Botany of legumes

- Legumes are dicotyledonous, i.e. the embryo consists of two cotyledons or seed- leaves).
- The legume family is sometimes divided into three groups or subfamilies: 1.Mimosoideae, woody plants and herbs with regular flowers,
- 2.caesalpinoideae, plants with irregular flowers;
- 3.papilionaceae, herbaceous and woody plants with a distinctive papilionate or butterfly shaped flower. Most of the forage and economically important legumes belongs to papilionaceae family. Legumes may be annuals, biennials or perennials.

Vegetative organs

Aerial parts

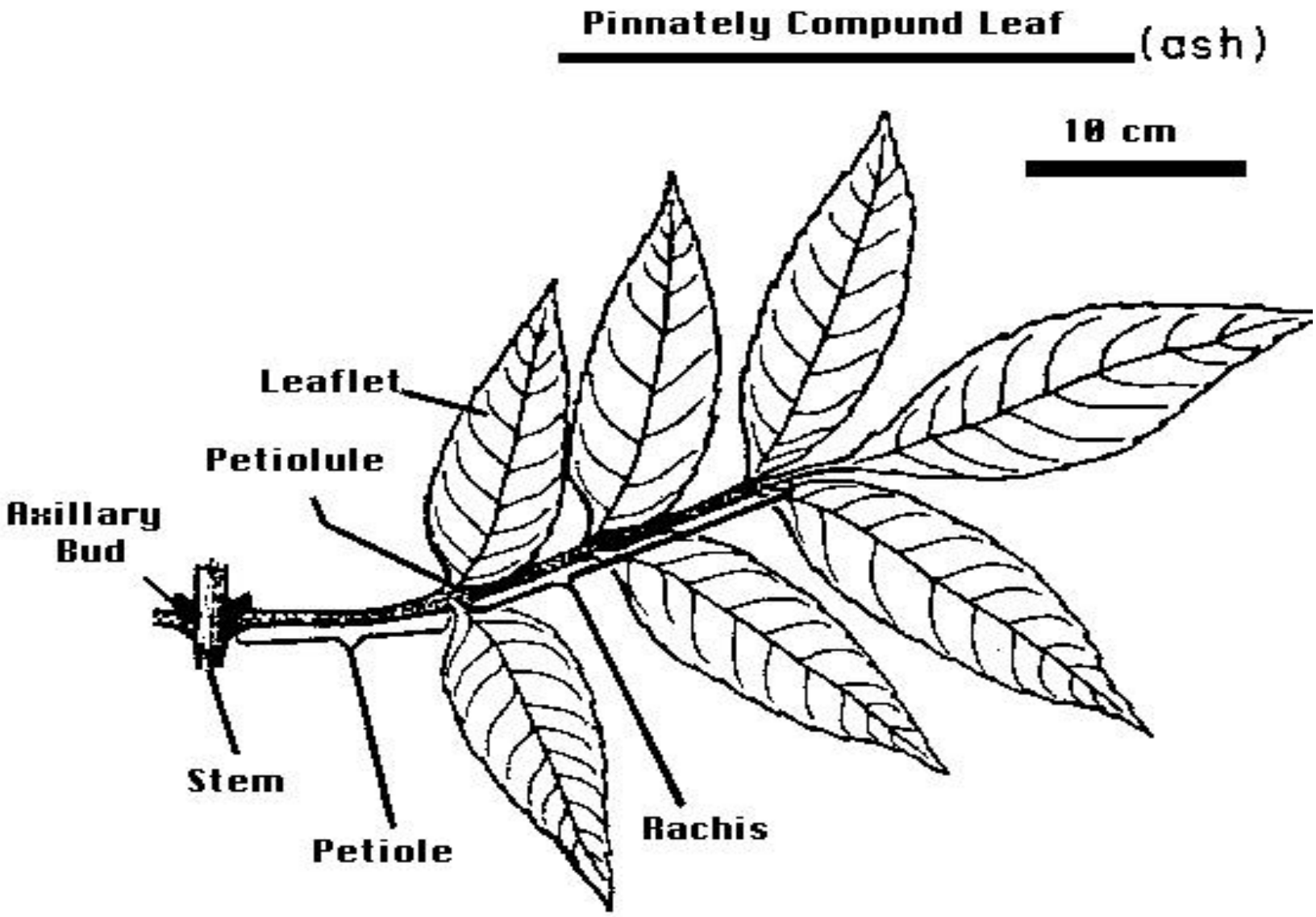
There are distinct morphological differences among the legumes but general characteristics of some plant are similar and rather uniform. The above ground portion consists of a main stem with axillary branches, usually compound leaves, stipules and inflorescences.

