B.Sc. Semester-II

PAPER – II

PALAEOBOTANY & MORPHOLOGY OF ANGIOSPERMS

UNIT -IV

Topic:

- ***Androecium***
- ***Gynoecium***
- ***Fruit***

By

Dr. Prashant Shahare

D. B. Science College, Gondia. India.

Androecium of flower.

The androecium is the third set of floral organs composed of stamens or micro- sporophylls.

Ordinarily, each stamen is composed of a slender stalk-like filament supporting a knob-like spore case or the anther .

Each anther consists of two lobes (anther lobes) connected by a connective which can be clearly seen on the dorsal side as an extension of the filament. Each anther lobe, again, has two pollen sacs or pollen chambers placed longitudinally. There are longitudinal grooves or sutures along the ventral face of the anther demarcating the pollen chambers. Each pollen chamber represents a microsporangiur and contains innumerable microspores or pollens.

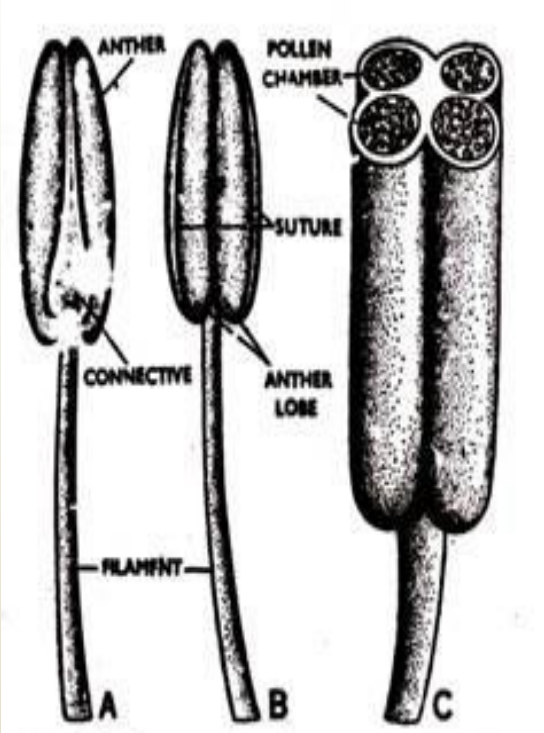


Fig. 336. Stamen showing parts. A. Dorsal view. B. Ventral view. C. Enlarged portion showing t... of anther.

The stamen, therefore, is a microsporophyll bearing four microsporangia. While this is the normal case, there are some flowers where the anther possesses only two pollen chambers (i.e., bisporangiate) and in Malvaceae even these two pollen chambers fuse developing a mature unilocular anther.

A flower may sometimes be reduced to a single stamen as seen in the cyathium inflorescence .

Filament:

In rare cases a stamen may be devoid of a filament or sessile as seen in the stamens of Arum maculatum . On the other extreme, a stamen may not develop any fertile anther when it is sterile and termed a staminode as seen in Cassia and Canna .

In the latter case it is also petaloid. The showy labellum of Scitaminae is formed of staminodes. In water-lily the filament is flat showing its transition from petals .

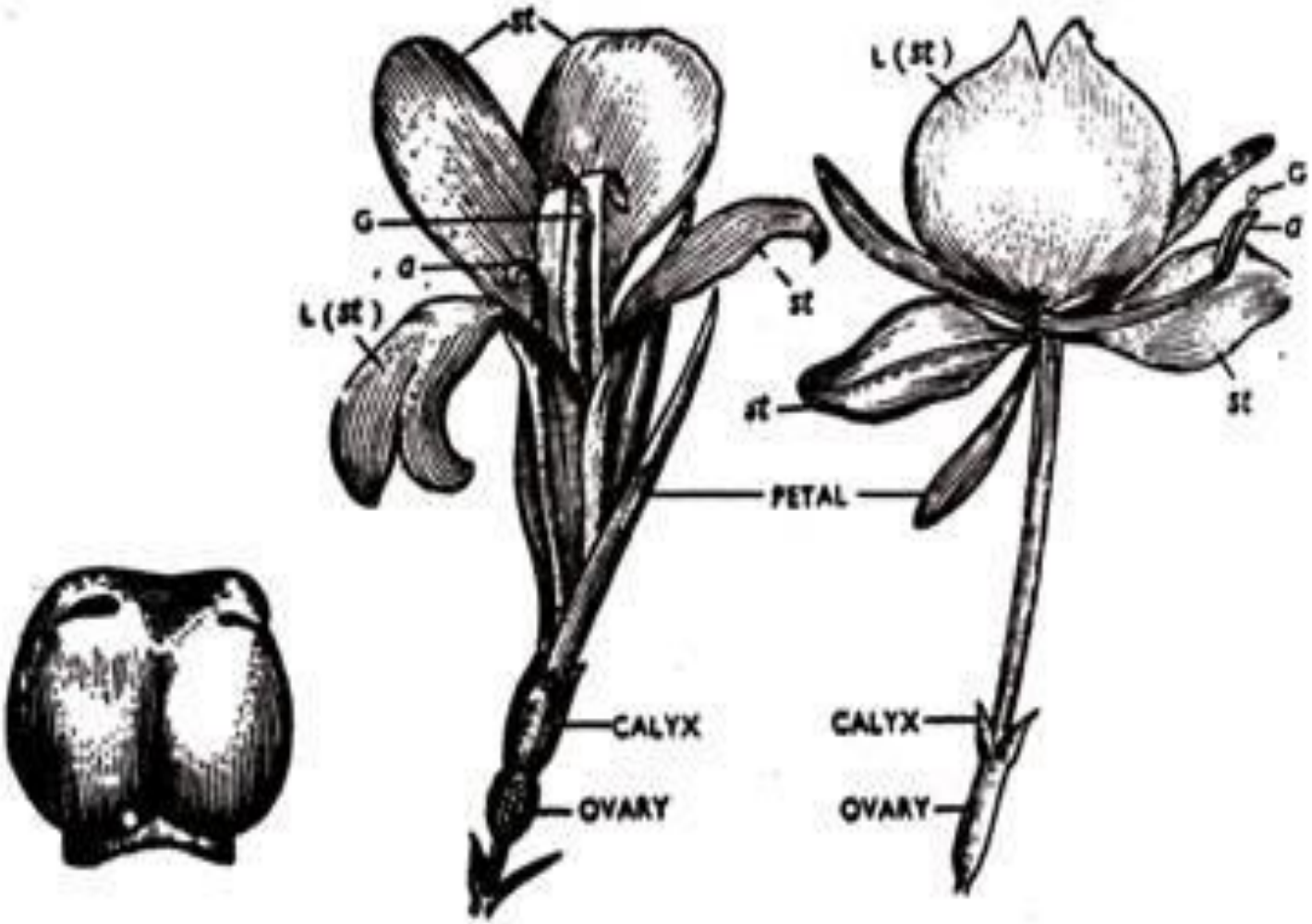


FIG. 337 FIG. 338 FIG. 339

FIG. 337. Sessile stamen of *Arum maculatum*. FIG. 338. Flower of *Canna indica* (Cannaceae of Scitaminae). FIG. 339. Flower of *Hedychium coronarium* (Zingiberaceae of Scitaminae). *st*=staminode; L=Labellum; *a*=anther; G=pistil.

The filament may be white or coloured yellow, blue, black, etc., like petals. While the filament is ordinarily simple, in Ricinus communis it is found to be branched. When filaments are very long, stamens protrude out of the flower and are termed exserted. On the contrary, when stamens remain within the flower; they are termed inserted.

Filaments sometimes bear appendages. Most characteristic of these is the staminal which is horny in Calotropis and cup-shaped in Eucharis , Pancratium and some other flowers of Amaryllidaceae.

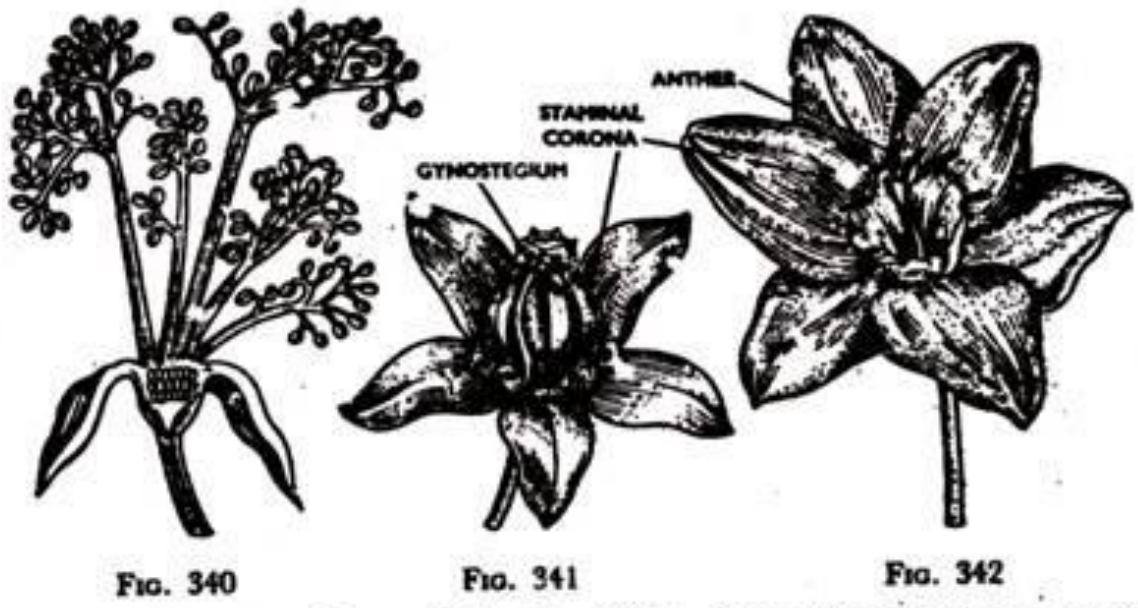


FIG. 340. Branched stamen of castor (after Van Tieghem). FIG. 341. Staminal corona in *Calotropis procera* flower. FIG. 342. Staminal corona in *Eucharis amazonica*.

Connective:

Ordinarily, the connective is a patch of tissues connecting the two parallel anther lobes .It is a prolongation of the filament and contains the conducting strands.

The connective, however, may be (1) extremely small or altogether wanting as in some species of Euphorbia and in Adhatoda zeylanica (Acanthaceae) where the anther lobes are very close together. This condition is termed discrete.

(2) In the lime tree (Tilia) and in fusticia gendarussa (Acanthaceae) the connective is called divaricate as it develops in such a way that the two anther lobes are separated from one another.

(3) In Salvia (Labiatae) a pet liar condition called distractile is noticed where the connective is a long stalk-like body placed crosswise on the filament separating the two anther lobes.

One anther lobe is fertile while the other is abortive, usually represented merely by a deltoid plate.

The connective also may bear appendages when it is called appendiculate. The connective is prolonged into a feathery appendix beyond the sagittate anther of the oleander (Nerium odorum) and some other flowers of Apocynaceae. These appendices in Nerium unite to form a staminal corona .

