

MODEL ANSWERS
B.Sc FORESTRY (VTH SEMESTER) EXAMINATION, 2013.
(AS- 2941)
PAPER- FIRST (UTILIZATION OF NON TIMBER FOREST PRODUCTS)
SECTION –A

1. (a) Fill in the blanks-

i. Canes

ii. *Bombax ceiba*

iii. Leather

1.(b) Multiple choice question :

iv. *Butea monosperma*

v. *Anogeissus latifolia*

vi. Red plaintain

Differentiate between :-

vii. *Drugs and Poisons* –

Drugs- A drug is a substance which may have medicinal, intoxicating, performance enhancing or other effects when taken or put into a human body or the body of another animal and is not considered a food or exclusively a food. Drugs from plants depend for their therapeutic effect upon a variety of extractives. They are alkaloids, glucosides or other organic compounds. They are usually product of living cells and appear as the waste product of the metabolism of the plant. They are extracted from the plant tissues by a variety of process and depend for their medicinal value on definite physiological effect produce on human body. E.g. *Rauwolfia serpentine* , *Withania somnifera*.

Poisons- Poisons are substances that cause disturbances to organisms, usually by chemical reaction or other activity on the molecular scale, when a sufficient quantity is absorbed by an organism or material which by contact with an organism , interfere with its wellbeing in a way that it causes disorders or death, most poisons are valuable medicines. The presence of poison in plants is to protect itself from its enemies. Most of the plant poison is utilized fish poison and some real economic value. For e.g. Aconite , Strychnine.

(viii) *Hard resin and Gum resin* –

Hard resin- Resin in the most specific use of the term is a hydrocarbon secretion of many plants, particularly coniferous trees. Resins are valued for their chemical properties and associated uses, such as the production of varnishes, adhesives and food glazing agents. They

are also an important source of raw materials for organic synthesis, and as constituents of incense and perfume. They are oxidation products of various essential oils and occur as derivative of starch. They are plastic in nature and soluble in alcohol and other organic solvents, and insoluble in water. Eg. Copal, Dammar.etc.

Gum resin- When gums and resins together are exuded from the same plant is called gum resin. They have the property of both gums and resins. They don't dissolve in water completely. They also contain small amount of essential oil. They are produced by plants of dry region. Important gum resin are, Gamboges , Assafoetida etc.

(ix) Wood Dye and Bark Dye.

Wood Dye-Dyes are material or matter used for colouring material in solution. Dyes can be obtained from various parts of plant. When the dyes are collected from wood than it is called wood dye the important wood dyes are – Brazilian dye, Santaline dye, Artocarpus dye.

Bark dye- the dyeing property in bark is inadequate because the maximum number of bark contains the tanning material. Generally the bark yield brown or black colored dye. The important bark dyes are Alnus, acacias, Casurina.

(X) Fibres and Flosses-

Fibres- Fibres usually occurs as sclerenchyma cells and serve to impart rigidity to the plant. They are long cells with thick walls and small cavities. They are found in various parts of plants stem, root, leaves, fruits and seed .fibers obtained from forest are used for making ropes, cordages, mattresses.

Flosses - The outer loose pieces of silk cocoon or other waste fiber which do not easily spun are termed as flosses. Any thread-like material having parallel strands that are not spun or wound around each other. They are generally used for Stuffing mattresses, pillows, Cushion and manufacture of lifebelts.

d) Define Terms –

xi) Animal Dye- Animal dye is obtained from the lac insect (*Kerria lacca*). It produces crimson red coloured dye. Earlier it is having high commercial value.

xii) Surface fibers- Fibers obtained from the surface of plant parts are called surface fiber from the surface of stem, leaves, seeds, etc.

xiii) Essential oils- An essential oil is a concentrated hydrophobic liquid containing volatile aroma compounds from plants. Essential oils are also known as volatile oils. They are

odoriferous liquids occurring naturally in various parts of plants. They are insoluble in water but soluble in alcohol, ether fatty oil and mineral oil. The chemical composition includes hydrocarbons, alcohols. Used as high quality perfumes, confectionary, liquors, medicines etc.

