Bamboo Diversity of India: An update

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Abstract

A total of approximately 148 species in 29 genera of bamboos are currently thought to occur in India (both wild and cultivated). The maximum concentration of species is found in the deciduous and semi-evergreen regions of North-east and the tropical moist deciduous forests of North and South India. The North-eastern hilly States of India harbour nearly 90 species of bamboos, 41 of which are endemic to that region. There are 3 large genera (*Bambusa, Dendrocalamus,* and *Ochlandra*) of bamboos in India with more than 10 species each. Together, these three genera represent about 45% of the total bamboo species found in India. On the other hand, there are some genera which are represented by only one species each *e.g. Ampelocalamus, Sarocalamus, Chimonobambusa, Pseudostachyum,* and *Stapletonia.* Bamboos in India show a great diversity in both their habitat and habit of growth. They occur in different forest types, ranging from tropical to sub-alpine zones. Some species are found only in cultivated state in few gardens. The state–wise distribution of bamboos in India is not completely known. Endemism in Indian bamboos is of very high order. More than 50% of the bamboos found naturally occurring in India (71sps) are endemic to the country. This projection is however tentative , since more than a dozen species have been described as new species from India in the recent years and their presence in other geographical regions remains unexplored. None of the wild species of Indian bamboos is known with certainty to have a threatened conservation status. This opinion may be due to the lack of data on exploitation or decline, and lack of systematic studies on distribution and assessment of threat to these plants, compounded by profound taxonomic uncertainties. In India, most of the cultivated bamboos are less vulnerable, and are already conserved in various Gardens or Bambuseta located in different parts of the country.

Introduction

It is now more than a century since the publication of Gamble's (1896) treatment of Indian bamboos. During the interim, many workers have taken up the study of Indian bamboos but the taxonomic status of these plants has improved very little. On the contrary, it has rather been complicated by much that has been published during this interval. Though several bamboo taxonomists have emphasized the importance of collecting vegetative parts of bamboos for future reference, the nature of bamboo specimens collected for herbarium records has improved very little. The record of these specimens still remain fragmentary,

the field notes are either brief or altogether lacking, and the published descriptions of new species fail to include vegetative features of fundamental taxonomic importance. There still exists a lot of confusion about the identity of some species since the same species has been described under different names, or the same name has been applied to different species, or species belonging to different genera have been placed under the same genus. In certain cases, new species have been published on the basis of very minor differences in some vegetative characters, which are known to exist, if taken from different regions of the same plant. The species *Bambusa teres*, *B. cacharensis, B.longispiculata, B.assamica and B. lixin* seem to be creations of such variations, since all these species are very likely to be minor variants of two species, *Bambusa tulda* and *B. nutans*. In the genus *Bambusa* alone, nearly a dozen new species have been proposed, most of these based only on minor variations in some vegetative characters alone. Many of these names are destined to fall into the limbo of synonymy, when flowering parts of these species become available. Wrong identifications, resulting in unauthentic records of species from India, *e.g*. *Bambusa affinis, B.oliveriana, Oxytenanthera parvifolia,*and *Indocalamus debilis* (perhaps also *Bambusa binghami, Bambusa griffithiana* and *B. kingiana*),to mention a few. The presence of all these species in India requires confirmation. Also, an undue haste in transferring species to other genera without any taxonomic justification has further complicated the nomenclatural problems. As an example may be cited the transfer of all the Asian species of *Oxytenanthera* to the genus *Pseudoxytenanthera,* only because Holttum (1956) had pointed out that the ovary structure in various Asian species was different than the type species (*O. abyssinica*) of *Oxytenanthera*, an opinion which later even Holttum himself admitted to have been wrong (Grosser and Liese 1973). Also, *Pseudoxytenanthera* was proposed as a monotypic genus by Soderstrom and Ellis (1987) and the transfer of all the Asian species of *Oxytenanthera* to this genus has no taxonomic support. The transfer of species of genus *Melocalamus* to *Dinochloa* is another such example. Likewise, Majumdar (1989) and many other later authors transferred all the Indian species of the genera *Cephalostachyum, Pseudostachyum,* and *Teinostachyum* to the genus *Schizostachyum*, only because Holttum (1956) had casually suggested such a merger, although without any supporting data. Dransfield (1980) strongly felt that the genera *Cephalostachyum, Pseudostachyum,* and *Teinostachyum* should be treated as distinct from *Schizostachyum*. Stapleton *et al.* (1997) remarked that species of *Cephalostachyum* differ from those of *Schizostachyum* in their dense synflorescences and preliminary molecular data, thereby suggesting that the two genera are not very closely related. These authors have defended *Cephalostachyum* as a separate genus from *Schizostachyum.* The authenticity of the genera *Cephalostachyum, Pseudostachyum,* and *Teinostachyum* has now been well accepted by various authors. *Sinarundinaria* is another example of such controversies. The genus *Sinarundinaria* was proposed by Nakai (1925) for two Chinese bamboos, *S. nitida* and *S. murielae* with *Sinarundinaria nitida* as the type species. This genus received wide recognition from bamboo