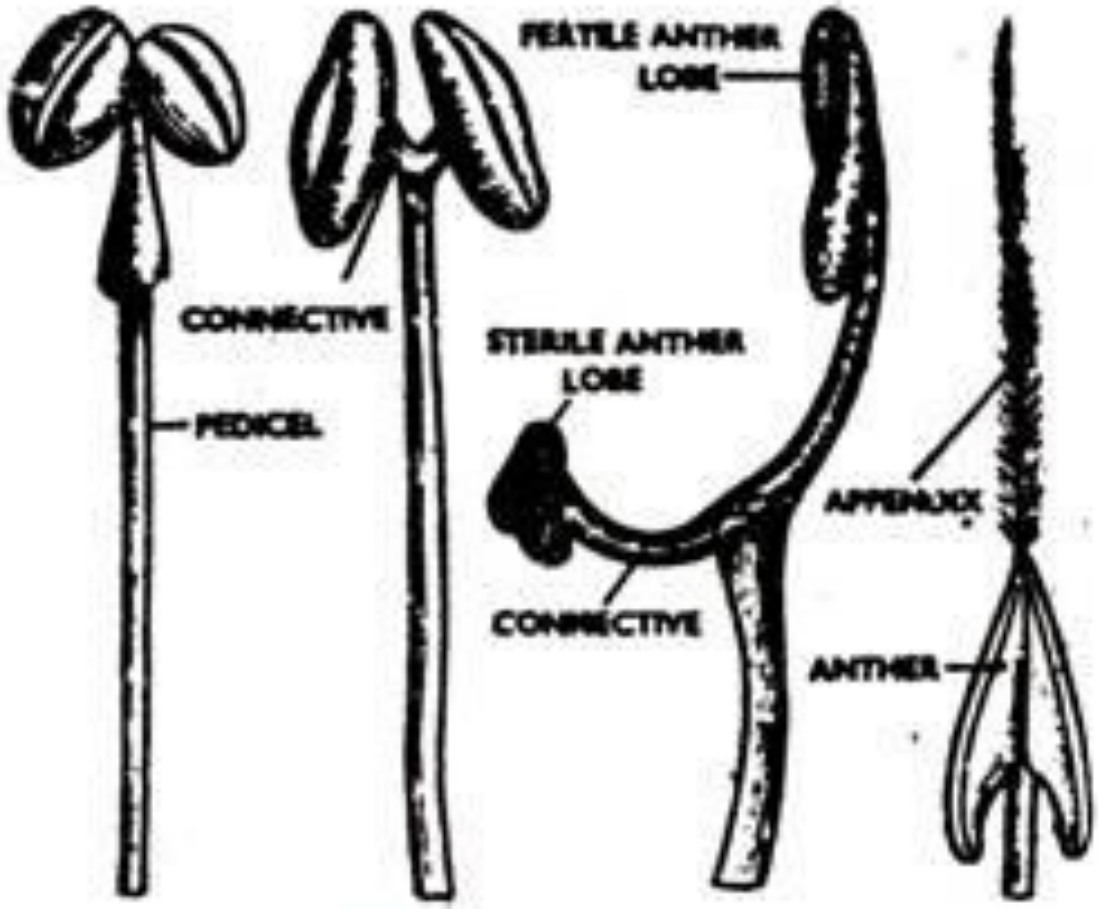


FIG. 343 FIG. 344 FIG. 345 FIG. 346

CONNECTIVE. FIG. 343. Discrete in *Poinsettia* (*Euphorbia*) *pulcherrima*. FIG. 344. Divaricate in *Tilia*. FIG. 345. Distractile in *Salvia verbenaca*. FIG. 346. Appendiculate in *Nerium odorum*.

Anther:

All Angiospermous anthers are bilobed and quadrilocular (i.e., formed of four micro-sporangia) at an early stage of development and this condition is seen in most mature stamens.

Rarely, however, the anther becomes unilocular or one-chambered either by the abortion of one lobe and destruction of the portion wall between the two chambers or the destruction of the entire partition tissue separating the four chambers.

This condition is seen in the family Malvaceae . The grooved ventral side of an anther usually faces the gynoecium or the centre of the flower and this condition is known as introrse; but, in a few cases as in Gloriosa superba, Iris, Colchicum, etc., the anther faces the petals when the condition is called extrorse.

Anthers may be linear (Acalypha), rounded (Mercurialis), sagittate (Vinca), sinuous (peculiar -shaped appearance as seen in the cucurbits), reniform (china-rose), etc. The anther also may be appendiculate like the connective as may be seen in Erica cinerea of Ericaceae.

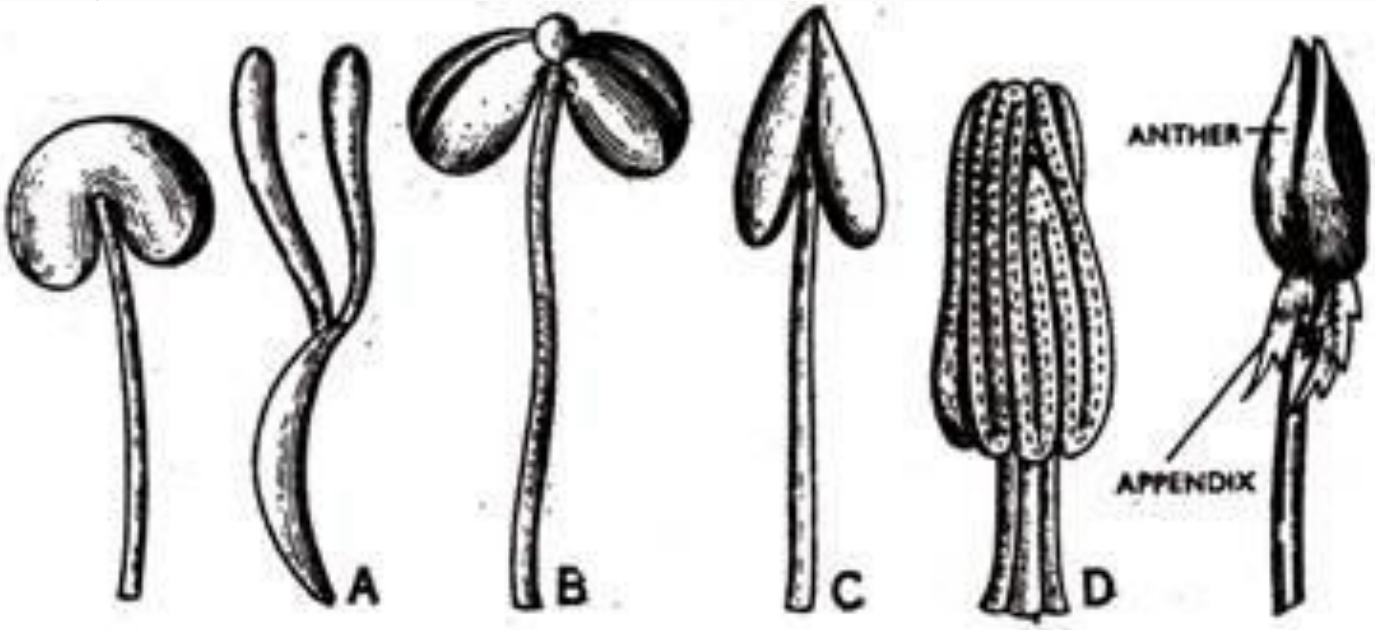


FIG. 347 FIG. 348 FIG. 349

ANTHER. FIG. 347. Unilocular and reniform in *Hibiscus rosa-sinensis*. FIG. 348. A. Linear in *Acalypha*. B. Rounded in *Mercurialis*. C. Sagittate in *Vinca*. D. Sinuous in *Cucurbita maxima*. FIG 349. Appendiculate in *Erica cinerea*.

Attachment of the Anther to the Filament:

The mode of attachment of the anther to the filament varies .

(1) It is adnate when the filament or its continuation, the connective, appears to be attached throughout the whole length of the back of the anther as seen in magnolia and water-lily.

(2) In mustard, Carex and other members of Cyperaceae, etc., the filament ends just at the base of the anther, the latter being firmly fixed on the top of the former. This condition is called basifixed or innate.

(3) The attachment is dorsifixed when the filament is firmly fixed to some position on the back of the anther as in passion-flower, Sesbania, etc.

(4) In most grasses and in many lilies the attachment is versatile where the filament, is attached merely at a point about the middle of the connective so that the anther can swing on it freely.

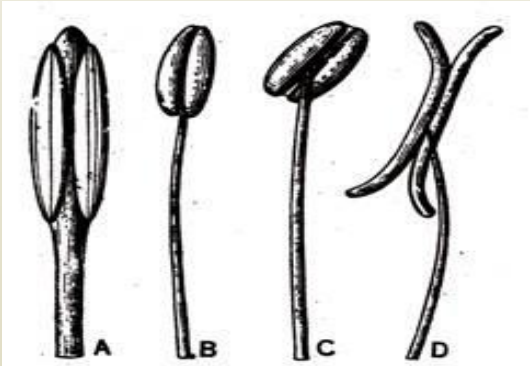


Fig. 350. Attachment of anthers. A. Adnate. B. Basifixed. C. Dorsifixed. D. Versatile.

Dehiscence of Anthers:

When the anthers become ripe they burst discharging the dry pollens. This act is called dehiscence and the time when this takes place is called anthesis.

Dehiscence may be of different types:

(1) Longitudinal—this is the common type of dehiscence when the anther lobes burst along the longitudinal sutures (i.e., the lines of fusion of the two pollen chambers in the two anther lobes) as may be seen in Datura, etc.;

(2) Transverse —seen in some unilocular anthers as those of Malvaceae (it appears to be transverse as the suture .is placed that way);

(3) Porous or apical the discharge of pollens is through apical processes seen in potato, brinjal, etc.;

(4) Valvular—when the whole or portions of the wall of the anther Open out like trap-doors releasing the pollens as seen in Berberis, Laurus, Cinnatnomum, etc.

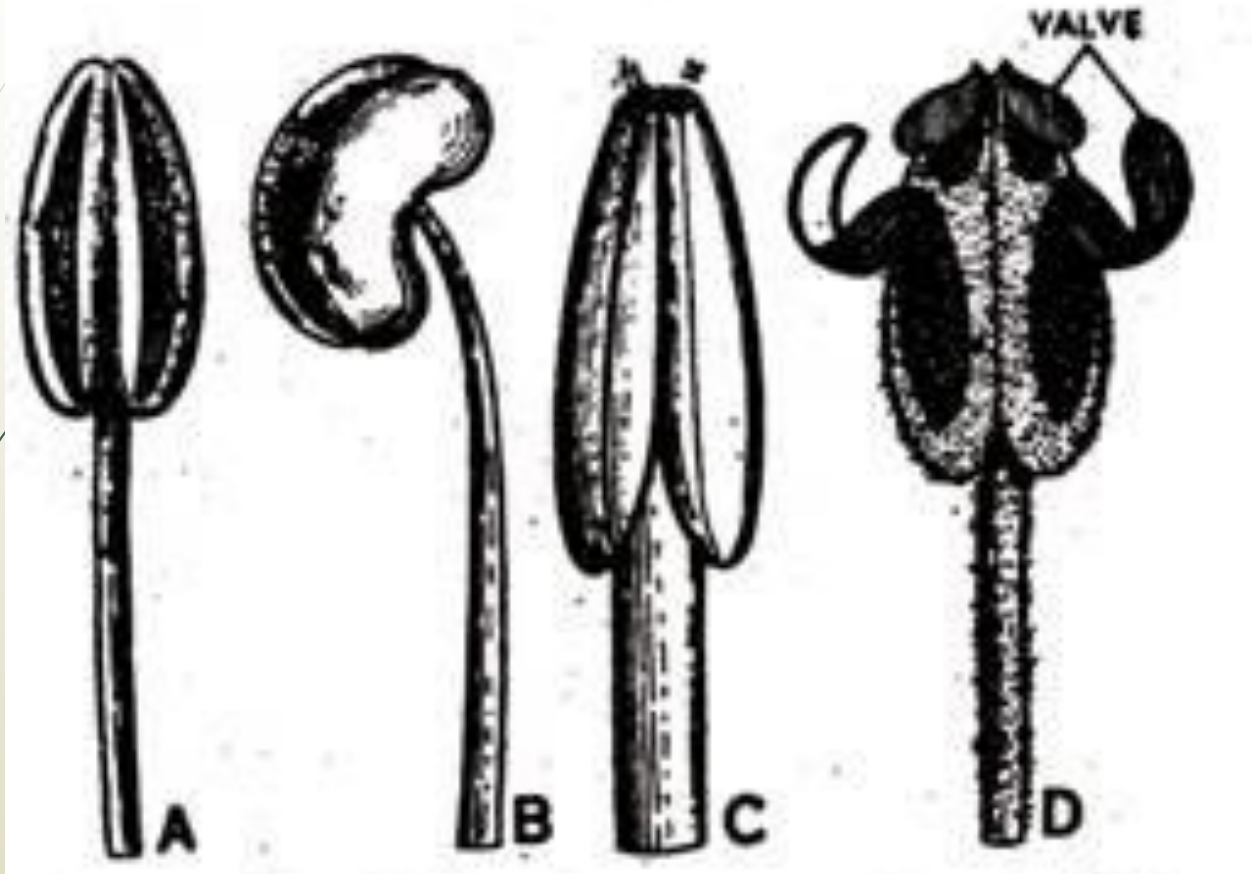


FIG. 351. Dehiscence of anthers. A. Longitudinal. B. Transverse. C. Porous. D. Valvular in *Laurus* sp.