Tillers sometimes arise from the basal portion of the stem (crown) and stems also develop axillary branches. The stems are jointed, with nodes and internodes, and are usually hollow, except at the nodes. They may be covered with hairs or may be glabrous. Herbaceous stems contains chlorophyll.

The leaves contains a common leaf stalk (petiole), with 3 or more leaflets, each with its own stalk (petiolule). The leaves could be 'palmately' compound i.e leaflets directly attached to the end of the petiole e.g. *Centrosema pubescense* or' pinnately'

Compound when the petiole extends into a long slender structure with leaflets e.g *Clitoria ternatea.* Some have leaflets modified to tendrils e,g *Lathyrus spp.* Presence of *pulvinus* is the characteristic feature of legume family.

<u>Stipules</u> are leaf-like outgrowths at base of the main leaf stalk, vary in shape and size and used for identification of species. The leaflets and stipules may be smooth or possess hairs. The veins on the leaves are netted pattern unlike parallel venation of grasses.


Pinnately Compound Leaf (ash)
10 cm
Leaflet
Petiolule
Axillary Bud
Stem
Petiole
Rachis

Unifoliate palmately compound leaves

Bifoliate palmately compound leaves

Trifoliate palmate compound leaves

Quadrifoliate palmately compound leaves

Multifoliate palmately compound leaves

Reproductive organs

Inflorescence

- **The Mimosoideae producer flowers in dense heads or small globular, spike – like inflorescences, and commonly has the floral parts arranged in the sets of four, They are rendered conspicuous by the long, coloured filaments of the numerous stamens. e.g *Leucaena leucocephala* and *Acacia spp.***
- **The caesalpinoideae flowers appears in clusters or racemes, with overlapping petals .The stamens are usually separated e.g *cassia spp., Ceratonia spp. and Gleditschia.***