Q.2. What do you mean by resin and oleoresin? Give the classification and formation process in plants? Explain by giving suitable examples.

Ans-2- Resin are the complex oxidation product of various essential oils and vary in their chemical composition. They originate through reduction and polymerization of carbohydrates. They occur as starch derivative and classified as true resin, Gum resin, Oleoresin. E.g.- Copal's, dammars, turpentine, balsam, gamboges etc.

Oleoresin-Resin mixed with fairly high percentage of essential oil is called as oleoresin they are more or less liquid in form. They have distinct aroma or flavor e.g.- turpentine's the balsams and elemis.

Classification of resin- Resin are classified into three classes

True resin

These are Hard and may be soft also,

These are Solid, brittle, more or less Colorless and odorless.

They are the best source of varnishes Oils are absent.

E.g. Copal's and dammars.

Gumresin-

These contain a water soluble gum.

These are mixture of both gums and resin and posses the properties of both the groups.

They contain traces of essential oil.

They are derived from plants occurring in dry and arid region.

Eg. Assafoetida , Gamboge, galbunam, myrrh.

Oleoresin

They contain essential oil.

They are liquids with considerable amount of essential oil and resinous material.

They possess a distinct aroma or flavor.

These groups include the turpentine, the balsams and elemis.

Formation

Resinous secretion occurs in special cavities or passages in plants. The resin originates through reduction and polymerization of carbohydrates. The resin normally oozes out through the bark and becomes hard on exposure. And they are collected from artificial wounds or fossil material. Natural gums and resins are present either in the intercellular space (ducts or cavities) of the plant parts or as exudates produced due to injury. The causes of gum and resin formation and their biosynthesis are not fully understood. Poor soil, drought and other hostile environmental conditions promote their production. Gums and resins do not re-enter the metabolism of the plant in which they are produced and therefore, they are considered as by-products or end products of certain metabolic changes. It is suggested that gum formation may be a pathological response of the plants to protect the injured part by sealing the region to prevent water loss and infection.

Examples-

Resin or true resin – Copals and dammars

Dammar- This is the Malay term for all gums and resin that exude from cracks or cuts and solidify upon exposure to air, but used as group of varnish resins obtained from Indian or east Indian trees belonging to family Dipterocarpaceae and Burseraceae..

The principal dammars of india are-

Sal dammar (Shorea robusta) – Sal is a large deciduous tree ,yields resin commonly called lal dhuma obtained resin possess an aromatic odour .it yields resin by tapping or insect injury ,the resin exudes from bark as liquid and on exposure to air it soon hardens . This Sal dammar is used as an incense and disinfectant fumigant, in the preparation of varnish, inferior quality paints and skin ointments. But generally the tapping of this tree for resin is not suggested because it causes damage to timber.

White dammar or white dhup (Valeria indica)- it is a large evergreen tree in the western ghats.this tree is locally called copal tree. The resin is exudes by cuts or blazes or by incision made on the bark of stem. This resin is used in varnish, paint and mostly used in coating furnitures.this resin is considered superior to copal. It is used in homemade varnish with coconut oil. It is used as substitute for amber in photographer varnish and used in medicines

Black dammar (Canarium strictum) It is a large deciduous tree yield black dammar. It is derived from the bark this dammar is utilized for varnish manufacture, bottling wax, and for caulking boats.

Rock dammar (*Hopea odorata*) it is large sized tree. The tree yields large yellow irregular tears, which hardens on exposure to air. It is used in preparation of varnish, painting pictures, caulking of boats and medicinal.

Copal's- These consist of resins of recent fossil and semi fossil origin .mostly they are devoid of oils. They yield a hard and elastic varnish best suited for outdoor work.

Q.3. What do you mean by Tannin? What properties are required in good Tannin ?

Explain it.

