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Diversity and distribution of Bamboos in Pangolakha Wildlife Sanctuary in Sikkim, India

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Abstract

The present paper recorded the occurrence of 14 species of bamboos in Pangolakha Wildlife Sanctuary of Sikkim along with their vernacular names, distribution and uses.

Key words: Bamboos, Pangolakha Sanctuary, Sikkim.

INTRODUCTION

Bamboos are a conspicuous group of plants with multifarious uses, belonging to the sub- family Bambusoideae of Poaceae. According to Soderstrom & Ellis (1987), there are 1250 species of bamboos under 75 genera all over the world. India is the second largest diversity centre for bamboos with 18 genera and 128 species (Seethalakshmi & Kumar 1998) of which 28 species, 1 variety and 1 forma belonging to 9 genera are recorded in Sikkim (Sharma & Borthakur 2007). Bamboo forests cover about 14 million hectares of the earth's surface, 80 % of which is present in Asia (Tewari 1992). Tropical Asia can be referred as the centre for diversity of bamboo germplasm (Biswas 1988). Bamboos occupy the habitats from sea level to high mountains, up to an altitude of 4000 m and prefer the region of high rainfall ranging from about 1270 mm to 6350 mm or even more.

From the utilization point of view there is no other plant equivalent to that of bamboos as important to the rural as well as urban people. It is deep rooted in our culture and civilization. Direct evidence for its use can be traced as far back as 5000 years ago in the Indus Valley civilization. Even in this mechanical age their usefulness beyond any doubt and is likely to continue because they are a necessity of life in South East Asian communities (Holttum 1956).

Although several botanical expedition have been carried out in Sikkim since Hooker's period, but adequate attention has not been given to asses the bamboo flora of any protected area of the State. Taxonomically, bamboos are considered as one of the most difficult group of plants to identify, due to non-availability of flowers, since most bamboo species flower only at irregular intervals and often die soon after. The present attempt is the first step toward the contribution to the bamboo flora of a particular protected area in Sikkim.

Study area and location

Pangolakha Wildlife Sanctuary, which is the largest Sanctuary of Sikkim was came into existence through the declaration of notification No. WL/ F/ 89 dated 07.11.2000. With the total area of 128 sq km i.e. of 29,424,53 Hectares (approx.), it is situated in between 27Ú 08´03" N latitude near *Phusrey* in southern tip to 27Ú 21´59" N latitude in northern tip near *Jelepla* and extended from 88Ú 55´ 23" E longitude near *Batangla* to 88Ú 41´ 28" E longitude at *Simane Khola* near *Aritar*. The lowest point of the Sanctuary falls at 27Ú 11´ 35" N latitude and 88Ú 43´ 43" E longitude at *Chukha* river in between *Rigu* and *Sangha* river, where as the highest elevation points falls on 27Ú 21´ 01" N latitude and 88Ú 53´ 16" E longitude.

The map of the Sanctuary is somewhat looks like human footprint. The vicinity of the Sanctuary is partially inhabited by Border Security Force (BSF), Indian Army and by few *Sherpa* and *Bhutia* tribal people who sustain the Indian Army in the form of labourers, suppliers etc.

The Pangolakha Wildlife Sanctuary is one of the richest areas located within the "Himalaya Hotspot" of biodiversity. It upholds the range of typical alpine to temperate to subtropical vegetation and supports a huge repository of Rhododendrons, Silver firs, Juniper forest and several species of herbs, moss-filled oak forests with dense bamboo thickets form an ideal habitat for various rare and endangered plants of the Sikkim to grow luxuriantly viz. *Panax pseudoginseng, Aconitum* spp, *Podophyllum hexandrum, Nardostachys jatamansi, Dactylorhiza hatagirea, Taxus wallichii, Paris polyphylla, Rheum nobile, Neopicrorhiza scrophulariiflora,* etc. It provides contiguous intact belt of habitat for many carnivores and ungulates connecting borders of adjoining Bhutan and West Bengal.

MATERIALS AND METHODS

In order to prepare the bamboo flora of the Pangolakha Wildlife Sanctuary a number of field explorations have been carried out in the sanctuary during 2004 – 2007. Along with the collection of plant materials, elaborate notes were taken on the habit, habitat and other characters. Collected specimens were made into mounted herbarium sheets following the procedure as recommended by Jain & Rao (1977). Provisional identification of the specimens were made with the help of available literature and were matched in different herbaria viz., BSHC, CAL and DD. Different associated plants were also recorded and identified in the similar manner. Specimens will be deposited in BSHC and NBU after the works are over.

