Semester	Course	Hours	Credit	Subject CODE	Marks
III	CC9	6	5	18KP3BO9	25+75=100

PLANT SYSTEMATICS AND ECONOMIC BOTANY

UNIT II : Taxonomical studies of selected families and their economic importance and medicinal uses. Polypetalae : Menispermaceae, Carryophyllaceae, Portulacaceae, Rhamnaceae, Sapindaceae, Anacardiaceae, Combretaceae, Myrtaceae, Umbelliferae.

UNIT IV : Taxonomical studies of selectd families and their economic importance and medicinal uses. **Monochylamydeae:** Chenopodiaceae, Aristolociaceae, Loranthecеae, Orchidaceae. **Monocotyledons:** Amarylidaceae, Commelineceae, Arecaceae and Cyperaceae

UNIT V: Economic Botany:

Cereals(Wheat,Maize), Pulses(Red Gram,Black gram),Vegetable oil(groundnut and oil palm), fibers(gossypium and corchorus),Nuts(cashew,walnut),Spices(pepper,clove), Wood(teak,pine)

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1.Lawrence, G.H.M., 1955, The taxonomy of Vascular Plants, Central Book Ddepot, Mac Millan, New York.
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UNIT II

Menispermaceae:

Distribution of Menispermaceae: It is commonly known as Moonseed family, includes 70 genera and 400 species, distributed largely throughout paleotropic regions and a few genera extend into the eastern Mediterranean region and eastern Asia

Characters of Menispermaceae:
Mostly woody vines – lianas, dioecious; flowers trimerous, unisexual; double whorls of sepals and petals; curved seed.

Habit: Mostly twining, woody vines (lianas), rarely erect shrubs or small trees. Root – Tap and branched.
Stem: Mostly woody and twining rarely erect.

Leaf: Simple (rarely trifoliate in a few tropical spp.) petiolate, exstipulate, mostly entire or occasionally palmately-lobed, mostly palmately-veined.

Inflorescence: Racemose, dioecious (monoecious in Albertisia).

Flower: Small, unisexual, greenish, generally actinomorphic, hypogynous, cyclic, trimerous or dimerous.

Calyx: Sepals 6, in two whorls of 3 each.

Corolla: Petals 6, in two whorls of 3 each, usually smaller than sepals.

Androecium:

Staminate flowers with usually 6 stamens (sometimes 3 or ∝) opposite to petals, when of same number, free; variously connate or monadelphous forming a central column (Cissampelos), anthers 4-celled, dehiscing longitudinally.

Gynoecium: Carpels 3 or more, in pistillate flowers, apocarpous; ovary superior, 1-loculed, ovules 2 aborting to 1, parietal placentation; style very short or absent; stigma terminal, capitate or discoid, entire or lobed.

Fruit: Drupe or achene.
Seed: Endospermic or non-endospermic, usually curved, endosperm fleshy in Menispermum, Cocculus, Calycocarpum.

Pollination: Entomophilous.

Floral formulae:

Male (Staminate) flower – $\oplus\ \delta\ K_{3+3}\ C_{3+3}\ A_{3+3}\ G_0$

Female (Pistillate) flower – $\oplus\ \varphi\ K_{3+3}\ C_{3+3}\ A_0\ G_{\underline{3-6}}$

Economic Importance of Menispermaceae:

Ornamentals: A few species of Menispermum, Cocculus and Cissampelos are grown as ornamentals.

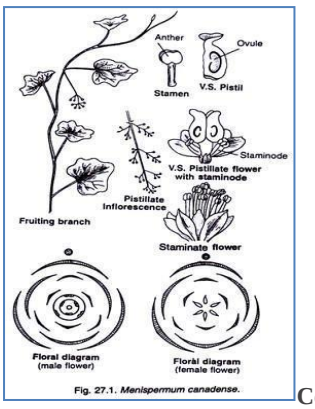


Fig. 27.1. *Menispermum canadense.*

Common plants of the family:

1. Menispermum. Menispermum canadense, a twinning vine.
2. Cocculus. Cocculus carolinus, a garden ornamental.
3. Cissampeols. Cissampeols pareira, a garden ornamental.
4. Calycocarpum. Calycocarpum lyoni. Common in Florida.

Caryophyllaceae: There are about 80 genera and 2100 species in this family**.**

The members of this family are commonly found in the temperate regions of the Northern hemisphere. Certain genera are found in the Southern hemisphere and few are found in the mountains of tropical regions. In our country the plants of this family are either found in the hilly tracts or they grow in the plains during winter season, e.g., Stellaria, Spergula, Dianthus, etc.The family is well represented in the British Flora and many species are cultivated as ornamental garden flowers.There are about 500 species in the genus Silene of this family, which is supposed to be the largest genus; Dianthus contains 350 species and Stellaria about 100 species.

Habit: An annual herb, ornamental, cultivated.

Root: Tap, branched.

Stem: Erect, aerial, herbaceous, branched, green smooth, solid.

Leaf: Cauline and ramal, simple, opposite decussate, sessile, exstipulate, sessile, lanceolate, entire, acute, glabrous, unicostate reticulate venation, leaf-base sheathing.

Inflorescence: Cymose, axillary or terminal dichasial cyme.

Flower: Pedicellate, ebracteate, hermaphrodite, actinomorphic, complete, hypogynuous. pentamerous, cyclic.

Epicalyx: 4, in two whorls of 2 each, outer whorl anterio-posterior.

Calyx: Five sepals, polysepalous, inferior, quincuncial aestivation

Corolla: Five petals, polypetalous, petals fimbriate, inferior, imbricate aestivation, variously coloured, caryophyllaceous, each petal possesses a claw and limb.

Androecium: Ten stamens arranged in two whorls of five each, obdiplostemonous, polyandrous, anthers bicelled, dorsifixed, introrse.

Gynoecium: Two-five carpels, syncarpous, ovary superior, unilocular, free-central placentation, ovules many, styles two, stigmas two, coiled and feathery.

Fruit: A capsule.

Floral formula: ⊕ ♂ Epi K 2+2, K (5), C 5, A 5+5, G (2 – 5)

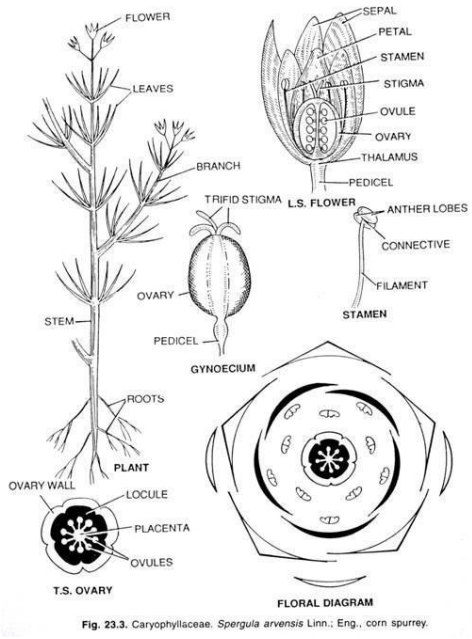


Fig. 23.3. Caryophyllaceae. *Spergula arvensis* Linn.; Eng., corn spurrey.

Economic value:

Cultivated in Europe as a fodder plant. Used as a diuretic.

Distribution of Portulaceaceae: It is represented by about 20 genera and 500 species. From India only 7 species have been reported.

Common plants of the family:

1. Portulaca grandiflora – Rosemoss – a garden annual with showy red coloured pollen flowers.

2. Portulaca oleracea – with golden yellow flowers – weed of waste places.

Habit:

A stout succulent glabrous annual weed, flowering through greater part of the year and often used as a pot-herb. Flowers open during noon.

RootTap-root, branched.

Stem: Herbaceous, prostrate or ascending, branched, succulent.

Leaf: Alternate or sub-opposite, clustered at the ends of the branches, 1 to 4 cm. long, very short-stalked, thick, cuneate, oblong or spathulate, truncate, or retuse at the apex; stipular appendages minute or 0.

Inflorescence: Terminal cluster of sessile flowers.

Flower: Ebracteate cyclic, actinomorphic, bisexual, hypogynous or half-inferior, bright- yellow.

Calyx: 2 sepals, free, green, anterio-posterior, acute, persistent.

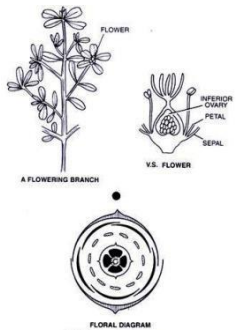
Corolla: 5 petals, free, bright-yellow, perigynous.

Androecium: Stamens 8-12, free.

Gynoecium: Carpels 3-5, syncarpous; ovary half-inferior, 1-celled, ovules many on a basal placenta; style 3—5—fid; stigma minute.

Fruit: A capsule, dehiscing transversely.

Seeds: Many, minute, reniform, dark-brown, endospermic.



Economic Importance of Portulaceaceae:

1. Food: **Portulaca oleracea is used as pot herb and in salad.**

2. **Medicine:** Portulaca oleracea is also used in the ailments of kidney and urinary bladder. Portulaca quadrifida is effective in cough and asthma.

3. **Ornamental:** Many garden varieties of Calandrinia, Lewisia, Portulaca and Talinum are cultivated.

Rhamnaceae:

Plant trees, shrubs or climbers, climbing by hooks or tendrils; leaves single, stipulate, stipules often spiny, cymose in florescences; flowers hermaphrodite, perigynous; sepals 4-5 free; petals 4-5, free; stamens opposite the concave petals; a well developed intrastaminal disc present; carpels 2-4, 2-4 locular with one basal ovule in each locule, fruit drupe or capsule seeds hard.

Habit: Shrubs or trees, often spiny and sometimes hook or tendril climbing (Gouania, Helinus) or twiner (Ventilago), rarely herbs.

Root:Tap root deep, branched.

Stem: Usually erect, often spinose, sometimes weak, climbing by hook tendrils or twiners.

Leaves: Simple, alternate or opposite, entire or toothed, with 3-5 prominent basal nerves; stipules small, soon falling off, spinous and persistent.

B. Floral characters: Inflorescence: Mostly axillary corymbs, cymes or panicles, rarely solitary; umbellate in Helinus, flowers small and inconspicuous.

Flower: Small, yellowish-green, regular, usually bisexual (rarely unisexual by abortion of one of the essential whorls as in Rhamnus) or polygamous (Gouania); perigynous or epigynous with generally a well-developed intra-staminal disc.

Calyx: Sepals 5 or 4, connate, lobes valvate, usually ridged internally, basally may be united with receptacle to form a hypanthium.

Corolla:Petals 4-5, valvate inserted in the calyx tube, free, usually clawed and hooded.

Androecium: Stamens 4-5, tree, opposite the concave petals, often enclosed within their folds and inserted with them on the axis at or below the margin or rim of the fleshy disc, which may be entire or lobed and either fills the calyx tube or is thin and simply lines it (Rhamnus)-, anthers two-celled, versatile, dehiscing longitudinally.

Gynoecium: Carpels 2-4; ovary sessile, superior or inferior (Helinus), viz., the degree of hypogyny, perigyny or epigyny varies greatly in different species according as the ovary is free from or united with the receptacular cup; 2- 4-celled, rarely 1-celled, one erect basal anatropous ovule in each cell; style short, simple; stigma 2-4-lobed.

