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## UNDERSTANDING BAMBOO

Have you seen a bamboo plant? Does it look like a herb, or a shrub or a tree? Well, bamboo is a tall fast-growing grass and belongs to the grass family Poaceae (Gramineae). Though it is a grass, it is a woody grass. We see this grass growing around very commonly. We use bamboo in our daily life for many uses. We use it to furnish our homes and various articles like baskets, mats etc. made of bamboo. With over 1500 documented uses for bamboo in the country, it may be said that there is a bamboo for every reason and region. In fact, bamboo is integral to the lives of 1.5 billion people, or around one fourth of the present world's population.

India has a rich bamboo resource—the second largest in the world. There are about 29 genera of bamboos among 148 species in India. The North East India has the largest stock and diversity of bamboos. Next to the North East, the Western Ghats have the second largest diversity of bamboos. They cover around 10 million hectares of forestland alone. In addition to this, bamboo is grown in private plantations and on community land. Indian bamboos grow in a wide range of habitats, and at altitudes ranging from sea level to over 3,000 meters though, we have vast bamboo resources but most of us are not aware of the huge potential for these fast-growing plants to provide a sustainable way out of poverty and a stable source of income through small and medium-sized enterprises. It is a resource that can generate income and employment, especially in backward areas and amongst disadvantaged communities.

In recent years there is a growing interest in the cultivation of bamboo, due to several factors. There is an increasing demand for good-quality bamboo culms for industrial and commercial applications, along with demand for traditional uses and crafts. Organized cultivation of bamboo shoot has found new markets from processors. Ecological awareness too has contributed to the recognition of bamboo as an environment-friendly material. Bamboo is renewable, versatile in application and has other qualities like strength, durability etc. Due to these, there



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has been increased commercial interest in the development and manufacture of bamboo-based materials.

This self learning material is aimed to provide you an easy guide to the cultivation and management of commercially useful species of Indian bamboo. It tells you about the economic benefits of raising bamboo as a managed plantation crop. It is hoped that the manual will encourage you to set up commercial bamboo plantations, especially on marginal agricultural and degraded lands.



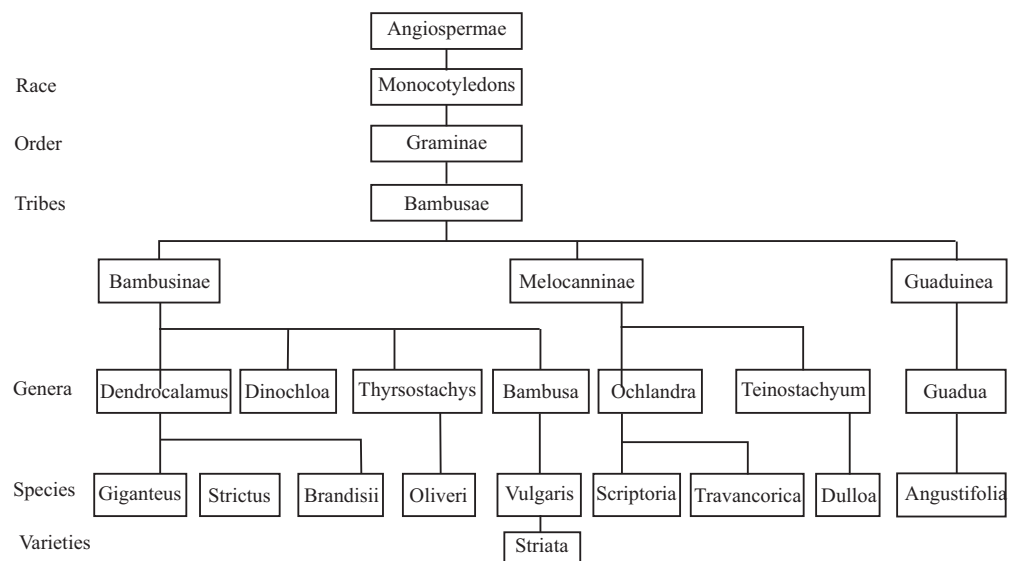
**OBJECTIVES**

After reading this lesson, you will be able to:

- differentiate different forms of bamboo present in India;
- identify different parts of the bamboo plant;
- understand the importance and use of each part;
- list out overall diversity present in India.

