Chapter - 18
Oil, Fibres, Spices and Medicine Producing Plants

In economic botany there is special importance of the classification of plants producing oil, fibres, spices and medicines. Study of important plants of these categories is provided in this chapter.

Oil Producing Plants – Mustard, Groundnut, Coconut, Castor Oil

From the chemical point of view, fatty oils are complex organic compounds which are insoluble in water and remain in liquid or solid or semisolid state at normal temperature. These are obtained from different plant parts such as stem, fruit and seeds.

Two types of oils are found in plants –

1. Aromatic, essential or volatile oils.

2. Fatty, fixed or non-volatile oils.

Aromatic oils are volatile hydrocarbons and have strong smell. These can be separated by distillation method. Examples – Arabian jasmine (mogra), jasmine (chameli), rose (gulab), poppy seeds (khas – khas) etc.

Fatty oils are non-volatile, which are esters of fatty acids and triglyceraldehyde alcohol (glycerol). These can not be separated by normal distillation method. Examples – all edible oils (ground nut, soyabean, mustard, sunflower) and many non-edible oils (Pongame oil tree, castor, neem).

Types of Fatty Oils

Depending upon their behaviour, when put in open, the fatty oils are of four types –

(i) Drying Oil – A thin flexible layer is formed when the oil is kept open, Example – Linseed, soyabean, safflower etc.

(ii) Semidrying Oil – A thin layer is formed on the surface of oil when kept open for a long period of time. Examples – Cotton seed, sesame and sunflower oils.

(iii) Non-drying Oil – These oils do not form a layer when come in contact with air. Examples – Mustard (oils of some species of mustard are also kept in semi drying type), castor and ground nut oils.

(iv) Fat or Tallow – These remain in solid or semi-solid state at normal temperature. Examples – Coconut oil, palm oil etc.

Mustard

Common name – Yellow mustard or Indian colza

Botanical name – *Brassica napus* var. *glauca*

Synonym – *Brassica campestris* var. *sarson*

Family – Brassicaceae (Cruciferae)

Useful plant part for oil – Cotyledons of seeds

Other species of mustard like Toria or black mustard, brown mustard, white mustard are also of economic importance.

Origin and Cultivation in different countries –

History of the use of mustard as spice is very old. **Asia minor (Iran, central Asia), Himalayan region** and **mediterranean sea region** are considered as centers of origin of different species of mustard. Mustard is a principle crop of Rabi season. It is sown during October-November and harvested

in February-March. It is mostly cultivated under unirrigated areas and somewhere under the irrigated areas. The plants of mustard crop attain 3-5 feet height and are poorly branched herbs.

India occupies the first position among the mustard producing countries of the world while Uttar Pradesh and Rajasthan are the main mustard growing states of India. Punjab, Bihar and Madhya Pradesh are the important mustard cultivating states of India. In Rajasthan, mustard is mainly cultivated in Bharatpur, Alwar, Sawai Madhopur, Kota, Baran, Sriganganagar and Hanumangarh districts.

Mustard Plant –

The plant of mustard is an annual, weak, long, poorly branched herb. Roots form tap root system. Stem is erect, herbaceous with smooth surface and branched. Leaves are simple, long, lyrate shaped, hairy with pungent smell. Inflorescence is racemose with many, bright yellow, tetramerous flowers. Fruit siliqua and seeds light yellow, oily and non-endospermic.

Under normal conditions, the production of mustard is 10-12 quintals per hectare. The seeds contains 30-48% oil, which is extracted by milling. Oil is heavy and with golden yellow coloured. Mustard oil has a very pungent smell due to the presence of allyl isothiocynate a sulphur containing compound. This oil is of non drying type, however the oil of some mustard species of semi drying type. The characteristic fatty acid of this oil erucic acid. Other fatty acids are oleic acid and palmitic acid present in this oil.

Improved Varieties –

Pusa Kalyani, varuna, durgamani, RH-30 and TM-11 varieties contain higher amount of oil in comparison to other varieties and are recommended for cultivation in Rajasthan.

Economic Importance –

1. Oil obtained from seeds is an important edible oil which is used as cooking medium.
2. Oil is used for massage, hair oil and for lighting (earthern) lamps.
3. Oil cake is used as animal feed.
4. This oil is used for production of substitutes of soap and rubber.
5. Oil is used as lubricant for machines.
6. Oil is used for softening leather goods.
7. Seeds are used as spices and in making pickles.

Ground nut (Peanut)

Botanical name – *Arachis hypogea*

Family – **Fabaceae (Leguminosae)**

Sub-family – **Papilionatae**

Useful plant part for oil – Seeds

Origin and Cultivation in different countries

Center of origin of ground nut is Brazil (South America). Wild species of groundnut are not known. In addition to Brazil six other secondary and tertiary centers of origin of ground nut are also recognized. In present times commercial production of ground nut is being done in the temperate and tropical regions of the world. India occupies the first position in the world in the production of ground nut, while China occupies the second place from this point of view. Nigeria is the biggest exporter and France is the biggest importer of ground nut. In India, Gujarat, Maharashtra, Andhra Pradesh, Tamil Nadu and Karnataka are the important ground nut producing states.

Ground nut plant

Ground nut plant in semi-erect or prostrate, branched, spreading, annual herb. Symbiotic bacterium – *Rhizobium* lives in the tap root system. Leaves are compound, pinnate with four leaflets. Flowers are characteristically papilionaceous type. Flowers are produced on the carpophores which develop from the basal part of stems. Carpophores are positively geotropic. After pollination, the carpophores enter the soil, therefore in ground nut fruits develop inside the soil. Thus the fruits are geocarpic. Self-pollination takes place in ground nut. Fruits of ground nut are elongated, indehiscent lomentums with 1-5 fleshy seeds. Cotyleons contain 43-55% oil and 25-28% protein. Ground nut crop is a rainy season (kharif) crop. The crop matures in 100-130 days. 10-15 quintals per hectare is the production from the improved varieties. From one

quintal of ground nut fruits 70-75 kilogram seeds are obtained.

