BOT-HC-3016 Morphology and Anatomy of Angiosperms

MORPHOLOGY OF STAMEN

Prepared By-
Dr. Debashree Kakati
Assistant Professor
Mangaldai College, Mangaldai
Darrang, Assam, 784125

STAMEN

1. The androecium is the third set of floral organ.
2. Each member of androecium is called stamens or micro sporophylls.
3. Stamen is composed of a slender stalk-like filament supporting a knob-like spore case or the anther .
4. Each anther consists of two lobes (anther lobes) connected by a connective.
5. Each anther lobe, again, has two pollen sacs or pollen chambers placed longitudinally.
6. There are longitudinal grooves or sutures along the ventral face of the anther demarcating the pollen chambers.
7. Each pollen chamber represents a microsporangium and contains innumerable microspores or pollens.
8. Number of stamen may very from one many, and arrangement of stamen on receptacle may whorled, spiral or fasciculate (Cluster).

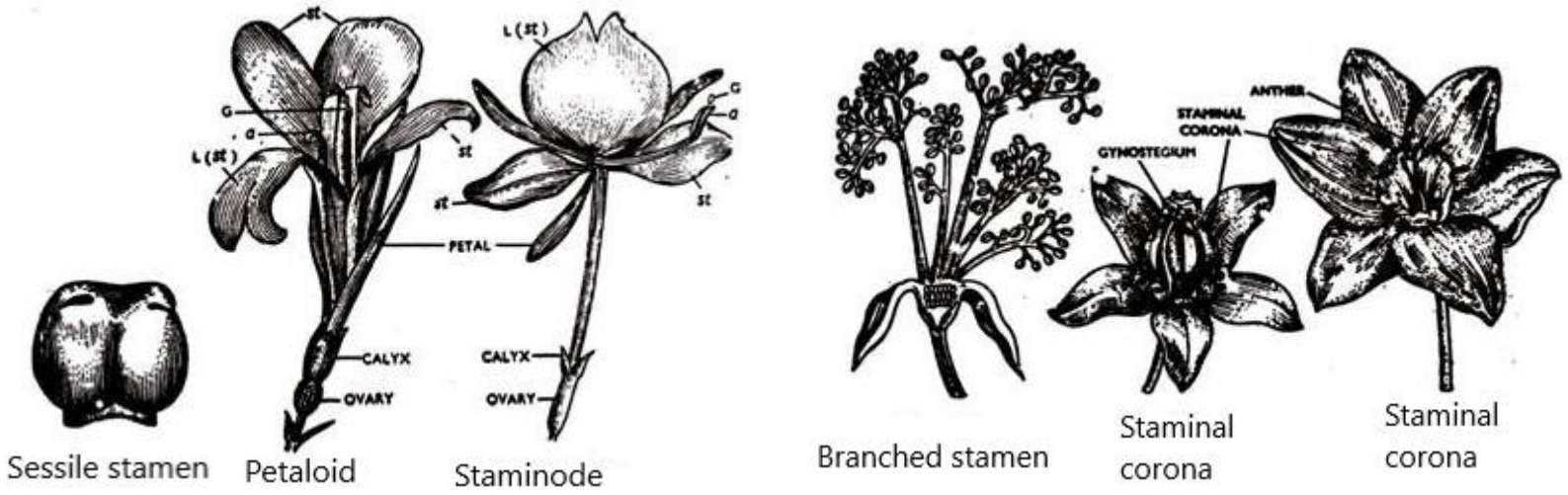
Variations:

1. Stamen may be devoid of a filament or sessile.
2. It may not develop any fertile anther when it is sterile and termed a staminode as seen in *Cassia* .
3. In water-lily and Canna the filament is flat showing its transition from petals called as petaloid .
4. Filament is branched in ***Ricinus communis*** .

