



FOREST BOTANY

Part - II



DIRECTORATE OF FORESTS
GOVERNMENT OF WEST BENGAL



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PREFACE

Botany is one of the core subjects of forestry. Scientific management of plant resources of forests requires a forest manager to familiarize himself with the fundamentals of the plants – their internal and external structure, diverse physiological functions, interaction with the environment in which they grow, their uses and other aspects related to plant life. As part of the JICA project on ‘Capacity Development for Forest Management and Training of Personnel’ being implemented by the Forest Department, Govt of West Bengal, these course materials on Forest Botany have been prepared for induction training of the Foresters and Forest Guards. The object of this training manual is to present the basic aspects of Forest Botany.

The subjects covered in these materials broadly conform to syllabus laid down in the guidelines issued by the Ministry of Environment of Forests, Govt of India, vide the Ministry’s No 3 -17/1999-RT dated 05.03.13. In dealing with some of the parts of the course though, the syllabus has undergone minor revision to facilitate better understanding of the subjects and to provide their appropriate coverage. The revised syllabus, with such modifications, is appended.

As the materials are meant for the training of frontline staff of the Department, effort has been made to present the subject in simple and easy language. However, as the subject unavoidably brings many scientific terms to make proper and precise presentation of the topics, it has been felt necessary to deal with and include such botanical terms in the lessons, particularly those on plant morphology.

The contents of the course materials have been compiled and edited by A Basu Ray Chaudhuri, IFS (Retd). Many books and literature including those available in internet have been made use of in preparing these course materials and references of such books and documents have been cited in the respective lessons. Shri A Basu Ray Chaudhuri is indebted to many forest officers who have helped in the preparation of these materials. A special word of thanks goes to Dr. Kana Talukder, IFS, CCF for helping with valuable suggestions and inputs.

Efforts that have gone into making of these course materials will be best rewarded if the frontline staff of the forest department find these materials useful in their day-to-day works.

Kolkata, 2015

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SYLLABUS

Forest Botany (17* hours) Excursion 1 day		
1. Basics	<p>1.1 External morphology (bark, branching pattern, phyllotaxy, leaf form, flower & inflorescence, fruit and seeds)</p> <ul style="list-style-type: none"> -parts of a plant -roots types and functions -stem – functions -Leaf parts functions -Inflorescence types -Flowers-unisexual and bisexual-parts and functions -fruits simple, aggregate and multiple -seeds dispersal germination <p>1.2 anatomy</p> <ul style="list-style-type: none"> -cells and tissues -heartwood and sapwood -annual rings <p>1.3 physiology</p> <ul style="list-style-type: none"> -photosynthesis -transpiration -translocation -respiration <p>1.4 taxonomy</p> <ul style="list-style-type: none"> -binomial nomenclature -species, genus, family <p>1.5 vegetative propagation</p> <p>1.6 ecology</p> <ul style="list-style-type: none"> -basic concepts - plant succession -eco-system -related energy in ecological system, food chain and -food web, -ecological balance* 	13* hours (4* hours practical in laboratory)
2. Economic botany	<ul style="list-style-type: none"> -local names of 47* timber and NW FP species, their description*, distribution*, economic importance and uses. -Preparation of herbarium sheet for 10 important species (to be done during tour)* 	4 hours
3. Field botany	<p>During JFM fieldwork, the trainees will learn to identify the local species from the villagers and learn their local names and uses.</p> <p>-it is sufficient if the trainee assimilates local and common names of 50 important species. However, the course material should give the botanical names. During on the job training RFO/DFO should test their field knowledge Teach the trainees the local and botanical names of the important species.</p> <p>Identification of plants from morphology will be continued during Saturday excursions and tours/with villagers during collaborative walk during PRA exercise.</p>	

* These are modifications to the MoEF-prescribed syllabus, indicating revision/addition of topics and change in lesson hours.



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Lesson Plan Objective:

- To study the following of Ecology
 - Introduction and definition
 - Objective and scope
 - Ecological factors
 - Plant community
 - Plant succession
 - Ecosystem – definition, components, food chain, food web, trophic level, flow of energy
 - Ecological balance

Backward linkage

- Study of plant physiology in lesson 7.

Forward linkage

- Study of ecosystems during tour

Training materials

- Copy of lesson 13 to be circulated beforehand

Allocation of time

- Ecology

Introduction, Definition	– 5 mts
Objective and scope	– 3 mts
Ecological factors	- 5 mts
Plant community	- 5 mts
Plant succession	- 12 mts Eco-
system	
– definition, components	- 5 mts
- food chain, food web,	
trophic level, flow of energy	- 15 mts Eco-
logical balance	- 5 mts
- Miscellaneous /Discussion - 5 mts.

1. Ecology – Introduction and Definition

The term 'Ecology' is derived from the Greek words 'Oikos' meaning house, or dwelling place and 'logos' meaning study. Thus literally, ecology is the study of 'house', 'home conditions', 'habitat' or more broadly 'environments' of plants and animals.

1.1 There are many definitions available for ecology. According to Warming and others, **plant ecology is the study of plants in relation to their environment.** According to Earnest Haeckel, ecology is defined as 'the study of the reciprocal relationship between the living organisms and their environments.' In essence, ecology is the detailed study of flora and fauna (together called **biota** or **biotic community**) of a particular region and also the various conditions of the environment prevailing in that region.

1.2 Objective and Scope of plant ecology

Plants grow in diverse habitats. They grow on high mountains, in deserts, in dry rocks and also in river banks and marshy areas. Plant behavior is regulated by the environmental conditions in which they grow. Plant ecology attempts to study all the environmental factors that influence the occurrence and growth of plants. Plant ecology also studies how the environments and plants interact with each other. Since ecological problems have direct linkage with soil conservation, flood control, deforestation, orcharding, town planning etc., the scope of ecology is now vast and useful in the large arena of applied sciences.

1.3 Divisions of ecology

Ecology is divided into **two** major divisions

- Autecology- Study of individual plant or animal species ;
- Symecology- Study of a population of species growing together or communities.

1.4 Ecological / Environmental factors

Environment includes all the factors that surround plants and animals and influence many aspects of their life. Environmental or ecological factors that affect the growth of plants and determine the nature of plant communities can be grouped under the following categories.

- Climatic factors** – These include all the conditions of atmosphere such as temperature, light, water (precipitation), wind, humidity etc. These factors primarily affect the shoot system of the plant.
- Physiographic factors** – Physiographic or topographic factors include altitude, steepness or slope, exposure, direction or placement of mountain valleys. Type of vegetation is largely influenced by these factors.
- Edaphic factors**- This constitutes all the conditions of the soil such as chemical and physical properties, availability of water and air, temperature, acidity or alkalinity. These factors affect primarily the root system of the plants.
- Biotic factors**- These factors constitute effects of the activities of living organism viz. plants, animals and soil micro organisms like bacteria. The effects of biotic factors include interactions among plants growing in a community, between plants and animals including man and between plants and soil microorganism.

2. Plant Community

Plants do not live alone in nature. Instead they tend to form groups and live together in a particular place. In ecology such groups of individuals of **any one type of organism** having high degree of uniformity and occupying an area of uniform environment is called **population**. Again a plant **community** includes all plants (individuals) of the populations in a given, that is, limited geographical area.

3. Plant Succession

Plant communities in a particular area keep on changing from one type to another after their migration and occupation. **Plant succession** is the natural process by which a locality becomes successively colonized by different groups or communities of plants. The occupation of an area from the beginning to end, i.e **final or climax** stage is continuous and marked by a series of communities. The communities in the intermediate stages in the process of succession are called **seral communities** or **seral stages**. The final steady state or stage in the succession is called **climax**.

3.1 Process of succession

First of all, plants migrate to a bare area from the neighbouring areas and aggregation takes place. The migrants interact with the soil and try to adapt themselves with the local climatic conditions. Thus they become **pioneer plants**. As pioneers begin to multiply, competition for multiplication among the species and among individuals within a species occurs. As a result of this struggle for survival and supremacy, number of pioneer plants decreases, and as the pioneer plants continuously interact with the environment, the latter undergoes change. The changed environment becomes unsuitable for establishment and propagation of the existing plants and arrivals of new communities start. Due to death and decay of pioneer plants the soil becomes more fertile and more suitable for new invaders. Thus community development progresses and number of new-comers decreases at each stage. When the climax stage is reached, entry of further new-comers becomes very difficult, as the plants in the climax stage establish a good equilibrium with the environment.



1.1.1 Primary Succession

(Source: Undergraduate Program in Plant Biology, University of Maryland <http://www.life.umd.edu/classroom/bsci124/lec34.html>)

Primary succession occurs when plants become established on land completely devoid of soil and vegetation. Primary succession is essentially the development of soils. The plant communities will generally change as the soil develops.

Stages of possible primary succession on barren rock for a forest habitat:

- Lichens (pioneer species) --> mosses & ferns --> grasses --> shrubs --> trees
- Each stage alters the habitat and develops the soil in such a way that it prepares the way for the next invasion of species. As succession proceeds, **soil is formed and thickens** - the result of decomposition;
- When the changes in the composition of plants stop and the plant community remains generally the same for many years, the community is mature or at climax. A climax community is the relatively stable community at the end of succession.

1.1.2 Secondary succession

(Source: Undergraduate Program in Plant Biology, University of Maryland <http://www.life.umd.edu/classroom/bsci124/lec34.html>)

A plant community may be disturbed causing some plants to be destroyed, as from a fire or from human logging or cultivation. If the disturbance stops, the community will begin a **secondary succession**, changes in the vegetation that will lead back to a climax community.

- In secondary succession, the progression of plant communities occurs on areas where there has been previous vegetation (destroyed by fire, farming, or other).
- Since the soil is already in place, secondary succession can take place five to ten times faster than primary succession.
- It is important to remember that the abiotic factors (such as weather, humidity, and temperature) affect the nature of the plant community.
- Also the plant community affects these abiotic factors. Therefore, if a plant community is significantly disturbed, the loss of the vegetation may change the abiotic conditions. If this occurs and the habitat has changed, secondary succession may lead to a different climax community.

4. Ecosystem

The term ecosystem was first coined by Tansley in the year 1935. All the population of a given area, that is, the community or the grouping cannot be separated functionally from the environment. Both the community and the environment function together as a system. This system is known as ecological system or ecosystem. According to the modern



ecologists, an ecosystem is a functional unit where the biotic and abiotic components of the environment interplay.

4.1 Components of ecosystem

From the structural point of view, an ecosystem has the following components.