Number and Insertion of Stamens:

A flower may be monandrous (Poinsettia), diandrous (Acanthaceae), triandrous (many monocots), tetrandrous (Labiatae), pentaindrous (most dicots), hexandrous (rice, bamboo, etc.) or polyandrous (Rosaceae) according as the usual number of stamens in the flower is 1, 2, 3, 4, 5, 6 or many. The number of stamens, however, may sometimes vary as discussed later.

When the stamens form a single whorl and the number of stamens is the same as that of the sepals and petals, the flower is isostemonous. In such a flower the stamens alternate with the petals, i.e.; they are antisepalous.

Occasionally, however, such stamens may be antipetalous as found in different members of Rhamnaceae, Portulacaceae, etc. Sometimes there are two whorls of stamens, the first whorl alternating with petals (antisepalous) and the second whorl alternating with sepals (antipetalous).

This type of flower is termed diplostemonous. A third condition is seen in some Rutaceae where there are two whorls of stamens of which the first whorl is antipetalous and the second whorl is antisepalous. This condition is described as obdiplostemonous.

Like other floral members, stamens also may be epigynous, perigynous or hypogynous in their insertion on the thalamus.

The stamens in an androecium may not be of the same length.

Two conditions are rather common:

(1) In the family Cruciferae there are six stamens of which the four in the inner whorl are taller than the two in the outer whorl. This condition is termed tetradynamous .

(2) Similarly, it is didynamous when out of four stamens present two are longer than the two others. This is found in Labiatae and the allied families Acanthaceae, Verbenaceae and Scrophu- lariaceae. Presence of stamens of different sizes in the same whorl, as often seen in Cassia flowers, is known as heterostemony.

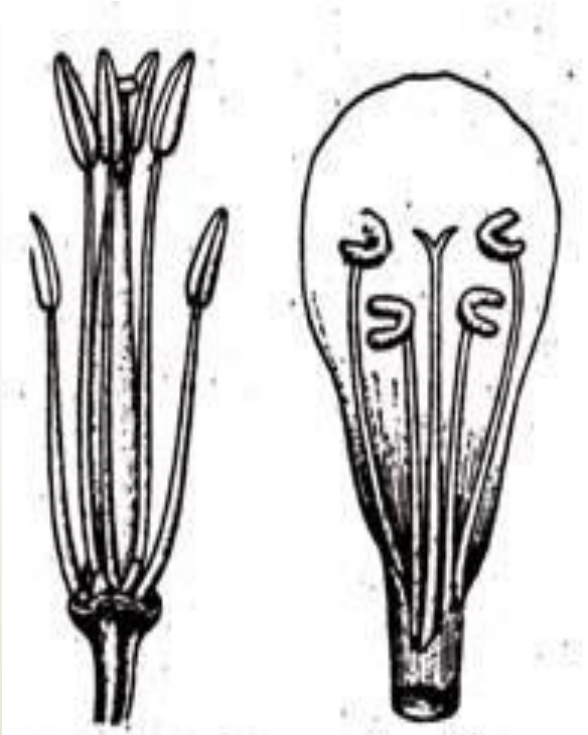


FIG. 352 FIG. 353

FIG. 352. Tetradynamous stamens in mustard. FIG. 353. Didynamous stamens in *Leonurus*.

Union of Stamens:

Union of stamens may involve **adhesion** (union with other members, viz., petals, perianth leaves or gynoecium) or cohesion, i.e., among the stamens themselves.

When stamens adhere, to petals they are termed epipetalous—a condition found in many flowers. When the adherence is to perianth leaves, the condition is termed epiphyllous as seen in the tube-rose.

Another inteiesting adhesion is between stamens and carpels (gynandrous condidon) as seen in the gynostegiom of Asclepia- daceae and the gynostemium of Orchidaceae .

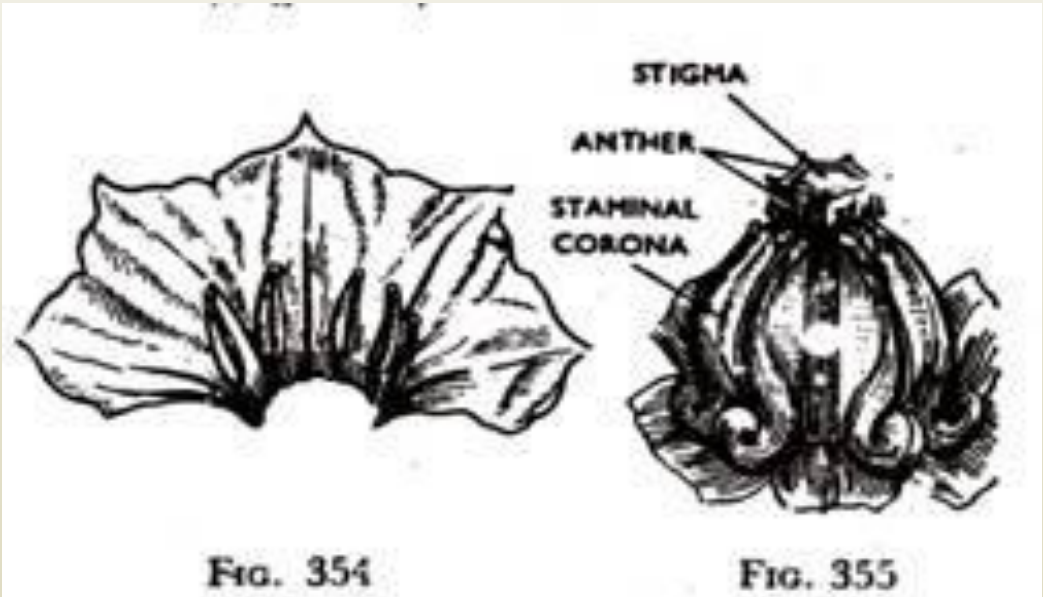


FIG. 354. Epipetalous stamens in brinjal.
FIG. 355. Gynostegium in *Calotropis*

Cohesion usually involves either only the filaments (adelphy) or only the anthers (syngeny). In adelphy, all the stamens may unite by their filaments forming one bundle of stamens with all the anthers free.

This is the monadelphous condition. In the family Malvaceae and in many other flowers the united filamen's form a staminal lube through which the long style of the pistil passes.

Oxalis (Oxalidaceae) also show's a similar staminal tube in which the few stamens are clearly unequal . In unisexual female flowers of Jatropha (Euphorbiaceac), the filaments unite to form a central column.

Diadelphy (two bundles) is very commonly seen in Papilionaceous flowers where rine stamens form one bundle and the tenth remains free as the second bundle .

In the silk-cotton tree (Salmalia or Bombax ceiba) the stamens form several separate groups with the filaments uniting to form several bundles or fascicles giving rise to the polyadelphous condition.

This is often seen in the families Guttiferae, Tilia- ceae, Bombacaceae, Rutaceae (e.g., orange), Myrtaceae (e.g., Melaleuca), etc. When the stamens unite only by the anthers leaving the filaments free, the condition is termed syngenesious.

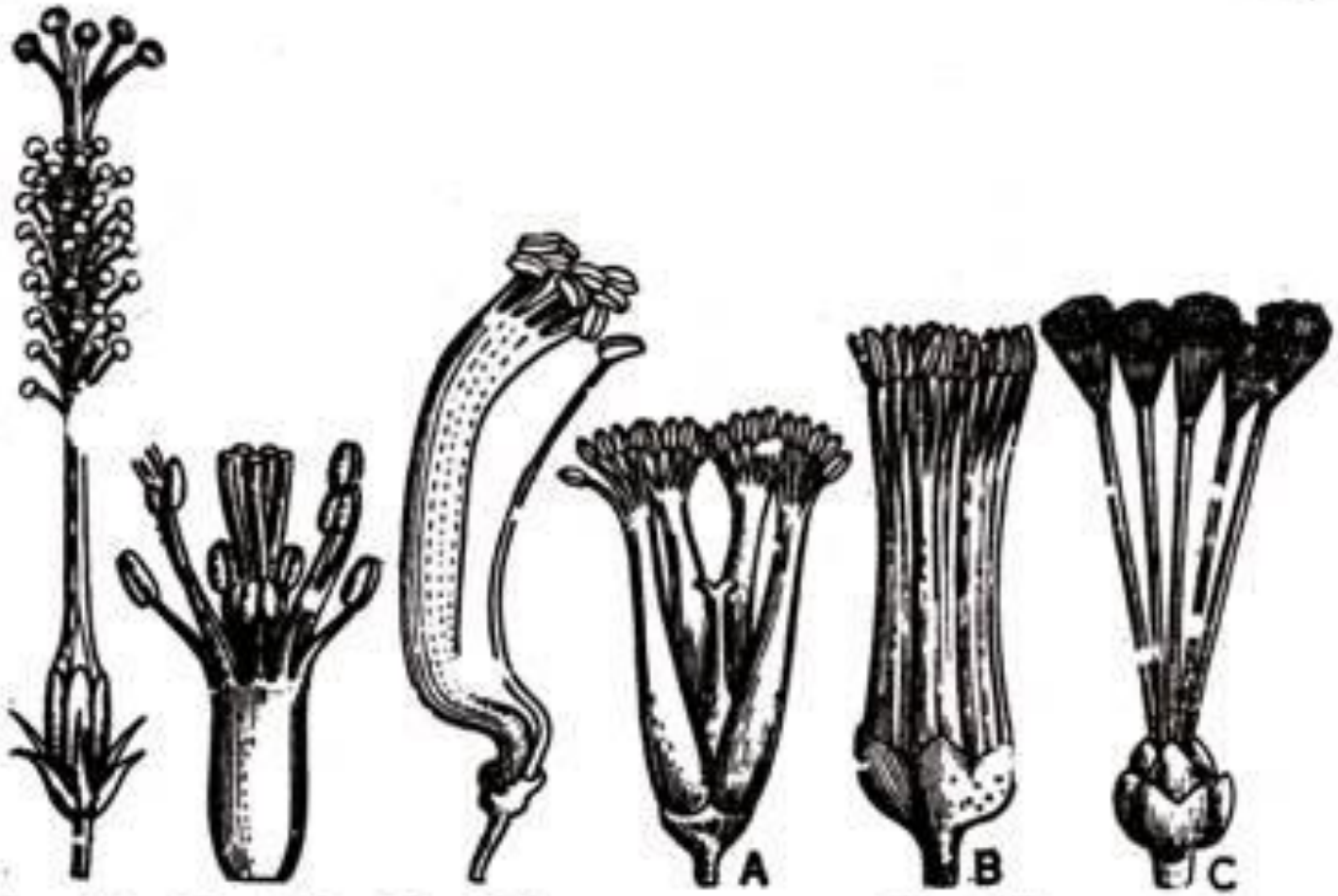


FIG. 356 FIG. 357 FIG. 358 FIG. 359

FIG. 356. Monadelphous stamens of *Hibiscus rosa-sinensis*. FIG. 357. Monadelphous and unequal stamens of *Oxalis*. FIG. 358. Diadelphous stamens of pea. FIG. 359. Polyadelphous stamens in A. *Bombax ceiba* ; B. Orange and C. *Melaleuca* (after Van Tieghem).