taxonomists. However, Stapleton (1994) pointed out that Nakai's description of the genus *Sinarundinaria* was inaccurate, since he incorrectly attributed the genus with leptomorph rhizomes and multiple branch buds, and it did not include the description of flowers which were unknown at that time. The type species of *Sinarundinaria, S. nitida* flowered in 1993 (Renvoize 1993) and was found to possess unilateral spathed inflorescences, similar to both *Fargesia spathacea* and *Sinarundinaria murielae* showing that the genus *Sinarundinaria* was a synonym of the earlier genus *Fargesia* (Franchet 1893). Although *Sinarundinaria* in no more recognised as a distinct genus, several Indian authors (*e.g.* Seethalakshmi and Kumar 1998; Naithani 2008) continue placing several species of bamboos with pachymorph rhizome, loose semelauctant inflorescences, and 3 stamens in *Sinarundinaria* including several other well distinguished genera like *Yushania* , *Drepanostachyum,* as its synonyms. In view of all what has been pointed out above, the earlier published accounts of Indian bamboos (Tewari 1992; Gamble 1896; Seethalakshmi and Kumar 1998; Naithani 2008) have now become out-dated in the context of recent taxonomic research and discoveries, resulting in the need for change in the generic allocation, taxonomic status and nomenclature of many taxa mentioned in these works. Also, new genera and several new species have been published for bamboos from India, subsequent to these publications. The present update is based on the extensive field study of live bamboos from various bamboo rich localities of India by the authors, perusal of published literature, study of herbarium specimens housed in various herbaria, and advice from bamboo specialists.

Bamboo diversity in India:

India has abundant resources and species diversity of bamboo. About 25% of bamboo species of the world are found in India, distributed widely in almost all states. They are particularly abundant in the Western Ghats and the "Sister States "of North-east India (Biswas 1988; Rai and Chauhan 1998). Bamboos occupy 13% of the total forest area of the country (Varmah and Bahadur 1980), growing right from the coastal plains and ascending to elevations of 3700 meters in the Himalayas (Mehra and Sharma 1975). Nearly 123 species and 23 genera of bamboos were reported to grow in India by Seethalakshmi and Kumar (1998). According to a later report by INBAR (2005), a total of 145 species belonging to 23 genera were reported to be found in India, although no list of species was provided. According to Naithani (2008), a total of 20 genera and 115 species of bamboos are present in India. Our present assessment has suggested that a total of about 148 species and 4 varieties in 29 genera grow in India (both wild and cultivated). This figure also includes a few species tentatively included here (e.g. *Bambusa binghami, B. griffithiana,* and *B. kingiana*) whose presence in India requires confirmation. The maximum concentration of species is found in the deciduous and semi-evergreen

regions of the North-east and the tropical moist deciduous forests of North and South India. The North-eastern hilly States of India harbour nearly 90 species of bamboos, 41 of which are endemic to that region. There are 3 large genera (*Bambusa, Dendrocalamus,* and *Ochlandra*) of bamboos in India with more than 10 species each. Two of these, *Bambusa* (37 sps. and 2 varieties), and *Dendrocalamus* (18 sps.) are predominantly arborescent bamboos growing in diverse regions and habitats while the third, *Ochlandra* (with 11 species and 1 variety) is a genus of reed bamboos, restricted to South India. Together, these three genera represent about 45% of the total bamboo species reported from India. On the other hand, there are some genera which are represented by only one species each *e.g. Ampelocalamus, Sarocalamus, Chimonobambusa, Pseudostachyum,* and *Stapletonia.* A list of various genera (with number of species in parenthesis) and species of bamboos found in India (both wild and cultivated) is as follows:

1. *Ampelocalamus* (1): *A. patellaris* (Gamble) Stapleton

2. *Bambusa* (37sp + 2var.): *Bambusa affinis* Munro; +*B. alemtemshii* Naithani; +*B.assamica* Barooah and Borthakur; *B. atra* Lind.; *B. balcooa* Roxb.; *B. bambos* Voss; +*B. bambos* var. *gigantea* Bennet and Gaur; + *B. barpatharica* Borthakur and Barooah; *B. binghamii* Gamble; *B. burmanica* Gamble; +*B.cacharensis* Majumdar; +*B. comillensis* Alam ; +*B. dampaeana* Naithani; +*B. garuchokua* Barooah and Borthakur; **B. glaucescens* (Willd.) Sieb.ex Munro; *B. griffithiana* Munro; *B. jaintiana* Majumdar; *B. khasiana* Munro; *B. kingiana* Gamble; +*B. majumdarii* Kumari and Singh; +*B. manipureana* Naithani and Bisht; +*B. mizorameana* Naithani; *B. memberanacea* (Munro) Stapleton; +*B. mohanramii* Kumari and Singh;**B. multiplex* (Lour.) Raeusch ex Schult. and Schult.f.; +*B. nagalandeana* Naithani; +*B. nairiana* Kumari and Singh; *B. nutans* Wall. ex Munro; *B. oliveriana* Gamble; *B. pallida* Munro; *B. polymorpha* Munro; +*B. pseudopallida* R. Majumdar; +*B. rangaensis* Barooah and Borthakur;+*B. salarkhanii* Alam; *B. teres* Ham. ex Munro; *B. tulda* Roxb.; *B. vulgaris* Schrad. ex Wendl.;**B. vulgaris* var. *vittata* A. and C. Riviere; **B. wamin* Camus. (The natural occurrence of *Bambusa affinis* and *B. oliveriana* is controversial but both these bamboos are grown at the Indian Botanic Garden, Howrah).

3. *Cephalostachyum* (8): *C. capitatum* Munro; *C. flavescens* Kurz.; +*C. fuchsianum* Gamble; *C. latifolium* Munro; + *C. longwanum* Naithani; + *C. mannii* (Gamble) Stapleton and Li; + *C. pallidum* Munro; *C. pergracile* Munro.

4. *Chimnobambusa* (1): + *C. callosa* (Munro) Nakai.

5. *Chimonocalamus* (4): + *C. griffithianus* (Munro) Hsuch and Yi; *C. longiusculus* Hsueh and Yi; + *C. nagalandianus* (Naithani) M.L. Sharma c*omb. nov.*; +*C. lushaiensisi* (Bor) M.L.Sharma c*omb. nov.*

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6. *Dendrocalamus* (18): **D.asper* (Schult.) Backer; +*D. brandisii* (Munro) Kurz.*;* +*D. calostachyus* (Kurz) Kurz ; *Dendrocalamus collettianus* Gamble; **D. copelandii* (Gamble ex Brandis) Xia and Stapleton*;* * *D. giganteus* Munro; *D. hamiltonii* Nees and Arn. ex Munro; *D. hookeri* Munro; *D. latiflorus* Munro*; D. longifimbriatus* Gamble; *D. longispathus* Kurz ; +*D. manipureanus* Naithani and Bisht; +*D. parishii* Munro; +*D. sahnii* Naithani and Bahadur; +*D. sericeus* Munro; *D. sikkimenis* Gamble;+ *D. somdevai* Naithani; *D. strictus* (Roxb.) Nees.

7. *Dinochloa* (2):+*D. andamanica* Kurz.; + *D. nicobariana* Majumdar.