- **Abiotic components** – It includes the basic elements of the environment, such as water, carbon dioxide, oxygen, nitrogen, calcium, phosphorus, amino acids, humic acid (derived from dead bodies of organism or their excretion).
- **Producer Components** – It includes autophytes, that is, green plants. They capture light energy and with the help of abiotic components (CO₂, H₂O, N etc.) synthesise food.
- **Consumer components** – It includes all the other types of living organisms in the community (heterotrophic organisms, i.e. mostly animals) which take as food other organisms or foods synthesised by producers.
- **Decomposers** – it also includes the heterotrophic organisms, mainly the bacteria, and fungi. They excrete digestive enzymes which break down the complex dead tissues of producers and consumers.

5. Food Chain

Every organism needs to obtain energy in order to live. For example, plants get energy from the sun, some animals eat plants, and some animals eat other animals. A **food chain** is the sequence of who eats whom in a biological community (an ecosystem) to obtain nutrition. (Source: <http://www.enchantedlearning.com/subjects/foodchain/>) A food chain thus shows interrelationship among the different categories of consumers (from primary to top) starting from producers indicating successive nutritional dependency.

Following is an example of food chain.

It shows who is eating who. The arrow means “is eaten by” .



Grass ----> Grasshopper ----> Toad ----> Snake ----> Hawk

Grass is eaten by Grasshopper is eaten by Toad is eaten by Snake is eaten by Hawk

Please note:

A food chain always starts with a green plant
... (All plants are PRODUCERS.)

..... which is eaten by an animal.
(All the animals in a food chain are CONSUMERS)

A food chain ends with a predator.
(The predator is at the top of the food chain)

(Source: <http://resources.woodlands-junior.kent.sch.uk/>)

6. Food Web

In nature independent and linear food chains are very rare. Instead several food chains are linked together forming a complicated and interconnected pattern known as food web.

6.1 Difference between food chain and food web

A food chain only follows just one path as animals find food. eg: A hawk eats a snake, which has eaten a frog, which has eaten a grasshopper, which has eaten grass. However, a **food web shows the many different paths plants and animals are connected,** eg: A hawk might also eat a mouse, a squirrel, a frog or some other animal. The snake may eat a beetle, a caterpillar, or some other animal. And so on for all the other animals in the food chain. **A food web is several food chains connected together.**

Following picture shows a typical food web in a forest.

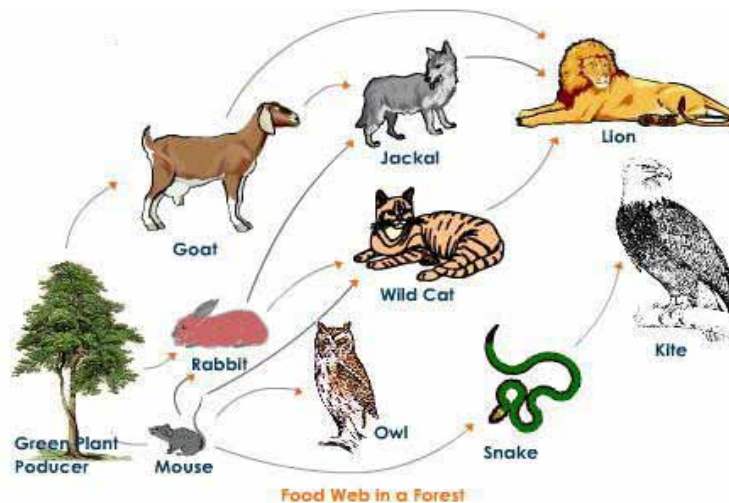


Fig. 13.1 (source: <http://biology.tutorvista.com/ecology/food-web.html>)

(Source: <http://oaks.of.the.world.free.fr/> ;

<http://www.forestrynepal.org/>

7. Trophic level

Trophic level of an organism is the **position** of that organism in a **food chain**. A food chain represents the organism that feeds on other organisms which in turn are preyed upon by organisms of higher trophic level. Biodiversity in an ecosystem can be organized into **trophic pyramids**. In a trophic pyramid the **vertical dimension** represents **feeding relations**, food energy being consumed from the base of the food chain up to the top predators and the **horizontal dimension** represents the **abundance** at each level.

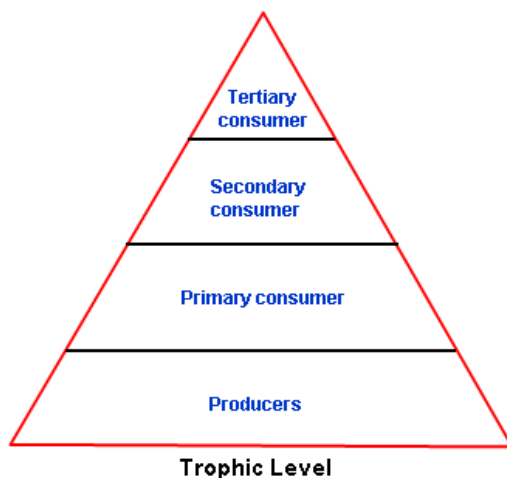


Fig.13.2 Trophic Level

(Source: <http://biology.tutorvista.com/ecology.html>)

8. Energy Flow in Ecosystem

(Source: <http://www.learner.org/courses/envsci/unit/text.php?unit=4&secNum=3>) Ecosystems maintain themselves by cycling energy and nutrients obtained from external sources. At the **first trophic level**, **primary producers** (plants, algae, and some bacteria) use solar energy to produce organic plant material through photosynthesis. **Herbivores**—animals that feed solely on plants—make up the **second trophic level**. **Carnivores** that eat herbivores comprise the **third trophic level**; if **larger carnivores** are present, they represent still **higher trophic levels**. **Decomposers**, which include bacteria, fungi, molds, worms, and insects, break down wastes and dead organisms and **return nutrients** to the soil.

8.1 On average about 10 percent of net energy production at one trophic level is passed on to the next level. Processes that reduce the energy transferred between trophic levels include respiration, growth and reproduction, defecation, and non-predatory death (organisms that die but are not eaten by consumers). The nutritional quality of material that is consumed also influences how efficiently energy is transferred, because consumers can convert high-quality food sources into new living tissue more efficiently than low-quality food sources.



☞☞☞ The low rate of energy transfer between trophic levels makes **decomposers** generally **more important** than producers in terms of energy flow. Decomposers process large amounts of organic material and return nutrients to the ecosystem in inorganic forms, which are then taken up again by primary producers. Energy is not recycled during decomposition, but rather is released, mostly as heat (this is what makes compost piles and fresh garden mulch warm). Figure 13.3 shows the flow of energy (dark arrows) and nutrients (light arrows) through ecosystems.

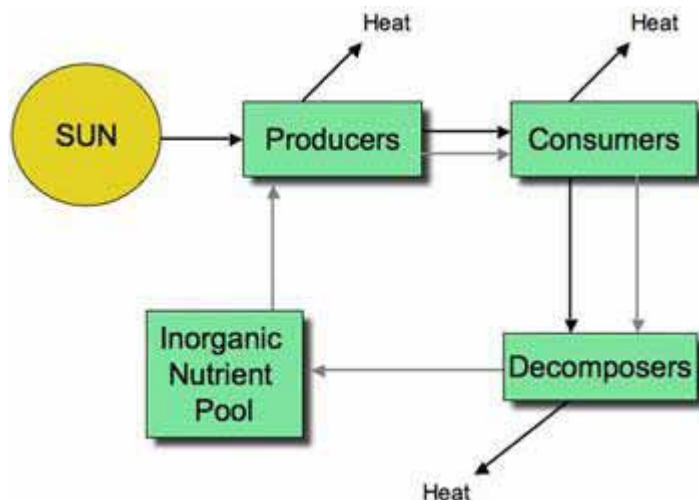


Fig.13.3 Flow of energy in ecosystem

(Source:<http://www.learner.org/courses/envsci/unit/text.php?unit=4&secNum=3>)

9. Ecological balance

Ecological balance has been defined as a state of **dynamic equilibrium** within a community of organisms in which genetic, species and ecosystem diversity remain relatively **stable**, subject to gradual changes through natural succession, and a **stable balance in the numbers of each species** in an ecosystem. The most important point being that the **natural balance** in an ecosystem is **maintained**. This balance may be disturbed due to the **introduction of new species**, the **sudden death of some species**, **natural hazards** or **man-made causes**. (Source: http://wwf.panda.org/about_our_earth/teacher_resources/webfieldtrips/ecological_balance/)

The man-made causes include

- pollution of the environment by unscientific use of natural resources;
- growing consumption rate of energy;
- rapid increase of demand on ecosystem services (that is, supply of food, nutrition, fuel, fodder, fibres-cloth, medicine etc.);
- deforestation, shrinkage and fragmentation of natural habitat of wildlife (both flora and fauna);
- unscientific disposal of chemical and toxic waste etc.

(Note: The various factors causing ecological imbalance may be explained by giving examples of some ecological disasters that have been observed in the past. It would also be relevant to touch upon briefly the concept of threatened species.)

Source of Lesson materials:

1. D Mitra et.al 2014, *Studies in Botany, volume two, Moulik Library, Kolkata*
2. A C Dutta, 1984, *A Class Book of Botany, Oxford University press.*

3. Undergraduate Program in Plant Biology, University of Maryland <http://www.life.umd.edu/classroom/bsci124/lec34.html>
4. <http://www.enchantedlearning.com/subjects/foodchain>
5. <http://biology.tutorvista.com/ecology/food-web.html>
6. <http://www.learner.org/courses/envsci/unit/text.php?unit=4&secNum=3>
7. http://wwf.panda.org/about_our_earth/teacher_resources/webfieldtrips/ecological_balance





Lesson Plan

Objective:

To study the following of Economic Botany

- Introduction – what is economic botany
- Classification of economically important plants
- Basic information about some plants

Backward linkage

- Study of plant morphology in previous lessons.

Forward linkage

- Identification and observation of the plants during tour

Training materials

- Copy of lesson 14 to be circulated beforehand

Allocation of time

- Economic Botany
 - Introduction – 2 mts
 - Classification of plants of economic importance – 3 mts
 - Study of some plants of economic importance - 50 mts
 - Miscellaneous /Discussion - 5 mts

1. Economic Botany – Introduction

Economic Botany forms the applied part of plant science. It deals with botany of the various plants that are essential to man's well-being. Since the beginning of human race, man is dependent on plants for the essentials of his existence. For survival and livelihood man has been deriving a wide range of benefits from plants. These benefits include food, clothing, shelter, animal feed, fuel, medicine, wood, gums, resins, starch, sugar etc.

