

CORE PAPER- VIII

**PLANT SYSTEMATICS ECONOMIC BOTANY
AND
ETHNOBOTANY**

UNIT - IV

Amaranthaceae

Systematic position

Kingdom: Plantae
Class : Dicotyledons
Sub class : Monochlamydeae
Series : Curvembryeae
Order : Caryophyllales
Family : Amaranthaceae

Distribution of Amaranthaceae

The family Amaranthaceae is commonly called 'Amaranth family'. It is a small family comprising 65 genera and 850 species which are chiefly represented in tropical and temperate regions. In India it is represented by 50 species.

Vegetative characters

Habit: Mostly herbs, rarely shrubs or undershrubs (*Deeringia*), annual or perennial (*Bosia*, *Ptilotus*).

Root: A branched tap root

Stem: Aerial, herbaceous or woody, erect or straggling, cylindrical, or angular, branched, solid, hairy, green or striped green.

Leaves: Simple, alternate or opposite, petiolate, exstipulate, reddish in colour, unicostate reticulate venation.

Floral characters

Inflorescence: Axillary or terminal spikes (*Achyranthes*, *Digera*). Some times in cymose panicles.

Flower: Bracteate, sessile or sub-sessile, bracteolate, bracteoles two, actinomorphic, hermaphrodite or unisexual hypogynous, small inconspicuous, green or variously coloured.

Perianth: Usually five tepals, free or united, sometimes two or three (*Amaranthus*), dry membranous, valvate or twisted, sometime, hairy, green or coloured, persistent, inferior.

Androecium: Stamens 5 or 3 (*Amaranthus*), free or united, staminodes sometimes present, introrse, ditheous or monotheous (*Alternanthera*). In *Achyranthes* 5 fimbriated scales alternate with 5 fertile stamens.

Gynoecium: Bicarpellary, or tricarpellary; syncarpous, ovary superior, unilocular, usually one campylotropous ovule; basal placentation; style short or filiform; stigma 2 or 3.

Fruit: Dry one seeded achene or several seeded capsule or one to several seeded berry.

Floral formula:

$\oplus \ominus P_{3-5 \text{ or } (3-5)} A_5 \underline{G_{(2-3)}}$

Economic Importance

The Amaranthaceae is of little economic importance.

Food: Seeds of *Amaranthus caudatus* are edible. *Amaranthus cruentus* and *A. frumentacea* are raised as cereals by primitive tribes in Tropical Asia. The leaves of *Amaranthus viridis*, *A. spinosus* and *A. tricolor* are also used as vegetables.

Medicinal: *Achyranthes aspera* is diuretic and purgative. Decoction of *Aerua tomentosa* is used to remove swellings. The stem and leaves of *Alternanthera* are used in snake-bite. The flowers and seeds of *Digera muricata* (*syn. D. arvensis*) are given for urinary discharges.

Dye: Leaves of *Bosia amherstiana* yield a black dye. The fruit juice of *Deeringia* is a substitute for red ink.

Weeds: Some genera are weeds e.g. *Amaranthus*, *Celosia*, *Digera*, *Achyranthes*, *Gomphrena* etc.

Ornamentals: *Celosia cristata* (Cockscomb), *Gomphrena globosa* (Globe amaranthus) are cultivated in gardens.

Common plant of the family

1. *Aerua javanica*:
2. *Achyranthes aspera*:
3. *Alternanthera sessilis*:
4. *Bosia amherstiana*:
5. *Celosia* (Cockscomb):
6. *Digera muricata*:
7. *Gomphrena globosa*:
8. *Cyathula tomentosa*:
9. *Amaranthus viridis*

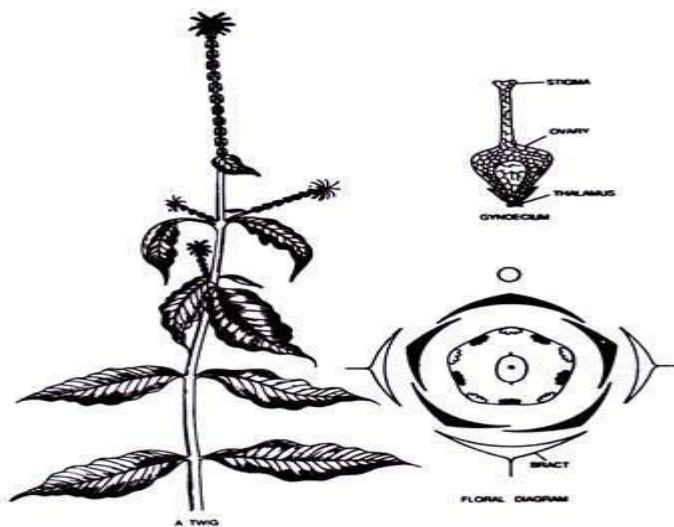


Fig. 90.1. *Achyranthes aspera*.

Euphorbiaceae

Systematic position

Kingdom: Plantae

Class : Dicotyledons

Sub class : Monochlamydeae

Series : Unisexuales

Order : Euphorbiales

Family : Euphorbiaceae

Distribution: There are about 283 genera and 7,300 species in this family.

The plants of this family are found throughout the world. However, they are not found in arctic regions. In our country the family is represented by several genera such as, *Euphorbia*, *Ricinus*, *Phyllanthus*, *Croton*, *Pedilanthus*, etc. In the desert regions of Africa and elsewhere the family is represented by cactus-like plants of different species of *Euphorbia*. Heath like *Euphorbias* are quite common in Australia. In Britain only two genera, i.e., *Euphorbia* and *Mercurialis* are found, which are represented by sixteen and two species respectively.

Habit: The plants exhibit great variation in their habit. The plants may be herbs, shrubs or trees. *Euphorbia hirta*, *E. thymifolia*, *E. helioscopica*, *E. peplus*; *E. heterophylla*, *E. cristata*, *E. elegans*; *Phyllanthus niruri*, *Croton sp.*, *Acalypha indica*, etc., are annual or perennial herbs. *Euphorbia pulcherrima*, *E. splendens*, are beautiful shrubs. *Pedilanthus sp.*, and *Jatropha sp.*, are shrubby plants.

Euphorbia royleana, *E. tirucalli* are cactus like shrubs. *Ricinus communis* (Arand) is a tall annual and becomes small tree-like in habit. The tree habit of the family is represented by *Phyllanthus emblica* (Amla), *Bischofia javanica*, *Putranjiva roxburghii*, etc.

Havea brasiliensis (rubber tree) is a large tree 60 to 100 feet in height and 8-12 feet in girth. Species of the genus *Tragia* are tropical climbers. Majority of the members of the family possess large laticiferous vessels which contain latex.

Root: Tap and branched. The roots of *Manihot utilissima* and *M. palmata* are tuberous and rich in starch.

Stem: Herbaceous or woody, erect, very rarely climbing as in a tropical genus *Tragia*. The species of *Xylophylla* possess flat phylloclades. The stem is branched. It may be cylindrical, angular or flat. Usually solid but sometimes hollow as in *Ricinus communis*. Many stems possess spines. In many *Euphorbia sp.*, the stems become fleshy, green and cactus like in appearance.

Leaves: The form and position of leaves are variable. The arrangement is usually alternate but sometimes they are opposite, e.g., *Euphorbia hirta*. In *Pedilanthus* the leaves are arranged alternately in the lower region of the plant whereas opposite in the floral region. Usually the leaves are simple but in some they are deeply incised, e.g., *Ricinus*, *Manihot*, etc. In many *Euphorbias*

the leaves are scaly and caducous. In many cases the leaves are reduced to spines. In few cases the leaves are replaced by cladodes. Usually the leaves are stipulate. In *Jatropha* sp., the stipules become branched and hair-like. In many *Euphorbia* sp., they are represented by glands or spines.