This is characteristically shown by the family Compositae . Here, the syngenesious anthers form a tube enclosing the style and the stigma. In Compositae the syngenesious stamens are also epipetalous .

In the family Cucurbitaceae, of the five stamens four unite in pairs so that the androecium shows three bundles 2+2+1- Each composite structure of two stamens shows complete union of the filaments as well as the sinuous anthers . This is called the synandrous condition.

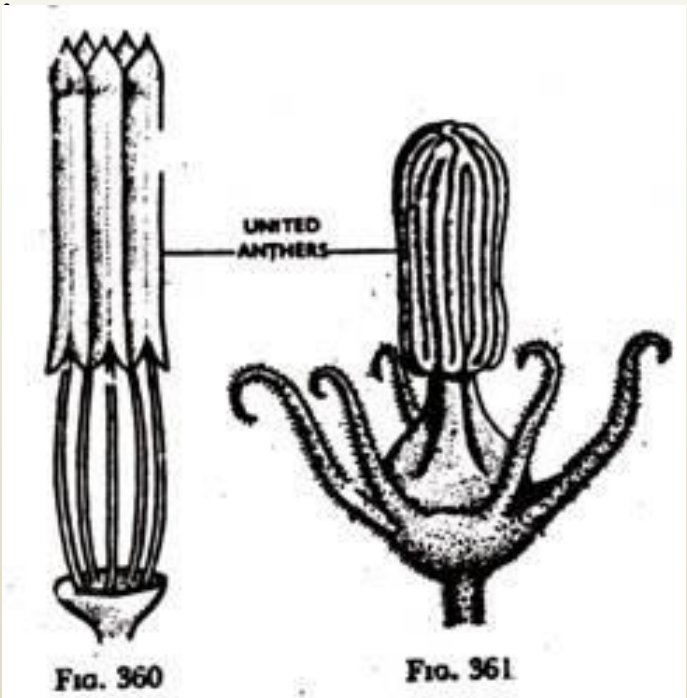


FIG. 360, Syngenesious stamens of Compositae.
FIG. 36.. Synandrous stamens of *Cucurbita maxima*.

Gynoecium:

The gynoecium (also spelt gynaeceum) or pistil is the central or the topmost whorl of the flower usually terminating the thalamus. It is composed of one or more carpels or megasporophylls.

When there is a single carpel the pistil is called simple or monocarpellary which is not very common although it is a characteristic of the large families of Leguminosae and Gramaneae .

A typical carpel has three parts—ovary, style and stigma. The lowermost swollen part is the ovary containing one or more swollen bodies called ovules which are the rudiments of seeds.

Above the ovary the carpel is protruded into a long or short style which ends in a somewhat rounded and usually sticky stigma on which the pollens are deposited during pollinatior.

A sterile pistil devoid of fertile ovules is called a pistillode.

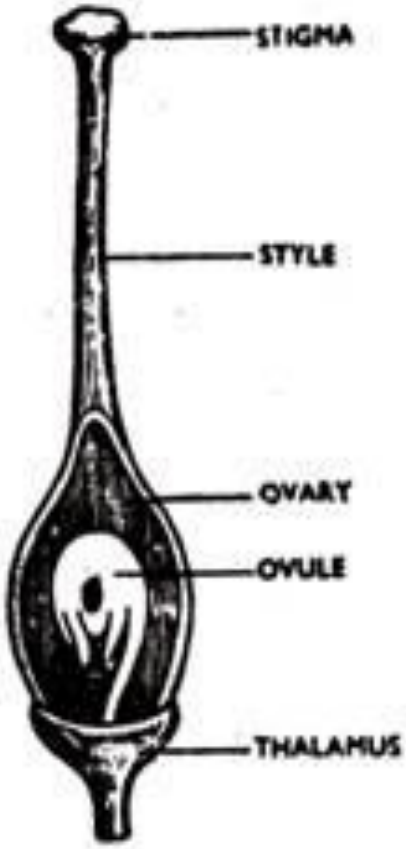


FIG. 362. A typical carpel.

Compound or polycarpellary gynoeciums are much more common than the simple type. In such a gynoecium, the different carpels may remain completely free from one another when it is termed apocarpous (apocarpous multiple, as opposed to simple, as there are multiple carpels) or the carpels may unite with each other, wholly or partially, forming syncarpous gynoeciums.

Apocarpous gynoeciums may be seen in the familie Annonaceae, Magnoliaceae, Ranunculaceae, Nymphaeaceae, Rosaceae, etc.

In Annonaceae and Magnoliaceae the carpels are arranged on a more or less elongated thalamus, in Nymphaeaceae they are sunk on the flat spongy top of the thalamus shaped like an inverted cone, while in Rosaceae they are arranged on the bottom of the cup-shaped thalamus.

The syncarpous gynoecium is much more common and involves union of different degrees, e.g., in Solatium the carpels are completely united ; in china-rose the ovaries are united to form a five-locular compound ovary, the styles are united completely while the five stiginas are free; in Linum usitatissimum of Linaceae and in the pink flower the ovaries are united but the styles and stigmas are free.

FIG. 363 FIG. 364 FIG. 365 FIG. 366 FIG. 367

FIG. 363. Apocarpous pistil of three carpels in *Aconitum* of Ranunculaceae. FIG. 364. Apocarpous pistil of many carpels in *Michelia champaca* of Magnoliaceae. Note elongated thalamus. FIG. 365. Completely united pistil of *Solanum melongena*. FIG. 366. Pistil of china-rose with free stigmas. FIG. 367. Pistil of *Linum usitatissimum* with free styles and stigmas.

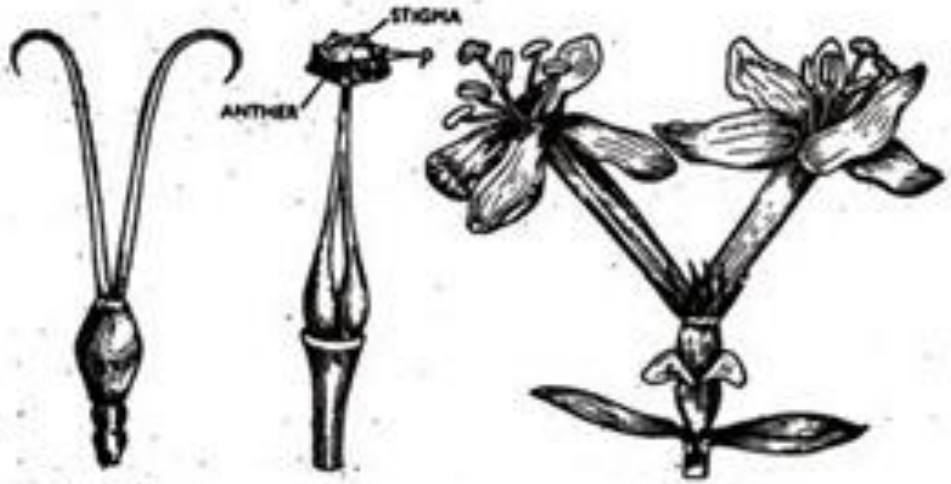


FIG. 368 FIG. 369 FIG. 370

FIG. 368. Pistil of *Dianthus* like that of *Linum*. FIG. 369. Pistil of *Calotropis* (Asclepiadaceae) united only at the stigma which again is united with anthers forming *gynostegium*. (Filaments and corona removed). *p* shows location of pollinia. FIG. 370. Syngynia in *Lonicera*.

Style and Stigma:

The style connects the ovary with the stigma and usually arises from the top or the summit of the ovary, i.e., it is apical. In some cases, however, the ovary apex itself may be deflected so that the style may appear to originate from near the base (basillar) or from the side (lateral) as in Alchemilla and mango .

In plants belonging to the Labia- tae the Ovary is peculiarly, four-lobed so that the ovary apex is depressed at the centre of the four lobes. As a result, the style appears to arise from the central base of the ovary and is termed gynobasic. In Gloriosa superba the style is placed at right angles to the ovary axis instead of being its direct prolongation.

The style is usually deciduous, dropping off after fertilization. But, in some cases, as in Naravelia zeylanica, Clematis, Digitalis, etc., it may be persistent . The style of Carina , Iris, etc., is petaloid. The base of the style in the family Umbelliferae is swollen forming what is known as the stylopodium.

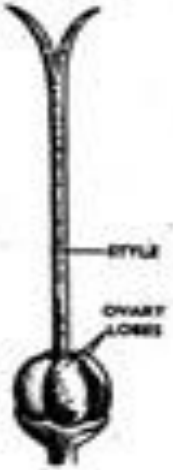


FIG. 371 FIG. 372
FIG. 3. Lateral style.
FIG. 37. Zygobasic style.

FIG. 373. Branched styles. (After Green).

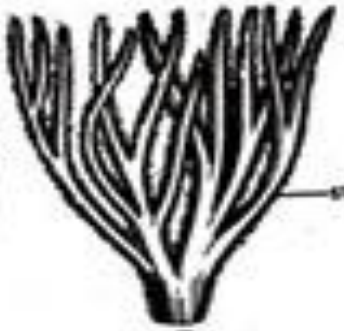


FIG. 374. STIGMA. A. Sessile in *Sambucus nigra*. B. Bifid in sunflower. C. Bifid and feathery in rice. D. Striate and sessile in poppy. E. Highly branched in *Begonia*. F. Funnel-shaped in *Crocus sativus*.

The styles of a compound pistil may sometimes be completely united as in china-rose . But, even when united, anatomical study shows separate vascular supplies for the different carpels. Thus, a cross-section of the china-rose style shows five vascular traces corresponding to the five carpels. When the styles are free, usually there is one style for each carpel but sometimes the style may be branched as in some Euphorbiaceae .

The stigma is usually placed on the style. Sometimes, there may be no style, the stigma being placed on the top of the ovary as in Sambucus , Berberit, lotus, etc. Then it is termed sessile. The stigma top is usually rough, papillose or even hairy and somewhat sticky due to secretions. This shows a receptive surface where the pollens alight and germinate.

In a syncarpous ovary there may be separate stigmas as in china-rose or the stigma may be lobed when it is described as bifid (e.g., Compositae), trifid, etc.

Usually, the number of lobes correspond to the number of carpels but, monocarpellary flowers of Graminaceae show bifid feathery stigmas . The stigma of poppies (Papaver) is sessile as well as striate showing a star like radiate appearance .