2. Classification of plants of Economic importance

Economically important plants may be classified as follows:

- a) Food Plants – plants yielding food of various kinds. These include
 - Cereals – rice, wheat, maize etc.
 - Millets – plants yielding small grained food stuff e.g. jowar, bajra, ragi etc.
 - Pulses – gram, pea, pigeon pea (arhar), lentil (musur), mung etc.
 - Vegetables
 - Fruits
- b) Food Adjuncts - Plants yielding spices, flavouring materials, beverages etc, e.g. ginger, turmeric, cloves, pepper, tea, coffee etc.
- c) Drug Plants – plants yielding drugs;
- d) Industrial Plants and Plant Products – plants yielding fibres, timber, rubber, tannin, essential oils, sugar etc.

3. Some Forest Species of Economic Importance

Forests are vast repositories of plants of diverse kinds. We shall restrict our discussion to species that are found in forests (including man-made) of West Bengal, that is, those economic plants which are available in forests of the state.

3.1 *Abroma augusta* Linn.F

Family: Sterculiaceae

Local name: Ulatkambel, Kumal, Olak.

Description: An evergreen shrub or small tree. Leaves membranous, the upper ovate or lanceolate, sometimes entire, about 6 in. long; the lower cordate, lobed and toothed, in a young tree. Flowers bisexual in terminal or leaf-opposed cyme; sepals 1 in long, persistent, pale green; petals whitish and dark purple, with purple hairs, terminating above in chocolate coloured elliptic appendages, 1 in long. Capsules membranous, 5-angled, 5-winged, 5-valved, 2 in long. Seeds numerous and covered with silky hairs.

Distribution: A native of Malaya, but established throughout plains of West Bengal.

Uses: From its **bark** is extracted a **fibre**, superior to jute and also sunn hemp. The **bark** and the **root** have **medicinal use**. It has wide application in treating **female disease**.



Fig. 14.1(a)

Fig. 14.1(b)

(Fig. 14.1(a) and 14.1(b) – *Abroma augusta*; Source: <http://www.natureloveyou.sg/Abroma%20augusta> and <http://www.shubhamhomeopathy.com/>)

3.2 *Abrus precatorious* Linn.

Family: Leguminosae

Local name: Kutch, rakti, ratei

Description: Shrubby climber, leaves compound, leaflets 12-20 pairs. Flowers in axillary, many-flowered raceme, corolla white tinged with purple. Pods silky pubescent with a narrow deflexed beak. Seeds 3-6 round, hard, bright scarlet or white with a black spot or white only.

Distribution: Throughout the plains of West Bengal.

Uses: This plant is best known for its **seeds**. They are used by the jewelers as a **unit of weight**. Each seed, on an average weighs 1.75 grains, weight being known as “**Ratty**” or “**Ratei**” weight. The **leaves, roots and seeds** have **medicinal uses**. **Leaves, fruits and roots** are used to cure **colic, cough, eye disease** etc. **Leaves** are also used to cure **dyspepsia**.

Fig.14.2(a) *Abrus precatorious*

Source: <http://www.banana-tree.com/>

Fig.14.2(b) *Abrus precatorious*

Source: <http://www.examiner.com/>



1.3 *Acacia auriculiformis* A. Cunn. ex Benth.

Family: **Fabaceae (Leguminosae)** Local

names: **Akashmoni, Sonajhuri**

Description: Evergreen, unarmed tree to 15 m (50 ft) tall, with compact spread, often multi-stemmed; young growth glaucous. Leaves alternate, simple, reduced to phyllodes (flattened leaf stalks), blade-like, slightly curved, 11-20 cm (5-8 in) long, with 3-7 main parallel veins and a marginal gland near the base; surfaces dark green. Flowers in loose, yellow-orange spikes at leaf axils or in clusters of spikes at stem tips; flowers mimosa-like, with numerous free stamens. Fruit a flat, oblong pod, twisted at maturity, splitting to reveal flat black seeds attached by orange, string like arils. (http://www.fleppc.org/ID_book/Acacia)

Distribution: It is native to Australia, Indonesia, and Papua New Guinea, but has become naturalized in India. It is planted extensively in lateritic soils in south West Bengal.

Uses: It is an extremely useful plant to **reclaim** arid and rocky areas.

The **wood** is heavy and hard and its timber now finds application in the making of furniture. It is in high demand as **firewood**.

The **dry leaves** are also excellent fuel and used extensively in the forest fringe villages.

The **bark** contains sufficient tannin (13-25%) for commercial exploitation and contains 6-14% of a natural dye suitable for the batik industry.



(Source: http://en.wikipedia.org/wiki/Acacia_auriculiformis <http://mgonline.com/media/Images/e/earleafacacia01.jpg>)

Fig.14.3 *Acacia auriculiformis*

1.4 *Acacia Catechu* Willd

Family: Leguminosae

Local Name: Kath, Khair, Khair-Babul

Description: A moderate-size deciduous tree; bark dark-greyish brown, rough; spines short and hooked. Flowers yellow in axillary spikes, 2-4 inch long. Calyx and petals white-villous.

Distribution: **Common** in most of the dryer part of India and in northern plains of the state.

Uses: The **wood** is dark or light red, **very hard, durable**, takes a **fine polish** and resists white ants. The wood is used for **house-posts, agricultural implements tool handles etc.** The wood is very highly priced as **fire wood**, specially by gold smiths; it is one of the best woods for production of **charcoal**. The articles of commerce, namely, **Cutch and Kath** are obtained by boiling the softer parts of the wood. The active astringent principles in both are **catechin and catechu-tannin**. **Cutch**, dark in appearance, is extensively used in **dyeing** cotton, canvas for boat sails, silk and in calico printing. **Kath**, pale in look, has extensive medicinal uses and is almost universally used with **pan or betel leaf**. The tree is a host for lac insects.



Fig.14.4 *Acacia catechu*

Source: <http://krisadawan.wordpress.com/>

3.5 *Adhatoda Vasica* Nees. Family:

Acantaceae

Local Names: Vasaka

Description: A gregarious, evergreen, densely branched shrub. Leaves opposite, elliptic, pointed at ends, entire, 5-8 inch long. Flowers white with red spots and streaks in axillary, stalked, bracteate spikes, 1-3 inch long; bracts leafy, 1-flowered; calyx deeply divided into 5 lobes; corolla 2 lipped, upper lip notched, curved; lower leaf 3-lobed.

Distribution: Common in plains of north Bengal.

Uses: It is used for **reclaiming waste lands**, as it is not grazed or browsed. The **wood** makes very good **charcoal for gun powder**. The twigs and leaves are used as a **green manure** in rice fields. The **leaves** are also used as **weedicide, insecticide and fungicide**.



The plant has many **medicinal uses**. The **leaf decoction/ juice** is used to treat **asthma, stomachache, cough and fever**.



Fig.14.5 *Adhatoda vasica*
Source : <http://www.vasa.co.in/>

3.6 *Adina Cordifolia* Benth. & HOOK. F. (Syn.*Haldina cordifolia*)

Family: Rubiaceae

Local Names: Haldu, Karam

Description : A large deciduous tree, often buttressed. Leaves cordate – orbicular, pubescent beneath, leathery, 4-12 inch long. Flower heads stalked, yellow, about 1 inch diameter; stalk 2-4 inch long, 1-3 from one leaf axil. Fruit head a collection of numerous very small capsules.

Distributions : Occurs in deciduous forests. Found in the forests of south west Bengal.

Uses : The freshly cut wood is **yellowish**, though later it turns reddish brown. The **wood** is moderately strong and takes a **good polish**. It is used for **interior use** but not suitable for external work. It is used for canoes, packing cases, cigar boxes, furniture, toys, handles for brushes, agricultural implements, carving, picture frames etc. It has a great demand for making good quality **combs and bobbins**. It is also one of the best timber for **flooring and paneling**.



Fig.14.6 *Adina cordifolia*
(Source: [http://commons.wikimedia.org/wiki/File:Haldina_cordifolia_\(Haldu\)_](http://commons.wikimedia.org/wiki/File:Haldina_cordifolia_(Haldu)_))

1.7 *Aegle marmelos* Corr.

Family: Rutaceae

Local names: Bael tree

Description: A moderate sized deciduous tree, armed with axillary, straight, strong spines, 1 inch long. Leaves usually tri- foliate, alternate, glabrous; leaflets oblong, crenulate, membranous . Flowers bisexual, greenish-white, fragrant; calyx pubescent; petals 4-5 , oblong , leathery, gland- dotted. Fruit woody usually globose, grey-yellow or greenish, 2-6 inch diameter; seeds numerous, embedded in a thick, sweet aromatic orange coloured pulp.

Distribution: Occurs throughout the plains of West Bengal.

Uses: The **wood** is yellowish or greyish-white, hard, and is suitable for **agricultural implements, tool handles, combs** etc., though the tree is **too valuable to felled for its timber**.

The **twigs and leaves** are used as **fodder**.

The **most valuable** part is the **fruit**. A yellow dye is obtained from the unripe rind which is used with myrobalans in calico printing. The sweet aromatic **fruit pulp** is very **nutritious**. Mixed with lime the **pulp** makes a tenacious **cement**, which is used for construction of wells. The pulp is often used as a substitute for soap for **washing clothes**. The **gum** that exudes from the bark makes good adhesive paste.

It is a sacred tree for the Hindus; the leaves are used as offerings to deities. Almost **every part** of the tree is used in **herbal medicine**.



Fig.14.7(a) *Aegle marmelos*

Source: <http://thehealingherbsfindia.blogspot.com/>



Fig. 14.7(b) *Aegle marmelos*

Source: <http://www.sanjiviniherbals.co.in/>



1.8 *Albizzia Lebbeck* Benth.

Family: Leguminosae

Local names : Kalasirish, Kalsish

Description : A large, deciduous tree; branches spreading; bark brownish-grey, rough with numerous cracks. Leaves twice pinnate ; axis 3-12 inch long, with 2 glands; pinnae 2-4 pairs; reflects 3-9 pairs, 1-2 inch long, unequal sided, dark green. Flowers white fragrant, 1.5 inch long in large, globose, umbellate heads; Calyx small tubular; corolla glabrous; stemens very long, greenish. Pods large, 4-12 inch long, thin, dehiscent; seeds 6-12.

Distribution: Occurs in plains of West Bengal.

Uses : The **wood** is dark brown, hard, lustrous and durable. It is used for **house building, furniture, agricultural implements, rollers, canoes, boats, picture frames etc.** It is also useful for carving, internal decorations, paneling and flooring. The “Burrs” highly priced for making superior furniture and veneers.

The Bark is used for tannin and dyeing.