Fruit: Drupe or a capsule.

Seed:Endospermic, occasionally aril is present.

Pollination:Entomophilous.

Floral formula

: $\mathrm{Br} \oplus \mathrm{\varnothing}\, K_{4-5}\, C_{4-5}\, A_{4-5}\, G_{(2-4)}$

Sapindaceae:

Distribution of Sapindaceae:

Sapinadaceae or Litchi family or soap-berry is an important family with 158 genera and 2230 species. In India the family is represented by 24 genera and 72 species. Commonly found in North Eastern and North Western Himalayas. The family is mainly restricted to tropical and sub-tropical regions.

Characters of Sapindaceae:

Trees, shrubs or climbers usually pinnate leaves, the spring like circinately, coiled tendrils of lianous genera. Flowers polygamous or polygamodioecious; the scale or gland-appendaged petals; unilateral extrastaminal disc, tricarpellate ovary, trilocular, superior and usually arillate seed.

Habit: Trees, shrubs or climbers with watch-spring like tendrils.

Root: Tap, deep in tree species, branched.

Stem: Erect, or weak, climbing by tendrils which are axillary and represent the modified inflorescence axis. They are forked at the apex and the branches are often flat and rolled like a watch-spring.

Leaf: Alternate compound, pinnate, stipulate (climbing species), stipules small and soon falling off, sometimes imparipinnate, the end leaflet of a paripinnate leaf is bent round to serve as a terminal leaflet. Latex or resin present in special sacs or cells in the lamina.

Inflorescence: Cymose, unilateral, cymes arranged in racemes or panicles.

Flower: Obliquely pentamerous, zygomorphic, or actinormophic, bisexual or unisexual, hypogynous, polygamous or polygamodioecious, extra staminal disc is unilateral or glandular. Both bisexual and unisexual flowers are found in the same individual (polygamous) or bisexual and staminate or bisexual and pistillate flowers (polygamo-dioecious) occur in separate individual plants.

Calyx: Sepal 5, polysepalous, imbricate, in actinomorphic flowers sepals become 4 by the union of 3rd and 5th.

Corolla: Petals 5 in actinomorphic flower becomes to 4 as a result of suppression of one of the five petals, polypelatous, with hairy or scaly appendages, Petals are absent in Schleichera, Dodonaea etc. Between petals and

stamens the floral axis is developed to form a disc, which is generally ring-like and bears glandular swellings opposite the petal insertions.

Androecium: Stamens 8 or 10, in two whorls, polyandrous, inserted inside the dise; dithecous, basifixed, introrse.

Gynoecium: Tricarpellary, syncarpotfs; ovary superior, trilocular, with one or two ovules in each loculus, axile placentation; style terminal; stigma trifid.

Fruit: Capsule, nut, berry, drupe.

Seed: Arillate, non-endospermic.

Pollination: Entomophilous.

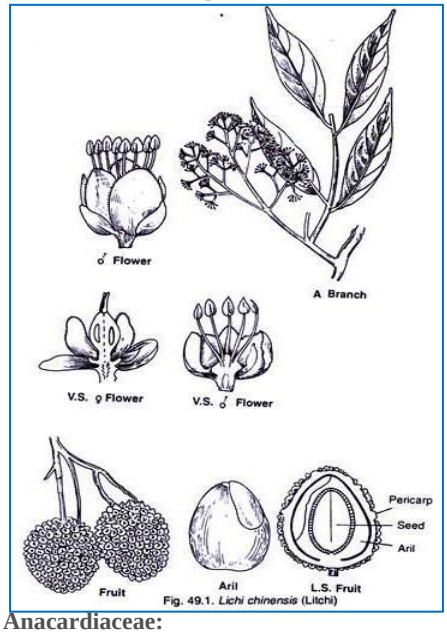


Fig. 49.1. *Lichi chinensis* (Litchi)

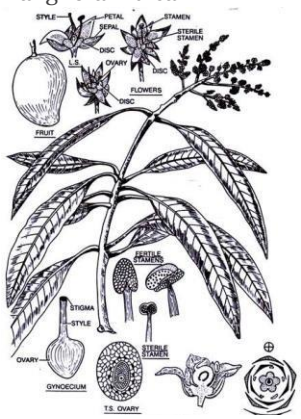
⊕ or ○|○ ☿, ♂ or ♀ K_{5-4} C_{5-4} A_{8-10} $\underline{G_{(3)}}$.

Anacardiaceae:

Distribution of Anacardiaceae:

The family is also called Mango or Cashew family. It includes 80 genera and over 600 species according to Jones and Liechsinger (1987). Chiefly tropical but occurs in S. Europe, temperate Asia and also America. Mangifera extends from India to Malaya and the Philippines.

Mangifera indica



Habit: A medium sized tree.

Root: Tap root, deep, branched.

Stem: Erect, branched, hard, woody with resinous bark.

Leaf: Simple, alternate, exstipulate, smooth, entire, long ovate lanceolate, acute, thick, coriaceous.

Inflorescence: Racemose (Panicle).

Flower: Bracteate, hermaphrodite, complete, actinomorphic. cyclic, hypogynous small pentamerous, yellowish green.

Calyx: Sepals five, polysepalous, pale-green, imbricate.

Corolla: Petals five, polypetalous, white or creamish with yellowish hue at base, imbricate. A fleshy, five-lobed disc is present between stamens and petals.

Androecium: Stamens five, usually only one fertile, rest-reduced and sterile, filament long, anthers dorsifixed becoming versatile.

Gynoecium: Monocarpellary, unilocular, superior, ovule one, marginal placentation, style long terminal or slightly laternal with one flat fringed stigma, a prominent 5-6 lobed hypogynous disc present, lobe : either opposite or sometimes alternate to petals. Carpels slightly (oblique) tilted to one side.

Fruit: A fleshy large drupe with luscious mesocarp, long fibres.

Floral formula:

$$Br \oplus K_5\, C_5\, A_{1+4\ staminodes}\, G_{\underline{1}}$$

Economic Importance of Anacardiaceae:

1. Food: Many plants yield edible fruits such as Mangifera indica (mango), Anacardium occidentale (Cashew-nut), Buchanania lanzan (Chironji), Harpephyllum caffrum (Kaffir plum), Spondias pinnata (Hog plum), Pistacia vera (pistachio-nuts).

Pistacia lentiscus (mastic tree) yields a mastic resin used in chewing gums, alcoholic beverages etc.

2. Varnish: Many species of Rhus and Semecarpus yield resins and varnishes.

3. Gum: Lannea coromandelica bark provide gum. Schinopsis lorentzii and bark of Lannea coromandelica are used in tanning industry.

4. Ink: Insect galls on the branches and leaves of various species of Rhus, Pistacia are used in manufacture of ink. Semecarpus anacardium (Dhobis-nut) fruits provide black ink used for dyeing textiles and marking cotton clothes.

5. Skin irritants: Rhus toxicodendron, R. quercifolia etc. are skin irritants.

6. Ornamentals: Continus coggyria, Rhus typhina and Spondias pinnata are ornamental plants.

Combretaceae:

Distribution of Combretaceae:
Combretaceae or Combretum family or Terminalia family includes 18 genera and 500 species. The largest genera are Combretum of 370 species and Terminalia of 200 species.

Quisqualis indica

Habit: A creeping sub-scadent shrub, commonly planted in the gardens.

Root: Tap-root.

Stem: Weak, sub-scadent.

Leaf: Opposite, superposed, simple, ovate, entire, exstipulate, unicostate reticulate.

Inflorescence: Dense racemose clusters of sweet-scented flowers, which appearing first at night are white but turn pink at day-break.

Flower: Bracteate, bisexual, regular, epigynous, pentamerous.

Calyx: Sepals 5, calyx-tube adnate to the ovary and produced beyond it, lobes reflexed. superior.

Corolla: Petals 5, white at first, turning pink, alternating with the sepals, superior, imbricate in bud. **Androecium:** Stamens ten, free in two whorls, the upper opposite the petals and the lower opposite the sepals, filaments long, anthers dorsifixed, superior.

Gynoecium: Monocarpellary, ovary 1-celled, inferior, 5-angled, angles alternating with calyx segments; ovules pendulous from the top of the ovary on long united funicles; style one, long filiform; stigma minute, capitate. **Fruit:** Five-angled, one-seeded achene.

Seed: Small, non-endospermic.

Floral formula:

$\oplus \, ♀ \, K_{(5)} \, C_5 \, A_{5+5} \, \underline{G}_{\bar{1}}.$

Economic Importance of Combretaceae:

1. Food: The fruits of Terminalia catappa – Indian almond H. Jungali badam are edible.

2. Medicinal: Terminalia is the most important medicinal plant. The bark of Terminalia arjuna is used as cardiac tonic; and in feminine diseases T. tomentosa, T. paniculata, T. angustifolia, T. coricea, and T. glabra are some others useful species. Most of them are astringent and administered as purgative, as also in dropsy, diarrhoea, piles, leprosy and cough. The fruits of T. bellirica H. Bahera and T. Chebula (H. Harach) are of medicinal value.

3. Gum: The fruits of T. bellirica constitute one of the myrobalans (an adhesive) of commerce.

The gum exuding from the trunk of Anogeissus latifolia is used in cali coprinting, paper-sizing and confectionery.

4. Timber: The wood obtained from T. bialata and T. belerica is used for cabinet work furniture and interior fittings.

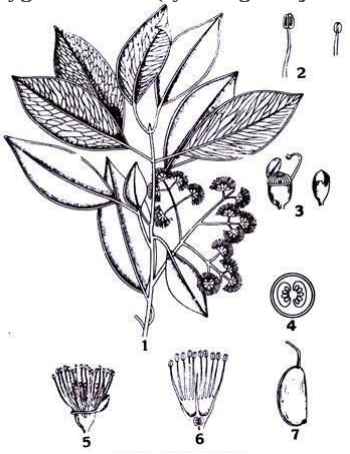
5. Tannin: The young fruits of T. alata, T. arjuna, T. chebule, etc. are used for tanning and dyeing.

6. Ornamental: Quisqualis indica (Rangoon creeper), Terminalia arjuna (Arjun), Bucida, Combretum are of ornamental value.

Myrtaceae:

The family contains 100 genera and 300 species out of which India contributes 116 species. The chief centres of distribution are Australia and America.

3. Syzygium cumini (syn. Eugenia jambolana)



Habit: An evergreen tree.

Root: Tap, branched.

Stem: Erect, woody, cylindrical, solid, branched, smooth.

Leaf: Opposite, petiolate, simple, exstipulate, ovate-elliptical, entire, unicostate reticulate.

Inflorescence:

Flower crowded in clusters on branches of lateral panicles; cymose.

Flower: Pedicellate or sub-sessile, hermaphrodite, actinomorphic, pale green, epigynous.

Calyx: Sepals 5, gamosepalous, calyx tube adnate to ovary, funnel shaped, superior, valvate aestivation.

Corolla: Petals 4, polypetalous, falls off as the flower opens, imbricate aestivation.