Fig. 18.1 : Groundnut : Plant, Fruits

Oil Characters

Ground nut oil is non-drying edible oil. It is golden yellow coloured oil with a pleasant smell. Oleic acid content (56%) is maximum in the oil. In addition, linolenic acid (25%), palmitic acid (6-12%) and arachidic acid are also present. Phosphorus and vitamins (Thiamine, Riboflavin and Neocine) are also present in sufficient amount.

Improved Varieties –

RS-1, RSB-87, AK-12, 24 MA-10, Chandra and girnar are suitable varieties for Rajasthan.

Economic importance –

(1) Seeds of ground nut are very nutritive therefore these are consumed raw or roasted. One pound of ground nut provides 2700 calories of energy.

(2) Oil is mainly used for cooking food and as a medium of frying.

(3) Vegetable ghee is prepared after hydrogenation of this oil.

(4) Oil cake formed after extraction of oil from the seeds is the best quality animal feed.

(5) Oil is used for making soap and as lubricant in the manufacture of cosmetics.

(6) Due to presence of *Rhizobium* bacteria, ground nut is used for crop rotation and mixed crop.

(7) An artificial fibre known as Ardil is made from the ground nut protein.

(8) Ground nut oil is mixed with insecticides such as rotenon and Nicotine to increase their toxicity.

Coconut

Botanical name – *Cocos nucifera*

Family – **Arecaceae (Palmae)**

Useful plant part for oil – Endosperm

Origin and Cultivation in different countries

There are three different views of scientists regarding origin of coconut. According to one view coconut originated in North Andes,. According to the second view coconut originated in the coastal areas of southern or central America and according the third view its main center of origin is some place in south-east Asia.

Coconut palm is a crop of humid tropical region which is widely grown in the coastal areas. Indonesia, Philippins, India, Tanzania, Kenya, Bangladesh, Sri Lanka, Pappu New Guinea etc. are the main coconut producing countries. Although during the last century India occupied first position in the world on the basis of coconut production but presently India's position has come down to third place in this regard. Indonesia and Philippins have the first and second position respectively in the world so far as coconut production is concerned. Kerala is the main coconut producing state in India. Kerala state contributes 46% of total production of coconut in India. In addition to Kerala, coconut is

also grown in the states of Tamil Nadu, Karnataka, Andhra Pradesh, Goa, Daman & Deev, Orissa, Maharashtra, Gujarat and West Bengal. Coconut is not commercial crop in Rajasthan.

Coconut Plant–

Etimology of the botanical name of cocos, is from a Portuguese word-coco, which means a monkey i.e. the shape of coconut fruit resemble the head of a money. The meaning of its species epithet-nucifera means a hard nut bearing plant.

Coconut tree is a wonderful boon of nature to man. All the parts of a coconut tree are useful for man. In addition to cotton plant, this is the second important plant which gives edible oil and fibres at commercial level. Therefore coconut is called wonder plant.

Coconut plant has a very long and unbranched stem reaching a height upto 10-24 meters. From technical point of view coconut plant cannot be referred as a tree. Trunk of coconut is erect, long, thin, surface bears leaf scars and leaf bases and a crown of very large, (reaching upto 2-6 meters) peripinnate leaves. A mature coconut plant produces compound spadix inflorescence. Flowers are unisexual in coconut but the plant is monoecious.

Fig. 18.2 : Coconut-Tree with fruits

A branch of inflorescence has 30-40 lateral branches and each lateral branch produces 10-15 friuts. After fertilization, it takes an year to form a mature fruit. Fruit of coconut is a drupe, which is triangular is shape and 15-30 cm long. The fruit wall (pericarp) consists of three layers – outer smooth epicarp, middle fibrous mesocarp and inner stony endocarp. Fibrous mesocarp provides coir-a commercial fibre which is used for stuffing mattresses and making coarse ropes. The stony endocarp encloses an oily endosperm which is commonly known as 'copra'. Oil is extracted from this mature endosperm. The mature endosperm contains 60-70% fatty oil. In immature condition the endosperm remains in liquid state in the form of coconut milk which is known as liquid endosperm. Coconut milk is very nutritive and it is widely used as a drink. Coconut plants provide fruits round the year. Oil is extracted by different methods from the mature endosperm.

Characters of coconut Oil –

Coconut oil in pure form is colourless or light yellow colored which remains in liquid state above 23-24°C temperature and gets solidified or semi solidified at lower temperatures than this. Lauric acid (44.51%), myristic oil (13-18.5%) and palmitic acid (7.5 – 10.5%) fatty acids are present in this oil. This oil is of non-drying type.

Improved Varieties–

Andaman general. Anand Ganga, Chandralakshya, VHC-1 etc.

Economic Importance

Uses of Coconut oil

1. Edible oil is widely used as cooking medium.
2. Many food stuffs like margarine, candy bar, sweet meats and biscuits etc are made from coconut oil and mature endosperm.
3. Vegetable ghee is manufactured from the oil by hydrogenation.
4. Coconut oil is a very popular hair oil. It is used is many cosmetic items such as bathing soap, shampoo, creams, shaving creams.
5. Oil cake "Poonac" formed after extraction of oil is a very good animal feed.

Other uses of coconut :

6. In India, coconut fruit is considered as very auspious fruit for religious, cultural and marriage ritual purposes.
7. A sweet drink-Toddy is prepared by making incisions on inflorescence and sugar is obtained from the stems.
8. Coir fibre is made from the mesocarp of fruit wall is used for making ropes, strings, brushes, mattresses and brooms.
9. Coconut milk is an excellent and nutritive drink.
10. Poles are made from the stem of coconut plants, its leaves are used for thatching the roofs and central core of stem is used for making charcoal.

Castor Oil Plant

Botanical name – *Ricinus communis*

Family – **Euphorbiaceae**

Useful plant part for oil – Endosperm

Origin and Cultivation in different countries -

Castor plant originated in India and North Africa. There is description of castor plant in "Sushruta Samhita". Presently it is grown in tropical and sub-tropical climatic zones of the world. Brazil, India, Russia, Argentina, China, Thailand, Sudan etc are the important castor growing countries of the world.

In India, it is abundantly grown in the states of Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Orissa and Rajasthan. In Rajasthan, Sirohi district is the maximum castor producing district in Rajasthan.