5. The showy labellum of Scitaminae is formed of **staminodes.**

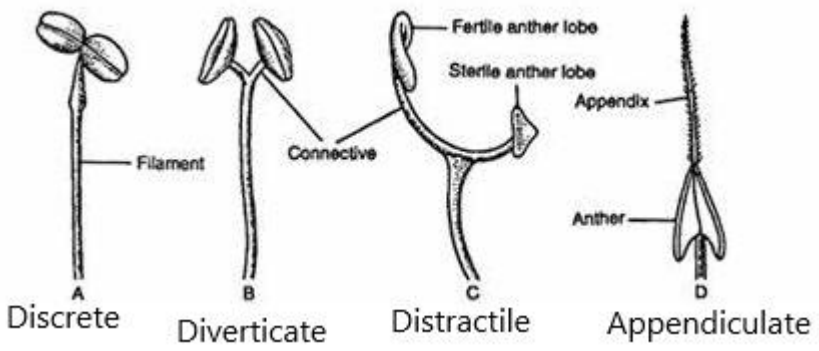
6 . When filaments are very long, stamens protrude out of the flower and are term-ed exserted. On the contrary, when stamens remain within the flower; they are termed inserted.

7. Filaments sometimes bear appendages such as, horny in *Calotropis*, cup-shaped in *Eucharis* , *Pancratium* and some other flowers of Amaryllidaceae.



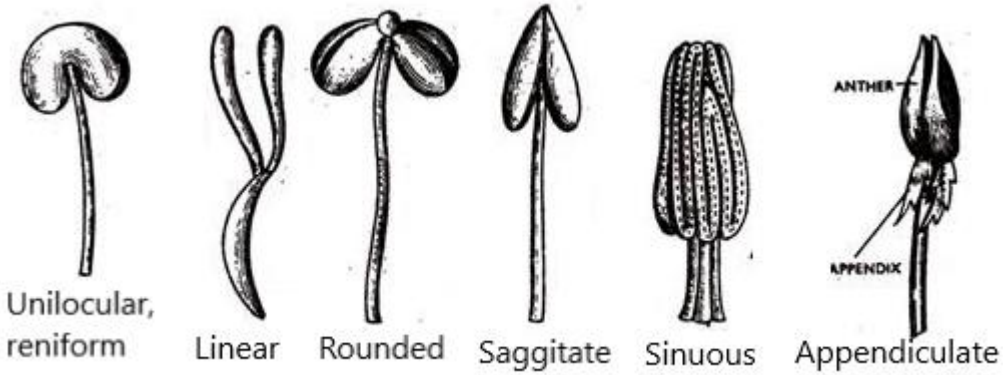
Connective:

1. Connective is a patch of tissues, prolongation of the filament, connecting the two parallel anther lobes.
2. It may be extremely small where the anther lobes are very close together termed as **discrete**. Eg. *Euphorbia, Adhatoda zeylanica* (Acanthaceae).
3. 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.
4. In *Salvia* (Labiatae) connective is **distractile**, where the connective is a long stalk-like body placed crosswise on the filament separating the two anther lobes.
5. The connective also may bear appendages when it is called **appendiculate**. It may be prolonged, feathery and grows beyond the anther of the *Oleander* (*Nerium odorum*) and some other flowers of Apocynaceae. These appendices in *Nerium* unite to form a **staminal corona .**



Anther:

1. Anthers are bilobed and quadrilocular.
2. However, in Malvaceae the anther becomes unilocular either by the abortion of one lobe or the destruction of the entire partition tissue separating the four chambers.
3. When grooved ventral side of an anther faces the gynoecium or the centre of the flower, this condition is known as **introrse**; but, in *Gloriosa superba, Iris, Colchicum*, etc., the anther faces the petals when the condition is called **extrorse.**
4. 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



Attachment of the Anther to the Filament:

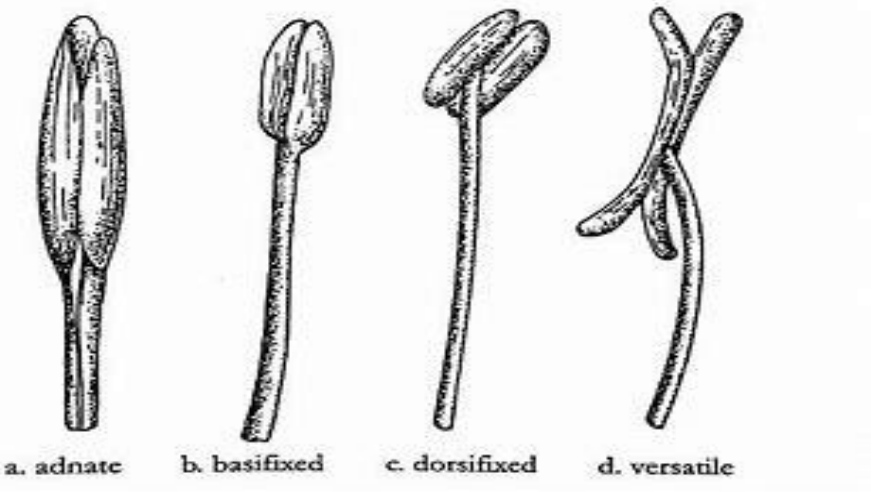
The mode of attachment of the anther to the filament varies .