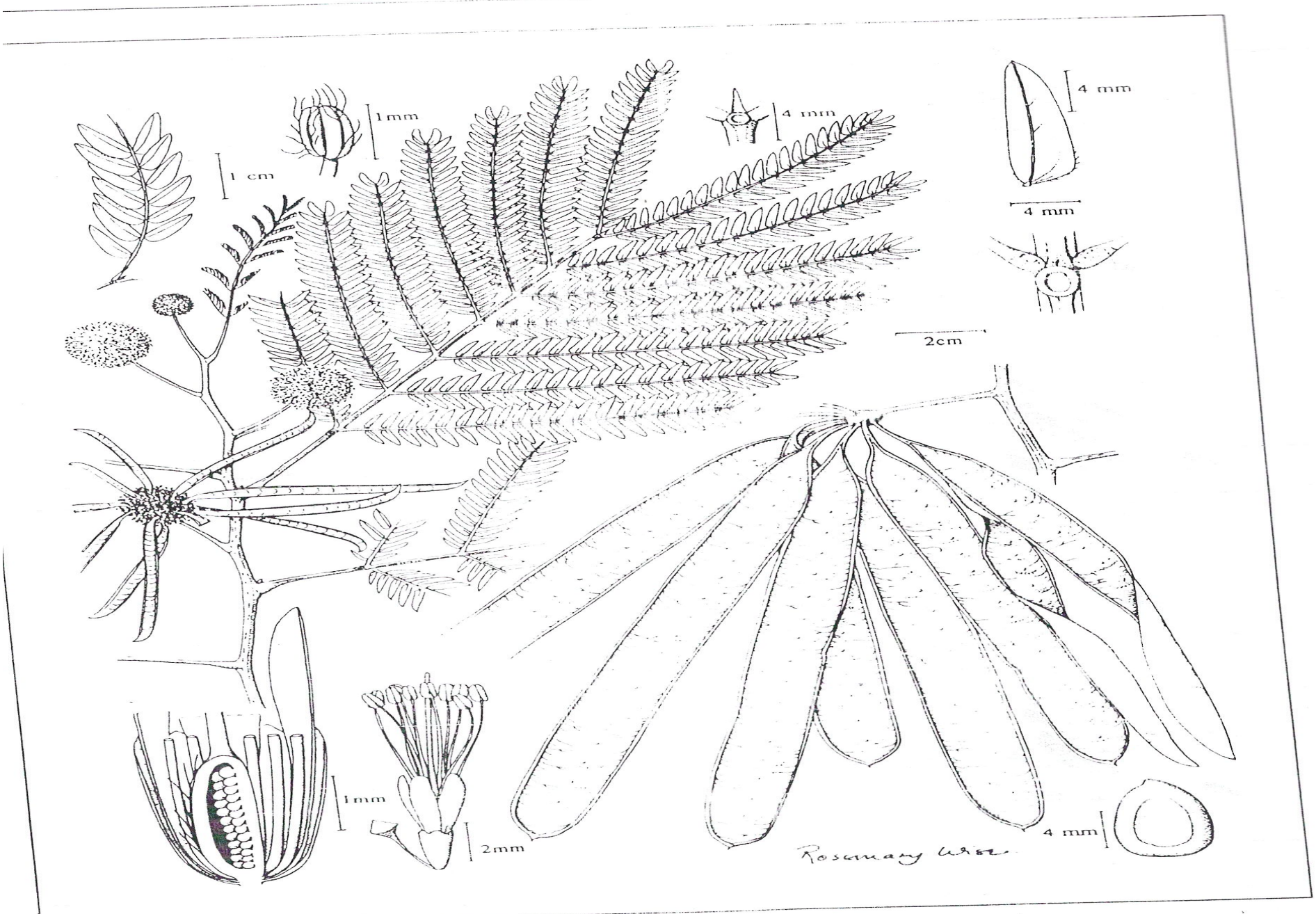
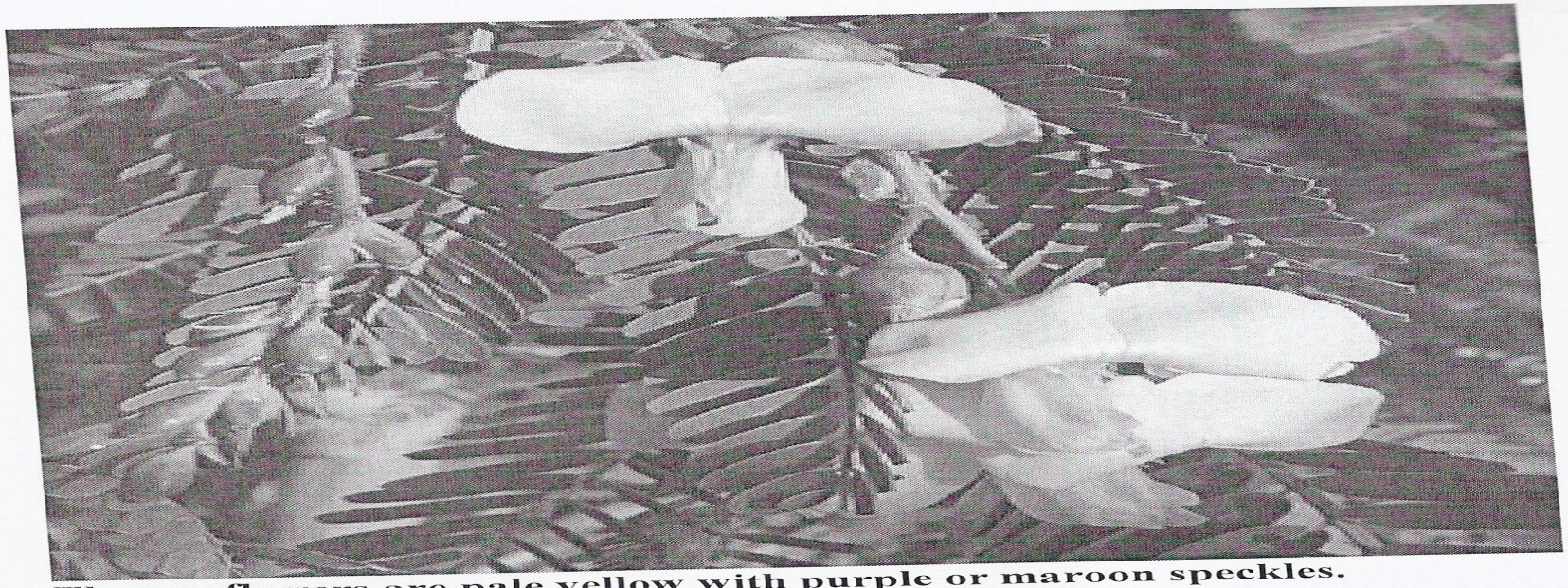