The **flowers, bark and the oil from the seed** find use in indigenous medicine

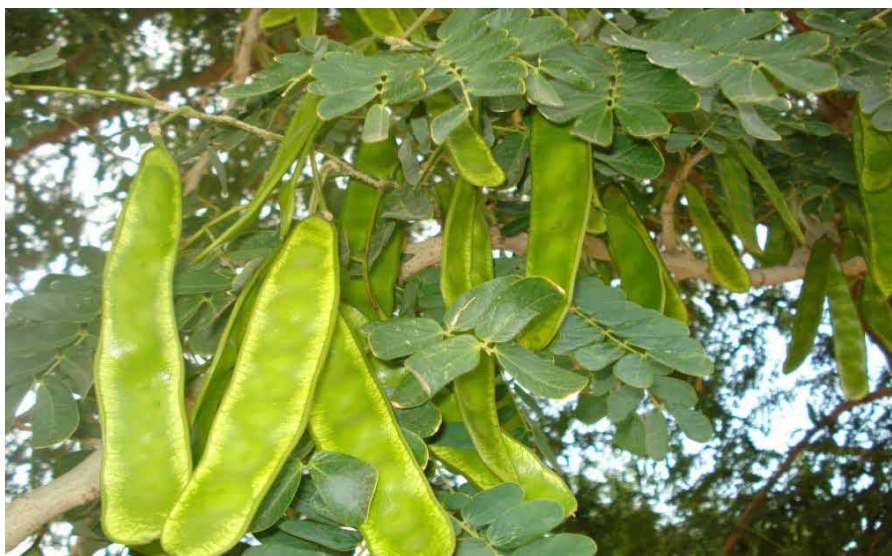


Fig.14.8 *Albizzia lebbeck*

Source : <http://commons.wikimedia.org/>

1.9 *Agave Americana* Linn

Family: Agavaceae

Local Name: Bans keora

Description: Stout, shrubby, rhizomatous plant with short aerial stem, more or less concealed by the leaf bases, and with thick fleshy spine-tipped leaves. The flower stalk is branched, 20-40' tall, and bears large (3-4") yellow-green flowers.

Distribution: Occurs in plains of WB.

Uses: The plant has many **medicinal uses**. The **sap** of century plant is used as a diuretic and a laxative. The juice of the leaves is applied to bruises and taken internally for indigestion, flatulence, constipation, jaundice and dysentery.

The **leaves** also yield **fibres**, which are suitable for making rope, matting, and coarse cloth. (http://www.cactus-art.biz/schede/AGAVE/Agave_americana/)



Fig.14.9 Agave Americana

Source: http://www.biodiversityexplorer.org/plants/asparagaceae/agave_americana.htm)

1.10 *Andrographis paniculata* (Burm.f.) Wall.ex Nees

Family : Acanthaceae

Local name: Kalmegh

Description: Erect Annual bitter herb; stem branched, quadrangular. Leaves lanceolate, glabrous. Flowers in axillary and terminal horizontal effuse panicles of racemes. Corolla white with purple tinge.

Distribution: Throughout south west Bengal.

Uses: The plant has many medicinal uses. The **whole plant** is used in fever, general debility, dysentery etc. The **leaves** are used to improve digestion and liver function.





Source : <http://www.amazon.com/>



Source : <http://commons.wikimedia.org/>

Fig 14.10 *Andrographis paniculata*

1.11 *Anthocephalus cadamba* Miq. Family : Rubiaceae

Local names: Kadam

Description: A large, deciduous tree having horizontal branches and smooth, dark –grey bark. Flower heads single, terminal, yellow, globose, 1.5-2 inch diameter. **Distribution:** Available in the plains of north Bengal forest.

Uses: The **wood** is white or light yellowish- grey and soft. It makes excellent **veneers**. It is suitable for match **boxes** and **splints**, **cheap paper**, **furniture**, **boxes**, **tea- chests** etc.

The **flowers** are sacred to the Hindus and offered in shrines.



Fig 14.11 *Anthocephalus cadamba*

Source: <http://www.srivijayadurganursery.com/avenue.html>

Source of Lesson materials:

1. *D Mitra et.al 2014, Studies in Botany, volume two, Moulik Library, Kolkata*
2. *J. F. Dastur. Useful Plants of India and Pakistan*
3. *Research Wing, Directorate of Forests, Govt of West Bengal, 2005. Medicinal Plant Resources of South West Bengal*
4. *Websites cited in the lesson*





Lesson Plan

Objective:

- To study some plants of economic importance

Backward linkage

- Study of plant morphology in previous lessons.

Forward linkage

- Identification and observation of the plants during tour

Training materials

- Copy of lesson 15 to be circulated beforehand

Allocation of time

- Economic Botany
 - Study of some plants of economic importance - 54 mts
 - Miscellaneous /Discussion - 6 mts

1 Some plants of Economic importance

1.1 *Avicennia officinalis* Linn

Family : Verbenaceae **Local names :** Baen

Description : A small ever green tree; bark thin, grayish brown. Leaves ovate or elliptic-oblong, 2-4 inch long and shining above, white or brownish pubescent beneath. Flowers yellow.

Distribution: Throughout the salt marshes and tidal forests of the state.

Uses: The astringent **bark** is used as a **tan**. **The ashes of the wood** are used for washing and cleaning clothes. **The wood** is chiefly used as **fuel**. **The fruit is edible**. **The green fruit** is used as a **poultice** for boils etc.



Source : <http://lt.wikipedia.org/wiki/Avicennia>



Source : <http://commons.wikimedia.org/> Fig

15.1 *Avicennia officinalis*

1.2 *Azadirachta indica* A. Juss

Family: Meliaceae

Local names: Neem, Nim

Description: A large evergreen tree; leaves pinnate, crowded near the end of the branchlet; leaflets sub-opposite, obliquely lanceolate, acuminate, serrate. Flowers white, fragrant, shorter than the leaves. Drupe yellow when ripe, 1-seeded.

Distribution: Throughout south West Bengal, wild and cultivated.

Uses: The **wood** is red or brown, aromatic, durable and takes good polish. It is used for furniture, carts, axles, yokes etc. The **bark** has **medicinal value** and used in vomiting, cough, intermittent fever etc. The **leaves** used in **herbal medicine** and **insect repellent**. The **twigs** are commonly used as **chew sticks** or tooth brushes.

The most useful and valuable part is the **seed**. The seed contains **fatty oil**, deep yellow in colour, known as **margosa oil of commerce**, which constitutes about 40% of the seed. The **main active principle** of this oil is 'nimbidin', which has many therapeutic uses, and several pharmaceutical preparations containing 'nimbidin' have been evolved. The unrefined margosa oil is much used as a luminant and also in the manufacture of soap. The **seed cake** is a very good fertilizer.

All the parts of the tree have considerable therapeutic uses in indigenous medicine.



<http://www.iherbalstore.com/shop/margosa>

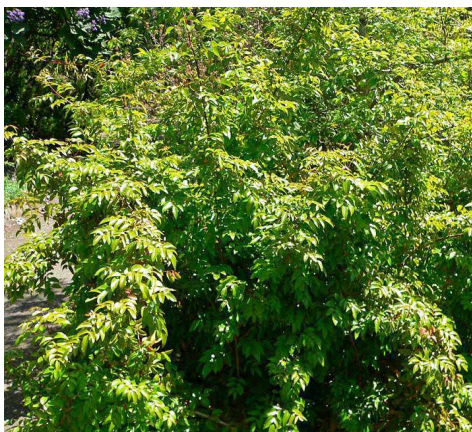
<http://commons.wikimedia.org/>

Fig.15.2 *Azadirachta indica*

1.3 *Berberis aristata* Dc

Family : Berberidaceae

Local names: Chitra, daru haridra, kashmal



(Source: http://en.hortipedia.com/wiki/Berberis_aristata ; <http://www.101herbs.com/berberis-aristata>)

Fig.15.3 *Berberis aristata*

Description: A small shiny shrub, bright shining, slightly drooping. Flowers golden-yellow, in large, drooping, long-stalked racemes. Berries spindle shaped, red.

Distribution: A native of the Himalayas at a height of 2000-3000 metres; found in forests of Darjeeling hills.



Uses: A valuable product is the **yellow dye** extracted from the **root**; it is soluble in water and alcohol. Another product called “rasaunt” is a brown extract obtained from the roots and the lower parts of the stem; when added to water, it is supposed to make the water cool. Its active principle is berberine.

The stem, the berries and the root have many **medicinal uses**. The plant is used to treat liver, ulcers, fever, infection in intestine, inflammation, cuts, wounds, eye and skin diseases, diarrhoea etc.

1.4 *Bischofia javanica* Blume

Family: Euphorbiaceae

Local names: Kainjal, Paniala

Description: A large evergreen tree. Bark brown, slightly scaly; blaze deep and pale pink in alternate layers. Leaves long-stalked, alternate, 3-5 foliate; leaflets serrate, shiny, dark green.

Flowers greenish-yellow, male and female flowers on different individuals.

Distribution : The plant grows near water in the mixed plains forest, and in the lower and middle hill forests (altitude up to 6000 feet) of North Bengal.

Uses : The **wood** is fine red, hard and durable; it is best used for pile foundations because of its durability in contact with water. It is suitable for railway sleepers, bridges, buildings and other works of constructions. The **bark** contains tannin.

The **juice of the leaves** has medicinal properties.

The plant is highly suitable for reclamation of low-lying waste lands prone to water logging.



Source : www.cnseed.org



Source : es.wikipedia.org

Fig.15.4 *Bischofia javanica*

1.5 *Bixa orellana* Linn

Family: **Bixaceae**

Local names: **Sindure, Latkan**

Description : Large spreading shrub or small trees. Leaves alternate, cordate, petioled. Flowers showy, white or purple. Capsules ovoid, reddish-brown, 1.5 inch long, softly bristly. Seeds enclosed in a red pulp.

Distribution: A native of America, naturalized in India, cultivated in plains of West Bengal. **Uses**: The plant is best known for the **red pulp** of its fruit, which yields a valuable **dye**. The dye is extensively used for **colouring** cotton and silk and also butter, cheese, confectionary, hair oils, floor polishes and pharmaceutical ointments.

The plant has diverse **medicinal uses**. The fruits are used in dysentery, kidney disease; the **root bark** is useful in treatment of fever; **leaves** are used to treat jaundice, fever; the entire plant is also used in dysentery, kidney disease and other ailments.



Source : www.messersmith.name

Source : commons.wikimedia.org

Fig. 15.5 *Bixa orellana*

1.6 *Bombax ceiba* L.

Syn : *B. malabaricum* DC

Family : **Bombacaceae**

Local names: **Simul, semal**

Description : A tall deciduous tree; young stem covered with big conical prickles; the stem is cylindrical, except at the base, where, when old, it forms large buttresses. The branches are in whorls. Leaves compound with 5-7 radiating leaflets. The flowers are large red, appearing before the leaves. Fruit a woody capsule enclosing seeds covered in silky fibre.

