

COURSE CODE:	FRM 516
COURSE TITLE:	TAXONOMIC METHODS AND HERBARIUM TECHNIQUES
NUMBER OF UNITS:	2 UNITS
COURSE DURATION:	Two hours per week

COURSE DETAILS:

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Other Lecturers:	

COURSE CONTENT:

WHAT IS PLANT TAXONOMY?, MEANING OF THE KEY WORDS IN THE DEFINITION, THE OBJECTIVES OF TAXONOMY, IMPORTANCE OF PLANT TAXONOMY, CLASSIFICATION, UNITS OF CLASSIFICATION, SYSTEMS OF CLASSIFICATION, FIELD CHARACTERS IN TREE IDENTIFICATION, STRUCTURE OF LEAVES, TYPES OF LEAF, LAF ARRANGEMENT (PHYLLOTAXY), LEAF FORMS, LEAF APEX, LEAF BASES, LEAF MARGING, LEAF VENATION, THE FLOWER, A TYPICAL FLOWER, FLORA FORMULAR, SEMETARY OF THE FLOWER, AESTINATION TYPES OF FLOWER, THE ANDROECIUM, THE GYNOECIUM (PISTIL), TYPES OF PLACENTATION, INFLORESENCE, FRUITS, CLASSIFICATION OF FRUITS

COURSE REQUIREMENTS:

. This is compulsory course for all students in the Department of Forestry and Wildlife Management. In view of this, students are expected to participate in all the course activities and have minimum of 75% attendance to be able to write the final examination.

Dutta, A. C. Botany for degree students.

LECTURE NOTES

What is Plant Taxonomy? – Plant taxonomy or systematic botany is a science that deals with IDENTIFICATION, DESCRIPTION, NOMENCLATURE (naming) of plants, and their CLASSIFICATION into different groups according to their resemblances and differences, mainly in their morphological characteristics.

Meaning of the key words in the definition

IDENTIFICATION - This is what one does when keying out an unknown, when determining the kind of plant by comparing it with a plant of known identity; or with a description of such a plant. Identification may be accomplished by the aid of books or papers on the subject (such as manuals, florals, monographs or revisions) or by direct comparison with plants of known identity (such as living plants in collection or pressed and dried herbarium specimens). Identification is quite different from nomenclature; it has nothing to do with the correct name of the plant or determining that name. Technology is presently available for the use of computers to aid in identification.

DESCRIPTION- This is the listing of features or characteristics of a plant. Each plant name is accompanied by a description.

NOMENCLATURE- This is a function of taxonomy which deals with the correct naming of plant that has been identified and classified. Taxonomy tells how to go about the determination of what name is correct whether a particular name is only a synonym or whether it has no standing at all. Botanical nomenclature is concerned with the Latin or scientific names of plants.

CLASSIFICATION- This is the placing of a plant or group of plants in categories according to a particular system and in conformity with a nomenclatural system e.g. classification into trees, shrubs, or herbs.

There is no agreement or etymological basis for the distinction between **systematics** and **taxonomy**, therefore these two terms could be used interchangeably.

THE OBJECTIVES OF TAXONOMY

Plant taxonomy has **four** objectives:

1. To inventory the world's flora. The term flora refers either to the plants growing in a particular geographic area or to a systematic listing or description of those plants.
2. To provide a method for identification and communication.
3. To produce a coherent and universal system of classification.
4. To demonstrate the evolutionary implications of plant diversity.

IMPORTANCE OF PLANT TAXONOMY

1. Plant taxonomy is the basis for co-ordinating in all branches of botany as well as forestry which involve identity of species .e.g. morphology, physiology etc are comparable only after identification, nomenclature and classification.
2. It provides a classification which as far as possible expresses the natural relationship of the plants.
3. It provides a convenient method of identification and communication.
4. It is a means to detecting evolution at work.
5. It provides an accounting of the kinds growing on the earth. It demonstrates the great diversity of plants in nature and their relationship.
6. It is an aid to evaluating the raw materials requisite to allied activities such as forestry, medicinal work, horticultural pursuits and biological industries.

CLASSIFICATION

This is the placing of a plant or group of plants in categories according to a particular system and in conformity with a nomenclatural system.

AIM OF CLASSIFICATION

1. In addition to expressing relationships based upon common features, classification serves as a filing and information retrieval system.
2. The ultimate object of classification is to arrange plants in such a way as to give us an idea about their phylogenetic relationships i.e. the sequence of their origin and evolution from simpler, earlier and more primitive types to more complex; more recent and more advanced types in different periods of the earth.