(1) It is **adnate** when the filament 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 attachment is **basifixed or innate** where the filament ends just at the base of the anther, the latter being firmly fixed on the top of the former.

(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.



Primitive stamen:

1. Stamens are modified reproductive leaves which can be evident from the ontogeny, morphological, anatomical nature of the stamen.
2. Stamen in course of evolution has undergone various phylogenetic modifications.
3. Primitive stamens are more or less leaf like structure having very little distinction between fertile and sterile part.
4. Position of sporangia i.e. The anther lobe was also not distinct.
5. In most of the members of Magnoliale-Ranales eg. *Michelia, Magnolia, Degeneria, Himatendra, Nymphea* etc. which considered as primitive angiosperms, stamens are broad, petaloid with leaf like filament known as laminar stamen. Anthers are born on the centre of the sporophyll. Anther lobes are separated by broad longitudinal sterile tissue i.e. Connective extended down to the filament Eg. *Alnus, Ostrya*.
6. In course of evolution the there has been reduction of the sterile tissue with retraction of marginal area.
7. Lamina r part progressively become narrower, folding inside, proximal part become filament and distal part become anther.
8. In primitive angiosperm families connective is hardly separable from the filament,but in advanced families connective is well developed and shows various modifications too.

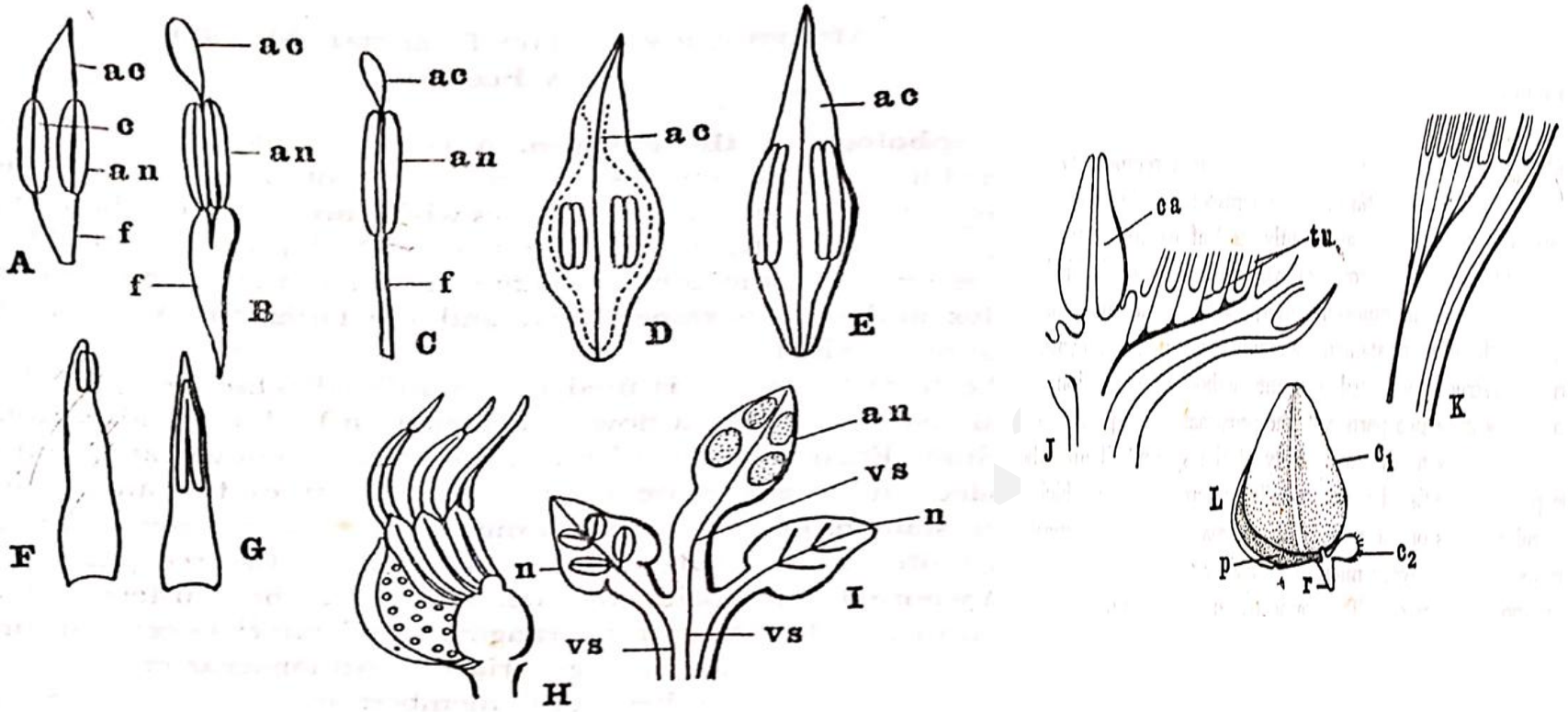