Distribution: Found in plains of West Bengal and also in the lower hill forests of north Bengal. **Uses**: The **wood** is light, soft and is often used for tea boxes. The **bark** exudes a yellowish gum. The **Fruit** gives the “**simul**” cotton which is collected in large quantities and sold for stuffing mattresses, pillows etc.





Source :www.flickr.com

Source :www.justagirlwithahammer.com

Source :www.richardlyonsnursery.com

Fig 15.6 *Bombax ceiba*

1.7 *Bucklandia populnea* R.Br.

Family : Hamamelidaceae

Local name: Pipli

Description: A large evergreen tree growing in height upto 60-100 feet. Bark brown, rough. Blaze reddish-white. It is easily recognized by its thick poplar-like leaves with big fleshy conspicuous stipules. The tree bears flower and fruit all the season.

Distribution : Found in the middle and upper hill forest (Altitude 3000-8000 feet) of North Bengal.

Uses: It is the most ornamental tree of the upper hills. The **timber** is considered to be very valuable. The **wood** is reddish brown, close grained, hard and extensively used for planking, beams and rafters; wood gives good charcoal.



Source : www.botanicalstockphotos.com

Source: <http://calphotos.berkeley.edu/>

Fig 15.7. *Bucklandia populnea*

1.8 *Buchanania Lanzas* Spreng

Syn. *B. latifolia* Roxb

Family: Anacardiaceae Local

names: Piyal, Chironji

Description: A tall tree; bark very characteristic, dark grey, divided by deep narrow cracks into small quadrangular plates. Leaves thick, leathery, oblong, glabrous, shining above, softly hairy beneath, 5- 10 in. long. Flowers small, without stalk, greenish white, in large, dense, many flowered, branched panicles. Drupe black, sub-globose, 0.5 in. long. Seedstone hard.

Distribution: Occurs in wild (also available in plantation) in forests of south West Bengal.

Uses: The **bark** is used for tanning; both the **bark and the fruit** yield a natural varnish.

The **fruit** is sweetish in taste and forms an important article of food amongst the tribes.

The **seed** is an **important article of commerce**. It is used as a **substitute for almond in confectionery**. From the **seeds** are extracted a pale, straw coloured, sweet, aromatic oil, known as “**chironji oil**”.

The plant has also **medicinal uses**. The **seeds** are used to treat burning sensation of the body; **seed oil** applied to treat baldness, ulcer etc. **Leaves** are used to purify blood, and treat diarrhoea.



Source : www.mpbdl.info



Source : www.mdcdevelopers.in

Fig .15.8 *Buchanania Lanzas*

1.9 *Casuarina equisetifolia* Linn.

Family: Casuarinaceae

Local name; Jhau



Description: A large evergreen tree; bark scaly peeling off in vertical streaks; the ends of branches densely bearing numerous, long, filiform (thread like), slender, green, jointed, pendulous branchlets. Flowers are unisexual, both sexes borne on the same individual. Fruit ovoid or globose, small.

Distribution: Indigenous in West Bengal; very common in coastal forests (plantations) West Bengal.

Uses: The species is very **suitable as a vegetal cover in coastal areas** and for **reclamation of sand dunes**.

The long straight **stem** is in good demand for use as **beams, posts, rafters, mine props, masts of country boats**.

The **timber** is useful for making **oars, yokes** and felloes (circular rim) of wheels. The **wood** is also in great demand for use as **fuel**.

The **bark** contains 6-18% **tannin**, and is used for **tanning and dyeing** fishing nets brown, and also for tanning leather.

The **astringent bark** has medicinal uses.



Source : agritech.tnau.ac.in



Source : pt.wikipedia.org

Fig. 15.9 *Casuarina equisetifolia*

1.10 *Chukrasia tabularis* Adr. Juss.

Syn.: *Chikrassia tabularis* Adr. Juss.

Family: **Meliaceae**

Local Names: **Chickrassy**

Description: A large deciduous tree. Leaves pinnate, alternate; leaflets, usually alternate, unequal sided. Flowers white, in panicles with spreading branches. Fruit woody ovoid capsule; seeds winged, numerous.

Distribution: Found in mixed plains forest and lower hill forest (altitude upto 3000 feet) of North Bengal.

Uses: The **wood** is reddish or yellowish-brown, hard, richly veined, scented when fresh; it takes a fine polish. It is one of the finest timbers for ornamental veneers. It is largely used for high class furniture, piano cases, panelling etc.

The young **leaves** contain 22% of tannin, and the bark 15%. The astringent bark has medicinal uses.



Source : <http://davesgarden.com/>

Source: www.flickr.com

Fig.15.10 *Chukrasia tabularis*

1.11 *Cinnamomum cecidodaphne* Meissn.

Family : Lauraceae

Local name: Malagiri

Description: A large evergreen tree; bark dark grey, outside corky, highly scented. Leaves elliptic, blade 3-4 inch long. Flowers in crowded axillary, densely tomentose panicles. Fruit oblong.

Distribution : Found in mixed plains forest and lower hill forest (upto 4000 feet) of North Bengal **Uses:** The wood is yellowish brown, soft, easily worked and durable, strongly scented and takes a good polish. It is a valuable timber and being highly aromatic, it is considered to be very good for furniture and boxes, as it keeps off insects. The wood is also suitable for planking, oars, ploughs, yokes etc.

1.12 *Cryptomeria japonica* (Lf) D. Don

Family: Cupressaceae

Local name: Dhupi

Description: *Cryptomeria japonica* is an evergreen tree that grows to a height of 35-60 m and attains a bole diameter of 1-3 m. Trunk straight, in old trees massive, buttressed; bark thin on young trees, smooth, purplish-brown, on large trees 2-3 cm thick, reddish-brown, weathering grey, exfoliating in long, shredding strips. Branches spreading to assurgent, forming a conical crown in young trees, self-pruning to leave a clear bole in large trees. Branch foliage dense, with



leaves lasting 6-12 years, shedding not individual leaves but ultimate lateral branchlets. (Source: <http://www.worldagroforestry.org/>). Cones ripen in July-August at lower elevation, and somewhat later at higher elevation. Seeds can be collected from the cones by gentle thrashing.

Distribution: Indigenous to Japan the plant was introduced in India in 1844, and planted in the hills of Eastern Himalayas-Darjeeling and Shillong where it is thriving between 1200 m and 1800

○📖 Extensive plantations of pure *Cryptomeria* are found in Darjeeling hills.

Uses: A fast growing species *Cryptomeria* coppices well (unusual for a conifer). It is moderately frost resistant, fire-tender and shed-tolerant exotic; not resistant to drought.

Timber is soft, straight-grained and fragrant. It produces excellent tea boxes; is very useful as general purpose timber; suitable for pulp, clipboards, packing cases, cheap planking etc. Timber produced here is far inferior in quality to that produced in Japan.

The species is very useful and hardy for beating up blanks in old plantations. However, large scale mono-crop of *Cryptomeria* is no longer encouraged now. Rather blanks in *Cryptomeria* plantations produced naturally or by regulated felling are now planted with indigenous broad-leaved species.



(Source: <http://luirig.altervista.org/>)

Fig.15.11 *Cryptomeria japonica*

Source of Lesson materials:

1. *J. F. Dastur. Useful Plants of India and Pakistan*
2. *Research Wing, Directorate of Forests, Govt of West Bengal, 2005. Medicinal Plant Resources of South West Bengal*
3. *A.M Cowan and J.M Cowan 1979, The Trees of Northern Bengal*
4. *Ram Parkash 2007 Plantation and Nursery Technique of Forest Trees, International Book Distributors, Dehradun.*
5. *Websites cited in the lesson*

Lesson Plan

Objective:

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- Study of plant morphology in previous lessons.

Forward linkage

- Identification and observation of the plants during tour

Training materials

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Allocation of time

- Economic Botany
 - Study of some plants of economic importance - 54 mts
 - Miscellaneous /Discussion - 6 mts.

1. Some plants of Economic importance

1.1 *Dalbergia sissoo* Roxb.

Family : Papilionaceae (Fabaceae)

Local name: Sisoo, Shisham

Description: A large deciduous tree. Leaves alternate; leaflets 3-5. Flowers yellowish-white in short axillary panicles. Pods strap-shaped, glabrous and narrowed at base, 2-4 seeded.

Distribution: Planted in south West Bengal

Uses: The wood is brown, hard, strong and durable. The timber is in great demand for all structural works, frames, furniture, carts, ploughs, oars etc. It has considerable use in manufacture of sports equipments. It is one of the principle woods for carving inlaid work and lacquered ware.

The roots, leaves, bark and heart wood have medicinal uses.



Source :<http://www.hear.org/>

Fig 16.1 *Dalbergia sissoo*

1.2 *Diospyros Melanoxylon* Roxb. Family:

Ebenaceae

Local names: Kend, Tendu

Description : A middle sized deciduous tree ; bark black, exfoliating in rectangular scales; young parts yellowish tomentose. Leaves alternate, elliptic-oblong, softly tomentose on both sides when young. Fruit yellow when ripe, globose.

Distribution: Found in deciduous forests of South West Bengal

Uses: The wood is light roseate-grey or roseate brown with a jet black core - the ebony; the outer light coloured wood is hard and elastic, and the central ebony portion is extremely hard; both the lighter and darker portions are durable and take a good polish. When the wood is of pole size, it is used for building purposes, shafts and poles of carts and carriages; the outer lighter coloured wood is suitable for tool

handle, golf sticks, carpenter's mallets etc. The ebony is used for combs, toys, snuff boxes, carving, fancy work, walking sticks etc.

The leaves are largely used as "bidi patta", that is wrappers for "bidis". The fruit is edible.

The bark of the tree has medicinal use and is used as astringents, and also used to treat diarrhea and dyspepsia.



Source: <http://www.discoverlife.org/>



Source: <http://es.wikipedia.org/>

Fig 16.2 *Diospyros Melanoxylon*

1.3 *Emblica officinalis* Gaertn. Syn.

Phyllanthus emblica Linn. Family:

Euphorbiaceae

Local names: Amlaki, amla, aonla

Description: A small or medium-sized deciduous tree. Foliage feathery, light green. Leaves

0.5 in. long, narrowly linear, closely borne on deciduous branchlets. Flowers small, greenish-yellow, densely clustered along the branches. Fruit fleshy large.

Distribution: Found and planted in deciduous forests of south West Bengal, and in mixed plains forest and lower hill forests of north Bengal.

Uses: The **leaves and fruit** contain 22 and 23% of **tannin** respectively; **the bark** from the trunk contains 8-9 % of **tannin**, and that from the tender twig contains 21% . They are used for **tanning** leather.