Figure 42 *Leucaena leucocephala* subsp. *glabrata*

The flowers of papilionaceae are arranged in racemes as in *Desmodium spp.* in heads as in T*rifolium spp.* or spike-like racemes as in *Medicago sativa*. There is a central axis, along with the individual flowers develop. Each flower has its own short stalk or peduncle. The inflorescence may be terminal or auxiliary.

The flower

The corolla consists of five petals of three distinct kinds : 'standards' or 'banner' uppermost or outer petal, largest and most showy; two wing petals, with slender stalks called the claw , and an expanded portion; keel, two petals folded together, partially concealed by the wing petals, the expanded portions more or less united at the outer margin into a boat-shaped structure.

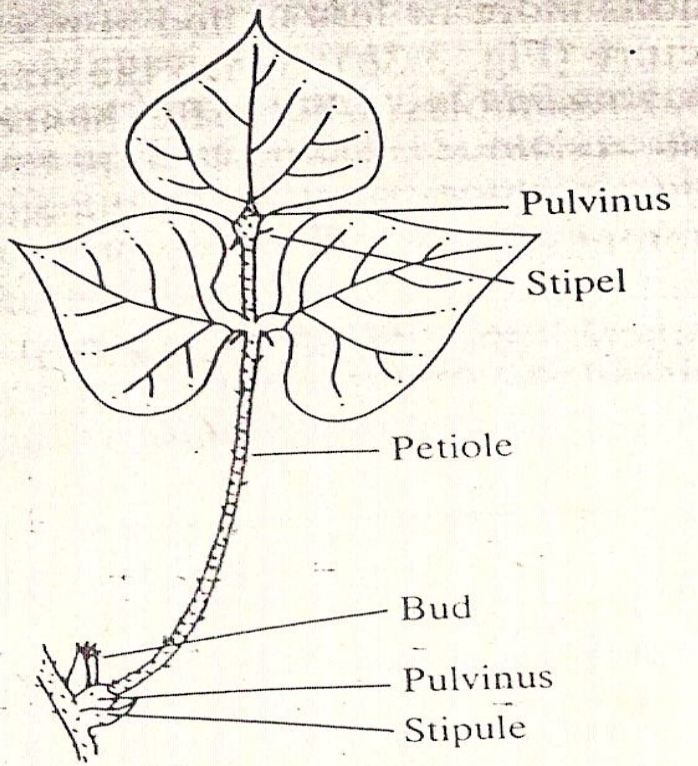


The pea flowers are pale yellow with purple or maroon speckles.
Photo by R. P. Ellis courtesy Ecoport
(source URL: http://www.ecoport.org)