Fig.. Morphology of the stamens and carpels of the Magnoliales-Ranales etc. A—Stamen of *Michelia champaka* L.; f, wide filament; ac, distal broad appendage of the protruding connective (primitive character); c, anther lobe i.e. microsporangium; an, anther—note central position of microsporangia—primitive character. B. & C—Stamens of *Nelumbo nucifera* Gaertn., note protruding connective. D. & E—Stamens of *Himantandra & Magnolia* respectively (note the central large remote microsporangia, broad filament and practically no distinction between filament and connective). F. & G—Stamens of *Nymphaea* showing the broad filament. H—Portion of L.s. of gynoecium of *Nymphaea* showing 3 simple carpels with long stigmatic surfaces and laminal placenta. I—Stamen fascicle of *Umbellularia*; n, lateral stamens modified into nectaries; an, fertile anther; vs, vascular supply. J. & K—Portion of fasciculate androecium of *Paeonia & Dillenia* respectively; ca, carpel; tu, trunk vascular supply. L—Embryo of *Trapa*; c_1 & c_2, large and minute cotyledons; r, radicle, p, testa. (*A, B, C, F, G, H & L original, rest after Eames*).

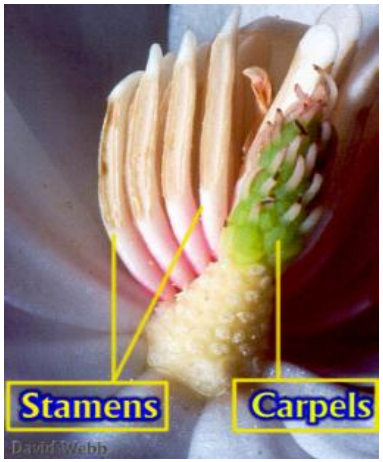
9. Morphologically filament corresponds to the major portion of the microsporophyll, including stalk, base and greater part of the lamina.

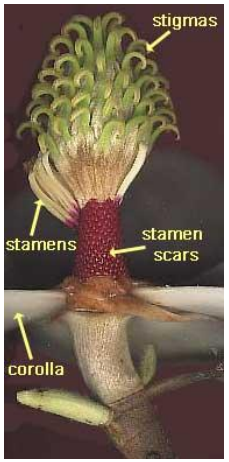
10. Primitive filaments are wider, shorter or might be sessile. In advanced families filaments are slender thread like, sometimes bear horn like or hood like appendages. Morphological nature of such appendages varies considerably. They are either parts of branches of the filament or expanded outgrowth.