Castor Plant

Castor plant is a tall, perennial, evergreen, small tree or a shrub, reaching upto 9-3 meters. Many dwarf varieties of castor are very popular. Stem is weak with smooth surface and fistular. Leaves simple, palmalty lobed, multi costate divergent venation and bear watery latex. Inflorescence is branched raceme. Flowers unisexual but the plants are monoecious. Both male and female flowers are present in the same inflorescence. Male flowers are present at the basal part of inflorescence and the female flowers occupy the upper part of the inflorescence. Male flower has five stamen, the filaments of the stamen are profusely branched. In female flower, the gynoecium is tricarpellary and trilocular. Each locule has one seed. Fruit is regma, which at maturity splits into three parts. Seeds are elongated, smooth, spotted and bear an outgrowth known as caruncle. The seed has two papery cotyledons and fleshy, oily endosperm. Thus the castor seeds are endospermic and oil is extracted from the endosperm. Castor crop is grown during rainy season and it takes 9-12 months to produce mature seeds.

Fig. 18.3 : Seeds of Castor

Characters of Castor Oil –

Castor oil is non-drying type, colourless or light yellow green, insoluble in petroleum ether and it is viscous. It contains the maximum quantity of ricinolic acid (91-95%). In addition castor oil contains low amount of linolic acid (4-5%) and very low quantity of fatty acids-palmitic and stearic acid.

Uses of Castor Oil

1. The fatty oil of castor is cathartic and lubricant. It is used as mild purgative in the treatment of constipation. Its purgative effect is due to the ricinolic acid.

2. It is used for the preparation of transparent soaps and tooth pastes.
3. It is used as lubricant for machines and aeroplanes.
4. Although its oil is of non drying type, yet by some special methods, it is made suitable for preparation of paints and varnishes.
5. Grease, polish and other products are prepared by hydrogenation of castor oil.
6. This oil is also used for manufacturing insecticides.
7. Its oil cake is used as manure and as an insecticide.
8. Castor oil is used in the production of artificial leather, oil clothes and plastic.

Fibre Producing Plants

Plant fibres are used to fulfill various needs of man. From economic point of view, fibre producing plants are the most important after food plants. Among the three basic needs of a man, after the first basic need- the food, clothing, occupies the second position. From the mythological times, man is using plant fibres for his clothing. In comparison to plant fibres, the use of animal fibres such as wool, silk and fur is very limited.

Types of Fibres

Plant fibres are obtained from different parts of the plants in various forms. On the basis of origin and structure, the fibres are of three types –

1. **Surface fibres** – These fibres originate as outgrowth on the surface of plant organs such as seed or fruit. Example – **cotton**.
2. **Soft, Stem or bast fibres** – These are obtained from the phloem fibres and pericycle of some dicotyledonous stem. These fibres consist of special type of narrow, elongated and thick walled cells. Example – **Jute, sunn, patsun.**
3. **Hard or leaf fibres** – These are obtained from the leaves of monocotyledonous plants. Example – Moonja, Typha, *Agave* (patera).

Classification of Plant Fibres –

Renowned economic botanist – A.F. Hill (1952) in his book "Economic Botany" has classified plant fibres into six classes on the basis of their use –

1. **Textile fibres** – Clothes, ropes, bags and strings are made from these fibres. Example – Cottons, jute, sunn etc.
2. **Brush fibres** – These are used for making brooms and brushes, such as leaves of palm.
3. **Plaiting and rough weaving fibres** – Baskets, carpets, caps and seats of chairs etc. are made from these fibres. Example – Bamboo.
4. **Filling fibres** – These fibres are used for stuffing quilts, mattresses, pillows. Examples – cotton, madar, cotton silk, coir etc.
5. **Natural fibres** – these are directly used as clothing or dress materials. Example – Tapa cloth made from the bark of *Braussnetia papyrifera.*
6. **Paper making fibres** – Paper, card board etc. are made from these fibres. Example – Bamboo, *Eucalyptus,* many types of grasses, *Populous alba* etc.

Munj

Botanical name – *Erianthus munja (Saccharum munja)*

Family – **Poaceae (Gramineae)**

Local name – Munj, sarkanda

Useful Plant part for fibre-leaves

Munj Plant

Munj palnt is monocot, perennial, dense grass which mostly grows in sandy habitats. It is grown in desert to check soil erosion. The height of this grass reaches upto 5-8 feet. Roots and underground part of

Fig. 18.4 : Munj plant

stem are tufted and form a dense, thick, perennial, perennating body. It remains green during rainy season and by the end of winter season it dries up.

Stem unbranched, thickness about that of a chalk stick, solid and with well marked nodes and inter nodes. Stem is used for making Muddas (sofa made of the stem sticks) and chicks. Leaves quite long, elliptical, sharp margins, leaf sheath covering a large part of internodes, unicostate parallel venation.

Fibre –

During mid-winter season, leaves are cut and made into bundles for drying. Stems are also cut and kept of their various uses. Munj fibre is obtained by beating the dried leaves with a wooden hammer. Munj fibre is rough and thick. Thin strings are made from this fibre. These strings are weaved to make net of wooden cots, carpets and other uses.

Cotton

Botanical name – *Gossypium spp*

Family – **Malvaceae**

Useful plant part for fibre - Seed testa hairs; seeds are used of obtaining fatty oil

Species of Cotton

There are many species of cotton but its four species are mainly cultivated at commercial level –

(1) *Gossypium hirsutum* – It originated in the new world (America). It is termed as upland cotton. Cultivation of this species is the maximum in the world. It fibre is thin, white and long.

***(2) G. herbaceum* –** It originated in the old world (Africa). It is widely cultivated in countries like – India, Iran, China, Russia etc. Its fibres are of medium quality. This cotton is known as uppam cotton.

***(3) G. arboreum* –** This is known as Asiatic cotton. It probably originated in Indo-China. It is cultivated in India, Myanmar, Malaysia, China and Taiwan. Its fibre is thick and short.

***(4) G. barbadense* –** It probably originated in South America (Brazil). It is called Egyptian cotton. From the point of view of fibre, this is the best quality of cotton. Its fibre is used for making underwear, hosiery items, towels and soft clothes.