Ans 3- Tan or tannin are organic substances obtained from different plant parts which are complex in chemical constitution. The term tannin was introduced by Seguin in the year 1976 .The plant extract which have the capacity to convert hides and skins into leather are called tannin. Tannins are simple chemical compound of carbon, hydrogen and oxygen, along with some nitrogen and their empirical formula is $C_{76}H_{52}O_{46}$. The tannins are water soluble poly phenolic compounds and are mostly amorphous, astringent and feebly acidic in nature.

Properties

Tannins are not a single compound they include a large class of organic substances which differ in chemical composition and reaction.

They should have resistant to decomposition

They shall be flexible, stronger and greatly improved wearing quality.

They have high impregnation quality.

The tanning materials are obtained from different parts of plants.

Wood tans, Bark tans, Fruit tans, leaf tans

Wood tans- Forest trees with wood yielding tannin material are termed as wood tans. The important species yielding wood tan is *Quebracho Colorado*. it is widely distributed in south America. The heartwood contains 20-27% tannin, In India the cutch obtained from Khair (*acacia catechu*) heart wood is used for tanning purpose. Which have 40-60% of tannin, alongwith wattle it is used for producing heavy leather it is also use for dyeing leathers.

Bark Tans- Bark of several tree species yield tannins which are commercially utilized.the important species known to yield bark tans are *Acacia mearnsii*, *Cassia auriculata*, *Acacia nilotica*, *Shorea robusta*, *Terminilia arjuna*, *Cassia fistula*, mangrove species *Rhizophora mucronata* etc.

Fruit tans- Fruits of some of the forest species are employed in tanning industries for the extraction of different tanin . the important species yielding fruit tans are *Terminilia chebula* *Myrobalans*, *Acacia nilotica pods*, *Shorea robusta*, *tamarindus indica*.

Leaf tans- leaves of some of the plants provide tanning material for lcal use. They are not utilized extensively for tanning purpose by large tanneries. Generally local people or shoe makers utilize leaves tans. The important leaf tan are *Anogeissus latifolia*, *carrisa spinarum*, *Emblica officinalis*, *Lawsonia enermis* etc. leaf galls found on several trees are used locally for tanning purpose *Tamarix spp.*, *garuga pinnata*, *prosopis cineraria*, *terminlia spp.*

Q.4. What do you understand by essential oils? Give the method of extraction and uses of following oils : (i) Mint oil (ii) Lemon grass oil.

Ans.4. Essential oil is a concentrated hydrophobic liquid containing volatile aroma compounds from plants. Essential oils are also known as volatile oils. They are odoriferous liquids occurring naturally in various parts of plants. They are insoluble in water but soluble in alcohol, ether fatty oil and mineral oil. The chemical composition includes hydrocarbons, alcohols. These oil consist chemically variety of organic substances, they are typically liquid and posses a pleasant taste and strong aromatic odour. Almost any part of the plant may be the source of oil . These oils are by-products of carbohydrates and fat metabolism. They occur as a rule in small concentration in special cells, glands or ducts, either in particular organ of the plant or distributed over many parts. Used as high quality perfumes, confectionary, liquors, medicines , cosmetics etc.

Methods of extraction-

Essential oils are extracted from plant tissues in many different ways depending on the quantity and stability of compound. Some need delicate technique as they are unstable and become altered under drastic treatment. The methods can be classified as-

Distillation- the oldest and simplest method of distillation is boiling water or water distillation, and steam distillation.

Expression- In species where heat can destroy the odours expression method is used. Expression usually involves squeezing the material at great pressure in order to press out the oils; the process is carried out either manual presses .or huge mechanical presses in industrial centers.

Extraction by solvent- both volatile and nonvolatile solvent are used in this process, The two methods involve in this process are Enfluerage and maceration.

Mint oil- Mint oil is obtained by steam distillation of leaves of *Mentha piperita*, *Mentha arvensis* and *Mentha arvensis var.Piperascens*. These species belong to family labiateae.

