



Inventorying bamboo biodiversity of North Bengal: A Case Study

Arvind Kumar Goyal, Prasanta Kumar Ghosh¹, Ajay Kumar Dubey¹, Arnab Sen*

Molecular Genetics Laboratory, Department of Botany, University of North Bengal, Siliguri-734013, West Bengal, India, ¹Directorate of Forests, Government of West Bengal, Silviculture (Hills) Division, Kurseong Research Range, Darjeeling, West Bengal, India.

Abstract

Bamboo harboring both herbaceous and woody members has both ecological and economic importance and is included in the Non-timber forest product, but regional assessment is still lacking. North Bengal covers six districts including both hills and plains are rich in biological diversity. It houses different genera having several species of bamboo. Inventory resulted in recording of 34 species of bamboos under the tribe *Bambuseae* from North Bengal belonging to 13 genera of which 26 species (76.47%) under 8 genera are sympodial type while rest 8 species (23.53%) under 5 genera belongs to monopodial type. In spite of having extensive insufficiency and discrepancies of bamboo taxonomy and distribution, this approach may help in the conservation of this natural resource. Enumeration of different species with botanical name, common name, vernacular name(s), the sub tribe they belong to and the type of rhizome is provided. However extensive study is required to know emphatically about the bamboo diversity of this region.

Keywords: Bamboo, Bambuseae, Diversity, Conservation, North Bengal

©2012 BioMedAsia All right reserved

1. Introduction

Bamboo is the fastest growing perennial evergreen arborescent plant belonging to the true grass family *Poaceae*, subfamily *Bambusoideae*¹. Bamboo is commonly known as “poor man’s timber” since it is used by the rural population of this country on daily basis². Because of its global demand and diverse uses bamboo is now known as “green gold” of the forest³. Their adaptability to grow in a wide range of climate and regions make them the principal and the most productive members of the grass family. Bamboo can thrive in hot, humid rainforests and also cold hardy forest having temperature of about -20°C. It can tolerate extreme precipitation ranging from 32-50 inches annual rainfall. Bamboo’s unique rhizome structure is responsible for its accelerated growth rate. Comprising of over 1,500 species included in 87 genera worldwide⁴, bamboos are unevenly distributed in different parts of the humid tropical, sub-tropical and temperate regions. Well endowed with large number of bamboo, India has the second largest bamboo reserve after China⁵. About 8.96 million hectares of land are used for bamboo cultivation through out the country including forest land, homesteads and private plantation, which accounts for nearly half of the total land area under bamboo cultivation in Asia.

As per Sharma *et al.*⁶, in India there are about 136 indigenous and exotic species, under 36 genera found to grow naturally and/or under cultivation. North Bengal has varied type of forest

cover. North Bengal has the potential to a house a large diversity of bamboo. Its wide range of uses and versatility makes it eligible to be of multiple use alternatives to timber, food for rural poor and tribal in particular. North Bengal is endowed with some important genera of bamboo which include different species, subspecies and varieties. The main problem that poses in bamboo is its flowering because of which its taxonomy has been fairly neglected. Moreover, depending upon the parts of the plant, taxonomists took in consideration classified them variously. Bamboo is considered to be a multipurpose plant having about 1500 documented uses⁷ as medicine, food and fodder, preventing soil erosion etc. and is one of the worlds best engineering material because of its high tensile strength thus contributes to the ecology of the area but because of the human pressure the forest cover is shrinking at an extensive rate which in turn hampers the survival of many commercially important bamboo species. The high antioxidants and nutritive value contributes to its importance in therapeutics and folkloric medicine^{8,9}. Keeping the merits of bamboo in mind and the status of their forest cover, the foremost attempt must be to conserve their diversity and this can be done by protecting their natural habitat and also conscious management and cultivation.

Considering the ecological and economical significance of bamboo in North Bengal, the aim of the present investigation is to have an insight into the different types of bamboo (both indigenous and exotic) growing in North Bengal and the maintenance of germplasm to conserve their biodiversity.