Floral characters

Inflorescence: The inflorescence varies greatly. It may be racemose or cymose or sometimes complex. In *Euphorbia*, the inflorescence is peculiar but very characteristic and known as cyathium. This is the modification of a cyme. In cyathium inflorescence a large number of male flowers each represented by a stalked stamen are found arranged around a central stalked female flower. The female flower consists of gynoecium only.

The complete inflorescence looks like a single flower. The bracts are being arranged like a perianth. The bracts are so united that they form a cup-like structure. In *Acalypha* the inflorescence is catkin type. In *Croton and Ricinus* the flowers are arranged in terminal racemes. In *Jatropha* the inflorescence is of cymose type and the flowers are arranged in terminal cymes. In *Manihot* the flowers are being arranged in racemes.

Flowers: The flowers are always unisexual. They are much reduced and may be monoecious or dioecious. In *Euphorbia* sp., each male flower is represented by a single stalked stamen. The flowers are incomplete, regular, actinomorphic and hypogynous.

Perianth: Occasionally, both calyx and corolla are present, e.g., *Croton*. In majority of cases either calyx or corolla or both are absent. In *Ricinus communis* the calyx is present and the corolla absent. In *Euphorbia hirta* both the whorls of calyx and corolla are absent. In *Jatropha* sp., both calyx and corolla are present.

In *Acalypha indica* the perianth is represented by four minute sepaloid petals. In *Phyllanthus* only sepaloid perianth is present. In *Euphorbia* the perianth is absent or represented by tiny scaly structures.

The perianth consists of 4 to 5 petals. The calyx and corolla consists of 4 or 5 sepals or petals. The aestivation is valvate or imbricate.

Androecium: The number of stamens varies from one to many. Usually as many stamens are present as many perianth leaves. In *Euphorbia* a single stalked stamen represents a single male flower. In *Ricinus* sp., usually five stamens are present, each stamen is profusely branched. In *Jatropha* they are arranged in two whorls each of five stamens. In many the stamens are indefinite, e.g., *Croton*. The filaments may be free or united. The anthers are ditheous. They dehisce either by apical pores or by transverse or longitudinal slits.

Gynoecium: Three carpels (tricarpeal), syncarpous; the ovary is trilocular, superior. Each locule contains one or two pendulous, anatropous ovules. The placentation is axile.

Fruit: The fruits are schizocarpic. The fruits break violently and dehisce into one seeded cocci. Such type of fruit is termed regma which is characteristic of *Ricinus* sp. The sp., of *Trewia* and

Bridelia bear drupe fruit. *Phyllanthus emblica* also bears drupe.

Floral Formulae:

The floral formulae of different genera are as follows:

- Euphorbia* — ♂ K0, C0, A1
 ♀ K0, C0, G(3).
- Ricinus* — ⊕ ♂ K5, C0, A5 (branched)
 ⊕ ♀ K3, C0, G(3).
- Croton* — ⊕ ♂ K5, C5, A ∞
 ⊕ ♀ K5, C5, G(3).

1. *Ricinus communis*;

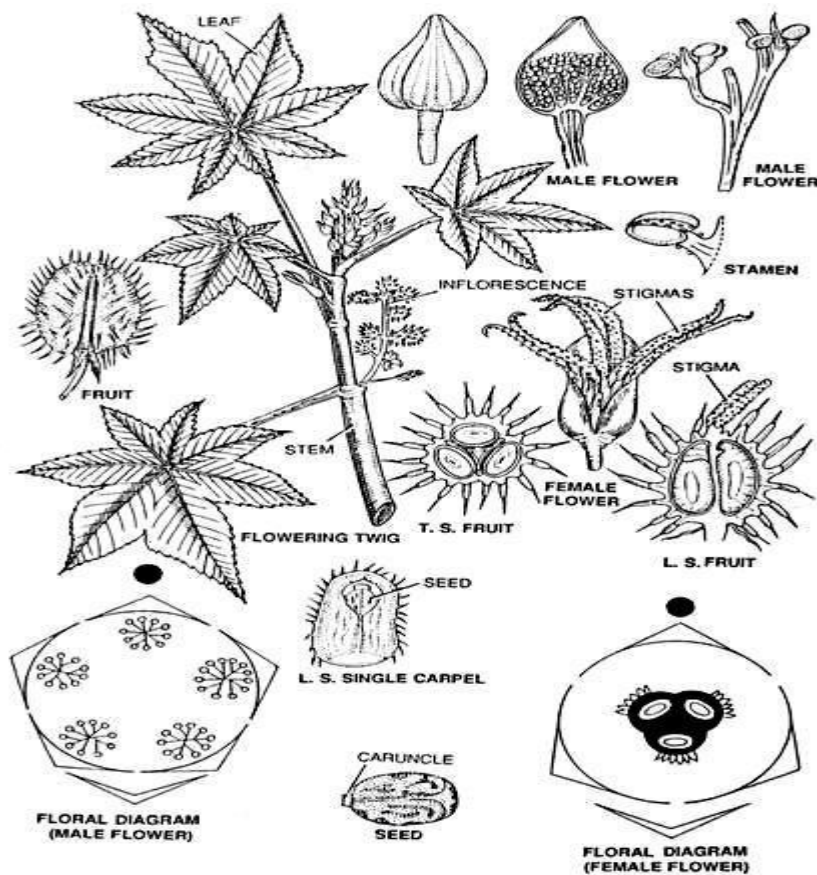


Fig. 17.2. Euphorbiaceae—*Ricinus communis* Linn., Eng., Castor oil plant; Verna. Arand.

Euphorbia hirta:

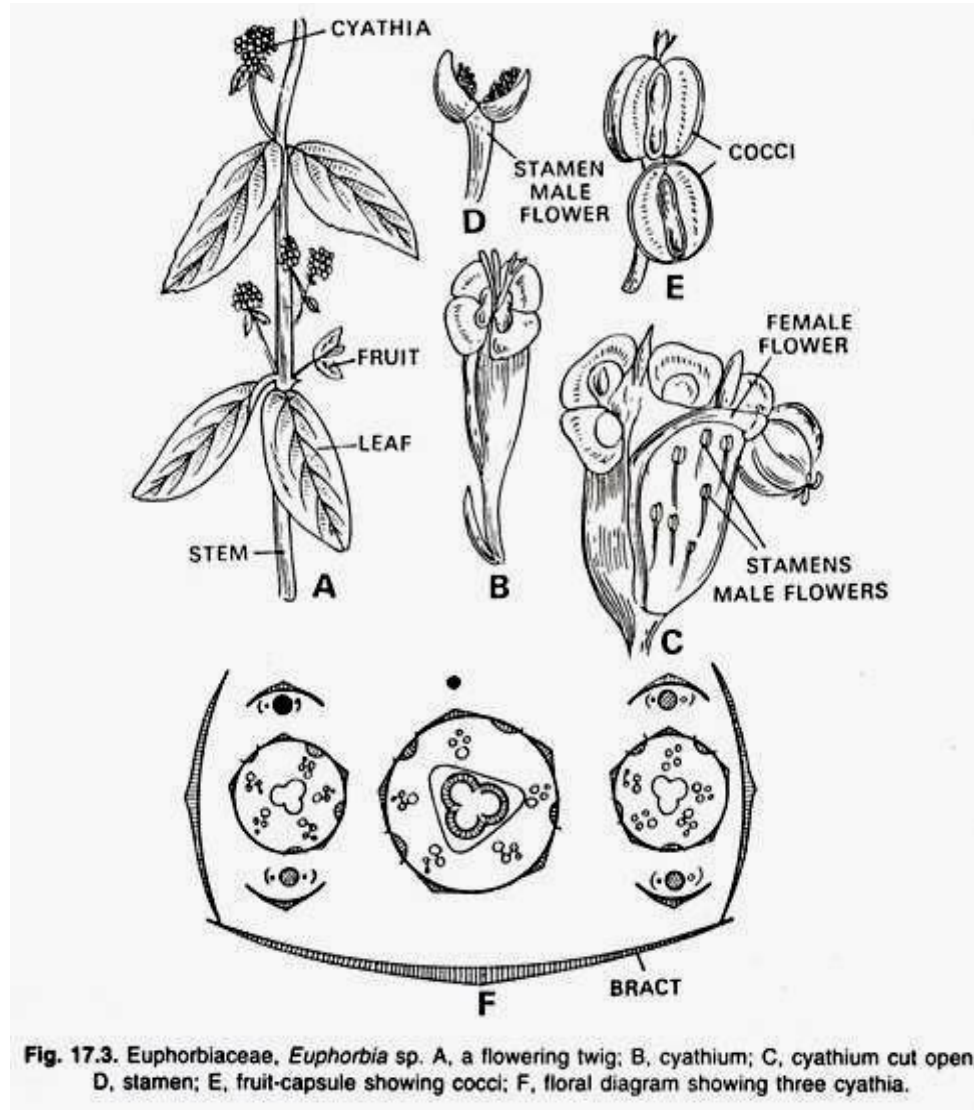


Fig. 17.3. Euphorbiaceae, *Euphorbia* sp. A, a flowering twig; B, cyathium; C, cyathium cut open; D, stamen; E, fruit-capsule showing cocci; F, floral diagram showing three cyathia.

Croton sparciflorus:

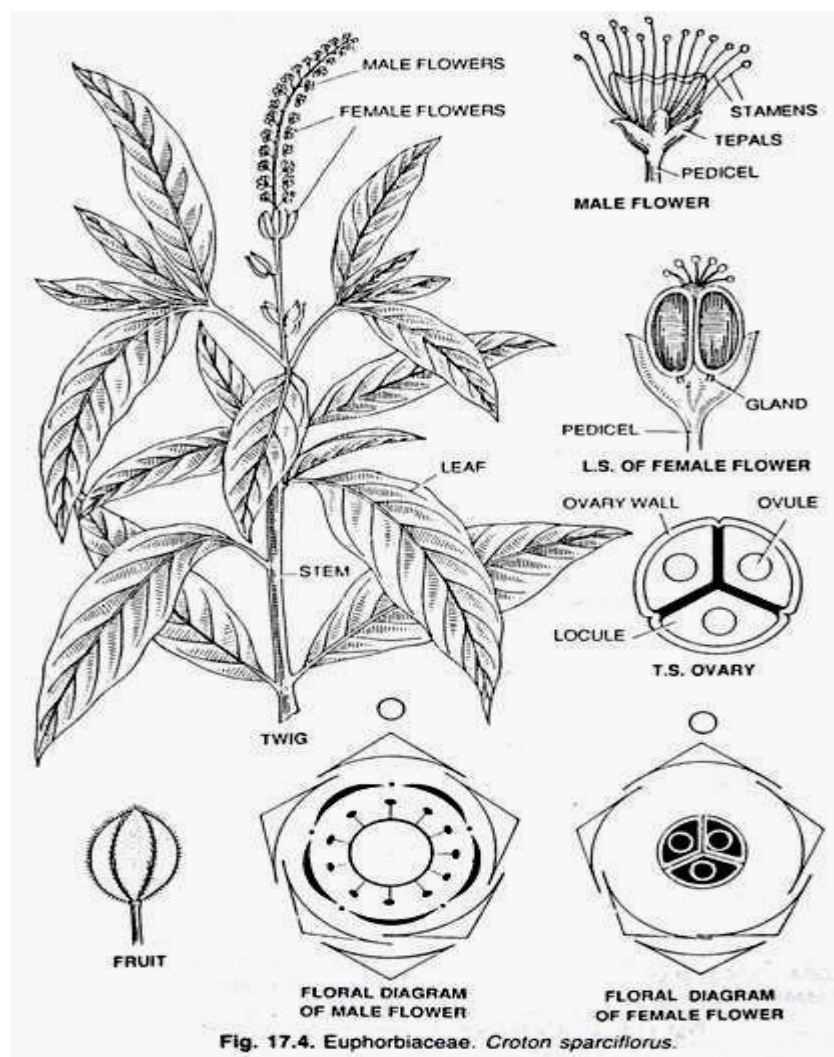


Fig. 17.4. Euphorbiaceae. *Croton sparciflorus*.

Phyllanthus reticulata;

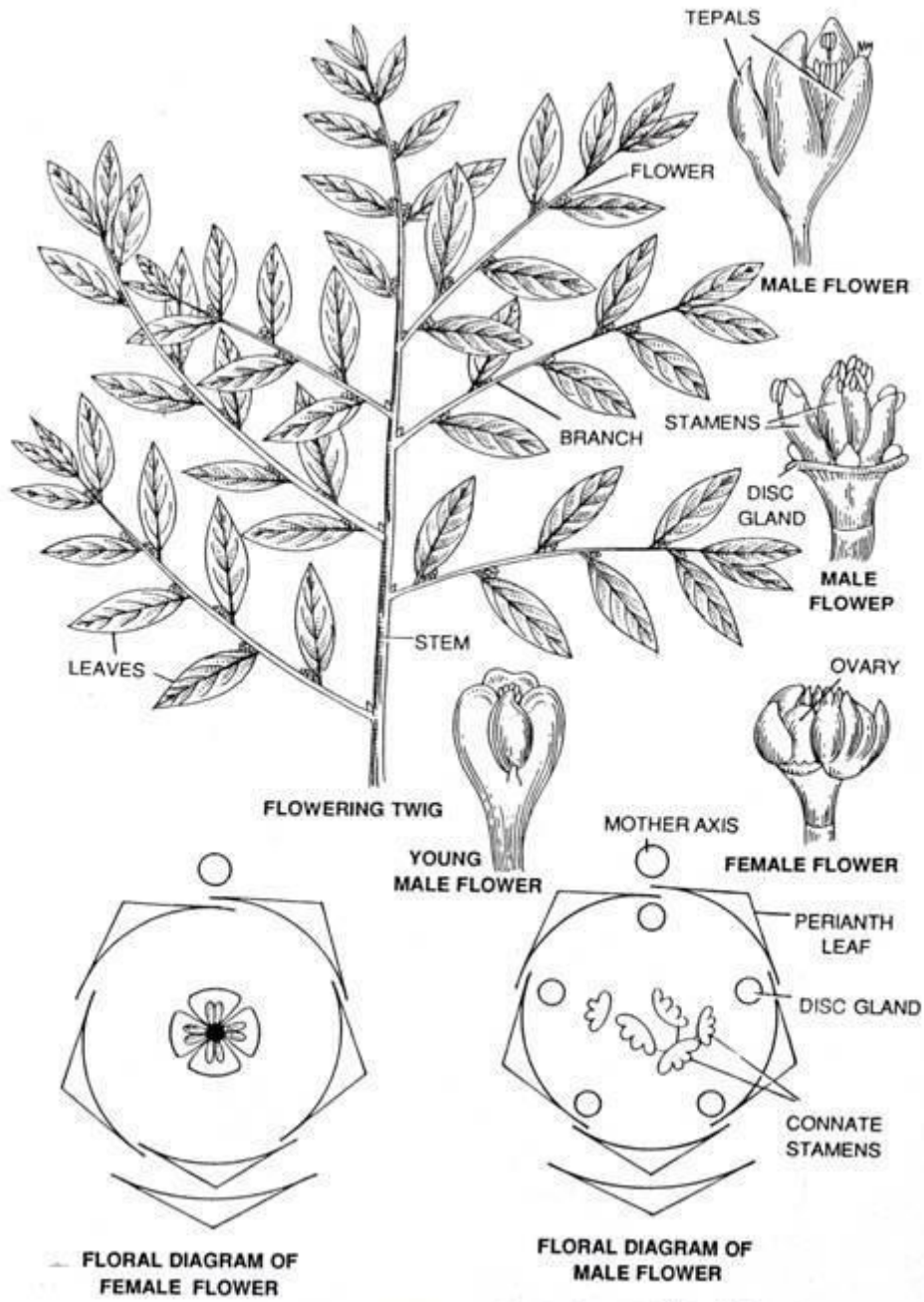


Fig. 17.5. Euphorbiaceae. *Phyllanthus reticulata* Poir.

