

**PERIYAR INSTITUTE OF DISTANCE EDUCATION
(PRIDE)**

**PERIYAR UNIVERSITY
SALEM - 636 011.**

**B.Sc. BOTANY
THIRD YEAR
PRACTICAL – III : MAJOR PRACTICAL
(PAPERS COVERING V, VI)**

Prepared by :
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B.Sc. BOTANY
THIRD YEAR
PRACTICAL – III : MAJOR PRACTICAL
(Papers Covering V, VII)

Time : 3 Hrs

Maximum : 100 Marks

Practical : 80 Marks

Herbarium : 10 Marks

Record : 10 Marks

1. Refer A and B, to their respective families, Point out the characters on which the identification is based at each level. (Diagrams not necessary) (16)
2. Make acetocarmine preparations of C (Squash) (any one stage)
Draw diagrams (8)
3. Describe D in technical terms. Draw diagrams of the floral parts only.
Construct the floral diagram. Give the floral formula (16)
4. Construct chromosome map with the data provided (16)
5. Solve the given genetic problems E and F. (12)
6. Spot at sight G and H (Name of the Genus and the Family) (4)
7. Write the name of the Genus, Species, Family and Morphology of
The useful parts of I & J (8)

ANNONACEAE

Annona Squamosa Linn.

Stem - Herbaceous, lower portions woody, aerial, erect, cylindrical, branched, solid, green: **Leaf** – Cauline and ramal, alternate, exstipulate, simple, elliptic – lanceolate, entire, obtuse, glabrous, unicostate reticulate – Dichasial cyme or solitary axillary; **Flower** - Bracteate, pedicellate, complete, actinomorphic, hermaphrodite trimerous, hypogynous and and spirocyclic, **Calyx**- Sepals 3, gamosepetalous, connate at the base, valvate; **Corolla**- petals 3, polypetalous, valvate; **Androecium** - Stamens indefinite, spirally arranged on an elongated thalamus, filament short, ditheous, adnate, extrorse, **Gynoecium**-Multicarpellary, apocarpous, carpels spirally arranged on an elongated thalamus, ovary superior, unilocular, basal placentation, style short, stigma long and papillose; **Fruit** – Etaerio of berries.

Floral formula - $Br, \oplus K(3), C3 A_{\infty}, G_{\infty}$

Classification and Identification, Dicotyledonae- Venation reticulate, flowers pentamerous; **Polypetales**- Petals free; **Thalamiflorae** - Thalamus dome shaped, ovary superior, **Ranales** - Stamens indefinite, carpels free; **Annonaceae** - Flowers usually trimerous, stamens and carpels usually many, fruit etaerio of berries

CAPPARIDACEAE*

Cleome gynandra Linn.

(= **Gynandropsis pentaphylla D.C**)

Stem. Herbaceous, aerial, erect, cylindrical, branched, solid hairy and green.

Leaf Cauline and ramal, alternate, exstipulate, palmately compound, pentafoliate, some trifoliate leaves are also present on the inflorescence axis, petiolate, pinnae elliptic – ovate, serrulate, acute, hairy, unicostate, reticulate.

Inflorescence, Corymbosse raceme.

Flower. Ebracteate, pedicellate, complete, actinomorphic, hermaphrodite, tetramerous, hypogynous and cyclic

Calyx. Sepals 4, in two whorls of 2 each, polysepalous, imbricate.

Corolla. Petals 4, polypetalous, valvate, distinguished into a claw and a limb, white

Androecium. Stamens 6, (2+4) polyandrous, ditheous, dorsifixed, introrse, floral axis is elongated between the petals and stamens to form androphore on which the stamens are raised.

Gynoecium. Bicarpellary, syncarpous, ovary superior, unilocular with many ovules, placentation parietal, style short and hairy, stigma capitate, floral axis is elongated between androecium and gynoecium to form gynophore.

Fruit . Capsule.

Floral Formula , Ebr, \oplus K₂₊₂, C₄, A₂₊₄ G(2)

Classification and identification.

Class. Dicotyledonae

1. Venation reticulate.
2. Flowers pentamerous.

Sub-Class. Polypetalae

1. Petals free

Series Thalamiflorae

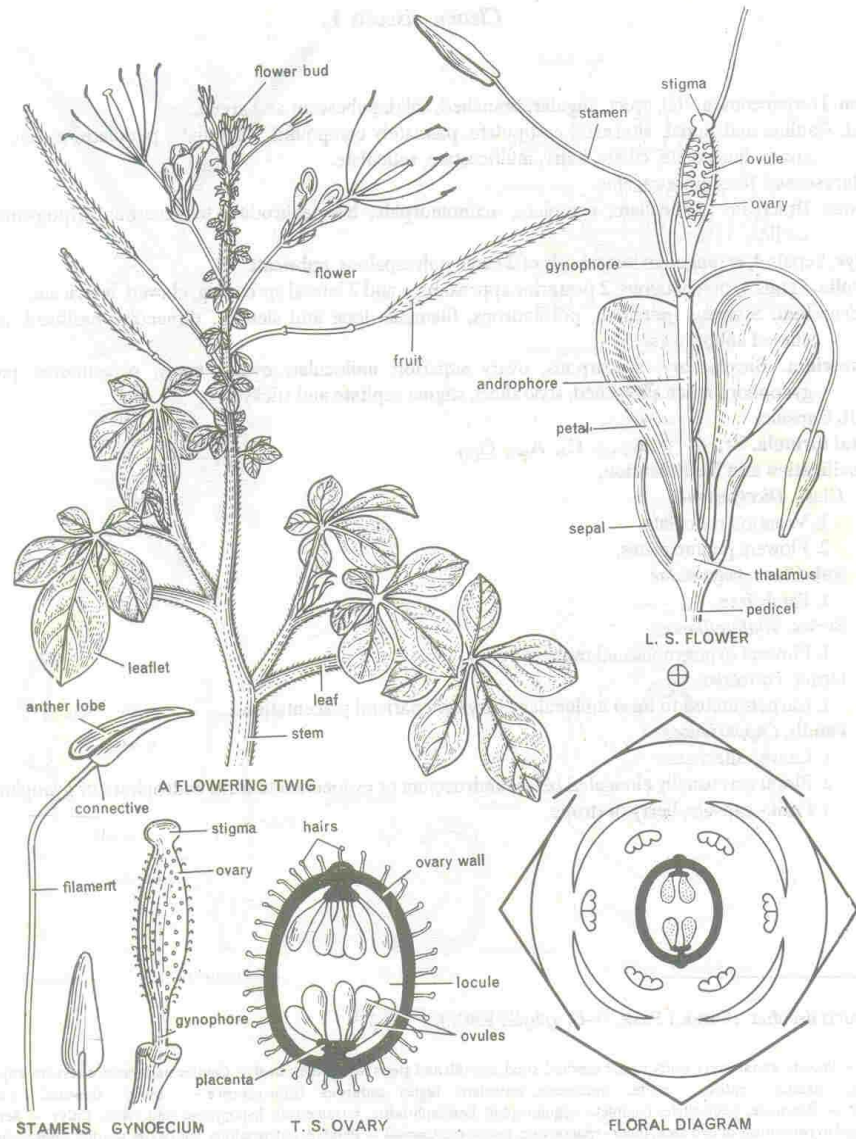
1. Flowers hypogynous and ovary superior

Order. Parietales

1. Carpels united to form unilocular ovary with parietal placentation.

Family. Capparidaceae

1. Leaves alternate
2. Floral axis usually elongated below androecium or gynoecium to form androphore or gynophore.
3. Fruit - capsule, berry or drupe.



1. Vernacular name. Hui-hui.

2. Economic importance. The leaves are used in rheumatism. The plant is also used as an antidote to snake bite and scorpion sting.

Cleome viscosa L.

Stem. Herbaceous, acrial, erect, cylindrical, branched, solid hairy and green.

Leaf Cauline and ramal, alternate, exstipulate, palmately compound, pentafoliate, some trifoliate leaves are also present on the inflorescence axis, petiolate, pinnae elliptic –ovate, serrulate, acute, hairy, unicostate, reticulate.

Inflorescence, Racemose raceme.

Flower. Ebracteate, pedicellate, complete, actinomorphic, hermaphrodite, tetramerous, hypogynous and cyclic

Calyx. Sepals 4, in two whorls of 2 each, polysepalous, imbricate.

Corolla. Petals 4, polypetalous, valvate, distinguished into a claw and a limb, white

Androecium. Stamens 6, (2+4) polyandrous, ditheous, dorsifixed, introrse, floral axis is elongated between the petals and stamens to form androphore on which the stamens are raised.

Gynoecium. Bicarpellary, syncarpous, ovary superior, unilocular with many ovules, placentation parietal, style short and hairy, stigma capitate, floral axis is elongated between androecium and gynoecium to form gynophore.

Fruit . Capsule.

Floral Formula , Ebr, ⊕ K₂₊₂, C₄, A₂₊₄ G(2)

Classification and identification.

Class. Dicotyledonae

3. Venation reticulate.
4. Flowers pentamerous.

Sub-Class. Polypetalate

2. Petals free

Series Thalamiflorae

2. Flowers hypogynous and ovary superior

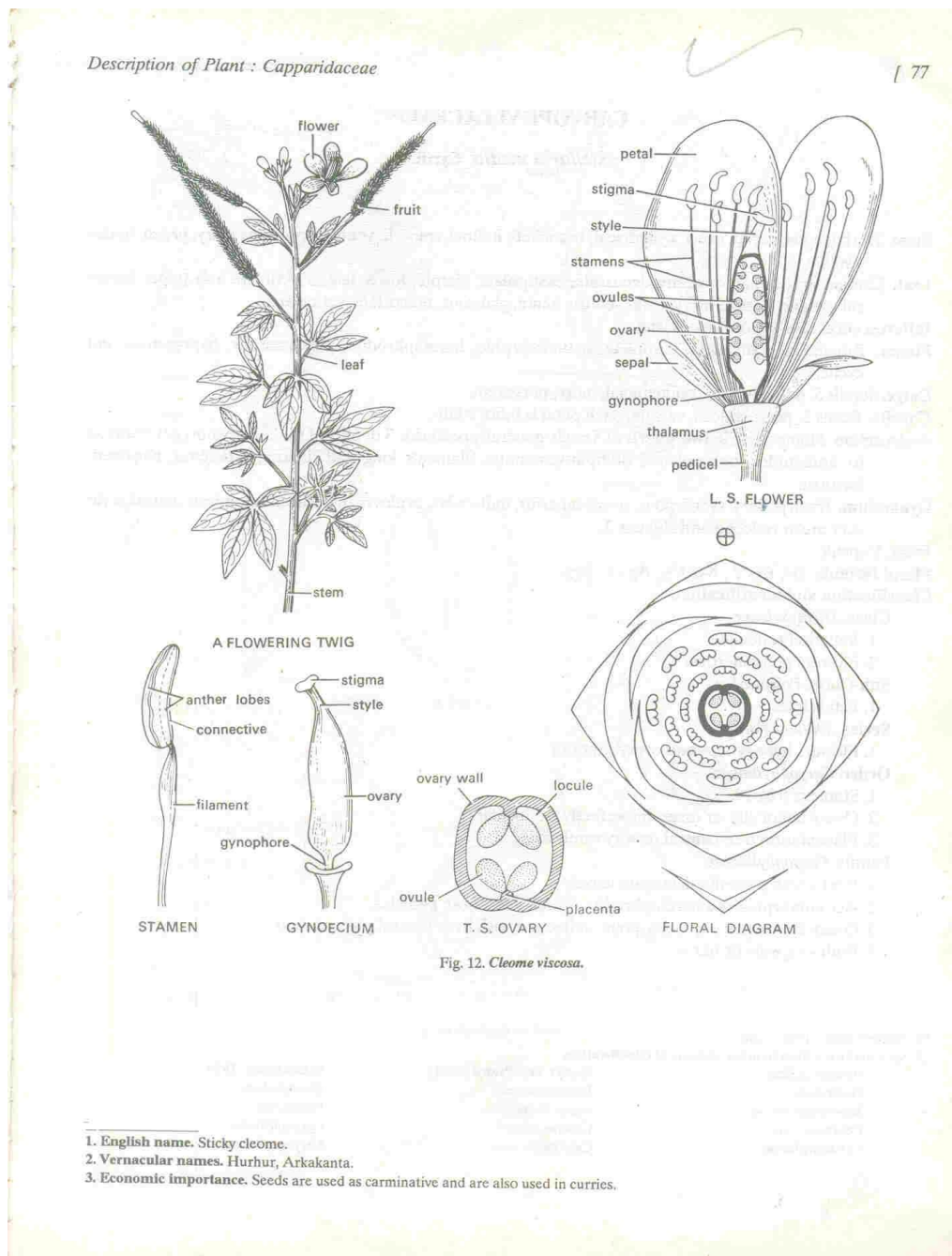
Order. Parietales

1. Carpels united to form unilocular ovary with parietal placentation.

Family. Capparidaceae

4. Leaves alternate
5. Floral axis usually elongated below androecium or gynoecium to form androphore or gynophore.

6. Fruit - capsule, berry or drupe.



RUTACEAE*

Stem. Woody, aerial, cylindrical, branched, solid, sparsely spiny and green

Leaf. Cauline and ramal, alternate, exstipulate, palmately compound, unifoliate, petiolate, petiole winged. Elliptic - lanceolate, crenate, obtuse, glabrous, gland dotted, unicostate, reticulate.

Inflorescence. Axillary umbellate cyme.

Flower . Bracteate, bract small and caduceus, pedicellate, complete, actinomorphic, hermaphrodite, penta or tetramerous, hypogynous and cyclic.

Calyx. Sepals 5 or 4, gamosepalous, valvate.

Corolla. Petals 5 or 4, polypetalous, imbricate, white, coriaceous and gland dotted.

Androecium. Stamens indefinite, polyadelphous, ditheous, dorsifixed, introrse, pointed at the apex.

Gynoecium . Multicarpellary , syncarpous, ovary superior, multiocular with generally one vule in each locule, placentation axile, a nectariferous annular disc is present below the ovary, style stout, stigma capitate.