UNITS OF CLASSIFICATION

A taxon (pl. taxa) is a convenient term which is applied to any taxonomic group at any rank . e.g. species, genus or family.

A unit of classification is a coherent group of like individuals called SPECIES. Following the development of natural system of classification a number of natural units evolved. These include the Species, Genus, Family, Order, Class, Variation, Sub-class, Division of sub-class etc.

SPECIES –is the basic unit of classification. A species is a group of individuals (plants or animals) having a very close resemblance with one another structurally and functionally.

GENUS – One or several related species make up a genus (pl. Genera) e.g. *Piliostigma reticulum*, *Piliostigmathonningii*, *Miliciaexcelsa*, *Khayasenegalensis*, *Adansoniadigitata*, etc. The first names are the generic names while the second names are the species names or the specific epithet. A genus is often recognizable by one or more characters of gross morphology. In delimiting a genus, two important requirements that should be taken into consideration are:

1. That of showing natural affinities
2. That of aiding correct identification.

FAMILY – is the largest category commonly encountered in routine taxonomic work. It is usually a readily recognized taxon composed of one or more genera with obvious relationships e.g. Caesalpinaceae family comprises many genera e.g. *Piliostigma*, *Bauhinia* etc. Genera of a Family show general structural resemblances to one another mainly in their floral organs.

ORDERS – are aggregated into successively higher groups on the bases of a few fundamental morphological characters common to the members of each category. This higher groups include the Class, Sub-class, Division, Sub-division and finally the Kingdom.

DIAGRAM

Names of genera are nouns from any source whatsoever. It may be masculine, feminine or neutral in gender; and in Latin or Latinized derivatives from Greek. A species name is composed of two words, - generic name, and the specific epithet known as binary name or binomial. Sub-units occur below the species, these are referred to as intraspecific units of classification. These are sub-species (S sp) varietas (var), the forma (*f*), the clone (cl).

A **sub-species** may be defined as one whose evolutionary development has not progressed to the extent of its being markedly and consistently distinct from its parent species.

A **varietas** is a unit subordinate to sub-species.

A **forma** is a minor variant (one whose minor variation is perhaps often caused by a single gene difference or distinguished by a single character) of a species or higher intraspecific unit.

Clone is a vegetative propagule.

SYSTEMS OF CLASSIFICATION

Classification may again be defined as an arrangement of plants into an orderly sequence. Plant classification follows a system of arrangement set forth by a specialist in matters of **phylogeny**. Up to the present day; the system of classification is based on the form of plants – whether trees, shrubs or herbs or the numerical distribution of parts of the flowers – number of stamens, pistils, ovary or real phylogenetic relationships. Not less than 50 different systems have been proposed with three holding positions of dominance. These are:

1. Artificial system;
2. Natural system and
3. Phylogenetic system.

1. **Artificial system**- was originated by Carolus Linnaeus (between 1707 – 1778). In this system; all flowering plants were sub-divided among 23 Classes. The first ten contain those plants with 1, 2, 3, 4 up to 10 stamens. Other classes were those with didynamous, tetradynamous, monodelphous, syngenesious. The system is artificial because it does not bring related genera and often; related species are not brought together.

2. **Natural system** – was originated by two French Botanists Bernard de Jussieu and Antoine Laurent de Jussieu (1699 – 1766 and 1748 – 1836 respectively). The system was based on the natural characters such as ovary position, fusion of floral parts and types of ovule arrangement. The system brings together the related taxa.

3. **Phylogenetic system** – This is a system based on Darwin's theory of evolution and descent. It is believed now that existing forms of life are products of evolutionary processes and in combination of characters and the result of gene exchange and others of rotation.

Other systems are the modifications of the above named systems.

PLANT NOMENCLATURE

The assignment of names to plants is called **plant nomenclature**. The International Code of Botanical Nomenclature has provided series of ranks of taxa. The Code, in effect, defines the categories only by listing their sequence. It may not be necessary to use all the categories provided by the Code for a small Order, Family or Genus, but the sequence of categories must not change. However, certain categories (i.e. species, genus, family) are essential if nomenclature is to function. The categories commonly used in the flowering plants are the Class, Sub-class, Order, Family, Genus, Species, and sometimes either Subspecies or Variety or even sometimes both. Categories such as Sub-family, tribe, Subgenus, Section and so on may be used and are frequently necessary in large and complex groups. In actual practice, species are grouped into genera and genera into families and so on through the sequence of categories. Each rank in turn is more inclusive than the lower categories. This categorization gives order and accessibility to the classification of plants and provides a meaningful system of information input or retrieval. The principles adopted in plant nomenclature provide that botanical progress is predicated on a universally accepted system of nomenclature that has for its objectives the following:

1. Fixity of names,
2. Nomenclatural clarity,
3. Freedom from ambiguity and
4. Avoidance of useless creation of names.

The scientific name of plant is its Latin name i.e. a name taken from Latin words or a name Latinized. The name of a species is binary combination consisting of the name of the genus. e.g. *Nauclea* then followed by the single specific epithet as *diderrichii* or *latifolia*. The generic name begins with capital letter while the specific name begins with small letter except where it signifies the name of a person. The scientific name of a species is undelined e.g. Khayagrandidfoliola or typed in italics without underlining, if word processing packages are used.

The scientific name is usually followed by the name of the first person to describe and name the species. Such a person is referred to as the author or authority. If a name is changed the original author's name is put in parenthesis or bracket, then write the new name.

Family names ending with –aceae are based upon generic names; for example, Brassica is the base of Brassicaceae.

FIELD CHARACTERS IN TREE IDENTIFICATION

Leaves, stems, roots and the reproductive parts are of great importance in tree identification.

Generally, leaves provide more characters for identification purposes than all other vegetative parts.

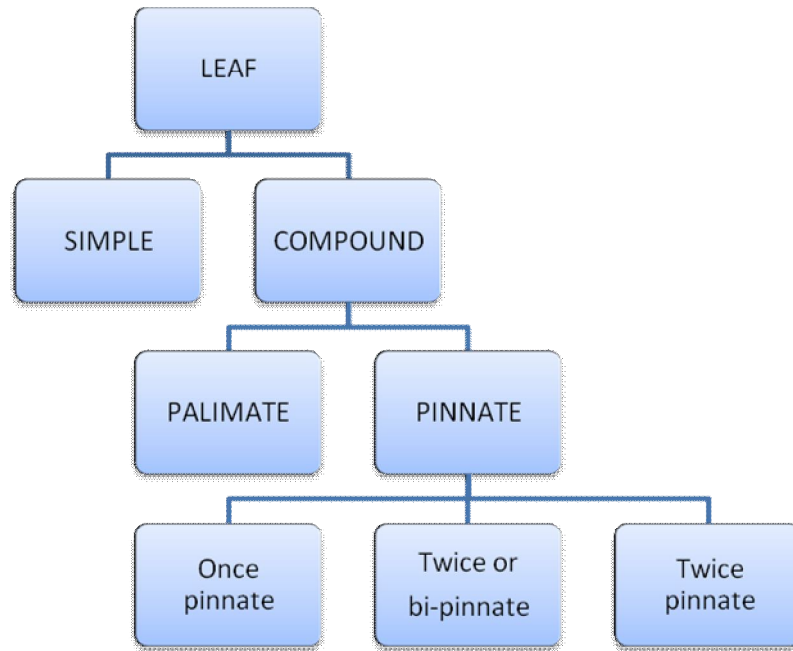
The descriptive value of leaves is found in the characters of :

1. The leaf structure
2. Type of leaf
3. Arrangement of leaves on the stem
4. The shape or form of the leaf/leaflet
5. Tips and margins of leaves
6. Vestiture – the covering (hairy/glabrous)
7. The leaf bases
8. Texture

1. STRUCTURE OF LEAVES

Basically, a leaf consists of a blade and its petiole. When petiole is absent the leaf is termed sessile. There is often a small earlike appendage at each side of the leaf base named stipule. In a compound leaf, each apparent blade is called a leaflet. The stalk of each leaflet is called a Petiole and the earlike appendage of each leaflet is called stipule.

2. TYPES OF LEAF



A simple leaf is one that is not divided into leaflets.

A compound leaf is one that is divided into many leaflets. The leaflets have no leaf or flower bud. Compound leaf may be pinnate or palmate. Palmately compound leaf is one with leaflets radiating from a common point e.g. cassava, *Vitexdoniana*.

Pinnately compound leaf is one with the leaflets arranged along the sides of an elongated mid-rib. The leaf may be once pinnate, twice pinnate or thrice pinnate. In these cases it means the leaflets are further divided.

Compound leaves also have difference types of leaf arrangements namely:- Trifoliate, paripinnate, imparipinnate, Bipinnate and digitate.