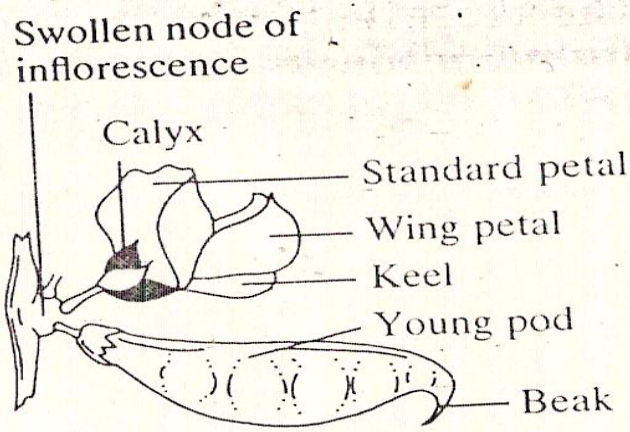
Habit. A soft wooded tree up to 6 m tall.
Photo by R. P. Ellis courtesy Ecoport

The calyx with five teeth forms a tube at the base of the corolla.

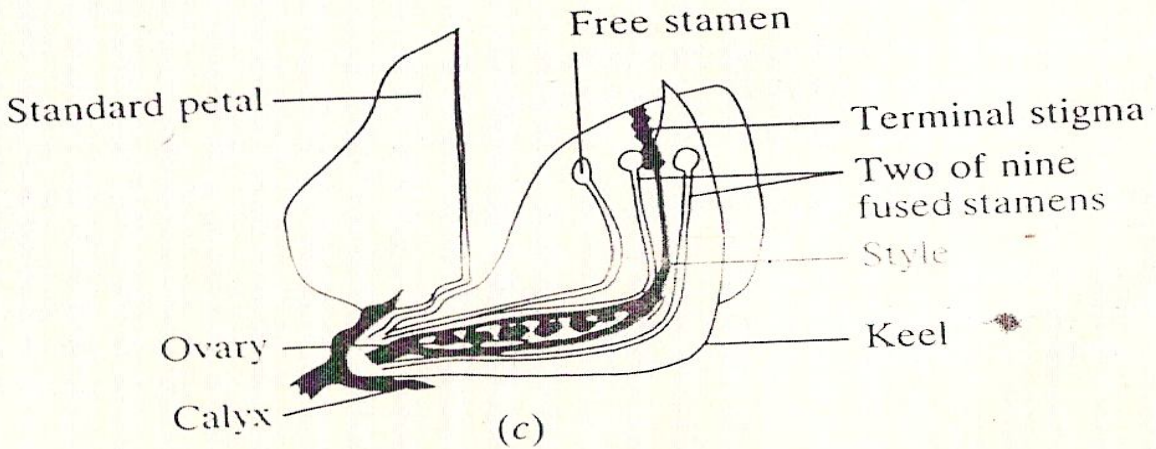
The keel encloses the stamens and pistil. The androecium consists of the ten stamens, the filaments of which may be united.
The Staminal tube surrounds a superior ovary, an elongated structure comprising one carpel with one ovule or a single row or several ovules.
A bent style surmounts the ovary and the stylar tip broadens into the stigmatic surface.
The nectar resides at the bottom of the corolla tube.


Pulvinus
Stipel
Petiole
Bud
Pulvinus
Stipule

(a)


Swollen node of inflorescence
Calyx
Standard petal
Wing petal
Keel
Young pod
Beak

(b)


Free stamen
Standard petal
Terminal stigma
Two of nine fused stamens
Style
Keel
Ovary
Calyx

(c)

Fruit and Seed

- **The ripened ovary forms a fruit of variable shape, called legume or pod. Some seeds shatters - dehiscent e.g. *Macroptilium atropurpureum* and *Centrosema pubescens* while some are non-dehiscent e.g. *Crotolaria* spp. some have indentations between the enclosed seeds e.g. Glycine wightii.**
- **The legume seeds has no endosperm, the reserve food is stored in the cotyledons.**
- **The pods can be glabrous or covered with hairs. Each seeds is enclosed in the testa or seedcoat. A large oval scar called the *hilum* marks place of attachment to the ovary walls. The legume seed has no endosperm.**

Subterranean parts : **The roots system of most legumes consists principally of an actively growing primary roots or tap root and its branches(secondary).**

The primary roots may penetrate the soil to a depth of 6-8m e.g. Lucerne.