2. Materials and Method

2.1 Study Area

The Northern half of the State of West Bengal is referred to as North Bengal which is surrounded by International borders of Bhutan, Nepal and Bangladesh. The inventory was conducted

*Corresponding author

Full Address:

Molecular Genetics Laboratory, Department of Botany, University of North Bengal, Siliguri-734013, West Bengal, India

Phone no. +91-353-6528172

E-mail: senarnab_nbu@hotmail.com

Bengal which comprises of six districts- Darjeeling (Latitude 27.03° N, Longitude 88.18° E), Jalpaiguri (Latitude 26.16" to 27.0° N, Longitude 88.04' to 89.53" E), Coochbehar (Latitude 25.57'47" to 26.36'2" N, Longitude 89.54'35" to 88.47'44"E), North Dinajpur (Latitude 25.11' to 26.49' N, Longitude 87.49' to 90.00' E), South Dinajpur (Latitude 26.35'15" to 25.10'55" N, Longitude 89.00'30" to 87.48'37" E) and Malda (Latitude 24.40'20" to 25.32'08"N, Longitude 88.28'10" to 87.45'50"E), covering an area of about 21,540.66 sq. km. It has wide and diverse forest cover that houses different type of bamboo.

2.2 Sampling Methods

The study was conducted in selected places from all the six districts included in North Bengal. The field work was completed in nine months. Initially random walk in the forest was opted for sampling and later regular interval was maintained to have fixed sampling intensity for the study.

Exploration of different places like Kalimpong, Lataguri, Siliguri, Patharghata, Madarihat, Lava, Sukna, Kalijora, Pundibari, Gorubathan and Malda (Fig. I) during different season of the year resulted in the collection of over 100 bamboo specimens. The initial identification was made using some manuals and taxonomic keys available in the public domains, like Bamboos of Nepal¹⁰, Bamboos of Sikkim (India) Bhutan and Nepal¹¹. The specimens thus collected were planted in "Bambusetum" at Kurseong Research Range, Sukna to maintain the germplasm. The authentication of the bamboo species was finally done with the help of bamboo taxonomist.

3. Results and Discussion

The survey resulted in the documentation of 34 species of bamboo under 13 genera after authentication by the bamboo

taxonomist. The genera of bamboo encountered in this region included *Bambusa*, *Cephalostychnum*, *Dendrocalamus*, *Drepanostachyum*, *Gigantochloa*, *Himalayacalamus*, *Melocanna*, *Pleiolblastus*, *Phyllostachys*, *Pseudosasa*, *Sasaella*, *Shibataea*, and *Yushania*. Maximum number of species was recorded under the genera *Bambusa* with fourteen species followed by *Dendrocalamus* having five species, *Phyllostachys* three species and *Drepanostachyum* and *Pleiolblastus* were represented by two species each while only single species was documented under rest genera (Fig II).

The species are enumerated with brief ideas on their sub-tribe, common name, what they are called locally and the type of rhizome they possesses (Table 1). It was interesting to note that a number of genera have been encountered in North Bengal which did not have any records of their occurrence in West Bengal previously. The genera of bamboo previously recorded from West Bengal include *Arundinaria*, *Bambusa*, *Dendrocalamus*, *Dinochloa*, *Gigantochloa*, *Melocanna*, *Pseudosasa*, *Schizostachyum*, *Sinarundinaria*, *Thamnocalamus* and *Thyrsostachys*¹². The new genera that we encountered in North Bengal include *Cephalostychnum*, *Drepanostachyum*, *Himalayacalamus*, *Pleiolblastus*, *Phyllostachys*, *Sasaella*, *Shibataea*, and *Yushania*. Thus it is seen that out of 13 genera recorded from North Bengal, 8 genera were found to have been recorded for the first time. Exploring the study area resulted in enhancing our knowledge regarding the available bamboo resources in this region. The regional impression also lays the foundation for geographic prioritization of efforts to conserve the bamboo biodiversity. The present communication provides information of the different bamboo species adapted to grow in North Bengal with some knowledge on the sub-tribe they belong to, type of rhizome, common and vernacular names. The 13 genera identified so far comprises of both the sympodial or clump