**1.1 BAMBOO PLANT FAMILY**

If you see a bamboo plant carefully, it will look like a large form of the grass that you see commonly in the parks or gardens. Actually, bamboo belongs to the same grass family which is called Gramineae (also called Poaceae, Fig. 1.1). It is the fifth



**Fig. 1.1: Bamboo plant family**

largest flowering plant family. Most of the cereals that you eat like rice, wheat, oats, barley and maize belong to this family. Bamboos are perennial (everlasting) tall grasses.



### 1.2 FORMS OF BAMBOO PLANT

The bamboo plant can grow in many forms as follows:

#### Tree Forms

These are bamboos up to 35 meters in height, and with large or medium sized, usually thick-walled, culms (Fig. 1.2). Examples: *Bambusa balcooa*, *Dendrocalamus hamiltonii*, *Dendrocalamus strictus*, *Dendrocalamus giganteus*. Most bamboos in India are tree (woody) forms.

#### Reed Forms

These are medium sized bamboo, which commonly grow as reed brakes (Fig. 1.3). They have thin-walled culms up to 9 meters in height with long internodes. Example: *Ochlandratra vencorica*. Reed bamboos are common in Kerala and adjacent parts in southern India.



Fig. 1.2: Tree form

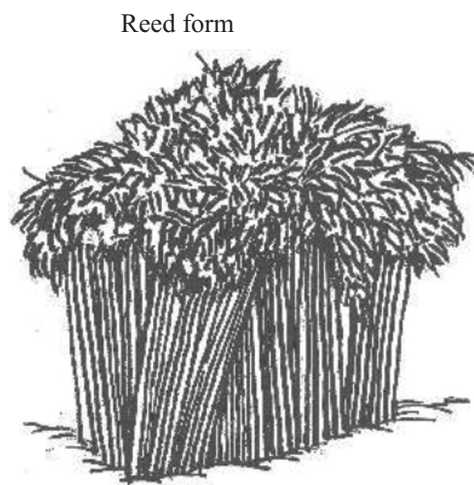


Fig. 1.3: Reed forms

#### Straggler Form

These are medium-sized bamboos up to 15 meters tall, with the tip of the culm arching or drooping down or climbing on adjacent trees (Fig. 1.4). Example: *Meloacalamus compactiflorus* (climbing bamboo). Straggler forms are rare in India.



### Shrub Forms

These are erect, short forms of bamboo found as temperate species (Fig. 1.5). They mainly occur at high altitudes, and have thin culms that rise to a height of up to 5 meters. Examples: *Arundinaria racemosa*, *Sinarundinaria falcata*. Shrub forms are widespread in India's Himalayan regions, nearer the snowline in Arunachal Pradesh, Uttarakhand, Himachal Pradesh and Sikkim. They also occur in the ghat areas of Kerala and Karnataka.



Straggler form

Fig. 1.4: Straggler form



Shrub form

Fig. 1.5: Shrub form

### 1.3 PARTS OF A BAMBOO PLANT

The bamboo plant is a complex system. It consists of two sets of similar vegetative axes: one above the ground and the other below the ground.

- The above ground axis consists of jointed, tall, cylindrical stems. They are called culms (Fig.1.9). The branches coming out from the culms laterally, form the secondary above ground axis.
- The underground axis is a solid rhizome (modified stem) system with roots and buds on it.

Now, let us learn the structure of different parts of the bamboo plant in a little detail. We will also understand what these parts do for the plant.



### 1.3.1 Rhizome

You must be using many rhizomes in your daily life like ginger, turmeric (haldi) etc. The rhizome is the underground portion (stem) of a plant. In bamboo, the rhizome grows laterally under the soil surface and is branched. It helps the plant to spread its area of growing. It contributes to growth and vegetative reproduction of the plant and also holds the food reserve.