The **fruit** is edible and has many **medicinal uses**. **Dried fruits** with fruits of bahera and haritaki, soaked in water overnight, taken in the morning to cure dyspepsia. **Ripe fruit** with common salt is given to children to treat diarrhea.

The **leaves, seeds and roots** have also many **therapeutic** uses.





(Source: <http://bestamla.com/> ;

<http://en.wikipedia.org/wiki>)

Fig. 16.3 *Emblica officinalis*

1.4 Eucalyptus sp. Family: Myrtaceae

Local names: Eucalyptus

Description: Some 170 species, varieties and provenances of eucalypt have been tried in India, of which the most outstanding and favoured has been the *E. hybrid*, a form of *E. tereticornis*. Other species which are grown on plantation scale are *E. grandis*, *E. citriodora*, *E. globulus*, and *E. camaldulensis*.

A tall Tree - erect single-stemmed woody plant with various crown forms.

Each year there is an increment of living **bark** that results in the continual expanding girth of the tree. In all species the outermost layer dies each year. In about half of the species this dead layer completely sheds, exposing a new layer of living bark, and the process continues year after year. These are known as the smooth barks. Often the dead bark comes off in pieces at various times of the year such that the trunk is mottled depending on the amount of time the newly revealed patches of bark are exposed to weathering. Most species have **lanceolate or falcate (curved) and odorous leaves**. The leaves have oil glands. (Source: <https://www.anbg.gov.au/>). The woody **fruits** or **capsules** are roughly cone-shaped and have valves at the end which open to release the **seeds**, which are waxy, rod-shaped, about 1mm in length, and yellow-brown in colour. Most species do not flower until adult foliage starts to appear. (Source; <http://en.wikipedia.org/>)

Distribution: Eucalypt plantations have been raised in West Bengal since 1960s on laterite soils of South and South Western Districts. It has also been a popular farm forestry crop. **Uses:** (Source: Eucalyptus in India - R.M. Palanna, at <http://www.fao.org/docrep>)

The most important characteristics of *E. hybrid* contributing to its popularity under Indian conditions are: it is **fast growing**, capable of over topping weeds, **coppices well**, is fire hardy, browse resistant and it has the ability to adapt to a wide range of edaphoclimatic conditions.

Eucalypt is a very good substitute for **firewood** because of its calorific value and moderate burning qualities. Eucalypt gives good **charcoal**.

Eucalypt poles are good for **transmission purposes** and are also used in construction of **dwelling houses**, work sheds and in **mines**. Eucalypt poles have good demand near cities for use as **scaffolding material**.

Earlier, eucalypt **wood** was not considered a good timber. The quality of the timber depends upon the species and edapho-climatic factors. Considering the cost of eucalypt timber, it is found to be **quite economical** to use in **low cost houses**; as **mine timber** and in other **construction purposes**. It is also being used as **furniture wood**.

Several eucalypt species are rich in **nectar and pollen**. **Bee keeping** is profitable and this activity is improving. Leaves of *Eucalyptus globulus* and *E. citriodora* are used for **extraction of oil**. It is a cottage industry providing employment in some parts of India.

Paper and pulp: One of the most important uses of eucalypt wood so far has been in the paper and pulp industry.

The demand for paper and pulp is going to increase many fold in India and eucalypt, being one of the good pulpwood materials, will be in continuing demand.



(Source: <http://dir.indiamart.com/>) Fig.16.4
Plantation of Eucalyptus.

1.5 *Gloriosa superba* Linn. Family:

Liliaceae

Local names: Bishalanguli, Ulatchandal

Description: Rambling herb. Root-stock a chain of cylindric fleshy tubers with fibrous roots. Leaves sessile or sub-sessile, entire, tip modified into coiled tendril-like structure and used in climbing. Flowers solitary, petals yellowish-red. Fruits capsule, linear oblong, seeds brown.

Distribution: Occurs in wild, though infrequent, throughout south west Bengal, and also in the plains forest and lower hill forests of north Bengal.

Uses: It is a very valuable medicinal plant. **Leaves** used as antiasthmatic. **Tubers** used as anticancer, antimalarial, febrifuge, purgative, stomachic; used in skin diseases, chronic ulcers etc. **Roots** used as diuretic; beneficial in gout and rheumatism.





(Source: <http://okeechobee.ifas.ufl.edu/> ; <http://commons.wikimedia.org/wiki/>)

Fig. 16.5 *Gloriosa superba*

1.6 *Gmelina arborea* Linn.

Family: Verbenaceae

Local names: Gamar, gamari, khamari

Description: A moderate sized or large deciduous tree; bark grey or brownish white, exfoliating in small scales. Stem rather irregular, but cylindrical. Bark light grey coloured exfoliating in light coloured patches when old. Leaves opposite, broadly ovate or cordate, entire or dentate (toothed margin), having two glands at the junction of the petiole. Flowers in a terminal yellowish, tomentose panicle; corolla brownish yellow.

Distribution: Found in the mixed plains forest and lower hill forests of north Bengal.

Uses: The **wood** is yellowish white, strong, light, with numerous very fine medullary rays and pores of different sizes. It is easily worked and does not warp. Wood is used for various purposes, namely, planking, furniture, cabinet work, paneling, agricultural implements etc. It is one of the best of the lower hill timbers. The wood also finds use in the manufacture of matches. The wood is particularly suitable for match sticks, inside boxes and peeling purposes.

The **bark, root and the fruit** are of medicinal value.



(Source: <http://www.agbiotek.com/>; https://www.flickr.com/photos/shubhada_nikharge)

Fig.16.6 *Gmelina arborea*

1.7 *Lagerstroemia speciosa* (L.) Pers Syn. L.

flos-reginae Retz.

Family: Lythraceae Local names: Jarul

Description: A large deciduous tree; bark smooth, grayish or cream coloured, peeling off in broad, irregular flakes.

Leaves glabrous, elliptic or lanceolate, dark green above, pale beneath. Flowers purple. Capsule ovoid, woody.

Distribution: Common in plains forest in north Bengal, mostly as a shrubby tree beside stream. Planted frequently in low-lying forest blocks.

Uses: An important timber species of north Bengal. The wood is light red to reddish-brown, shining, hard, very durable under water. It is suitable for ship building, boats, canoes, carts etc. It is used for constructional works, furniture (preferably treated timber), planking etc.,. It is often used as a substitute for walnut.

The leaves and the fruit contain 12-17 % of tannin.

The various parts of the tree have **medicinal uses**. The roots, stems and leaves contain **hydrocyanic acid**.



Source: <http://www.ntbg.org/plants/>

<https://www.flickr.com/photos/eddingrid>

Fig. 16.7 *Lagerstroemia speciosa*

1.8 *Madhuca indica* J.F. Gmel. Family: sapotaceae

Local names: Mahua, mahul

Description: A large deciduous tree with short straight trunk and rounded crown. Bark thick, dark coloured, fissured, scaly. Leaves clustered near the end of branches, elliptic or oblong- elliptic, leathery. Flowers in dense clusters at or near the ends of branches; calyx or corolla segments 4 or 5; calyx leathery, corolla cream coloured, fleshy, sweet. Fruit ovoid, green, fleshy, 1-2 in long.

Distribution: Indigenous in deciduous forests over lateritic soil in south West Bengal.

Uses: Though the wood is very suitable for building purposes, bridge piles, boats, dugouts, well construction and various other purposes, the tree is not felled for timber, as its **flowers** and **fruits** are more valuable commercially. Fleshy corolla contains sugar and pleasant to



taste. Fallen flowers are collected; besides being an important part of **diet**, they are extensively used for **distilling spirit**.

The **fruit** is of considerable importance; the outer part is eaten raw or cooked; the inner part is made into flower for cakes etc. The most valuable part of the fruit is the **seed**. The seed contains oil, which is used in cooking, and for burning lamps. The dried seeds are used in the manufacture of margarine and soap. The **oil cake** makes a valuable fertilizer.

The **gum** exuding from the tree is a natural substitute for gutta-percha. The bark is used as a dye.

The **flowers**, the **spirit distilled from flowers**, and the **oil** from the seeds have medicinal properties.



(Source: <http://www.shivorganics.com/> <http://www.discoverlife.org/mp>)

Fig.16.8 *Madhuca indica*

1.9 *Michelia champaca* Linn. Family:

Magnoliaceae

Local names: champ, champaka

Description: A large evergreen tree; stem very cylindrical. Bark dark grey, smooth. Leaves ovate, lanceolate, entire, shining above, blade 8-10 in long. Sapwood yellow soft, heartwood light olive-green with narrow medullary rays, rather large pores, and very distinct annual rings, very durable. Flowers axillary, yellow, strongly scented. Capsules thick, grey ovoid.

Distribution: The tree is characteristic of most evergreen forests, extending into semi- evergreen forests, and occasionally into moist Sal forests. It occurs in the lower hill forests (from the plains upto 3000 feet) of north Bengal. It is raised artificially in mixture with other species.

Uses: It is a tall handsome, evergreen tree; very fast-growing, frost-hardy, fire sensitive.

The **timber** is lustrous, smooth, easy to saw, peels easily into excellent veneers. Timber is very suitable for light furniture and all indoor works, for Grade - I commercial plywood, for heavy packing cases, boxes, pencils etc. It is widely used for general joinery and carpentry works, cabinet making, boat building etc.

The **flowers** on distillation produce "Champaca oil" of commerce.

The **leaves, bark, roots and flowers** have medicinal use.



