J. : 17 : 57, 1938.

Local Name : Budha's bamboo (Eng.) ; Ghati Bans. (Beng.).

Comparatively smaller in size. *Culms* 4-6 m long. The species can easily be identified by the appearance of pitcher like swollen nodes. D.N. 3.

A native of China and Japan. Cultivated in the gardens of tropics and subtropics.

Occurrence of this species in this garden was first reported by A.T Gage, 1913.

Used mostly as ornamental bamboo.

9. **B. vulgaris** Schrad. in Wendl. Collect. pt. II. 26 : t 473, 1810.

Specimens examined : Hort. Bot. Calc, Dec. 1888, *Gamble s.n.*, Acc. no. 110411 (CAL); *Ibid. Banerjee s.n.* (CAL). Jan. 1965.

Culms 7-10 m × 5-9 cm with narrow rings of brown hairs on nodes. *Culm-sheath* — 15-25 × 12-22 cm rounded at top covering a good part of internode concavely truncate, striate with thick brown hairs on upper surface, edges ciliate. *Imperfect-blade* — somewhat triangular, hairy on both surfaces, margins revolute. D.N. 2, 3 & 13.

Distributed in the warmer parts of India; Sri Lanka, Burma to S.E. Asia. It is a native of Mexico.

Proudlock introduced this species into this garden from Burma in 1872. Sir George King collected the flowers in 1890. A few clumps of this species were recently (1983) introduced from the F.R.I., Dehra Dun.

Propagation through offsets.

Used as building materials, preparation of baskets etc. and in the paper industry.

10. **B. vulgaris** Schrad var. **striata** (Lindl.) **Gamble** in Ann. Roy. Bot. Gard. Calc. 7: 44, 1896, *B. striata* Lodd. ex Lindl. in Peney, Cyclop. 3 : 357, 1835.

Comparatively smaller, culm pale yellow stripped with green, varying in numbers. Leaves comparatively smaller in size compared to *B. vulgaris*. Available in D.N. 3.

A native of China and Japan. Much cultivated as ornaments. Introduced and added to the existing stock in 1983 from F.R.I. Dehra Dun.

11. **Cephalostachum pergracile** Munro in Trans. Linn. Soc. 26: 141, 1896.

Moderately tall bamboo. *Culms* 8-10 m × 4-6 cm. *Culm-sheath* —12-15 cm × 15-18 cm densely covered with black hairs.

Imperfect-blade — about 5 cm ovate, densely hairy, decurrent into a wavy fringe bordering at the top of the sheath and ending on either side of the fringed auricles. Available in the D.N. 3 and 9.

Distributed in Central India, Bihar, E. India to Burma and elsewhere. In Naga hills it attains the height of more than 100 m.

Kurz sent the planting materials of this species from Burma for introduction in this garden during 1863. Used for the preparation of fishing rods, baskets and in the paper industry.

12. **Dinochloa maclellandii** (Munro) Gamble in Ann. Roy.Bot. Gard.Calcutta7:113 1896.

Scandent bamboo with a tendency to climb zig-zagly. Thinner culms about 5-6m ×3-4 cm.*Culm-sheaths*-cylindrical,leathery 15-22×18-22 cm having 5-7 cm densely covered golden hairs ending above the narrow blade. The blade is lanceolate – acuminate rounded at base. Leaves quite large. Available in D.N. 3.

Distributed in W Bengal, Bangladesh, N.E. India, Andamans, Indonesia etc.

Probably introduced during the earlier part of the last century - Kurz (1863), Brandis (1881), Gamble(1896), Sen and Naskar (1965) reported the existence of this species at I.B.G.

Used mostly as ornamental bamboo.

13. **Dendrocalamus giganteus** Munro in Trans. Linn. Soc. 26 : 150, 1868.

A gigantic bamboo. *Culms* very large and broad 12-15 m/20-25 cm. Nodes slightly swollen. *Culm-sheaths*-papery, large 36-45 × 15-20 cm, glabrous, embracing at the top a depressed sinus on which recurved bifurcated blade is inserted. The *Imperfect-blade* is 25-30 cm densely hairy on back. Available in D.N.1,2,3,11,12 & 25

A native of Malaya – Peninsula. Much cultivated in the gardens of tropics.

Introduced during the early part of the last century.

Used as pillers, building materials, flower vasses etc.

14. D. **longispathus** Kurz in For. Fl. Burma II : 561, 1877.

Specimen examined : Hort. Bot. Calc., Dec.1888,*Gamble s.n.* Acc. no. 111001-66 (CAL).

A tall and fairly large bamboo. *Culms* 10-12 m × 10-12 cm. Nodes slightly swollen. *Culm-sheaths*-papery very long elongated gradually embraced the depressed sinus on which imperfect-blade is inserted. The blade is densely clothed with black hairs. Available in D.N.3.