Androecium: Stamens indefinite, in several series, inserted around the mouth of calyx tube, anthers dithecous, dorsifixed introrse.

Gynoecium: Bicarpellary, syncarpous, ovary inferior, bilocular, axile placentation, ovules many, style simple, linear, stigma terminal.

Floral formula:

⊕ ☿ K (5) C4 A α G (2).

Economic Importance of Myrtaceae:

1. Fruits: Some members of the family produce edible fruits e.g. Syzygium cumini (syn. Eugenia jambolana) (H. Jamun), Psidium guajava (Amrood) with edible fruits.

2. Oil: The essential oils are obtained by the steam distillation of leaves and branches of Eucalyptus species.

3. Spice: Syzygium caryophyllata (syn. Eugenia caryophyllata) yields the cloves of commerce. Clove oil (H. Laung ka tel) is extracted out of them.

4. Medicine: Eucalyptus oil is used in influenza. It is mixed with clove oil and used in rheumatism. The roots of Eucalyptus are purgative. Clove oil is antipyretic and largely used in gum troubles. The leaves of S. cumini are used in indigenous medicine for dysentery.

The fruits of Myrtus communis are carminative and given in dysentery, diarrhoea, and rheumatism.

5. Wood: The wood of Eucalyptus and Psidium is used in engraving and making handles. In Australia the wood of Eucalyptus is used for railway sleepers, bridges and plywood industries.

6. Ornamental: Many plants viz., Callistemon, Myrtus, Melaleuca leucadendron, Tristania, Eucalyptus are cultivated for their showy nature in the gardens.

Umbelliferae

Habit: Annual aromatic cultivated herb.

Root: Tap and branched.

Stem: Erect, branched, glabrous, fistular, ribbed, nodes slightly swollen.

Leaf: ompound 2, 3-4 pinnate, ultimate segments linear, cauline, alternate, petiolate, petiole sheathing at the base, exstipulate.

Inflorescence: Racemose, compound umbel, primary umbels with an involucre of bracts at the base and the secondary umbel with an involucel of bracteoles.

Flower: Pedicellate ebracteate, hermaphrodite, actinomorphic, complete, yellow, epigynous.

Calyx: 5 sepals, gamosepalous, calyx tube adnate to the ovary wall, calyx wall, calyx teeth 0.

Corolla: 5 petals, polypetalous, emarginate, yellow, valvate aestivation, superior, yellow.

Androecium: 5 stamens, polyandrous, alternating with petals filaments long, anthers introrse, bicelled, basifixed.

Gynoecium: 2 carpels, bicarpellary, syncarpous, ovary inferior, bilocular, one ovule in each loculus, axile placentation, style extremely short, stylopodium present, stigma bilobed, vittae present in ovary wall.

Fruit: Cremocarp.

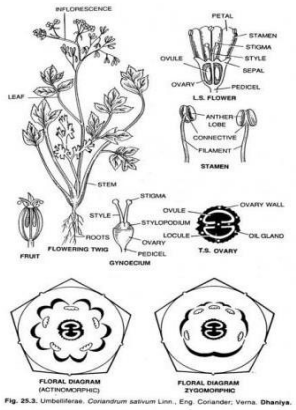


Fig. 25.3. Umbelliferae. *Coriandrum sativum* Linn., Eng. Coriander; Verna. **Dhaniya.**

Economic Importance of Family –Apiaceae (Umbelliferae):

The family is very important from the economic point of view.

The fruits of some plants are used as condiments whereas the other plants are of medicinal value:

1. Apium graveolens var.dulce (Eng.-Garden celery; Verna.-Ajmud, Karas)-Native of Europe, now cultivated in the North-Western Himalayas and in the hills of Uttaranchal, H.P. and South India. Used as a vegetable. The roots and seeds are used medicinally.

2. Apium graveolens var. rapaceum; Syn. A. rapaceum (Eng.-Celeriac; Verna.-Ajmud, Salari)-The roots are eaten as vegetable. The fruits are used for extracting an oil, which is much valued, and the seeds as spice. Cultivated in the hills of Uttaranchal, H.P. and South India.

3. Coriandrum sativum (Eng.-Coriander; Verna.-Dhania)-An aromatic herb, native of the Mediterranean region, now cultivated chiefly in Madhya Pradesh, Maharashtra, Karnataka, Bihar and Uttar Pradesh for its fruits and leaves, which are used as condiment and spice. The fruits are also used as stimulant, carminative, stomachic and tonic.

4. Cuminum cyminum; (Verna.-Jira)-A herb, native of the Mediterranean region but commonly grown in the Punjab and Uttar Pradesh, for the aromatic fruits, which are used for flavouring purposes.

5. Carum carvi; (Eng.-Caraway; Verna.-Shiajira)-A herb, native of Europe and West Asia, now cultivated in Bihar, Orissa, the Punjab, Bengal and Andhra Pradesh. The fruits are used as condiment, and are also used medicinally as stomachic and carminative.

6. Bunium persicum; Syn. Carum bulbocastanum; (Verna.-Kala zira)-A perennial herb, found in Kashmir. The starchy tubers are eaten as vegetable and the seeds are used as spice.

7. Trachyspermum ammi; Syn. Carum copticum; (Verna.-Ajwain)-A herb, cultivated throughout India. The fruits are used as spice, and also used medicinally as carminative, stimulant, tonic and in indigestion.

8. Trachyspermum roxburghianum; Syn. Carum roxburghianum-, (Eng.-Ajmud; Verna.- Ajmuda, Radhuni); used as spice and condiment

UNIT IV

CHENOPODIACEAE

Systematic position

- Class :Dicotyledons
- Order :Caryophyllales
- Family :Chenopodiaceae
- Genus :*Chenopodium*
- Species:*album*

Distribution of Chenopodiaceae

- It is commonly called Beet or Goosefoot family. It has 102 genera and 1400 species (Willis 1966) out of which 45 species are found in India. They are nearly all halophytic and play important role in coastal flora of Australia, Karro, Mediterranean, S.W. Caspian cost, Red sea shores and Indian sea. In India the members of this family are common in dry, xerophytic, alkaline soils and the estuaries of sea.

Characters of Chenopodiaceae

- Plants herb, halophytic or xerophytic; leaves alternate, often fleshy, granular or mealy due to small hairs; inflorescence cymose, flowers monochlamydeous, hermaphrodite or unisexual, pentamerous, tepals five, sepaloid; stamens five, antiphyllous, bent inwards in bud, carpels two, syncarpous, unilocular, basal placentation, fruit nut; seeds endospermic.

Vegetative characters

Habit : Mostly succulent annual or perennial herbs rarely shrubs or trees (*Haloxylon ammodendron*).

Root : Tap, much branched, thick and swollen in *Beta vulgaris* (*H. Chukandar*).

Stem : Aerial, erect, cylindrical, hairy, glacous in floral region; succulent and jointed in *Salicornia*.

Leaves : Cauline and ramal; radical in young plants of *Beta*; exstipulate, simple, succulent and fleshy, petiolate or sessile, alternate rarely opposite (*Polycnemum*), hairy or gloomy. Leaves are of various types due to their xerophytic and halophytic nature.

Floral characters

Inflorescence : Primarily racemose, but partial inflorescences are always cymose (Beta), spike or panicles (*Chenopodium*), solitary (*Polycnemum*).

Flower : Bracteate (*Nitrophila, Polycnemum*), or ebracteate (*Chenopodium*), sessile (*Chenopodium, Beta*) pedicellate; monochlamydeous, small, actinomorphic, hermaphrodite (*Chenopodium, Kochia, Beta*) or unisexual (*Atripl Sarcobatus*), hypogynous (except *Beta*).

Perianth : Tepals five or less, sepaloid, uniseriate, imbricate, persistent, gamophyllous or free, rarely absent (*Atriplex nitens*), inferior.

Androecium : Stamens five or fewer than perianth segments, opposite to tepals, bithecous, basifixed or dorsifixed, introrse, longitudinal dehiscence, hypogynous or situated on a disk.

Gynoecium : Bi or-tricarpellary, syncarpous, ovary superior (except *Beta*), unilocular, single ovuled, basal placentation; style short; stigma capitate, bi- (*Chenopodium*) or tri- (*Beta*) lobed.

Fruit : Indehiscent nut or achene, enclosed in a persistent perianth.

Seed : Endospermic, embryo spirally twisted or horse-shoe like.

Pollination : Entomophilous or anemophilous.

Floral diagram Floral formula

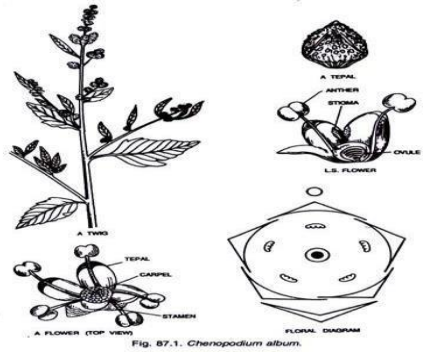


Fig. 87.1. *Chenopodium album.*

$\oplus \, ☿ \text{ or } ♂ \text{ or } ♀ \; P_{(2-5)} \, A_5 \, \underline{G_{(2-3)}}$

Economic Importance of Chenopodiaceae

1. Food : It surpasses all other for "greens" or pot-herbs due to succulent nature of young stems and leaves. The pot-herbs are *Spinacea oleracea* (Spinach. *H. Palak*); *Chenopodium album* (White Goosefoot *H. Bathua*), *Basella rubra, Beta vulgaris*, and even *Salsola* and *Atriplex* sp. *Beta vulgaris* (*H. Chakandar*) is a source of sugar and only second to sugarcane.

2. Forage : The family have considerable forage value because none of the members is poisonous. The members are palatable and nutritious. *Salsola, Atriplex* spp. and beet are good forage plants.

3. Medicine : The oil obtained from seeds of *Chenopodium anthelminticum* is vermifuge. The seeds of Spinach oleracea are laxative, and are used in difficult breathing and in jaundice. The *Kochia indica* is a cardiac stimulant. The ashes of *Arthrocnemum indicum* is used in scorpion sting.

4. Chemicals and dyes : The *Salsola foetida* is used in preparation of Sodium bicarbonate. The red sap of beet root yields dye.

5. Ornamental : Some members like *Kochia scoparia* and *K. trichophylla* are grown for ornamental purposes.

ARISTOLOCIACEAE

Systematic position

- Class :Dicotyledons
- Order :Aristolochiales
- Family : Aristolochiaceae
- Genus : *Aristolochia*
- Species:*bracteolate*

Distribution of Aristolochiaceae

- The family Aristolochiaceae or Birthwort family contains 7 genera with 625 species (*Rendle*) having fairly wide range of distribution, the main centre of distribution being north temperate and

tropical regions of the globe. Aristolochia is mainly tropical. According to Willis genera 5, species 300.

Characters of Aristolochiaceae

- Plants twinner, flower actinomorphic, trimerous, stamens 6-36 free or attached with the style forming gynostemium, generally 6-loculed inferior ovary.

Vegetative characters

Habit : Mostly climbing herbs or shrubs with woody stems or low herbs.

Root : Tap and branched.

Stem : Softly woody or herbaceous, branched twinner.