8. *Drepanostachyum* (including *Himalayacalamus*, which is recognised by several authors) (6): +*D. falcatum* (Nees) Keng f.*;* + *D. falconeri* (Munro) D.C. McClint. *;D. hookerianum* (Munro) Keng f.; + *D. intermedium* (Munro) Keng f.; *D. kurzii* (Gamble) Majumdar*;* +*D. polystachyum* (Kurz.ex Gamble) Majumdar.

9. *Gigantochloa* (7): *G. albociliata* (Munro) Kurz ; *G. andamanica (*Kurz.) Kurz; *G. apus* (Bl. ex Schult.f.) Kurz *;***G. atroviolacea* Widjaja*;* +*G.bastareana* Naithani and Pal; *D. macrostachya* Kurz ;**G. pseudoarundinacea* (Steud.) Widjaja.

10. *Indocalamus** (2+1 var.): *I. walkerianus* (Munro) Nakai; +*I. wightianus* (Munro) Nakai; + *I. wightianus* var. *hispidus* (Steud) Nakai.

*Though a new name Karuna has been given to *Indocalamus*, the old name *Indocalamus* is retained as more studies need to be conducted before the new name is used.

11. *Melocalamus* (5): *M. compactiflorus* (Kurz) Benth.; *M.gracilis* Majumdar; +*M. indicus* Majumdar*;* *M. maclellandii* (Munro) Naithani; +*M. mastersii* (Munro) Majumdar.

12. *Melocanna* (3): *M. arundina* Parkinson; *M. baccifera* (*Roxb*.) Kurz; +*M. clarkei* (Gamble ex Brandis) Kumari and Singh.

13. *Neohouzeaua* (2): *N. dullooa* (Camus) Gamble*; N. helferi* (Munro) Gamble.

14. *Neomicrocalamus* (2): *N. andropogonifolius* (Griffith) Stapleton; +*N. prainii* (Gamble) Keng f.

15. *Ochlandra* (11+1 var.): +*O. beddomei* Gamble; +*O. ebracteata* Raizada and Chatterji; + *O. keralensis* Muktesh, Ramesh and Stephen; +*O. scriptoria* (Dennst.) Fischer ;+*O. setigera* Gamble ; +*O. sivagiriana* (Gamble) Camus; + *O. soderstromeana* Muktesh and Stephen ; +*O. spirostylis* Muktesh, Seetha. and Stephen; +*O. talbotii* Brandis; + *O. travancorica* var. *travancorica* Benth. and Hook. f.; +*O. travancorica* var. *hirsuta* Gamble; + *O. wightii* (Munro) Fischer.

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16. *Oxytenanthera* (5): *O. abyssinica* (A. Rich.) Munro; +*O. bourdillonii* Gamble; *O. monadelpha* (Thw.) Alst.; +*O. ritcheyi* (Munro) Blatter and Mc Cann.; + *O. stocksii* Munro.

17. *Phyllostachys* (5):**P. aurea* Carr. ex A. and C. Riviere;* *P. bambusoides* Sieb. and Zucc.; **P. edulis* (Carr.) Lehai; + *P. mannii* Gamble; **P. nigra* (Lodd.) Munro.

18. **Pleioblastus* (1):**P. viridi-striatus* (Regel) Makino.

19.**Pseudosasa* (1): **P. japonica* (Sieb. and Zucc. ex Steud.) Makino ex Nakai.

20. *Pseudostachyum* (1): *P. polymorphum* Munro.

21. *Sarocalamus* (1): *S .racemosa* (Munro) Stapleton.

22. *Schizostachyum* (5): +*S. andamanicum* Kumar and Ramesh; + *S. kalpongianum* Kumar and Ramesh; *S. kurzii* (Munro) Majumdar*; +S. rogersii* Brandis*; +S. seshagirianum* Majumdar.

23.**Shibataea* (1):**S. kumasasa* (Zoll. ex Steud.) Makino ex Nakai.

24. *Stapletonia* (1): + *S.arunachalensis* (Naithani) Singh, Dash and Kumari.

25. *Teinostachyum* (2): +*T.beddomei* Fischer; +*T. griffithii* Munro.