ENUMERATION

Exploration of the Pangolakha Wildlife Sanctuary has resulted in the documentation of twelve species of bamboo belonging to six genera and has been enumerated below along with their vernacular names, distribution, uses, and references to voucher specimens (Exsiccatae) In addition *Viburnum mullaha, Holoboelia latifolia, Rubia manjith, Panax* spp., *Poa* spp., *Alnus nepalensis, Urtica dioca, Elastostemma* spp. are recorded as most common associated plants of Bamboos in Pangolkha Wildlife Sanctuary.

Arundinaria racemosa Munro in Trans. Linn. Soc. 26(1): 17. 1868; Gamble in Ann. Roy. Bot. Gard. Cal. 7: 9.1896; Seethalakshmi & Kumar, Bamboos of India: 28. 1998. *Yushania racemosa* (Munro) R. Majumdar in Karthikeyan *et al*., Fl. Ind. Enum. Mono. 283. 1989.
Vernacular names*: Sanu malingo* (Nepali); *Miknu* (Bhutia); *Fyung* (Lepcha).
Distribution: INDIA: Arunachal Pradesh, Manipur, Sikkim and West Bengal (Darjeeling district); BHUTAN, CHINA, MYANMAR, NEPAL.
Uses: Making mats, roofing of native houses, fencing and leaves as fodder.
Exsiccatus: Pangolakha, *SR Lepcha, AP Das, T Prasad 3434*, dated 13.10.2008.

Bambusa nutans Wallich ex Munro in Trans. Linn. Soc, 26 (1): 92. 1868; Gamble in Ann. Roy. Bot. Gard. Cal. 7: 32. 1.30, 1896: *et* in Hook. f., Fl. Brit. India, 7: 387. 1896; Seethalakshmi & Kumar, Bamboos of lndia: 62. 1998.
Vernacular names*: Malbans* (Nepali), *Yusing* (Bhutia), *Matlu, Whalo* (Lepcha).
Distribution: INDIA: Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, Orissa, Sikkim, Uttaranchal, West Bengal; NEPAL.
Uses: Construction of houses, making baskets, mats etc.
Exsiccatus: Below Rachela, *SR Lepcha, T. Sharma & AP Das 3435*, dated 13.10.2008.

Bambusa tulda Roxburgh, Hort. Beng. 25. 1814; *et* Fl. Ind. 2: 193. 1832; Munro in Trans. Linn. Soc. 26 (1): 91. 1868; Seethalakshmi & Kumar, Bamboos of India: 79. 1998.
Vernacular names*: Borem* (Bhutia), *Sigaray bans* (Nepali), *Paoshiding ying* (Lepcha).
Distribution: INDIA: Arunachal Pradesh, Assam, Karnataka, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Uttar Pradesh, West Bengal; BANGLADESH, BHUTAN, INDONESIA, MYANMAR. NEPAL, PHILIPPINES, SINGAPORE, THAILAND.
Uses: Construction of houses, agricultural implements, house-hold articles and weaving materials.
Exsiccatus: Subaney – Pangolakha, *SR Lepcha, T. Sharma & AP Das 3436*, dated 13.10.2008.

Dendrocalamus hamiltonii Nees *et* Arnott ex Munro in Trans. Linn. Soc. 26(1); 151. 1868; Gamble in Ann. Roy. Bot. Gard. Cal. 7: 84. 1896; Seethalakshmi & Kumar, Bamboos of India: 109. 1998.
Vernacular names*: Choya bans, Bans bans, Tama bans* (Nepali), *Yim-yot- pao* (Lepcha), *Pasing* (Bhutia).
Distribution: INDIA: Arunachal Pradesh, Assam, Manipur, Mizoram, Meghalaya, Nagaland, Sikkim, Tripura; BHUTAN, BANGLADESH, MYANMAR. NEPAL, THAILAND.
Uses: Construction of houses, making baskets, mats, firewood, as containers for water, milk, young shoots as vegetable.
Exsiccatus: Subaney – Pangolakha, *SR Lepcha, T. Sharma & AP Das 3437*, dated 15.10.2008.

Dendrocalamus patellaris Gamble in Ann. Roy. Bot. Gard. Cal. 7: 86. 1896; R. Majumdar in Karthikeyan *et al.*, Fl. Ind. Enum. Mono. 276.1989; Seethalaksmi & Kumar, Bamboos of India: 122.1998.
Vernacular names*: Neba bans* (Nepali), *Pagjiok, Burmyakyang* (Lepcha).
Distribution: INDIA:Arunachal Pradesh, Assam, Nagaland, Sikkim; BHUTAN, NEPAL.
Uses: Used for weaving.
Exsiccatus: Subaney Danra, *SR Lepcha, T. Sharma & AP Das 3438*, dated 15.10.2008.

Dendrocalamus sikkimensis Gamble in Ann. Roy. Bot. Gard. Cal. 7: 82. 1896; Seethalakshmi & Kumar, Bamboos of India: 126. 1998**.**
Vernacular names: *Bhalu bans* (Nepali), *Thungsing* (Bhutia), *Pugriang, Podyang* (Lepcha).
Distribution: INDIA: Arunachal Pradesh, Meghalaya, Nagaland, Sikkim; BHUTAN, CHINA, NEPAL.
Uses: Making chungas to carry milk and water , construction of houses etc.
Exsiccatus: South Rigu boarder, *SR Lepcha, T. Sharma & AP Das 3439*, dated 19.10.2008.

Schizostachyum dullooa (Gamble) R. Majumdar in Karthikeyan *et al*., Fl. Ind. Enum. Mono. 281. 1989; *Teinostachyum dullooa* Gamble in Ann. Roy. Bot. Gard. Cal. 7: 101. 1896; *et* in Hook. f., Fl. Brit. India 7: 411. 1896; *Neohouzeaua dullooa* (Gamble) A. Camus in Bull. Mus. Nat. Hist. Paris 28: 100. 1922.
Vernacular names: *Tokrebans* (Nepali), *Paksula* (Lepcha).
Distribution: INDIA: Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, Sikkim, Tripura; BANGLADESH, BHUTAN, MYANMAR.
Uses: Making baskets, mats, etc.
Exsiccatus: South Rigu boarder, *SR Lepcha, T. Sharma & AP Das 3447*, dated 19.10.2008.

Schizostachyum munroi Kumar & Singh in J. Ind. Bot. Soc.701. 423. 1991. *Cephalostachyum capitatum* Munro in Trans. Linn. Soc. 26 (1): 139. 1868. *Schizostachyum capitatum* (Munro) R. Majumdar in Karthikeyan *et al*., Fl. Ind. Enum. Mono. 281. 1989.
Vernacular names: *Gopay bans* (Nepali), *Payong* (Lepcha).
Distribution: INDIA: Arunachal Pradesh, Manipur, Mizoram, Nagaland, Sikkim; BHUTAN

Uses: Making baskets, mats, rope etc.
Exsiccatus: South Rigu boarder, *SR Lepcha, T. Sharma & AP Das 3440*, dated 19.10.2008.

Sinarundinaria hookeriana (Munro) Chao & Renvoize in Kew Bull. 44: 358. 1989; Seethalakshmi & Kumar, Bamboos of India: 274. 1998. *Drepanostachyum hookerianum* (Munro) Keng. F. in J. Bamb. Rec. 2(1) : 17. 1983; Tewari, Monograph: 84. 1992. *Himalayacalamus hookerianus* (Munro) Stapleton in Fl. Bhutan 3 (2): 510. 2000.
Vernacular names*: Prong* (Lepcha), *Paryang* (Nepali); *Blue Bamboo* (English).
Distribution: INDIA: Arunachal Pradesh, Meghalaya, Sikkim, West Bengal (Darjeeling district); BHUTAN, NEPAL.
Uses: Making baskets, firewood, and leaves as animal fodder. Young shoots as vegetable.
Exsiccatus: Subaney Danra, *SR Lepcha, T. Sharma & AP Das 3441*, dated 17.10.2008.

Sinarundinaria intermedia (Munro) Chao & Renvoize in Kew Bull. 44: 357. 1989; Seethalakshmi & Kumar Bamboos of India: 276. 1998. *Drepanostachyum intermedium* (Munro) Keng.f. in J. Bamboo. Res. 2(1): 18. 1983; R. Majumdar in Karthikeyan *et al*., Fl. Ind. Enum. Mono, 277. 1989; Stapleton. Fl. Bhutan 3(2): 506. 2000.
Vernacular name: *Titay nigalo* (Nepali).
Distribution: INDIA: Arunachal Pradesh, Sikkim, North Bengal (Darjeeling district); BHUTAN, NEPAL.
Uses: Weaving, making arrow and fishing rods.
Exsiccatus: Pangolakha, *SR Lepcha, T. Sharma & AP Das 3442*, dated 15.10.2008.

Sinarundinana maling (Gamble) Chao & Renvoiz in Kew Bull. 44: 356. 1989. *Arundinaria maling* Gamble in Kew Bull. 1912: 139. 1912; *Yushania maling* (Gamble) R. Majumdar in Karthikeyan *et al*., Fl. Ind. Enum. Mono. 283. 1989.
Vernacular names: *Malingo* (Nepali), *Phum* (Bhutia), *Phuem miknu* (Lepcha).
Distribution: INDIA: Arunachal Pradesh, Manipur, Sikkim, West Bengal (Darjeeling district); BHUTAN, NEPAL.
Uses: Making baskets, brooms, walls, roofing, musical instruments etc. Young shoots as vegetable.
Exsiccatus: On way to Rachela, *SR Lepcha, T. Sharma & AP Das 3443*, dated 17.10.2008.

Sinarundinaria pantlingii (Gamble) Chao & Renvoize in Kew Bull. 44: 359. 1989. *Arundinaria pantlingii* Gamble in Ann. Roy. Bot. Gard. Cal. 7: 129. 1896; *et* in Hook. f., Fl., Brit. India 7: 380. 1896. *Yushania pantlingii* (Gamble) R. Majumdar in Karthikeyan *et al*., Fl. Ind. Enum. Mono: 283. 1989.
Vernacular name: *Rani-malingo* (Nepali).
Distribution: INDIA: Arunachal Pradesh, Sikkim, West Bengal (Darjeeling district); BHUTAN.
Uses: Culms are used for making mats, walls. Youg shoots are edible.
Exsiccatus: Rachela, *SR Lepcha, T. Sharma & AP Das 3444*, dated 23.10.2008

Thamnocalamus aristatus (Gamble) Camus Les, Bambusees: 54.1913; Seethalakshmi & Kumar, Bamboos of India: 294. 1998. *Arundinaria aristata* Gamble in Ann, Roy. Bot.Gard. Cal. 7: 18. 1896; *et* in Hook. f., Fl. Brit. India 7: 382. 1896.
Vernacular names*: Ratonigalo* (Nepali), *Bhesha* (Bhutia), *Babain* (Lepcha).
Distribution: India: Arunachal Pradesh, Sikkim.
Uses: Weaving, making musical instruments etc.
Exsiccatus: On way to Neora Border, *SR Lepcha, T. Sharma & AP Das 3445*, dated 15.10.2008.

Thamnocalamus falconeri Hook.f. ex Munro in Trans. Linn. Soc. 26 (1): 34. 1868; *Arundinaria falconeri* (Hook.f. ex Munro) Bentham in Bentham and Hook.f., Gen. Pl. 3: 1208, 1883; Gamble in Ann. Roy. Bot. Gard. Cal. 7: 20-21, 1896 and in Hook.f., Fl. Brit. India 7: 383, 1897; *Himalayacalamus falconeri* (Hook.f. ex Munro) Keng, J. Bamboo Res. 2(2): 24, 1983.
Vernacular name: *Singhane* (Nepali), *Purnoon* (Lepcha).

Distribution: INDIA: Sikkim, West Bengal (Darjeeling district); BHUTAN.
Uses: Young shoots as vegetable and also fodder for *Red Pandas*
Exsiccatus: On way Pangolakha, *SR Lepcha, T. Sharma & AP Das 3446*, dated 15.10.2008.

RESULTS AND DISCUSSION

While studying Bamboo flora in particular, it revealed that the Pangolakha Wildlife Sanctuary is very rich in Bamboo representing 14 species out of 28 species recorded for Sikkim (Sharma & Borthakur 2007). *Sinarundinaria pantlingii* which is known to be endemic to Rachela is the most dominating species in the region.

Further explorations might result in addition of some more species from the Sanctuary. It is also known from the study that these Bamboo species are playing a vital role in balancing ecosystem and achieving socioeconomic development of the area, special mention can be related to the conservation of wildlife diversity, as most of the species act as fodder, and nesting materials to the different species of Wildlife. Almost as many as 40 % of Bamboo shoots are eaten as food by the tribal people living at the vicinity. As such, 10 species of common associated plants of Bamboos has been recorded from the study area.

A bamboo being culturally associated with the tribal communities living in the vicinity of the sanctuary but the unsystematic harvesting of young shoot imposes threats on the species diversity. Therefore, proper attention for biodiversity conservation is needed in such sensitive and vulnerable spots including Pangolakha Wildlife Sanctuary.

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