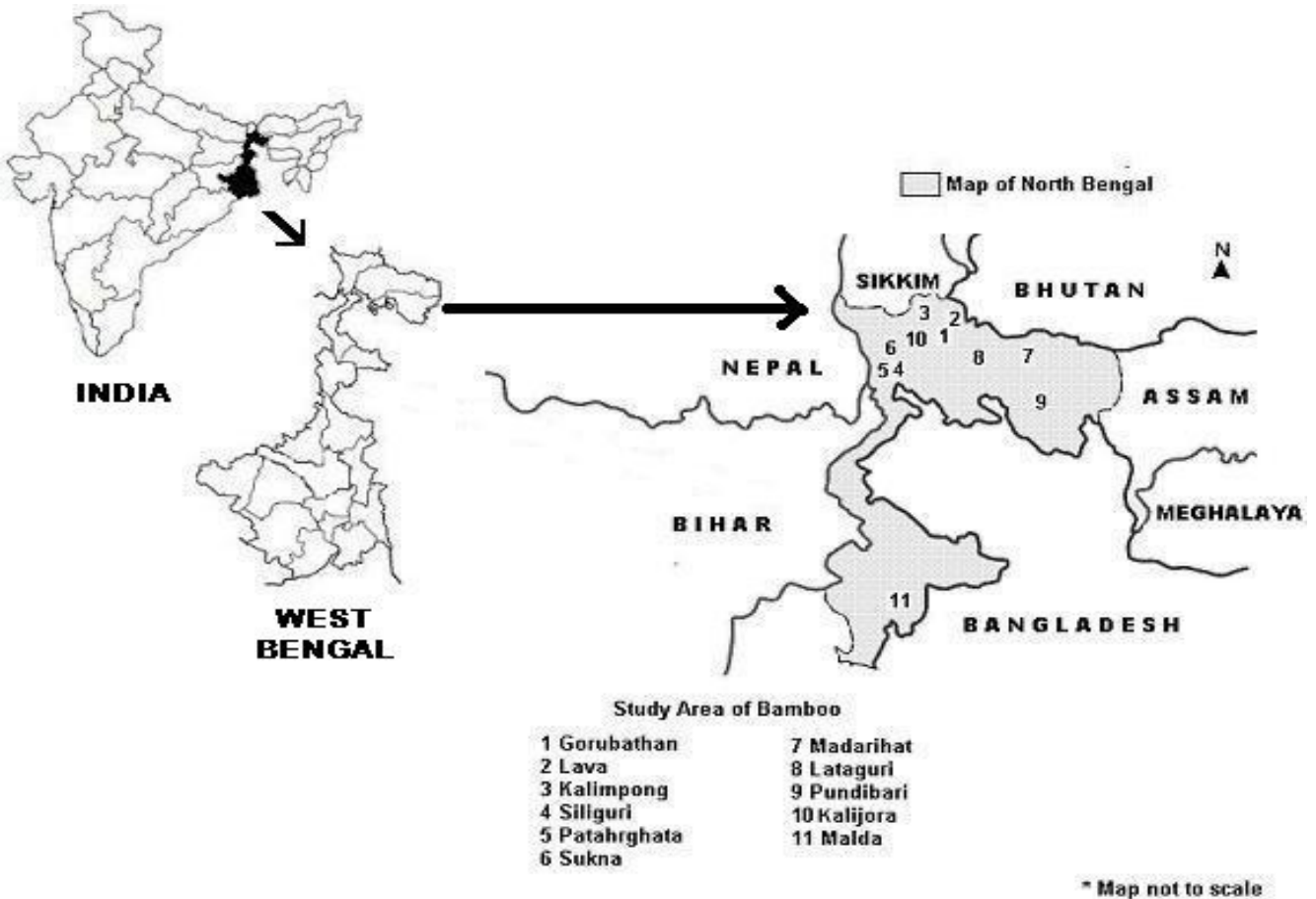


Figure I: Map showing the different places of study.

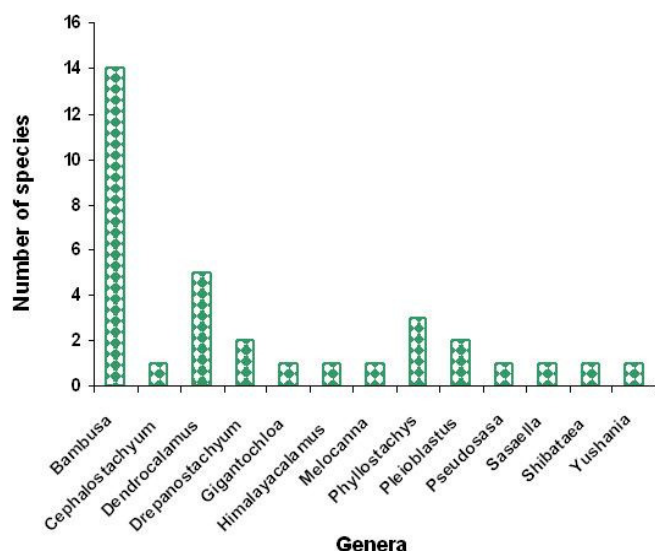


Figure II: Number of species in each Genera.