Fruit. Ahesperidium

Floral formula Br, \oplus , K5, or (4), C5, Or 4 A (∞ polyadel), G (∞)

Classification and identification

Class. Dicotyledonae

1. Venation reticulate
2. Flowers pentamerous

Sub-Class. Palypetalae

1. Petals free

Series Disciflorae

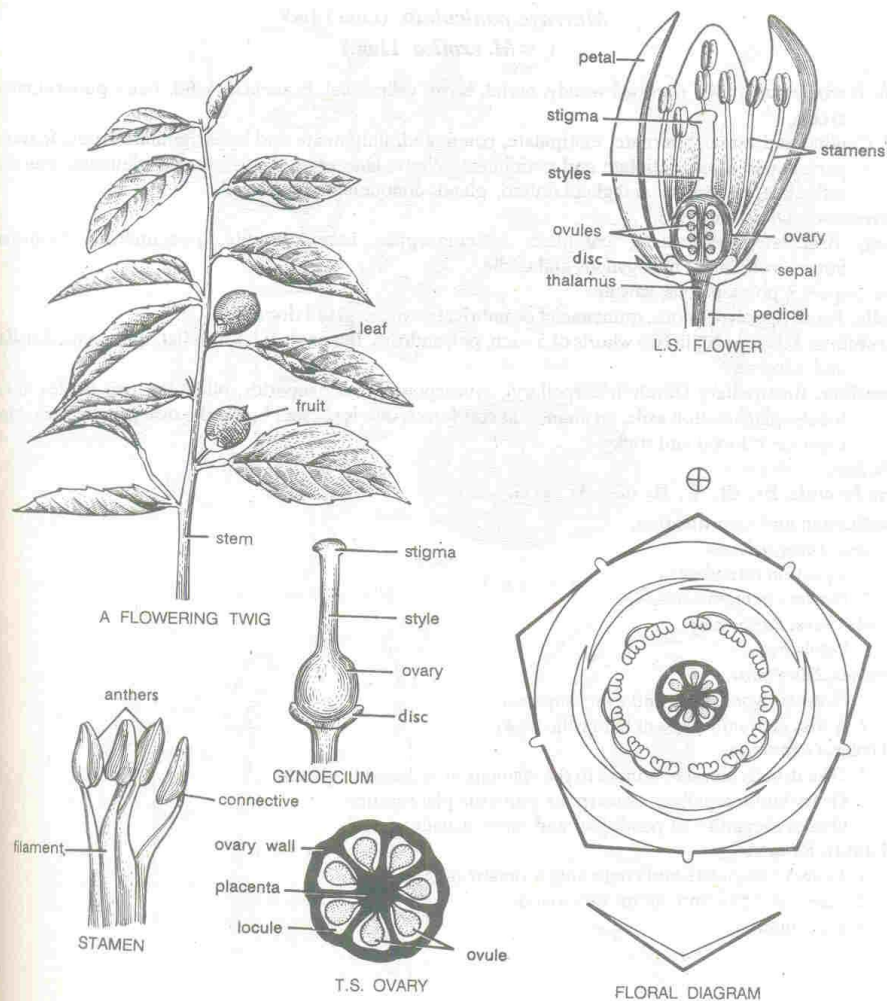
1. Flowers hypogynous and ovary superior
2. A disc is usually present below the ovary.

Order. Geraniales

1. Disc usually annular, adnate to the stamens or reduced to glands
2. Ovary multicarpellary, syncarpous with axile placentation
3. Ovules ascending or pendulour and raphe usually ventral.

Family Rutaceae

1. Leave exstipulate and containing aromatic oil glands.
2. Stamens 2-5 or and obdiplostemonous.
3. Disc annular.
4. Fruit hesperidium

Fig. 22. *Citrus medica*.

1. English name. Citron.

2. Vernacular names. Bara Nimbu, Bijawara.

3. Economic importance. The fruit juice is rich in vitamin c which is an astringent. The fruits are pickled.

(B-15)

Murraya paniculata (linn) Jack

Stem. Herbaceous, lower portions woody, aerial, erect, cylindrical, branched, solid, hairy puberulous and green.

Leaf. Cauline and ramal, alternate, exstipulate, compound, unipinnate and imparipinnate (Some leaves are paripinnate also), petiolate and petiolulate,

elliptic-lanceolate, entire, retuse, glaucous, uncostate reticulate, coriaceous and gland dotted, glands containing aromatic oil.

Inflorescence. Dichasial cyme.

Flower: Bracteate, pedicellate, complete, actinomorphic, hermaphrodite, pentamerous (Sometimes hexamerous also), hypogynous and cyclic.

Calyx, Sepals, 5, polysepalous, valvate.

Corolla , Petals 5, Polypetalous, quincuncial or imbricate, white, gland dotted.

Androecium, Stamens 10, in two whorls of 5 each, polyandrous, filaments thick and flat, ditheous, dorsifixed and introrse

Gynoecium. Bicarpellary (rarely tricarpellary), syncarpous, ovary superior, bilocular, two ovules in each locule, placentation axile, anannular nectariferous disc is present below the ovary, style thick, stigma capitate, bilobed and sticky.

Fruit Berry.

Floral Formula $\text{Br, } \oplus, \text{K5, C5, A+5 } 5, \text{G(2)}$

Classification and identification

Class. Dicotyledonae

3. Venation reticulate
4. Flowers pentamerous

Sub-Class. Palypetalae

2. Petals free

Series Disciflorae

3. Flowers hypogynous and ovary superior
4. A disc is usually present below the ovary.

Order. Geraniales

4. Disc usually annular, adnate to the stamens or reduced to glands
5. Ovary multicarpellary, syncarpous with axile placentation
6. Ovules ascending or pendulous and raphe usually ventral.

Family Rutaceae

5. Leave exstipulate and containing aromatic oil glands.
6. Stamens 2-5 or and obdiplostemonous.
7. Disc annular.
8. Fruit hesperidium

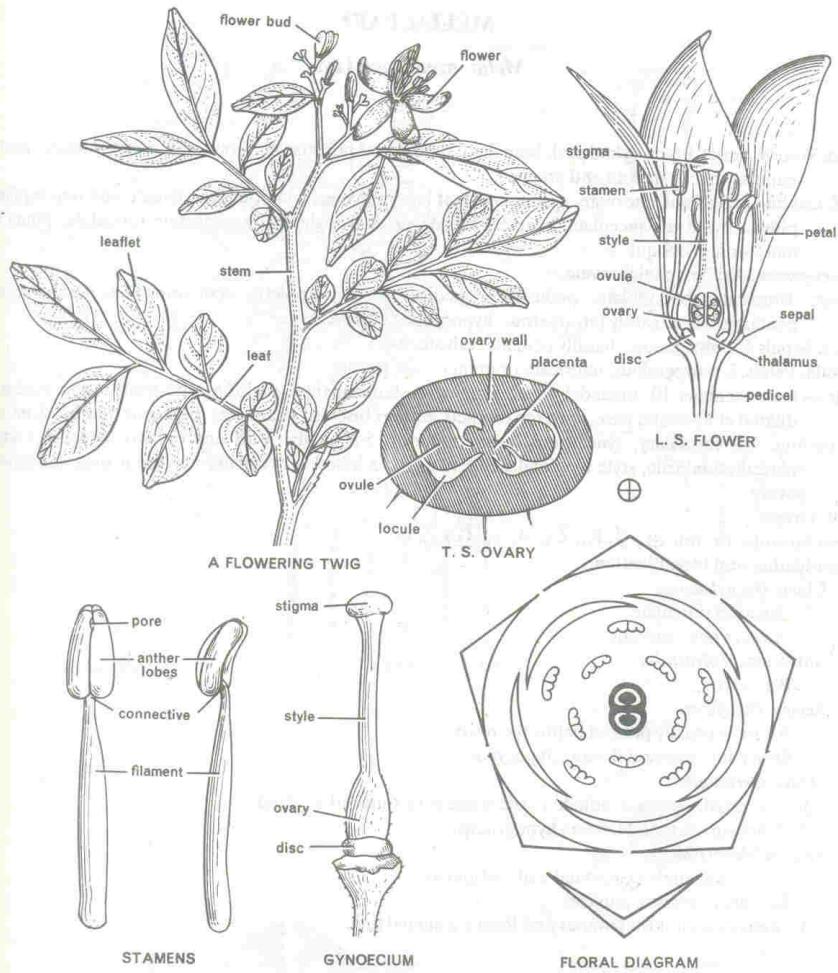


Fig. 23. *Murraya paniculata*.

1. English name. Orange-jessamine.

2. Vernacular names. Kamini, Bisar.

3. Economic importance. The plant is cultivated for its fragrant flowers. The leaves are astringent and are used in dysentery.

MYRTACEAE*

Callistemon citrinus (Curtis) Skeels

(= **Callistemon lanceolatus, DC**)

Stem. Herbaceous, lower portion woddy, aerial, erect, cylindrical, branched, solid and glabrous, younger portions puberulous, brown.

Leaf. Cauline and ramal, alternate 2/5, exstipulate, simple, sub-sessile, lanceolate, entire, acute, unicostate reticulate, leathery, gland dotted.

Inflorescence,. Pendent intercalary spike.

Flower. Bracteate, sessile complete, actinomorphic, hermaphrodite, pentamerous, epigynous and cyclic.

Calyx, Sepals 5, gamosepalous, imbricate or valvate, persistent

Corolla Petals 5, polypetalous, imbricate, boat-shaped.

Androecium , Stamens indefinite, polyandrous, filaments bright red and united at tehvery base forming a staiminal sheath, ditheous, versatile, introrse.

Gynoecium. Trichrapellary, syncarpous, ovary inferior, trilocular, placentation axile, many ovules in each locule, style long and stigma capitate.

Fruit. Capsule.

Floral Formula Br, \oplus , K5, C5, A ∞ , G(3)

Classification and identification.

Class. Dicotyledonae

1. Venation reticulate
2. Flowers pentamerous

Sub-class polypetalae

1. Petals free

Series Calyciflorae

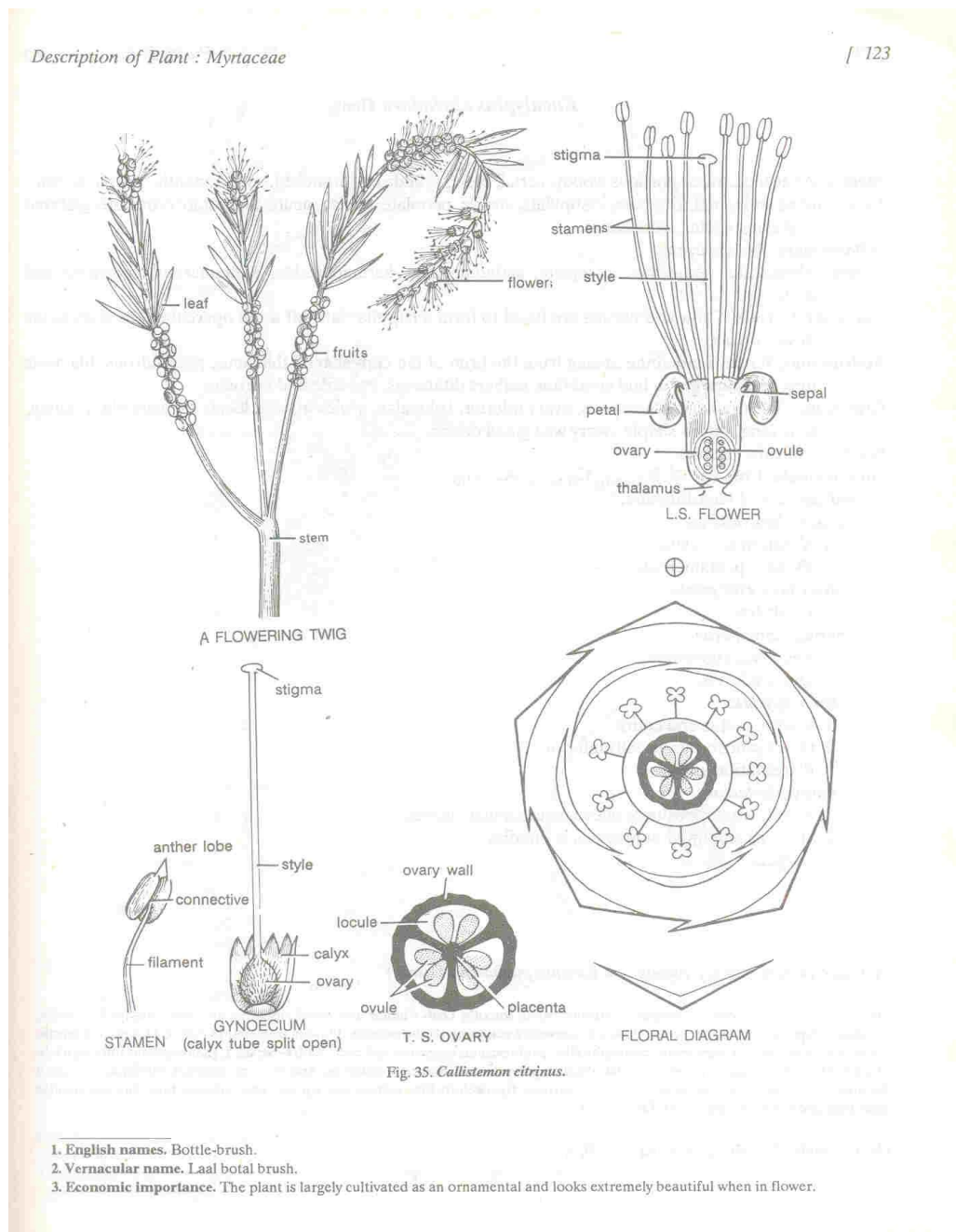
1. Thalamus cup-shaped
2. Ovary inferior

Order. Myrtales

1. Leaves simple and entire .
2. Ovary syncarpous, usually inferior
3. Placentation axile.

Family Myrtaceae

1. Woody, with opposite or alternate, exstipulate leaves
2. Stamens indefinite sometimes in bundles
3. Carpels 2 to 8



Eucalyptus citriodora Hook

Stem. Herbaceous, lower portion woody, aerial, erect, cylindrical, branched, solid smooth, purple brown.

Leaf. Cauline and ramal, alternate exstipulate, simple, petiolate, falcate, acute uncostate reticulate, glabrous and gland dotted, coriaceous.

Inflorescence, Panicle cyme.

Flower. Bracteate, pedicellate, complete, actinomorphic, hermaphrodite, pentamerous, epigynous and cyclic.

Calyx, and Corolla. Calyx and corolla are fused form a cup that falls off as an operculum as soon as the flower opens.

Androecium , Stamens indefinite, arising from the brim of the cup-shaped thalamus, polyandrous, filaments long and incurved in bud condition, anthers ditheous, versatile and introrse.

Gynoecium. Trichrapellary, syncarpous, ovary inferior, trilocular, ovules in each locule on axile placentation style long, stigma simple, ovary wall gland dotted.

Fruit. Loculicidal Capsule.

Floral Formula $Br, \oplus, K (fused), C(Fused), A\infty, G (3)$

Classification and identification.