(Source: <http://en.wikipedia.org/wiki/Michelia>; http://www.biotik.org/india/species/m/michcham/michcham_01_en.html)

Fig.16.9 *Michelia champaca*

1.10 *Oroxylum indicum* Vent Family:

Bignoniaceae

Local names: Shona, Bhaluksukti, Totala

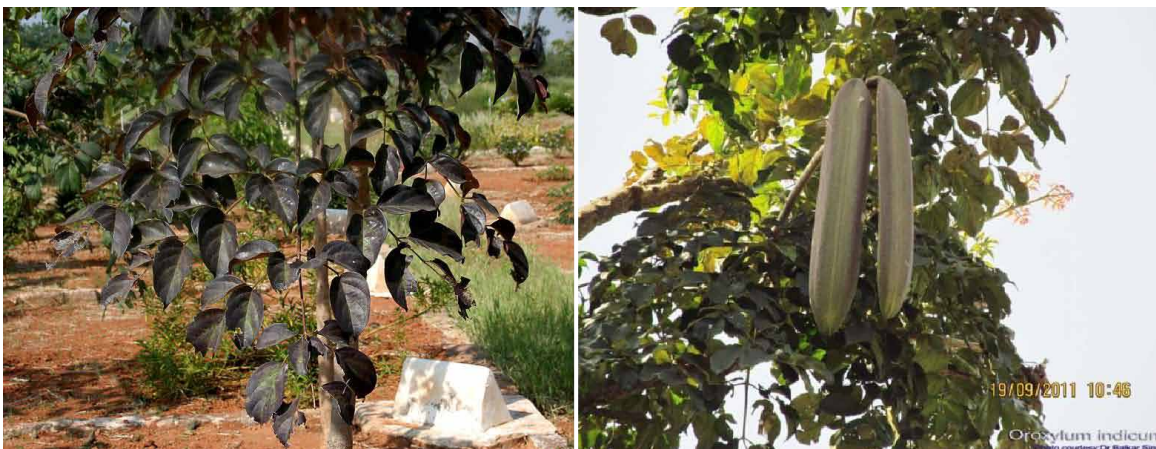
Description: Medium sized tree. Leaves very large with a stout main axis, opposite, 2-3 pinnate; leaflets stalked, ovate or elliptic. Flowers large in erect, terminal, 1-2 ft long cymes, purple, foetid (disagreeable odour). Capsules 1-2.5 ft long, tapering at both ends, flat woody, fruits are conspicuous when the tree is leafless; seeds numerous, winged.

Distribution: Available in hotter parts of south West Bengal, and in mixed plains forest and lower hill forest (upto 2000 ft) of north Bengal.

Uses: The bark and the pods are of value in dyeing and tanning.

The plant has considerable medicinal value. The root bark is used to treat diarrhea, dysentery, asthma, bronchitis, vomiting etc. The stem bark paste is applied in rheumatism, gout and swelling. Fruits are useful in heart disease, bronchitis and dyspepsia.

Stem and root bark are in demand in the market.



(Source: <http://en.wikipedia.org/wiki/> <http://medplants.blogspot.in/>)

Fig.16.10 *Oroxylum indicum*

1.11 *Pongamia pinnata* Linn.

Syn. *P. glabra* Vent.

Family: Leguminosae Local

name: Karanj

Description: A medium sized, almost evergreen tree, bark soft grey, covered with tubercles (rounded nodules); crown rounded. Leaves odd-pinnate, glabrous, bright green; leaflets 5-9 opposite, shining on both surfaces, ovate or elliptic. Flowers purple and white in axillary racemes. Pods woody, glabrous, oval-oblong, with a short decurved lateral beak.

Distribution: Found in hotter lateritic zones of south West Bengal.

Uses: **Wood** is moderately hard, but not durable. It is used for building purposes, ploughs, combs, yokes, fuel etc.

The **ash of the wood** is used for dyeing. The **bark**

yields a coarse fibre.

The plant, however, is known for the oil extracted from its **seeds**. The villagers use the oil as illuminant and insecticide. It is also used in soap making.



(Source:<http://www.jatropha.pro/pongamia>)

Fig.16.11 *Pongamia pinnata*

1.12. *Pterocarpus marsupium* Roxb. Family:

Leguminosae

Local names: Piyasal, Bijasal

Description: A large deciduous tree with widely spreading branches. Leaves alternate imparipinnate; leaflets 5-7, leathery, shining above, paler beneath, glabrous when fully grown. Flowers pale yellow or white. Pods nearly round, glabrous, winged, 1-seeded.

Distribution: Throughout the hotter parts of south West Bengal.

Uses: The **wood** is yellowish-brown, very hard, durable, and takes a good polish. It is highly valued for constructional and ornamental work and superior class of furniture. It is also used for agricultural implements, carts, boats, oars etc.

The red **gum** “kino” of commerce that exudes from the bark is very valuable. It is used as a medical gum; it contains 75% of tannic acid.

The **leaves** make good cattle fodder.

The plant has many **medicinal uses**. The bark is used in diarrhea, leucorrhoea. Heartwood soaked in water overnight and taken to treat diabetes. Gum is used in diarrhea, toothache. Leaves applied to boils, sores.



(Source:<http://opendata.keystone-foundation.org/>; <http://www.discoverlife.org/>)

Fig.16.12 *Pterocarpus marsupium*

Source of Lesson materials:

1. J. F. Dastur. *Useful Plants of India and Pakistan*
2. Research Wing, Directorate of Forests, Govt of West Bengal, 2005. *Medicinal Plant Resources of South West Bengal*
3. A.M Cowan and J.M Cowan 1979, *The Trees of Northern Bengal*
4. Ram Parkash 2007 *Plantation and Nursery Technique of Forest Trees, International Book Distributors, Dehradun.*
- 5.. *Websites cited in the lesson*





Lesson Plan

Objective:

- To study some plants of economic importance

Backward linkage

- Study of plant morphology in previous lessons.

Forward linkage

- Identification and observation of the plants during tour

Training materials

- Copy of lesson 17 to be circulated beforehand

Allocation of time

- Economic Botany
 - Study of some plants of economic importance - 54 mts
 - Miscellaneous /Discussion - 6 mts.

1. Some plants of Economic importance

1.1 *Quercus lamellosa* Smith

Family: Fagaceae

Local name: Buk

Description: A tall evergreen tree growing upto 100-120 feet height. Bark grey-brown with rough spots. Leaves large, serrate, glaucous beneath. The flowers are monoecious (individual flowers are either male or female, but both sexes can be found on the same plant) and are pollinated by Wind. (Source: <http://www.pfaf.org/>). Cupules (cup shaped whorl of bracts) very large with circular lamellae.

Distribution: It is usually a gregarious plant and found in the upper hill forests (altitude 6000- 9000 ft) in north Bengal.

Uses: The wood is hard, heavy, with broad medullary rays. It is extensively used for building purposes in the hills.

It is a good firewood.

The bark and acorns (ovoid fruit) are astringent. Any galls produced on the tree are strongly astringent and can be used in the treatment of haemorrhages, chronic diarrhoea, dysentery etc. (Source: <http://www.naturalmedicinalherbs.net/>).



Fig.17.1 *Quercus lamellosa*

1.2 *Rauvolfia serpentina* Benth.ex Kutz Family:

Apocynaceae

Local name: Sarpagandha

Description: Sparingly branched, glabrous shrub. Leaves in whorls, smooth, shining green above. Cymes many flowered. Calyx glabrous, bright red. Corolla rose or pinkish white. Drupe single or didymous, purplish black when ripe.

Distribution: Occurs occasionally under forest cover in the plains, also cultivated.

Uses: The plant is very important for its **medicinal values**. **Roots** are used to treat high blood pressure, rheumatism, epilepsy, snake bite. **Leaves** are used in removal of opacity of the cornea; paste and decoction of black pepper used to treat pneumonia.

Dry roots are in demand in the market.



(Source: <http://www.flowersofindia.net/> ;

<http://trade.indiamart.com/>)

Fig. 17.2 *Rauvolfia serpentina*

1.3 *Schima wallichii* Choisy

Family: Theaceae

Local name: Chilaune

Description: A medium to large evergreen tree growing upto 60-100 feet. Bark dark grey with deep vertical clefts. Blaze red, juicy.

Leathery leaves are elliptic-oblong in shape and look somewhat like Champa (*Michelia*) leaves. Leaf margins are entire or slightly toothed. Flowers white, fragrant, 3-4 cm across. Sepals rounded. Five white petals are broadly ovate and rounded. There is a dense bunch of orange- yellow stamens in the center. (Source: <http://www.flowersofindia.net/>).

Distribution: Schima grows in moist and dry evergreen as well as in mixed deciduous forests. Found in the Sal forest and mixed forest in the Terai, Duars, and in the lower and middle hill forests of north Bengal.

Uses: The plant has a fast growth even under infertile soil conditions. The main value of the plant is its hard and durable **timber**. Timber is used for fence posts and beams and boards for house construction. (Source: <http://www.flowersofindia.net/>).

Good-quality **plywood** can be manufactured from the wood, and it is suitable for the production of wood-wool boards. **Bark** is used for dyeing and its tannin is used in processing skins. Leaves also contain tannin but not in quantity enough for economic use in tanning. (Source: <http://www.worldagroforestry.org/>)





(Source:<http://www.flowersofindia.net/>)

Fig.17.3 *Schima wallichii*

1.4 *Schleichera oleosa* (Lour.) Oken

Syn. *S. tririjuga* Willd & Klein Family:

Sapindaceae

Local name: Kusum

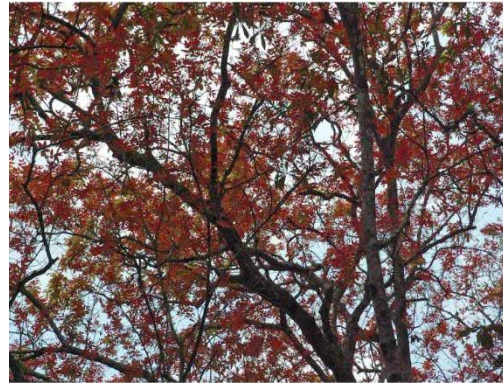
Description: A large deciduous tree; trunk fluted, thick; bark smooth, grey; young shoots silky. Younger leaves bright red. Flowers white or yellowish. Fruits ellipsoid, spinous or smooth.

Distribution: Found throughout the hotter parts of south West Bengal. The plant grows in red lateritic soil.

Uses: The wood is strong, durable, red, heavy and hard. It is in demand in making oil and sugarcane mills. It is valued for making carts and agricultural implements. It is also useful as firewood and makes excellent charcoal. The **Kusum oil of commerce** is the yellowish-brown oil extracted from the seeds. It is much used for lighting and cooking and as hair oil. It is also used for soap making. The pulp round the seed is edible.

A dye is extracted from the **flowers**. The **bark** contains 9 % of tannin. The leaves and twigs are lopped for fodder. The tree is one of the best **hosts** for culture of **lac insects**.

The plant has **medicinal use**. The bark is used for skin disease, ulcers, inflammation and malaria. The seed oil is also used for skin disease and ulcer.



(Source: <http://www.biotik.org/india/>)

Fig.17.4 *Schleichera oleosa*

1.5 *Shorea robusta* Gaertn.F.

Family: Dipterocarpaceae
Local name: Sal

Description: A large gregarious tree. Bark brown, thick with deep longitudinal cracks. Leaves long, broad ovate. Flowers yellowish, on short stalks, calyx and petals softly grey tomentose outside, petals orange inside. Wood pale brown, darkening on exposure.

Distribution: Gregarious in the laterite tracts of south West Bengal, in the well drained land in the Terai and the lower hill forests upto 3000 feet.