Leaf : Simple, alternate, with oil glands, entire, petioled, exstipulate.

Floral characters

Inflorescence : Either solitary or clustered or in racemes of spikes.,

Flower : Hermaphrodite, actinomorphic or zygomorphic, epigynous and with haplochlamydous trimerous perianth usually. In *Aristolochia* flowers aire, the perianth members are united to form a pitcher like structure having constricted neck, the interior of which is lined with downwardly directed hairs.

Perianth : 3 petaloid, united, 3-lobed or unilateral often bizarrely coloured occasionally an inner whorl of 3 minute teeth (vestigial corolla) present.

Androecium : Stamens 6-36. free or adnate to style and producing a column or gynostemium, filaments short and thick or anthers sessile, bithecous dehiscing longitudinally.

Gynoecium : Carpels usually 6 rarely 4, connate in an inferior six chambered, rarely four chambered ovary. Ovules anatropous, many on axile palcentas.

Fruit : Septicidal capsule with basal dehiscence.

Seed : Endospermic and small.

Pollination : Entomophilous.

Floral diagram Floral formula

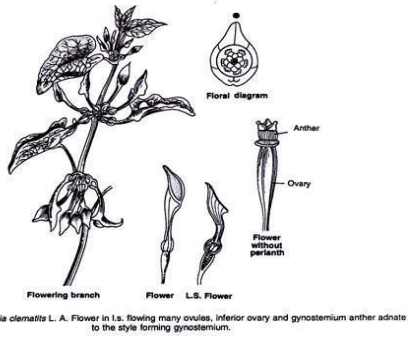


Fig. 91.1. *Aristolochia clematis* L. A. Flower in l.s. flowing many ovules, inferior ovary and gynostemium anther adnate to the style forming gynostemium.

$\oplus$ or $\circ|\circ$ ☿ $P_{(3)}\, A_{6-36 \text{ or } (6-36)}\, \underline{G_{(6)}}$.

Economic Importance of Aristolochiaceae

1. Medicinal : The roots of *Aristolochia, serpentaria* and *Bragantia wallichii* serve as a cure for snake-bites. The roots of *Aristolochia indica* are used by snake-charmers for catching snakes.

2. Ornamental : *Aistolochia grandiflora, A. clematis, A. microphylla, A. gigas* are ornamental plants.

LORANTHACEAE

Systematic position

- Class :Dicotyledons
- Order :Santalales
- Family :Loranthaceae
- Genus :*Dendrophthoe*
- Species:*falcata*

Characters of Loranthaceae

- Aerial parasite usually, cup-shaped receptacle; inferior ovary and the absence of distinct ovules.

Distribution of Loranthaceae

- Mistletoe family consists of 36 genera and 1300 species, mostly distributed in tropical and temperate regions. About 10 genera and 52 species have been reported from India.

Vegetative characters

Habit : Herbs, perennial, aerial parasitic or semi-parasitic on trees.

Root : Modified adventitious roots in the form of haustoria, *Nuystia* rooted in earth.

Stem : Herbaceous, soft, branched, branching dichotomous, swollen nodes.

Leaf : Simple, opposite, entire, exstipulate, thick and leathery, ever-green, often reduced to mere scales.

Floral characters

Inflorescence : Flowers are solitary or in racemes and cymes.

Flower : Hermaphrodite or unisexual, e.g., *Viscum* (when so, plants dioecious), actinomorphic or slightly irregular, often brightly coloured, dimerous or trimerous, apetalous, epigynous with cup-shaped or disc-like receptacle.

Perianth : Biseriate, the two whorls similar and 2-3 merous, both green and sepal-like (*Viscum*) or both large, brilliantly coloured and petaloid, e.g., *Loranthus* (no apparent differentiation into calyx and corolla), an irregular rim, called calyculus, is present below the perianth and is interpreted as calyx.

Androecium : Stamen 4—6, opposite to the perianth members, and borne on them (epiphyllous) or at their base; anthers 2-celled, dehisencing by longitudinal or by transverse slits or by pores (in staminate flowers a rudimentary pistil may be present).

Gynoecium : Carpels 1-3 or 5, syncarpous, inferior, unilocoular, ovules not differentiated from placenta, basal placentation, style simple or absent, stigma 1 and often sessile.

Fruit : Berry or drupe, often viscid.

Seed : Fleshy endospermic.

Pollination : Entomophilous.

Floral diagram Floral formula

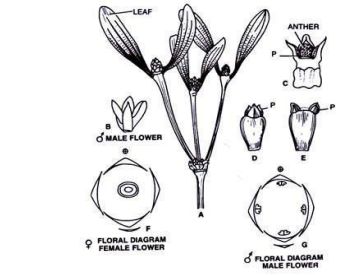


Fig. 92.1. *Viscum album*. A. Portion of the twig bearing staminate flowers. B. Male flower, C. Staminate flower in L.S.; p, perianth; a, anther. D & E. Pistillate flower, entire and in L.S. respectively; p, perianth member; F. Floral digram female flower (♀); G. Floral diagram male flower (♂).

$$\text{Br Brl} \oplus \female\ P_{4-6}\ A_{4-6}\ \underline{G_{\bar{1}}}$$

$$\text{Br Brl} \oplus \male\ P_{4-6}\ A_{4-6}\ G_{0}$$

$$\text{Br Brl} \oplus \female\ P_{4-6}\ A_{0}\ \underline{G_{\bar{1}}}$$

Economic importance of family

- *Loranthus ferrugineus* Roxb.-childbirth, snake bite, wounds, fever, and beri-beri. *L. pentandrus* L.-childbirth. *L. granclifrons* King-ringworm.
- *Elytmnthe globosa* (Roxb.) *G. Don* and *Macrosolen cochinchiensis* (Lour.) van Tiegh.-headache and childbirth. Mistletoes are used as medicine by tribesmen in Australia (Blakely 1922-28) and other parts of the world (Baillon 1892).

ORCHIDACEAE

Systematic position

- Class :Moncotyledons
- Order : Orchidales
- Family :Orchidaceae
- Genus : *Zeuxine*
- Species: *strateumatica*

Distribution of Orchidaceae

- It is second longest family of angiosperms. It is represented by about 900 genera and 20,000 species, which are cosmopolitan in distribution. In India it is represented by about 130 genera and over 800 species. The family 13 having great variety of flowers in shape, longevity and beauty.

Characters of Orchidaceae

- Perennial herbs, epiphytes or saprophytes may be terrestrial; flowers zygomorphic, hermaphrodite, epigynous, resupinated; perianth 6 in two whorls, the posterior segment of the inner whorl developed as lip or labellum; presence of peculiar structures – Labium, column and Rostellum; Stamens 1-2, one or two staminode pollengrains united into pollinia; gynoecium tricarpellary, inferior unilocular with parietal placentation; the fertile stamen is adherent to the style and forms with it the column or gynostemium, which projects more or less in the centre of flower; Stigma 2 or 3 lobed, in some two fertile and one sterile and modified into rostellum.

Vegetative characters

Habit : Perennial terrestrial, succulent, scapose herbs; many are epiphytic or saprophytic, sometimes climbers *Vanilla*.

Root : Adventitious, tuberous, (*Orchis*), fleshy, climbing or aerial. Main roots always absent.

Stem : Erect, sometimes climbing or trailing, annual in terrestrial forms, perennial in epiphytic forms; generally thickened into rhizome or pseudobulbs (*Phajus, Bulbophyllum*), bearing aerial assimilatory roots. (*Taeniophyllum*).

Leaf : Simple, alternate, sometimes opposite or whorled, usually fleshy, linear to ovate, sheathing base, sometimes reduced to achlorophyllous scales.

Floral characters

Inflorescence : Solitary or spike, racemes or panicle (*Oncidium*).

Flower : Flowers are of variable and peculiar, shape, size and colour, often showy, bracteate, zygororphic, bisexual or rarely unisexual, eipgynous, trimerous, mostly resupinate i.e. twisted to 180° or upside down.

Perianth : Tepals 6, in two whorls of each, outer 3 tapals (representing calyx) green; inner 3 tepals coloured (representing corolla), dissimilar-the 2 lateral or wings like, the third posterior tepals is lightly modified often projected basally the labellum or lip; broad, shoe-like spursed, tubular, strap-shaped or butterfly shaped or variously branched and contributing most to the oddity and beauty of the flower. Actually posterior it comes to lie on the anterior side of the flower due to twisting (or resupinationl) of the inferior ovary through 180° or by the bending back of pedicel over the apex of the stem.

Androecium : Stamens 3, which unite with the pistil to form a column, the gynandrium or gynostemium opposite to the labellum; functional stamen (*Orchis*) or 2 (*Cypripedium*), bithecous, introrse; pollen granular or coherent in each cell into one, 2 or 4 stalked pollen masses or pollinia. A connection between ovary and stamen is made by the beak-like sterile stigma; occupying almost the centre of the column. Sometimes staminodes are also present.

Gynoecium : Tricarpellary, syncarpous, ovary inferior, unilocular, parietal placentation, rarely trilocular and axile placentation (*Apostasia*); stigmas 3, of which 2 lateral are often fertile, the third stigma is sterile forming a small beaked outgrowth – the rostellum lying in the centre of column between the anther and fertile stigma. In *Cypripedium* and Paphiopedium, all the 3 stigmas are functional.

Fruit : A capsule.

Seed : Small, light (0.004 gm. each), non-endospermic.

Pollination : Entomophilous.

Floral diagram Floral formula

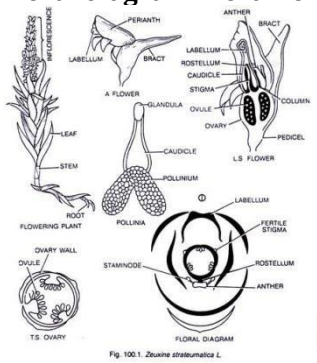


Fig. 100.1. *Zeuxine strateumatica L.*

$$Br,\ o|o,\ \mathbb{Q},\ P_{3+3}\ A_{1+2\ std}\ \underline{G_{(3)}}$$

Economic Importance of Orchidaceae

1. Food : During scarcity the tuberous roots of *Habenaria susannae* and *Orchis latifolia* are used as food.

2. Flavour : The capsules of *Vanilla planifolia V. fragrans* yield commercial 'Vanilla' a flavouring agent for chocolate and confectionary.

3. Medicine : The root-stocks of *Eulophia epidendraeas* are used as vermifage.

4. Dye : The leaves of *Calanthe veratrifolia* contain a glycoside 'indican', which on hydrolysis yields 'indigo blue'.

5. Ornamentals : Many orchids are cultivated in the green houses for their beautiful sweet-scented flowers of various forms, shapes with highly attractive labellum of various hues and bright colours. The orchid flowers are in great demand and are much more sought after than any other flowers. Hence extensively grown from a commercial point of view. Some commonly grown orchids are – *Cypripedium* (lady's slipper), *Epidendrum* (Green-fly orchid) *Habenaria* (fringe- orchid), *Oncidium* (butterfly orchid), *Vanda, Vanilla, Odontoglossum* (lady orchid).