***Mentha piperita* linn (peppermint)** is one of the most important of the aromatic herbs. it is found in the temperate regions of Europe, Asia and is now largely cultivated in Kashmir, nilgiris, Mysore and dehradun. peppermint has a refreshing odour, the leaves are used for flavoring purposes, but the oil is obtained by steam distillation, plant is not indigenous to India and not grown in large scale. this oil is largely used in confectionary, medicine, being antiseptic, carminative and stimulant.

Mentha arvensis is found throughout temperate north Asia up to Himalayas and in Europe. it is found wild in Kashmir at 1500-3000m. the volatile oil content from this plant is 0.45 % and it is not conform to standards.

***Mentha arvensis* Lonn. Piperacens (Japanese mint)** it is cultivated in Jammu and in parts of Uttar Pradesh. it is easily propagated from root suckers from old vigorous plant. It grows well in sandy loam soils, the herbs yield a volatile oil on distillation known in the trade as Japanese mint oil. the average yield on steam distillation being about 20% (on dry weight basis) this oil contains chief constituent as menthol 70-80% besides these other constituents are methyl acetate, menthane, acetic acid etc. this oil has strong odour and an aromatic taste, followed by cooling sensation. The oil is used in flavorings, medicines, toothpaste, mouth wash, cough drops, soaps etc.

Lemon grass oil- the lemon grass oil distinguishes between two principal types of lemon grass oil namely East Indian lemon grass oil or Malabar lemon grass oil, is obtained from *Cymbopogon flexuosus* or *Andropogon nardus*. This grass is indigenous to India and is chiefly found in Kerala and to much lesser parts of Tamil Nadu. there are the two varieties of lemon grass that is East Indian type of oil is obtained from *Cymbopogon flexuosus* or *andropogon nardus*. And the plant yielding West Indian lemon grass oil is *cymbopogon citratus*. The oil is reddish-yellow to reddish brown liquid with intense lemon odour. The quality of lemon grass oil is judged by its citral content and solubility in alcohol, the citral content varies from 41-85% by volume. It is used in perfumery, soap and cosmetic industries and in various flavorings, mosquito repellent and many pharmaceutical preparations. the important constituent of oil is citral content and others are methyl heptanone, decyl aldehyde, geraniol etc. the oil is extracted by distillation process, either by water or steam distillation.

Q.5. Define gum. Write about the following gums: (i) Kino (ii) Ghatti gum (iii) Arabic gum.

Ans-5- Gums are defined as the more or less sticky substances which have plastic consistency and dissolve or soften in water, but remain insoluble in alcohol and other organic solvents. These are supposed to be the result of disintegration of internal tissues in which cellulose is decomposed into more or less viscous substance through a process called gummosis, which exudes from cracks and wounds of the stem, they contain a large quantity of sugar and carbohydrates and consist of polysaccharides and their derivatives and are closely related to

pectin, they decompose completely on heating without melting and tend to become charred. They come out in liquid but on exposure dry up into translucent, amorphous ovoid tear shaped bodies which remain stuck to the bark or stem. The gums are mainly exuded by stem but few gums are obtained from roots, leaves and other parts of plants.

Kino gum –The kino gum is obtained from a large tree *Pterocarpus marsupium* (*bijasal*) tree, it is distributed in central and southern India. It is the source of an important gum, the kino of the Indian pharmacopoeia and officinal kino of the British pharmacopoeia. The blood red or ruby coloured astringent gum exudes from the bark. It is valuable medicine in cases of diarrhea and dysentery. The gum contains 75% of tannic acid and the chief constituents are flavonoid constituents marsupin, pterosupin, it is one of the chief medicinal gums of the world.

Ghatti gum – The ghatti gum is obtained from a large tree *Anogeissus latifolia* found in dry deciduous forest almost throughout India. The tears are round or vermicular, opaque externally and transparent internally and almost free of cracks. The colour varies from whitish yellow to amber. It is sometimes brown because of impurities. The gum is said to be superior to babul gum in colour. This gum is a substitute for gum Arabic and is used for calico printing, pharmaceutical purposes, and sizing of paper. In recent years it has been used in the petroleum industry as a drilling mud conditioner and in the explosives industry as a water absorbent. It is also used in ceramics and food.