Fig. 18.5 : Cotton *(Gossypium)* plant

Quality of cotton fibre depends upon many characters such as strength, length, number of twists, fineness, colour, texture, counts, napiness and ginning percentage etc.

India, U.S.A, Russia, China, Brazil, Egypt, Pakistan, Turkey, Mexico and Sudan are the important cotton producing countries in the world. In India, it is mainly grown in Maharashtra, Gujarat, Karnataka, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh and Tamil Nadu.

In ancient time, India has been an important center of cotton and its related products. Dacca muslin manufactured in India was the world famous cotton product.

Cotton Plant

Most of the cultivated species of cotton are annual plants. Cotton is sown during April to July and harvested from October to March. The height of cotton plants varies from 2 to 6 feet. Stem is erect, branched, soft wooded and brown coloured, leaves are palmately lobed, flowers are large sized, pedicillate, epicalyx three in number and large sized. Corolla large, mostly yellow coloured, twisted aestivation. Stamen indefinite, monoadelphous, fruit loculicidal capsule. Immature fruit is called boll. Seeds oval shaped, grey or brown coloured and from the outer seed coat originate long, white filamentous outgrowths which is the commercial fibre. This is known as Lint or Staple. Small fibres which are called fuzz are also present along with the lint fibres. From the chemical point of view lint fibres are mainly composed of cellulose (94%), proteins (1.3%) and some other material.

High Yielding Varieties

In India, cotton technological research laboratory (CTRL), Matunga (Maharashtra) and Central Institute for Cotton Research (CICR) Nagpur have developed high yielding varieties of cotton like MC_u-2,3; AK-277, Sujata, Mahalaxmi, Varahlaxmi etc.

Uses of Cotton

Both fibres and edible oil are obtained from cotton. Important uses of fibres are as follows –

1. Cotton clothes, blended clothes and hosiery materials are produced from cotton.
2. Cotton fibres are made up of pure cellulose hence these are used as raw material in cellulose industry.
3. Cotton fibres are used in blankets, ropes, carpets, flooring and tyres.
4. Fibres are used for stuffing of mattresses, pillows, quilts etc.
5. Cotton fibres are used for making absorbent cotton and bandages etc.
6. Cotton seeds are used for extraction of a semidrying edible oil.

Sunn, Sun hemp

Botanical name – **Crotalaria juncea**

Family – **Fabaceae (Leguminosae)**

Useful plant part for fibre – Stem- phloem and pericycle fibres

Sunn crop for obtaining fibres and its use as green manure is being cultivated in India from ancient period. Its center of origin is uncertain but majority of scientists consider India sub-continent as the center of origin of sunn. Sunn is also being cultivated in the Asian and African countries of the world. In India, sunn is cultivated as a major crop in the states of Andhra Pradesh, Tamil Nadu and Madhya Pradesh while it is grown at moderate level in the other states as well.

Sunn Plant

Sunn is an annual herbaceous plant reaching upto 1.5 meter height. It is grown during rainy season. The crop matures and gets ready for harvesting within four months. Sunn fibre is obtained from the stem as bast fibre. Separation of fibres from the stem is by retting method. In this method the bundles of mature sunn plants are kept immerged in water for 5-7 days for retting. Retting is mainly carried out by bacteria mainly by *Closteridium butyricum* species. After retting the fibres are separated from the stem, washed and tied in knots after drying.

Fig. 18.6 : Sunhemp plant

Uses of Sunn Fibres

1. Ropes are made after twisting the sunn fibres.
2. Canvas, bags, fishing net and their strings are made from sunn fibres.
3. Cigarette papers and tissue papers are made from the immature sunn fibres.
4. Whole plant is useful for green manure.
5. Gum obtained from sunn seeds is useful in printing industry.

Spices Producing Plants

Association of man and spices is a very interesting story. In the ancient period man's lust for spices as been second only after gold. In those days international trade was mainly done for these things only.

Hill (1952) has defined spices as "In general dry and hard plant materials which possess essential oil and which are used in powder form are called spices".

Spices are commonly called **food Adjuncts.** From the point of view of nutrients and source of energy spices do not have an important role because of their very low calorific value, but due to their use, the food becomes very tasty, palatable, aromatic and digestive. They induce secretion of gastric juices due to which human digestive system functions properly.

In India spices are obtained from many plants. Likewise, many spices are cultivated in Rajasthan. Some important spices which are grown in India are cloves (*Syzyium aromaticum*), fennel (*Foeniculum vulgare*), red chillies (*Capsicum annuum*), black pepper (*Piper nigrum*), cumin (*Cuminum cyminum*), lovage (*Trachyspermum ammi*), coriander (*Coriandrum sativum*), turmeric (*Curcuma longa*), ginger (*Zingiber officinale*) etc.

Clove

Botanical name – *Syzygium aromaticum*

Family – **Myrtaceae**

Plant part used – Dried flower buds

Clove is a native plant of a small Island-Moluccas. Its plant is a medium sized (10-12 meters high), evergreen, branched beautiful tree. Its dark red coloured flowers are borne on compound raceme inflorescence. Flower buds are cylindrical, nail shaped with a fleshy stalk. Cloves are obtained from these unopened or partially opened flower buds after drying.

Tanzania is the largest clove producer country in the world. Zinzibar, Medagascar and Indonesia are the other countries which are clove producers. Cloves are also grown at moderate level in India, Sri Lanka and Malasia. In India cloves are mainly produced in Tamil Nadu (Kanya Kumari, Nilgiri Hills) and Kerala (Kottoyam and Quilon).

Fig. 18.7 : Clobe

Pleasant odour in cloves is due to the presence of euginol (13.2%), which is a volatile oil. Clove oil is extracted from the flower buds of clove by steam distillation method.

Uses

1. Cloves possess compounds with aromatic characters which are mostly used as spices and in medicines. Cloves are one of the main ingredient of 'garam masala'.
2. Cloves are stimulants and 'vaathar'. They are used to cure indigestion and stomach ailments.
3. Clove oil is used in the manufacture of toothpaste, soaps, cosmetics, bakery products, pickles and syrups etc.
4. Cloves are commonly used in many medicines such as tooth ache, swollen gums, bronchitis, skin lotion and Ayurvedic preparations.
5. Cloves are used in making of 'Kretek' a fumigatory tobacco used in Indonesia.