- | | |
|------------------|----------------|
| 1. Trifoliate | 2. Paripinnate |
| 3. Imparipinnate | 4. Bipinnate |

Bipinnate leaves are those in which each pinnate leaflet is itself divided into pinnate leaflets i.e. (Twice pinnate).

5. Digitate:-Digitate leaves are those in which leaflets radiate out from the end of the stalk, like the fingers of a hand.

Thrice pinnate leaves are sometimes called bi-compound leaves. i.e bi-compound leaves are formed when a common stalk develops from the common stalk of the compound leaf/leaves.

3. LEAF ARRANGEMENT (PHYLLOTAXY)

There are difference types of phyllotaxy. The object of the various modes in which the leaves are arranged on the stem is to avoid shading one another so that the leaves may get maximum amount of sunlight to perform their normal functions, such as manufacturing.

Three major types of phyllotaxy are observed in plants.

1. Alternate/spiral
2. Opposite
3. Whorled

These three types of phyllotaxy are common with simple leaves.

1. Alternate/Spiral:- This occurs when a single leaf arises at each node in an alternate form e.g. tobacco, sun flower etc.
2. Opposite:- When two leaves arise at each node standing opposite each other. In opposite phyllotaxy, at time a pair of leaves may stand at right angle to the next upper or lower pair. Such an arrangement is called DECUSSATE phyllotaxy e.g. *Psidiumgaugajava* (*guava*). Sometimes, however, a pair leaves is seen to stand directly over the lower pair in the same plane. Such as arrangement of leaves is said to be superposed.

LEAF FORMS

Botanists have assigned certain geometrical terms as elliptic, oblong, acute etc to leaf forms in order to give precision where exactness and conformance to definition may not exist. While some leaf forms are equivalents of these terms others approach equivalents and more represent intermediates. To this latter class (intermediate class), hyphenated combination of the terms are applied. Among the various leaf forms are:-

1. Linear:- e.g. grasses :- Long and narrow, flattened, the sides parallel or almost parallel.
2. Acicular:- Long, narrow and cylindrical if i.e. needle-shaped as in pines leaves very slender and usually round in cross-section.
3. Lanceolate:- The shape is like that of a lance. The leaf is lanceolate e.g. bamboo leaf. *Mangifera indica* etc such leaves taper at both ends.
4. Ovate:- Ovate leaves are shaped in such a way that the lower half is bigger than the upper half i.e. an egg-shaped leaf, broadest below the middle e.g. hibiscus leaf.
5. Oval or Elliptical:- A leaf that is shaped in such a way that there is little or no difference between its lower and upper leaves. Such a leaf is said to be oval or elliptical i.e. it has more or less the shape of an ellipse.
6. Oblong:- When the blade is wide and long, with the 2 margins running straight up e.g. banana.
7. Oblong:- Two halves of a leaf unequal e.g. *Azadirachta indica*.
8. Obovate:- Inversely egg-shaped leaf.
9. Cordate:- Heart-shaped as in betel.
10. Obcordate:- Inversely heart-shaped.
11. Round or Orbicular:- Circular blade as in lotus.
12. Spathulate:- When the shape is like that of a spatula, i.e. broad and somewhat rounded at the top and narrower towards the base, as in sundew (*Drosera*).

5. LEAF APEX

Leaf apex is the terminal end of the leaf fartherest from the point of attachment of the leaf. Among the several variations are:

1. Fillicorm and curling as in tendril.
2. Acuminate:- Sharp apex of a leaf. If its always pointed.
3. Acute:- Ending in a point with straight sides.
4. Cordate;- Tail-like appendage as tip or apex.
5. Round/Obtuse:- Round apex.
6. Retuse:- Shallow notch e.g. Water lettuce.
7. Emarginate:- Deep notch e.g. Bauchinia

6. LEAF BASES

Leaf bases refer to the end of the blade nearest to the point of attachment. Several variations can again be distinguished; among which are:-

1. Cuneate:- A type of leaf base that tapers to the leaf stalk.
2. Cordate base:- Deeply notched base of a leaf e.g. Gmalinaarborea.
3. Obtuse:- The nature of the base is rounded constricting sharply or abruptly to the petiole.
4. Rounded:- Rounded base as shown.
5. Altenuate:- With narrow sides constricting concavely and gradually into somewhat wing-like petiole.
6. Oblique:- With the lower most sides markedly unequal.