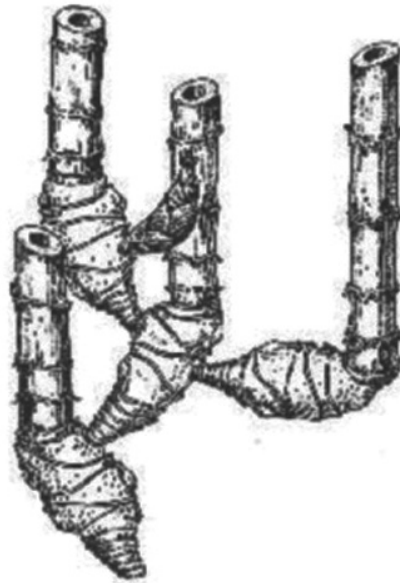


Fig. 1.6: Sympodial rhizome

The rhizome consists of nodes from which roots emerge (comes out). Buds come from it and develops into more rhizomes under the ground. On rhizome, nodes are very close to each other and are protected by sheaths (covering).

There are usually two broad types of rhizomes in bamboo:

- **Pachymorph (sympodial):** Clump-forming, that is, many bamboo stems (culms) come out close to each other from the rhizome. They form a close group (Fig.1.6)
- **Leptomorph (monopodial):** Non-clump-forming, that is, the bamboo stems (culms) coming out from rhizome are not very close to each other (Fig.1.7)

Most Indian bamboos have sympodial rhizomes and are therefore clump-forming.

Some bamboos have both sympodial and monopodial rhizomes. They have characters common to both types. These are called amphipodial rhizomes (Fig 1.8).



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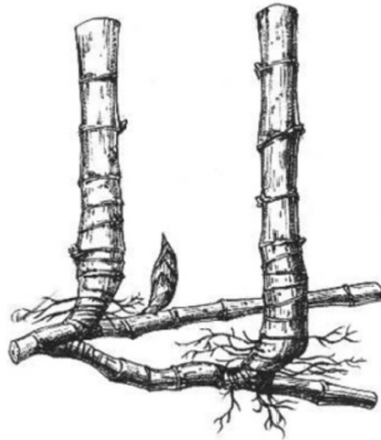


Fig. 1.7: Monopodial rhizome

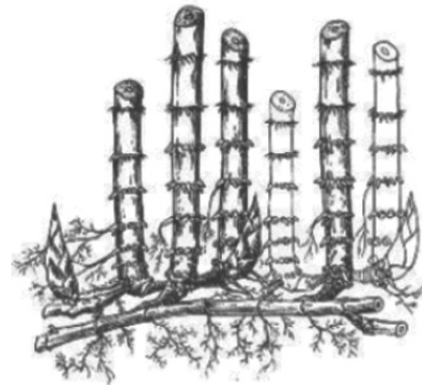


Fig. 1.8: Amphipodial rhizomes

### 1.3.2 Clump

You must have observed that bamboo usually doesn't grow alone but mostly grows in a group. The group of bamboos is called a clump (Fig 1.9). A bamboo clump can develop from a seed or from another clump that has been cut away.



Fig. 1.9: Clump

Bamboo clumps take 4–6 years to mature. Each year, culms of larger height and girth (diameter) are produced. Clumps can be tightly packed (as in *Dendrocalamus hamiltonii*, *Bambusa tulda*, *Bambusa bambos*) with many closely spaced culms,



or they may be loosely spaced but still in a cluster (as in *Bambusa vulgaris*, *Oxytenanthera stoksii*).

### 1.3.3 Culm

The stem of the bamboo is called culm. It is like a hollow cylinder that becomes narrow towards the top (Fig. 1.10). It is the most easily seen part of the plant. It is also the most widely used part. There are many uses of culm that range from basket making, furniture to timber etc. These have high demand in the market.

The culm emerges (comes out) from the ground as a shoot. It then grows fast and turns woody. It reaches its full height and girth within 80–110 days. In the fourth year its strength is highest. After the fifth year, it becomes increasingly weak and brittle (easily breakable).

Most bamboo culms are green in colour but some can be yellow, black, or even purple-black. Some bamboos are striped also, in yellow or green. In many species, the color changes as the culm matures.

