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BAMBOO GERMPLASM-DIVERSITY AND CONSERVATION IN NORTH-EAST INDIA*

Sudhir Kochhar[1], R.N. Prasad[2], Bhag Mal[3], R.G. Chaudhary[4], M. Rai[5] and B.D. Sharma[6]

ICAR Research Complex for NEH Region A.P. Centre, Basar-791 101 (Arunachal Pradesh)

Results of survey, collection and live-conservation of bamboo germplasm between 1984-90 at ICAR Research Complex for NEH Region, AP Centre, Basar under the All India Coordinated Research Project on Under-Utilized and Under-Exploited plants are discussed. North-East India is the home of diversity of bamboo germplasm and accounts for half of the total species variability in the country. Sixty three species were reported to occur in this region. Thirty species have established well in the live-collections out of 8 genera viz. Bambusa *(12 species),* Dendrocalamus *(6 species),* Cephalostachyum *(3 species)* Arundinaria *(2 species),* Phyllostachys *(2 species),* Pseudostachyum *(1 species) and* Teinostachum *(1 species). Their prevalence, local name(s), habitat frequency and preliminary categorization for general vigour or utility class is discussed. The live collections of bamboos could be broadly classified into tall and sturdy (14 species), medium tall (3 species), medium short highly prolific (5 species), wild but cultivable (2 species) and wild types (6 species). Nine species were reported for food from young sprouts, 5 were suggested useful for live fencing of jhum (shifting cultivation) fields, 9 were used for pulping and 18 could be used for light timber. Status of live collections as in June 1990 is documented.*

Bamboos are integral part of life of tribal folks in India. These serve rural people in several ways from cradle to coffin e.g., for shelter, food, industry, medicine, ethno-religious rituals and energy plantation. Though bamboos are basically tropical plants (ers. comm.) yet nearly half of their species diversity in India is available in North-Eastern region alone. The existing diversity in this region was reported to be 58 species belonging to 16 genera as against 116 species from all over India (Varmah and Bahadur, 1980). Subsequent reports included an inventory of North-East Indian

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[1]Senior Scientist (Plant Breeding), present address : NBPGR, New Delhi; [2]Director, ICAR Research Complex for NEH Region, Shillong; [3]Project Coordinator (UU & UEP), NBPGR, New Delhi; [4]Joint Director, A.P. Centre, Basar; [5]Senior Scientist (Hort.), present address : NBPGR, New Delhi and [6]Scientist-in-charge, NBPGR Regional Station, Shillong

bamboos showing the distribution of 54 species, representing 15 genera, in the seven states (Shukla, 1986) and a preliminary appraisal for the occurance of 40 species of bamboos in different altitude zones of Arunachal Pradesh (Haridasan *et al.*, 1986), thereby adding up 8 species which were not common in the former. Another rare species, *Pleioblastus simonii* (Carriers) Nakai, was reported from Arunachal Pradesh (Naithani and Bennet, 1986). Thus, the number of species of bamboos in the North Eastern region counts to 63. A few might be added further to this list.

Systematic efforts were taken up under the All India Coordinated Research Project on Under-utilized and Under-exploited Plants to survey, collect, conserve and document this variability besides other related studies. The studies were conducted between 1984-1990 at ICAR Research Complex for NEH Region, Arunachal Pradesh centre located at Basar (27°95' N latitude, 94°70' E longitude and 660 m altitude above a.s.l.), Kochhar (1986), in the approach paper for present studies, apprehended the variability in bamboos to be confounded due to polymorphism, indefinite non-identification of many collections because of long flowering cycle or lack of other marker traits and likelihood of repeat sampling due to different growth stages of some material yet having different tribal names. The higher-order of available diversity is further clear from the fact that the number of identified species from this region increased from 48 in the Gamble's list to above 63. Nonetheless, the need for preserving germplasm was strongly emphasized because the number of predominating semi-cultivated types was very low (5-7 species) in contrast with the splendid variability of bamboos available in the North-East.

During these studies extensive survey was conducted in the states of Arunachal Pradesh, Assam, Meghalaya, Nagaland and Tripura. In Arunachal Pradesh, survey was conducted in representative areas of almost all geographical districts whereas in other states these were limited to a few pockets (Fig. 1). One to two exploration trips were conducted every year in addition to short duration specific collection tours. A total of 53 classified or unidentified types (biotypes or variant species) were collected out of which 37 distinct types established at Research Farm, AP Centre, Basar. This conserved germplasm belongs to 8 different genera and 30 identified species (Table 1). A nearly equal number of more variants were collected during these exploration trips which, however, could not survive when planted at Basar. The objective of this paper is to document only the conserved variability of bamboos (Upto June, 1990) for future reference of the users.

GENERIC DIVERSITY AND DISTRIBUTION

Out of the eight genera represented by the bamboo collections available at AP Centre, Basar (Table 1), the maximum diversity is shown in the genus

Table 1. Particulars of various species of bamboos established at Arunachal Pradesh centre, Basar upto June, 1990

Sl. No.	Species	Common Name	Place, District of Collection	Month/Year of planting	Number of clumps	Status	General Category	Usage Class(es)
1	2	3	4	5	6	7	8	9
I. *Bambusa* (12 species)								
1.	*B. tulda*	Ejo (1), Diban(2), Hojo/ Hoji (5), Jati (8), Serangjai/ Serangtah (10), Bari (11)	Basar, W. Siang Lal Mati, Kohima Mowlin (NH 40), Khasi Hills; FRI, Dehradun	04/85 10/85 10/87 11/87	9	I (5) II (2) II (2)	I	I-V
2.	*B. pallida*	Eso (1), Someng/Some (2), Hosi (5), Bijuli (8), Murlibah (12) (Bio-type), Skien (10)	Basar, W. Siang NH 36, Karbi Anglong	04/85 10/85	5	I (5)	II	II-IV
3.	*B. nutans*	Dibang (2), Mokal/ Mokol(8), Sejrangtieh/ Serangjai (10)	Chessa, L. Subansiri	06/85	2	I (i) IV (1)	I	I-V
4.	*B. polymorpha*	Paura (11)	Sipaijola,	10/85	2	I (2)	I	II-IV; O
5.	*B. cacharensis*	Boom (11)	Chodeh Devta, W. Tripura	10/85	2	I (2)	I	I-IV
6.	*B. nana* syn. *B. glauscens* *B. glauscens*	--	Chessa, L. Subansiri	06/85	2	I (2)	III	III-V; O
7.	*B. multiplex* syn. *B. glauscens*	Hedge Bamboo (17)	Chessa, L. Subansiri	06/85	1	1 (1)	III	III-V; O

Cont....

Table 1 Cont....

Sl. No.	Species	Common Name	Place, District of Collection	Month/Year of planting	Number of clumps	Status	General Category	Usage Class(es)
1	2	3	4	5	6	7	8	9
8.	*B. balcoa*	Boluka (8) Dzutere (14)	Chessa, L. Subansiri	06/85	2	I (2)	I	I-IV
9.	*B. arundinacea*	Katva (16)	Chessa, L. Subansiri	06/85	1	I (1)	I	I-V
10.	*B. variegate*	Variegated Bamboo (17)	Shillong lake, Khasi Hills	10/87	1	II (1)	III	II-IV; O
11.	*B. vulgaris*	–	Naharlagan, L. subansiri	04/89	1	II (1)	I	II-V
12.	*B. khasiana*	Tabum (1)	Sododoke, W. Siang	07/88	2	II (2)	V	IV
II. *Dendrocalamus* (6 species)								
13.	*D. hamiltonii*	Eni (1), Eom (2), Epo (3), Eb1/Heni (5), Yai (6), Et E/Het E (6) (wild forms), Kanan Wah (7), Kako (8) Rahto (13), Bakkan (15), Barak/Sil Barak (11)	Basar, W. Siang Zoram, L. Subansiri Akashi Ganga, W. Siang	04/85 09/88 08/89	5	I (2) II (3)	I	I-V
14.	D. *hookerii*	Seijong (10) Et E/Hus (E5) Tama Bans (9)	Umbir (Nh 40), Khasi Hills	10/87	1	II (1)	I	I-IV
15.	D. *giganteus*	Surung (2) Aph1 Bo (13)	Sema, Dinapur	10/87	2	II (2)	I	I-V
16.	D. *sikkimensis*	Egi (1)	Basar, W. Siang	04/85	2	I (2)	I	II-IV

Cont....

Table 1 Cont....

Sl. No.	Species	Common Name	Place, District of Collection	Month/Year of planting	Number of clumps	Status	General Category	Usage Class(es)
1	2	3	4	5	6	7	8	9
17.	*D. sahnii*	Helap (5)	Zoram, L. Subansiri	09/88	1	II (1)	II	II-IV
18.	*D. longispathus*	--	F.R.I. Dehdradun	11/89	1	IV (1)	I	I-IV
III. *Cephalostachyum* (3 Species)								
19.	*C. pergracile*	Madang (2) Magang (4)	Pasighat, E. Siang	08/89	1	II (1)	I	II-V
20.	*C. fuschianum*	Taok (1)	Garu, W. Siang	08/89	1	IV (1)	I	II-IV
21.	*Cephalostachyum* Sp. novo		Likabali, W. Siang	08/89	1	IV (1)	I	II-IV
IV. *Chimonobambusa* (3 species)								
22.	C. griffithiana syn. *Arundinarid grifithiana*	Boji (1) Budh (5) Tabyo (6)	Basar, W. Siang Highest point, L. Subansiri	04/86 09/88	2	II (2)	IV	IV; O
23.	*C. callosa syn. Arundinaria callosa*	Tao (1), Reji (5)	Sago, W. Siang	09/88	1	IV (1)	V	IV
24.	*C. armata* syn. *Arundinaria armata*	Ebum/Hibum (5)	Ziro-Daporijo Road	08/98	1	II (1)	IV	II-IV

Cont....

Table 1 Cont....

Sl. No.	Species	Common Name	Place, District of Collection	Month/Year of planting	Number of clumps	Status	General Category	Usage Class(es)
1	2	3	4	5	6	7	8	9
V. *Arundinaria* (2 species)								
25.	*A. hirsuta*	Sejnaka (10)	Shimit, Khasi Hills	10/87	2	II (2)	III	III-IV; 0
26.	*A. manii*	Tajir (1)	Doke, W. Siang	09/88	1	II (1)	V	IV
VI. *Phyllostachys* (2 species)								
27.	*P. manii*	Tabo (1)	Mebo, E. Siang Basar, W. Siang	08/88	2	II 92)	III	III-IV:0
28.	*P. assamica*	Tabe/Tabye (5) Bije (6)	Zoram, L. Subansiri	09/89	2	II (2)	II	II-IV
VII. *Pseudostachyum* (1 species)								
29.	*P. polymorphum*	Tador (1), Tadol (4)	Gori, W. Siang	04/88	1	II (1)	V	IV
VIII. *Teinostachyum* (1 species)								
30.	*L. helferii*	–	GTC, Pasighat, E. Siang	09/89	1	IV (1)	V	(IV)

Dialect code : Adi Gallong (1); Adi Minyong (2); Adi Borhi (3); Adi Padam (4); Nishi (5); Apatani (6) Khanti (7)—All from Arunachal Pradesh); Assamese (8); Nepalese (9); Khasia (10); West Tripuri (11); Karbi Anglong (12); Angami Naga (13); Nagamese (14); Manipuri (15); Hindi (16); English (17)

Status (of establishment) code : Fully growth (I), Established (II); Juvienile (III); Tentative (IV)

General category Code : Tall & sturdy (I); Medium tall (II); Medium short (III); Wild cultivable (IV); Wild (V)

Usage Class Code: Pulping (I); Timber (II); Handicraft & Furniture (III); Miscellaneous (IV); Food (V); Live fencing (0)

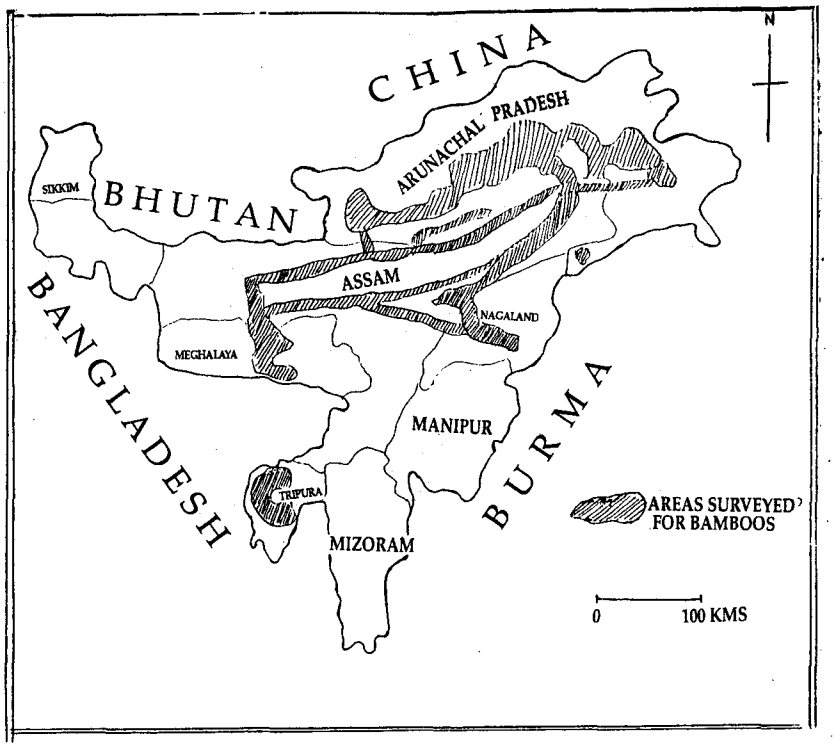

Fig. 1. Areas surveyed for Bamboos (1984-1990)

Bambusa. Twelve species of *Bambusa* established well which comprise 4 species viz., *B. tulda*, *B. pallida*, *B. nutans* and *B. balcoa* spread over the entire North Eastern region, two species (*B. polymorpha B. cacharaensis*) found frequently in the southern part of the region, i.e., the states of Tripura and North Cachar. One species, viz., *B. khasiana* was found in frequent wild patches in Arunachal Pradesh and the rest were non-native cultivated species.

The genus *Dendrocalamus* ranked second to *Bambusa* in terms of conserved diversity. It was represented by 6 species, out of which *D. hamiltonii* and *D. hookerii* were abundant in different zones within the region. These two species together cover more than half the tonnage potential of bamboos in the North Eastern States. Two species, *D. giganteus* and *D. sikkimensis* were found semi-cultivated to semi-wild in low frequency. *D. sahnii* was a rare species from Zoram, lower Subansiri district whereas *D. longispathus* was a non-native cultivated species yet tentatively established.

Two genera viz. *Cephalostachyum* and *Chimonobambusa* were represented by 3 species each. *C. fuschianum* is a scandant, wild, hill bamboo available frequently in Siang; *C. pergracile* is a cultivated species native of the Far East and seen in very low frequency during survey whereas another

Cephalostachyum sp. novo was a new report from Likabali, West Siang and is tentatively established. The spinous-at-nodes bamboos from the genus *Arundinaria* were recently regrouped botanically under the genus *Chimonobambusa*. Two confirmed species, *C. friggithiana* and *C. callosa* found frequently, and one *C. armata* syn. *A. armata* Gamble available in rare frequency, all wild and hilly, are now established in live collection.

The genera *Arundinaria* and *Phyllostachys* are represented by 2 species each. *A. hirsuta* and *P. assamica* are highly cultivated species in Shillong and lower Subansiri areas respectively. *A. manii* (wild) and *P. manii* (semicultivated) have got ethno-religious importance particularly in Siang and Subansiri. All these species are well established. *Pseudostachyum polymorphum* is the only species representing its genus in the live collections. It is a wild, abundant to frequent species in the understory of forest thickets in patches, in the entire northern part of the region; considered of least significance due to thin culms, yet used extensively for various purposes like fencing, rope making, walking sticks in thickets etc. Similarly, *Teinostachyum helferii*, is a singly represented species for the genus. It is a rare wild species surveyed in Siang and is tentatively established.

In addition to the above conserved species, the variability in bamboos was surveyed and collected for species belonging to the genera *Melocana*, *Melocalamus*, *Oxytenanthera* and *Pleioblastus*. More than 10 botanically unidentified local types were also collected. These materials, however, failed to establish, died after initial establishment or died on flowering after establishment (e.g. Mritinga, W. tripuri) and hence are not documented.

APPRAISAL OF SPECIES DIVERSITY

A brief description of individual species of bamboos conserved is given in Table 1. This conserved diversity is viewed and presented with respect to local tribal name (s), place of collection, planting date, number of clumps, their status of establishment, general category (clump morphology) and usage class(es). Salient features of the species for the above parameters along with their availability (frequency), habitat, nitche, polymorphic forms and common or anticipated utility are discussed.

I. *BAMBUSA*

Bambusa tulda : It is a tall and sturdy semi-cultivated, masculine bamboo highly preferred for cultivation in low altitude to mid-hills throughout the region particularly the northern part. Profuse branching at lower nodes is characterized in *B. tulda*. The habitat ranges from open valley to mid hill slopes adjoining the thick forest areas. A definite change in population behaviour was observed within species in the contrasting habitat. In the valley area, average clump height and general vigrour as

determined by number of culms per clump, culm diameter and internode length were higher as compared to the corresponding performace at mid-evaluation range; culm thickness, however, showed a reverse trend (Kochhar *et al.*, 1989). Eight different tribal names were recorded for *B. tulda* during the survey and collection trips (Table 1). The species is good for timber, pulping and furniture making, young sprouts are edible but not commonly preferred for consumption. Nine clumps of 4 different morphotypes of *B. tulda* one each from Siang, Nagaland, Meghalaya and Dehradun were established well. Sporadic flowering was recorded in this species at Doimukh, Lower Subansiri (Arunachal Pradesh) in 1987. A variant **Khupari** from Medziphema, Nagaland is botanically unconfirmed yet but resmebles more with *B. tulda*.

Bambusa pallida : It is a medium tall, slender, semi-cultivated, bamboo found under cutlivation all along with North Eastern Hill region. The species is conspicuous due to smaller leaves with white powdery ventral surface. Habitat varies widely from cultivated to semi wild conditions, in the valleys to mid-hills. The population behaviour of *B. pallida* in contrasting environments varies similar to that of *B. tulda*. A distinct biotype with longer internodes and lesser culm diameter, used for flute making, was available in Assam valley. Seven different tribal names were recorded for *B. pallida* (Table 1). The species is widely used for light decorative work, flooring and indoor walling in the bamboo mole houses, furniture work and young edible sprouts. The live collection of *B. pallida* is represented by two biotypes collected one each from Siang and Karbi Anglong. Flowering was seen in this species in larger patches in Siji, Kamki and Doje in West Siang and in sporadic fashion at a few more sprouts during 1987-88 (Kochhar and Rai, 1987). Improvement studies through chemical treatment were taken up from natural seedlings collected from Siji and a good response of ethereal treatment was obtained (Kochhar *et al.*, 1991).

Bambusa nutans : It is a tall, semicultivated, slender but sturdy bamboo having close resemblance with *B. tulda* for height and vigour and with *B. pallida* for leaf size and few branches at nodes. Its frequency is lower than the above two species. Five tribal names are recorded for this species in Table 1, out of which 3 are common with those of *B. tulda*. It is commonly used for timber and usable for pulping. Young sprouts are edible but less preferred. It is represented by one fully grown and another tentatively established clump. A few clumps were seen in flowering in district North Lakhimpur in 1987.

Bambusa pulymorpha : It is a tall growing cultivated species. It is used for timber, making handicrafts and as wind break. The sample was collected from fully grown natural seedlings in 1985 from Tripura where

it is locally known as ***Paura***. A severe incidence of thrips was recorded on both the established clumps of this species at Basar during 1989.

Bambusa cacharensis : It is the taller, sturdy bamboo in live collections at present because giant bamboo has shown slow initial growth. Its common name was ***Boom*** in Tripura from where it was collected in 1985 as rhizome sample. *B. cacharensis* has good potential for timber and pulping. The species showed better adaptability potential on mid-hill slopes at Basar.

Bambusa nana syn. *B. glauscens* and *Bambusa multiplex* syn. *B. glauscens*: These are medium short, highly/prolific, non-native, cultivated species adapted well in plains as well as mid hills. Although the two species have been renamed into single *B. glauscens* yet there are enough phenotypic differences to warrant these two separate types for cultivation purposes. *B. multiplex* is having very thin culms and leaves as compared to with *B. nana*. The sprouts are edible. Further, due to high prolificacy and dense clumps these species can be used for live fencing in the local *jhum* (shifting-cultivation) fields.

Bambusa balcoa : It is the tall, cultivated, strongest bamboo prevalent mostly in valley areas in Assam. It is characterized by a thick tuft of branches at lower nodes like *B. tulda*. The middle branch is curved like sicklet. Its frequency was found occasional in Siang, Subangiri and Kohime districts during survey. The species is good for timber and pulping. Initial growth of *B. balcoa* was slower at Basar than in valley areas.

Bambusa arundinacea : It is a cultivated non-native species earmarked as National Check. It is a tall, sturdy bamboo characterized by spines on culm branches. It is extensively used for pulping and the young sprouts are edible. At Basar, it suffered with a heavy incidence of sooty mould and black ants during 1989 on the sole surviving clump.

Bambusa vulgaris : It is a tall, cultivated, non-native species characterized by green and yellow vertical stripes on culms. It is used for garden purposes and the young sprouts are edible.

Bambusa khasiana : It is a scandant, wild hill bamboo characterized by the persistent culms sheaths which are violet when young and have a conspicuous bulged ring at the sheath and blade joint. It was found frequent in paches in Siang and Subansiri and is locally known as Tabum (Adi Gallong dialect). The species has two distinct morphotypes; a thin-leaved and another broad leaved. The leaf size in latter case is exceptionally big (15-20 cm wide). It is commonly used for rope making, fencing or roof tops of thatched houses. The thin leaved species is established well at Basar and it flowered in 1991. The reference location for the other biotype is 11 km

from Likabali near Akashi Ganga towards Basar on Likabali–Along Road, West Siang.

II. *DENDROCALAMUS*

Dendrocalamus hamiltonii : It is a tall, semi wild species characterized by arching over the drooping culms. It is one of the endemic species of the region, dominant in larger patches, covering upto 40 per cent area of forests in its adaptability zone which stretches upto an elevation of 1200 m above a.s.l. An increased height, clump vigour and diameter of culm was observed at population level in *D. hamiltonii* in valley areas as compared to mid-altitude 600 m above a.s.l. (Kochhar *et. al* 1989). However, in the undisturbed habitat at higher altitude (Mow, West Siang, 1200 m above a.s.l. (Kochhar *et al.*, 1989). However, in the undisturbed habitat at higher altitude (Mow, West Siang, 1200 m above a.s.l.), very tall clumps (above 25 m) were seen in which the branches emerging at lower nodes were diagonally placed between culms and measured the size of an ordinary bamboo clump at lower elevations. As many as 15 local names were recorded for *D. hamiltonii* during survey which are presented in Table 1. The species was found good for pulping and is one of the major component species for the Nagaland paper mill. It is also used for timber, handicrafts, irrigation channels and vessels. The sprouts of *D. hamiltonii* are a delicacy and are most commonly used for food. Three morphotypes, two from Siang and one from Subansiri were duly established at Basar. Sporadic flowering was recorded on this species in West Siang near Nigmoi in 1987 and Nyorak (Basar) in 1989.

Dendrocalamus hookerii : It is a tall, very dark green wild, drooping bamboo having bigger but thinner leaves. It is characterized by apparent semi-wilting of leaves during hotter period of day due to fast transpiration which is restored to normalcy during night. The species is abundant at medium high altitude zone above 1200 m a.s.l. like *D. hamiltonii* at the lower altitude. Miles and miles of forest cover was seen under this predominant species in Subansiri and Khasia hills. It is used for pulping, timber, handicraft, irrigation channels and vessels etc. One clump has established well whereas and other succumbed to red-ants attack in the second year.

Dendrocalamus giganteus : It is the tallest bamboo, also commonly known as giant bamboo. The species was found cultivated in Siang and Kohima districts in low frequency where individual culms measured 30 m tall and 20 cm in diameter. It was slow in initial growth, like *B. balcoa*, at Basar. The culms of this species can be used for various purposes and the young sprouts are edible.

Dendrucalamus sikkimensis : It is a tall, sturdy, light green semi-cultivated bamboo found in very low frequency in West Siang where it is locally known as Egi (Adi Gallong dialect). It is usable for timber, pulping making, handicraft etc.

Dendraocalamus sahnii : It is a medium tall, arching over, rare species collected from Zoram, Lower Subansiri. It is characterized by spiny ligules on culm sheaths. The species is used for timber, water channels etc. It could establish well on treatment of boric acid @ 100 ppm by drenching the rhizome samples during collection and spray of the same on nodal buds after planting.

Dendrocalamus longispathus : It is a tall, cultivated, non-native, sturdy bamboo collected from Forest Research Institute, Dehradun in October, 1989. The species is yet tentatively established.

III. *CEPHALOSTACHYUM*

Cephalostachyum pergracile : It is a tall, slender, feminine, non-native cultivated bamboo characterized by white powdery culm surface. A few isolated clumps were seen under cultivation in Siang during survey. The species is good for furniture making. Young sprouts of *C. pragracile* are edible.

Cephalostachyum fuschianum : This is a wild, scandant, hill bamboo. Its culms upto lower 1/3rd portion were found solid in some samples in West Siang at 1200 m above a.s.l. It is used for rope making etc. and is locally known as Taok (Adi. Gallong dialect). The species could be established at Basar after 3-4 replantings. The clump flowered on planting in 1991.

Cephalostachyum Sp. Novo : It is a tall, sturdy, semi-cultivated arching over bamboo reported from Likabali, West Siang. The species is usable for timber, pulping and making furniture. It was collected in 1989 and was yet tentatively established. The reference location is 1 km from zero-point on Likabali-Along road at the base of watershed towards hill side from main road.

IV. *CHIMONOBAMBUSA*

Chimonobambusa griffithiana syn. *Arundinaria griffithiana* : The species was earlier kept under the genus *Arundianaria*. It is a medium tall, wild prolific bamboo having spines at each culm node. Its frequency was high in Subansiri and Siang at mid-high altitude (1500-170 m above a.s.l.). Three tribal names were recorded for this species (Table 1). It is used for making bamboo mats and light handicraft etc. Two different samples from Siang (Boji) and Subansiri (Tabyo) are well established at Basar.

Chimonobambusa callosa syn. *Arundinaria callosa* : It is a wild, aborescent,

thin, drooping bamboo having spines at culm nodes. its adaptability zone is common with that of *A. griffithiana*. It is differently known in various tribal dialects of Siang and Subansiri. This species is yet tentatively established in the live collections after 4-5 attempts. The reference location is 5 km from Hapoli towards the highest point on Ziro-Kimin load in lower Subansiri where it is abundant in around 1 sq km area.

Chimonobambusa armata syn. *Arundinaria armata* : It is a medium tall, dark green wild species having under ground runner which give individual culms at regular intervals thereby giving the appearance of avenue trees. The habitat is moist and shady area in the thick forest along the watershed. The species is originally described in the supplementary of Gamble's 'Bambusae of British India' under *Arundinaria* and is tentatively kept under *Chimonobambusa* due to spines at culm-nodes. The species is locally known as Ebum or Hibum which means black and handsome in Nishi dialect. One clump survived due to treatment with boric acid @ 100 ppm by drenching the rhizome stock of the sample collected and frequent spray on the nodes after planting.

V. *ARUNDINARIA*

Arundinaria hirsuta : It is a short, stiff, cultivated bamboo having D shaped culms when young. It grows in single culms arising at short intervals on a leptomorph (underground runner) rhizome. It is highly cultivated in Khasi hills around Shillong (1500-1600 m above a.s.l.) along the boundaries of houses and cultivated fields. It is usable for bators and fishing rods etc. The species showed a fast initial growth at Basar.

Arundinaria manii : It is a wild, scandant, hill bamboo having long, flexible, near solid culms. It is available on hill slopes at medium high elevation range of Siang and Subansiri in low frequency and is locally called Tajir. It has got sacred ethno-religious value and is used as incens-sticks during religious performances of Adi tribals. It is used for rope making, like cane, also. The species could establish well at Basar after 3-4 replantings.

VI. *PHYLLOSTACHYS*

Phyllostachys manii : This is a short, stiff, semi-wild bamboo having single culms arising from an underground runner rhizome. It has got ethno-religious importance and can be used for decorative brushes etc. at rituals of Adi tribals and also for making fishing rods. Two samples from West Siang and Mebo circle, East Siang are well established at Basar.

Phyllostachys assamica : Two morphotypes of this species, one medium short and another medium tall are widely cultivated in Nishi and Apatani

tribal areas of lower Subansiri. Slender and sturdy single culms arise from the underground runner rhizome. It is used for timber, fencing and walking sticks etc. 2 clumps showed fast initial establishment at Basar.

VII. *PSEUDOSTACHYUM*

Pseudostachyum polymorphum : It is a wild, aborescent endemic species seen frequently in forest undercover or abandoned cultivation fields. Culm thickness is very less. It is used for farm fencing rope or walking stick in thickets. The species could establish well after 3 plantings at Basar. It was seen sporadic flowering in Siang during these years on multiple occasions but seed formation was not observed.

VIII. *TEINOSTACHYUM*

Teinostachyum helferii : It is a wild, arching over, semi-scandant bamboo collected during last leg of the survey and is tentatively established. It is rare and the reference location is 5 km from Pasighat at the bank of a stream on the hill side at Pasighat-Along road towards Along.

PRELIMINARY CATAGORIZATION OF CONSERVED SPECIES

Preliminary data were recorded on various phenological and morphological characters from third year onwards of clump establishment individual species. Three categories of established clumps of 8 fully established species viz. tall and less prolific; medium tall and medium prolific and short and highly prolific types which could be used for pulping, timber, handicraft and food canopy, handicraft and light timber; and live fencing of shifting cultivation (*Jhum*) fields, respectively (Kochhar and Rai 1987). Further observations on status of establishment of new collections and categorization for clump habit and usage class(es) are summarized in Table 1. A perusal of the table shows that the live bamboo collections at AP Centre, Basar can be subdivided into 5 distinct catagories, viz., (i) tall and sturdy types (14 species), (ii) medium tall, semi-cultivated types (3 species), (iii) medium short, highly prolific types (5 species), (iv) wild but cultivable types (2 species) and (v) wild types (6 species). *Chimonobambusa griffithiana* syn. *Arundinaria griffithiana* and *Arundinaria armata* (Gamble) due to their clump habit and better utilization potential were earmarked for category (iv) i.e. wild but cultivable.

The utilization potential of individual category and species can be ascertained on further studies. However, the preliminary information from literature or local communication a few generalizations could be made. These collections are grouped into 6 usage classes, viz., pulping, timber; handicraft and furniture making, miscellaneous uses which include

making ropes, bamboo mats, irrigation channels, walking sticks, fishing rods etc. food from juvenile sprouts and live fencing. Nine species were recorded for their usability as food from young sprouts (Table 1), out of which *D. hamiltonii* is predominantly used. Five species from general category (iii) i.e. medium tall and highly prolific and 1 species, *Chimonobambusa griffithiana*, from general category, (iv) (wild but cultivable) were suggested for live fencing of shifting cultivation fields due to their short stature, prolificacy and fast growth. The last one is further useful due to its spininess at nodes. Out of the medium tall or tall species this categorization is not done because of their shading effect on crops. However, *B. polymorpha* was clearly used for wind break and soil binding in a boundary of hilly, terraced cultivation fields at its collection site in Tripura. Nine species were found and soil binding in a boundary of hilly, terraced cultivation fields at its collection site in Tripura. Nine species were found usable for pulping and 18 for timber or light timber. A systematic and seasonal recording of observations on various traits related to growth, morphology and production potential will be useful for classification of this conserved variability in bamboos for species prospects and promise for future use. A data sheet is finalised for use of bamboo workers (Anon, 1990) which takes into account the above parameters.

To conclude with, it is essential to collect and conserve variability in bamboos which is pre-requisite for apt classification and ascertaining the potentials of this useful group of plants. Nearly half the variability in bamboos from North Eastern India is duly collected and preserved live. This includes further higher proportion of economically useful types. Nonetheless, collection of wild and less frequent or rare species is equally important. Bamboo types which were surveyed, collected and planted but did not survive at Basar should be re-collected on priority through location specific collection trips in order to give a final shape to the live collection bamboo garden at Basar.

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REFERENCES

Annonymous (1990). Annual Progress Report 1989-90 AICRP on UU & UEP Bamboos. ICAR Research Complex for NEH Region, AP Centre, Basar. pp. 52.

Haridasan, K. B.S., Beniwal, M.L. Deori, (1986). Bamboos in Arunachal Pradesh-Distribution and utilization, A preliminary appraisal; Presented at Seminar on bamboos and Canes, NEC, Shillong, Nov. 26-27 pp. 7.

Jsoeph, J. (1985). Personal Communication Botanical Survey of India, Shillong.

Kochhar, S. (1986). Some aspects of standardization of technology for bamboo preservation, cultivation and utilization in NEH Region. Approach paper. Presented at III Annual Workship AICRP on UU & UEP, New Delhi. June 30-July 1, 1986.

Kochhar, S. and Rai, M. (1987). Studies on bamboos in West Siang. Presented at National Seminar on UU & UEP, NBPGR, New Delhi. June 9, 1987. pp. 9.

Kochhar, S., Bhag Mal and R.G. Chaudhry (1988). Population aspect of phenological behaviour of bamboo germplasm and its derived studies. Presented at III Intl. Bamboo Workship, Cochin, India. Nov. 14-17. pp. 16.

Kochhar, S. R.S. Paroda, Bhag Mal, R.G. Chaudhry and B.K. Sharma, (1991). Improvement studies in *Bambusa pallida* through chemical treatment. (Submitted.)

Naithani, H.B. and S.S.R. Bennet, (1986). *Pleioblastus simonii* (Carriere) Nakai-A bamboo new to India from Arunachal Pradesh. *Ind. For.* **112** (1) : 85-87.

Shukla, U. (1986). An inventory of the bamboos of the North-East India. Presented at Seminar on Bmaboos and Canes. N.E.C. Shillong, Nov. 25-27. pp.6.

Vermah, J.C. and K.N. Bahadur, (1980). Country report and status of Research on bamboos in India. Presented at IUFRO-IDRC Bamboo Workshop, Singapore. May 28-30 pp. 28 + vii.