7. LEAF MARGIN

Among the numerous variations of leaf margin patterns are:

1. Entire:- Uncut, without indentation smooth margin.
2. Undulate:- With an edge wavy in a vertical plane.
3. Serrate:- With deep rather coarse sawlike teeth that point forward e.g. balsam and hibiscus leaves.
4. Ciliate:- With a row of hairs sometimes so minute as scarcely to be discernible by naked eyes.
5. Dentate:- Teeth almost (1) per pendicular to the mid-rib.

6. Lobed:- With incisions or sinuses not more than half way from margin to mid-vein e.g. Triplochiton senegalensis.
7. Parted:- Here the incisions are nearly reaching the mid-rib.

8. LEAF VENATION

Venation is the arrangement of the veins and veinlets in the leaf blade. There are 3 major types of leaf venation.

1. Parallel Veination:- This occurs when the veins run parallel to each other. It is common with monocots.
2. Reticulate Venation/Pinnate:- Is the irregular distribution of the veins and veinlets to form a network. This is characteristic of dicots.
3. Palmate Venation:- In this type of venation, 3 or more 1° veins diverge from the point of petiole, similar to the trees of a duck.

THE FLOWER

The study of flower is very important because it helps greatly in tree identification. The flower is the reproductive organ which produces pollen grains and seeds during sexual reproduction in plants. Flower parts are conservative and less affected by the environment than other traits. A flower is termed solitary or axillary when it appears singly in the axil of ordinary foliage leaves. When several flowers are arranged on a common peduncle, the arrangement is referred to as inflorescence. A flower is sessile when pedicel (flower stalk) is absent, otherwise it is pedicellate. An inflorescence flower may be determinate or indeterminate. It is determinate when the terminal or central flower matures first thereby arresting the growth by elongation of the primary axis. It is indeterminate when the lower flowers mature first, and the inflorescence often elongating as the flowers develop from the lower to the upper portions of the primary axis. A typical or complete flower is made up of four whorls – 2 lower accessory whorls – calyx and corolla, and two upper essential or reproductive whorls – androecium and gynoecium.

The petals and the sepals protect the flower at the bud stage, and in most cases give it the attractive look after the bud stage. The outer-most part of the flower is the sepals collectively called CALYX. In some spp, below this outer-most part of the flower are epicalyx e.g. Malvaceae family (Okro, Cotton, hibiscus etc).

When a flower has 5 sepals, it is said to be PENTAMEROUS.

Generally speaking, most flowers have 3 or 5 sepals. This is common with the cereal crops. The collective name for the petals is corolla. The essential or reproductive part of the flower is made up of the androecium is the male part of a flower and it consists of anther and filament which are collectively called stamen.

The sign for representing this male part is ♂. The female part of the flower is gynoecium consisting of stigma, style and ovary collectively called Pistil. The sign for representing this female part is ♀.

The four whorls of the flower develop in an ascending order from the swollen suppressed end (thalamus) or receptacle) of the floral axis or stalk (pedicel). The shape of the receptacle/thalamus varies in flowers. Below the receptacle is the pedicel, followed by the peduncle or the stalk.

A stamen without the pollen grain is said to be antherid.

Drawing

A TYPICAL FLOWER

When a flower has the four whorls, it is said to be complete, but if one of the parts is lacking, the flower is said to be incomplete. Stamen and pistil are regarded as the essential parts of the flower because both must be present either in the same or different flowers in order to have sexual reproduction and the resultant formation of seeds. If any of them (stamen and pistil) is missing in a flower, the flower is said to be imperfect while if both are present the flower is said to be perfect regardless of whether sepals and petals are present. Therefore all complete flowers are perfect, incomplete flowers may either be perfect or imperfect depending on whether or not both stamen and pistil are present. There are two types of imperfect flowers: 1. Pistillate and 2. Staminate.

Pistillate are flowers bearing only pistil while staminate are those bearing only the stamens.

Based on the relative positions of the ovary to the floral parts, flower may be hypogynous, perigynous or epigynous.

1. Hypogynous flower:- In a hypogynous flower, the thalamus is either conical, convex, flat or slightly concave, and the ovary occupies the highest position on the thalamus, while

the stamens petals and sepals are separately and successively inserted below the ovary. The ovary is said to be superior e.g. cassia flower, hibiscus and mango flowers.

Drawing

2. In a Perigynous flower:- the thalamus is cup-shaped with the gynoecium at its centre. The sepals, petals and stamens are found around the ovary. The ovary is also said to be superior e.g. pea, bean and also common in the family Papilionaceae e.g. Bauhinia.