Distributed in West Bengal, Assam; Bangladesh etc.

Gamble reported the presence of this species in this garden during 1896.

Propagation is done through rhizomes and seeds. Culms are used for building materials and other miscellaneous work.

15. D. **membranaceus** Munro in Trans. Linn. Soc. 36 : 149, 1868.

A moderate sized bamboo forming loose clumps. *Culms* are 10-12 m × 8-10 cm. The nodes strongly ringed.*Culm-sheaths* slightly longer than internodes 30-48 × 15-20 cm narrowed above bearing fringed auricles. *Imperfect-blade,* long narrow having brown hairs on both sides. Available in D.N.3 & 6.

Distributed in Burma and cultivated in the gardens of Tropics.

Plants and offsets were collected by A, Hoqe from Martaban (Burma) during1892 and introduced in this garden. Clumps of this species were also introduced from F.R.I., Dehra Dun, in 1983.

Propagation through seeds and offsets.

16. D. **strictus** (Roxb.) Nees in Linnaea, 9, 476, 1854. *B. stricta* Roxb. Cor.

Pl. I : 58, t. 80, 1798.
Local name : Muli Bamboo (Hind.).

A densely tufted bamboo with strong solid culms about 8-12 m × 3-5 cm. Nodes somewhat swollen. *Culm-sheaths*-variable in sizes lower ones 10-25 cm long curved at base having golden brown stiff hairs, rounded at the top, ciliate at edges possessing small auricles. *Imperfect-blade*-triangular hairy on both sides, ligules 1-1.5 mm. Available in D.N. 3.

Distributed in deciduous forests and dry hills of India; Nepal, Sikkim and Burma.

This is the most common bamboo of India and introduced by Kyd and subsequently by other Superintendents of this garden. Roxburgh described this species in 1814 as *Bambusa stricta.*

Used as building materials, handicraft articles, in paper industry etc.

Propagation through clumps, offsets, seeds etc.

17. **Gigantochloa ater** Kurz in Ind. For. 1 : 344, 1876.

A large tufted bamboo. *Culms* 12-15 m × 6-10 cm, green. *Culm-sheaths*- crisp 24-28 × 24-30 cm. *Imperfect-blade* erect, ovate, acuminate, recurved. Holttum (1968) preferred to retain this name described by Kurz in place of *G. verticillata.* Gamble referred to this species as 'Bamboo ater'. Available in D.N. 3.

Distributed in lower Burma, Malaya Peninsula, cultivated in the gardens of Tropics.

Actual period of introduction to this garden could not be traced.

Propagation through offsets, rhizomes etc.

Used like other bamboos. (Ref. *Fl. Java,* Becker, 1968).

18. **G. hasskarliana** (Kurz) Backer ex Heyne in Nutt. Pl. Ned. Ind. : 1, 299, 1927. *G. macrostachya* Kurz in For. Fl. Burma 2 : 557, 1877.
Oxytenanthera nigrociliata Munro. pp. in Trans. Linn. Soc. 26 : 128 (1868).
Specimen examined. : Hort. Bot. Calc., Dec. 1888, *Gamble s.n.* Acc. no. 11123c (CAL).

A large evergreen bamboo more or less similar in appearance and in many characters to that of *Bambusa nutans* and *B. tulda.* Nodes not thickened much, hairy, *culm-sheaths*-not much narrowed above, densely covered with black hairs. *Imperfect-blade*-hairy beneath. Rounded at the base having wavy sides and rounded auricles. Stamens 6, filaments jointed into a tube. Spikelets long.

Gamble reported the presence of the species in this garden in 1896. Flowering of this species was noted during Dec., 1975 by A.K. Mukherjee.

Used as building materials, for preparation of mats, baskets, in other products of handicrafts etc.

Propagation through seeds, offsets, rhizomes, etc.

19. **Melocanna bambusoides** Trin. in Sprengel New. Entd. II : 43. 1821.

An erect arborescent bamboo with long rhizome. *Culms* straw-coloured, 10-12 m × 5-7 cm; *Culm-sheaths*-yellowish hairy, 12-18 × 16 cm, concave near the attachment of imperfect blade. The *blade* is long, 06 — 08 cm forming a narrow strip at the top. Available in D.N. 3 & 4.

Distributed in Assam; Bangladesh, Burma, Malaya etc.

Voigt (1845) reported the presence of this species in this garden. Probably it was introduced by Griffith (1835). Introduced again in 1978 by R.B. Bose from Delhi University.

Used for building purpose and in handicrafts.