The roots of many leguminous plants become infected by bacteria of the species, Rhizobium, Which grows and multiply, forming nodules which differ in size, shape and arrangement on the roots.

Growth habit

1. **Bush – type – a central stalk with side branches appearing along the main stem and with axillary branches developing *Cajanus cajan*; *Desmodium tortuosum*.**

2. Bunch – type- a single crown from which several stems and new tillers arise, making it difficult to identify a main stems, stems can be erect or decumbents e.g *Stylosanthus guianensis* and *Medicago sativa.*

3. Creeping – the stems trail over the ground surface e,g *Calopogonium mucunoides*, *Macroptilium atropurpureum*, some vigna spp.

4. Scrambling – many of the creeping plants climb onto and grow over upright objects. Some are also twining and encircle upright objects e.g *Centrosema pubescens, Pueraria phaseoloides.*

5. Rosette- a vegetative form of some perennials developed after flowering or the onset of cool weather e.g *Medicago sativa* and *Trifolium pratense* at the higher elevations of the tropics.

SYSTEMATICS OF PASTURE PLANTS

- **Gramineae (grass family) and leguminoseae (legume family) are divided into lower or minor categories of the tribes, genera and spp. (Lawrence, 1951)**
- **Tribes are group with certain phylogenetic (evolutionary) relationships.**
- **A genus comprises of plants with common reproductive structures. Which extends beyond morphological differences to genetics, cytologic, physiologic, ecologic and geographic relationships.**

- **The generic name of a plant is the first of the words making up the botanical binominal e.g Chloris gayana .**

Species consists of a natural population of plants with common morphological characteristics (phenotypically similar), having a common ancestry and capable of replacing like types (Lawrence 1951)

it is identified taxonomical by the secondary name of the binominal used as a scientific name. this group is the most important botanical unit for the pasture agronomist and cattleman, since plants of species may have broad adaptability to diverse soil and climatic conditions.

The species is a particular interest to the plant breeder, who brings together introductions of the species from different sources and searches for the type which excel in adaptation, herbage yield, persistent e.t.c which may be released as cultivars e.g *Chloris gayana* 'Masaba'.

•'varieties' are morphological variants and subdivisions of the species. In botanical literature, they will be written with the specific name e.g *Panicum maximum var. Ntchisi, Imperata cylindrical* var. africana to distinguish it from those of other area.It can refer to plant population of the same species which differs from another one in one or more recognizable inherited characteristics.

‘Cultivars’ is the internationally recognizable term for the agricultural variety . A cultivar is a cultivated population of plants with recognized, morphological, physiological, chemical or other differences. They may follow generic, specific or common names e.*g* *Desmodium* Greenleaf. *Desmodium intortum* Greenleaf or *desmodium Greenleaf*.

Ways of classification

- **The earliest system of classification were based on pre selected characteristics, such as form or habit e.g. trees, shrubs, herbs, annuals, biennials, perennials.**

- **Carolus Linnaeus(1707-1778) a Swedish, revolutionised plant classification through sexual system of flora characteristics especially stamens and pistils.**

- **But attention is now on microscopic and submicoscopic features of spines, hairs, spores, pollen grains, starch grains, cellular inclusions e.t.c.**

- **Later knowledge of cytology in determining chromosome number, size and morphology, behaviour and structure in meiosis led to establishing cytotaxonomic relationships.**
- **Biochemical properties of plants have been studied to been studied and used by taxonomists, for a long time e.g essential oils, pigments, alkoids, flavonoids, glycosides, and non protein free amino acids, which is chemotaxonomy.**
- **Immunological studies of proteins yields measures of taxonomic relationship. The implications of each development is that plants are always reclassified but this does not alter plant adaptability and response to management practices.**

Nomenclature

- **Scientific names (botanical or Latin names) may be long, unfamiliar or difficult to pronounce but it has the following advantages:**