26. *Thamnocalamus* (4): +*T. aristatus* (Gamble) Camus; *T. longispiculatus* (Majumdar) M.L.Sharma + *T. spathiflorus* (Trin.) Munro. *; T. occidentalis* Stapleton.

27. *Thyrsostachys* (2): *T. oliveri* Gamble;**T. regia* (Munro)Bennet.

28. *Yushania* (9): *Y. densifolia* (Munro) Majumdar; *Y.elegans* (Kurz.) Majumdar; +*Y. hirsutea* (Munro) Majumdar; +*Y. jaunsarensis* (Gamble) Yi; *Y. maling* (Gamble) Majumdar; +*Y. microphylla* (Griffith) Majumdar; +*Y. pantlingii* (Gamble) Majumdar; + *Y. rolloana* (Gamble) Yi; *Y. yadongensis* Yi.

29. *Borinda* (1): *B. grossa* (T.P.Yi) Stapleton.

_____*Only cultivated.

_____+ Endemic to India.

Range of bamboo diversity in India

India has abundant resources and species diversity of bamboos which is next only to China and Japan. Bamboos in India show a great diversity in both their habitats and habit of growth. Bamboos in India

occur in different forest types, ranging from tropical to sub-alpine zones. Some species are found only in cultivated state at few places.

Habitat diversity: In India, bamboos grow naturally in almost all states except in Kashmir region of Jammu and Kashmir. About 70% of species of bamboos in India are reported from the eight Sister States of North-east India and the Western Ghats, which happen to be the two biodiversity hot-spots. Bamboos grow right from the southern coastal plains and ascend to elevations of up to 3700 meters in the Himalayas Bamboos occur in different forest types, ranging from tropical to sub-alpine zones. On a conservative estimate, the forest area under bamboos in India was estimated at about 9.57 m. ha., which is nearly 12.8% of the total forest area of the country. The physical geography along with precipitation, temperature and altitudinal variations, play a significant role in the diversity and richness of the country's bamboo flora in forests of North-eastern and eastern part of Indian Himalayas. In general, the richest bamboo diversity occurs in the various forests. Bamboos in temperate forests: In India, Temperate forests are confined to elevations ranging from 1500 m to 3000 m. The principal bamboo species in these forests are the shrubby bamboos belonging to the genera *Chimonobambusa, Drepanostachyum, ,Phyllostachys, Thamnocalamus ,* and *Yushania.* Bamboos in sub-alpine and alpine forests: The vegetation in these types occurs at higher reaches from 3000 m and above.These forests are represented by species of firs (*Abies*), birches (*Betula*), *Rhododendron*, Juniperus *etc.* Very few bamboo species are present in this zone (*e.g. Sarocalamus racemosa , Thamnocalamus aristatus, Yushania microphylla*). The upper altitudinal limit of alpine bamboos is around 3,500-4,000 m in the North-east but considerably lower in the west, where lower winter temperatures are encountered. At higher altitudes, bamboos are a very important source of food for wildlife and useful in protecting the fragile environments.

Habit diversity

The bamboo diversity in habit includes arborescent, shrubby and climbing bamboos. Within all these types, both clump-forming and non-clump-forming bamboos are found.

Arborescent bamboos: A major percentage of the Indian bamboos is constituted by arborescent bamboos with several large- sized bamboos like *Bambusa bambos*, *B. balcooa, B. oliveriana, B. polymorpha, B. tulda,, Dendrocalamus calostachyus, D. giganteus, D. hamiltonii, D.hookeri,D.latiflorus, D. longispathus, D. manipureanus* and some species belonging to the genera *Cephalostachyum, Gigantochloa, Oxytenanthera*, and *Schizostachyum.* Approximately 75 Indian species may be classified as arborescent bamboos.