Black Pepper

Botanical name – *Piper nigrum*

Family – **Piperaceae**

Plant part used – Immature, dry, drupe fruit

Origin

Center of origin of black pepper is south India and Indo-Malaya region. Among the spices which

are exported from India, black pepper occupies the highest top position, therefore it is called 'King of Indian spices'. India and Indonesia are the top black pepper producing countries in the world. It is also cultivated in Phillipense and Siam. Kerala is the largest black pepper producing state in India. In addition to Kerala, black pepper is also cultivated in Karnataka, Andhra Pradesh, Assam and West Bengal in India.

Black Pepper Plant –

Plant of black pepper is a weak stemmed perennial twinner which grows by coiling around poles and other supports. Leaves are simple, alternate, ovate, large with pungent taste. Inflorescence is spike in which 50-100 very small bisexual or unisexual flowers are present. Fruit is drupe with a single seed, round shaped and it is bright red coloured at maturity and become wrinkled and black after drying. After removal of black fruit wall, a white seed is obtained which is sold in market as white pepper. Taste of black pepper is pungent with a strong smell.

Fig. 18.8 : Black paper plant and fruits

Uses

Dried fruits of black pepper contain starch (28-49%), aromatic oil (1-3%), fibres and alkaloids in very small quantity. Aromatic oil contains pinene a,b and its pungent taste is due to presence of piperene.

Black pepper is widely used as a spice and as medicine.

1. It is widely used in preparation of various food items and vegetables. By addition of black pepper food and vegetables become easily digestible.
2. It helps in the secretion of carminatives, digestive, salivary and gastric juices.
3. For good eye sight, powder of black pepper with 'Desi ghee' should be taken.
4. It makes sauces, chutnies and drinks more tasty.
5. Decoction of black pepper made along with basil, sugar and ginger helps in curing fever, cough, cold and irritation of throat.
6. Black pepper is used in the preservation of meat.
7. It is one of the constituent of many ayurvedic medicines.

Turmeric

Botanical name – *Curcuma longa*

Family – **Zingiberaceae**

Plant part used – Dried, underground modified rhizome

Origin

Native place of origin of turmeric is South Asia. Main producer countries of turmeric are India, China, Sri Lanka, Indonesia and West Indies. India is the biggest turmeric producer and consumer country in the world. Andhra Pradesh is the largest turmeric producer state in India. In addition to Andhra Pradesh, turmeric is also cultivated in Tamil Nadu, Maharashtra, Bihar, Kerala, West Bengal and Orissa.

Turmeric Plant

Turmeric plant is an annual or perennial herb with a thick, underground modified stem- the rhizome. Rhizome grows horizontally in the soil. Leaves are large, broadly lanceolate and with parallel venation. Inflorescence is a large, yellow coloured spike. Fruit is capsule.

Fig. 18.9 : Turmeric plant

Useful Plant Part

Fresh rhizomes are cured and dried to obtain turmeric. The yellow-orange colour of turmeric is due to the presence of curcumin and its musky smell is due to the presence of volatile oils such as zingeberine, sesquiterpene, turmeric oil etc.

Uses

Turmeric is used as spice as well as medicine –

1. Turmeric is essentially used a spice in the preparation of vegetables, pickles, butter and paneer.
2. It is an effective medicine for purification of blood, Turmeric is also used for external and internal injuries as antiseptic agent. It is used as carminative and anthelmintic.
3. It is widely used to cure skin diseases and in making of cosmetics, lotions etc.
4. Turmeric is used to dye cottons fibres, silk fibres and woolen fibres.
5. It is used in many religious and cultural functions as a sacred material.
6. It is useful to cure cold, cough, jaundice and asthama.

Chillies

Botanical name – *Capsicum annuum*

Family – **Solanaceae**

Useful plant part – Mature, red coloured dried berry (as spice) and immature green berries for vegetables.

Origin

The center of origin of chillies is tropical America and West Indies. It was brought to India quite late in 17th century. Except the colder regions, during the present time it is cultivated world wide viz. Africa, India, Japan, Mexico, Turkey and U.S.A. In India, chillies are widely cultivated in Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu, Madhya Pradesh, Punjab, Bihar and Rajasthan.

Chilly Plant

Chilly plant is an annual, branched, 1-3 feet high plant. Leaves are simple, ovate. Solitary, white coloured flowers are borne in the axils of leaves, fruits are many seeded fleshy, long, conical or cylindrical berries. Unripe fruits are green but at maturity they turn shiny red. The fruits contain a volatile, pungent compound-capsin, vitamin, proteins, carbohydrates and many other constituents in varying quantities. The red colour of chillies is due to the presence of capsenuhene, capsorubin, carotene and lutein etc. Many varieties of chillies are available such as sweat pepper, bell pepper, Preprica, Tabasco etc.

K1, K2, CO2, CO4, PKM1, PMK1, Pusa Sadabahar, Pusa Jwala, Pant C1, Habanero, jalapeno, cayenne, Serrano, birds eye, poplano etc. Simla Mirch is another species of *Capsicum* © *fruttescens*), which is used as salad also. Chillies are mainly cultivated during winter season but many varieties of chillies are grown round the year. For their use as spice, the fruit are plucked during December-February. The mature, dried fruits are powdered for their use as spice.

Uses

1. Chilli powder is an important spice. In Asian

and African countries it is widely used in making vegetables, snacks, sauces, chutnies and pickles.

2. Chillies are stimulant and carminative, chillies are given to patients suffering from flatulence.
3. Its tincture is used for gargaling in case of pharyngitis.
4. Chilly paste is externally applied in the treatment of waist pain, nerve pain, rheumatism and hair follicle infection.
5. Green chillies are used as salad and in making chutney.