Ovary:

Ovary is the most important part of the carpel as it contains the ovules which develop into seeds. A carpel without a functional ovary is sterile. The foliar origin of the ovary is rather clear in the simple ovary of pea .

It is even clearer in the inflated ovary of its relative Colutea arborescens . One may easily realise that a leaf like carpel, i.e., a megasporophyll as seen in the Gymnosperms, is folded about its midrib and forms a chamber by the fusion of the margins.

There is a special tissue called placenta along the margin and the marginal line along which the carpel fuses is called the ventral suture, the midrib being the dorsal suture . Ovules develop from this placental tissue and remain within the ovary chamber.

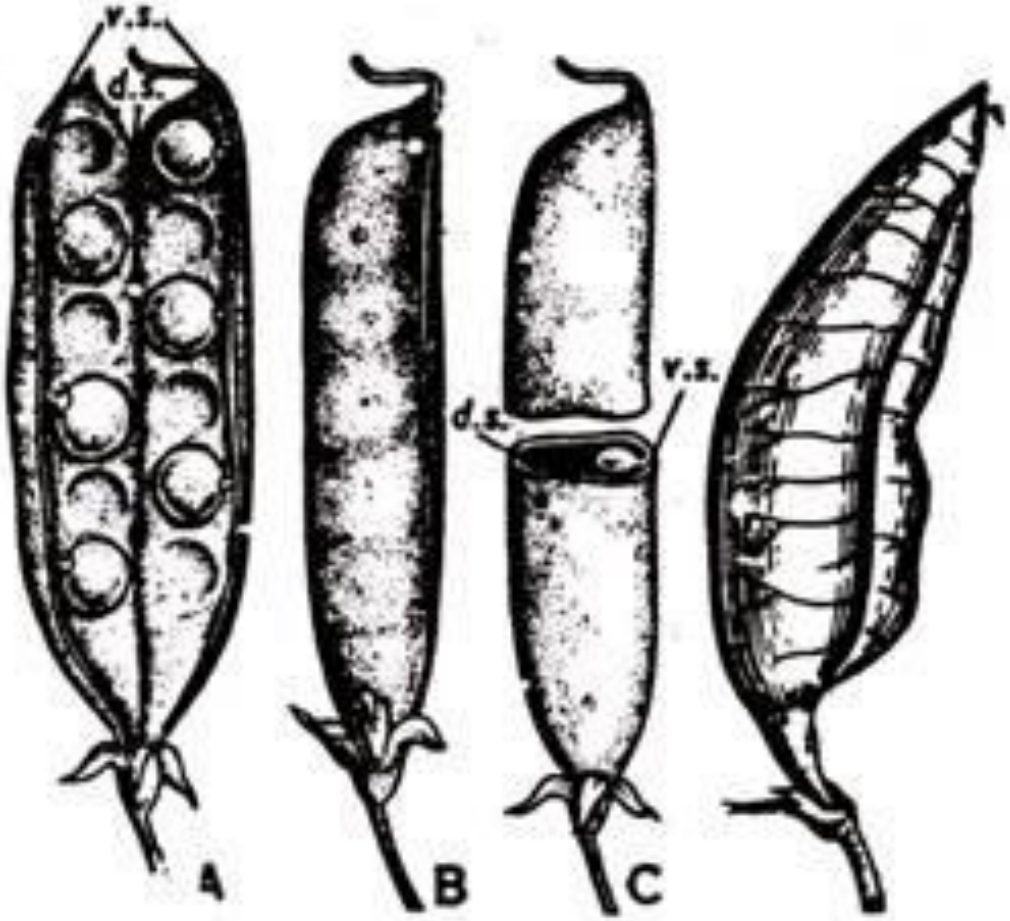


FIG. 375 FIG. 376

FIG. 375. Pod of pea. A. Split along ventral suture (*v.s.*); *d.s.* = dorsal suture. B. Whole pod. C. Cut transversely into two. Note placenta along ventral suture giving rise to ovules. FIG. 376. Inflated ovary of *Colutea arborescens* looking like a folded leaf.

When more than one carpel form the ovary of a compound gynoecium, the different carpels may fuse along the margins giving the appearance of a one- chambered ovary.

Another way of joining of the carpels may be as shown in . In this latter case each carpel first fuses along its own margin and then the three carpels fuse so that the ventral sutures all meet together at the axis of the ovary which latter is clearly divided into as many loculi or chambers as there are carpels.

The ovaries of syncarpous pistils are frequently formed as in the second case. But, sometimes the number of chambers does not correspond to the number of carpels due to the development of false partition walls or septa within the ovary chamber.

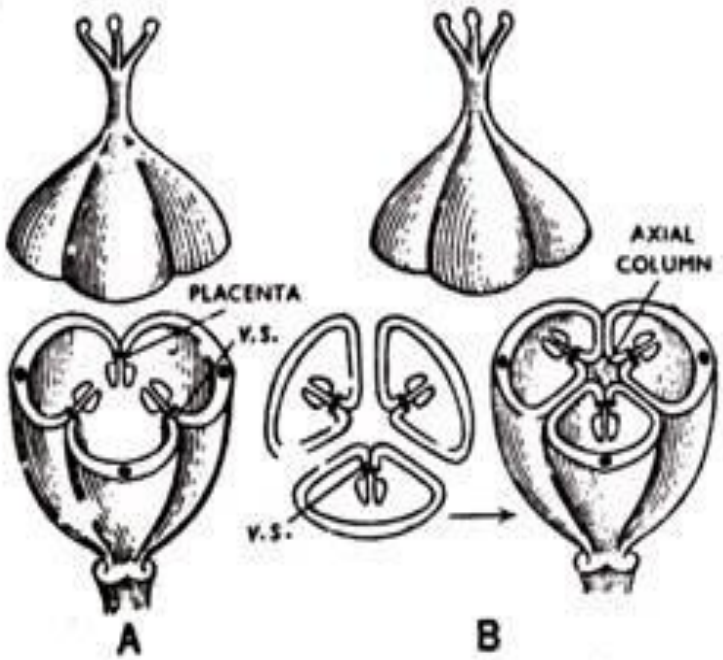


FIG. 377. Union of carpels. A. Fusion along margins (*v.s.*) only. B. Fusion along margins (*v.s.*) to form an axial column

Thus, many bicarpellary flowers of Solanaccac (Datura , brinjal, etc.) show four-chambered ovaries. Such false partition walls usually develop as outgrowths of the placenta.

Placentation:

It has already been seen that the placental tissue develops along the margin of the megasporophyll so that, when the latter closes to form a chamber, the placenta is located along the ventral suture.

But, ma-gin is not the only place where placenta develops. Placenta may also develop on a direct prolongation of the thalamus at the base of the carpel. As a result, we get different types of placentation, i.e., distribution of placenta, in different ovaries.

As this placenta is the tissue on which the ovules or the future seeds develop, a study of placentation is of importance in the study of the fruit and the flower.

The following types of placentation are usually met with:

(1) Marginal: This is the placentation of the simple ovary of pea (Leguminosae). The pea ovary is developed by the union of one megasporephyll along the ventral suture. The placenta forms a ridge along this suture and the ovules are borne on this forming two rows. The ovary is one-chambered and superior .

(2) Parietal: When two or more carpels unite along the ventral sutures as shown in , the ovules also are located on the placenta along these sutures. The ovary is unilocular as may be seen in papaw. But, in Cruciferae showing this type of placentation, the ovary becomes falsely two-chambered by the development of a false partition wall called replum.

Ovaries of many Cucurbitaceous plants (also parietal) become falsely trilocular, or even hexalocular, because of later projections of the placental tissue .

(3) Axile: As shown in a number of carpels independently form chambers as in. the marginal type, i.e., folding inwards and then fusing together so that the ventral sutures are all placed along the axis.

This is termed axile as all the placenta and therefore the ovules are axial. The ovary is divided into as many chambers as there are carpels. This is found in Solanaceae, Malvaceae, Rutaceae, Liliaceae, etc.

But, here also the number of chambers may increase by the development of false partition walls .

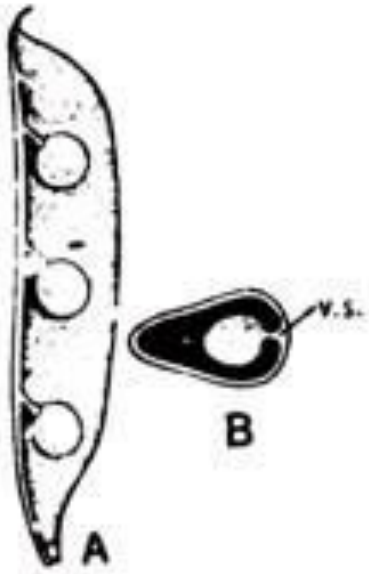


Fig. 378

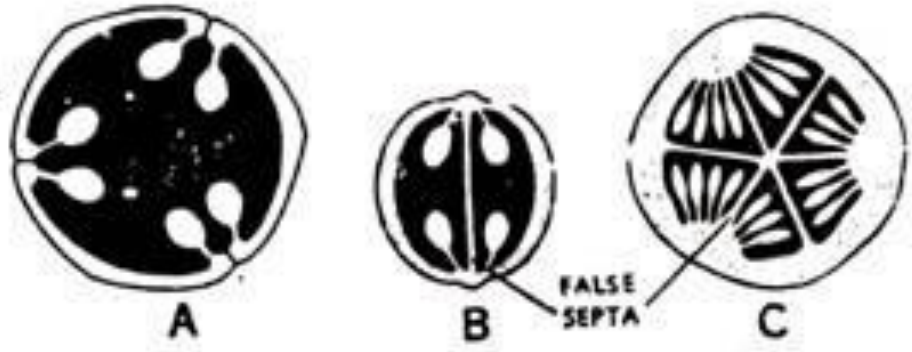


Fig. 379

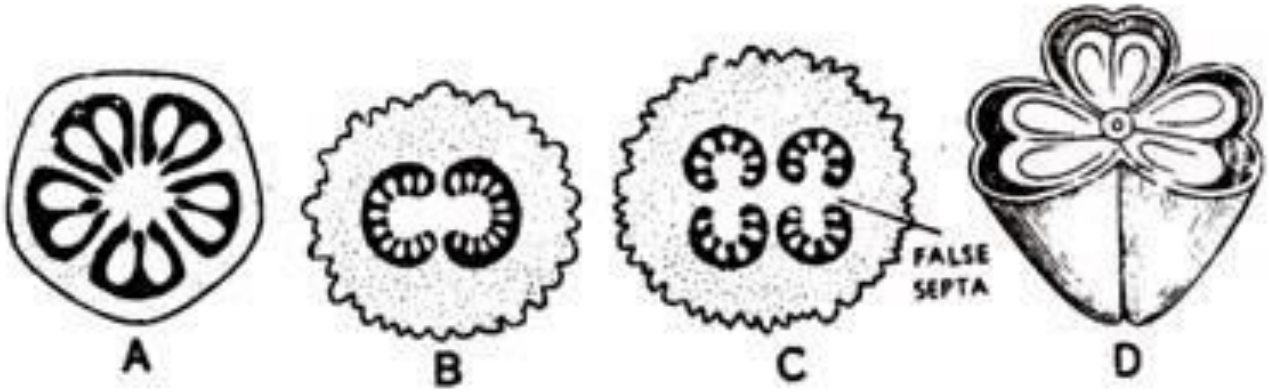


Fig. 380

Placentation types. Fig. 378. Marginal. A. Longitudinal half of pea pod. B. T.s. Fig. 379. Parietal. A. Typical. B. Mustard—Falsely bilocular. C. Cucumber—Falsely trilocular or hexalocular. Fig. 380. Axile. A. Typical. B. *Datura* showing normal bilocular ovary. C. *Datura* showing tetralocular ovary by formation of false septa. D. Axile in inferior ovary of lily.