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Shrubby/reed bamboos: Shrubby and reed bamboos form the second most abundant group of bamboos represented by about 48 species in India. Maximum diversity of shrubby bamboos exists in tropical and sub-tropical areas with abundant rainfall, like Western Ghats, sub-Himalayan belt and North-eastern hilly areas. These bamboos include mostly species of *Ochlandra, Oxytenanthera, Drepanostachyum* and *Yushania*. The sub-temperate and temperate areas of North-western and North-eastern Himalayas support diverse shrubby species belonging to genera *Arundinaria, Chimonobambusa, Chimonocalamus, Drepanostachyum, Neomicrocalamus, Phyllostachys, Thamnocalmus*,and *Yushania.* The genus *Ochlandra,* with 11 species and one variety and endemic to southern India, is the largest genus of shrubby /reed bamboos in India, followed by *Yushania* (9sps.), *Drepanostachyum* (6sps.), and *Oxytenanthera* (5sps.).

Climbers

Climbing bamboos (scandent or semi-scandent) are restricted to Tropical semi-evergreen and evergreen forests of Western Ghats, Andaman and Nicobar Islands, and North-eastern states. They are characterized by features like thin, flexible, whip-like culms from mid-culm upwards, strong central branches that can spread widely, and geniculate culm and branch nodes which help them in their climbing habit. Climbers are mostly found in the genera *Dinochloa, Melocalamus, Neomicrocalamus, Ochlandra,* and *Oxytenanthera.*

Cultivated bamboos

Some species in India are known only in cultivated state. These include:*Bambusa glaucescens* (The Chinese Goddess bamboo ; Hedgebamboo)*, B. multiplex* (Oriental hedge bamboo; Hedgebamboo)*, B. vulgaris*var.*vittata* (Golden bamboo;Tiger bamboo), *B. wamin* (Wamin bamboo), *Dendrocalamus calostachys* (Sweet bamboo); *Dendrocalamus copelandii*; *Dendrocalamus giganteus*(Giant bamboo), *Gigantochloa atroviolacea* (Black bamboo); *Gigantochloa macrostachya*; *Phyllostachys aurea* (Fishpole bamboo ; Golden bamboo), *P. bambusoides* (Japanese timber bamboo), *P. edulis* (Moso bamboo), *P. nigra* (Black bamboo); *Pleioblastus viridi-striatus* (Golden pygmy bamboo), *Pseudosasa japonica* (Arrow bamboo), *Shibataea kumasaca* (Fortune - inviting bamboo), and *Thyrsostachys regia* (Monastery bamboo; Umbrella- handle bamboo) . Of these, *Pleioblastus viridi-striatus, Pseudosasa japonica,* and *Shibataea kumasaca* are in cultivation only at the Lloyd Botanical Garden, Darjeeling from where these were taken to one or two more places for cultivation. The exotic genera include *Pleioblastus*, *Pseudosasa* and *Shibataea.* Some of the cultivated bamboos were introduced in India very early (before 1850) by the British for the purpose of exploring the possibility of exploiting their resources. The bamboos introduced

later were mostly for ornamental value. The records of introduction and the other details of these bamboos are, however, very scanty. Many of the cultivated bamboos have now become naturalized in few states. Most of the cultivated bamboos are conserved in various Gardens or Bambuseta.

State–wise distribution of bamboos in India (wild and cultivated)

Although bamboo grows naturally in every state, its frequency varies in different regions, primarily due to variations in climatic conditions. The state–wise distribution of bamboos in India is not completely known for all states. While such a study has recently been undertaken in some states, particularly in the North-eastern region, the information is lacking on the bamboo species present in those states where bamboo has as yet not been adopted in the social forestry or agroforestry system. The states rich in bamboo species include: Meghalaya (46-50), Arunachal Pradesh (47), Manipur (40+1 var.), and Assam (38 + 2var.) Mizoram (33), Sikkim (29-30), West Bengal (32), Nagaland (32), Kerala (22+2var.), Andaman's (22+2var.), Tripura (19+1var.), Bihar (19), Odhisa (12+1var.), Jharkhand (10+1var.), Karnataka (10), Chhattisgarh (9)), Himachal Pradesh (8), Madhya Pradesh (8), Maharashtra (7+1 var.). The States with the least number of species are: Punjab (4), Jammu and Kashmir (2, only in Jammu area), Rajasthan (2), Gujarat (2), Haryana (2), and Goa (2).