AMARYLIDACEAE

Systematic position

- Class :Moncotyledons
- Order :Asparagales
- Family :Amarylidaceae
- Genus :*Crinum*
- Species:*asiaticum*

Distribution of Amaryllidaceae

- It is commonly called "Narcissus family". The Amaryllidaceae covers 90 genera and 1300 species. The members are widely distributed throughout the world. The family is chiefly distributed in the tropics and sub-tropics.

Characters of Amaryllidaceae

- Plants perennial herbs, distichous radical leaves and leafless scape, inflorescence monochasial cyme; two or many spathaceous bracts around the flowers; flowers hermaphrodite, actinomorphic rarely zygomorphic; perianth generally gamophyllous; stamens 6, epiphyllous; gynoecium tricarpellary, trilocular, ovary inferior, axile placentation; fruit capsule; seed endospermic.

Vegetative characters

Habit : Mostly perennial herbs perennating by means of underground stem that may be bulb, rhizome or corm; in general habit the members resemble lilies.

Root : Adventitious, fibrous.

Stem : Underground rhizome, bulb or corm. Agave reproduces vegetative by bulbils.

Leaves : Radical leaves arranged spirally, sessile, exstipulate, simple, mostly narrow, entire margin, thick, fleshy, linear-lanceolate, persistent, fibrous, rigid, coated with wax, multicostate parallel venation.

Floral characters

Inflorescence : Flowers borne on leafless scape (aerial floral axis) either singly or in cymose or umbellate clusters; flowers protected by large bracts called spathes.

Flower : Bracteate-bract large, sub-sessile or pedicellate, hermaphrodite, complete, sessile, actinomorphic rarely zygomorphic (Sprekelia), epigynous.

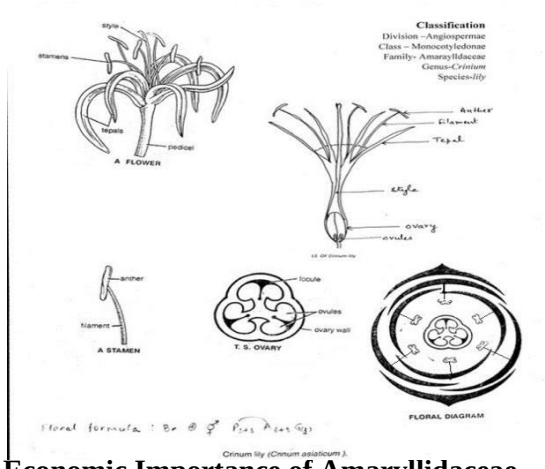
Perianth : Six, in two whorls of three each, gamophyllous rarely polyphyllous. In Narcissus and Eucharis at the junction of corolla tube and limb there is a crown or corona. According to Baillon the corona is the late development of the floral axis at the base of the perianth, appearing after stamens and carpels. Eichler and others consider it as combined ligular outgrowth of the six perianth lobes i.e. perigonal in nature.

Androecium : Stamens 6, polyandrous, epiphyllous – as the tepals arranged in two whorls; anthers bithecous, dorsifixed or basifixed, introrse or extrorse, filament distinct, sometimes connate basally by staminal tube. In Gethyllis 12 to 18 stamens are present.

Gynoecium : Tricarpellary, syncarpous, ovary inferior, trilocular or unilocular in Calostemma-, axile placentation with numerous ovules in each loculus; style slender, stigma simple or trifid.

Fruit : Loculicidal capsule or berry.

Seed : Endospermic.
Pollution : Entomophilous.
Floral formula and Floral diagram



Economic Importance of Amaryllidaceae
1. Food : The roots of *Alstroemaeria* and *Curculigo orchioides* yield flour.
2. Medicinal : The thick rhizome of *Curculigo orchioides* is used in piles, jaundice, asthma, diarrhoea and gonorrhoea, *Crinum asiaticum* is laxative and diuretic. *Polyanthes tuberosa* is used in gonorrhoea.
3. Beverage : The fermented juice from the flowering axis of Agave is a national drink of Mexico and is commonly called pulque. From the juice the *Mexicans* also distil spirit.
4. Fibres : From the leaves of *Agave sisalinea* and *A. fourcryodes* excellent fibres called sisal hemp and henquen are obtained respectively. In Indian desert Agave can be extensively grown and fibre industry can be developed.
5. Ornamentals : *Agave, Amaryllis, Narcissus, Galanthus, Crinum, Agapanthus, Lycoris, Leucojum vernum* (Snow drop), *Polyanthes* (tube rose) etc., are cultivated in garden as ornamentals.

COMMELINACEAE
Systematic position
- Class :Moncotyledons
- Order :Commelinales
- Family :Commelinaceae
- Genus :*Commelina*
- Species:*benghalensis*

Distribution of Commelinaceae
- Commelinaceae includes about 50 genera and 700 species. In India it is represented by 11 genera and 75 species.

Characters of Commelinaceae
- Herb with jointed stem; leaves sheathing and alternate; in florescence cincinnus; flower, hermaphrodite, actinomorphic; perianth leaves 6 in two whorls; stamens 3+3 or 3; some reduced to staminodes; carpels 3, superior, axile placentation.

Vegetative characters
Habit : Herb annual or perennial, erect or creeping rarely climber.
Root : Adventitious.
Stem : Rhizome, branched jointed with swollen nodes.
Leaf : Simple, alternate with sheathing base and narrow grass-like blades, entire margin, linear, oval or lanceolate parallel venation.
Floral characters
Inflorescence : Axillary, cincinnus, sometimes a monochasial cyme which arises either in the axil of a foliage leaf, e.g., *Tradescantia* or of a spathe-like bract.

Flower : Actinomorphic (*Zebrina, Pollia*) zygomorphic hermaphrodite, hypogynous, cleistogamous (*Commelina*), pedicellate, complete, trimerous usually subtended by foliaceous bract or spathe.
Perianth : Tepals six, in two whorls of three each, the outer whorl green and the inner usually blue, violet, yellow or white, free, imbricate.
Androecium : Stamen 6, in two whorls, all functional (*Tradescantia* and *Pollia*) or more commonly some of them are absent or represented by staminodes, filaments often hairy or beared, bithecous.
Gynoecium : Tricarpellary, syncarpous; ovary superior trilocular or sometimes bilocular, axile placentation; ovules one to many in each loculus; style terminal; stigma capitate.
Fruit : A loculicidal or indehiscent capsule.
Seed : Endospermic.
Pollination : Entomophilous. Some are cleistogamous, so self-pollinated.
Floral formula and Floral diagram

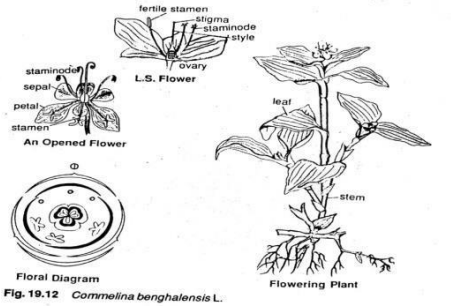


Fig. 19.12 *Commelina benghalensis* L.

Economic Importance of Commelinaceae
1. Food : Leaves of *Commelina* are edible and fried with gram flour as Pakoras. The rhizomes of *Commelina benghalensis* are used as vegetable.
2. Medicinal : The roots of *Commelina obliqua* are used as antidote to snake poison. The stem juice of *Floscopa scandens* is put in sore eyes. Many species of *Murdannia*, *Aneilema* and *Commelina* are used in leprosy. The roots of *Cyanotis* and *Tradescantia* are used for expelling worms in cattle as also for fever.
3. Ornamental : Rhoeo discolor is used as potherb. *Tradescantia*, *Cyanotis*, *Zebrina pendula* (Wandering Jew) are ornamental.

ARECACEAE
Systematic position
- Class :Moncotyledons
- Order :Arecales
- Family :Arecaceae
- Genus :*Cocos*
- Species:*nucifera*

Distribution of Arecaceae
- The family is commonly known as "Palm family". It includes 217 genera and 2500 species. The members are confined to tropics in both the hemispheres and extending in the warmer regions of the world. In India it is represented by 225 species belonging to 25 genera.

Characters of Arecaceae
- Mainly trees with stout unbranched stem ending in crown of leaves; leaves large, compound, alternate, young leaves are plicate, exstipulate with long petioles; inflorescence enclosed in a persistent spathe; flowers unisexual; perianth 6 in two whorls of 3 each; in male flower 6 stamens in two whorls, anthers versatile; in female flowers carpels three; apocarpous or syncarpous, superior, trilocular or rarely unilocular; fruit berry or drupe; seed endospermic.

Vegetative characters
Habit : Large unbranched trees (*Phoenix, Areca catechu*), shrubs or garden palms, trailing (*Calamus*), herbs (*Reinhardtia*).
Root : Adventitious roots arising from the base of bulbous stem. Thick aerial roots are also found in some species of *Manicaria*.

Stem : Aerial, woody, erect, unbranched, very rarely branched, (*Hyphaene*), in some short rhizome (*Nipa*), cylindrical, hairy, old stem protected by woody leaf bases, climbing (*Calamus*).

Leaves : Alternate crowded at the apex of stem giving palmlike appearance to the plant; petiolate, leaf-base sheathing, broad and persistent; exstipulate, compound pinnately (*Phoenix, Areca*), palmately (*Borassus*), acute, thick, leathery, parallel venation. In some palms (*Copernica*) the petiole is prolonged into a ligule like structure called histula. In monoecious flower the position of male and female flowers is variable i.e. male flowers at the base or at the apex and the female flowers at the upper part (*Ruffia*, Rapis) or male and female flowers are inter-mingled or female flowers in the centre, made on the either side as the *Cocos*, *Caryota*.

Perianth : Tepals 6, in two whorls of 3 each, polyphyllous or slightly connate at the base; perianth lobes tough, persistent, coriaceous, leathery or fleshy, valvate or imbricate aestivation, white or petaloid.

Floral characters

Inflorescence : It is simple or compound, spike or branched panicle, usually a spadix with a woody spathe which opens by two valves; spadix may have sessile or pedicellate flowers, simple racemose (*Borassus*), or compound racemose (*Cocos*) or even profusely branched panicle (Daemonorops).

Flower : Sessile or shortly pedicellate, bracteate, mostly unisexual (*Phoenix*) or hermaphrodite (*Livingstonia*), actinomorphic, incomplete or complete, hypogynous trimerous, flowers are of small size and produced in large numbers. Plant may be monoecious or dioecious.

Androecium : In male or hermaphrodite flowers, stamens are 6 in number, two whorls of 3 each, polyandrous, staminodes may be present in the female flowers; anthers versatile, dithecous, basifixed or dorsifixed, introrse, filament short and distinct.

Gynoecium : Hermaphrodite flower-carpels 3 in number, apocarpous or syncarpous, ovary superior, trilocular, axile placentation, single ovule in each loculus; style short, stigma small or broad or 3 lobed.

Fruit : Usually a berry, fleshy or fibrous waxy coating on the fruit; the mature fruit contains a single seed (*Phoenix*); drupe (*Cocos nucifera*).

Seed : Endospermic.

Pollination : Anemophilous or entomophilous.