Class. Dicotyledonae

3. Venation reticulate
4. Flowers pentamerous

Sub-class polypetalae

2. Petals free

Series Calyciflorae

3. Thalamus cup-shaped
4. Ovary inferior

Order. Myrtales

4. Leaves simple and entire .
5. Ovary syncarpous, usually inferior
6. Placentation axile.

Family Myrtaceae

4. Woody, with opposite or alternate, exstipulate leaves
5. Stamens indefinite sometimes in bundles
6. Carpels 2 to 8

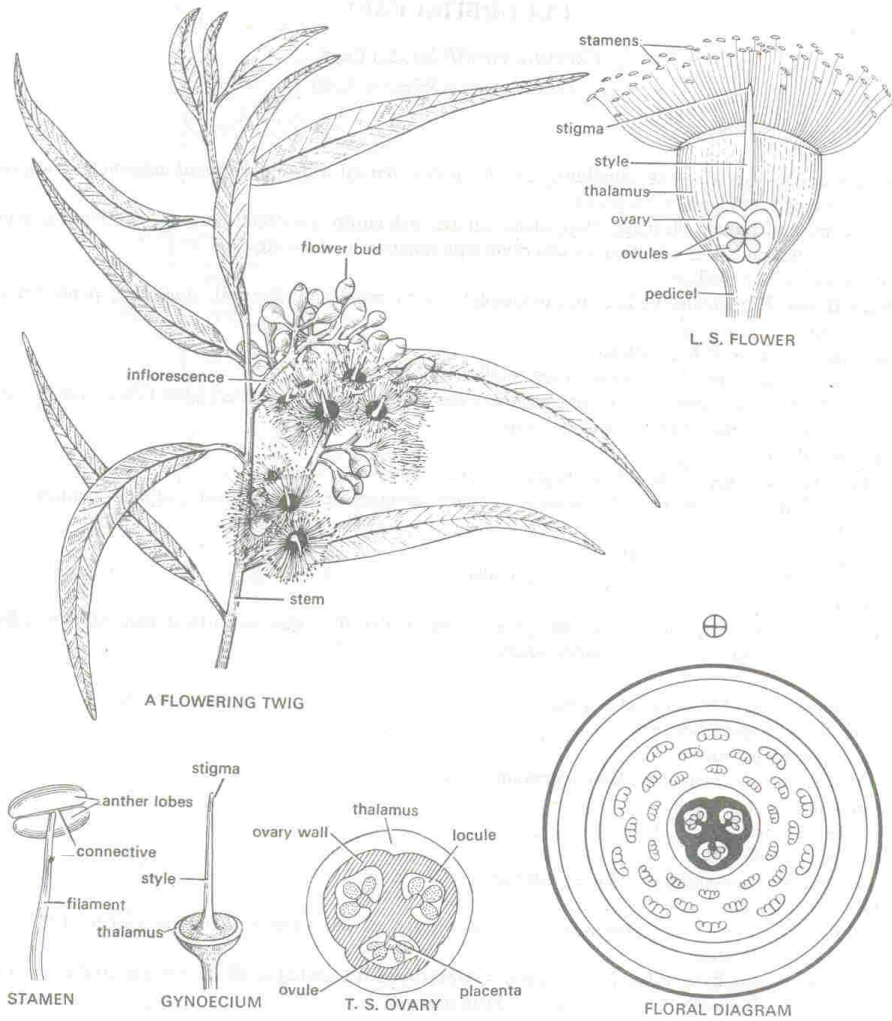


Fig. 36. *Eucalyptus citriodora*.

1. English names. Lemon-scented gum, Eucalyptus.

2. Vernacular name. Safeda.

3. Economic importance. The leaves yield an essential oil which is used in perfumery. Now-a- days the pulp from stem is being used in the manufacture of paper.

CUCURBITACEAE*

***Coccinia cordifolia* (L) cogn.**

(=*Coccinia indica* Wight & Arn).

Stem. Herbaceous, aerial, weak, climbing tendril climber, tendril opposed and unbranched, angular, branched, solid, glabrous, green.

Leaf. Cauline and ramal, alternate, exstipulate, simple, palmatifid, petiolate, cordate, denticulate, acute, glabrous, multicostate reticulate diverging type venation, coriaceous.

Inflorescence. Solitary axillary.

(I) **Male flower** . Ebracteate, pedicellate, incomplete, actinomorphic, unisexual, staminate, pentamerous, cyclic.

Calyx. Sepals 5, gamosepalous, valvate

Corolla. Petals 5, gamopetalous, valvate, campanulate

Androecium Stamens 5, arranged in 3 groups, there are two stamens in 2 groups and in 1 group there is only one stamen, monothecous and extrorse.

Gynoecium. Absent

Floral formula. Ebr, \oplus K(5), C(5), A(2) + (2) + 1, GO

(II) **Female flower.** Ebracteate, pedicellate, incomplete, actinomorphic, unisexual, pistillate, pentamerous, cyclic.

Calyx. Sepals 5, gamosepalous, valvate

Corolla. Petals 5, gamopetalous, valvate, campanulate.

Androecium. Absent

Gynoecium. Tricarpellary, syncarpous, ovary inferior, unilocular, placentation parietal, placentae intruding style short, stigma 3, forked and feathery.

Fruit . Pepo.

Floral formula Ebr, \oplus K(5), C(5), Ao, + 1, G(3)

Classification and identification

Class. Dicotyledonae

1. Venation reticulate
2. Flowers pentamerous

Sub –Class. Polypetalae

1. Petals free

Series. Calyciflorae

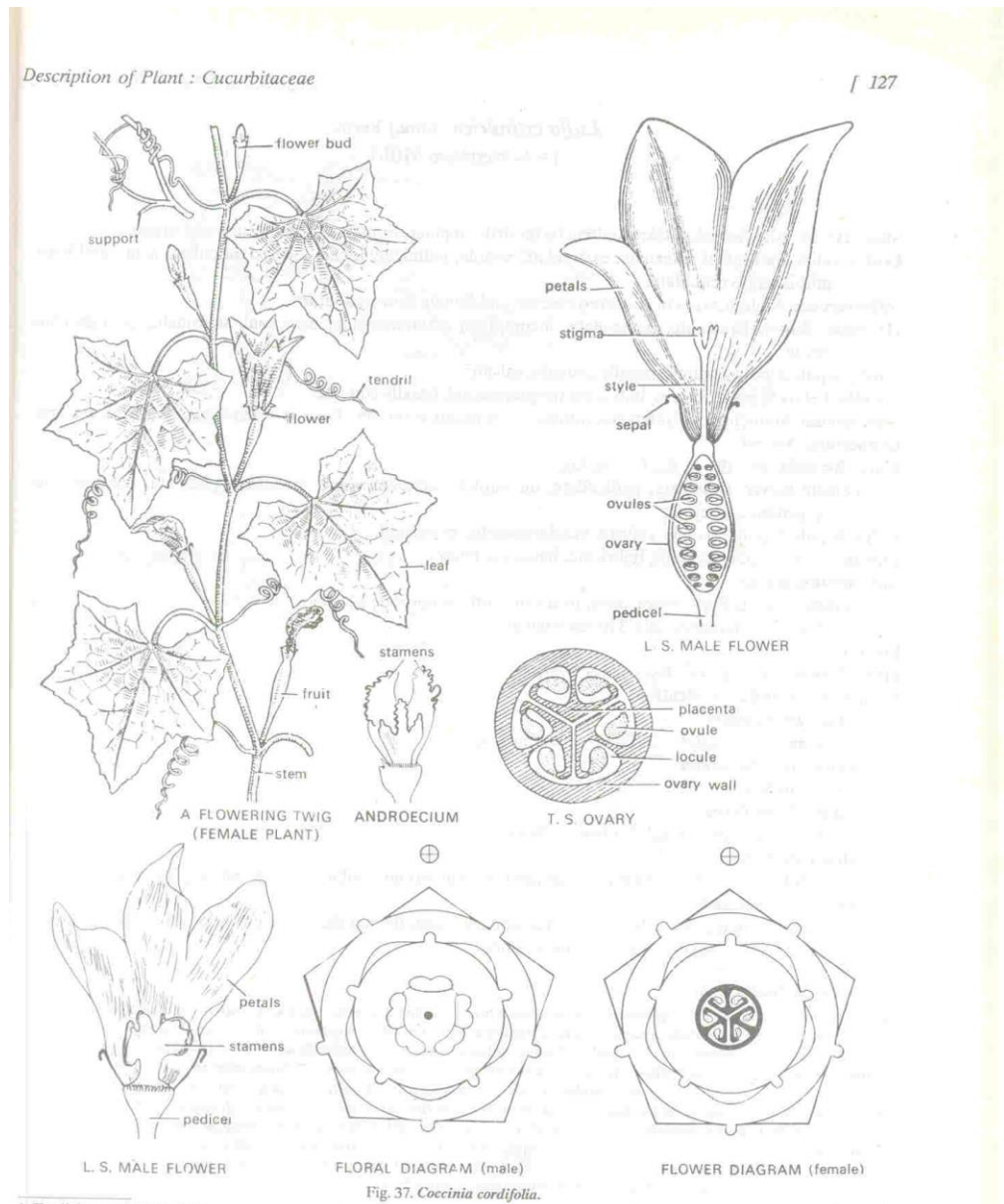
1. Thalamus cup-shaped.
2. Ovary inferior

Order. Passiflorales

1. **Tendrils** climbers.
2. Ovary usually inferior, syncarpous, unilocular with parietal placentation .

Family Cucurbitaceae

1. Flowers usually unisexual.
2. Stamens 5, free or each 2 united or all the 5 in a central synandrium
3. Carpels usually 3, stigma forked.
4. Fruit a pepo.



- Fig. 37. *Coccinia cordifolia*.
1. English name. Kovai fruit.
 2. Vernacular names. Kanduri, Kudroom.
 3. Economic importance. Plant is dioecious. The fruits are used as vegetable.

Luffa Cylindrica (Linn) Roem.

(= *L.aegyptiaca* Mill)

Stem . Herbaceous, aerial, weak, climbing by tendrils, branched, solid , rough and green.

Leaf . Cauline and ramal, exstipulate, simple, palmately lobed, lobes denticulate, acute and hairy multicostate reticulate.

Inflorescence. Male flowers in clustered raceme and female flowers solitary

(1) **Male flower** . Bracteate, pedicellate, incomplete, actinomorphic, unisexual, staminate, pentamerous, cyclic.

Calyx. Sepals 5, polysepalous, basally connate, valvate

Androecium. Stamens 5, polyandrous, adnate to the petals at the very base, monothecous, basifixed , extrorse.

Gynoecium. Absent.

Floral formula Br, \oplus K5, C5, A5, + 1, G_o

II. Female Flower. Bracteate, pedicellate, incomplete, actinomorphic, unisexual, pistillate, pentamerous , epigynous and cyclic

Calyx. Sepals 5, polysepalous, valvate, basally connate, persistent.

Corolla. Petals 5, Polypetalous , imbricate, basally connate.

Androecium. Absent

Gynoecium. Tricarpellary, syncarpous, ovary inferior, unilocular, placentation parietal, placentae intruding styles 3, terminating into 3 lobed stigmas.

Floral formula Ebr, \oplus K5, C5, A_o, + 1, G(3)

Class. Dicotyledonae

1. Venation reticulate
3. Flowers pentamerous

Sub –Class. Polypetalae

2. Petals free

Series. Calyciflorae

3. Thalamus cup-shaped.
4. Ovary inferior

Order. Passiflorales

3. Tendri climbers.

4. Ovary usually inferior, syncarpous, unilocular with parietal placentation .

Family Cucurbitaceae

2. Flowers usually unisexual.
3. Stamens 5, free or each 2 united or all the 5 in a central synadrium
4. Carpels usually 3, stigma forked.
5. Fruit a pepo.

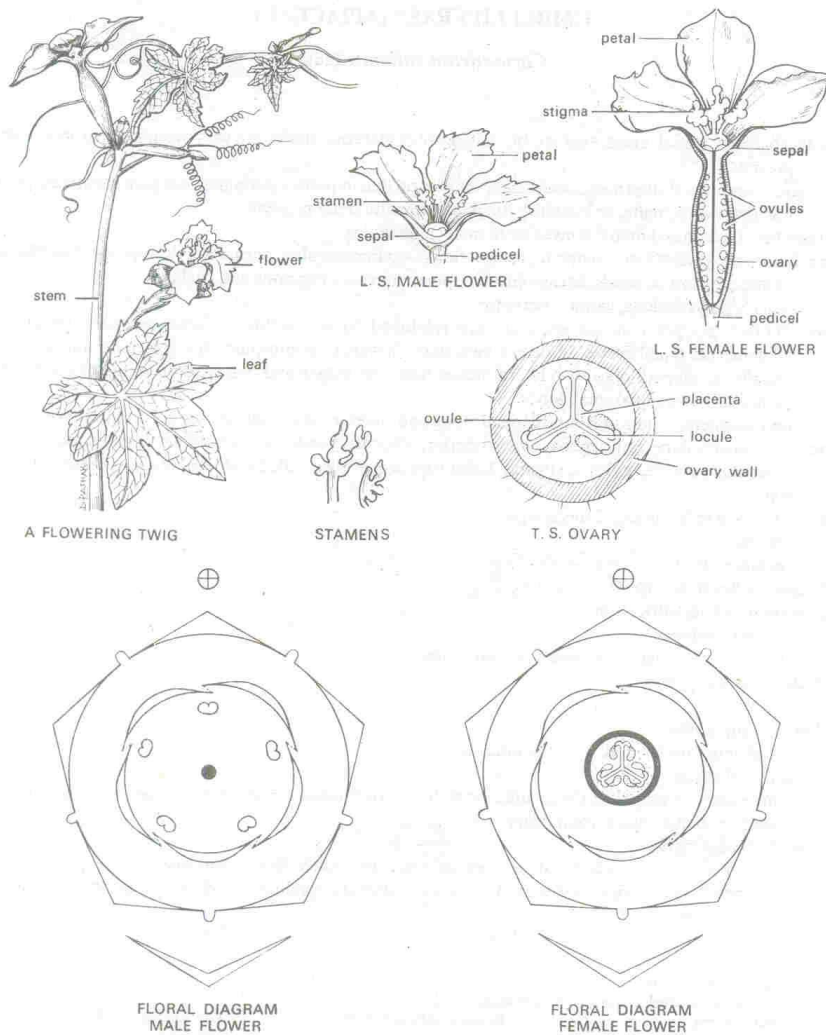


Fig. 38. *Luffa cylindrica*.

1. English names. Vegetable sponge, Dishcloth gourd.
2. Vernacular name. Ghia tori.
3. Economic importance. Cultivated for its fruits which are used as vegetable. Dried fruits yield sponge.

(B-15)

Compositae* (Asteraceae)

***Sanchus brachyotes* DC.**

(=*S.arvensis* Linn).

Stem . Herbaceous, aerial, cylindrical, branched, fistular, glabrous, younger portions with glandular hairs, green.

Leaf. Cauline and ramal, alternate, exstipulate, simple, sessile, amplexicaul, hastate, dentate, acute glabrous, unicostate reticulate.

Inflorescence. Capitulum, homogamous and ligulate, involucre of bracts present at the base of inflorescence.

Calyx. Reduced to pappus.

Corolla. Petals 5, gamopetalous, valvate, corolla ligulate, with 0/5 arrangement.

Androecium. Stamens 5, syngenesious, epipetalous, anthers are joined around the style, ditheous, basifixed and introrse.

Gynoecium. Bicarpellary, syncarpous, ovary inferior, unilocular, placentation basal, ovule only one, style long and stigma bifid

Fruit. Cypsella.