Arabic gum– *Acacia Senegal* tree yields true gum arabic, it is also known as Sudan, kordofon or Senegal gum depending upon the source. It is a small thorny tree found in Punjab, Himachal Pradesh, and the northern Aravalli hills and other parts of Rajasthan. It is abundant in the arid tracts of north Africa, particularly in Sudan. It has been used from the Christian era. Formerly it was shipped from Egypt to Arabia and then sent to Europe and that's why it is called gum Arabic. The gum exudes from the cracks on the bark of the tree, it is yellowish in colour. It exudes in the form of tear vermiform in shape, the cracks on the surface make it opaque, it is colourless and has a bland taste. This gum is mostly used in medicine as a demulcent and an emulsifying agent, textile industries, mucilage paste, polish and confectionary industries and as a glaze in painting.

Q.6. Define dyes. Explain the dyes obtained from the different parts of plant ?

Ans 6- Dyes are the coloring materials obtained from plants. Dyeing is the process of impregnating with colour, the fixing of colour in solution in textile and other absorbent substances. Dyes are substances used for colouring, which includes paints, varnishes, leather, paper, wood, medicines, food etc. These are chiefly used in textile industries. Dyes can be obtained from animal and various parts of the plant namely wood, bark, flower and fruit.

The dyes obtained from different part of the plant –

a) Wood dye-

Santaline dye- Bright red santaline dye obtained from the heartwood of *Pterocarpus santalinus*, the red sanders tree of Andhra Pradesh, the dye is used as a coloring agent in pharmacy, for dyeing leather and for staining wood. When dissolved in alcohol, essential oils or ether, it dyes a cloth a most beautiful pink colour. With sappan wood this is employed for dyeing silk and cotton. Different colours can be produced on wool, cotton and linen according to mordant used.

Brazilian- *Caesalpinia sappan* yields a valuable red dye known as brazilin. It is tree or small shrub indigenous to India and Malaysia and is cultivated as a hedge plant in south India. The orange red heartwood finds use in the dyeing of cotton, silk and wool fabrics. The source of colouring material is brazilin which is soluble in water and alcohol. The dye is used in calico printing for producing red and pinks.

The artocarpus dye from *Artocarpus heterophyllus* and cutch dye from *Acacia catechu* are other important wood dyes.

Bark dyes- The dyeing property is not satisfactory because the maximum number of barks contain tanning material. The bark mostly yield brown or black coloured dye.

Acacias- The bark of acacia species namely *A.concinna*, *A.farnesiana* and *A.leucopholea* yield a black dye.

Alnus species- The bark is used in dyeing to deepen the colour of the red or brown dye obtained from himalayan madder (*Rubia cardifolia*).

The other bark dye are *Casurina equisetifolia*, *Manilkara littoralis*, *Myrica esculenta*, *Terminalia alata*.

b) Flower Dyes-

Butea monosperma (Dhak) dyes- a popular flower dye is that obtained from the well known dhak or palash tree the flower yield a bright but a very fugitive yellow colouring matter obtained in the form of a decoction or infusion from dried flowers the addition of alum, lime or an alkali depend the colour to orange and renders it less fugitive. The dye was extensively used for colouring Indian saris but has been largely supplanted by the more permanent aniline dyes.