Fennel

Botanical name – *Foeniculum vulgare*

Family –**Apiaceae (=Umbelliferae)**

Plant part used – Mature cremocarp fruit

Origin

Fennel originated in the mediterranean region. It is cultivated in many countries of the world like India, Morocco, Egypt, China etc. Main fennel producer states of India are Maharashtra, Gujarat, Rajasthan, Uttar Pradesh and Karnataka.

Fennel Plant

The plant of fennel is a strong smelling, branched herb reaching a height upto 1.5 meter. Its leaves are very finely dissected into many constricted segments leaf base is quite broad. Inflorescence is compound umbel which contains many, small greenish yellow flowers.

Fruits are oblong ovate schizocarpic cremocarp, green coloured and surface with longitudinal ridges. Schizocarp splits into two mericarps. Seed surface ridges are five in number. Fruits contain aromatic oil (1-6%), anethol, Fenchone and semi drying fixed oil (12-18%). Fennel is cultivated during winter season.

Uses

1. Fruits are used as spice in pickles, biscuits and in many other items.
2. Aromatic oil is used in manufacture of soaps, medicinal syrups and to provide aroma to drinks.
3. Fennel is carminative and stimulant. It is used to cure abdominal pain and to expel the intestinal worms in the children.
4. Fruits are used as masticatory and in the treatment of flatulence and rheumatism.

Coriander

Botanical name – *Coriandrum sativum*

Family – **Apiaceae (=Umbelliferae)**

Plant part used – Mature, dry cremocarp fruit & leaves

Origin

Native place of coriander is mediterranean region. It is cultivated in Russia, India, Morocco, Poland, Romania and America. Main coriander producer states of India are Madhya Pradesh, Maharashtra, Rajasthan, Tamilnadu, Karnataka and Bihar. It is mostly cultivated in Baran, Kota and Jhalawar of Rajasthan.

Plant

Coriander plant is strong smelling annual herb. It is cultivated for its fruits and leaves. Its plant is 2' - 3' long, weak, branched and with hollow stem. Lower leaves are less segmented where as upper are multi pinnate. Inflorescence is compound umbel, flowers small, white, fruits barrel shaped or illipticle, cremocarp, with two mericarp and ten longitudinal straight strips on surface and ten wavy strips or costal in alternate manner in it. Fruit contain aromatic oil (1%) coriandrol and dark brown fixed oil (11-21%) coriander is cultivated during winter season.

Uses

1. The powder of its dry fruits is used in vegetables, curry, chat as spices.
2. Fruits are used in preservation of beverages (gin) tobacco products and other food items.
3. Fruits are used as stimulant, carminative, acute gastric, heart beat.
4. Fresh green leaves are used for perfumation cooked vegetables and formation of souce.

Cumin

Botanical name – *Cuminum cyminum*

Family – **Apiaceae (=Umbelliferae)**

Plant part used – Mature, dry cremocarp fruit

Origin

Cumin originated in Levant state of Mediterranean region. It is cultivated in Iran, India, Moracco, China, Russia, Indonesia, Japan and Turkey. India is the biggest producer and largest exporter of Cumin in the world. It is grown as a commercial crop in Gujarat and Rajasthan states of India.

Cumin Plant

Cumin plant is an annual, small sized, erect and poorly branched herb. Leaves are finely dissected with very thin segments. Inflorescence is compound umbel. Flower buds are light violet coloured and the flowers are white. Fruit is an elongated, cylindrical cremocarp, which splits into two mericarps. Seed surface possess five well marked primary and four secondary ridges. Fruits contain 4% cuminaldehye, an essential oil and 10% light coloured fixed oil. Cumin is grown as Rabi crop.

Uses

1. Cumin fruits are used in the preparation of vegetables to provide aroma.
2. Powder of roasted cumin fruits is used in various preparations of curd, jaljira and many ayurvedic medicines.
3. Cumin is a stimulant, stomacheic and carminative therefore it is used to cure indigestion and hyperacidity.
4. Essential oil obtained from seeds is used in perfumery and to give pleasant smell to drinks.

Lovage, Bishop's weeds or Carom Seed

Botanical name – *Trachyspermum ammi*

Family – **Apiaceae (=Umbelliferae)**

Plant part used – Mature, dry, cremocaro fruit

Origin

Carom seed plant is considered as native of Europe, Asia and North Africa. In India, it is cultivated in Madhya Pradesh, Andhra Pradesh, Gujarat, Maharashtra, Uttar Pradesh and Rajasthan.

Carom Seed Plant

Carom seed plant is an aromatic, weak, 1-1.5 feet high, branched, annual herb. Leaves are pinnately decompound. Inflorescence is compound umbel. Flowers are small sized, white or very light blue. Fruits are small, curved, rough cremocarps. Fruits contain essential oil. Carom seed plants are cultivated as rabi crop, during winter season.

Uses

1. Fruit are carminative, stimulant and provide immunity. Therefore these are used in the treatment of stomach pain, joint pain, asthma, cough etc.
2. An essential oil – Thymol is obtained from the fruits, which is used in the preparation of lotions, Amritdhara, creams, soaps etc.
3. Fruits are used as condiment in the preparation of biscuits, snacks etc.
4. Sweat meat made with its fruits is given to ladies after child birth.

Medicine Producing Plants

Use of plants as medicines is as old as the human civilization. In very old times evil spirits were considered as the cause of diseases and for their eradication toxic materials were used.

'Rig veda' (1100 B.C) is perhaps the oldest treatise in which medicinal plants have been included. Ayurveda (written before 3000 years) is the authentic Indian treatise which explains human diseases, health and the description of medicines. 'Charak Samhita' and 'Sushruta Samhita' are the original treatises of medicinal plants written by the eminent Ayurveda experts of India. During 15th century important 'Herbals' were written in France and Europe. Hippocrates (460 - 370 BC) is considered as 'Father of Medicine'.

Importance of medicinal plants is due to the presence of different chemical constitutents present in them such as alkaloids, glycosides, tannins,

resins, volatile oils, mucilage, gums etc. It is an important fact that most of the medicinal plants are wild, only a few plants are cultivated for medicinal purposes. Majority of ayurvedic, homeopathic and yunani medicines are obtained from plants.