Floral formula Ebr, \oplus Kpappus, C(0/5), A(5), G(2)

Class. Dicotyledonae

1. Venation reticulate
2. Flowers pentamerous

Sub –Class. Polypetalae

3. Petals fused

Series. Calyciflorae

- 4 Ovary inferior
5. Stamens usually as many as corolla lobes

Order. Passiflorales

6. Stamens epipetalous
7. Ovary unilocular with one ovule.

Family Cucurbitaceae

1. Leaves generally alternate
2. Inflorescence capitulum
3. Calyx reduced to hairy pappus
4. Stamens epipetalous and syngenesious.

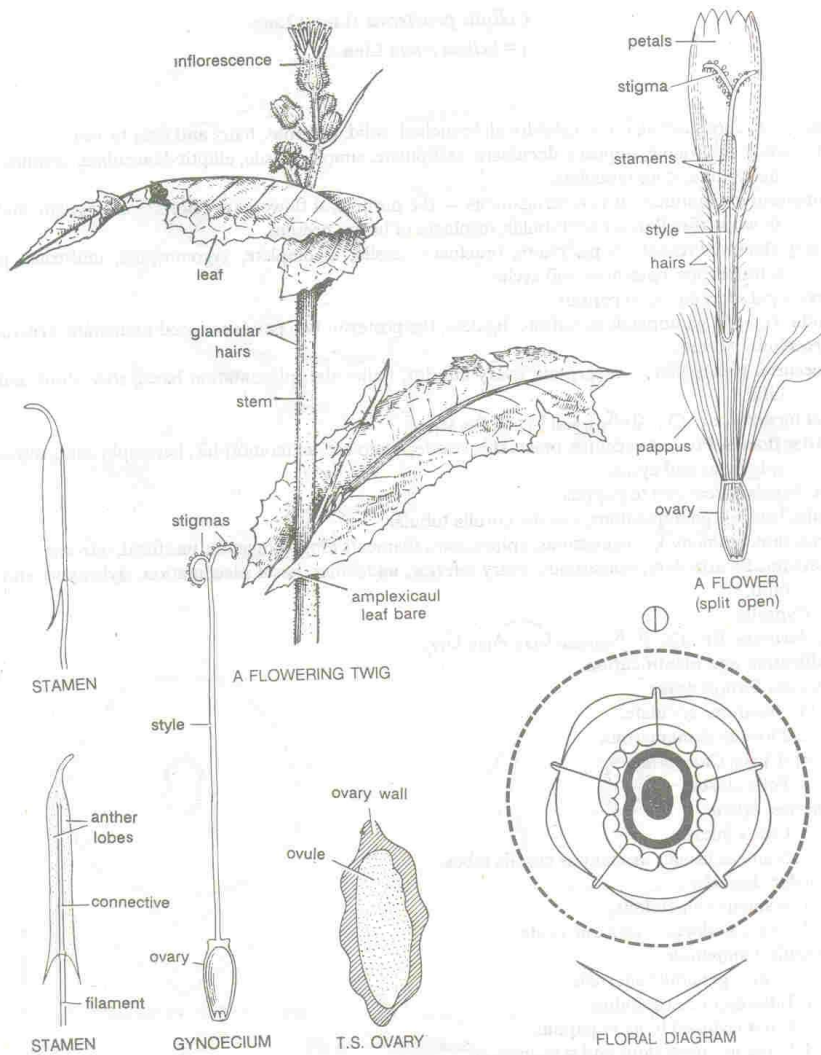


Fig. 43. *Sonchus arvensis*.

1. **Economic importance.** The plant is used medicinally in many parts of this country.

***Eclipta prostrate* (Linn). Linn.**

(= *Eclipta erecta* Linn).

Stem . Herbaceous, aerial, cylindrical, branched, solid, glabrous, hairy and light brown.

Leaf. Cauline and ramal, alternate, exstipulate, simple, sessile, elliptic - lanceolate, crenulate, acute, hairy, unicostate reticulate.

Inflorescence. Capitulum, homogamous –the peripheral flowers (ray florets) are ligulate and central flowers (disc florets) are tubular, involucre of bracts present.

Ray florets. Present on periphery, bracteate, sessile, incomplete zygomorphic, unisexual, pistillate, tetramerous, epigynous and cyclic

Calyx, Sepals 4, reduced to pappus.

Corolla. Petals 4, gamopetalous, valvate, ligulate, the posterior two petals reduced to dentate structures.

Androecium. Absent

Gynoecium. Bicarpellary, syncarpous, ovary inferior, unilocular, placentation basal, style short and stigma bifid

Floral formula $Br, \oplus Kpappus, C(2/2), A(o), G(2)$

Class. Dicotyledonae

1. Venation reticulate
2. Flowers pentamerous

Sub –Class. Polypetalae

3. Petals fused

Series. Calyciflorae

4. Ovary inferior
5. Stamens usually as many as corolla lobes

Order. Passiflorales

5. Stamens epipetalous
6. Ovary unilocular with one ovule.

Family Cucurbitaceae

1. Leaves generally alternate
2. Inflorescence capitulum
3. Calyx reduced to hairy pappus
4. Stamens epipetalous and syngenesious.

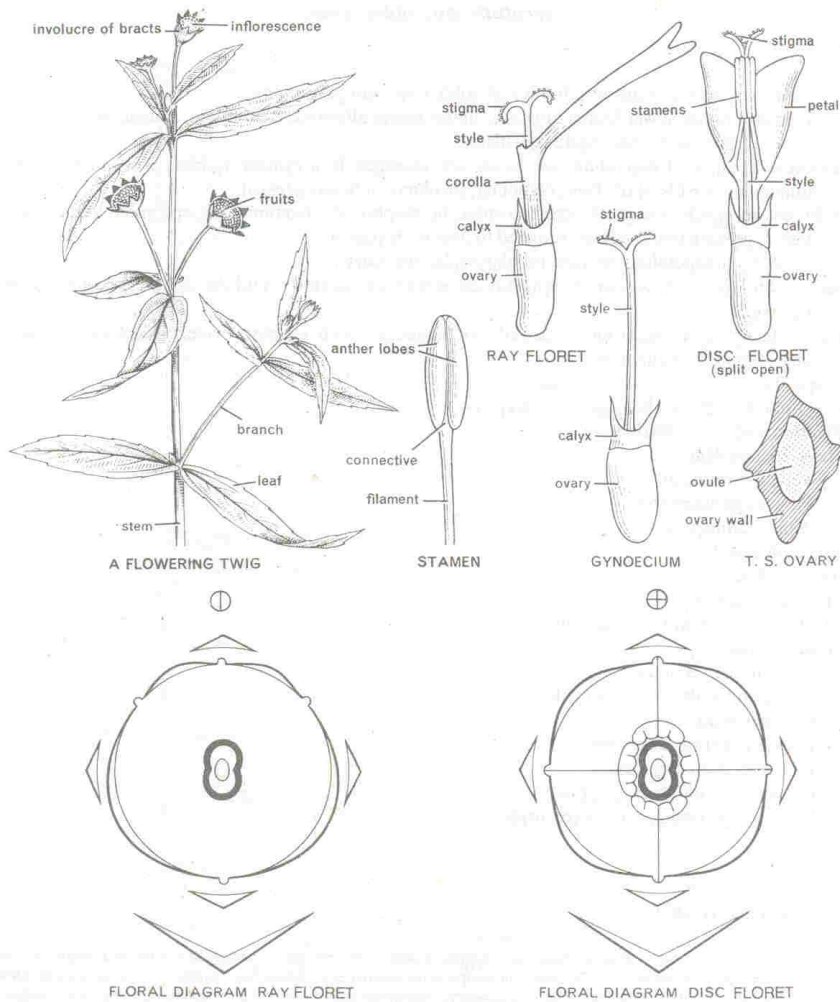


Fig. 44. *Eclipta prostrata*.

1. Vernacular name. Bhangra.

2. Economic importance. The juice of the plant is used in cases of spleen enlargement. In Bengal the fresh leaves are employed in tattooing the skin.

***Ageratum conyzoides* Linn**

Stem . Herbaceous, aerial, cylindrical, branched, solid, hairy and purple - green.

Leaf. Cauline and ramal, alternate, exstipulate, simple, sessile, elliptic - lanceolate, crenulate, acute, hairy, unicostate reticulate.

Inflorescence. Compound Capitulum, the heads are arranged in a cymose fashion. The inflorescence is homogamous with all the flowers tubular, involucre of bracts present

Flower . Bracteate, sessile, complete, actinomorphic, hermaphrodite, pentamerous, epigynous and cyclic.

Calyx, Sepals 5, polysepalous, valvate, reduced to long scaly pappus.

Corolla. Petals 5, gamopetalous, valvate, tubular, violet and hairy

Androecium. Stamens 5, syngenesious, epipetalous anthers are jointed round the style, ditheous, basifixed, introrse.

Gynoecium. Bicarpellary, syncarpous, ovary inferior, unilocular, placentation basal, style stigma bifid and hairy.

Floral formula $Br, \oplus Kpappus, Ebr, \oplus Kpappus, C(5), A(5), G(2)$

Class. Dicotyledonae

1. Venation reticulate
2. Flowers pentamerous

Sub –Class. Gamopetalae

1. Petals fused

Series. Inferae

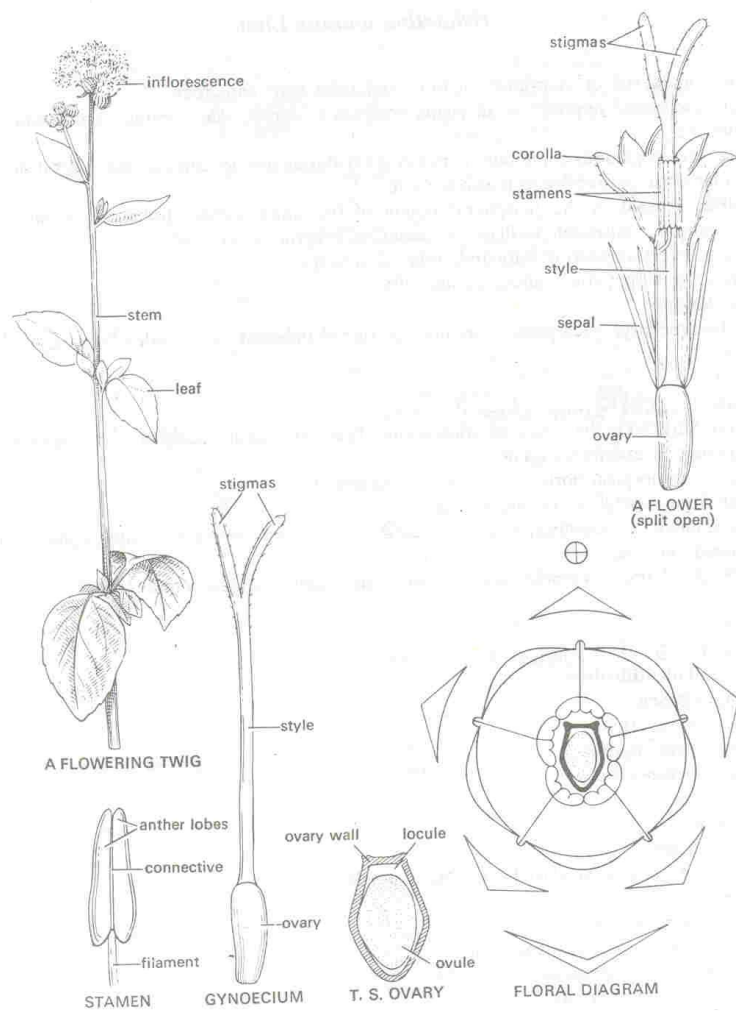
1. Ovary inferior
2. Ovary unilocular with one ovule.

Order. Asterales

1. Stamens epipetalous
2. Ovary unilocular with one ovule.

Family Compositae

1. Leaves generally alternate
2. Inflorescence capitulum
3. Calyx reduced to hairy pappus
4. Stamens epipetalous and zygomorphic.

Fig. 45. *Ageratum conyzoides*.

Helianthus annuus Linn

Stem . Herbaceous, aerial, cylindrical, branched, solid, hairy and - green.

Leaf. Cauline and ramal, opposite or alternate, exstipulate, simple, ovate, serrate, acute, hairy uncostate, sessile, elliptic - lanceolate, crenulate, acute, hairy, uncostate reticulate.

Inflorescence. Heterogamous capitulum, peripheral ray florets are ligulate and the central disc florets are tubular. Involucre of bracts is also present.

(1) Ray florets. Present in the peripheral region of the inflorescence, bracteate, sessile, incomplete, zygomorphic, unisexual, pistillate, pentamerous epigynous, cyclic

Calyx. Sepals 2, anterior-posteriorly situated, reduced to pappus

Corolla. Petals 5, gamopetalous, valvate, ligulate, 0/5

Androecium. Absent

Gynoecium. Bicarpellary, syncarpous, ovary inferior, One Chambered, placentation basal, style short, stigma Fruit, Cypsela.

Floral formula Ebr, \oplus K2 Kpappus, C o/5, (5), Ao, G(2)

Class. Dicotyledonae

1. reticulate Venation
2. Flowers pentamerous

Sub –Class. Gamopetalae

1. Petals fused

Series. Inferae

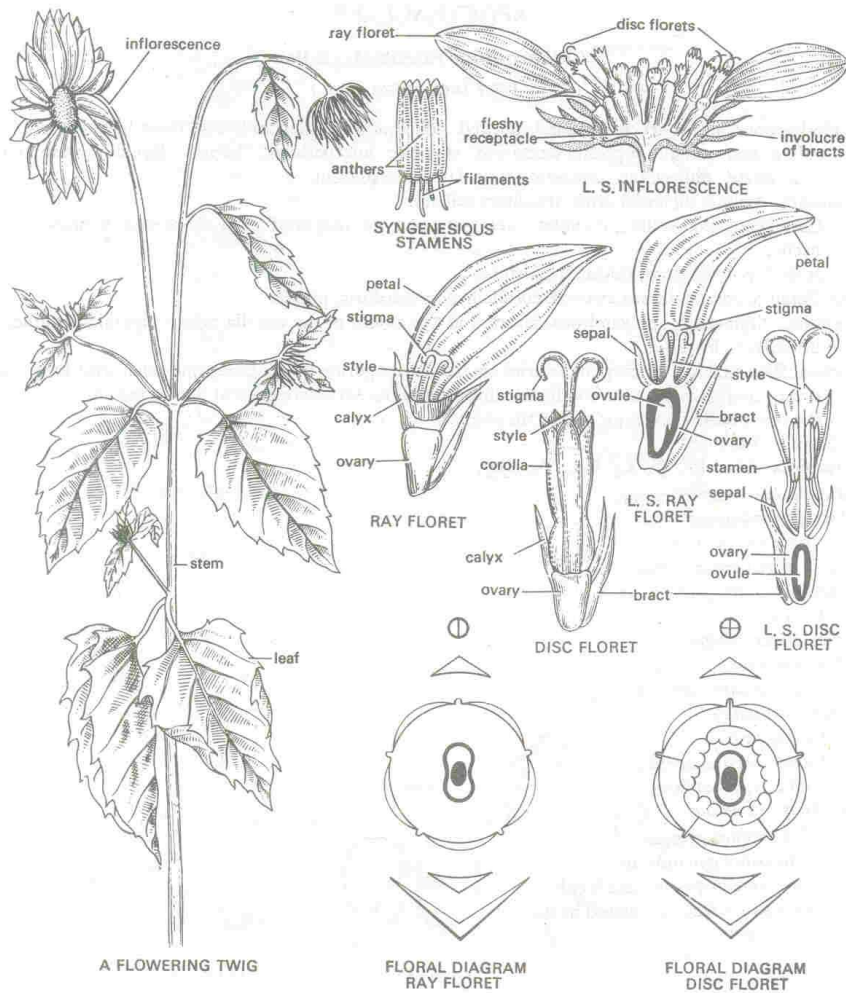
1. Ovary inferior
2. Number of stamens equal to the number of petals.