- **1. Same names used in all languages.**
- **2. Uniform binomial (two names)**
- **3. Binomials are exact in delineating a species.**
- **4. Descriptive (for those versed in Greek and Latin)**
- **5. The choice of names is governed by international rules of botanical nomenclature**

- Common names (called vernacular, colloquial, folk names) it depends on language of a place and descriptive (sword bean, lemon grass-*Cymbopogon flexuosus*) or bear name of a person (Rhodes grass-*Chloris gayana*), location (Townsville stylo-*Stylosanthes humilis*) or associated with a habitat (beach grass-*Ammophila spp*).

- May refer to genus e.g desmodium. Its use can be confusing and misleading.

1. Restricted to one language or dialect, and perhaps to one locality.

2. Names are indefinite

3. Are not regulated by a constituted authority.

Classification & distribution

- **Grasses**
- **Graminae (Poaceae) is a large botanical family with about 10,000 spp. grouped into some 650 genera and genera into 50-60 tribes; with sub families of 2 to 12.**
- **3 group are of interest- Festucoid group-temperate grasses; Panicoid group- tropical and subtropical and Chloricoid group- few tropical cultivated and a number of valuable wild grasses the tropical and warmer areas of North American .**
- **Examples of festucoid- Tribes of Triticae (Agropyron spp) Festuceae (Festuca, Dactylis, Lolium, poa) Bromeae (Bromus), Aveneae (Avena,Arrhenetherum) Agrostideae (Agrostis, Alopecurus, Phleum)**

Panicoid- Paniceae or mellinidae (*Panicum, Brachiaria, Digitaria, Mellinis*, Pennisetum, Cenchrus), Andropogoneae (Andropogon, Hyparrhenia, Sorghum, Lasiurus, Themedia) and Maideae (Zea, Euchlaena, Tripsacum)

Chloridoid- chlorideae (Chloris, Cynodon) and Eragrosteae (Eragrostis, Dactyloctenium, Eleusine)

Legume

- **Order- Leguminosae (Fabaceae) family is divided into three distinct groups or families- Mimosoideae, Caesalpinoideae, Papilionoideae and subfamilies- Mimosaceae, Caesalpinaceae and Papilionaceae of the botanical order Leguminosae.**
- **Only two spp of mimosoideae are important to us – *Leucaena leucocephala* and *Desmanthus virgatus*, although a number of shrubs and trees are browse plant of Acacia spp.**
- **A number of Caesalpiniodeae are cultivated for fodder and only very few are used as natural browse plants.**

Species of Papilionoideae are widely grown as pasture or fodder crops and are of considerable important for natural grazing or browsing.

It is a large subfamily with 200 genera and some 12,000 spp. distributed throughout the world.

Leguminosae in general are of tropical origin with Caesalpinaceae as the most primitive type .
17 tribes of Papilionoideae are recognized .

With important ones as Indigofera, Aeschynomeneae, Sesbanieae, Genisteae, Psoraleae and Trifolieae but majority of legume in cultivation belongs to the tribes – Stylosantheae, Desmodieae and Phaseoleae. The above tribes especially the last three are distributed all over the world, with Desmodieae and Phaseoleae concentrated in Latin American.

Centre of distribution

- **TROPICAL GRASSES**
- **1. East Africa- species of *Brachiaria, Cenchrus, Chloris, Cynodon, Panicum, Setaria,* and *Urochloa***
- **2.South Africa- species of Digitaria and urochloa**

  3.Arabia, Pakistan, and Northern India – *Cenchrus*
- **4.Subtropical South American- *Axonopus, Bromus, Paspalum and Sorghum***

LEGUMES

1.Centres of high species density exist in Central America, Bolivia, Southern Brazil, and Paraguay- *Macroptilium, Desmodium and Leucaena*

2.Central and Southern American- *Centrosema, and Stylosanthes*

3.East Africa – *Glycine and Macrotyloma spp*

4.Southern African- *Lotononis*

5.Southern-East-Asia-*Pueraria, Vigna, Calopogonium, Indigofera*