Jatropha gossypifolia L. Vernat Bherenda:

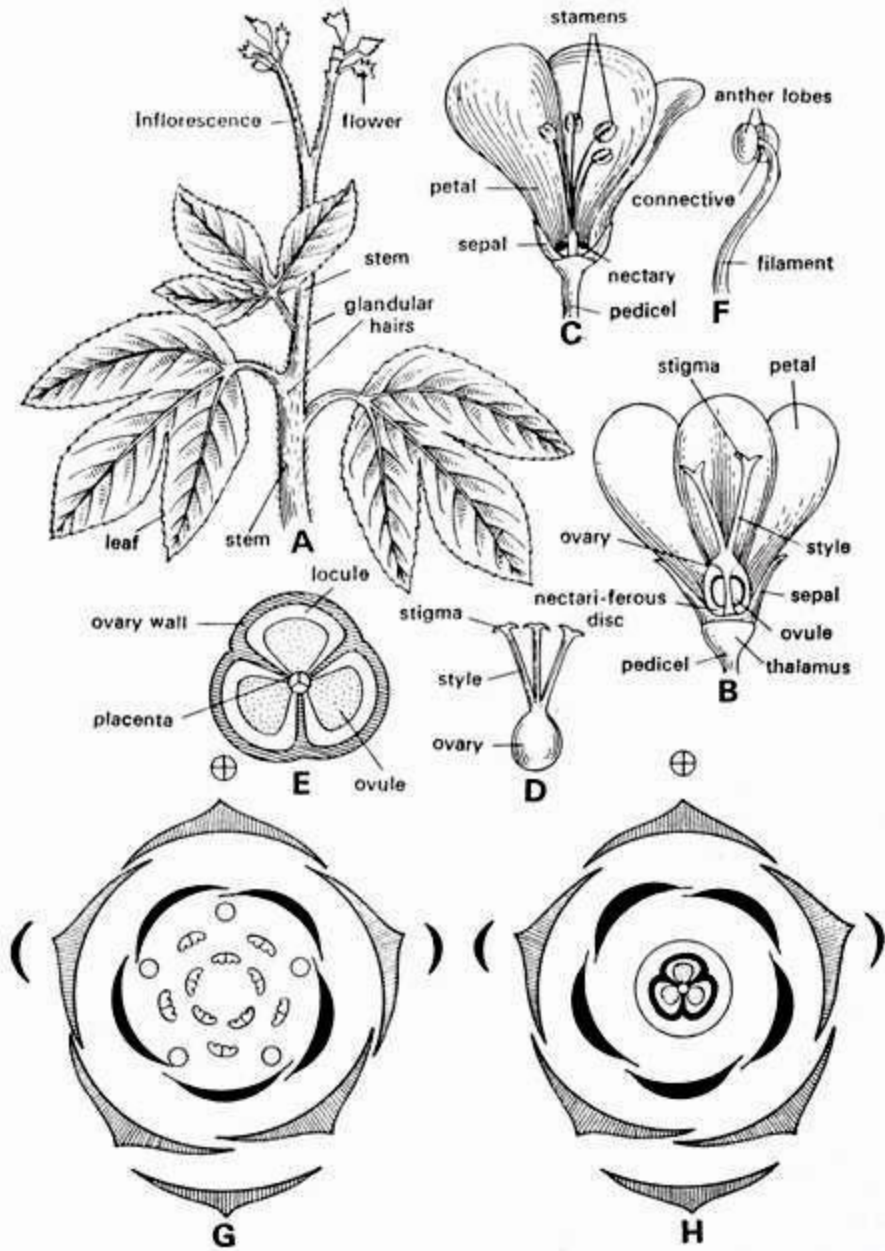


Fig. 17.6, Euphorbiaceae. *Jatropha gossypifolia* L. (Bherenda). A, flowering twig; B, L.S. of female flower; C, L.S. of male flower; D, gynoecium; E, T.S. of ovary; F, stamen; G, floral diagram of male flower, H, floral diagram of female flower.

Euphorbia pulcherrima:

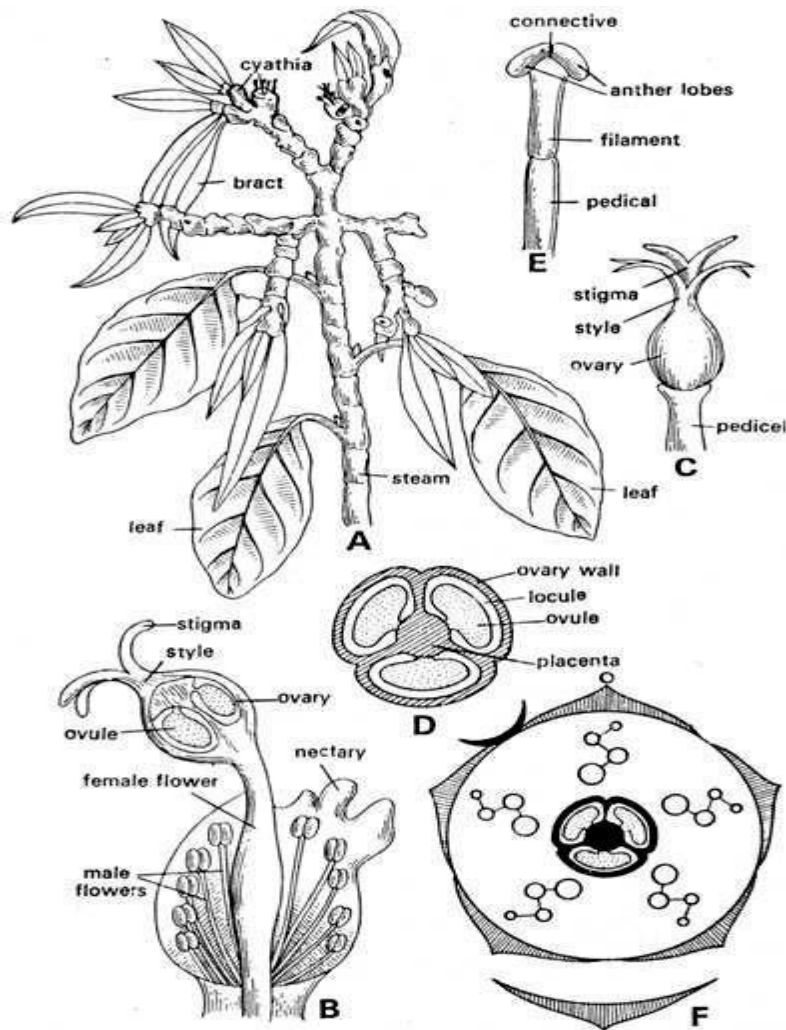


Fig.17.7. Euphorbiaceae, *Euphorbia pulcherrima* Willd (Lal patta). A. flowering twig; B. L.S. of cyathium; C. female flower, D. T.S. of ovary; E. male flower represented by a stamen; F. floral diagram of cyathium (inflorescence).

Economic importance

Acalypha hispida; An ornamental herb.

1. *Acalypha wilkesiana*- (Eng. -Garden *Acalypha*). Grown in the gardens as ornamental plant.

2. *Bischofia Javanica*; (Eng.-Bishop wood; Verna-Bhillar)- A tree. A red dye, obtained from the bark is used to stain rattan baskets. The bark is also used as a tan. The wood is extremely resistant to water effect and therefore, largely utilized in the construction of bridges and boats.

3. *Bridelia retusa*, (Verna.-Ekdania, Khaja)-A tree, found in Rajasthan, Madhya Pradesh, the

Western Peninsula and Bihar. The bark is used for tanning. The fruits are edible and the leaves are used as fodder.

4. *Cleistanthus collinus*' (Verna-Garari)-A small tree, found in Tamil Nadu, Malabar, Bihar, Orissa and Madhya Pradesh. The bark, leaves and green fruits are used as tan.

5. *Croton aromaticus*; An aromatic shrub or small tree found in Andhra Pradesh produces a gum-resin, which is used in varnishes.

6. *Croton oblongifolius*; (Verna-Chuka) – The seeds yield an oil, which is used as a purgative and also as an insecticide.

7. *Croton tiglium*; (Verna-Jamalgota)-A shrub or small tree, native of South East Asia but cultivated in Assam, Bengal and South India. The seeds are the source of croton oil, which is used as a purgative.

8. *Baccaurea courtallensis*: Found in the Western Ghats. The fruits are edible.

9. *Baccaurea sapida*- (Verna-Lathua)-Found in Assam, Bengal and Andaman Islands The fruits are edible.

10. *Chrozophora prostrata* (Verna-Subali)-The root ashes are given to the children for cough treatment. The seeds are used as a purgative.

11. *Baliospermum montanum*; (Verna-Danti)-The seeds are used as a strong purgative. The decoction of leaves is used in asthma.

12. *Euphorbia milii*; *Syn. E. splendens*; A small climbing shrub; native of Madagascar. Grown in gardens as ornamental.

13. *Euphorbia pulcherrima*-, *Syn. Poinsettia pulcherrima*', Eng-Poinsettia; (Verna.-Lal Patta)-A shrub, native of Central America. Grown as an ornamental.

14. *Euphorbia tirucalli*, (Verna.-Tohar)-Succulent spineless small tree, native of Africa. The roots are used for poisoning fish and birds.

15. *Euphorbia hirta*, (Verna.-Dudhi)-The plant is of medicinal value and used in many diseases of children and adults.

16. *Euphorbia thymifolia*; (Verna.-Chhoti dudhi)–The juice of leaves and seeds is used as a strong purgative. The juice is also used for remedy of ringworms and other skin diseases. It is an antidote for snake bite.

17. *Euphorbia royleana*- (Verna.-Thar)-The plants are used in hedges. The latex is used medicinally in several ways.

18. *Euphorbia antiquorum*- (Verna.-Tridhara, sehund)-The decoction of stem is used as a remedy of gout. The juice of the plant is also used as a strong purgative. The root bark is also used as a purgative.

19. *Glochidion zeylanicum*; (Verna.-Kumbalm)-The leaves are used in itches.

20. *Securinega leucopyrus*; Syn. *Phyllanthus leucopyrus*; *Flueggea leucopyrus* (Verna.- Hartho)- A large shrub or small tree, found in Uttar Pradesh, the Punjab, Maharashtra and Tamil Nadu. The fruits are edible.
21. *Jatropha curcas*; (Verna.-Safed arand)- A shrub or small tree, native of tropical America, now cultivated in Travancore. The seed oil is used for manufacturing candles, soaps and as a lubricant and for illumination. The seed oil is also used as a purgative. The tender shoots are edible. Oil also used as biodiesel.
22. *Jatropha gossypifolia*; (Verna.-Bherenda)-A shrub, native of Brazil. Cultivated as an ornamental.
23. *Jatropha hastate*; Grown as an ornamental for bright crimson flowers.
24. *Jatropha padagrica*; (Eng.-Gouty stemmed Jatropha)-Native of Panama, grown for its bright scarlet flowers.
25. *Manihot esculenta*; Syn. *M. utilissima*; (Eng.-Tapioca; Verna.-Sakarkand)- A small shrub; native of Brazil, now grown in Kerala, Tamil Nadu and Karnataka. The tapioca tubers are exploited commercially to obtain starch, sago, semolina and flour.
26. *Hevea brasiliensis*; (Eng.-Para rubber; Verna.-Rabar) – A tall tree; native of Brazil; now grown in Kerala, Tamil Nadu, Karnataka and North-Eastern Assam. The latex, obtained from the bark of the tree, is used for preparing rubber, which is used for tyres and inner tubes, waterproof clothing and various electrical goods.
27. *Mallotus philippinensis*- (Verna.-Kamala, Rauni)-A small tree found commonly in Bengal, Madhya Pradesh, Maharashtra and Orissa. The red dye, obtained from the surface of the fruits, is used for dyeing silk. Also used medicinally to remove thread worms and Ascaris.
28. *Cicca acida*; Syn. *Phyllanthus acidus*; *Averrhoa acida*; (Eng.-Stargoose-berry; Verna.-Hariphul)- A small tree cultivated in Bengal and South India for the edible fruits. The leaves are edible. The bark is used as a tan.
29. *Emblica officinalis*; Syn. *Phyllanthus emblica*; (Verna.-Amla)- A common tree with edible fruits. The fruits are also used in diarrhoea and dysentery. The bark, leaves and fruits are used in dyeing and tanning. The wood yields excellent charcoal. The pickle or jam is prepared from the fruits. The fruit is very rich in vitamin C.
30. *Emblica fischeri*; A small tree, found in South India. The fruits are edible.
31. *Kiganelia reticulate*; Syn. *Phyllanthus reticulatus*; (Verna.-Panjoli)- A climbing shrub, commonly found in Northern India. The roots are the source of a red dye.
32. *Putranjiva roxburgii*, (Eng.-Child-life tree; Verna.-Putranjiva)-A tall tree, grown as a hedge plant. The nuts are made in rosaries. The Hindus believe that if the hard stones of the fruits are made into rosaries and placed around the neck of the children, they keep them in good health. The seeds also yield an oil which is used for burning purposes. The leaves are used as fodder. The

leaves, fruits and stone of fruits are used medicinally in colds and fevers.

33. *Ricinus communis*; (Eng.-castor-oil plant; Verna-Arand)-A small tree, cultivated chiefly in Andhra Pradesh, Maharashtra, Karnataka and Orissa. The seeds are the source of castor-oil, which is mainly used as a lubricant and as a purgative. It is also used for transparent soap, textile soap, typewriter-inks, perfume, aromatics, varnishes and paints.

The seed cake is used as a fertilizer. The writing and printing-papers are made of the wood-pulp. Castor stems are used for strawboards and cheap wrappings.

34. *Tragia involucrate*; (Verna-Barhaita)-The roots and fruits are used medicinally.

Commen plants in Euphorbiaceae

- cassava (*Manihot esculenta*)
- castor-oil plant (*Ricinus communis*)
- copperleaf (genus *Acalypha*)
- croton (*Codiaeum variegatum*)
- jatropha (genus *Jatropha*)
- manchineel (*Hippomane mancinella*)
- mercury (genus *Mercurialis*)
- *Omphalea*
- *Phyllanthus*
- purging croton (*Croton tiglium*)
- rubber tree (*Hevea brasiliensis*)
- sandbox tree (*Hura crepitans* and *H. polyandra*)
- spurge (genus *Euphorbia*)
 - crown of thorns (*E. milii*)
 - poinsettia (*E. pulcherrima*)
 - slipper spurge (*E. tithymaloides*)
 - snow-on-the-mountain (*E. marginata*)
- tallow tree (*Triadica sebifera*)
- tung tree (*Vernicia fordii*)

Orchidaceae

Systematic position

Kingdom: Plantae
Class : Monocotyledons
Series : Microspermae
Order : Orchidales
Family : Orchidaceae

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 is having great variety of flowers in shape, longevity and beauty.

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, zygomorphic, bisexual or rarely unisexual, epigynous, trimerous, mostly resupinate i.e. twisted to 180° or upside down.

Perianth: Tepals 6, in two whorls of each, outer 3 tepals (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 spurred, tubular, strap-shaped or butterfly shaped or variously branched and contributing most to the oddity and beauty of the flower.

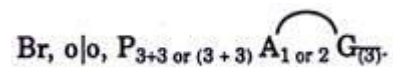
The labellum is actually posterior it comes to lie on the anterior side of the flower due to twisting of the inferior ovary through 180° or by the bending back of pedicel over the apex of the stem.

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*), bithecal, 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 trilobular 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.

Floral formula:



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 epidendreaeas* are used as vermifuge.
- 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).

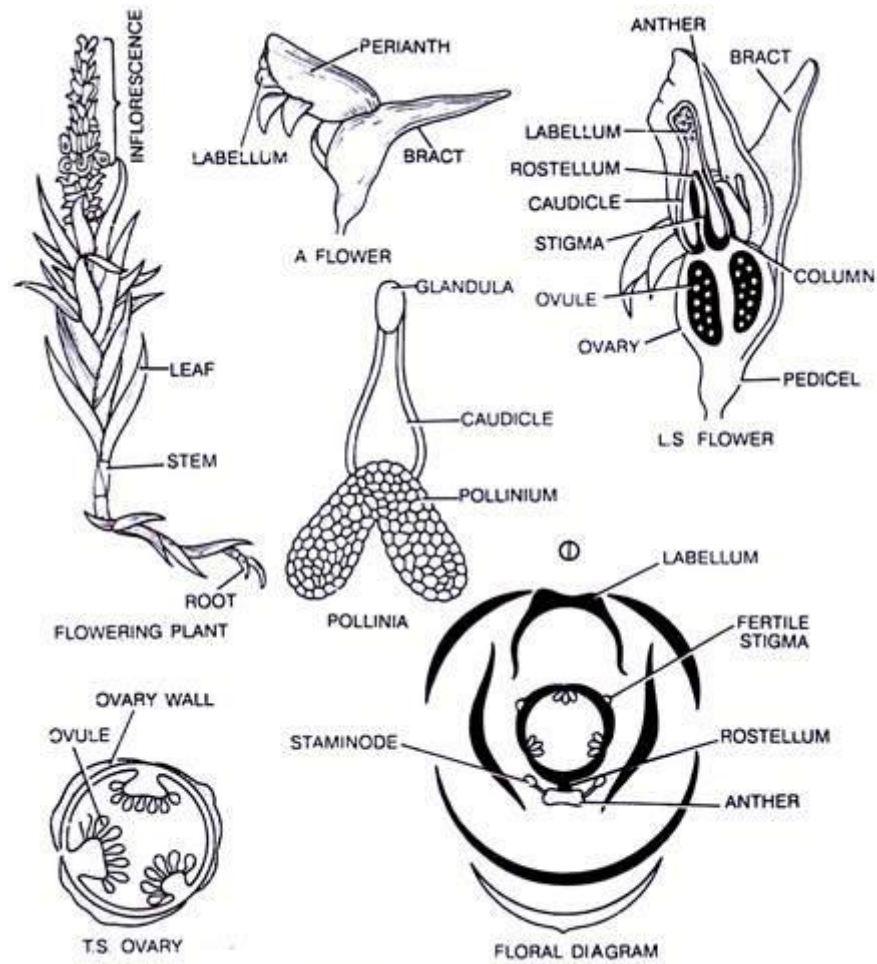


Fig. 100.1. *Zeuxine strateumatica* L.

Zeuxine strateumatia

Common plants

- bucket orchid (*Coryanthes*)
- *Bulbophyllum*
- butterfly orchid (various genera)
- *Calanthe*
- *Calopogon*
- *Cattleya*
- *Coelogyne*
- coralroot (*Corallorhiza*)
- *Cymbidium*
- *Dactylorhiza*

- *Dendrobium*
- *Disa*
- donkey orchid (*Diuris*)
- dragon's mouth (*Arethusa*)
- *Epidendrum*
- fairy slipper (*Calypso bulbosa*)
- frog orchid (*Dactylorhiza viridis*)
- greenhood (*Pterostylis*)
- helleborine *Cephalanthera* and *Epipactis*)
- jewel orchid ()
- ladies' tresses (*Spiranthes*)
- lady's slipper (*Cypripedioideae*)
- *Laelia*
- lizard orchid (*Himantoglossum hircinum*)
- *Lycaste*
- *Masdevallia*
- *Maxillaria*
- moth orchid (*Phalaenopsis*)
- *Odontoglossum*
- *Oncidium*
- *Ophrys*
- *Orchis*
 - man orchid (*O. anthropophora* and *O. italica*)
- *Pleurothallis*
- *Pogonia*
- rein orchid (*Platanthera*)
- *Serapias*
- spider orchid (*Brassia* and *Caladenia*)
- sun orchid (*Thelymitra*)
- twayblade (*Liparis* and *Neottia*)
 - bird's nest orchid (*N. nidus-avis*)
- *Vanda*
- *Vanilla*
- *Zygopetalum*

Liliaceae

Systematic position

Kingdom: Plantae
Class : Monocotyledons
Sub class : Liliidae
Series : Coronarieae
Order : Liliales
Family : Liliaceae

Distribution of Liliaceae

It is commonly called “Lily family”. It includes 250 genera and 4000 species, which are world wide in distribution. In India it is represented by 169 species.

Vegetative characters:

Habit: Mostly herbs (*Asphodelus*), perennating by rhizome (*Aloe*), bulb (*Lilium*, *Tulipa*, *Allium*), tree (*Dracena*), climber (*Asparagus*, *Smilax*), xerophytic plants like *Yucca*, *Aloe*; cladodes in *Asparagus* and *Ruscus*.

Root: Fibrous adventitious, sometimes tuberous (*Asparagus*).

Stem: Herbaceous, or woody, solid or fistular, underground; aerial climbing or erect; underground stem may be corm, bulb or rhizome. In *Ruscus* and *Asparagus* aerial stems bear phylloclades (modified leaf-like branches), corm (*Colchicum*); secondary growth in *Yucca*. *Dracaena*, *Aloe*.

Leaves: Alternate, opposite or whorled, radical and cauline, exstipulate, sessile or petiolate, sheathing leaf base; shape is variable scale-like (*Asparagus*), thick succulent and mucilaginous in *Aloe*, broad in *Phormium tenax*. In *Smilax* stipulate and stipules are modified into tendrils. Venation is usually parallel but reticulate in *Smilax* and *Trillium*.

Floral characters:

Inflorescence: Variable-solitary (*Tulipa*, *Fritillaria*), paniced raceme (*Asphodelus*), cymose umbel (*Allium*, *Smilax*), solitary axillary (*Gloriosa*).

Flower: Pedicellate, actinomorphic or zygomorphic (*Lilium*, *Hemerocallis*), hermaphrodite or unisexual in *Smilax*, *Ruscus*; hypogynous, complete or incomplete (in unisexual flowers), trimerous rarely 2 or 4-merous (*Maianthemum*, *Paris*).

Perianth: 6, in two whorls of three each, polyphyllous (*Lilium*, *Tulipa*) or gamophyllous (*Aloe*, *Asparagus*) and of various shapes; petaloid or sepaloid; imbricate in bud, usually valvate aestivation, perianth may be scarious or membranous.

Androecium: Stamens 6 or 3 (*Ruscus*), 8 in *Paris*; polyandrous, epiphyllous, antiphyllous, filaments long, anthers versatile or basifixed, dithecal, introrse or extrorse. In *Ruscus* outer whorl of stamens is reduced to staminodes.

Gynoecium: Tricarpellary, syncarpous, ovary superior or half inferior, trilobular or unilocular with two ovules, axile placentation, style simple; stigma trilobed or 3-parted.

Fruit: A berry (*Asparagus*, *Smilax*), capsule (*Asphodelus*).

Floral formula: $\oplus \text{ } \overline{\text{P}}_{3+3 \text{ or } (3+3)} \text{A}_{3+3} \text{G}_{(3)}$.

Economic Importance of Liliaceae:

- 1. Food:** *Allium cepa* (Onion), *Allium sativum* (Garlic) and *Asparagus* are edible and used as food.
- 2. Medicinal:** *Smilax*, *Aloe*, *Gloriosa*, *Veratrum*, *Colchicum*, *Scilla* and *Urginea* yield useful drugs. Rat poison is obtained from *Urginea* and the bulbs of *Scilla*. *Aloe vera* yields "Aloin". The roots of *Asparagus* (*H. Satavaer*) yields a tonic. From *Colchicum*, colchicine is obtained.
- 3. Fibres:** *Yucca*, *Phormium tenax* yield fibres of commerce.
- 4. Resin:** *Dracaena* and *Xanthorrhoea* yield resin. From the acrid resin of *Xanthorrhoea* sealing wax is prepared.
- 5. Ornamentals:** The common cultivated garden plants are *Tulipa*, *Lilium*, *Gloriosa*, *Aloe*, *Ruscus*, *Dracaena*, *Asparagus*, *Yucca*, *Hemerocallis* etc.

Common plants of the family:

- 1. *Allium***
- 2. *Aloe***
- 3. *Asphodelus*:**
- 4. *Asparagus*:**
- 5. *Colchicum* (Meadow saffron):**
- 6. *Dracaena*:**
- 7. *Fritillaria*:**

8. *Gloriosa* (Glory lily):

9. *Ruscus*:

10. *Smilax*:

11. *Tulipa*:

1. *Asphodelus tenuifolius*

Allium cepa

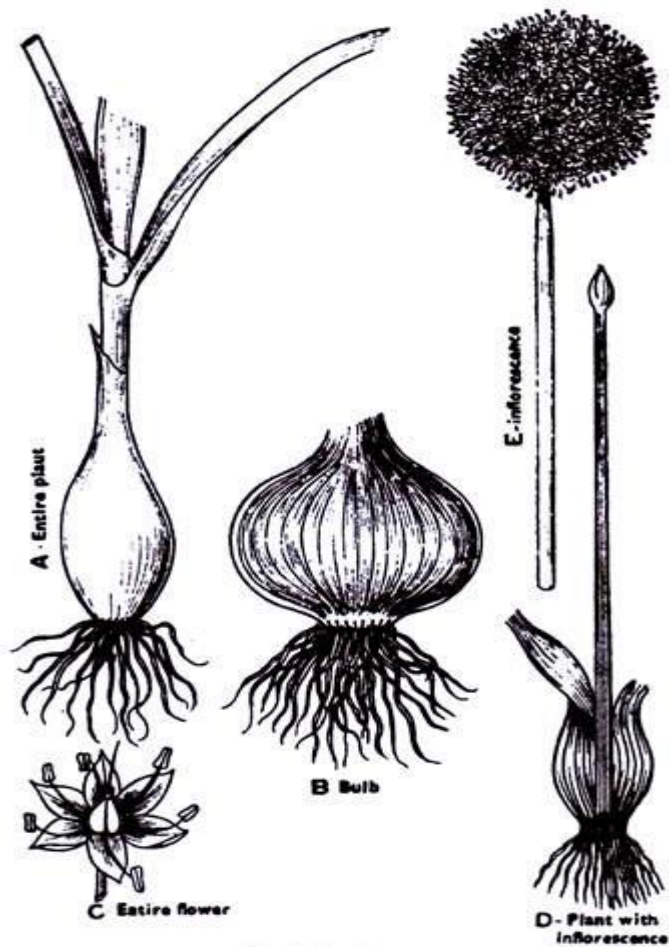


Fig. 107.2. *Allium cepa*.

Poaceae

Systematic position

Kingdom: Plantae

Class : Monocotyledons

Series : Glumaceae

Order : Graminales

Family : Poaceae

Distribution of Poaceae

The family is commonly known as grass family. It is one of the largest among the angiospermic families. It consists of 620 genera and 6,000 species. The members are cosmopolitan in distribution. The plants represent all the 3 ecological types as hydrophytes, xerophytes and mesophytes. In India it is represented by 850 species.

Vegetative characters:

Habit: Herbs, annuals or perennials or shrubs, sometimes tree like (*Bambusa, Dendrocalamus*).

Root: Adventitious, fibrous, branched, fascicled or stilt (*Zea mays*).

Stem: Underground rhizome in all perennial grasses, cylindrical, culm with conspicuous nodes and internodes, internodes hollow, herbaceous or woody, glabrous or glaucous, vegetative shoots are arising from the base of aerial stem or from underground stems are called tillers.

Leaves: Alternate, simple, distichous, exstipulate, sessile, ligulate (absent in *Echinochloa*), leaf base forming tubular sheath, sheath open, surrounding internode incompletely, ligule is present at the junction of the lamina and sheath, entire, hairy or rough, linear, parallel venation.

Floral characters:

Inflorescence: Compound spike which may be sessile or stalked. Each unit of inflorescence is spikelet. The spikelets are arranged in various ways on the main axis called **rachilla**. A compound inflorescence may be spike of spikelets (*Triticum*), panicle of spikelets (*Avena*).

The spikelet consists of a short axis called rachilla on which 1 to many sessile or short stalked flowers are borne. The florets may be arranged in alternate or opposite manner on the central axis.

At the base of rachilla two sterile scales, called glumes, are present. The glumes are placed one above the other on opposite sides. The lower one is called first glume and the upper is called second glume. Both the glumes are boat shaped and sterile. Above the glumes a series of florets are

present. Each floret has an inferior palea or lemma and above it a superior palea. The lemma frequently bears a long, stiff hair called awn.

Flower: Bracteate and bracteolate, sessile, incomplete, hermaphrodite, or unisexual (*Zea mays*), irregular, zygomorphic, hypogynous, cyclic.

Perianth: Represented by membranous scales called the lodicules. The lodicules are situated above and opposite the superior palea or may be absent, or many (*Ochlandra*), or 2 or 3.

Androecium: Usually stamens 3, rarely 6 (*Bambusa*, *Oryza*) and one in various species of *Anrostis*, *Lepturus*; polyandrous, filaments long, anthers dithecal, versatile, linear, extrorse; pollen grains dry.

Gynoecium: Monocarpeal, according to some authors carpels 3, of which 2 are abortive, ovary superior, unilocular with single ovule, basal placentation, style short or absent; stigmas two feathery or papillate and branched.

Fruit: Caryopsis (achene with pericarp completely united or adherent with the seed coat) or rarely nut

Floral formula: $0 \mid 0 \quad \text{♂} P_{0 \text{ or } 2} \text{ (Lodicules)} A_{3 \text{ or } 6} G_{\underline{1}}$

Economic Importance of Poaceae:

The family stands first and foremost in respect of economic importance in whole of Angiosperms. The staple food grains of the population of world .

Food: *Triticum aestivum*, *Oryza sativa*, *Zea mays* (Maize), *Hordeum vulgare* (Jaw), *Sorghum vulgare* (Jowar), *Avena sativa* (Oats), *Pennisetum typhoides* (Bajra) are cultivated for cereals and food grains.

Fodder: Many grasses as *Cynodon dactylon*, *Panicum*, *Cymbopogon*, *Agrostis*, *Poa* are grown for fodder.

Sugar: *Saccharum officinarum* (Sugarcane; *H. Ganna*) is cultivated for gur and sugar.

Building material: Some species of *Bambusa* e.g. *B. tulda*, *B. vulgaris* are used for scaffolding, thatching huts etc.

Furniture: Species of *Dendrocalamus* (*H. Bent*), *Arundinaria*, *Melocalamus* are used in manufacture of furniture.

Aromatic grasses: Many grasses yield scented oils which are used in perfumery viz. *Vetiveria zizanioides* (H. Khus khus) yields vetiver oil from the roots. The roots are also woven into curtains. *Andropogon odoratus* (Ginger grass), *Cymbopogon citratus* (Lemon grass), *Cymbopogon martini* (Geranium grass), *Cymbopogon jawarancusa* etc. also yield oil.

Medicinal: *Phragmites karka*, *Cymbopogon schoenanthus* etc. are medicinal. *Secale cereale* is cultivated for infection of its inflorescence by *Claviceps purpurea* for production of Ergot and for extraction of ergotine. Ergotine is an excellent remedy for uterine contraction.

Paper: It is manufactured from certain species of grasses and bamboos.

Ornamental: *Rhynchelytrum repens*, *Cortaderia selloana* and some species of the tribe Bambusoideae are ornamentals. Besides these a number of grasses are grown to form fine lawns, play grounds etc.

Triticum aestivum

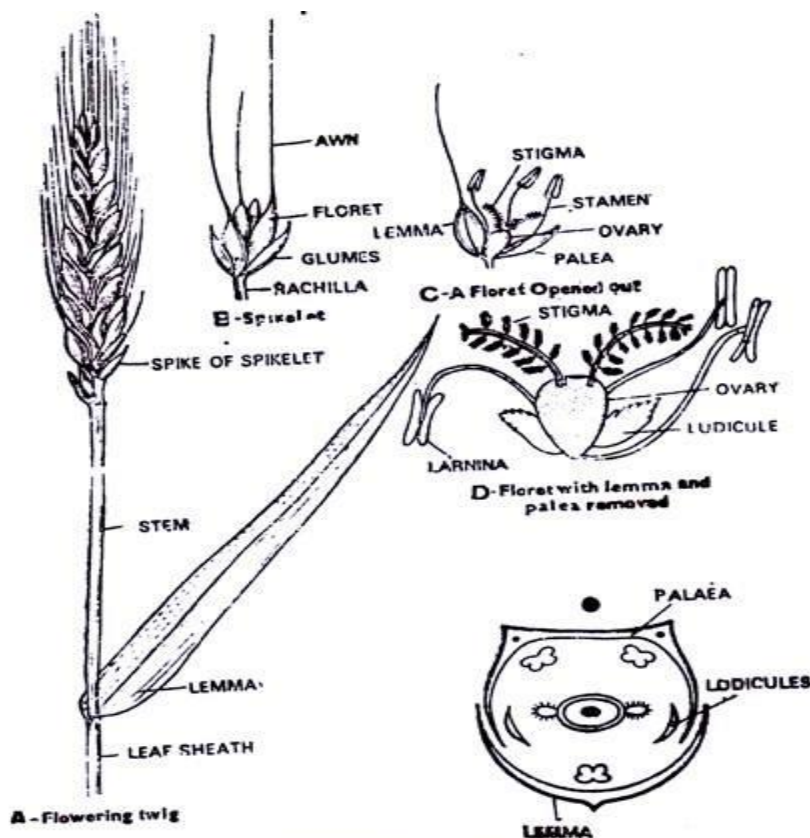
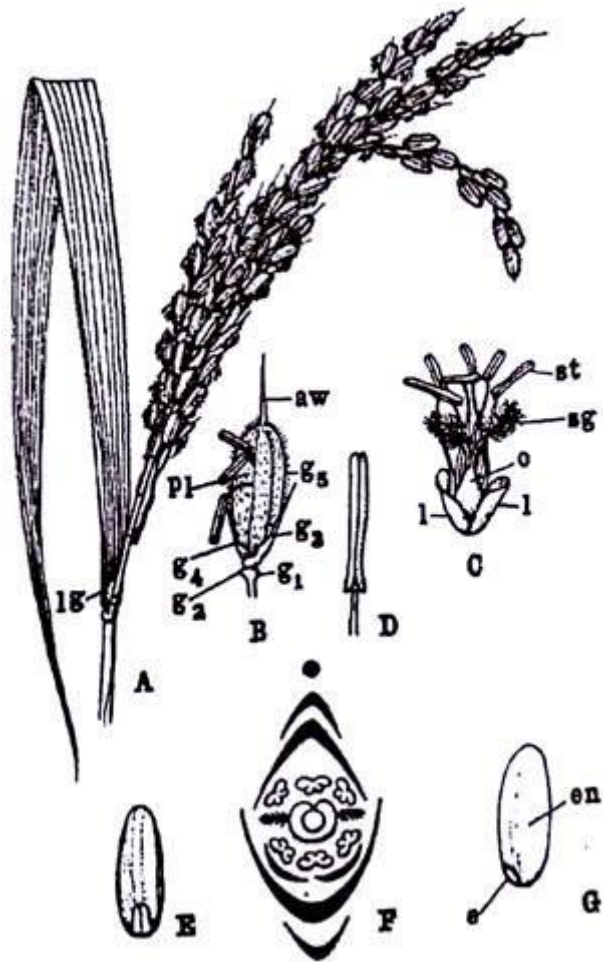


Fig. 118.1. *Triticum aestivum*.

. *Zea mays*:



Common plants in the family Poaceae

- bamboo (Bambusoideae)
 - *Arundinaria*
- barley (*Hordeum vulgare*)
- barnyard grass (*Echinochloa crus-galli*)
- beach grass (genus *Ammophila*)
- bentgrass (genus *Agrostis*)
 - creeping bent (*A. stolonifera*)
- Bermuda grass (*Cynodon dactylon*)
- bluegrass (genus *Poa*)

- bluestem (genus *Andropogon*)
- brome grass (genus *Bromus*)
- carpet grass (*Axonopus fissifolius*)
- cogon grass (*Imperata cylindrica*)
- common reed (genus *Phragmites*)
- cordgrass (genus *Spartina*)
- crabgrass (genus *Digitaria*)
- curly mesquite (genus *Hilaria*)
- esparto (*Lygeum spartum* and *Stipa tenacissima*)
- fescue (genus *Festuca*)
- foxtail (genera *Alopecurus* and *Setaria*)
- giant reed (*Arundo donax*)
- goatgrass (genus *Aegilops*)
- goldentop (*Lamarckia aurea*)
- grama grass (genus *Bouteloua*)
 - buffalo grass (*B. datyloides*)
- hare's-tail grass (*Lagurus ovatus*)
- Indian grass (*Sorghastrum nutans*)
- Job's tears (*Coix lacryma-jobi*)
- love grass (genus *Eragrostis*)
- millet (various genera and species)
- genus *Miscanthus*
- muhly (genus *Muhlenbergia*)
- natal grass (*Melinis repens*)
- needlegrass (genus *Stipa*)
 - esparto (*S. tenacissima*)
- oat grass (genera *Arrhenatherum* and *Danthonia*)
- oil grass (genus *Cymbopogon*)
- orchard grass (*Dactylis glomerata*)
- pampas grass (*Cortaderia selloana*)
- genus *Panicum*
- genus *Paspalum*
- genus *Pennisetum*
- plume grass (genus *Erianthus*)
- quackgrass (*Elymus repens*)
- quaking grass (genus *Briza*)
- rice (*Oryza sativa*)
- rye (*Secale cereale*)
- ryegrass (genus *Lolium*)
- sandbur (genus *Cenchrus*)

- genus *Sorghum*
 - broomcorn (*S. vulgare*)
- genus *Stenotaphrum*
 - Saint Augustine grass (*S. secundatum*)
- sugarcane (*Saccharum officinarum*)
- sweet vernal grass (genus *Anthoxanthum*)
- teff (*Eragrostis tef*)
- timothy (*Phleum pratense*)
- triticale (× *Triticosecale*)
- velvet grass (*Holcus lanatus*)
- vetiver (*Chrysopogon zizanioides*)
- wheat (*Triticum* species)
 - durum wheat (*T. durum*)
 - emmer wheat (*T. dicoccon*)
 - spelt (*T. spelta*)
- wheatgrass (genus *Agropyron*)
- wild oat (genus *Avena*)
 - oats (*A. sativa*)
- wild rice (*Zizania aquatica* and *Z. palustris*)
- wild rye (genus *Elymus*)
- windmill grass (genus *Chloris*)
- *Zea*
 - corn (*Z. mays*)
 - teosinte (various species)
- *Zoysia*