Economic Importance of Arecaceae

1. Food : Pith of *Metroxylon rumphii* and M. leave (Sago palm) yield sago of commerce. The sap of *Borassus* yields a sugar, which on fermentation gives alcoholic drink "Toddy". Fruits of Phoenix dactylifera are very delicious and eaten throughout the Arab world. The nuts of Areca catechu serve as a asteringent and used with betel leaves. The milk of *Cocos nucifera* makes a refreshing drink, endosperm is eaten raw and stored when dry.

2. Medicinal : Tender leaves of *Calamus travancoricus* are given in bilousness, worms and dyspepsia.

3. Fibres : Mesocarps of the drupes of Coconut are extensively used for stuffing pillows and sofa sets. The cane of commerce is obtained from *Calamus tenuis* and *C. rotang* and are used for making mats, baskets and other furniture. *Borassus flabellifer* – yields palmyra fibres which are used to prepare brushes and brooms. The leaves are used in the manufacture of hand fans, umbrellas, baskets and mats.

4. Wax and oil : Wax is obtained from the leaves of *Copernicia cerifera* and *Ceroxylon andicola*. The wax is used in making gramophone records, candles and models. Coconut oil is obtained from the *Cocos nucifera* and is used as hair oil, in soap industry and also for cooking.

5. Ornamentals : *Roystonea regia* (Royal palm), *Corypha elata* (Talipot palm).

CYPERACEAE

Systematic position

- Class :Moncotyledons
- Order :Cyperales
- Family :Cyperaceae
- Genus :*Scirpus*
- Species:*articulatus*

Characters of Cyperaceae

 Plants usually herbs with 3 angled stem, solid culm; leaves with entire sheathing base not split on one side; flowers in spikelets of cymes, subtended by a single glume, naked or with perianth of scales or hairs; stamens 1 to 3; carpels 2 or 3, ovary superior, unilocular with single basal ovule; fruit an achene or nut, seed endospermic.

Distribution of Cyperaceae

- The family is commonly known as 'Sedge family'. It is distributed throughout the world but most abundant in temperate zones. It comprises 70 genera and 4000 species. In India it is represented by 441 species.

Vegetative characters

Habit : Plants are commonly perennial herbs rarely annual; perennating by means of creeping rhizomes or tubers. The members are inhabitants of damp places.

Root : Adventitious, fibrous, branched or tuberous.

Stem : Underground rhizomes, tubers or stolons, aerial shoots terete (angled), solid glaucous or glabrous, without distinction into nodes and internodes; usually unbranched rarely branched near the tip.

Leaves : Exstipulate, sessile, leaf base sheathing, sheath closed, eligulate, arranged in three rows, alternate, simple, lamina linear, narrow, pointed, sharply edged.

Floral characters

Inflorescence : Inconspicuous flowers arranged in spikelets, panicles or in spikes of cymose rarely solitary terminal (*Oreobolus*).

Flower : Sessile, bracteate, zygomorphic hermaphrodite or unisexual arising in the axil of a single glume, hypogynous, small.

Perianth : Absent but in some by hairs or scales (*Oreobolus*); flowers naked (*Cyperus*, *Carex*).

Androecium : In male or hermaphrodite flowers stamens usually 3, may be 1 to 6 or one (Hemicarpa), polyandrous; anthers dithecous, basifixed, oblong or linear; filaments long and thread-like.

Gynoecium : In female flowers or hermaphrodite flowers gynoecium is bicarpellary (*Rhyncospora*) or tricarpellary (*Carex*), syncarpous, superior, unilocular, single basal ovule; style single or divided into the equal number of carpels; stigma linear or feathery corresponding to the number of carpels. In *Kobresia* ovary is enclosed in a bract or utricle.

Fruit : A flattened 3-angled nut.

Seed : Endospermic.

Floral formula and Floral diagram

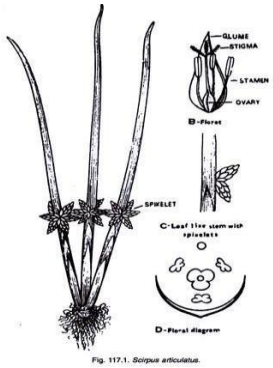


Fig. 117.1. *Scirpus articulatus*.

$$\oplus \; \varnothing \; P_0 \; A_3 \; G_{(3)}$$

Economic Importance of Cyperaceae

1. Food : The tubers of *Cyperus esculentus* (*H. Kaseru*) are used as food due to their high oil content. The tubers yield 25 to 30% oil of pleasant taste. The tubers of *Eleocharis tuberosa* are also edible.

2. Fodder : Many species of *Cyperus* are taken by cattle as fodder.

3. Medicinal : The tubers and rhizomes of *Cyperus articulatus, C. iria, C. longus* are carminative, stimulant and tonic. The tubers of *Cyperus stoloniferous* are stimulant for heart. The tubers of *Scirpus kysoor, S. grossus* are used in diarrhoea and vomitting. *Scirpus articulatus* is purgative. *Kyllingia triceps* is used in diabetes.

4. Poisonous : *Carex cernua* is cattle poison.

5. Other uses : *Carex arenaria* and species of *Cyperus* are good sand binders. *Scirpus lacustris* is used for matting. Aromatic scented oil is obtained from *Cyperus stoloniferous*.

6. Ornamentals : *Cyperus alterifolius* and *Isolepis* are cultivated in gardens.

UNIT V: ECONOMIC BOTANY

CEREALS

Wheat

Common Name – Wheat
Tamil - Godumai
English – Wheat
Family – Gramineae (Poaceae)
Binomial Name – *Triticum aestivum* Linn.,

History – According to M.A. de Candolle, the cultivation of wheat is prehistoric in Old World. Very ancient Egyptian monuments show the establishment of this cultivation. However, when Egyptians of Greeks speak of its origin, they attribute it to mythical personages – Isis, Ceres, Triptolemus, etc. It is cultivated as a food crop mainly in Uttar Pradesh, Punjab, Madhya Pradesh, Maharastra, Bihar and Rajasthan. Wheat is the second stable food crop of India and occupies about 29 million acres of land. Wheat is also cultivated in Gujarat.

Cultivation and Harvesting - In northern India sowing of wheat is done in October November. Wheat may be sown broadcast, either by hand or by sowing machines. Germination begins immediately and the first leaves appear within a fortnight. Wheat is properly manured and irrigated. The crop is harvested by cutting the plants with a sickle close to the ground, in March-April. Threshing is the next process, and this involves the separation of the grain from the spike. Threshing is generally done under the feet of bullocks or by threshing machines. After threshing the wheat is winnowed and sifted. In the Punjab, recently the combines are introduced for the purpose. The combines reap, clean, thresh, winnow and sift the grains; wheat must be stored in firmly built structures, and it must be well ventilated.

Uses - There are three main kinds of flour-*suji, maida,* and *ata* which are used for various purposes. The flour is used chiefly for making 'bread' and 'chapatis'. The flour is also used for making biscuits, cakes, pastry and similar articles. Wheat flakes are used as breakfast food. Wheat is also used in the manufacture of beer and other alcoholic beverages. Wheat straw is used for seating chairs, stuffing mattresses, etc. It makes a good food for livestock. Wheat straw is also used as fodder.

This makes a staple food in most parts of the world. Properties of gluten in the grains are such that it produces bread-stuffs generally superior to those from any other cereal grains. By products of wheat milling, such as bran, germ and middlings constitute valuable feed for stock, readily eaten; supplementary feeds are provided to supply protein and minerals in which the straw is deficient. The straw is used as bedding for cattle; it is also used for padding, as in mattresses, for packing fragile goods, for thatching and many other purposes. It may be used also for production of furfuryl alcohol. Straw-pulp is utilized for the manufacture of paper, straw-board, and building - board.

Non-feed industrial uses of wheat include the manufacture of starch, industrial alcohol, malted wheat, and core-binder flour; only small quantities of wheat are used for starch and gluten manufacture. Grain is regarded as a stand-by for alcohol production. Low-grade flours are utilized in the preparation of pastes for wall papering and ply-wood adhesives, and in iron foundries as a core binder. Wheat products include peeled wheat ; Bulgur, a parboiled wheat product; *Wurld wheat*, similar to Bulgur, but of lighter colour ; *Instant* or *agglomerated* flour; *Farina* or *semolina*; *Wheat flakes*; *Shredded wheat; Puffed wheat ; Grape-nuts*, prepared from toasted slices of malted bread; *Gluten*, used in special breads; and *wheat germ*, rich in vitamin E.

Maize

Common Name – Maize
Tamil - Makka-cholam
English – Maize, Corn, Indian corn
Family – Gramineae (Poaceae)
Binomial Name – *Zea mays* Linn.,

History – It is universally admitted that Maize of Indian corn is born in America. This species probably originated in a wild state in the tropical South America. A tall annual cultivated grass. Maize mainly grown as 'kharif crop'. It is grown as a food crop mainly in Uttar Pradesh, Punjab, Madhya Pradesh, Bihar, Andhra Prdesh, Jammu and Kashmir.

Cultivation and harvesting - Maize is a summer annual. It thrives best in fertile, well irrigated, medium, heavy loamy soil. It is also commonly grown in the coarse gravel soils of hilly tracts. In India the crop is generally sown in June-July and harvested in September-October. The maize stems are cut close to the ground with the help of corn knife or sickle. The stalks are stacked to allow the grain to ripe further. After a month of this curing process, the ears (cobs) are husked b hand or by machine. Maize must be stored I well ventilated bins so that the excess of moisture is evaborated.

Uses - The chief use is as a food for man and livestock. The grain is very nutritious, with a high percentage of carbohydrates, fats and proteins, Not only is the grain valuable as a stock feed, but the plant as a whole is an important fodder crop. The immature cobs are largely eaten after roasting. The grains are also used in making corn starch and industrial alcohol. The glucose is also manufactured from the grain. The corn oil is prepared which is used for soap making, lubrication and as salad oil. Corn flakes make a good breakfast food. The fibres in the stalks are utilized for making paper and yarn. Zein, the protein which occurs in maize grain, is utilized for making artificial fibres with good tensile strength and wool-like qualities.

PULSES

Red gram

Common Name – Red gram
Tamil - Thovaray
English – Cajan pea, Pigeon pea, Red gram, Congo pea
Family – Leguminosae (Papilionaceae)
Binomial Name – *Cajanus cajan* Millsp.,

History – according to De Candolle (Origin of Cultivated Plants) pigeon pea (*Cajanus cajan*) is more probably a native of tropical Africa, and introduced perhaps 3,000 years ago into India.

Cultivation and Harvesting – In India, it is chiefly grown in Madhya Pradesh, Bihar, Andhra Pradesh, Maharashtra, Uttar Pradesh and Karnataka. Grown mostly as a '*Kharif*' crop and used in form of 'dal'. This is the second important pulse crop of India. It is grown as a dry crop mixed with millets like *jowar*, *bajra* and *ragi*. In North India, however, the crop is irrigated over considerable areas. It is sown in the *kharif* season from May to July, and is harvested in about six to eight months' time (*i.e.,* from December to March). The area covered by it is about six million acres and annual production is about 2 million tons.

Cultivation and Harvesting - There are two main varieties grown in India (i) *Cajanus cajan* var. bicolor DC. (*arhar*) and (ii) *Cajanus cajan* var. *flavus* DC. (tur). *Arhar* comprises of late-maturing, large, bushy plants, bearing purple streaked, yellow flowers and dark coloured pods, each having four or five seeds. *Tur* on the other hand comprises early maturing and smaller plants having yellow flowers and plain pods, each containing two or three seeds.

Uses - Both the immature and ripe seeds are used for human food as a good source of protein. The leaves and twigs are used for fodder. The pericarp and husk, separated in threshing are used as cattle feed. The enzyme urease, obtained from it, is required for estimation of urea in blood, urine, etc. Livestock and poultry are very much fond of it. It is chiefly consumed in south Indian homes. This contains two globulins: *cajanin* and *concajanin*. The leaves are used in Madagascar for rearing silkworms. Green pods are used as a vegetable. Husk makes useful fodder Green leaves are used as green manure.

Black gram

Common Name – Black gram
Tamil - Ulundu
English – Black gram
Family – Leguminosae (Papilionaceae)
Binomial Name – *Vigna mungo* Linn.,

Cultivation and Harvesting - A herb, cultivated as a pulse crop in Uttar Pradesh, Madhya Pradesh, the Punjab and Bengal.

Uses - The small oval black seeds are highly nutritious. It is good source of protein for vegetarians. The seeds are used in the form of dal (splitted seeds). It is largely used by south Indians to make vada idili, dosa, etc. Black gram is the main ingredient of these items. The plants are used as cattle fodder. This pulse is a good source of phosphorus. It is the chief constituent of wafer-biscuits (papds). Also cooked as a vegetable. Fried and salted seeds are eaten as a snack. Pulse is used in rheumatism and nervous and hepatics diseases. Also used in dropsy cephalagia as a diuretic. Root is narcotic, and used for aching bones.

VEGETABLE OIL

Ground nut

Common Name – Ground nut
Tamil - Verkadalai
English – Peanut, Ground nut
Family – Leguminosae (Papilionaceae)
Binomial Name – *Arachis hypogaea* Linn.,

History – the round nut is native of South America, now generally cultivated throughout India. This was not known in the Old World before the discovery of America. According to Dymock this plant reached India through China. It does not appear to have been cultivated for more 150 years. This was brought to wstern India from Africa. It is native of Brazil. It is widely grown in South India, Maharashtra and Utar Pradesh. North Gujarat is famous for peanut cultivation. The plant is a bushy or creeping annual with the peculiar habit of ripening its fruit underground. A sandy soil is best for its cultivation. The soil must be friable so that the ripening fruit can be buried, and it must be well fertilized.

Uses - The peanuts (seeds) are used for roasting or salting and for the preparation of peanut butter. Peanuts are a very nutritious food. One lb. of peanuts yields 2700 cal. The filtered refined oil is used for cooking and in making margarine. Peanut oil is important food oil. The oilcake is used as fodder. The protein in peanuts is used in the manufacture of ardil, a synthetic fibre. The vegetable ghee is made from the peanut oil after hydrogenation.

The kernels are also used in various foods and confectionery. They are ground and made into peanut butter. Peanut flour is prepared by grinding the finest grades of peanut cake; it is used for supplementing the white flour. Cake is used as feed for cattle and other farm animals; also used as manure. Cake has high nutritive value. Seed coats are mixed with groundnut husk and the product is called groundnut bran. Some commercial products are groundnut milk, peanut ice-cream Speed and peanut massage oil for infantile paralysis. Hulls are used s filter for fertilizer, or ground into meal for insulation blocks, for floor sweeping compounds, bedding the stables, etc. Peanut oil also finds some use as a lubricant, and blends with mineral oil have been developed.

Palm oil

Common Name – Palm oil
Tamil - Palm oil
English – Oilpalm
Family – Palmaceae/Arecaceae
Binomial Name – *Elaeis guineesis* Jacq.,

History and Cultivation - A tree. It is native of West Africa. In India it is grown in Travancore. The oil is obtained from the nuts. The oilpalm is a very productive tree. It begins to bear at the age of 5 to 6 years, reaches full bearing at 15, and continues until 60 or 70 years of age. Each tree bears 10 bunches of 200 nuts a year. The fibrous pulp of these fruits contains 30 to 70 per cent of fat. The oil is obtained by crude native methods. The oil is yellow-orange or brownish in colour.

Uses - The oil is used in making soap, margarine and as a fuel for diesel motor. Source of palm oil, obtained from the fleshy pericarp, and palm kernel oil from the seeds; the former is edible and rich source of vitamin A and the latter mostly used for the preparation of margarine, soap and hair oils.

FIBERS

Gossypium

Common Name – Cotton
Tamil - Paruthi, Panji
English – Cotton
Family – Malvaceae
Binomial Name – *Gossypium* Linn.,

History – The history of cotton (*Gossypium* sp.) is most interesting, and perhaps no more remarkable example of a sudden development exists in the whole history of Economic Products, than in the case of cotton. Cotton has been in the use in India since 1800 B.C. and from 1500 B.C. to A.D. 1500 India was the centre of the industry. The hindus were the first people to weave cloth. Cotton was introduced into Europe by the Mohammedans. This was first grown in the United States soon after the first settlements were made. The first cotton mill was established in 1787.

Cultivation and Harvesting – All the cultivated cottons fall under four species. These are *Gossypium arboreum, G. herbaceum, G. hirsutum* and *G. barbadense*. ***G.arboreum*** this is most widespread of all the species of Old World cottons, beings distributed throughout the rain-fed savannah areas from Africa, through Arabia and India, to Chin, Japan and E.Indies. ***G. herbaceum*** this is also an Old World species. It occurs in Africa, Middle East countries, Central Asia and Western India. It is utilized for low-quality fabrics, carpets and blankets and is especially suitable for blending with wool. ***G. hirsutum*** this is a New World species. ***G. barbadense*** this is a New World species. It includes perennial shrubs or small trees, 3-15feet high or annual shrub moderately high. Cotton is essentially a tropical crop, but its cultivation is carried on successfully over may parts of the world, far removed from the tropics. It is grown either at sea level or at moderate elevations not exceeding 3,000 feet. Cultivation is confined largely to flat open country and rough hilly tracts, where the minimum temperature does not fall below 70°F. Higher temperatures are very favourable, and the upper limit may go up even to 1050F in the picking season. The crop thrives well in moderate rainfall. Rainfall exceeding 35 inches is supposed to be harmful to the crop. The lower limit for a purely rain-fed crop is 20 inches.

Uses - The bulk of cotton production is consumed in the manufacture of woven goods, alone or in combination with other fibres. The principal types of woven fabrics are-print cloth, yarn fabrics, sheetings, fine cotton goods, napped fabrics, duck, tyre fabrics and towels. Products in the form of yarn and cord include unwoven tyre cord, thread, cordage and twine and crochet yarns. Unspun cotton finds use in mattresses, pads and upholsteries. Cotton waste of good grade is employed in making cotton blankets, sheets, towels and flannelettes. Cylindrical strips from carding machine, which are constituted of fibres of good strength, are used for warps, twines, ropes and nets; they are also useful for wadding, padding for upholstery, bed quilts, etc.

Corchorus

Common Name – Jute
Tamil - Sanal
English – Jute
Family – Tiliaceae
Binomial Name – *Corchorus* Linn.,

History – *Corchorus* as native of India. The commercial fibre jute is obtained from either one or both of the following species of *Corchorus*, viz., *C. capsularis* Linn., grown in West Bengal and Bangladesh, and *C. olitorius* Linn., raised in the vicinity of Calcutta.

Cultivation - In India, the crop is sown between March and May, and harvested between July and September, It is grown mainly in West Bengal, Assam and Bihar, which together account for 90 per cent of the total area sown. Orissa, Uttar Pradesh and Tripura are the other states, which contribute the remaining 10 per cent area. Jute is a bast fibre obtained from the secondary phloem. The bast fibre is obtained from *C. capsularis*, a species with round pods which is grown in lowland areas subject to inundation. Fibre from *C. olitorius*, an upland species with long pods, is but little inferior.

In India, the time for harvesting the crop depends entirely upon the date of sowing; the season commences with the earliest crops about the end of June, and extends to the beginning of October. The crop is harvested within three or four months after planting, while the flowers are still in bloom.

Uses - Jute is used chiefly for rough weaving the thick cloth made from jute fibre is used for making gunny-bags. Another type of fine cloth prepared from jute fibre is chiefly used as a cloth to sleep on. Another type of coarse cloth is largely used for making the sails of country boats, and also for bags to hold large seeds or fruits.

Jute is extensively used in the manufacture of carpets, curtains, shirtings, and is also mixed with silk or used for imitating silk fabrics. The fibre is also used for making twine and ropes. Short fibres and pieces from the lower ends of the stalks constitute jute butts, which are used to some extent in paper making. India not only grows most of the jute, but it is the largest manufacturer and exporter of jute products.

NUTS

Cashewnut

Common Name – Cashewnut
Tamil - Mindiri
English – Cashew
Family – Anacardiaceae
Binomial Name – *Anacardium occidentale* Linn.,

History – The cashewnut is native of West Indies. It has been originally introduced into India from South America. The cashew tree is an evergreen of spreading somewhat straggling habit low branched and reaching a height of 35 to 40 feet. The wood of the tree exudes a yellow gum. The most conspicuous product of the tree is the 'false fruit' the swollen peduncle of hypocarp commonly known as the 'cashew apple'. The apple is actually the receptacle for the true fruit the cashewnut which is lightly attached to its apex and which attains full size prior to the enlargement of the receptacle.

Cultivation and Harvesting – The cashew ranks second only to the almond among the nine tree nuts that are of importance in world trade. India, the world's chief source of cashews, produces, nearly 80,000tons of the nuts annually. In Kerala alone there are more than 200 cashwnuts processing factories. Cashew trees flower 2-2.5 months before the maturing of the frit crop. In India, the cashew crop is harvested in April, with a few trees bearing light crop in October and November. The yield varies from 10lbs. To 200lbs of nuts per tree. An average tree is said to bear 7lbs. of nuts when 3 years old, increasing to 70lbs. in the 15^{th} year. About 5% of the cashewnuts produced in India, especially in South Kanara, Tanjore and South Arcot district of Tamil Nadu State, are simply dried and stored after harvest and then dried in the sun for 2 to 3 days and shelled without roasting.

Uses - Cashew kernels, sugared or salted, are consumed primarily as tablenuts and some are used in bakery goods and confectionery. Cashew contains proteins, vitamins, calcium, iron, etc.

Anacardic oil derived from cashew kernels is light-yellow and similar to aimond oil. It is used for hardening the chocolate and it is given medicinally as an antidote for irritant poisons, bo Cashewnut shell liquid (CNSL), a by-product of cashew industry, is extracted during the roasting of raw cashews in the course of processing. This liquid is used in the manufacture of brakes, linings, paints, foundry, electrical insulators, resins, etc. Annual export of CNSL is about 5000 tonnes.

Cashew apple, which is not a fruit, but thickened peduncle, is used for jams and for preparation of wines and beverages.

Cashew shells yield a drying oil used as water proofing agent, preservative in painting of boats and fishing-nets, and light wood work. Oil has high heat resistance and is an excellent lubricant in magnets armatures in aeroplanes; also used in varnishes, inks, termite proofing of timber, and insulation coatings. Tree produces a gum, which is used in varnishes and as protection for books, and wood work against insects. Peelings obtained during the preparation of kernels may be utilized as a wholesome poultry feed. Milky sap of the bark turns black on exposure to air and is used as an indelible ink for marking linen. Wood is used for packing cases and boat-building.

Walnut

Common Name – Walnut
Tamil - Vaathumai kottai
English – Walnut, Persian walnut
Family – Juglandaceae
Binomial Name – *Juglans regia* Linn.,

A large tree; native of Iran. In India, it is grown in Kashmir, Himachal Pradesh, the Khasia hills and in the hills of Punjab and Uttar Pradesh. The beautiful trees are usually planted in rows. The outer limbs produce perfect nuts. The edible kernels are easily freed from the pericarps. The characteristic furrowed kernels are the cotyledons of the seeds, no endosperm being present.

Uses - The kernels are eaten raw. Walnuts yield excellent oil for table use. They retain their flavour when cooked and have a food value four times greater than meat. They are used in the preparation of candy and ice creams. The oil cake is a good feed for livestock.

The young fruits are pickled, a rich source of ascorbic acid. Mature kernels yield a fatty oil, walnut oil, used for edible purposes, small quantities for artist's oil colours, printing inks, varnishes and soap-making. Green hulls are used for dyeing and tanning. The leaves are astringent, tonic and anthelmintic. They yield an essential oil.

SPICES

Pepper

Common Name – Spices
Tamil - Milagu
English – Black pepper
Family – Piperaceae
Binomial Name – *Piper nigrum* Linn.,

A branching, climbing perennial shrub, mostly found cultivated in the hot and moist parts of India, Ceylon and other tropical countries. Branches stout, trailing and rooting at the nodes; leaves entire, 12.5-17.5 by 5.0-12.5cm., very variable in breadth, sometimes glaucous beneath, base acute rounded or cordate, equal or unequal; flowers minute in spikes, usually dioecious; fruiting spikes very variable I length and robustness, rachis glabarous; fruits ovoid of globose, bright red when ripe; seeds usually globose, testa thi, albumin hard.

Cultivation and harvesting - In India, pepper is cultivated mostly as a mixed crop in homestead gardens. Under this system, the vines are trained on to existing trees like jack, mango, coconut or arecanut. The vines receive intensive care and continue to be productive upto 60 or even 100 years. The vines also grown as in inter - or subsidiary crop along with other plantation crops like coffee, cardamom, arecanut, coconut and orange. This practice is more common in North Kanara, Coorg and parts of Kerala.

The pepper vine is found growing upto an altitude of 1,500 m., but thrives best at about 500 m. Pepper requires a warm and humid climate. It thrives in places where the annual rainfall is well over 200 cm. Pepper plants are pollinated by rain-water and consequently satisfactory yields are obtained when frequent showers of rain occur during blossoming period. The pepper vine can be propagated either vegetatively or by seeds. Vegetative propagation is universally adopted. However, it is believed that the plants raised from seeds live longer, and give heavier crops in later years than plants raised vegetatively.

An adult vine yields annually 0.5 kg. dried fruits under Indian conditions. The yield goes on increasing as the vines get older upto about the tenth year. Usually there are two crops in a year. One in August-September and the other in March-April. When the fruits are ready for harvest, the whole spikes are removed from the vines with the aid of a ladder. They are dried in the sun for 3-4 days, and the fruits separated from the stalks by beating the dried spikes with a stick or by trampling under foot. When completely dry, the outer skin of the Is become black and wrinkled. It is estimated that 100 kg. of green pepper roughly yield 33kg. of dried pepper. India, the average yield of commercial black pepper has been found to vary from 110 to 335 kg. per hectare.

Uses - Pepper fruits are used as spice or condiment. In Kerala, fresh green pepper is sometimes used for preparing pickles. Black and white pepper make the major condiments employed for seasoning freshly cooked and prepared foods. In U.S.A. and other European countries they are used mainly for preserving

meat. The whole fruits are added to pickles, certain types of sausages etc., but the bulk of the product is generally ground before use. Black pepper is mostly used for its characteristic aroma and pungent taste. White pepper is less pungent. The aromatic odour of pepper is due to a volatile oil, while the pungent taste is caused by an oleoresin. An alkaloid is also present. Pepper stimulates the flow of saliva and the gastric juices and has a cooling effect. In modern Indian medicine, it is much employed as an aromatic stimulant in cholera, weakness following fevers, coma, etc., as a stomachic in dyspepsia, as an antiperiodic in malarial fever.

Chemical composition of different type of black pepper (*Piper nigrum* Linn.) varies. MO! 8.7-14.1%; total nitrogen 1.55-2.60%; nitrogen in non-volatile ether extract 2.70-4.22%; volatile ether extract 0.3-4.2%; non-volatile ether extract 3.9-11.5%; alcohol extract 4.4-12.0%; starch 28.0-49.0%; ash 3.6-5.7%; crude fibre 8.7-18.0%; crude piperine 2.8-9.0%; piperine 1.7-7.4%; Alkaloid piperine makes the biting taste.

Clove

Common Name – Clove
Tamil - Kiramber, ilavanga ap-pu
English – Clove
Family – Myrtaceae
Binomial Name – *Syzygium aromaticum* Linn.,

Clove is the dried unopened flower bud of *Syzygium aromaticum* a medium statured, cone shaped ever green tree belonging to the Family—Myrtaceae. Clove tree attains a height of 10 to 12 metres. The stem is usually forked near its base with two or three main branches. Smaller branches are slender, rather, brittle and covered with grey bark. The leaves appearing in pairs, are lanceolate, acute at both ends and are of dark shining green colour. The aromatic nature of the leaves is due to numerous oil glands found on their under-surfaces. The power outs and greenish when fresh and are borne on ends, which are picked green and dried in the sun till they become dark brown, form the 'clove of commerce. The buds have slightly cylindrical base and are surmounted by the plump ball like unopened corolla which is surmounted by the four toothed calyx. If the bud is left unpicked, the flower develops after fertilization into a fleshy, purple and one-seeded oval fruit as 'Mother of clove'. The fruit is about 2.5 cm. long and 1.25 cm. in width. The seed is oblong, rather soft in texture and grooved on one side. The leaves, unripe fruit and broken clove, including the stalk are all aromatic and yield an essential oil.

Soil and climate - Deep and rich loams with high humus content are best suited for clove cultivation. In India, clove has developed well in the open sandy loams and the laterite soils of South Kerala region. But the best growth is seen in black loams of the semi abhors water logging and, therefore, perfect drainage is essential. Clove is strictly a tropical plant and it requires a warm humid climate.

Propagation – Clove is propagated through seed. Usually the seeds become available for sowing from August and October. The seeds lose their viability within one week after harvest under normal conditions and hence it is necessary to sow them immediately after collection from the tree. The seeds can be sown with or without the fruit coat. Raised nursery beds are prepared in a shady place and the seeds are sown in rows adopting a spacing of about 12cms.

Harvesting – the flowering season is Septemer-October in the plains and December-January in high altitudes. The buds are ready for harvest in about four months. There is considerable variation in the yield of clove. Under favourable conditions well grown trees may yield as much 4 to 8kg of cloves.

Uses - Clove is very aromatic and fine flavoured and imparts warming qualities, m an homes, it is used as a culinary spice as the flavour blends well with both sweet and savoury dishes. Clove is used for flavouring pickle, curries, ketchup and sauces. It is highly valued in medicine as a carminative, aromatic and stimulant. Clove has stimulating properties and is one of the ingredients of betel chewing. In Jawa, clove is used in preparation of a special brand of cigarette for smoking. The essential oil which is obtained by distilling clove with water or steam, has even more uses. It is used medicinally in several ways. The chief constituent of the oil eugenol, is extracted and used as an imitation carnation in perfumes.

WOOD

Teak

Common Name – Teak
Tamil - Tekkumaram
English – Teak
Family – Verbenaceae
Binomial Name – *Tectona grandis* Linn.,

A large, deciduous tree, indigenous to both peninsulas of India. In Western India it does not extend far beyond the Mhye. In Central India it attains its northern most point in the Jhansi district, and from that point the line of its northern limit continues in a south-east direction to the Mahanadi river in Orissa. It is found wild in Assam. It is, however, cultivated throughout Bengal, Assam and Sikkim, and in North-West India without difficulty as far as Saharanpur. The forests richest in large timber on the west side of the Peninsula are the Travancore, Anamally, Wynad, Southwest Karnataka and North Kanara forests. In the centre of the Peninsula the Godavary forests are most compact and valuable.

Structure and utility of wood - Sapwood white and small; the heartwood when cut green, has a pleasant and strong aromatic fragrance and a beautiful dark golden yellow colour, which on seasoning soon darkens into brown, mottled with darker streaks. The timber retains its fragrance to a great age, the characteristic odour being apparent whenever a fresh cut is made. It is moderately hard, exceedingly durable and strong, does not split, crack, warp, shrink or alter its shape when once seasoned; it works easily, takes a good polish. Teak owes its chief value to its great durability which is ascribed, probably with justice, to the circumstance that it contains a large quantity of us matter which fills up the pores and resists the action of water. (At the Karli caves near Poona the teak-wood-work, two thousand years old, seems perfectly good at the present day).

The many uses of teak are well known. In India it is highly prized for construction, ship building, and for making sleepers and furniture. Wood is very durable and resistant to fungi. It is used for poles, beams, trusses, columns, roofs, doors, window frames, flooring, planking, panelling, stair cases, and other constructional work. It is one of the best timbers for furniture and cabinet making, wagons and railway carriages. Due to its better shape-retention ability, teak is popular in marine constructions and is a class by itself for boat and ship-building, particularly for decking. On account of its resistance to chemicals, teak articles are used in chemical industries and for making laboratory bench-tops; suitable for casks and vats for shipping corrosive liquids and for storing vegetable oils, fruit syrups, chutneys, etc. Teak is employed for sound-boards of musical instruments, keys, etc., and for different grades of plywood. Wood waste in the form of wood-shavings and sawdust is used for chip-boards, fibre-boards and plastic-boards.

Pine

Common Name – Pine
Tamil - Tevatarumaram
English – Long leaved Pine
Family – Pinaceae
Binomial Name – *Pinus roxburghii* Roxb.,

The principal source of Indian turpentine oil is *Pinus roxburghii* Roxb., an important Himalayan conifer. It grows abundantly in the sub-montane regions of the Himalayas upto 5,000 feet. Turpentine oil is obtained by the distillation of oleoresin (an exudate obtained by wounding trees) of various conifers. The approximate annual supplies of oleoresin amount to 4-8 lac gallons. The oleoresin contains 14-20 per cent oil. There are three large factories distilling oil at Bareilly, Nahn and Miran Sahib besides a large number of small factories at Hoshiarpur, Someshwar, Bhoali, Rishikesh and Bareilly.

Uses - The oil is used in the manufacture of varnishes, lacquers, disinfectants and paints. It is also used in the manufacture of linoleum, sealing-wax, oil cloth, lubricating compounds and several kinds of inks.