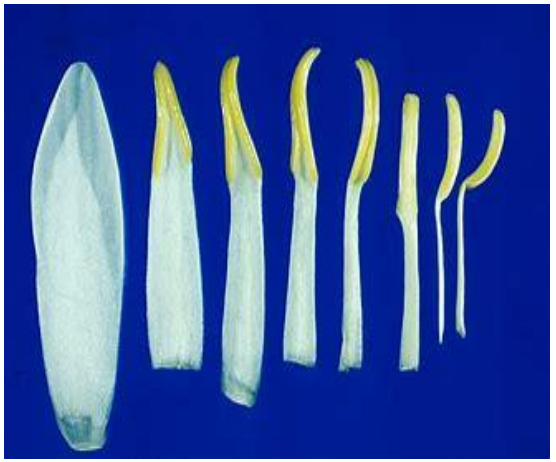
11. Anther exhibits great variety of forms. They are usually bilobed each represented 2 sporangia. But more than 4 sporangia in an anther are found in family Loranthaceae. The multisporangiate condition arises due to partitioning of the original sporangia by sterile plates. Stamen with single sporangia occurs in Malvaceae and Amaranthaceae. This monosporangiate condition is considered more advanced type.

12.Position and nature of sporangia also indicates the primitiveness of the taxa. Ventral position of sporangia is considered primitive than dorsal one.

13. Spiral arrangement of stamen on receptacle is considered primitive which later gave rise to whorled and fasciculate type of arrangement.

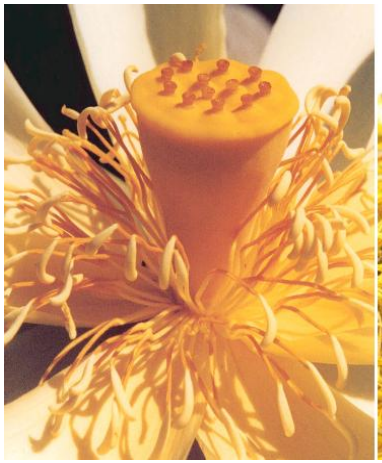






Stamen of *Magnolia*

Stamen of *Nymphea*



Stamen of *Nelumbo;* immense commercial value due to antioxidant activity

Stamen of *Umbellularis*

Depending on the number of whorl and their arrangement, stamen are of the following types:

a. Haplostemonous:

When there is one whorl of stamens, which usually alternate with the petal, it is called haplostemonous, e.g., morning glory, *Ipomoea pulchella* and many other plants of Convolvulaceae.

b. Diplostemonous:

When the stamens are arranged in two whorls and each stamen of outer whorl is opposite to a sepal (antisepa-lous), while each stamen of inner whorl is opposite to a petal (antipetalous), it is called diplostemonous, e.g., *Cassia fistula* of Fabaceae etc.

c. Obdiplostemonous:

When the stamens are in two whorls with those in outer whorl opposite to petals and those in the inner whorl opposite to sepals, it is called obdiplostemonous. e.g., many members of Rutaceae, Caryophyllaceae, *Geranium* sp. of Geraniaceae etc.

d. Polystemonous:

When stamens occur in more than two whorls, it is called polyste-monous. e.g., *Delphinium* sp. of Ranunculaceae etc.

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.

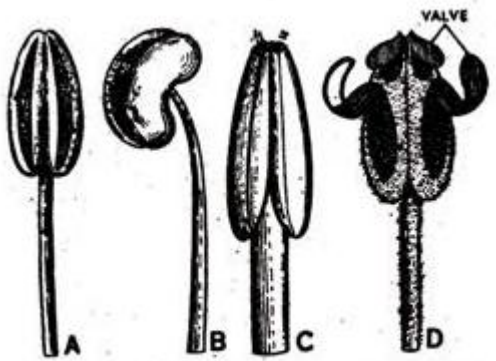


Fig. Dehiscence of anthers. A. Longitudinal. B. Transverse. C. Porous. D. Valvular in *Laurus* sp.

Union of Stamens:

Union of stamens among themselves is known as cohesion, and the union of stamens with other members i.e., perianth, petal or gynoecium is known as adhesion.

Cohesion of Stamens:

When the stamens are united by their filaments only (anthers remain free), it is called adelphous condition, and when the stamens are united by their anthers only (filaments remain free), it is called **syngenesious** condition. If, however, the filaments as well as the anthers of different stamens become united, it is called **synandrous** condition.