(4) Basal: In Compositae, a single ovule is developed at the base of the unilocular simple ovary. The placenta is apparently placed on the tip of the thalamus at the floor of the ovary .

(5) Free-central: In this type the ovules are found to develop on an axial column which is not connected with the ovary wall .

Such an ovary may arise in two different ways:

(i) In a placentation which was originally axile, the partition walls may break down at a later stage making the ovary falsely one-chambered. This is the case in the family Caryophyllaceae (pink flower, etc.).

(ii) The thalamus may slightly extend into the ovary and placenta may develop on it as in the family Primulaceae .

(6) Superficial: The multicarpellary flower of Nymphaea (water-lily) develops multilocular ovaries in which the whole inner walls of the chambers are lined with placental tissue so that ovules develop all round.

This is really an overdevelopment of the axile type, the placenta spreading to the chamber walls from the axial column .

A

B

FIG. 381 FIG. 382 FIG. 383

PLACENTATION TYPES. FIG. 381. Basal in Compositae. FIG. 382. Free-central. A. T.s. of ovary showing typical free-central placentation. B. Free-central in Primulaceae (l.s.) where the axial column of placenta seems to be a projection of the thalamus. FIG. 383. Superficial in water-lily.

The Ovule:

The ovule is the megasporangium contained within the ovary. There may be one or more ovules inside an ovary and these are destined to be the seeds.

When fully formed, the tissues in a typical ovule are as follows: The ovule is attached to the placenta by the funicle or funiculus which meets the ovule at the hilum.

An ovule devoid of any funicle and directly attached to the placenta is termed sessile. Raphe is an extension of the funicle and may extend up to the chalaza which is the base of the ovule. (The ovule commonly remains reversed).

The general tissue of the ovule is called nucellus and the embryosac (the female gametophyte within the megaspore—its development is described) is in the top part of it.

The ovule is enveloped by two integuments (inner and outer) which leave an opening called micropyle at the top. Abnormally, there may be a single integument as in some Compositae while in some parasites like Loranthus, Viscum album, etc., there may be no integument at all.

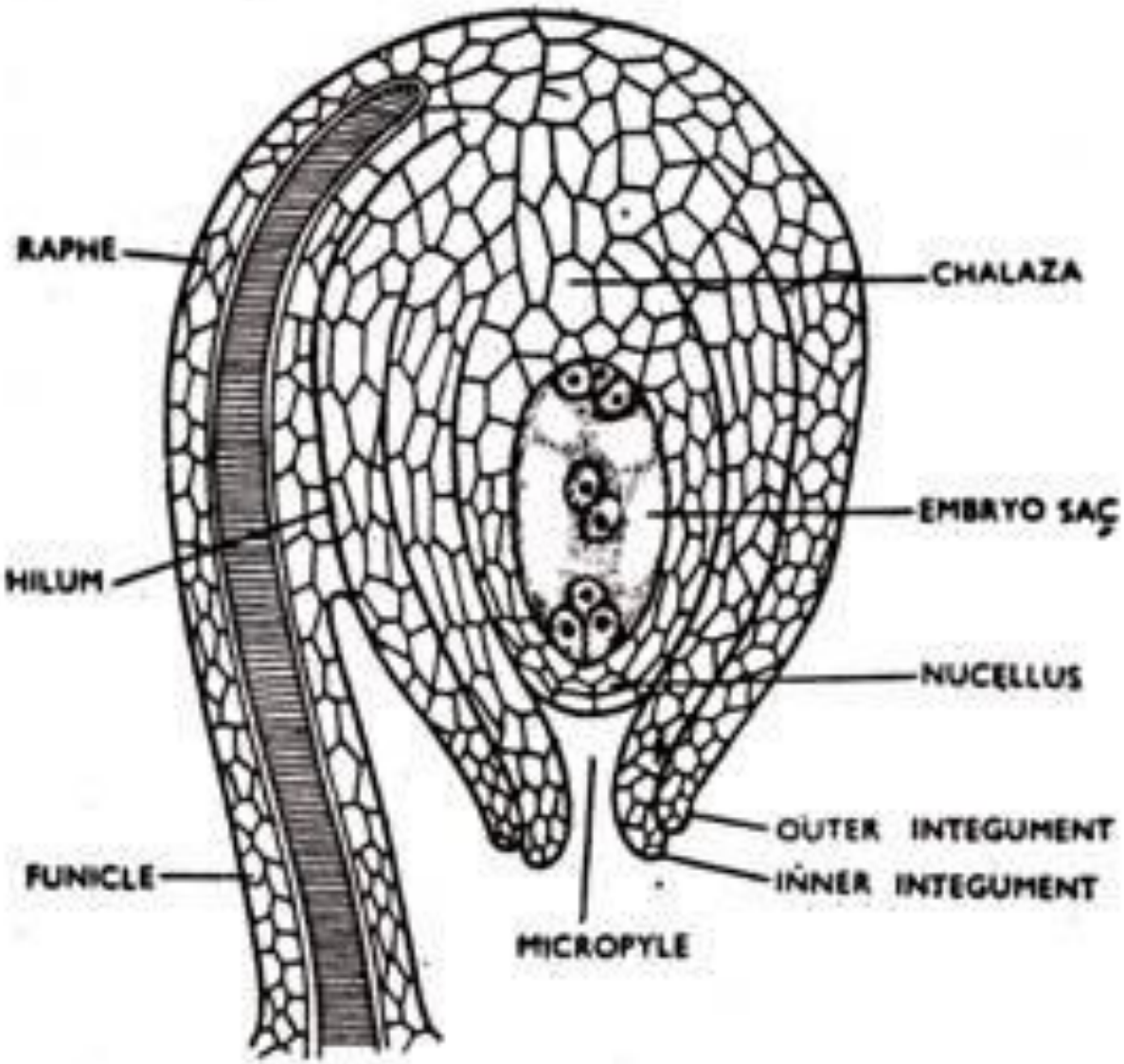


FIG. 384. Longitudinal section of a typical ovule (anatropous).

The ovule is the anatropous or reversed type which is the commonest and may be seen in pea, bean, castor, etc. When the ovule remains straight , as in Polygonaceae, Piperaceae, Urticaceae, etc., it is called orthotropous or atropous.

It is amphitropous when placed transversely at right angles to the funicle . This condition is not common but is met with in Ranunculus, Lemna and poppy.

Sometimes, a transverse ovule may be bent like a horse-shoe so that the micropyle is brought nearer to the chalaza . This is the campylotropous (kampylos— curved) condition found in many plants of Cruciferae, Chenopodiaceae, Caryophyliaceae, etc., and some other plants like Mirabilis (Nyctaginaceae).

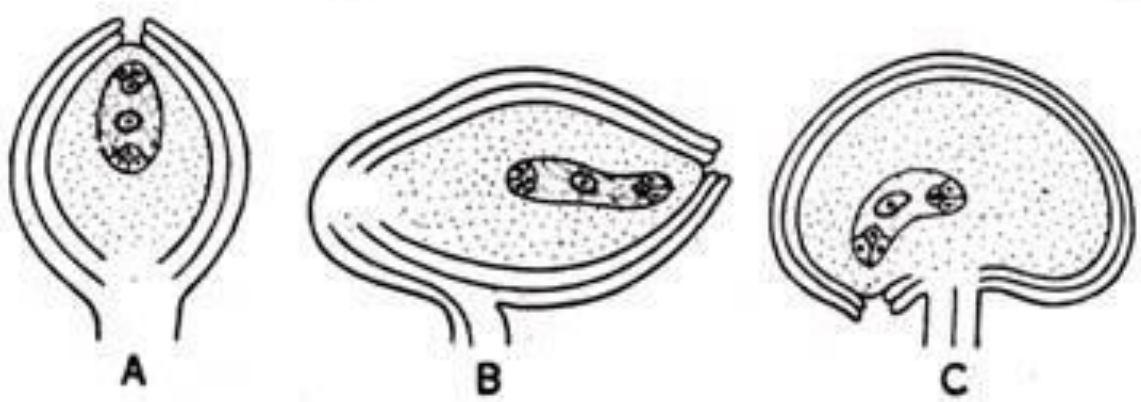


Fig. 385. Ovules. A. Orthotropous. B. Amphitropous. C. Campylotropous.

The position of the ovule in the ovary chamber (Fig. 386), specially in ovaries containing single ovules, may be (A) erect as in Compositae, (B) pendulous (hanging from top) as in some Annonaccae, (C) ascending (rising obliquely from a side of the ovary wall and not the direct base) as in some Ranunculaceae, (D) suspended (hanging from a side of the wall but no! the exact top) as in castor, or (E) horizontal as in Podophyllum.

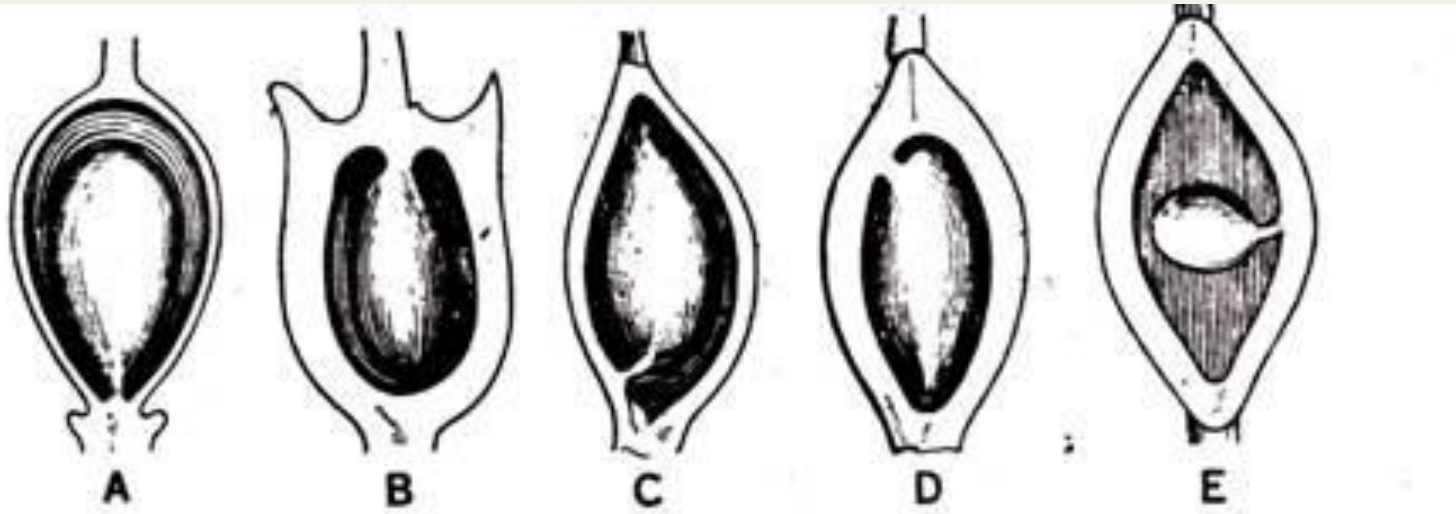


FIG. 386. Position of ovules. A. Erect. B. Pendulous. C. Ascending. D. Suspended. E. Horizontal.

Fruit:
Classification of fruits, simple and aggregate fruits, Composite fruit.

Group # 1. Simple Fruits:

Simple fruits may be dry or fleshy, according to the nature of the pericarp. Some dry fruits burst automatically to liberate the seeds. They are called dehiscent; others which do not dehisce are indehiscent fruits.