Drawing

3. Epigynous flower:- In an epigynous flower, the ovary of the gynoecium is completely enclosed in the thalamus. The sepals, petals and stamens are on the top of the ovary. In this case the ovary is said to be inferior e.g. guava flower, cannalily and all members of the sunflower family. It is also common in the Rubiaceae family.

Drawing

FLORAL FORMULA

Hermaphrodite

Calyx = K

Corolla = C

Gynoecium = G

Family

Leguminaceae

Sub-families

1. Mimosaceae = $K_{(5-4)} C_{(5-4)} A \& 10, 8 \text{ or } 4 G1$

2. Caesalpiniaceae

3. Papilionaceae

This symbol is used to represent irregular, zygomorphic or asymmetrical flower, while is for regular, actinomorphic or symmetrical flower.

4. Verbenaceae

SYMMETRY OF THE FLOWER

Symmetry of the flower means the way in which the floral parts are arranged, particularly the petals and the sepals.

IRREGULAR/ZYGOMORPHIC/ASYMMETRICAL FLOWER (.1.):- A flower is said to be irregular/zygomorphic/asymmetrical, when it can only be cut into two halves through one plane e.g. *Bauhinia* *Crotalaria* flowers. The symbol .1. is used to represent this type of flower.

REGULAR/ACTINOMORPHIC/SYMMETRICAL FLOWER:- A flower is said to be regular/actinomorphic/symmetrical when it can be cut through many planes. This is possible because of the similarity of the petals and the sepals of such flower. Examples of such flowers is hibiscus. The symbol used to represent this type of flower is ..

CALYX (sepals)

The word calyx is the collective name used to describe the sepals of a flower. Generally, calyx is greenish in colour, and when this is true in a flower, it is said to be SEPALOID. But when the calyx has other colours, it is said to be PETALOID. In some flowers, the sepals stand alone, are not united together. Such calyx is said to be POLYSEPALOUS, but when the calyx are united it is said to be GAMOSEPALOUS e.g. *Bauhinia*, hibiscus etc. Calyx of some flowers are modified hairs or scale. In this case they are called PAPPUS. This is common with the flowers of the plants in the composite family.

Immediately the flower bud opens, in some flowers, the calyx will fall off. Such calyx are said to be CADUCUS. In other flowers, the calyx fall off later when the flower is mature. Such calyx are said to be DECIDUOUS.

In some flowers, the calyx will still be attached to the fruit after the formation of the fruit. The calyx is said to be PERSISTENT. E.g. *Eugenia* and Tomato

2. **COROLLA (Petals)**

Petals of flowers are collectively called COROLLA. Usually the corolla is coloured other than green and contribute to the brightness of the flower. The odours of flowers are

caused by essential oils and other chemical substances that are formed in special secreting cells usually of the petals. If nectarines secreting a sugary liquid are present, they are often located at the bases of the petals on their inner surfaces but they may occur at other places. The colour of the flower is usually as a result of the presence of anthocyanin or carotenoid pigments. Colours and odours may be of importance in attracting insects that effect pollination.

There are different shapes of corolla.

1. **BELL-SHAPED/CAMPANULATE COROLLA**

When the shape of the corolla resembles that of a bell, as in bell flower (companula), gooseberry (Physalis) etc.

It is said to be companulate.

Drawing

2. **TUBULAR COROLLA:-** When the corolla is cylindrical expanded from base to apex, as in the central florets of sunflower, it is said to be tubular.

Drawing

3. **PAPILIONACEOUS/BUTTERFLY-LIKE**

The general appearance is like that of a butterfly. It is composed of five petals, of which the outer-most one is the largest and known as the STANDARD petal, the two lateral ones, partially covered by the former, are somewhat like the two wings of a butterfly and known as the WINGS. The two inner most ones are the KEEL petals e.g. Crotalaria, Papilionaceae family e.g. bean, pea, gram, butterfly pea etc.

Drawing

AESTIVATION

Aestivation is the mode of arrangement of the petals or the sepals, especially the petals, in a floral bud with respect to the members of the same whorl (calyx or corolla)

TYPES OF AESTINATION

There was four types of aestivation

1. Valvate aestivation:- When the members of a whorl are in contact with each other by their margin, or when they lie close to each other without any overlapping e.g. calotropis and Annona (madar).

Drawing

2. Twisted or contorted aestivation:- This occurs when one margin of the sepal or the petal overlaps that of the next one, and the other margin is overlapped by the 3rd one as in cotton, china rose. The twisting may be in clockwise or anticlockwise direction.