The cohesion may be of the following types:

a. Monadelphous:

All stamens are united by their filaments (anthers remain free), so forming a tube around style, e.g., china-rose (*Hibiscus rosa-sinensis*) lady's finger (*Abelmoschus esculentus*) and other members of Malvaceae; few members of Euphorbiaceae, Fabaceae etc.

b. Diadelphous:

The filaments are united (anthers remain free) and form two bundles, e.g., pea (*Pisum sativum*), gram (*Cicer arietinum)* and some other members of Fabaceae.

c. Polydelphous:

The filaments are united in more than two bundles and anthers remain free, e.g., *Bombax ceiba* of Bombacaceae, lemon, *Citrus* sp. of Rutaceae etc.

d. Syngenesious:

The anthers are united into a bundle, but filaments remain free, e.g., sunflower (*Helianthus annuus*) of Asteraceae etc.

e. Synandrous:

The anthers as well as filaments are united throughout their length to form a compact body, e.g., gourd (*Cucurbita maxima*) and many members of Cucurbitaceae.

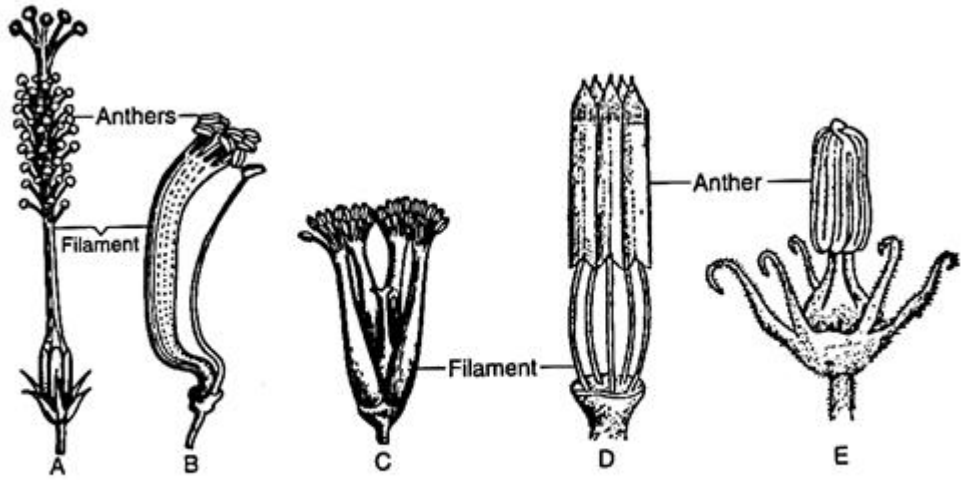
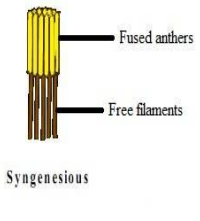


Fig.: Different types of cohesion of stamens : A. Monadelphous of *Hibiscus*, B. Diadelphous of *Pisum*, C. Polydelphous of *Bombax*, D. Syngenesious of *Helianthus*, and E. Synandrous in *Cucurbita*

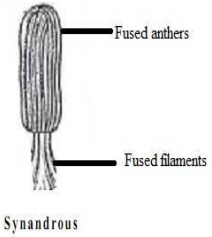
Monadelphous

Diadelphous

Polydelphous



Syngenesious



Synandrous

Adhesion of stamens is of the following types:

a. Epiphyllous:

The stamens are attached to or arise from perianths, e.g., tuberose (*Polyanthes tuberosa*), spider lily (*Crinum asiaticum*) and other plants of Amaryllidaceae etc.

b. Epipetalous:

The stamens are attached to or arise from petals, e.g., *Solanum nigram* of Solanaceae, *Lantana camara* of Verbenaceae, *Catharanthus roseus* of Apocynaceae etc.

c. Gynandrous:

The stamens are attached with the gynoecium, either wholly or by anthers only. In the members of Asclepiadaceae (*Calotropis procera)*, the stamens adnate to the stigma i.e., **gynostegium**, but in Orchidaceae the adnation of stamens takes place with the style and stigma forming **gynostemium**.