Nyctanthes arbortristis (harsingar)- The orange colour tube of the flower is rich in colouring matter which is readily soluble in water it gives beautiful orange or golden yellow colour, commonly used as an auxiliary to other dyes. Liquors are colour with this dye.

c) **Fruits dyes**

- 1) ***Mallotus philippensis***- Commercially known as kamela dye, it is common fruit dye almost throughout India. It is regarded as one of the best known fruit dye. The dye is obtained from the red glands on the surface of the capsule of the species. The dye is generally used for dyeing silk. It gives bright orange or flame colour. It is also used for colouring oils, soaps, ice creams and soft drinks.
- 2) ***Bixa orellana***: - The seed of *bixa orellana* yield a well known dye, commercially as annatto. The tree is mostly cultivated in south India. The major colouring material in the seed is bixin. A seed contain about 10-12 % of bixin the arils around the seed is used for extraction of dye. A bright yellow colour dye is obtained from the seed. The dye is used for the calico printing, woolen and silken fiber.

d) **Root dye:-**

- 1) ***Berberis aristata***: - Roots of this species yield yellow dye considered to be one of the best yellow dyes in India. It is soluble in water and alcohol alkalis change the yellow colour to the brown the dye is used in the manufacture of morocco leather.
- 2) ***Morinda coreia***: - the root bark contain morinone and its glucoside morindin.the roots and bark yield a red colouring material used for dyeing of handkerchief, turban etc.

e) **Leaf Dye:-**

- 1) ***Indigofera tictoria***- this tree was extensively cultivated for extraction of dye in India.this dye is known as the kings of dyestuffs, but now the cultivation is ceased due to the introduction of artificial dye, the leaves of several species of indigofera contain a soluble colourless glucosides, known as indicant which oxides in water to form the insoluble indigo.it is widely used for its stability and strength of colour.
- 2) ***Lawsonia inermis***:- This tree is commonly known as henna tree, it yields an orange color dye called as henna dye. It gives a fast colour and is used for fabrics and leathers. It is also used for dyeing hairs, nails and eyebrows.

Q.7. Write in detail any five important medicinal plants of india.

Ans-7- The five important medicinal plants of India are-

Glycyrrhiza glabra (liquorice)-This plant belongs to a genus of perennial herbs and under shrubs of the subtropical and warm temperate regions, G.glabra and its varieties constitute the source of commercial liquorice it is not naturally found but cultivation is done in Himachal Pradesh ,Delhi and Jammu Kashmir.Liquorice has tonic , expectorant , demulcent and mildly laxative properties. It is used for cough and catarrhal infections. The principal constituent is glycyrrhizin which is present in concentration of 2-14% in different varieties.

Rauwolfia serpentina (Sarpagandha)- This plants belong to family apocynaceae .it is small erect evergreen herb which is around 50cm in height. It grows on variety of soils. It is widely distributed throughout india,the plant grows only sporadically and is nowhere common . commercial supplies are comes from himachal Pradesh , U.p. Bihar, Orissa etc. this plant is useful in reducing high blood pressure the demand of this roots are far greater from foreign countries than the available supply from Indian forest. The main active constituent is alkaloid resperine.

Cinchona ledgeriana- The most important of all vegetable drugs is Quinine, it comes from Cinchona ledgeriana and C. hybrid. it is a fast growing tree cultivated in India between 1000-2000 altitude. The bark of tree yields quinine. It is used for the treatment of malaria..the quinine content of the bark is 14% in C.ledgeriana and 22% in C. hybrid. The active principal is the alkaloid quinine that resides in the bark.

Azadirachta indica- Neem leaves contain an onion smelling compound which repels insects, they are employed to preserve books papers and cloths from moths and termites. Powdered leaves when burnt are said to be fatal to insects. Leaves are used to cure boils, leaf decoction antiseptic given in ulcers bark is beneficial in malaria the active constituent is margosic acid, nimbdin,.

Asparagus racemosus shatawar- it is scan dent climber with densely crowded cladophylls. It occurs throughout the drier parts of india.roots are used as refrigerant , demulcent, diuretic, aphrodisiac, antidiarrhoea, also helps in preparation of medicinal oil used for nervous and rheumatism.

Emblica officinalis—The tree is common in the mixed deciduous forest of India. it is often cultivated in India . Amla fruit is highly used in indigenous medicine, it is refrigerant diuretic and laxative. The dried fruit are useful in diarrhea and dysentery.in combination with iron it is used as good remedy for jaundice, Anaemia.it is the richest source of vitamin C.