forming bamboo and the monopodial or non-clump forming bamboo of which 26 species (76.47%) under 8 genera constitute the first category while rest 8 species (23.53%) under 5 genera belongs to the other type. Conservation of bamboo diversity is of utmost importance both economically and in conservation terms. The study also resulted in creating a “Bamboosetum” covering an area of 0.6 hectare at Kurseong Research Range, Sukna where all the 34 species identified so far along with some non-identified are planted to maintain the germplasm, which in turn will represent the local bamboo flora and also help us to study their adaptability in the foot hill plains of North Bengal, growth behavior and reproductive biology and finally help in conservation of bamboo resource.

This survey opens up a new dimension for gaining insight into the micro-propagation techniques and for studying genetic diversity and medicinal properties of these species in details.

Recent advancement of molecular approaches has opened door to more sophisticated studies revealing much about the genetic diversity of Bamboo. The new techniques can also be employed to study the medicinal property of bamboo which in turn will prove what benefits bamboo has from Silviculture point of view.

Acknowledgement

The authors are thankful to the Directorate of Forests, Government of West Bengal, Silviculture (Hills) division,

Kurseong Research Range, Darjeeling, for providing the necessary help, support and information. The authors are also obliged to the bamboo taxonomist Mr. Punya P. Poudyal, consultant, Bamboo Mission, Sikkim for authentication of the bamboo species. AKG acknowledge UGC for providing the UGC Meritorious Fellowship in Science.

References

1. Kigomo BN, Distribution, cultivation and research status of bamboo in Eastern Africa. *KEFRI, Ecological Series Monograph*, 1(1988) 1-19.
2. Goyal AK, Middha SK, Usha T, Chatterjee S, Bothra A K, Nagaveni M B & Sen A, Bamboo-infoline: A database for North Bengal bamboo's. *Bioinformation*, 5 (2010) 184-185.
3. Keshari V P, Bamboo: From poor man's timber to green gold. Hamro Kalpana Brikshya, 164 (2005) 10-4.
4. Ohrnberger D, The Bamboos of the World: Annotated Nomenclature and Literature of the Species and the Higher and Lower Taxa. *Elsevier*, Amsterdam, (1999) 585.
5. Rai S N & Chauhan K V S. Distribution and Growing Stock of Bamboos in India. *Indian Forester*, 124 (1998) 89-98.
6. Sharma Y M L, Inventory and resources of bamboos. In: Rao AN, Dhanarajan G & Sastry CB, ed. *Recent Research on Bamboos*. CAF, China and IDRC, Canada, (1987) 14-17.
7. Scurlock J M O, Dayton D C & Hames B, Bamboo: an overlooked biomass resource. *Biomass Bioenergy*, 19 (2000) 229-244.
8. Goyal A K, Middha S K & Sen A, Evaluation of DPPH radical scavenging activity, total phenols and antioxidant activities in Indian wild *Bambusa vulgaris* 'Vittata' methanolic leaf extract. *J Natural Pharmaceuticals*, 1(2010) 34-39.
9. Goyal A K, Middha S K & Sen A, In vitro antioxidative profiling of different fractions of *Dendrocalamus strictus* (Roxb.) Nees leaf extracts. *Free Radicals and Antioxidants*, 1(2011) 42-48.
10. Stapleton C, Bamboos of Nepal: an illustrated guide. Royal Botanic Garden, Kew, (1994) 4.
11. Poudyal P P, Bamboos of Sikkim (India) Bhutan and Nepal. New Hira Books Enterprises, Kathmandu, Nepal, (2006).
12. Seethalakshmi K K & Kumar M S M, Bamboos of India: a compendium. Kerela Forest Research Institute and International Network for Bamboo and Rattan. (1998) 10.

Table1: List of the different species of bamboo included in the 13 genera with brief idea about the sub-tribe they belong to, their common name, vernacular name and the type of rhizome they possess.