Drawing

3. **Imbricate aestivation** is said to occur when one of the sepals or petals is internal being overlapped on both the margins, and one of them is external, and each of the remaining ones is overlapped on one margin and it overlaps the next one on the other margin. Imbricate aestivation is xteristic of the family caesalpiaceae.

Drawing

4. **VExillary aestivation**:- This occurs when there are 5 petals, of which the posterior one is the largest and it almost covers the 2 lateral petals, and the latter in their turn nearly overlap the 2 anterior or smallest petals. Vexillary aestivation universally found in all butterfly like/papilionaceous corolla e.g. crotalaria.

THE ANDROECIUM

This is the male part of a flower and it consists of a number of STAMENS. Each stamen also consists of filament, anther and connective. There are difference types of another, but the commest one is as shown below.

Drawing

There are four pollen sacs in an anther, each containing the pollen grains. In some flowers, there are sterile anthers (authors without pollen grains). Such anthers are called STAMINODES. Stamens may be of the following types.

1. **Monadelphous stamens**:- When all the filaments are muted into a single bundle, but the anthers are free, the stamens are said to be monadelphous, As in Malvaceae family, hibiscus, cotton (Gossypium). In them, the filaments are united in tubular structure called the stamina tube, ending in free anthers.

Drawing

2. **Diadelphous Stamens**:- When the filaments are united into 2 bundles, the anthers remaining free, the stamens are said to be diadelphous as in papilionaceae e.g. Crotalaria, butterfly pea etc. In them there may be altogether 10 stamens of which nine are united into 1 bundle and the 10th one is free but this is not a rule.

Drawing

3. **Polyadelphous stamens**:- When the filaments are united into a number of bundles more than two, but the anthers are free, the stamens are said to be polyadelphous as in Bombax citrus etc.
4. **Syngenesious stamens**:- When the anthers are united together into a bundle or tube, but the filaments are free, the stamens are said to be syngenesious, as in compositae e.g. sunflower, marigold etc.

Synandrous

4. **THE GYNOECIUM (PISTIL)**

Gynoecium is the female part of a flower; just as androecium is the male part. The gynoecium consists of the stigma, style and ovary. The pistil may be composed of one or more carpels. When it is one, it is said to be simple, and when there are many pistils, they are known to be compound. In the compound pistil, the carpels may be free, in such a case it is referred to as Apocarpous, but when the carpels are united they are called syncarpous.

The ovules are attached to the inner wall of the ovary by a thin membrane called placenta. The arrangement of the ovules within the ovary is placentation. There are different types of placentation.

TYPES OF PLACENTATION

1. Marginal placentation

This is as shown in the diagram. Marginal placentation has single pistil monocarpous. This is characteristic of caesalpiniaceae and papilionaceae families.

2. Axil placentation has united carpels as in the diagram.

This is common of Malvaceae family.

3. Parietal placentation

Typical example of parietal placentation is carica papaya (pawpaw).

4. Free central placentation

This type of placentation is typical of Entandrophragma.

5. Superficial placentation:- In this type, many carpels are fused together. Within the walls of the carpels are the ovules being attached. There are many chambers.

INFLORESCENCE

Inflorescence is the arrangement of the flowers on the shoot that bears them.

TYPES

A Raceme is an indeterminate single axis bearing pericellate flowers e.g. cassia, Brassica etc.

A spike is an indeterminate single axis bearing sessile flowers e.g. Amaranthus.

A panicle is an indeterminate branch system whose primary axis bears branched 2^o axis and pedicellate flowers e.g. Delonix spp.

An Umbel is a descriptive term applied to inflorescences whose flowers are pedicelled and the pedicels seemingly arise from a common point at the stem or peduncle apex. In this case, it may be determinate or indeterminate. Umbel is characteristic of coriander family or Umbelliferae.

A Head/Capitulum:- is an inflor. of sessile or nearly sessile flower on a very short or flattened axis producing a globose or flat topped cluster. This type of inflor is typical of sunflower or compositae family e.g. Marigold, sunflower, Tribulus, Acacia

A CYME is a determinate inflor representing a reduction from a compound dichasium by loss of 2^o axis producing a more or less flattened top or convex cluster.