Butea monosperma- it is a large deciduous tree with profuse bright orange red flowers. It occurs throughout the hotter parts of country up to an 1000m altitude. Three varieties of this species occur in India the most common one with red flowers. Leaves are astringent and tonic, flowers are astringent, diuretic and aphrodisiac, seeds are anthelmintic and gum astringent given in diarrhoea and dysentery, juice and paste are applied on the skin to control skin diseases.

Q.8. Write the various methods employed for resin tapping.

Ans 8- The resins or what we called oleoresin of the group turpentines which are yielded by coniferous trees species of the genus pines are the only commercial source of these oleoresin.

The oleoresin obtained from pines is translucent, viscous fluids consisting of complex substances they are soluble in alcohol and other organic solvent and insoluble in water. the resin tapping is done by exposing the resin ducts. The common method in resin tapping involves making a suitable incision on the stem of trees. The resin is exuded from the resin canals where incision is made. The resin canals are generally distributed in irregular fashion on the stem of trees.

The following methods are employed in resin tapping-

1. Box method- this is the oldest method of resin tapping. In this method , a cavity or box is made at the base of trees . the cavity made is generally 10x10cm and 10 cm deep. The object is to collect the resin as it exudes from the place of incision made just above the box. This is made by chipping the bark and other layer of of the sapwood. The resin oozes out from the blaze made and generally collected in the box. This method is not proper as the trees die after a few years of resin tapping.

2. Cup and lip method.

There are two types of tapping (i) light continuous tapping and (ii) heavy tapping

light continuous tapping: this is done in respect of all trees above 0.9m in girth in an area. Trees between 0.9 and 1.8m in girth are tapped in one channel, each at a time, and those above 1.8m in girth in two channels each. The first channel or each set of two channels is tapped for five years. At the end of five years a new channel or set of channel started in an anticlockwise direction leaving the suitable interspace between the old and new channels. Under this system a tree is always kept under tapping without any period of rest. This has many advantages over the old intermittent type of tapping, it is simple and give a sustained annual yield from areas advantageously situated as regards labour, transport etc. It is beneficial to labour and facilitates organization of labour and gives better yield without appreciably impairing the vitality of trees.

Heavy tapping: in this kind of tapping maximum possible outturn of resin from a tree is sought to be derived some time before the tree is due for felling and is achieved by cutting on it as many channels as it can bear with a minimum interspaces of 10cm between the successive channels. Heavy tapping is started in the case of chir pine five year in advance of main felling in prospective regeneration areas and two years in advance of thinning in areas marked for thinning. The lowest girth in heavy tapping is 60 cm.

The cup and lip method of resin tapping is most widely practiced in India in this method the area which is to be tapped is enumerated and the area is divided in to coupes, sub coupes and sections on the basis of no. of trees and number of channels, about 1000 channels spread in an

area of 10-15 hectare constitute section .one coupe of resin tapping generally consist of 25-30 sections. the area which is to tapped is enumerated for trees . the trees are given serial number and number of channels to be made on tree is determined (girth 1-2m =1 channel, above 2 m =2 channel.) for making the channels outer bark is scraped this is 15cm in width 60cm in length and 25cm above the point where the lip is to be fixed a pot is placed below the lip for collecting the resin.

For fixing the lip a 15cm wide cut is made with a chisel about 25cm below. The resin channel are blazed is made with special edge above the pint of insertion of lip, once the lip is fixed and channel is made a pot of clay are an inverted cone of tin is hang the lip for collecting resin. Generally the five freshening are recommended.

3. Rill method- in this method the blazes are made by freshening knife which does not make more than two mm deep blaze. There are series of such small blazes made on the trunk .the method envisages a tapping life of 20 yrs for the trees of 30cm diameter and above, in this method the yield is higher than above two methods.

Factors regulating capacity for resin production-

Genetical Factors

Vigour and size

Climatic factors

Method and timing of freshnings