Uses: It is the chief forest tree and the major source of forest revenue in south West Bengal as well as in the northern part (plains forest and lower hill) of the state. **Wood** is very durable and is used for building bridges, for railway sleepers. Resistant to attack of white ants it is in great demand for construction works, mine props, piles, boat building, well construction; the wood is also used for furniture, tent poles and pegs, carriages, wheels etc. It is good firewood and makes very good charcoal.

The **bark** contains 9% of tannin and is used as tanning material.

The **stem** exudes an oleo-resinous gum. The gum is burnt as an incense and as a disinfectant fumigant.

The well-known 'sal butter' is extracted from the **seeds**; it is used as a luminant, a substitute for butter in chocolates, and as cooking agent.

The **leaves** are made into plates which are in good demand in the market.



(Source: <http://www.panoramio.com/> ;

<https://www.flickr.com>)

Fig.17.5 Shorea robusta

1.6 *Strychnos nux-vomica* Linn.

Family: Loganiaceae

Local name: Kuchila.

Description: A medium-sized or large deciduous tree. Bark smooth, grayish and thin. Leaves opposite, broadly elliptic. Flowers greenish-white in short, terminal downy cymes. Fruit globose, orange red when ripe. Seeds immersed in white pulp, covered with silky hairs.

Distribution: Throughout south West Bengal. It is now infrequent in the wild.

Uses: The most important part of the tree is its **seeds**. The seed contains valuable **alkaloids** Strychnine and brucine. The seeds are highly poisonous to man and most animals, though eaten by langurs and some birds. All parts of the plant except the pulp of the fruit are poisonous.

The plant has many **medicinal uses**. Paste of leaves is applied to wounds and ulcers. Root bark is used in cholera, diarrhea, vomiting, dysentery, fever. Seed is used to treat nervous breakdown, blood dysentery, paralysis, dyspepsia, cold and cough, intermittent fever, low blood pressure and many other ailments.



(Source: <http://biogeodb.stri.si.edu/herbarium/species>)

Fig.17.6 *Strychnos nux-vomica*

1.7 *Taxus baccata* Linn

Family: Taxaceae

Local name: Dhengre Salla

Description: *T. baccata* is a small to medium-sized evergreen tree, growing 10-20 m tall, has thin scaly brown bark, leaves are lanceolate, flat, dark green, male cones are globose, 3-6 mm diameter, outcrossing, wind-pollinated, flowering occurs in September and fruiting in October, seeds are surrounded by a unique red fleshy cuplike aril which plays a key role in attracting birds and mammals that disperse the seeds. (Source: Prabha Sharma and P L Uniyal, 2010).

Distribution: *Taxus baccata* is distributed in Himalayas (Khasi & Jaintia Hills, Naga Hills and Manipur). Found in the upper hill forests (altitude 8000-10000 feet) of north Bengal, *Taxus baccata* is a rare and endangered tree species in India. (Source: Prabha Sharma and P L Uniyal, 2010).

Medicinal use of *Taxus baccata* : The Tree contains the highly poisonous taxane that have been developed as anti-cancer drugs. All parts of the tree are poisonous, with the exception of the bright red arils. (<http://www.kew.org/science-conservation/plants-fungi/taxus-baccata-common-yew>).





Fig. 17.7 *Taxus baccata* ripe seeds enclosed by a bright red aril. (Source:<http://www.kew.org/science-conservation/plants-fungi/taxus-baccata-common-yew>)

1.8 *Tectona grandis* Linn.f

Family: Verbenaceae

Local name: Segun, Teak

Description: A large deciduous tree. Bark light brown or grayish, peeling off in thin layers. Leaves large obovate-elliptic, stellately yellowish, tomentose beneath. Flowers white, shortly stalked, numerous in terminal large panicles of cymes. Fruit sub-globose, enclosed in the inflated calyx.

Distribution: Indigenous in the central and southern part of India. Planted extensively in the plains forest and lower hill forests in the northern Bengal. Planted occasionally in the central gangetic plains forest.

Uses: It is a very valuable tree as it gives one of the outstanding timbers. The **wood** is dark golden-yellow when freshly cut, ageing to brown or almost black, moderately hard, extremely durable, takes a beautiful polish. The timber is unique for ship building, extensively used for bridges, buildings, piles, cabinet work, beams, poles, decorative paneling, carving, general carpentry etc. Timber is easy to air-season, easy to work and saw, makes excellent plywood. Wood yields tar oil; scraps and rejections are used for this purpose.

The various parts of the tree have medicinal uses.



(Source: <http://thehealingherbsofindia.blogspot.com/>; <http://luirig.altervista.org/naturaitaliana>)
Fig. 17.8 *Tectona grandis*

1.9 *Terminalia alata* Heyne ex roth.

Syn. *T. tomentosa* W.& A.

Family: Combretaceae **Local names:** Pakasaj, Asan

Description: A large deciduous tree, bark rough black, deeply cracked. Leaves leathery, hard, elliptic or ovate, 3-8 in long, opposite, margin entire or toothed, with two wartlike glands at the junction of the petiole. Flowers dull yellow. Fruit 1-2 in long with five broad wings.

Distribution: Found in sal forests in the Terai, but principally on the ridges of lower hill forests (upto 3000 feet) of north Bengal. Also found in south West Bengal, though infrequent. Planted both in northern and southern part of the state.



(Source: <http://www.forestrynepal.org/> ; <http://www.impgc.com/plantinfo>)
Fig.17.9 *Terminalia alata*

Uses: Wood is dark brown, hard, fairly durable and very handsome when polished. It is refractory to season, has to be dried slowly to avoid cracking. Timber is widely used for buildings, beams, rafters, door and window frames and boarding; also used in carts, ploughs and boat building, posts, furniture etc. Treated timber is suitable for electric transmission poles, railway sleepers and wagon floor boards. Also used for agricultural implements and decorative plywood.



The bark contains 15-18% of tannin and is used as a cheap tanning material and as heap dye. Leaves are lopped for fodder, are also used for feeding tassar silk worm.

1.10 *Terminalia arjuna* (Roxb.) Wight. Am.

Family: Combretaceae

Local name: Arjun

Description: A large deciduous tree, trunk thick and often buttressed. Bark silvery grey, flaky. Leaves oblong or elliptic, hard, glabrous leathery, 3-6 in long. Flowers without stalk, yellowish. Fruit dark brown with 5 thick, narrow, striated wings, 1 in or more long.

Distribution: It occurs in the wild along the banks of rivers and streams. Planted throughout south-west and central part of West Bengal, and also in plains (preferably in low-lying areas) of north Bengal forests.

Uses: It is one of the finest avenue and shade trees. **Wood** is hard, strong, moderately heavy; ornamental, difficult to season; is used for agricultural implements, boat building, cart wheels, mine props, plywood, buildings etc. It makes excellent firewood and good quality charcoal.

Leaves are fed to tassar silk worms.

The most useful part of the tree is its **bark** which contains 20-24 % of tannin. It is extensively used for tanning and dyeing. The bark has **medicinal value**. It is used as styptic, antidiysenteric, cardi tonic, febrifuge; used in haematemesis, leucorrhoea, and many other ailments.

Fruits and leaves have also medicinal value.



(Source: <http://davesgarden.com/guides/pf> ; http://en.wikipedia.org/wiki/Terminalia_arjuna)

Fig. 17.10 *Terminalia arjuna*

1.11 *Terminalia bellirica* (Gaertn.)Roxb

Syn. *T. belerica* Roxb.

Family: Combretaceae **Local name:** Bahera

Description: A large deciduous tree often buttressed at the base. Bark thick, silvery grey or brownish with vertical cracks. Leaves at the end of branchlets, alternate, broadly elliptic, 4-9 in long, downy when young, glabrous when mature. Flowers greenish-yellow having an offensive smell. Fruit ovoid, 1 in long, stone-woody splitting into two halves.

Distribution: Occurs throughout hotter parts of south West Bengal, and in Sal forests, mixed plains forest and lower hill forests of north Bengal.

Uses: **Wood** is hard, strong, moderately heavy, coarse textured, easy to kiln season, not durable. It is used in petty construction, heavy packing cases, tea chests, commercial plywood, blackboards etc.

The **fruit** is astringent and is one of the well-known commercial myrobalans. Tannin content of the fruit without the stone is 25 %. It is not only used for tanning leather but also for dyeing cloth and leather.

The plant has many **medicinal uses**. The fruit is one of the constituents of native medicine 'triphalā', used to treat dyspepsia. The fruit is also used as antipyretic, antileprotic and purgative. The bark is used as diuretic, paste used to treat leucoderma.



(Source: <http://www.artslant.com/> ;

<http://www.discoverlife.org/mp/>

Fig. 17.11 *Terminalia bellirica*

1.12 *Terminalia chebula* Retz.

Family: Combretaceae

Local names: Haritaki, Harra

Description: A large deciduous tree often with a short crooked stem. Bark thick, dark brown, having numerous vertical cracks. Leaves often opposite, elliptic or ovate, 3-5 in long, leathery, pubescent when young, leaf-stalk with a large gland on each side at the top. Flowers all bisexual, whitish or yellowish. Drupes ovoid, pendulous, 5-ribbed when ripe; stones hard bony.

Distribution: Throughout hotter parts of South West Bengal, and available in Sal forests, mixed plain forests (chiefly near rivers) and the lower hill forest ridges and plateau of north Bengal. Infrequent in the wild.



Uses: Wood is dark purple, very hard, fairly durable, and takes a good polish. It is used for house building, furniture, carts, shafts, axles, agricultural implements etc.

The most valuable part is its **fruit**, which is the black myrobalan of commerce. It is the most important of all the myrobalans being the best tanning material for dyeing cotton, wool and leather.

The plant has valuable medicinal properties. The fruits are used as laxative, astringent, stomachic, and tonic. The fruit is one of the constituents of native medicine 'triphala', used to treat dyspepsia. The bark is used as diuretic and cardiotoxic.



(Source: <https://www.flickr.com/photos> ; <http://www.flickrriver.com/photos/ayurvista/>)

Fig. 17.12 Terminalia chebula

Source of Lesson materials:

1. J. F. Dastur. *Useful Plants of India and Pakistan*
2. Research Wing, Directorate of Forests, Govt of West Bengal, 2005. *Medicinal Plant Resources of South West Bengal*
3. A.M Cowan and J.M Cowan 1979 , *The Trees of Northern Bengal*
4. Ram Parkash 2007 *Plantation and Nursery Technique of Forest Trees, International Book Distributors, Dehradun.*
5. *Websites cited in the lesson*
6. Prabha Sharma and P L Uniyal 2010 *Tarditional knowledge and conservation of Taxaus baccata in Sikkim Himalaya, Department of botany, University of delhi, Delhi-110007, India at http://nebio.in/neceer/NEBIO12010_55-58.pdf*