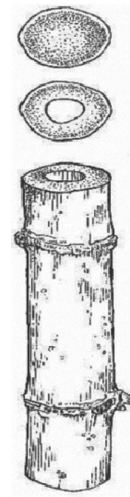


Fig. 1.10: Culm



### INTEXT QUESTION 1.1

Fill in the blanks

- (a) The primary axis of bamboo plant under the ground is ..... system.
- (b) ..... is the part of bamboo which is most widely used as timber.
- (c) Most of the Indian bamboos have ..... type of rhizome.
- (d) The culm reaches maturity in its ..... year of growth.

### 1.3.4 Shoot

Bamboo shoots are the new bamboo culms (stem) that come out of the ground (Fig. 1.11). Young bamboo shoots or bamboo sprouts of many species are edible (which you can eat). They are conical and creamy-colored when young. The soft shoots are cut from the bamboo plant when they are about 15cm or 6 inches long. They have a nice flavor and crunchy feel when you eat them. They are in great demand for preparation of various dishes like Asian stir-fries, and products like soups, pickles etc.



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Fig. 1.11: Bamboo shoots

### 1.3.5 Nodes And Internodes

When you observe the rhizome, culm and branches of the bamboo plant, you will see that they are divided by lines. These lines are actually the nodes. These are the points from where new shoots and rhizomes develop and grow.

The portion between two nodes is called an internode (Fig.1.12). Internodes are mostly (not always) hollow. They are covered by sheaths at the early stages of growth. After that, the sheath falls off as the plant matures. The length of the internode varies considerably across bamboo species. It ranges from 5cm to 60 cm. In general, the internodal length increases upwards as you go up on the culm to the middle, and then decreases.



Fig. 1.12: Culm internode

### 1.3.6 Buds and Branches

Buds are small structures which can grow into a branch. They are present on the nodes arranged on the sides of the culm (Fig. 1.13). The number of buds at a node



Fig. 1.13: Buds and branches





is directly related to the number of branches that will come out from that node. The buds at the nodes on the rhizome develop into culms coming out of the ground.

### 1.3.7 Leaves

Like all plants, the branch of the bamboo plant bear leaves (Fig. 1.14). They are important for photosynthesis by which plant makes its food. They also protect the plant from the rain and frost. They are a good source of fodder (food for cattle). You may be familiar with a carpet of leaves under bamboo plants. These are leaves fallen from the bamboo plant and are rich source of organic matter for the plant and soil.



Fig. 1.14: Leaves

### 1.3.8 Roots

The roots come out from rhizome nodes and culm nodes that are below the soil surface (Fig. 1.15). In some species, roots may also be present on the above-ground portions of culms and branches. Bamboo has a shallow (not very deep) root system. Most of the underground roots of the bamboo plant (75–85 per cent) are present in the upper layers of the soil at depths of up to 35 centimeters. Sometimes, the roots may penetrate more than a meter below the surface of the soil.



Fig. 1.15: Roots

Roots fix and hold the plant tight in the soil. They are responsible for taking up water and nutrients from the soil and give it to other parts of the plant.



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### 1.3.9 Flowers and Flowering

In bamboo, the flowering occurs relatively infrequently (sporadically) with long intervals. It varies from one year to sometimes more than a hundred years! For this reason, the flowering behaviour of the bamboo plant is not very well understood.

Flowering takes place in clusters of specialized leaves on bamboo branches (Fig. 1.16). They are important for reproduction which finally forms the seed. Bamboo flowers vary in color, size and other characteristics.

Flowering cycle in bamboo can be of two types:

- **Gregarious:** All the culms in a bamboo clump flower together and then the clump dies.
- **Sporadic:** Some culms in a bamboo clump flower, and die after that. Infrequent flowering can occur either across a larger number of culms of a clump or in a small number of culms. Some bamboos are known to flower sporadically every year.



Fig. 1.16: Bamboo flowering

There are bamboo species that show both kinds of flowering behaviour. A small number of clumps of *Dendrocalamus hamiltonii*, for example, flower sporadically at some places. The same species is also found to flower gregariously in many other areas with an interval of 30–40 years.