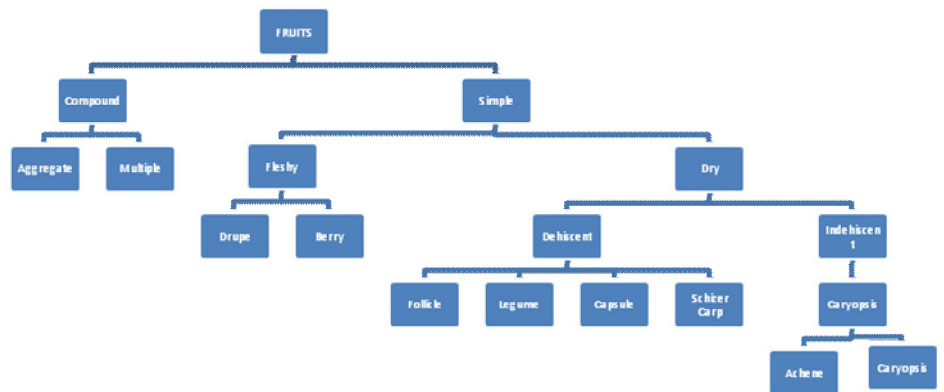
CAULIFLORY is a condition when flowers are borne directly on main trunk, branches or short stalk e.g. Theobroma cacao (cocoa).

A NUDE flower has one/both sexes but lacks calyx or corolla.

FRUITS

Fruits may be defined as the product of a ripened ovary, pistil/gynoecium of a flower. It is the seed containing organ of a plant. The ovules in the ovary develop into seeds. Fruits generally provide very reliable characters in the delimitation of genera and of families. Hence they are useful in the classification and identification. Fruits are classified on the basis of their descriptive features rather than on their comparative morphology and anatomy.

CLASSIFICATION OF FRUITS



Compound fruits may be aggregate or multiple.

1. Aggregate fruits:- An aggregate fruit is a collection of simple fruits (or fruitlets) develop from the apocarpous pistil (free carpels) of a flower e.g. *Annonasquamosa*
2. Multiple fruits:- A multiple fruit is that which develops from a number of flowers i.e. from an inflor e.g. pineapple, *FicusTreculia Africana*.

Simple fruits:- When only one fruit develops from the single ovary of a flower which without accessory part, it is said to be a simple fruit. A simple fruit may be dry/fleshy. The dry fruit may again bedehiscent, indehiscent or schizocarpic

1. Dry dehiscent fruits are those dry fruits that split open naturally, when ripe. They are usually classified accordance to the number of split which occur in the pericarp e.g. follicle, legume, capsule and schizocarp.
2. Follicle is a dry fruit formed from one carpel, which contains one or more seeds and splits down one side only e.g. *Cnestis* (false rubber) *Asclepias* (Sodom apple).

3. Capsule:- is a dry fruit formed from 2 or more carpels which contains many seeds. It may open on one or several ways e.g. cotton, poppy seeds, castor oil.
4. SCHIZOCARP:- also a dry fruit, having many seeds and break up into several parts, each containing one seed e.g. cassias, desmodium and Lomentum.

When legume is partitioned or constructed between the seeds into a number of one seeded compartments it is called LOMENTUM e.g. Acacia spp, Entadagigas, Aradius hypogeal

2. Dry Indehiscent fruits

These are dry fruits that do not split open naturally when ripe.

Achene:- This is the simplest possible fruit which consists of one seed surrounded by a dry pericarp which does not split e.g. sunflower.

Nut is similar to achene, but it has hard and tough pericarp e.g. the hard part of cashew fruit. Many so called 'nuts' (e.g. groundnut, coconut) are botanically not nuts at all.

3. Caryopsis:- This is an achene-like fruit in which the *pericarp* and seed coat are fused together. This is typical of the family Gramineae e.g. maize, rice and grasses.

Cypsela:- is an achene, formed from an inferior ovary, in which the calyx persists and forms a paraclute of hairs called pappus. This is common in the composites e.g. *Tridax* *Emilia*.

Samaria:- is an achene in which the pericarp has been extended to form one or more wings e.g. *Combretum*, *Terminalia*, *Anogeissus*.

FLESHY FRUITS

In fleshy fruits, at least part of the fruit is fleshy and can be eaten. They are usually drupes or berries.

- (i) **Drupe**:- This has a pericarp which consists of three layers outer skin or epicarp.
- (ii) Middle fleshy layer or mesocarp (fibrous in palm nut and coconut).
- (iii) Inner hard and woody layer or endocarp.

Examples of drupes are mango, coconut, palm nut

Drawing

Berry:- A completely fleshy fruit containing only hard seeds embedded in fleshy part e.g. *Psidium guajava*, *citrus spp*, *tomato*, *carica papaya*.

Drawing