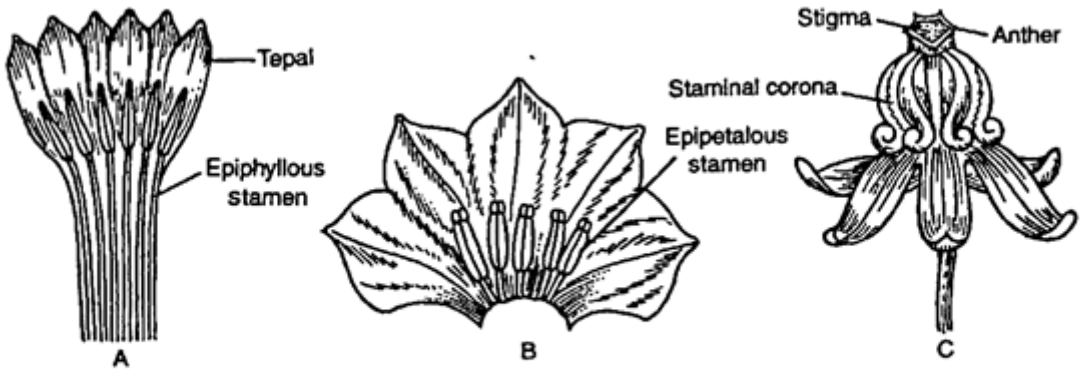
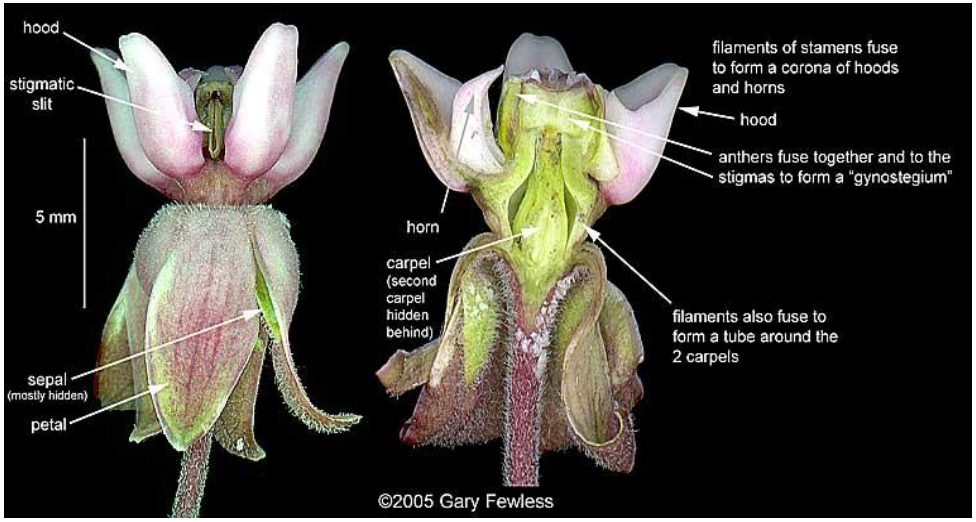


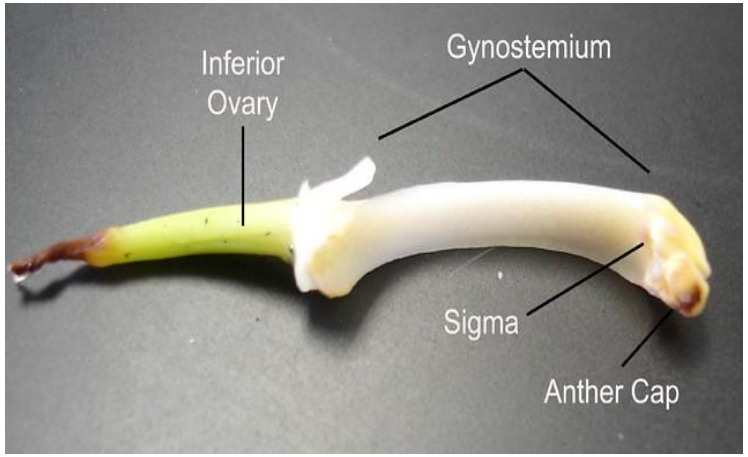
Fig.: Different types of adhesion of stamens : A. Epiphyllous of *Polyanthes*, B. Epipetalous of *Solanum* and C. Gynostegium of *Calotropis*

Epipetalous



Gynostegium

Gynostemium in *Aristolochia fimbriata*



Gynostemium in orchid