Order. Asterales

1. Stamens epipetalous
2. Ovary unilocular with one ovule.

Family Compositae (Asteraceae)

1. Leaves generally alternate
2. Inflorescence capitulum
3. Calyx reduced to hairy pappus
4. Stamens epipetalous and syngenesious.

Fig. 46. *Helianthus annuus*.

1. English name. Sunflower.
2. Vernacular name. Suraj mukhi
3. Economic importance. Fatty oil extracted from the seeds, is used in cooking.

(B-15)

APOCYNACEAE*

Stem. Herbaceous, aerial, angular, branched, solid, puberulous, purple-red, milky latex present.

Leaf. Cauline and ramal, opposite decussate, stipulate interpetiolar, simple, elliptic-ovate, entire mucronate, puberulous, unicostate reticulate, latex present.

Inflorescence. Axillary dichasial cyme or solitary axillary.

Flower. Ebracteate, pedicellate, complete, actinomorphic, hermaphrodite, pentamerous, hypogynous and cyclic.

Calyx, Sepals 5, polysepalous, valvate, persistent.

Corolla. Petals 5, gamopetalous, twisted, corolla hypocrateriform, purple.

Androeclum. Stamens 5, polyandrous, inserted at the mouth of the corolla tube, epipetalous, ditheous, dorsifixed, introrse.

Gynoecium. Bicarpellary, syncarpous, ovaries are free and superior, placentation marginal, style long, stigma drum-shaped and sticky. Two ligulate hypogynous nectarines are present one on the anterior side and the other on the posterior side of the ovary.

Fruit. Etaerio of follicles.

Flora formula Ebr, ⊕ K5, C(5), A5, G(2)

Classification and identification.

Class Dicotyledonae

1. Venation reticulate.
2. Flowers Pentamerous

Sub –Class Gamopetalae

1. Petals fused.

Series Bicarpellatae

1. Carpels two
2. Ovary usually superior

Order. Gentianales

1. Leaves opposite
2. Flowers actinomorphic
3. Stamens epipetalous

Family Acocynaceae

1. Inflorescence cymose.
2. Stamens not gynandrous
3. Ovules one or two in each locule.
4. Ovaries two, free, but united by the style.
5. Latex present.

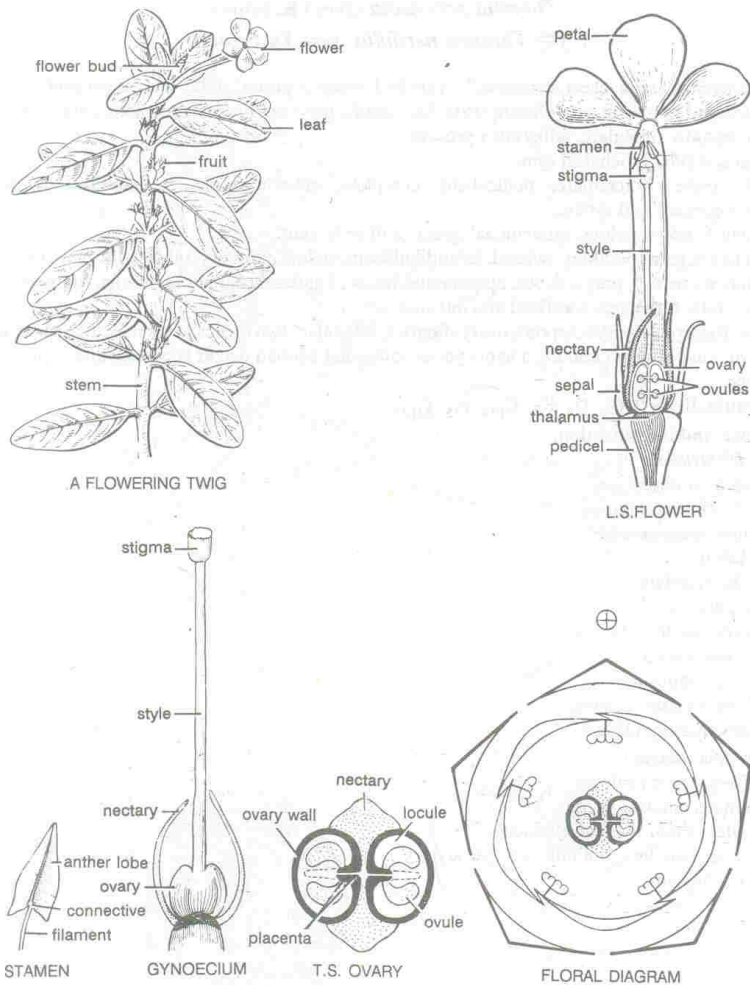


Fig. 47. *Catharanthus roseus*.

1. English name. Madagascar periwinkle.
2. Vernacular names. Sada Sawagan, Sadabahar.
3. Economic importance. The plant is grown as an ornamental.

***Thevetia peruviana* (pers) K.Schum**

Stem. Herbaceous, aerial, erect, cylindrical, branched, smooth green, milky latex is present.

Leaf. Cauline and ramal, alternate, extipulate, sub-sessile, pulvinus, linear-lanceolate, entire, acute, glarous, unicastate reticulate, milky latex present.

Inflorescence, Axillary dichasial cyme

Calyx, Sepals 5, polysepalous, guincunical, green and persistent

Corolla. Petals 5, gamopetalous, twisted, infundibuliform, yellow coronary outgrowths present.

Androecium. Stamens 5, polyandrous, epipetalous, inserted at the throat of the corolla, filament short, anther sagittate, dithecal, basifixed and introrse.

Gynoecium. Bicarpellary, syncarpous, ovary superior, bilocular, two ovules in each locule, placentation axile, style long, stigma capitate, a hypogynous somewhat 5 lobed nectar secreting disc is present.

Fruit. Drupe

Flora formula Br, brl, ⊕ K5, C(5), A5, G(2)

Classification and identification.

Class Dicotyledonae

1. Venation reticulate.
2. Flowers Pentamerous

Sub-Class Gamopetalae

1. Petals fused.

Series Bicarpellatae

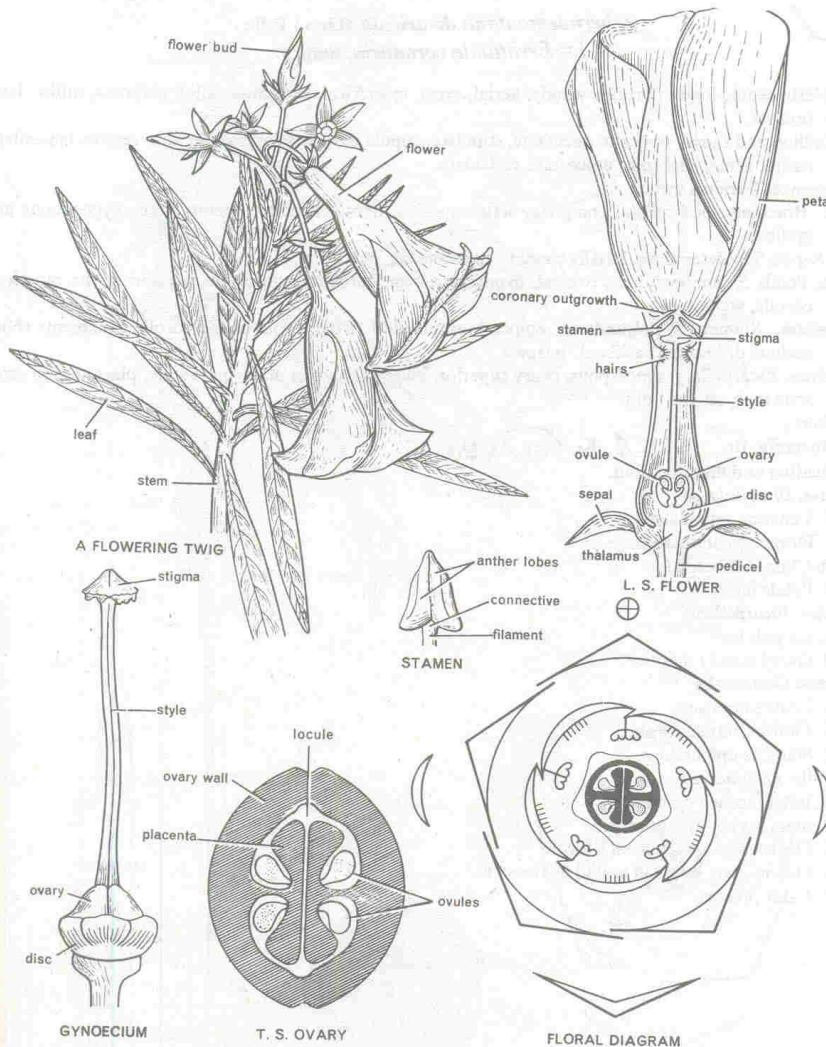
1. Carpels two
2. Ovary usually superior

Order. Gentianales

1. Leaves opposite
2. Flowers actinomorphic
3. Stamens epipetalous

Family Acocynaceae

1. Inflorescence cymose.
2. Stamens not gynandrous
3. Ovules one or two in each locule.
4. Ovaries two, free, but united by the style.
5. Latex present.

Fig. 48. *Thevetia peruviana*.

1. English name. Yellow oleander.

2. Vernacular name. Peeli kancr.

3. Economic importance. Bark is used in different kinds of intermittent fevers.

***Tabernaemontana divaricata* (Linn) R.Br.**

Stem. Herbaceous, Lower portions woody, aerial, erect cylindrical, branched, solid, glabrous, milky latex present.

Leaf. Cauline and ramal, opposite decussate, stipulate, stipule intrapetiolar, simple, sub-sessile, lanceolate, entire, acute, glabrous, unicostate reticulate.

Inflorescence, Terminal cyme.

Flower . Bracteate, pedicelolate, complete, actinomorphic, hermaphrodite, pentamerous, hypogynous and cyclic.

Calyx. Sepals 5, polysepalous, basally connate, guincuncial, persistent

Corolla. Petals 5, gamopetalous, twisted, hypocrateriform, coronary outgrowths present at the mouth of corolla white.

Androeclum. Stamens 5, polyandrous, epipetalous, inserted at the throat of the corolla, filament short, anthers ditheous, basifixed, introrse.

Gynoecium. Bicarpellary, syncarpous, ovary superior, bilocular, two ovules many per locule, placentation axile, style long, stigma bifid.

Fruit. berry

Flora formula Br, ⊕ K5, C(5), A5, G(2)

Classification and identification.

Class Dicotyledonae

3. Venation reticulate.
4. Flowers Pentamerous

Sub –Class Gameopetalae

2. Petals fused.

Series Bicarpellatae

5. Carpels two
6. Ovary usually superior

Order. Gentianales

4. Leaves opposite
5. Flowers actinomorphic
6. Stamens epipetalous

Family Acocynaceae

6. Inflorescence cymose.
7. Stamens not gynandrous
8. Ovules one or two in each locule.
9. Ovaries two, free, but united by the style.
10. Latex present.

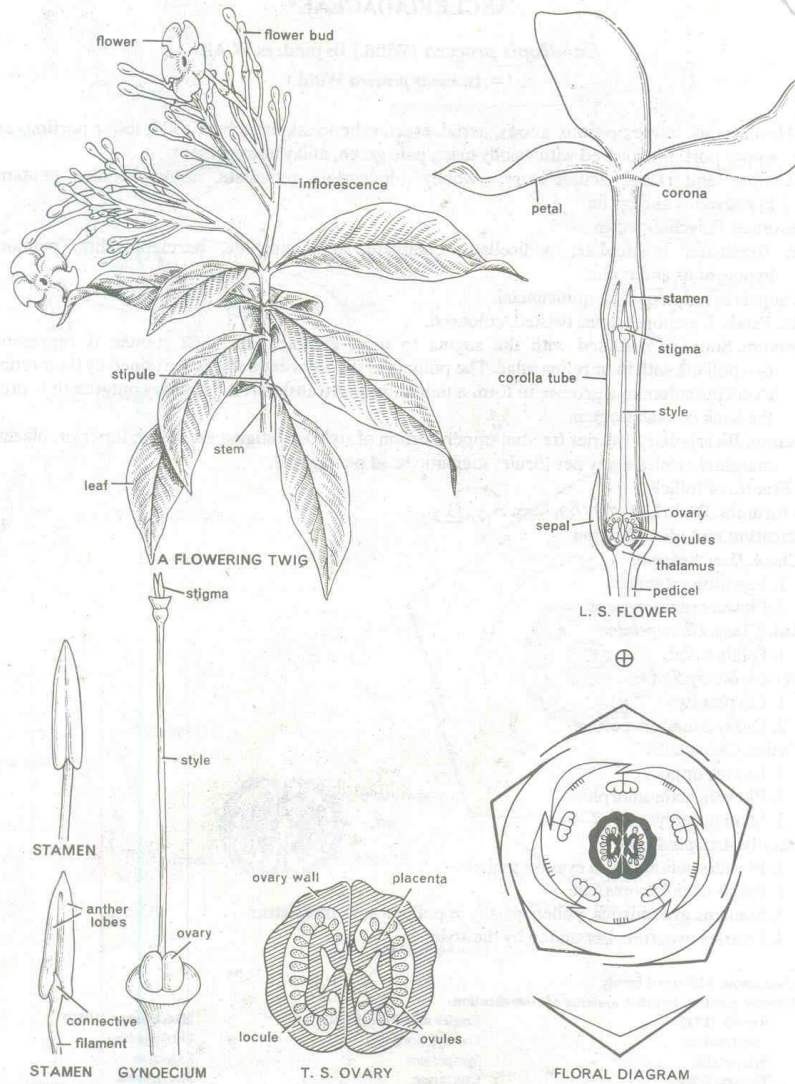


Fig. 49. *Tabernaemontana divaricata*.