Dry indehiscent fruits are usually one-seeded. Following are the types:

(a) Achene is a dry indehiscent one-seeded fruit from a superior simple pistil where the seed coat is separable from the pericarp, e.g. Naraveha (B. Chagalbati, Fig. 113, 4).

(b) Caryopsis is just like an achene but the seed coat and pericarp are inseparably united, e.g. maize, grasses.

(c) Cypsela is a one-seeded fruit from an inferior bicarpellary pistil, as in sunflower (Fig. 113, 3).

(d) Nut is a one-seeded fruit from a superior bi- or polycarpellary pistil with tough and woody pericarp, e.g. chestnut.

(e) Samara is the same type of fruit with a pair of winged outgrowths, e.g. Hiptage (B. Madhabilata), Dipterocarpus (B. Garian, Fig. 113, 5).

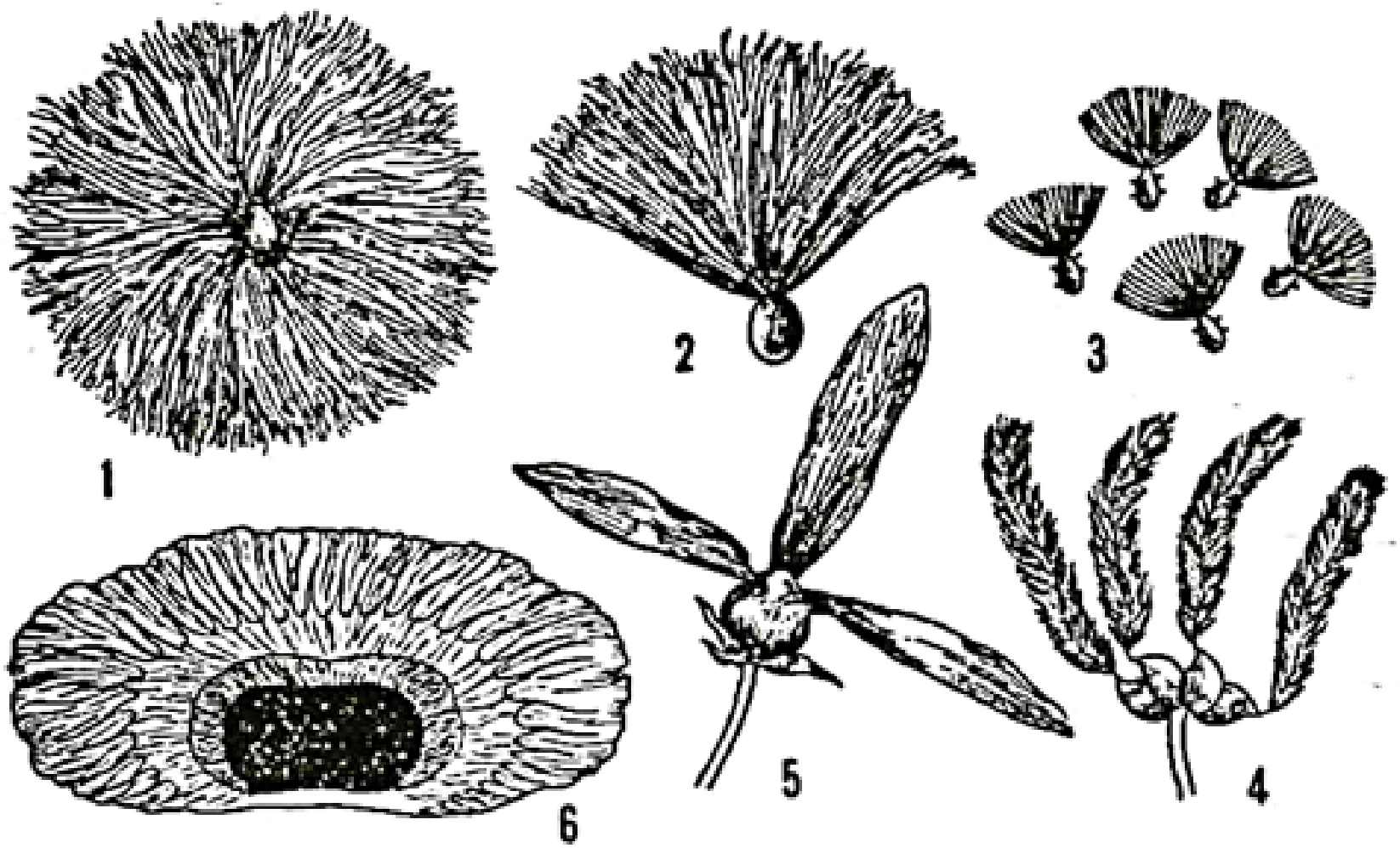


Fig. 113. Seeds and fruits with hairy and winged outgrowths. 1—seed of cotton; 2—seed of *Calotropis*; 3—fruits (cypsela) of sunflower family; 4—achenes of *Naravelia*; 5—samara of *Hiptage*; 6—winged seed of *Oroxylon*.

(f) Schizocarpic fruits are dry indehiscent ones from inferior bicarpellary pistil. After ripening the two one-seeded parts separate and remain attached to an axis , coriander , anise (B. Mouri, fig .105).

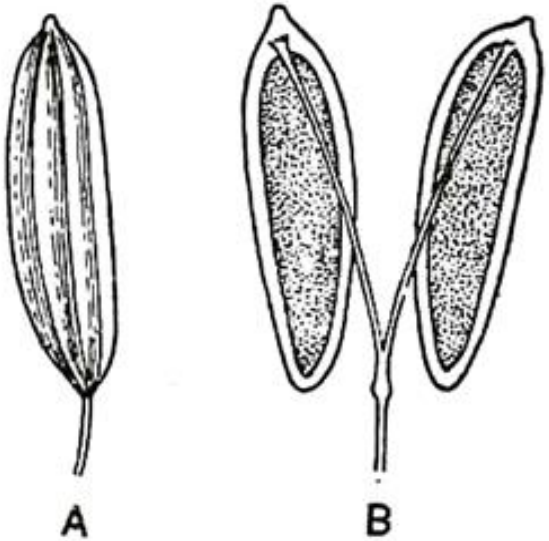


Fig. 105. Schizocarpic fruit of anise.

Dry Dehiscent Fruits:

(a) Follicle is a dry dehiscent fruit from a monocarpellary pistil which dehisces by one suture only, along the ventral suture, e.g. Calotropis (B. Akanda, Fig. 106).

(b) Legume or Pod is a many-seeded fruit from a monocarpellary pistil which dehisces by both the sutures, ventrally and dorsally, e.g. pea (Fig. 107), Crotolaria (B. Atasi). Legume is often constricted into one-seeded parts. It is called lomentum, e.g. Acacia (B. Babla).

(c) Siliqua is a dry dehiscent many-seeded fruit from a superior bicarpellary pistil which dehisces from the base upwards. The seeds remain attached to a false partition wall called replum, e.g. radish, mustard (Fig. 108).

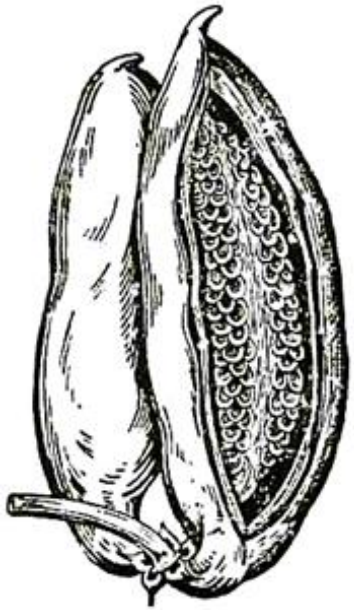


Fig. 106. Follicle of *Calotropis*.

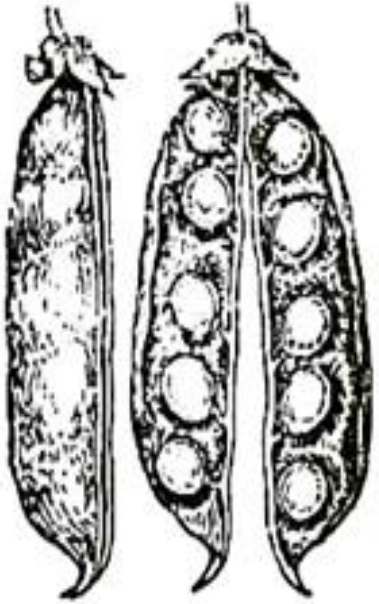


Fig. 107. Legume of pea.

Fig. 108. Siliqua of mustard.

(d) Capsule is a dry many- chambered fruit from a polycarpellary pistil which dehisces by splitting into a number of parts, e.g. Datura, cotton, lady's finger (Fig. 109).

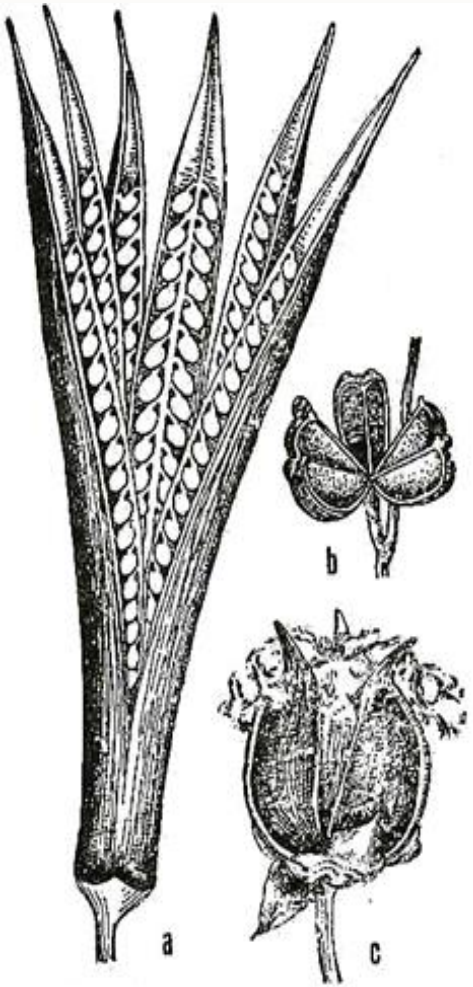


Fig. 109. Capsules of (a) Lady's finger; (b) Castor; (c) Cotton.

Fleshy Fruits (Fig. 110):

Fleshy fruits have succulent or juicy pericarp. They are usually indehiscent. Seeds are set free after decomposition of the pulp.

(a) Drupe is a fleshy fruit with one or more seeds from a monocarpellary or polycarpellary syncarpous pistil where the pericarp is differentiated into outer epicarp, juicy mesocarp and stony endocarp, e.g. mango [Fig. 110 (A & B)], Indian plum, etc. Cocoanut is a fibrous drupe in which mesocarp is not juicy but fibrous.

(b) Berry or Bacca is a fleshy fruit, usually many-seeded, from a simple or compound pistil where stony endocarp is lacking and seeds remain freely in the pulp, e.g. tomato [Fig. 110 (C & D)], brinjal, banana.

(c) Pepo is a fleshy fruit like a berry from an inferior syncarpous pistil with parietal placentation. Seeds remain attached in series to the placentae. Pepo has usually a tough rind, e.g. gourd [Fig. 110 (E&F)].

(d) Pome is a false fleshy fruit from cyncarpous pistil surrounded by thalamus, which, in fact, forms the main edible part of the fruit, e.g. apple [Fig. 110 (G & H)], pear.