### 1.3.10 Species Preferred for Industrial Uses

Though there are more than 136 species of bamboo in India but only few species (around 15 species) are industrially suitable (Table 1.1). They can be segregated according to their culm diameter. Culms of different diameters are used for different purposes.

**Species with culms of very large diameter:** Following are some examples of bamboo which have very large diameter. They are mainly preferred for use in building material (eg scaffolding and furniture).

- |                                  |                                    |
|----------------------------------|------------------------------------|
| ● <i>Dendrocalamus giganteus</i> | ● <i>Bambusa balcooa</i>           |
| ● <i>Bambusa bambos</i>          | ● <i>Bambusa polymorpha</i>        |
| ● <i>Dendrocalamus brandisii</i> | ● <i>Dendrocalamus hamiltonii</i>  |
| ● <i>Dendrocalamus hookeri</i>   | ● <i>Dendrocalamus sikkimensis</i> |



**Table 1.1: Bamboo Species at a glance**

Species	Form	Altitude (in metres)	Distribution in India	Culm height (in metres)	Flowering habit	Flowering cycle (in years)
<i>Bambusa balcooa</i>	Tree	0–600	Bihar, Jharkhand, North East, Orissa, Uttaranchal, West Bengal	20–25	Gregarious, but isolated and rarely sporadic	35–45
<i>Bambusa bambos</i>	Tree	0–1000	Throughout the country, common in Central and South India	20–25	Gregarious, occasionally sporadic	40–60
<i>Bambusa nutans</i>	Tree	600–1500	North East, Orissa, West Bengal	20–25	Gregarious / Sporadic	35, 15
<i>Bambusa pallida</i>	Tree	700–2000	North East	15–20	Sporadic	40
<i>Bambusa polymorpha</i>	Tree	0–800	Arunachal Pradesh, Assam, Manipur, Meghalaya, Tripura, West Bengal	20–25	Gregarious / Sporadic	55–60
<i>Bambusa vulgaris</i>	Tree	0–1200	Assam, Madhya Pradesh, Meghalaya, Orissa, Tripura, West Bengal	20–25	Rarely flowers, sporadic	80
<i>Bambusa tulda</i>	Tree	0–1500	North East, West Bengal	20–25	Gregarious / Sporadic	30–60
<i>Dendrocalamus brandisii</i>	Tree	0–1300	Andamans, Kerala, Manipur, Nagaland, West Bengal	20–25	Gregarious / Sporadic	40–45
<i>Dendrocalamus giganteus</i>	Tree	0–1200	Bihar, Northwest Himalayas, North East, West Bengal	30–35	Sporadic	80–90
<i>Dendrocalamus hamiltonii</i>	Tree	0–1200	North Bengal, Bihar, Himachal Pradesh, Manipur, North East, Uttaranchal	20–25	Gregarious	30–40
<i>Dendrocalamus hookeri</i>	Tree	300–1800	Arunachal Pradesh, North Bengal, Meghalaya, Mizoram, Nagaland, Sikkim	20–25	Sporadic	55–60
<i>Dendrocalamus sikkimensis</i>	Tree	0–2100	North East, Sikkim, West Bengal	20–25	Sporadic	50
<i>Dendrocalamus stocksii</i>	Tree	0–800	Northern Kerala, Karnataka along the Konkan Coast	10–15	Sporadic	7–15
<i>Dendrocalamus strictus</i>	Tree	0–1000	Throughout the Country, newly introduced in North East	10–15	Gregarious / Sporadic	24–28, 40–45, 65
<i>Melocanna baccifera</i>	Tree	0–600	Mizoram, South Assam, Nagaland, Manipur, Meghalaya, Tripura, West Bengal	10–15	Gregarious / Sporadic	60, 30±35, 45–48, 60–65
<i>Ochlandra scriptoria</i>	Reed	0–600	Western Ghats	6–9	Sporadic	4–10
<i>Ochlandra travancorica</i>	Reed	0–1000	Kerala, South Karnataka, Tamil Nadu	6–9	Gregarious	7–15
<i>Teinostachyum dullooa</i>	Tree	0–1200	Tripura, North Bengal, Assam, Meghalaya, Manipur, Sikkim	10–15	Gregarious / Sporadic	15, 35, 45
<i>Thyrsostachys oliveri</i>	Tree	0–650	Tripura	15–20	Gregarious	48–50
<i>Guadua angustifolia</i>	Tree	0–1400	Introduced in Kerala and Karnataka. Native of South America.	20–25	Not reported in India. Sporadic at South America	80–100