1. English name. Crape-jasmine.
2. Vernacular names. Chandni, Chamela, Tagar.
3. Economic importance. Plant is grown as an ornamental. Red pulp around seeds is used as a dye.

ACANTHACEAE*

Justicia gendarussa L.I.

Stem. Herbaceous, aerial, erect, cylindrical, nodes prominent and flat, branched, solid, glabrous, red-brown.

Leaf. Cauline and ramal, opposite decussate, stipulate, simple, petiolate, petiole small, lanceolate, crenate, obtuse, glabrous, unicostate reticulate, coriaceous.

Inflorescence. Dichasial cyme, arranged in a racemose fashion.

Flower. Bracteate, bracteolate, pedicellate, pedicel small, complete, zygomorphic, hermaphrodite, pentamerous, hypogynous and cyclic.

Calyx. Sepals 5, gamosepalous, valvate.

Corolla. Petals 5, gamopetalous, valvate corolla 2/3, bilabiate personate.

Androecium. Stamens 2, polyandrous, epipetalous, ditheous, anther lobes are situated at unequal heights and lower one bears an appendage, basifixed, introrse.

Gynoecium. Bicarpellary, syncarpous, ovary superior, bilocular with one ovule in each locule, axile placentation, style long, stigma simple and knob-like.

Fruit. Capsule

Floral formula. Br. Br1, ⊕ K5, C(2/3), A2, G(2)

Classification and identification.

Class. Dicotyledonae.

1. Venation reticulate.
2. Flowers pentamerous

Sub-Class Gamopetalae

1. Petals fused.

Series. Bicarpellatae

1. Carpels two.
2. Ovary usually superior

Order. Personales

1. Flowers zygomorphic.
2. Corolla bilabiate personate.
3. Stamens usually 4 didynamous, or two
4. Ovary uni-bi-or tetralocular, ovules usually indefinite.

Family. Acanthaceae

1. Herbs or shrubs with opposite leaves.
2. Flowers in spikes, racemes or cymose umbels
3. Anthers are situated at unequal heights
4. Gynoecium bilocular, each locule with indefinite to two ovules
5. Jaculators are present between the seeds.

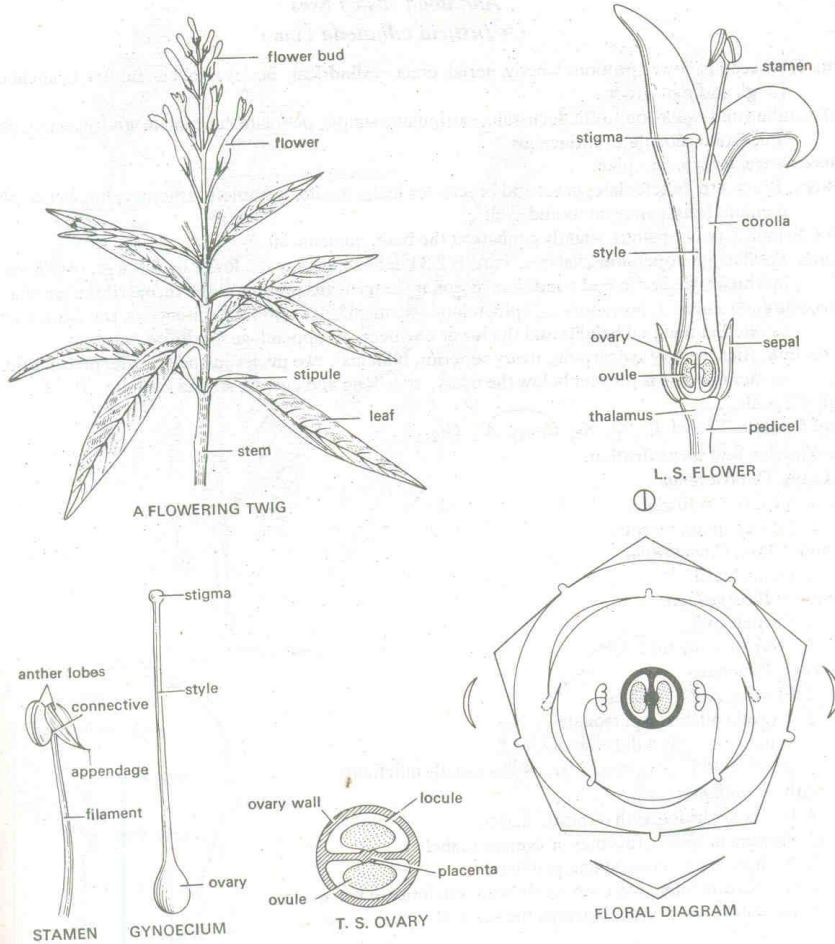


Fig. 61. *Justicia gendarussa*.

1. Vernacular name. Nili-nargandi.

2. Economic importance. It is used as a hedge plant.

ADHATODA VASICA NEES

Stem. Herbaceous, Lower portions woody, aerial, erect, cylindrical, nodes swollen and flat, branched, solid

Leaf. Cauline and ramal, opposite decussate, exstipulate, simple, petiolate lanceolate, entire, acute, glabrous, unicostate reticulate, coriaceous.

Inflorescence. Racemose spike.

Flower. Bracteate, bracteolate, bract and bracteoles leafy, sessile, complete, zygomorphic, hermaphrodite, pentamerous, hypogynous and cyclic.

Calyx. Sepals 5, polysepalous, slightly connate at the base, guineuncial.

Corolla. Petals 5, gamopetalous, valvate corolla 2/3, bilabiate personate. lower lip has a groove in the centre in which style lies in bud condition. Coronary outgrowths present at the throat of the corolla.

Androecium. Stamens 2, polyandrous, epipetalous, filament thick and long, ditheous, the anther lobes are situated at unequal heights and the lower one bears an appendage, basifixed, introrse.

Gynoecium. Bicarpellary, syncarpous, ovary superior, bilocular two ovules in each locule, placentation, axile an annular disc is present below the ovary, style long and curved, stigma capitate.

Fruit. Capsule

Floral formula. Br. Br1, \oplus K5, C(2/3), A2, G(2)

Classification and identification.

Class. Dicotyledonae.

1. Venation reticulate.
2. Flowers pentamerous

Sub –Class Gamopetalae

1. Petals fused.

Series. Bicarpellatae

3. Carpels two.
4. Ovary usually superior

Order. Personales

5. Flowers zygomorphic.
6. Corolla bilabiate personate.
7. Stamens usually 4 didynamous, or two
8. Ovary uni-bi-or tetralocular, ovules usually indefinite.

Family. Acanthaceae

6. Herbs or shrubs with opposite leaves.
7. Flowers in spikes, racemes or cymose umbels
8. Anthers are situated at unequal heights
9. Gynoecium bilocular, each locule with indefinite to two ovules
10. Jaculators are present between the seeds.

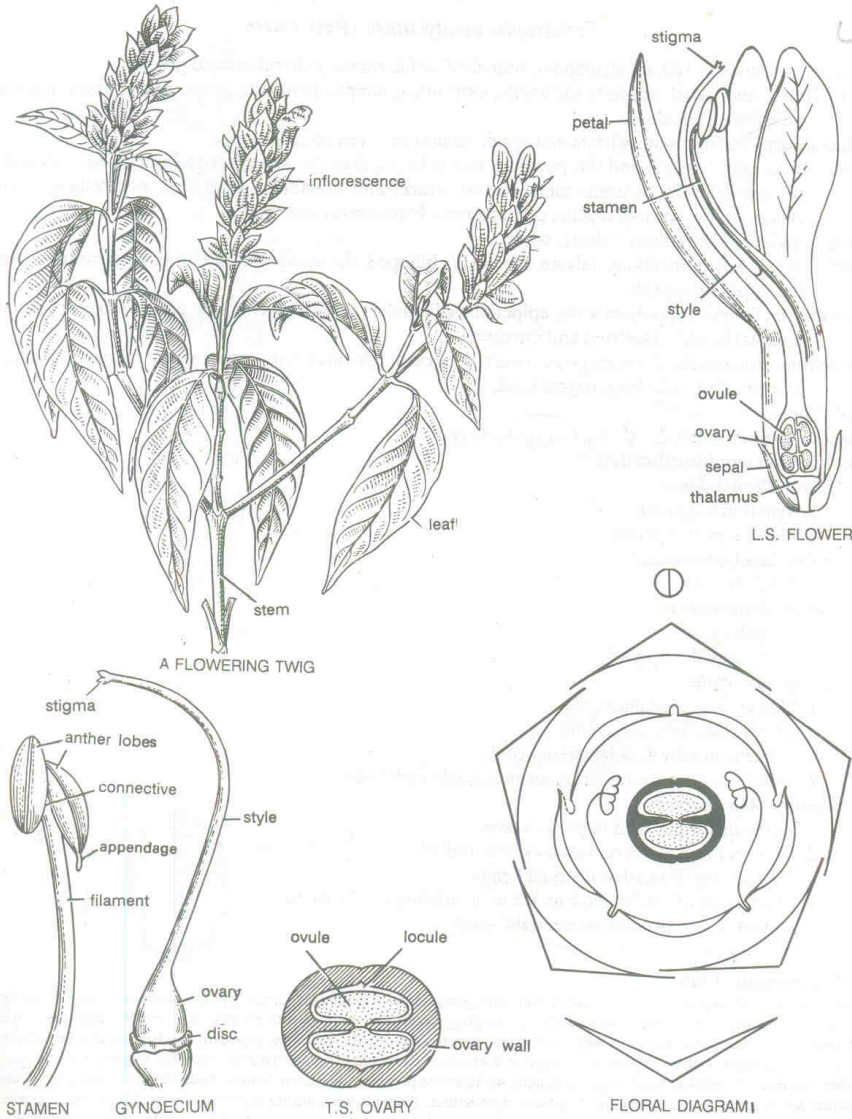


Fig. 62. *Adhatoda vasica*.

1. English name. Malabar nut.
2. Vernacular names. Adulasa, Basak, Safed bansa.
3. Economic importance. Leaves are used as Ayurvedic drug, used as an expectorant and relieves cough.

(B-15)

AMARANTHACEAE*

Amaranthus spinosus Linn

Habit. Herb.

Root. Branched tap root.

Stem. Herbaceous, aerial, erect, terete, branched, solid, spines present and green.

Leaf. Cauline and ramal, alternate, exstipulate, simple, petiolate, elliptic – ovate, entire, mucronate, unicostate, reticulate, membranous, 2 spines are present in the axil of each leaf which represent modified axillary branch.

Inflorescence. Condensed compound spike, terminal or axillary

(I) Maleflower. Bracteate, bracteolate, sessile, incomplete, actinomorphic, staminate, and cyclic

Perianth. Tepals 5, polyandrous, anteposed, filaments thin and long, ditheous, versatile, introrse.

Gynoecium. Absent

Floral Formula Br, brl, \oplus P5, A5, G₀

(II) Female flower. Bracteate, bracteolate, sessile, incomplete, actinomorphic, pistillate and cyclic.

Androecium. Absent

Gynoecium . Bicarpellary syncarpous, ovary superior, unilocular with single basal ovule, styles 2 spreading stigma bifid and hairy.

Fruit. Utricle.

Floral Formula Br, brl, \oplus P5, A₀, G(2)

Classification and identification.

Class Dicotyledonae

1. Venation reticulate.
2. Flowers pentamerous

Sub-Class Monochlamydeae

1. Flower usually with one whorl of perianth, commonly sepaloid or none.

Series. Curvembryae

1. Embryo curved

Family Amaranthaceae

1. opposite or alternate leaves.
2. Flowers small, haplochlamydous, usually hermaphrodite and actinomorphic
3. Tepals 4 or, 5, usually sepaloid.
4. Stamens 1 to 5 anteposed.
5. Gynoecium 2-3 carpellary, syncarpous, superior, unilocular with indefinite to 1 ovule.

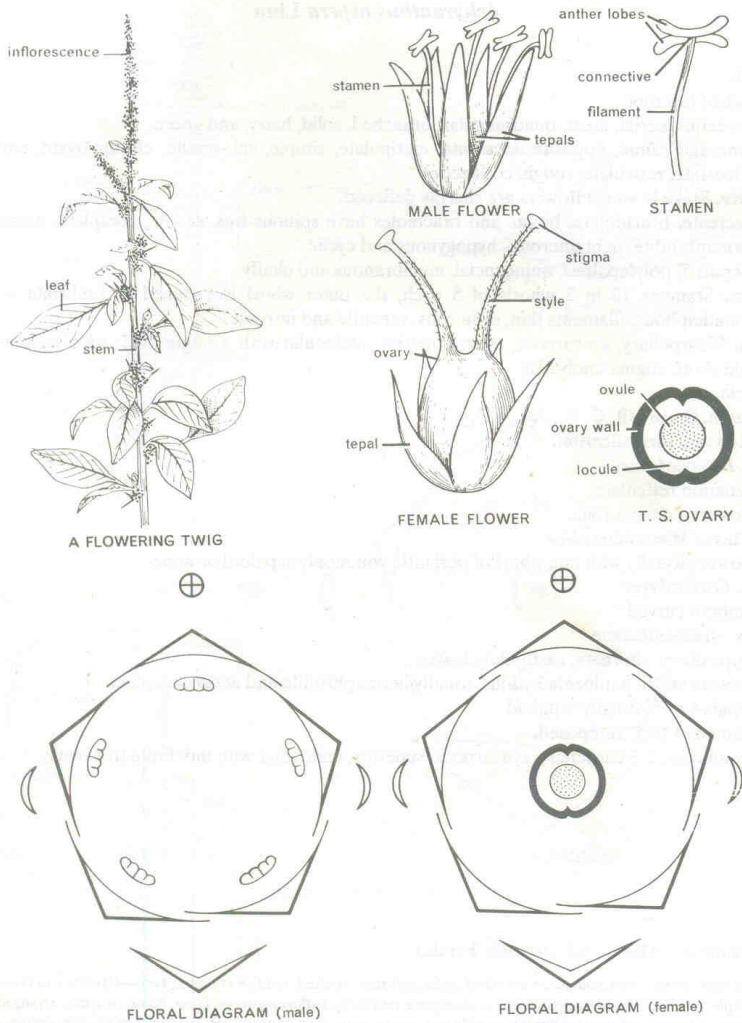


Fig. 68. *Amaranthus spinosus*.

1. English name. Amaranth.
2. Vernacular names. Jangli chaulai, Kantewali chaulai, Goja.
3. Economic importance. Tender tops are eaten.

***Achyranthus aspera* Linn**

Habit. Herb.

Root. Branched tap root.

Stem. Herbaceous, aerial, erect, terete, quadrangular, branched, solid, hairy, and green.

Leaf. Cauline and ramal, opposite decussate, exstipulate, simple, subsessile, elliptic – ovate, entire, acute, unicostate, reticulate, rough, coriaceous.

Inflorescence. Spike in which flowers are sharply deflexed

flower. Bracteate, bracteolate, bracts and bracteoles have spinous tips, sessile, complete, actinomorphic, hermaphrodite, pentamerous, hypogynous and cyclic.

Perianth. Tepals 5, polytepalous, quincuncial, membranous and chaffy.

Androecium. Stamens 10 in 2 whorls of 5 each, the outer whorl is reduced to fimbriate staminodes, monadelphous, filaments thin, ditheous, versatile and introrse.

Gynoecium . Bicarpellary syncarpous, ovary superior, unilocular with single ovule on a basal placentum, style short, stigma knob-like.

Fruit. Utricle.

Floral Formula $Br, brl, \oplus P5, A(5+5), G(2)$

Classification and identification.

Class Dicotyledonae

1. Venation reticulate.

2. Flowers pentamerous

Sub-Class Monochlamydeae

2. Flower usually with one whorl of perianth, commonly sepaloid or none.

Series. Curvembryae

2. Embryo curved

Family Amaranthaceae

5. opposite or alternate leaves.

6. Flowers small, haplochlamydous, usually hermaphrodite and actinomorphic

7. Tepals 4 or, 5, usually sepaloid.

8. Stamens 1 to 5 anteposed.

9. Gynoecium 2-3 carpellary, syncarpous, superior, unilocular with indefinite to 1 ovule.

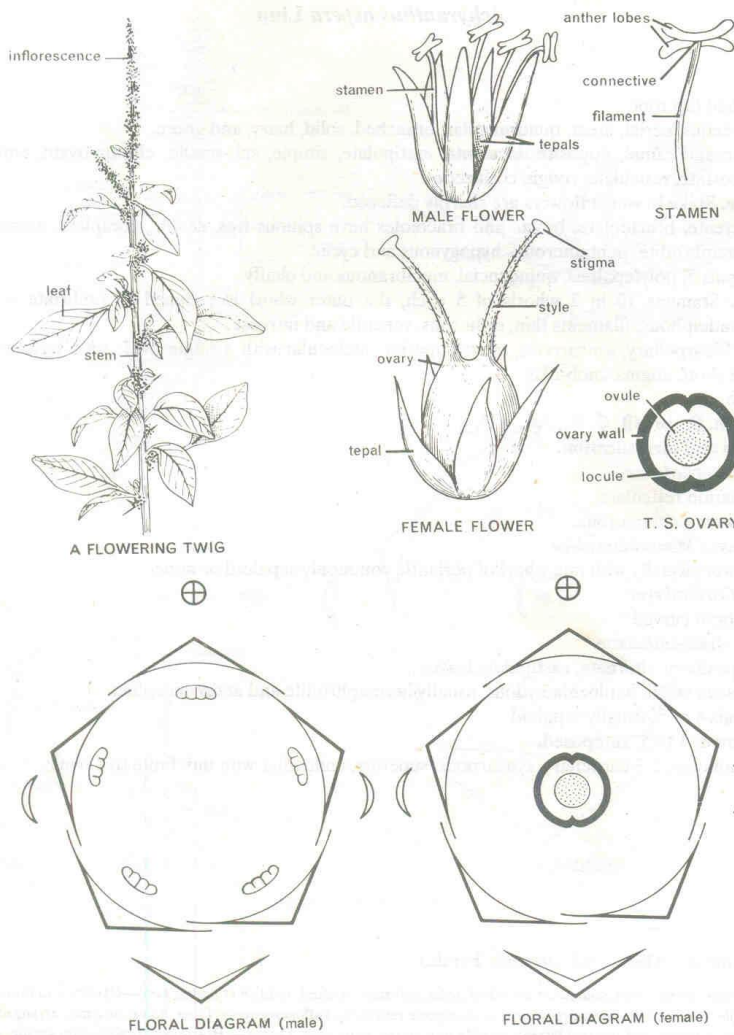


Fig. 68. *Amaranthus spinosus*.

1. English name. Amaranth.
2. Vernacular names. Jangli chaulai, Kantewali chaulai, Goja.
3. Economic importance. Tender tops are eaten.

POACEAE (GRAMINEAE)* (*Triticum vulgare* Vill)

Habit . Herb

Root . Adventitious, Fibrous,

Stem. Herbaceous, aerial, erect, cylindrical, branchedm branching is only at the basal

region of the stem and is known as tillering, culm, smooth and green.

Leaf. Alternate, exstipulate, simple, sessile, leaf distinguished into a linear leaf blade and a leaf sheath, and at the junction of these two a small membranous ligule is present, lamina lanceolate, entire, acute, minutely hairy, multicostate parallel.

Inflorescence, spike of spikelets, Each spikelet consists of the following parts –

(1) A pair of glumes present at the base; outer one is called the first glume and the inner one as second glume. These glumes are barren.

(2) After glume, is present lemma or inferior palea.

(3) There is present superior palea or pale. The essential organs of flower lie between superior palea or lemma and inferior palea or pale.

Flower. Sessile, complete, zygomorphic, hermaphrodite, hypogynous and cyclic.

Perianth. Represented by 2 rudimentary free tepals known as lodicules .

Androecium. Stamens 3, polyandrous, filaments long, ditheous, versatile and introrse.

Gynoecium. Monocarpellary, ovary superior, unilocular, with one marginal ovule, style absent, stigma 2 and feathery.

Fruit. Caryopsis.

Floral formula. $\text{Br, } \oplus \circ \text{P2, A3, G 1.}$

Classification and identification.

Class Dicotyledonae

1. Venation parallel

2. Flowers trimerous

Series. Glumaceae

1. Flowers solitary, sessile in the axil of bract.

2. Perianth of scales or none.

3. Ovary usually unilocular and one ovuled.

Family Amaranthaceae

1. Joined stems with alternate 2 ranked leaves with split sheath and ligule

2. Inflorescence spikelet and each begins with one or two empty glumes then palea with axillary flowers.

3. Stamens usually three.

4. Gynoecium superior with one ovule

5. Fruit caryopsis

Description of Plant : Poaceae

[2

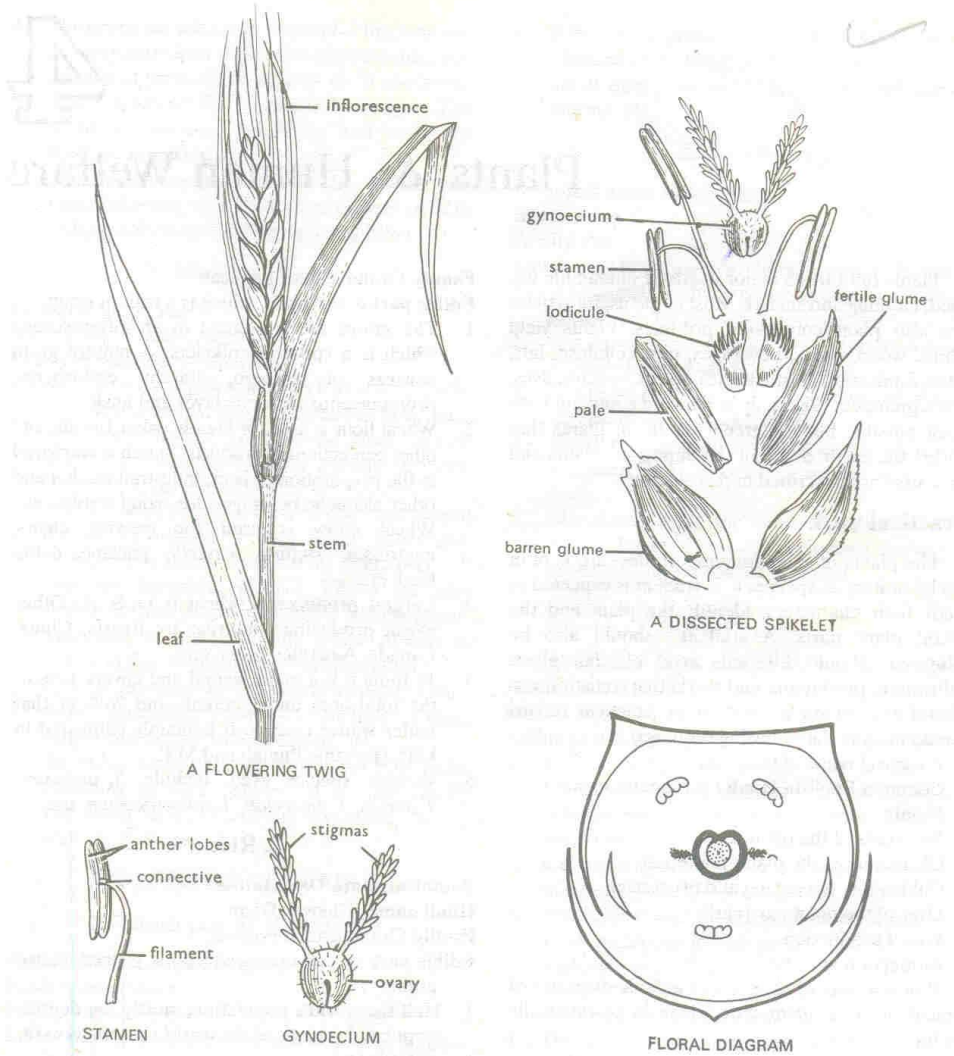


Fig. 84. *Triticum aestivum*.

1. English name. Wheat.

2. Vernacular names. Gehun, Kanak.

3. Economic importance. Cultivated as a food crop. The wheat straw is used as a cattle feed and in the manufacture of paper.

Make acetocarmine preparations of C (squash) (any one Stage) draw diagrams

SQUASHES

Some authors prefer to treat preparations under the method of preparing smears. There is a difference between the two. In smears, the cells which are already loose and not attached to each other are spread smeared over the surface of the slide. But in the case of squashes, soft tissues or organs are squashed on the slide to separate the constituent cells.

As the name literally means, the specimen placed on a clean slide is crushed under a coverslip and examined. This method is applicable to soft tissues/organs when it is desirable to tease or separate the cells to facilitate observation of individual cells.

In botanical microtechnique, specimens such as root tips, procarys and cystocarps of members of Rhodophyta, etc. are best studied by squashing.

The following two methods are generally followed.

WARMKE'S METHOD

This method has been found to yield very useful permanent micro preparations. It may also be applied on microsporocytes.

- Fix the tissue using formalin (1 part) and absolute alcohol (3 parts) mixture for a minimum of 12 hours.
- Leaving the specimen in the fixing solution helps increasing the affinity of the chromosomes for the stain.
- Fixed specimens can be stored for long in 70% alcohol
- Transfer the specimen to a mixture of equal parts of 95% alcohol and concentrated hydrochloric acid.
- Allow 5 to 10 minutes for the HCl to dissolve the middle lamella.
- Acid treatment softens the tissue.
- Treat the specimen in Carnoy's fluid containing chloroform for 5 minutes or longer. Carnoy's fluid hardens the tissue which has been softened by the acid

Procedure :

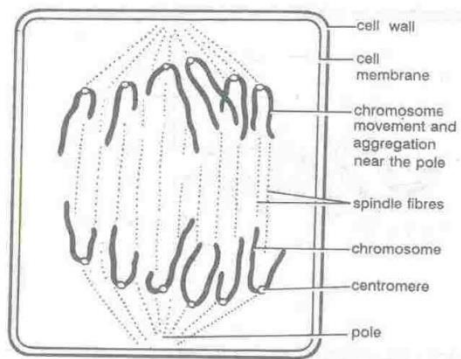
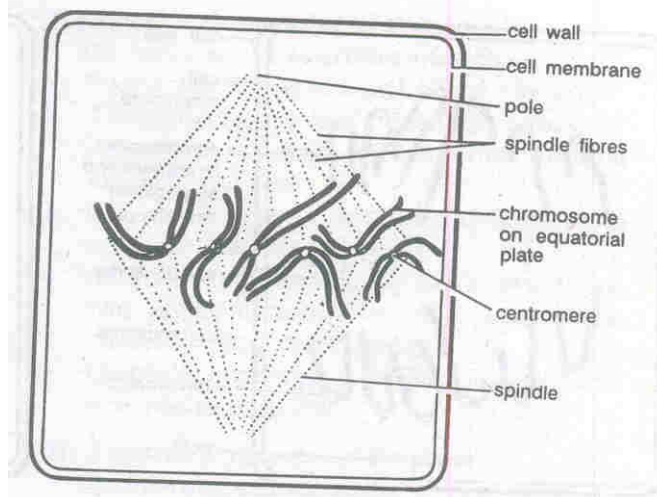
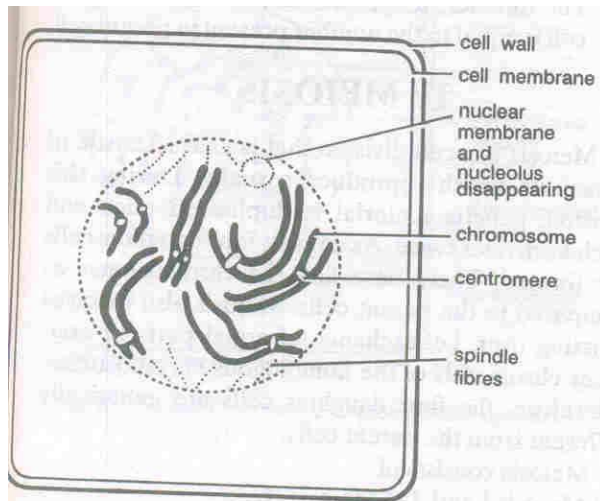
- Bring the slide down to distilled water
- Rinse in cold IN HCl

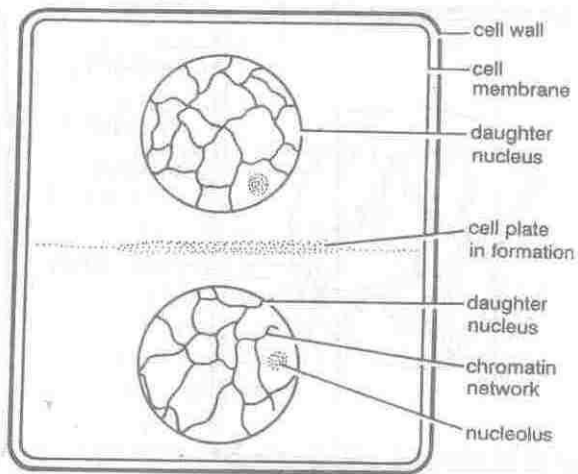
- Place the slide in fresh IN HCl and heat the solution quickly to 60°C. Avoid overheating. Allow the slide at that temperature for 4 to 5 minutes.
- Transfer the slide to the staining time of 3 to 5 hours, while for animal tissues the optimum time is 2 hours.
- Remove the slide from the stain and gently tap the lower edge on absorbent paper. This will withdraw the excess stain.
- Keep the slide for 10 minutes in the following differentiating solution mixture :

IN HCl	5 cc
10% aqueous potassium metabisulphite	5 cc
Distilled water	100 cc

Give three changes in the differentiating solution, each of 10 minutes duration.

- Plant materials may be counterstained quickly with 0.05% fast green in 95% alcohol.
- Pass the slide to xylol by gradual displacement method.
- Mount in balsam or DPX.





Problem : 2

Gene A is dominant over gene a what will be the phenotypic ratio in the offspring obtained from the following mating : Aa x aa?

Solution : Parents Aa x aa

Step : 1 Determination of Type of inheritance. This a monohybrid cross and presents a simple case of completed dominance. Gene A is dominant on gene a.

Step 2: Determination of genotype. One parent has genotype Aa and the other aa.

Step : 3 Types of gametes:

1. What will be the phenotype of the offspring of the following marriages concerned with the blood group.

genotype Aa and the other aa .

Step 3: Types of gametes:

Parent Aa produces two types of gametes

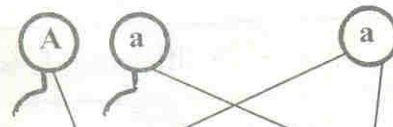


Parent aa produces only one type of gamete



Parent: Aa x aa

Gametes:



Offspring:

Aa 50% aa 50%

Answer:

Phenotypic ratio is 1:1.

This is an example of back cross.

Problems relating to Mendel's laws

Factors affecting the mapping

Chromosome map can be constructed only with the help of crossing over percentage. The crossing over percentage is highly modified by the interference and coincidence.

Interference

Normally the double crossing over frequency is very low. Because the crossing over and chiasma formation in the homologous non sister chromatids interferes with the crossing over and chiasma formation at other points nearby. This is called as interference. This was discovered by Muller (1911). The interference is inversely proportional to the crossing over percentage. The interference is maximum over a short distance and decreases as the distance increases.

Scan

Coincidence

The coincidence is an inverse measure of interference. It is measured as a ratio between actual number of double cross overs and the expected number of double cross overs.

$$\text{Coincidence} = \frac{\text{Actual number of double cross overs}}{\text{Expected number of double cross overs}}$$

If the actual number of double cross overs is zero, then coincidence is zero and interference is complete. If the actual number of double cross overs is the same as the expected number, coincidence is said to be one, and interference is nil. It ranges from 0 to 1

Problems

1. In corn, white endosperm (p) is recessive to purple shrunken is crossed to a pure white full. The F₁ is then crossed to a white shrunken, and the offsprings are as follows.

Purple shrunken – 1575 White shrunken - 58
 Purple full - 60 White full - 1667

Calculate the distance between white and shrunken. Total number of individuals = 3360

No. and % of parental combination individuals due to linkage.

Purple shrunken = 1575 = 46.9%
 White full = 1677 = 49.6%

Total % of individuals produced by crossing over 3.5%

So cross over value between

The gene P and F = 3.5%

So the distance between the

Gene P and F = 3.5 unit distance

Answer: The distance between white and shrunken

is = 3.5 unit. F _____ P

3.5

Expected double cross over = $\frac{7}{100} \times \frac{5}{100} \times 100$

 100 100

= 0.35%

So coefficient of coincidence =

$$\frac{\text{Observed D.C.O. Percentage}}{\text{Expected D.C.O. Percentage}}$$

$$= \frac{0.14}{0.35} = 0.4$$

Coincidence

3. In *Drosophila*, pink eyes (*r*) are recessive to red (R) the spineless condition (*s*) is recessive to the spined condition (*S*). Both pink and spineless are in the third chromosome. A pure red spined *Drosophila* is crossed to a pink spineless. Give the genotypes of the P 1 and F1. If an F1 female is crossed to pink spineless male, what is the genotypic nature of the offspring? What percent will each type be of the total, and what will be their appearance? Tell what % the cross over are of the total offspring and tell, therefore what the 'distance' between pink and spineless is judged to be.

4. A red spined *Drosophila* is crossed to a pink spineless and the F1 female is test crossed to a pink spineless male. The number of the offspring produced by the test cross is as follows.

Red spined	- 226	Red Spineless	- 25
Pink spined	- 28	Pink Spineless	- 221

Calculate the distance between pink and spineless as judged by this experiment

5. In maize genes P.S. and Py are on sixth chromosome. From the following cross and the test cross between the F1 and full recessive, what phenotypes would be expected and in what proportions.?

PSPy		PS PY
—	X	—
PSPY		PS PY

1. Colour Blindness

1. Colour blindness is a Sex – linked character discovered by Wilson in 1911.
2. It is a hereditary disease and the affected persons cannot distinguish red colour and green colour.
3. The red blindness is called protonopia. These persons cannot see red colour. The green blindness is called deuteranopia. Such persons cannot see green colour.
4. Colour blindness is a recessive character.
5. It is caused by recessive genes represented by CC,. The normal persons contain the genes CC or CC or C alone in man). The recessive genes prevent the proper development of colour sensitive cells in the retina.

6. The genes for colour blindness are located on the X chromosomes. Their alleles are absent from Y chromosome.

Some man has only one gene. The presence of only one gene for a character is called hemizygous. Some man is a hemizygote for colour blindness.

7. This character is common in man but rare in woman.

137

So man has only one gene. The presence of only one gene for a character is called *hemizygous*. So man is a *hemizygote* for colour blindness.

7. This character is common in man but rare in woman.

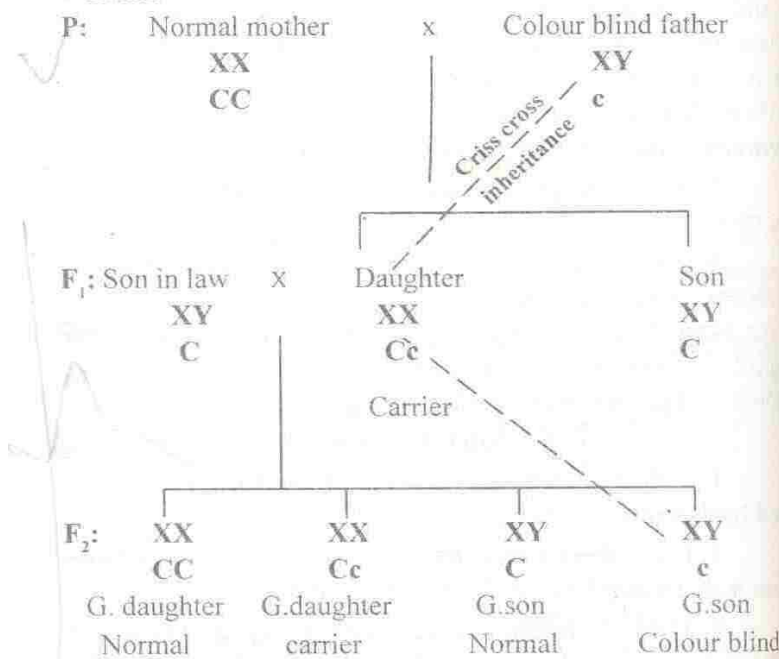


Fig. 10.1: Inheritance of colour blindness.

8. Colour blindness follows *criss-cross inheritance* as this character is transmitted from the father to the grandson through the daughter. It appears only in *alternate* generations.

9. This character is never transmitted to the son from the father.

10. The daughter carrying one recessive gene for colour blindness is called *carrier*. The carriers are normal in their vision.

8. Colour blindness follows criss - cross inheritance as this character is transmitted from the father to the grandson through the daughter. It appears only in alternate generations.
9. This character is never transmitted to the son from the father.
10. The daughter carrying one recessive gene for colour blindness is called carrier. The carriers are normal in their vision.

When a normal woman possessing the dominant gene for normal vision (CC) happens to marry a colour blind man (CY) all their daughters get one gene for colour blindness from their father. But they receive a dominant gene C from their mother. So they are normal. But they carry the recessive gene in one of their X chromosomes. So the daughters are called carriers because they carry the gene for colour blindness. The sons never get the disease because they receive their X chromosome from the normal mother, and the Y chromosome from their father. From which the allelic gene is absent.

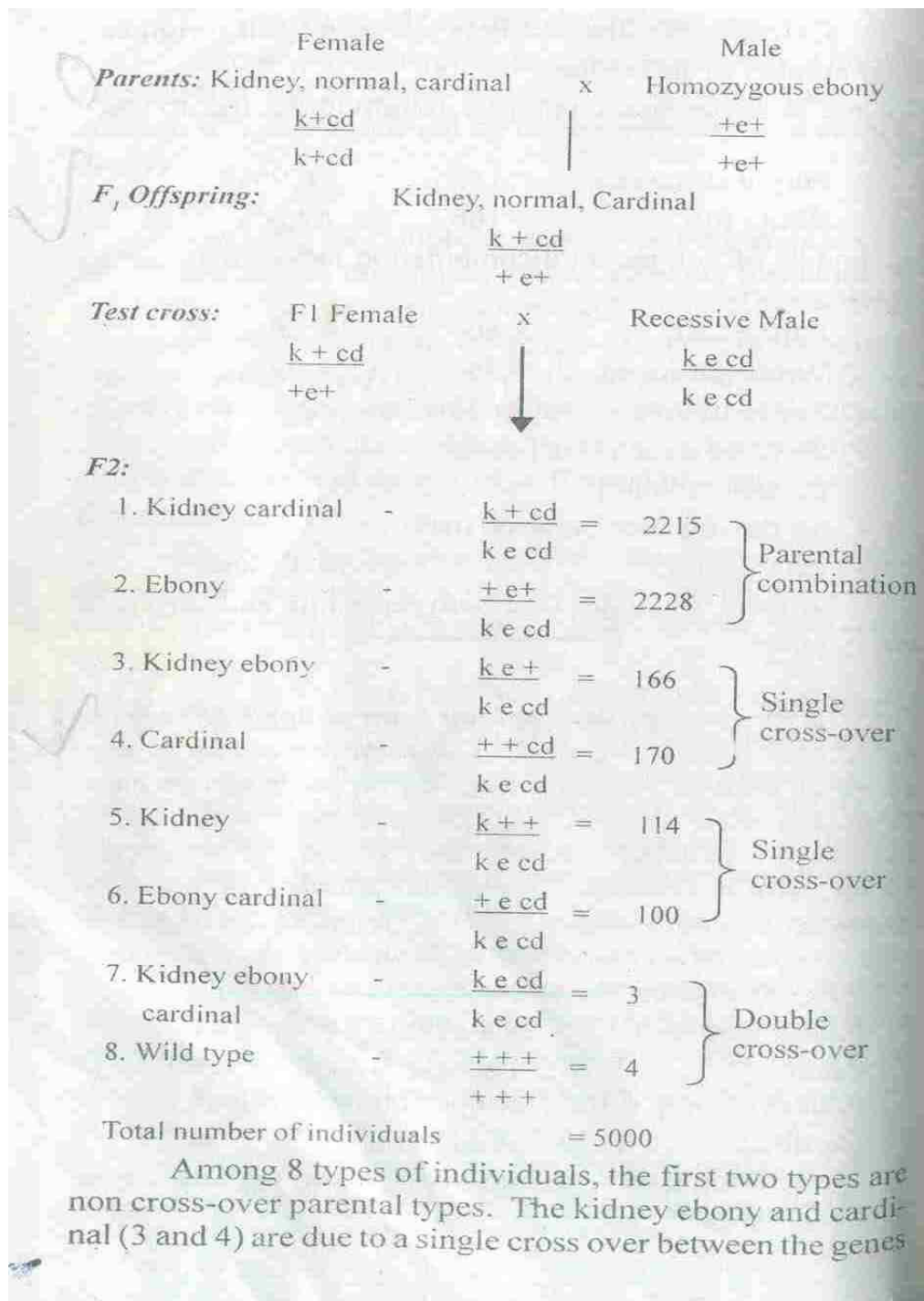
When the daughters (Carriers) are married to men with normal vision. Some colour blind sons are formed. These affected sons receive their one X chromosome (in which the recessive gene is present) from their mother (Carrier Cc).

If a colour blind woman is married to a normal man, all her sons are colour blind. The daughters are normal but they carry the recessive gene in one of their X chromosomes and they are carriers. When these daughters are normal but and they are carriers. When these daughters are married to a colour blind man, colour blind grandsons and grand daughters are produced in equal numbers. So it follows criss cross inheritance.

2. In *Drosophila* a kidney bean shaped eye is produced by a recessive gene *k*. Cardinal eye colour is produced by another recessive gene *cd* on the same chromosome. Between these two loci is a third locus with a recessive allele *e* producing ebony body colour. Homozygous kidney, cardinal normal body colour females are mated to homozygous ebony males. The F_1 females are then test crossed with the recessive parent to produce the F_2 . Among 5000 F_2 progeny are the following.

Kidney cardinal	2215	Kidney	114
Ebony	2228	Ebony-Cardinal	100
Kidney-ebony	166	Kidney ebony cardinal	3
Cardinal	170	Wild type	4

Determine the map distance between the genes. (use the modern symbols).



k and *e*. The kidney and ebony cardinal (5 and 6) are due to a single cross over between the genes *e* and *cd*. The kidney ebony cardinal and wild types (7 and 8) are due to double cross overs.

The cross over % between *k* and *e* =

$$\frac{\text{No. of S.C.O. individuals} + \text{No. of D.C. O individuals}}{\text{Total number of individuals}} \times 100$$

$$\begin{aligned} \text{No. of S.C.O. individuals} &= 166 + 170 = 336 \\ \text{between } k \text{ and } e & \end{aligned}$$

$$\text{No. of D.C.O. individuals} = 3 + 4 = 7$$

$$\text{Total number of individuals} = 5000$$

$$\begin{aligned} \text{So the C.O\% between } k \text{ and } e &= \frac{336 + 7}{5000} \times 100 \\ &= 6.86 = 7\% \end{aligned}$$

$$\begin{aligned} \text{No. of S.C.O. individuals} & \\ \text{between } e \text{ and } cd &= 114 + 100 = 224 \end{aligned}$$

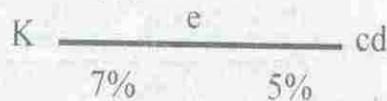
$$\begin{aligned} \text{So the C.O\% between } e \text{ and } cd &= \frac{224 + 7}{5000} \times 100 \\ &= 4.62 = 5\% \end{aligned}$$

Map unit distance between two genes is = % crossing over between the two genes

So the map unit distance between the genes

$$k \text{ and } e = 7\%$$

$$e \text{ and } cd = 5\%$$



Coefficient of coincidence

$$\text{Coincidence} = \frac{\% \text{ of actual double cross over}}{\% \text{ of expected double cross over}}$$

$$\text{Actual double cross over} = 4 + 3 = 7$$

$$\begin{aligned} \% \text{ of actual double cross over} &= \frac{7}{5000} \times 100 \\ &= 0.14\% \end{aligned}$$

$$\begin{aligned}\text{Expected double cross over} &= \frac{7}{100} \times \frac{5}{100} \times 100 \\ &= 0.35\%\end{aligned}$$

$$\begin{aligned}\text{So coefficient of coincidence} &= \frac{\text{Observed D.C.O percentage}}{\text{Expected D.C.O percentage}} \\ &= \frac{0.14}{0.35} = 0.4 \\ \text{Coincidence} &= 0.4\end{aligned}$$