20. Neohouzeana dullooa (Gamble) A. Camus in Bull. Mus. Hist. Nat. Paris 28 : 100, 1922.

Teinostachyum dullooa Gamble in Ann. Roy. Bot. Gard. Calcutta 7 : 101, 1896.

Somewhat scandent. *Culms* 6-7 m × 3-6 cm, dark green with whitish hairs below the nodes. *Culm-sheaths* variable, 12-20 × 22-25 cm, striate, hairy above, rounded at the top and thin, somewhat truncate and fringed with bristles. *Imperfect-blade* — narrowly recurved, densely hairy, edge-convolute. Available in D.N. 3.

Distributed at Northern W. Bengal, Assam, Bhutan; Bangladesh & Burma.

Introduced from F.R.I. Dehra Dun, 1983 by H.S. Pandey and successfully transplanted during 1984.

Used in making flutes, umbrella handles and in paper industry.

21. Ochlandra travancorica Benth. ex Gamble in Ann. Roy. Gard. Calcutta 7 : 110, 1896.

Shrubby bamboo. *Culms* 4-5 m × 2-2.5 cm. Nodes marked with the base of the fallen sheath. *Culm-sheaths* 12-15 cm, longitudinally wrinkled, striate, hairy when young and become glabrous with oldness, rounded above, furnished with long bristles on margins. *Imperfect-blade* narrow 4-6 cm. Available in D.N. 3.

Distributed on the mountains of South India, Travancore, Tinnevelly upto 1200 m.

Introduced during 1863 by Kurz and in 1979 by U.C. Bhattacharyya from South India into this garden and established.

Propagation through rhizomatus cubes, offsets etc.

Used like other bamboos.

22. Oxylenanthera abyssinica (A. Rich) Munro in Trans. Linn. Soc. 26 : 127, 1868.

A moderate sized bamboo, stem more or less solid. *Culms* with shorter internodes. Nodes prominent. *Culm-sheaths* — papery, striate, rounded above. *Imperfect-blade* narrow, 1-3 cm, without auricles. Available in D.N. 3.

Distributed in Tropics of Asia and Africa. Brandis Introduced this from Burma.

Culms used for preparation of shafts for spears etc.

23. Phyllostachys aurea A & Ch. (Rivision) in Bull. Soc. Acclim. III. (V) : 716, 1878.

"Golden Bamboo"

Shrubby (tufted) caespitose type bamboo. *Culms* golden-yellow when older with nodes and comparatively shorter internodes. *Culm-sheaths* 12-18 cm coriaceous, more or less papery, glabrous, rounded above. *Imperfect-blade* – linear-lanceolate, subulate. Rhizome-creeping. Available in D.N. 3.

Distributed in Assam, N.E. India; Burma, China, Japan etc.

24. Thyrsostachys oliveri Gamble in Ann. Roy. Bot Gard. Calcutta 7 : 58, 1896.

Specimens examined : Hort. Bot. Calc.; Dec. 1888, *Gamble s.n.*, Acc. no. 559839 (CAL), *Ibid., Biswas s. n.* (CAL). Jan. 1938.

A tall bamboo 12-16 m × 5-6 cm, bright green. Nodes not thickening much. *Culm-sheaths* somewhat thin, imbricating at the base covering ¾th of the internodes, green when young becomes orange to brown on oldness, back side hairy, somewhat rounded at top with ciliate edge ; auricles absent; *imperfect-blade* 18-20 cm long. Available in D.N. 3 & 20.

Distributed in moist forests of Burma and Thailand.

Introduced by Abdul Hoqe from Shan hills (Burma) in this garden in 1892.

Used for building purposes and making miscellaneous articles. Seeds are edible Flowered during 1940 and 1986 in this garden.

25. **T. siamensis** Gamble in Ann. Roy. Bot. Gard. Calcutta 7 : 59, 1896.

Specimen examined : Hort. Bot. Calc., Dec. 1888, *Gamble s.n.* (CAL).

A graceful gracious bamboo. *Culms* 8-12 m × 3-7 cm; nodes not prominent; internodes shorter, 18-22 cm long. *Culm-sheaths* 22-26 × 12 cm. Covered with whitish hair on the ventral side. *Imperfect-blade* with truncate top. Available in D.N.3.

Distributed in Burma and Thailand. Introduced prior to 1890. Gamble reported this species in 1896. Chiefly used for umbrella handles.

26. **Bambusa polymorpha** Munro in Trans. Linn. Soc. 26 : 98. 1868.

Specimen examined : Dec. 1888, *Gamble* 21046 (CAL).

Tall, *culm-sheaths* upto 15×30 cm, backside bristly. *Imperfect blade* — concave, triangular, apex sharp. Introduced from Burma in Dec. 1888 in D.N. 3 by Gamble.

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