**Species with culms of medium diameter:** There are few bamboo species which have medium sized diameter. They find their use for making various handicrafts and furniture etc. Examples are:

- *Bambusa nutans*
- *Bambusa pallida*
- *Bambusa tulda*
- *Bambusa vulgaris*
- *Teinostachyum dullooa*

**INTEXT QUESTIONS 1.2**

1. State whether True or False
  - (a) Rhizome is the edible part of the bamboo plant.
  - (b) The internodes of bamboo are hollow but nodes are solid.
  - (c) Bamboo has a deep root system.
  - (d) Some bamboo species show both gregarious and sporadic flowering cycles.
  - (e) Flowers are the most visible part of the plant.
2. Fill in the blanks
  - (a) In ..... flowering cycle, all the culms in a clump flowers together.
  - (b) ..... from bamboo are used as ingredients in various delicacies.
  - (c) Roots help the plant to uptake ..... from the soil.
  - (d) Branches arise from ..... present on the nodes.
  - (e) A bamboo clump matures over ..... years.

**WHAT YOU HAVE LEARNT**

Let us recapitulate and enlist the salient points we have learnt through this lesson:

- Bamboo is a perennial fast growing tall grass.
- There is vast diversity of bamboo present in India with around 148 species arranged into 29 genera and grow under diverse climatic conditions.
- It has huge market potential as variety of products can be obtained from it.
- There are various forms of bamboo like tree form, reed form, straggler or climber form and shrub form present in India.
- Bamboo plants have an under-ground and above-ground vegetative axes.
- Rhizome is the underground branched portion of bamboo important for spread of the plant. It also throws culm above the ground.

## Understanding Bamboo

- Bamboos grow in clumps, in which culms may be densely or loosely packed.
- Culm is the most visible part of the plant. It is also the part which is most important commercially.
- Bamboo shoots of some species also find their use as ingredients in various delicacies.
- Leaves are borne on branches and are important source of fodder and organic matter.
- Roots of the bamboo are shallow and typically present up to the depth of 35 cm below the ground. They hold the plant firmly and uptake water and minerals from the soil.
- Flowering in bamboo is rare and occurs at long intervals, varying from one year to sometimes over a hundred year. They show gregarious or sporadic flowering cycle.



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### TERMINAL EXERCISE

1. What are the different types of growth forms of bamboo in India?
2. Describe the structure and function of rhizome in bamboo plant.
3. Name the part of bamboo plant which is most conspicuous and of economic importance.
4. Why most of the species in India grow in cluster?
5. What are the methods of propagation used in bamboo? Which parts are used for that?
6. Discuss the flowering in bamboo with reference to types of flowering. Why is flowering in Bamboo the least understood?
7. Discuss the range of habitat in which bamboo grows in India.



### ANSWERS TO INTEXT QUESTIONS

1.1

- (a) Rhizome      (b) Culm      (c) Sympodial      (d) Fourth



Notes

**1.2**

1. (a) False (b) True (c) False  
(d) True (e) False
2. (a) Gregarious (b) Young shoots (c) Water and nutrients  
(d) Buds (e) 4 -5

**SUGGESTED ACTIVITY**

Find a bamboo plant growing in your surroundings. Carefully observe it. Observe the growth habit of the plant and identify its form as tree, straggler, reed or shrub. List out the features that helped you to identify the form of this bamboo plant. Now, carefully identify the different parts of the bamboo plants. Note the diameter of the bamboo culm. Is it a large diameter or medium sized diameter species?

**Key Learning Outcomes**

- List out the diverse bamboos present in India.
- Differentiate different parts of bamboo.