(e) Hesperidium is a many-chambered fruit from a syncarpous pistil where epicarp and mesocarp unite to form the separable rind. Many juicy hairs develop from the pericarp, which constitute the edible part of the fruit, e.g. orange [Fig. 110 (I & J)], lemons.

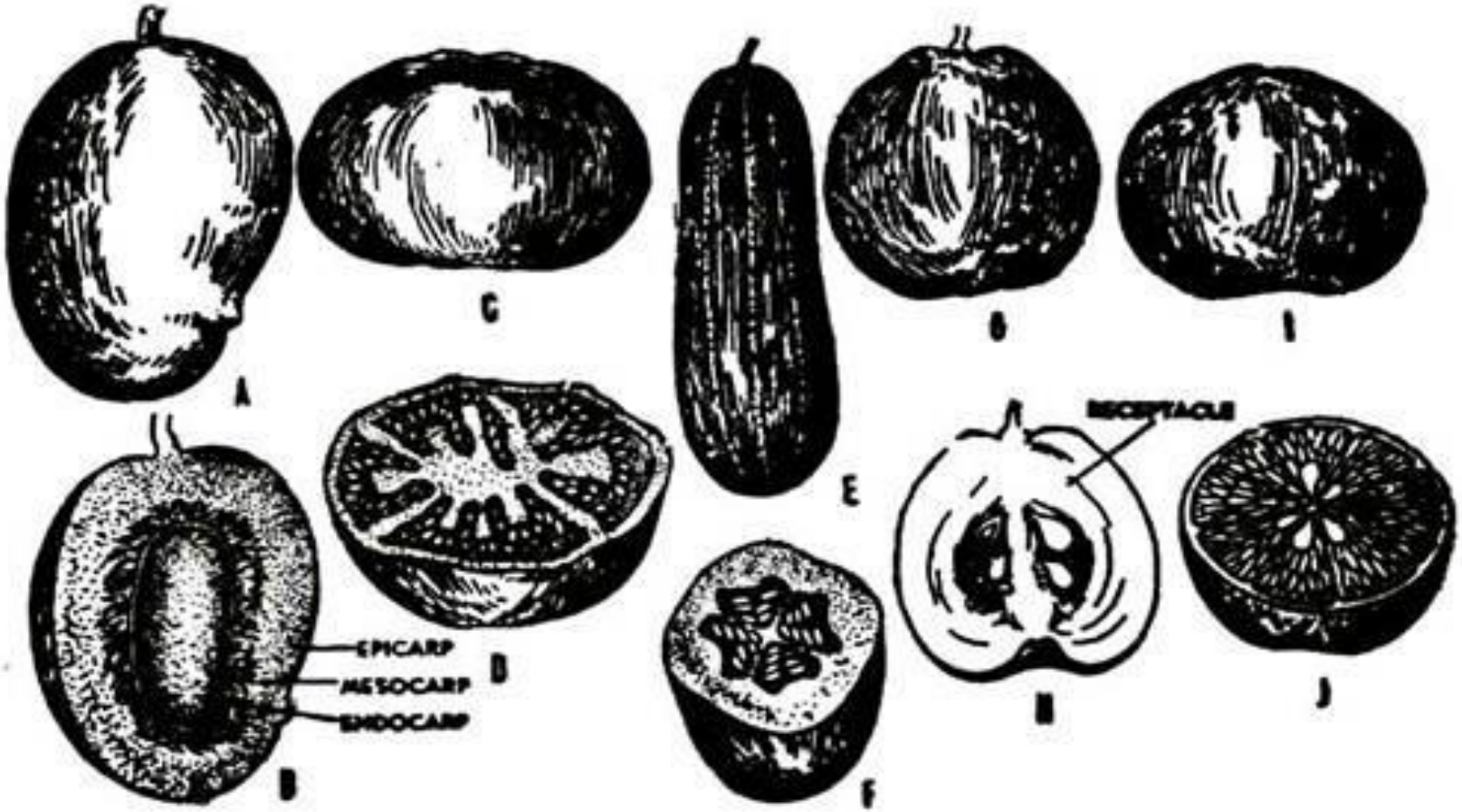


Fig. 110. Fleshy fruits.
A & B—drupe of mango; C & D—berry of tomato; E & F—pepo of cucumber; G & H—pome of apple; I & J—hesperidium of orange.

Group # 2. Aggregate Fruits:

We know that the aggregate fruits develop from polycarpellary apocarpous pistil. The aggregate or group of fruits from a single flower is known as an etaerio. They may be eiaerio of achenes, as in Naravelia (B. Chagalbati), etaerio of berries, as in Artabotrys (B. Kantali champa, Fig. 111).

Fig. 111. Aggregate of berries of *Artabo-*

Group # 3. Multiple Fruits:

Due to the stimulus of fertilisation often the whole of inflorescence develops into a single fruit. These types of fruits are multiple.

(a) Sorosis is a multiple fruit from an inflorescence spadix with fleshy axis, e.g. pine-apple (Fig. 112), jack fruit.

(b) Syconus develops from the special inflorescence, hypanthodium with fleshy hollow receptacle, e.g. fig.

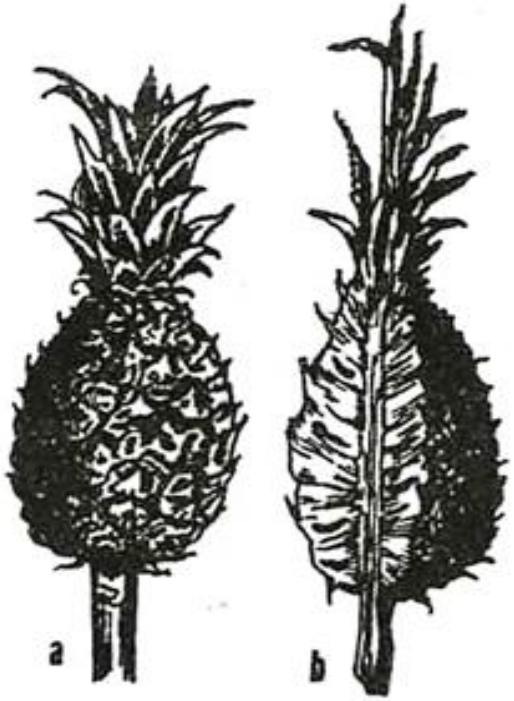
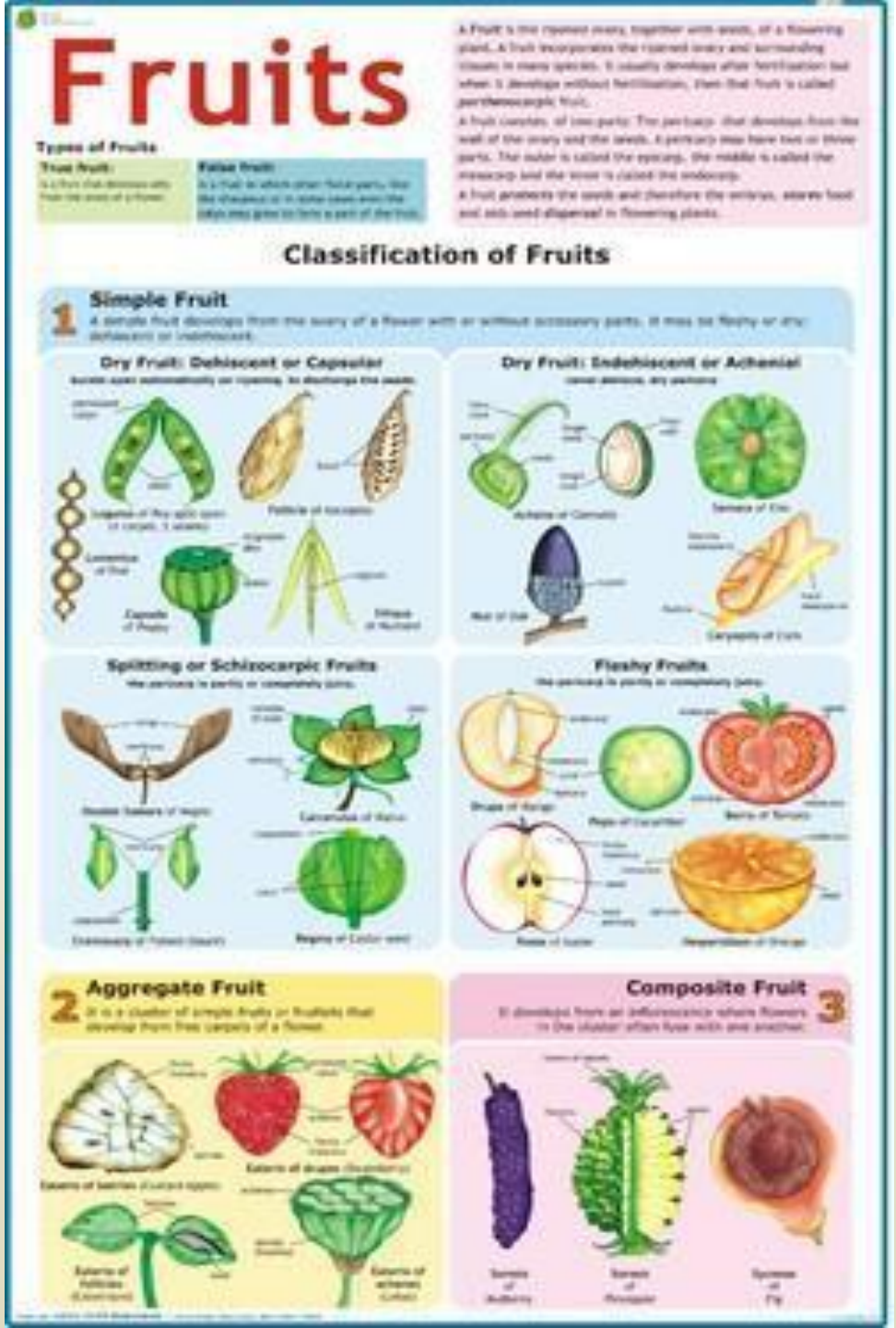


Fig. 112. Multiple fruit. a—sorosis of pine-apple; b—same cut lengthwise


Fruits
Types of Fruits
Classification of Fruits
1 Simple Fruit
Dry Fruit: Dehiscent or Capsular
Dry Fruit: Indehiscent or Achenial
Splitting or Schizocarpic Fruits
Fleshy Fruits
2 Aggregate Fruit
Composite Fruit 3

Classification of Fruits

- **Simple**
  - **Dry**
    - **Indehiscent**
      - (1) Achene, *e.g.* *Naravelia*
      - (2) Caryopsis, *e.g.* maize
      - (3) Cypsela, *e.g.* sunflower
      - (4) Nut, *e.g.* chestnut
      - (5) Samara, *e.g.* *Hiptage*
      - (6) Schizocarp, *e.g.* coriander.
    - **Dehiscent**
      - (1) Follicle, *e.g.* *Colotropis*
      - (2) Legume, *e.g.* pea.
      - (3) Siliqua, *e.g.* radish
      - (4) Capsule, *e.g.* *Datura*
  - **Fleshy**
    - (1) Drupe, *e.g.* mango
    - (2) Berry, *e.g.* tomato
    - (3) Pepo, *e.g.* gourd
    - (4) Pome, *e.g.* apple
    - (5) Hesperidium, *e.g.* orange.
- **Aggregate** (may be etaerios of drupes, achenes, etc.)
- **Multiple**
  - (1) Sorosis, *e.g.* pine-apple.
  - (2) Syconus, *e.g.* fig.

Thank You….!