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Classification of plants

According to the use of plants and plant products to man the grouping is made.

Cereals

It is generally applicable to the **grains** obtained from the members of the Family **Poaceae.** Rice, Wheat, Maize, Sorghum, Ragi, Barley, Pearl Millet, Fax tail millet, Rye, Oats etc come under this group. Principal source of food for man and animals. Botanically the characteristic fruit of the family Poaceae is **caryopsis.** Millet is generally used for the member of small grained cereals which are of minor importance as food. Few species of plants other than those of poaceae which produce small grains and used as food as in the of cereals. They are **pseudo cereals**. Buck wheat(*Agropyrum spp* – Chenopodiaceae, grain amaranthus – *Amaranthus spp* Amaranthaceae, Quina, (*Chenopodium quinoa* - Chenapodiaceae). The major cereals are paddy, wheat sorghum, ragi, maize , pearl millet, and the minor millets are fox tail millet, little millet etc . minor cereals are of important space of food in drought prone rural areas**.** Tillering habit is more common in cereals except in maize and sorghum. The infloresence is panicle, which may be compact or loose. The grain is caryopsis. Cereals supply food to man and straw to animals. Grain contains starch as the major components. Rice is the staple food for nearely half of the world population. Contains large proportion of starch wheat contains good preparation. Bearly is used as malted food and flour is processed in the form of light food.

Pulses

Seeds of leguminous plants. Pulses supply protein, chief source of in vegetarian food. Seeds are generally used, the whole fruit or pods, with young and mature leguminous plants fix atmospheric Nitrogen in their root nodules by the nitrogen fixing bacteria. The whole plant body in legumes in papilionaceous plants rich in nitrogen and the seeds, the pods and also the leaves and shoots contains a high proportions of protein and are hence used as food. The average per capita consumption of pulses in India is alone one ounce but the minimum require wet is along three ounces, *Cajanus cajan* – