Indian J.L.Sci. 5 (1) : 87-96, 2015

ISSN : 2277-1743 (Print)
ISSN : 2278-7879 (Online)

MORPHOLOGY OF DIFFERENT BAMBOO SPECIES OF NORTH CHOTA NAGPUR DIVISION (JHARKHAND)

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ABSTRACT

No country of South-east Asia is without indigenous bamboo flora. This resource has been variously called "the poor man timber". This natural resource plays a major role in the livelihood of rural people and in rural cottage industry. Only 11 species have been recorded from the village of seven districts (Hazaribagh, Chatra, Giridih, Bokaro, Dhanbad, koderma and Ramgarh) of the North Chhota Nagpur diviaion of Jharkhand. In this paper the main focus is to describe the Morphology of different bamboo species in North Chota Nagpur division.

KEYWORDS : Bamboo, North Chota Nagpur, Morphology.

The bamboo is a group of woody grass and regarded as 'Emperor' among the grasses. It belongs to the family poaceae and sub family bambusoidae. It is commonly called poor's man's timber. There are approximately 1500 species under 87 genera of bamboo worldwide (Ohrnberger, 1999) and area are confined in South and Southeast Asia and mostly in China, India and Myanmar. In India, it grows abundantly almost all over India, except in Kashmir Valley and represented by 20 genera and 136 species. On the basis of genetic diversity of bamboo India is second richest country after China. The forest of bamboo cover 10.3 million hectare which contributes 12.8% of total forest area of country (Rai and Chauhan 1998). In North Chota Nagpur, natural bamboos occur within dry bamboo brakes, 5B/9E (Champion and Seth, 1968) spread over most of the district. Outside the forest, large scale cultivation is practiced in villages.

The bamboo species are identified based on the morphological and anatomical descriptions of the plants (Gamble, 1986; Cambell, 1988; Vermah and Bahadur, 1980; Tewari, 1993) and culm sheath morphology (Chatterji and Raizada, 1963). The culm sheath is the best indicator to identify the bamboo plant.

In North Chota Nagpur, the knowledge of bamboo morphology is far from satisfactory and there are many gaps in our knowledge. Further, no concerted effort has so far been made to document the bamboo morphology in North Chota Nagpur division of Jharkhand. Still there exists some controversy over the morphology on different bamboo species. However, information on morphology of various species in forest and non-forest areas of North Chota Nagpur is not available. The present study aims at filling up this gap and assessing the morphology of different bamboo species.

MATERIALS AND METHODS

The present investigation is carried out in seven districts (Hazaribag, Chatra, Ramgarh, Bokaro, Giridih, Dhanbad & Koderma) of North Chota Nagpur division of Jharkhand. The North Chota Nagpur division of Jharkhand is lying between $23^0 37'$ N to $24^0 4'$ N latitude and $86^0 6'$ E to $86^0 1'$ E longitude.

Simple random sampling procedure is adopted for selection of the villages where information collections about morphological traits of different bamboo species have been carried out between 2012 and 2015 in North Chota Nagpur of Jharkhand. The ten villages are randomly selected from each district. In this way, the total 70 villages are selected from study area covering seven districts represent the entire study sites. All the bamboo species available in these villages are identified and then write the data of different parameters of bamboo species in each village separately on note book. The bamboo species are identified on the basis of some special characteristics of each bamboo species.

From each village, the information related to morphological traits like culm length (upto crown), diameter at breast height (DBH), Culm internodes length at breast height, length of culm sheath, breadth of culm sheath at base, length of blade, breadth of blade at base, length of leaves, and breadth of leaves at middle part are recorded. The sample culms are selected randomly. The data are

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collected from the old culms (> 1 year) of bamboo.

The height (total culm length) of bamboo plant is measured by multiply the number of internode with intermodal lenght at breast height or by measuring the length of fell down plant of bamboo. The diameter of bamboo culm is measured through digital calliper or vernier calliper at breast height. Internode distance, length & breadth of culm sheath, blade and leaves of bamboo are measured through tape. Height is measured in meter and rest of the parameters are measured in centimetre (cm). The digital calliper and verneer calliper are used for taking data of culm diameter at breast height (DBH). The scale is used for measure the length and breadth of required parameter of each bamboo species.

OBSEVATION AND RESULTS

Morphological Description

Taxonomic name

Bambusa balcooa (Roxb., Munro in Trans).

Common name

Vulki bans

Distribution of *B. balcooa*

Natural distribution of *B. balcooa* is uncommon. It mostly cultivated in the Dhanbad and Giridih districts of North Chota Nagpur division.

Habitat

Prefers heavy textured soil with good drainage.

Morphological Description

From the Table-1, result showed that the mean culm height of *B. balcooa* is 19.1 meter. The colour is dull but dark green (some time greyish green) with not very prominent taper. Culm branches are small, thin, leafless, recurved, pseudospiny branchlets, especially at lower culm nodes. Mean length of internode is 34.99 cm long and culm thickness is 8.6825 cm in diameter. Nodes are thickened with whitish ring above & hairy below. The culm wall thickness is 1.874 cm. It has thick-walled and branches from lower nodes leafless and hard, mostly spreading, sometimes thorn like structure. The culm sheath is deciduous. The mean length of culm sheath is 23.2 cm and breadth is 26.5 cm with smooth inner surface, brown hairy outer surface and ciliated margin. The length of blade is 7.14 cm and

Table 1: Mean Growth Performance of Different Bamboo Species in North Chota Nagpur

Species	Height	Diameter	Internodal length	Wall thickness	Culm sheath		Blade		Leaves	
					Length	Breadth	Length	Breadth	Length	Breadth
B.balcooa	19.1	8.6825	34.99	1.874	23.2	26.5	7.14	7.53	19.92	2.57
B.bambos	19.697	8.932	25.74	3.313	24.8	20.6	6.48	8.05	17.3	2.04
B.multiplex	2.2	0.911	23.35		7.53	4.37	3.13	1.27	9.42	0.80
B.nutans	16.844	7.1587	34.53	2.213	22.7	22.4	7.95	7.08	21.1	2.62
B.striata	10.15	6.033	23.40	1.17	16.1	29.5	7.01	7.65	21.1	2.74
B.tulda	17.5	7.0412	49.10	1.347	19.6	16.3	7.27	6.81	20.9	2.96
B.wamin	4.11	7.527	5.295		21.5	28.4	9.83	8.17	20.8	1.64
D. sericeus	4.615	4.67	19.60		8.12	6.57			22.5	1.95
D. strictus	11.925	5.372	25.55		20.2	10.0	6.33	3.90	20.1	2.66
S. palmata	2.16	1.612	14.7		9.16	5.25	1.85	0.49	10.2	0.82

breadth is 7.53 cm. with smooth inner surface and hairy outer surface. The blade is triangle with ciliated margin and auricle is absent. The length of leaves is 19.9 cm and breadth is 2.57 cm. (Figure I-1,2,3)

Taxonomic name

Bambusa bambos (L.) Voss

Common name

Kanta bans

Distribution of *B. bambos*

This species is one of the most important bamboos found almost throughout the North Chota Nagpur division of the Jharkhand. It is commonly found in Hazaribag, Ramgarh, chatra and some places of Koderma, Bokaro and Dhanbad. It is not reported from Giridih district.

Habitat

The best growth in villages which is near to moist deciduous forest. It attains its best development in rich and moist soil and near to bank of perennial rivers and valleys.

Morphological Description

A graceful longest bamboo of North Chota Nagpur. The culms are 19.697 m tall that are usually strong, bright to dark green and shining. Nodes are slightly swollen and lower nodes produces roots. The mean length of Internode is 27.68 cm long and mean value of diameter is 8.932 cm. The culm is wall thickness of 3.131 cm. The branches are curved that are develop from all nodes in upward direction, lower branches long, spreading and with recurved spines and spines usually in threes. The branches of big and old bamboo are usually bent towards the ground as shown in Figure-II(1). The mean length of culm sheath is 24.8 cm and breadth is 20.6 cm at the base. It had leathery texture with dark brown hairs. It is deciduous at the time of branch development. The mean length of blade is 6.48 cm and breadth is 8.05 cm at base that is erect and triangular with smooth outer surface and inner side covered with dark brown, velvety hair. Leaves are highly variable in size. The mean length of leaves is 17.3 cm and breadth is 2.04 cm. (Figure II-1,2,3).

Taxonomic name

Bambusa multiplex (Lour.)

Common name

Hedge bamboo

Distribution of *B. multiplex*

It is the best bamboo for growing potted indoors. This makes most beautiful hedges. Therefore, it is planted as ornamental plants in gardens, parks, etc. Therefore, it is found in some places of North Chota Nagpur where parks, gardens etc. are available. In Hazaribag, it is found in Shahid Nirmal Mahto Park.

Morphological Description

As shown in Table-1, B,multiplex is a ornamental bamboo plant. It is an evergreen bamboo. The smallest

Figures I : (1)

Figures I : (2)

Figures I : (3)

Figures-I: (1) Culm of *B. balcooa* (2) Culm sheath of *B. balcooa* (3) Node portion of *B. balcooa*

Figures II : (1)

Figures II : (2)

Figures II : (3)

Figures-II: (1) *B. bambos* at Kandtari Village of Barkagaon Block (Dhanbad) Shows Branches Bent Towards the Ground (2) Culm sheath (3) Measurement of Ulm Diameter

Figures III : (1)

Figures III : (2)

Figures III : (3)

Figures III: (1) *Bambusa Multiplex* at Shahid Nirmal Mahto Park (Dipugadha) of Sader Hazaribag (2) Culm Sheath Shows Length in Scale (3) Blade Shows Breadth

bamboo of North Chota Nagpur having mean culm height is 2.2 m that are usually smooth, green when young, afterwards yellowish, hard, much branched from base. The mean diameter is 0.91 cm with thickened nodes. Every node has a large number of branches from top to bottom. Hence, the name hedge bamboo. The mean length of internode is 23.35 cm. The mean length of culm sheath is 7.53 cm and breadth is 4.37 cm at base. The culm sheath usually green at first time and then yellowish slightly narrowed upwards and rounded at top. The auricles are absent or so small in culm sheath. The blades are linear, triangular and long as compared to its culm sheath as shown in Figure-III(2). The mean length of blade is 3.13 cm and breadth is 1.27 cm at base. Leaves are 9.42 cm long and 0.80 cm broad with a very

Figures IV : (1)

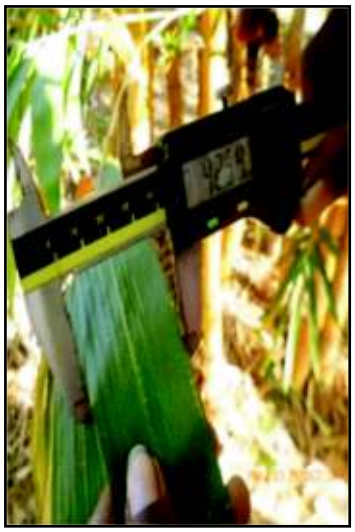
Figures IV : (2)

Figures IV : (3)

Figures IV : (1) *Bambusa nutans* at Kadwa Village of Ichak Block (Hazaribag) (2) Shows White Ring Below the Nodes (3) Culm Sheath

Figures V : (1)

Figures V : (2)



Figures V : (3)

Figures-V: (1) *B. striata* at D.A.V. School Kanhari road Hazaribag (2) Culm sheath on nodes in *B. striata* (3) Showing measurement of leaf breadth in *B. striata*

short stalk and finely velvety-hair beneath. This is the smallest bamboo of North Chota Nagpur. (Figure III - 1,2,3)

Taxonomic name

Bambusa nutans (Wall. Ex Munro)

Common Name

Jawa bans or Ropa bans or Dehati bans

Distribution of *B. nutans*

Most common bamboo after *D. strictus*. Naturally occurring and cultivated in some area of North Chota Nagpur. In North Chota Nagpur, it is found especially in and around the Hazaribag, Chatra, Ramgarh and occasionally found in some areas of koderma, Bokaro, Giridih and Dhanbad. It is one of the widely cultivated in the villages of North Chota Nagpur.

Habitat

Grow best in moist and well drained sandy loam to clay loam soil. However, being a rugged bamboo, it also tolerates dry conditions and stony soil.




Figures VI : (1) **Figures VI : (2)** **Figures VI : (3)** **Figures VI : (4)**

Figures VI : (1) *B. tulda* at Uranwa Village of Chanwara Block (Koderma) (2) Node of *B. tulda* (3) Long internode of *B. tulda* (4) Culm sheath of *B. tulda*



Figures VII : (1) **Figures VII : (2)** **Figures VII : (3)**

Figures VII : (1) *Bambusa wamin* at Shahid Nirmal Mahto Park (Sader Hazaribag) (2) Internodal Length Measurement

Morphological description: From the Table-1, result shows that it is a medium size bamboo. The mean culm height is 16.84 m long and diameter is 7.16 cm. The culm is dark to dull green in colour. There is white ring found below the nodes as shown in Figure-IV(2). Lower nodes bear rootlets. The mean length of internodes is 34.8 cm and wall thickness is 2.22 cm. The mean lenght of culm sheath is 24.7 cm and breadth is 28.2 cm at the base. The breadth of culm sheath is larger than length. The scattered black hairs are present on the back of culm sheath. The base hair of culm sheath is deciduous. The mean length of blade is 7.95 cm and 7.08 cm broad at base with black hair on the outer surface. The auricle is well developed, large and fringed with a curved margin as shown in Figure-IV(3). Leaves are 21.1 cm long and 2.62 cm broad at middle. (Figure IV-1, 2, 3)

Taxonomic name

Bambusa striata (Lodd. ex Lindl.)

Figures VIII : (1)

Figures VIII : (2)

Figures VIII : (3)

Figures VIII : (1) *Dendrocalamus sericeus* at Parusnath Hill of Pirtand block (Giridih) (2) Culm With Branching System in *D. sericeus* (3) Culm Sheath Attached at Node in *D. sericeus*

Figures XI : (1)

Figures XI : (2)

Figures XI : (3)

Figures IX : (1) *Dendrocalamus strictus* at Pathergadha (Chatra District) (2) *D. strictus* Showing Highly Compact Interlocked Culm at Barkagaon (Hazaribag District)

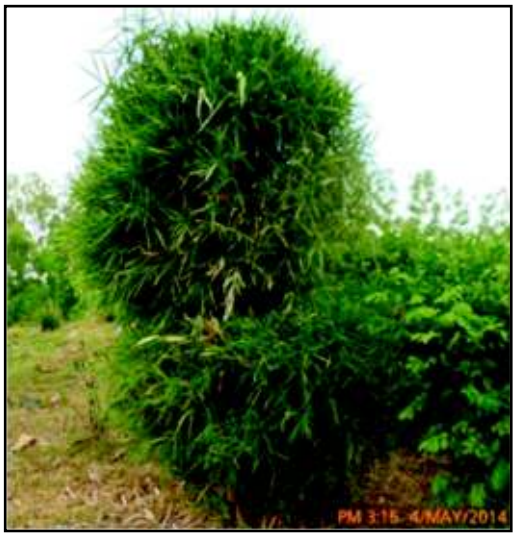
Common name

Pila bans

Distribution of *B. striata*

It is commonly cultivated in North Chota Nagpur as Ornamental plant. Presently it is available in Hazaribag.

Morphological description: From below the table, the mean height of culm is 10.15 m. and diameter is 6.033 cm. The culm colour is yellow with light green stripes or rarely light green with yellow stripes. The mean internode distance is 23.40 cm and wall thickness is 1.177 cm. The mean culm sheath length is 16.1 cm and breadth is 29.5 cm broad at base. The breadth of culm sheath is larger than length. The outer surface of culm sheath is covered with brown black hair. The edges are ciliated and have two auricles. The culm sheath is broad, rounded and often beautiful when young. The mean length and breadth of blade is 7.01 cm and 7.65



Figures X : (1) **Figures X : (2)** **Figures X : (3)**

Figures-X: (1) *Sasa palmata* at Shahid Nirmal Mahto Park Dipugadha (Sader Hazaribag) (2) Internode measurement in *Sasa palmata* (3) Culm sheath measurement in *Sasa palmata*

cm respectively. Average length of leaves is 21.1 cm and breadth is 2.74 cm. (Figure V- 1, 2, 3)

Taxonomic name

Bambusa tulda (Roxb.)

Common name

Taral bans

Distribution of *B. tulda*

This species is one of the most common bamboo species of North Chota Nagpur. It is found in all seven districts (Bokaro, Chatra, Dhanbad, Giridih, Hazaribag, Koderma and Ramgarh) of North Chota Nagpur. It is one of the major species of Giridih district followed by Dhanbad Bokaro and Koderma districts. It is also important species cultivated in North Chota Nagpur.

Morphological description: This bamboo species may be evergreen or deciduous bamboo. The mean height of culm is 17.5 m long and wall thickness is 1.347 cm at near to ground. The culm is strong, glabrous, upright and smooth. The young culm is green when young and grey-green on maturity as shown in Figure-VI. The young culm may be dark green in colour with slight whitish stripes on internode that comes easily. The mean length of internode is 49.108 cm and diameter is 7.0412 cm. The lower nodes had fibrous roots. The branches may be from almost all nodes, but lowest nodes have horizontal branches and almost leafless. The mean length of culm sheath is 19.6 cm and breadth is 16.3 cm. The inner surface of culm sheath is smooth and often whitish powder and outer surface covered with brown hair. The mean length of blade is 7.27 cm and breadth is 6.81 cm with broadly triangular structure. The average length of leaves is 20.9 cm and breadth is 2.96 cm. (Figure VI-1, 2, 3, 4).

Taxonomic name

Bambusa wamin (Camus)

Common name

Pitcher bamboo (Ghada bans)

Distribution of *Bambusa wamin*

Planted as ornamental plant may be cultivated throughout of many places of North Chota Nagpur. Presently, it is only reported from Hazaribag (Shahid Nirmal Mahto Park and V.B.U Campus hazaribag).

Morphological description: Table-1 shows that, the mean culm height of *B. wamin* is 4.11 m. The mean intermode length is 5.295 cm. Much swollen pitcher like shaped in the lower portion of internode. As far as diameter is concern, the mean diameter at the swollen part of the culm is 7.527 cm. The mean length of culm-sheath is 21.5 cm and breadth is 28.4 cm at base, often beautiful when young. The upper surface of the culm sheath is covered with brown hairs. The mean length of blade is 9.83 cm and breadth is

8.17 cm at base with two rounded ciliate auricles at the base. The average length of leaves is 20.8 cm and breadth is 1.64 cm at middle part. (Figure VII- 1, 2, 3)

Taxonomic name

Dendrocalamus sericeus (Munro in Trans.)

Common name

Pahari bans, Lathi bans

Distribution of *D. sericeus*

It is restricted in distribution and only found in Parasnath Hill of Giridih district of North Chota Nagpur division of Jharkhand.

Morphological description: It is a densely tufted bamboo with strong culms which is resemble with the culms of *D. strictus* as shown in Figures-VIII. The mean height of culm is 4.615 m long. The mean length of internode is 19.60 cm and diameter is 4.67 cm. The mean length of culm sheath is 8.125 cm and breadth is 6.57 cm at base. The mean length of leaf is 22.55 cm and breadth is 1.955 cm at middle. (Figure VIII - 1, 2, 3)

Taxonomic name

Dendrocalamus strictus (Roxb.)

Common name

Lathi bans, Pahari bans, Bon bans

Distribution of *D. strictus*

This species is widely distributed in every district of North Chota Nagpur division. It is highly adapted in dry areas to hilly tracks (Parasnath Hill).

Habitat

Hardy adapts well in dry areas and widely distributed in semi-dry and dry zones. Found normally at altitudes up to 1000 m.

Morphological Description

As shown in Table-1, the mean height of culm is 12.09 m. It is pale blue green when young and dull green or yellowish when old and much curved above half of its height. The branches arise almost throughout the length of the culm. The mean length of internode is 25.551 cm with thick-walled, almost without hollow. Therefore, it is also called solid bamboo. The mean diameter is 5.372 cm. Culm sheath long and their auricle small or absent. The mean length of culm sheath is 20.2 cm and breadth is 10.0 cm at base. The mean length of blade is 6.33 cm and breadth is 3.90 cm at base with erect, triangular and smooth. The auricle is short or may be completely absent. The mean length of leaf is 20.1 cm and breadth is 2.66 cm at middle. The leaves are highly variable, small in dry localities and long in moist areas with rounded at the base. (Figure IX - 1, 2, 3)

Taxonomic name

Sasa palmata

Common name

Japani bans

Occurrence

Planted as ornamental plant may be cultivated throughout of many places of North Chota Nagpur. Presently, it is only reported from Hazaribag (Shahid Nirmal Mahto Park and V.B.U Campus).

Morphological Description

Sasa palmata is an evergreen, clump forming bamboo. The mean height of culm is 2.16 m. The mean length of internode is larger in respect to culm diameter. The mean length of internode is 14.7 cm while the diameter is only 1.6125 cm at BH. Every node had a large number of branches from top to bottom. The mean length of culm sheath is 9.16 cm and the breadth is 5.25 cm at base. Some patches of brown hair present on the upper surface of the culm sheath. The mean length of blade is 1.851 cm and breadth is 0.495 cm at base. The mean length of leaf is 10.24 cm and breadth is 0.828 cm with linear white patches on the surface of leaves. Young shoot is not seen during the field survey. (Figure X - 1, 2, 3)

DISCUSSION

All the species found in forest and non-forest areas of North Chota Nagpur, *B. bambos*, locally known as Kanta bans is the tallest bamboo having mean culm length of 19.697 m followed by *B. balcooa* (19.1 m), *B. tulda* (17.5 m), *B. nutans* (16.844 m), *D. strictus* (11.925 m) and *B.striata* (10.15 m). Nath et al., (2012) reported that, among all the species of Jharkhand, B. nutans is the tallest bamboo having mean culm length of 15.52 m (15.46 and 15.58 m for older and newer culms respectively) followed by *B. bambos* (14.72 m), *B. vulgaris* (14.58 m), unidentified bambusa species (13.50 m), *G. atroviolaceae* (13.29 m), *B. tulda* (12.98 m), *B.balcooa* (12.54 m), and *B.striata* (11.10 m) *B. wamin* is the shortest bamboo with mean culm length of

4.15 m. *D. strictus* performs better in homestead than in natural forest of the state and its mean culm length is 8.96 m. Earlier studies (Krishnamurty, 2010) have shown that the mean culm circumference and internodal length at breast height of *D. strictus* vary between 3.1 to 15.5 cm and 12.8 to 27.2 cm. There is highly different in *D. strictus* in culm height, diameter, intermodal length and length-breadth of culm sheath, blade and leaves while mean value is slightly different among them.

In respect to internode diameter (circumference), *B. bambos* is the thickest of all having mean diameter at breast height of 8.932 cm and *B. multiplex* (0.911 cm) is the thinnest bamboo in North Chota Nagpur. The internode length of *B. tulda* is found the maximum among the bamboos encountered in North Chota Nagpur. It has the mean internode length of 49.10 cm and next to it *B. balcooa* has higher internode length (34.99 cm) at breast height followed by B. nutans (34.53 cm), *B. bambos* (25.74 cm), *D. strictus* (25.55 cm), *B. striata* (23.40 cm), *B. multiplex* (23.35 cm). Nath et al., (2012) reported that, maximum mean value of internode length has been recorded 44.1 cm in *B. tulda* at breast height immediately followed by G. atrviolaceae (43.8 cm). Shortest internodal length of 8.8 cm has been observed in *B. wamin*. All *Bambusa* sp. have moderate range of internode length from 23.8 to 34.7 cm. *D. strictus* has comparatively shorter internode length of 21.7 cm. The culm internode length of the bamboo species generally increased upto the length of mid height or slightly above it and then gradually decreased as also reported by Krishnamuty (2010). *B. bambos* exhibits maximum mean wall thickness (3.313 cm) except *D. strictus*. Kanta bans (*B. bambos*) exhibits maximum mean culm sheath length (24.8 cm) and least length is 7.53 cm in *B. multiplex*. The maximum mean breadth of culm sheath is 29.5 cm in *B. striata* and minimum is 4.37 cm in *B. multiplex*.

As regards leaf length and breadth, the unidentified bamboo had the longest leaves of all having mean length of 31.3 cm and also have maximum mean breadth of 5.98 cm.

ACKOWLEDGEMENT

The authors are thankful to the Head, PG Department of Botany, Dr. C. Prasad for providing research facilities and encouragement. They are also thankful to the supervisor Dr. S.C. Jain and other departmental faculty members for motivation. The authors express thankfulness to research members of Vinoba Bhave University, Hazaribag (Jharkhand) for granting the project research work to complete the Ph.D. course.

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