As per the prescribed syllabus, description of five medicinal plants is given below –

Serpent Wood

Botanical name – ***Rauvolfia serpentina (Rauwolfia serpentina)***

Family – **Apocynaceae**

Plant part used – Dried roots and root bark

Origin

This plant is known as 'Mad's Medicine'. Its place of origin is India. It is found in many countries of the world such as Bangladesh, Sri Lanka, Myanmar, Thailand, Indonesia, Malaysia, Africa etc. In India it is commercially grown in Assam, foot hills of Himalayas, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra and other places. This plant is not found in Rajasthan.

Serpent wood plant–

This plant is a perennial, evergreen, glabrous, small shrub.

Roots –

Its roots are tuberous, wavy (like the shape of a snake), wrinkled, rough and light brown coloured. Fresh roots smell like a snake.

Leaves

Simple, whorled, large and lanceolate

Inflorescence –

Cymose, flowers small, white or slightly pink and fruits are single seeded drupes.

Medicine is obtained from its wavy, tuberous roots and root bark. Three-four year old shrubs are harvested and dried.

Rauwolfia contains 80 different types of alkaloids. Majority of alkaloids are found in its root bark (90%). Roots have few and other organs have very few alkaloids. Important alkaloids found in its bark are Reserpine, Reserpinine, Serpentine, Ajamaline, Ajamalinine, Rauwolfinine etc.

Fig. 18.10 : Serpent wood plant

Uses

1. Reserpine is used in the treatment of mental disorders, insomnia and epilepsy. Serpertine is used in the treatment of high blood pressure.
2. It is used in the treatment of acute mental ailment, hence it is known as 'Mad's medicine.
3. It is used as antidote (antitoxin) in snake, scorpion and insect bites.
4. *Rauwolfia* helps constriction of uterine muscles, therefore it is given for easy child birth to the ladies, at the time of child birth.
5. Its decoction is useful in dysentery, diarrhoea and intestinal pain. It is anthelmintic as well.
6. Many medicines made of *Rauvolfia* are available in the market such as serpina, sarpgandha tablet, ghanvats, gutika and slipills.

Opium, Poppy

Botanical name – ***Papaver somniferum***

Family – **Papaveraceae**

Plant part used – 1. Latex of unripe capsule 2. Seeds

Origin

Opium is native of Asia Minor. Presently it is

being cultivated is many countries specially Australia, Czechoslovakia, Myanmar, Hungary, India, Pakistan, Iran and Turkey. In India it is grown during winter season. Madhya Pradesh, Rajasthan, Uttar Pradesh and Bihar are the important opium growing states. In Rajasthan it is cultivated in South-East districts such as Chittorgarh, Pratapgarh, Banswara, Dungarpur and Jhalawar. Opium is collected in the months of February to April. Opium cultivation is under the control of government.

Opium Plant

Opium plant is an annual, unbranched, erect and attain a height of 1-3 feet. Leaves are large, alternate, lobed and sessile. Inflorescence is solitary terminal. Flowers are large and showy, white a bluish coloured. Petals fall off very soon. Fruit is capsule which is quite large and has septa inside. Seeds numerous, small, slightly kidney shaped, white, oily and are edible.

Fig. 18.11 : Opium Capsule

Collection of Opium –

Latex is collected by making longitudinal incisions on the young capsules. After drying this latex is pure opium. About 35-50 gram opium is obtained from 1000 poppy plants. Collection of opium latex (milk) is done from February to April. Pure opium is semi-solid and brown or black coloured.

Chemical constitution of Opium

Opium has more than 25 types of alkaloids. In addition, gum, resin and maconic acid are also present is opium. Some important alkaloids are: morphine, codeine, thebaine, narcotine, papaverine, opianine etc.

Uses

Opium is sedative, antispasmodic, anodyne, sudorific, narcotic and hypnotic. Its alkaloids affect the cerebro spinal nervous systems of man.

Heroine (Diacetyle morphine) a narcotic substance is prepared from opium. Important uses of opium in the form of medicine are as follows –

1. Morphine is a very strong analgesic therefore it is used to relieve body pain.
2. Codeine is used to cure cough.
3. It is used to cure dysentery and diarrhoea.
4. It induces sleep and it is narcotic

Quinine tree, Cinchona, Fever bark tree

Botanical name – *Cinchona officinalis*

Family – **Rubiaceae**

Plant part used – Stem bark

Origin

The center of origin of *Cinchona* is Andes region of South America. India, Indonesia and Java are the main *Cinchona* producing countires. Java is the main exporter country. *Cinchona* trees are grown in Khasi hills, South India (Nilgiri hills) and Madhya Pradesh (Satpura mountain range) in India. Many species of *Cinchona* are found in India such as *Cinchona officinalis* (Loja bark quinine tree) *C. calisaya, C. ledgeriana* and *C. sucirubra.*

Cinchona Plant

Cinchona plant is an evergreen, medium sized tree or a shrub. Leaves are large and simple. Inflorescence is terminal compound cyme. Flowers are small and fruit is a capsule.

The stem bark of quinine tree contains the maximum quantity of quinine. Quinine is obtained by peeling off the stem bark and its subsequent drying.

Fig. 18.12 : Cinchona bark

30 types of alkaloids have been identified in the bark of different species of Cinchona. Main alkaloids are quinine, quinidine, cinchonine and cinchonidine. Some minor alkaloids are – cinchotine, hydroquinone, quinamine etc.

Medicinal Uses

1. Quinine is very effective medicine to treat malarial fever. This kills the schizont stage of *Plasmodium vivex* parasite.
2. Quinine is useful to treat pneumonia and amoebic dysentery.
3. Quinine is used as tonic and antiseptic.
4. It is used in the treatment of rheumatism and tonsilitis.
5. Use of heavy dose of quinine causes hearing loss, tiredness, vomiting, blindness and abortion in pregnant ladies.