Endemism in Indian bamboos

Endemism in Indian bamboos is of very high order. More than 50% of the bamboos (71 sps. +3 var., marked + in the above list) found naturally occurring in India are endemic to the country. This projection is however tentative, since more than a dozen species have been described as new species from India in the recent years and their presence in other geographical regions remains unexplored. The major zones of endemic taxa of bamboos are: North-east India (41 species), Western Ghats and Peninsular India (14 species and 3 var.), North-west and Central Himalayan region (6 species), and Andaman and Nicobar Islands (5-6 species). Many genera have a high composition of endemic species. Thus, 16of the 36species of *Bambusa;* all the 11species of *Ochlandra ;*6of the 18species of *Dendrocalamus*; 3 of the 5 species of *Oxytenanthera;,*4 of the 5 species of *Schizostachyum* ; 5 of the 9 species of *Yushania*; 4 of the 8 species of *Cephalostachyum;*5 of the 6 species of *Drepanostachyum*; 2 of the 4 species of*Chimonocalamus;*3 of the 5 species of *Melocalamus;* both species of the genera *Dinochloa*, *Teinostachyum,* and *Thamnocalamus;* one of the two species of *Neomicrocalamus;* one of the 3 species of *Indocalamus;*the lone species of *Chimonobambusa* and *Stapletonia; and* the lone naturally occurring species of *Phyllostachys* are endemic in the region of their distribution.

Theme: Biology, Morphology and Taxonomy

Rare and threatened bamboos of India

None of the bamboo species found in India is known to be threatened as per the CITES (Convention on International Trade in Endangered species of wild Fauna and Flora). This may partly be due to the lack of data on their exploitation from natural resources and partly due to lack of systematic studies on assessment of threat to these plants. A few bamboos from India were described as new species from single collections only and these have never been recollected. Consequently, these species have qualified to be known as rare bamboos. A preliminary perusal of secondary information from published literature and Herbarial records has revealed that about 17(-18) species of bamboos found occurring naturally in India may come under rare / threatened category. These species are: *Chimonocalamus longiusculus*, *C. nagalandianus, Cephalostachyu mannii, Dendrocalamus parishii, D. sahnii, D. somdevai, Dinochloa nicobariana, Indocalamus walkerianus, Melocanna clarkei, M. indicus, Ochlandra beddomei, Oxytenanthera bourdillonii, Schizostachyum rogersii, S. seshagirianum,, Yushania densifolia* ,and *Y. rolloana.*

Conservation of bamboos in India

Conservation of bamboos is practiced like other higher plants, both *in situ* and *ex situ* by traditional methods. With an aim to harness the potential of bamboo crop in the country, a "National Bamboo Mission" (NBM) was set up by Govt. of India in 2006, under the Ministry of Agriculture, New Delhi. Among others, one of the several objectives of the Mission was to increase the coverage of area, both in forest and non-forest areas with appropriate varieties. With the efforts of the Bamboo Mission, area under bamboo has increased manifold and this has given a big boost to *in situ* conservation of bamboo in India. Several research laboratories engaged in bamboo tissue culture are also playing a key role in bamboo conservation by standardizing *in vitro* bamboo propagation protocols and thereby making available bamboo propagules for raising large scale plantations of selected varieties. In India, most of the cultivated bamboos are conserved in various Gardens or Bambuseta. The best collection of bamboos in India is conserved at the following Bambuseta.1. Tropical Botanical Garden and Research Institute, Palode, Thiruvanathapuram, Kerala (48 sps.).

2. Kerala Forest Research Institute, Peechi, (sub-centreNilambur andPalappilly)Kerala (45 sps.).

3. Forest Research institute, Dehra Dun, Uttarakhand (35 sps.).

4. Van Vigyan Kendra, Chessa, Arunachal Pradesh (35 sps.).

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6. Botanical Garden, Panjab University Chandigarh (26 sps.).

7. Indian Botanic Garden Howrah, W. Bengal (24 sps.).

8. Institute of Himalayan Biotechnology, Palampur, Himachal Pradesh (*ca*.28 sps.).

9. Lloyd Botanical Garden, Darjeeling, W. Bengal (10 sps.), and few other places.

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