Name	Sub - tribe	Common Name	Vernacular Name	Clump type
<i>Bambusa vulgaris</i> 'Vittata' A. & C. Riviere	Bambusinae	Painted bamboo	Bansini	Clumping
<i>Bambusa pallida</i> Munro	Bambusinae	Makal	Deu bans	Clumping
<i>Bambusa multiplex</i> 'Alphonso-Karr' R.A. Young	Bambusinae	Alphonse Karr	-	Clumping
<i>Bambusa bambos</i> Willd.	Bambusinae	Giant thorny	Kanta bans	Clumping
<i>Bambusa nutans</i> Wallich ex Munro	Bambusinae	Makla Bans	Makla bans	Clumping
<i>Bambusa tuldoidea</i> 'Ventricosa' Kimmei	Bambusinae	Buddha's belly bamboo	Kalsi bans	Clumping
<i>Bambusa multiplex</i> 'Riviereorum' (R. Maire) Chia & Fung	Bambusinae	Chinese Goddess	Chituwa Nigalo, Jhapro	Clumping
<i>Bambusa balcooa</i> Roxb.	Bambusinae	Female bamboo	Boro bans	Clumping
<i>Bambusa vulgaris</i> 'Wamin' Brandis ex McClure	Bambusinae	Buddha's common bamboo	Lota bans	Clumping
<i>Bambusa longispiculata</i> Gamble ex Brandis	Bambusinae	Taru/ Talla	Mitenga, Khang	Clumping
<i>Bambusa atra</i> Lindley	Bambusinae	Bogor thin-walled	-	Clumping
<i>Bambusa oliveriana</i> Gamble	Bambusinae	Chinese spiny	-	Clumping
<i>Bambusa sinospinosa</i> McClure	Bambusinae	Chinese thorny	Chinese thorny	Clumping
<i>Bambusa tulda</i> Roxb.	Bambusinae	Bengal bamboo	Jowa	Clumping
<i>Cephalostachyum latifolium</i> Munro.	Melocannine	Large leaved hollow	Cope bans	Clumping
<i>Dendrocalamus hamiltonii</i> Munro.	Bambusinae	Kaghsi	Chawa bans	Clumping
<i>Dendrocalamus sikkimensis</i> Gamble ex Oliver	Bambusinae	Bhutan bamboo	Bhalu bans	Clumping
<i>Dendrocalamus giganteus</i> Munro.	Bambusinae	Giant bamboo	Koko bans	Clumping
<i>Dendrocalamus asper</i> (Schulte) Backer ex K. Heyne	Bambusinae	Rough bamboo	Thai tama	Clumping
<i>Dendrocalamus strictus</i> (Roxb.) Nees	Bambusinae	Male bamboo	Karali bans	Clumping
<i>Drepanostachyum khasianum</i> (Munro) Keng	Arundinariinae	Khasia bamboo	Ban nigalo, Khasia Nigalo	Clumping
<i>Drepanostachyum intermedium</i> (Munro) Keng	Arundinariinae	Tite nigalo	Tite nigalo	Clumping
<i>Gigantochloa</i> , Kurz	Bambusinae	-	-	Clumping
<i>Himalayacalamus hookerianus</i> (Munro) Stapleton	Arundinariinae	Paryang, Blue bamboo	Padang	Clumping
<i>Melocanna baccifera</i> (Roxb.) Kurz ex Skeels	Melocannine	Philing bans	Muli	Clumping
<i>Phyllostachys nigra</i> Lodd. ex Lindl. (Munro)	Shibataeinae	Black bamboo	Kalo nigalo	Running
<i>Phyllostachys aurea</i> Carriere ex A. & C. Riviere	Shibataeinae	Golden/ Fishpole bamboo	-	Running
<i>Phyllostachys edulis</i> (Carriere) J. Houz.	Shibataeinae	Moso bamboo	Katta bans	Running
<i>Pleioblastus fortunei</i> (Van Houtte) Nakai	Arundinariinae	Dwarf white stripe	-	Running
<i>Pleioblastus argenteostriatus</i> (Regel) Nakai	Arundinariinae	Argenteos-triatus bamboo	Dharkay Nigalo	Running
<i>Pseudosasa japonica</i> Makino	Arundinariinae	Arrow bamboo	Arrow	Running
<i>Sasaella ramosa</i> Makino	Arundinariinae	Ramosa bamboo	-	Running
<i>Shibataea kumasaca</i> Nakai	Shibataeinae	Ruscus bamboo	Sasa bans	Running
<i>Yushania maling</i> (Gamble) R.B. Majumdar	Arundinariinae	Maling bamboo	Malingo	Clumping