Some medicinal plants found in Rajasthan and their uses

S. No.	Name common	Botanical name	Plant family	Useful plant part	Medicine uses
1	Ashvagandha	*Withania somnifera*	Solanacene	Roots	General tonic, nerve tonic
2	Satavar	*Asparagus racemosus*	Liliaceae	Roots	Tonic
3	Safed Moosali	*Cholophytum borivilianum*	Liliaceae	Roots	Tonic
4	Arjun	*Terminalia arjuna*	Combretaceae	Stem bark leaves	Heart diseases
5	Neem	*Azadirachta indica*	Meliaceae	Bark leaves fruits	Antiseptic
6	A. Brahmi (Jalneem)	*Bacopa monnieri*	Scrophulariaceae	Whole plant	Nerve tonic
	B. Brahmi (Mandook parni)	*Centella asiatica*	Apiaceae	Whole plant	Nerve tonic
7	Gwar patha (Ghirt Kumari)	*Aloe vera*	Liliaceae	Leaves Tonic skin health	
8	Tulsi	*Ocimum tenuiflorum(=Ocimum sanctum)*	Lamiaceae	Leaves Cough, fever	
9	Sona mukhi	*Cassia angustifolia*	Caesalpiniaceae	Leaves Laxative	
10	Guggal	*Commiphora wightii*	Burseraceae	Oleo-gum resin Rhumatism	

Asafoetida, Devil's Dung

Botanical name – *Ferula asafoetida*

Family – *Apiaceae* (=umbelliferae)

Plant part used – Oleo-gum-resin secreted by the tuberous roots

Asafoetida Plant

Asafoetida plant is a perennial, small sized shrub, its roots and root tubers are conical shaped like that of a carrot. Stem is erect leaves are large and divided, inflorescence is umbel, flowers are unisexual or bisexual and fruits are small.

Asafoetida is cultivated in Afghanistan, Baluchistan, Iran, Pakistan and India (Jammu-Kashmir). One year old shrubs are cut near the ground level to obtain asafetida. Oleo-gum-resen oozed out by the underground tuberous roots from the cut portions becomes solidified and it is known as asafoetida.

Chemical Constitution of Asafoetida

Commercial asafoetida is yellow-brown, semi dry or dry, acellular oleo-gum-resin. Its taste is bitter and a very strong alliaceous smell. Aafoetida does not contain any alkaloids. In addition to resin, asafetida contains pienene, umbelliferene and ferrulic acid. The smell of asafoetida is due to pienene and the taste is due to ferrulic acid.

Medicinal Uses

1. Asafoetida is anthelmintic, antispasmodic, aphrodisiac, carminative, diaphoretic, digestive, diuretic, expectorant, laxative and stimulant.
2. Asafoetida is used in the treatment of chronic bronchitis, colic pain, toothache indigestion, low apetite, flatulence, epilepsy etc.
3. Many ayurvedic medicines are made from asafetida such as 'Hingvastak powder', 'Yograj Guggul', 'Hingrivati' etc.
4. Asafoetida is used as an important spice.

Turmeric

Description of turmeric is provided in the beginning of this chapter under the head 'Spices'.

Important Points

1. From various parts of many plants, two types of oils are obtained, these are – aromatic or essential oils and fatty or fixed oils.
2. Fatty oils are esters of fatty acids and triglyceraldehyde alcohol.
3. Fatty oils are of four types – drying, semi-drying, non-drying oils and fat or tallow.
4. Some oil yielding plants are – mustard, ground nut, coconut and castor.
5. Fibres are obtained from various parts of many plants.
6. Fibres are classified into many classes on the basis of origin, structure and their uses.
7. Some fibre yielding plants are munja, cotton, sunn etc.
8. Some plants like cloves, black pepper, turmeric, red chillies, fennel, coriander, cumin, carom seed are important spice producing plants.
9. Many plants are sources of medicines such as serpent wood, opium. *Cinchona,* asafoetida, turmeric, ashwagandha, safed moosali, arjun, neem, tulsi, *Aloe,* guggul etc.

Practice Questions

Multiple Choice Questions –

1. In which plant, fatty oil is not found –
   (a) Mustard (b) Coconut
   (c) Rose (d) Sunflower
2. Which plant provides both the fibres and fatty oil?
   (a) Coconut (b) Cotton
   (c) Linseed (d) All of these above
3. Which plant yield a very strong pungent smelling oil having allyul isothiocynate?
   (a) Soyabean (b) Mustard
   (c) Castor (d) Ground nut
4. Oil from endosperm is obtained from which plant?
   (a) Sunflower (b) coconut
   (c) Soyabean (d) Ground nut

5. Munj fibre is obtained from which part of the plant?
   (a) Leaves (b) Stem
   (c) Roots (d) Seeds
6. Fibre obtained from *Crotalaria juncea* is known as –
   (a) Cotton (b) Coir
   (c) Sunn (d) Jute
7. Which part of plant is clove?
   (a) Flower buds (b) Seed
   (c) Fruit (d) All of the above
8. The pungent taste of red pepper is due to the presence of which of the following compounds?
   (a) Curcumine (b) Capseine
   (c) Thymol (d) Anethol
9. Who is the father of medicines?
   (a) Charak (b) Hippocrates
   (c) Theophrastus (d) Dhanvantari
10. Morphine is obtained from which plant?
   (a) Opium (b) Cinchona
   (c) Asafoetida (d) Serpent wood

Very Short Answer Questions –

1. Due to the presence of which compound the mustard oil smells pungent?
2. Write the botanical name and family name of castor?
3. Why fennel seeds taste sweet when chewed?
4. Which compound gives yellow colour to turmeric powder?
5. In which disease quinine is useful?
6. What is the difference between oil and fat?

Short Answer Questions –

1. Differentiate between non-drying and drying oil giving examples.
2. Write the botanical name and the plant part used of one plant each providing fixed oil, fibre, condiment and medicine.
3. Give an account of alkaloids of opium.
4. Give two examples of spices obtained from seed?
5. Write classification of fibres on the basis of origin.
6. Write a note on quinine.

Essay Type Questions –

1. Give classification of plant fibres on the basis of utility and describe the textile fibres in detail.
2. Describe serpent wood and asafoetida in detail.
3. Write a short essay on spices.
4. Describe the important medicinal plants of Rajasthan.

Answer Key-

1. (c) 2. (d) 3.(b) 4. (b) 5. (a)
6. (c) 7. (a) 8. (b) 9. (b) 10. (a)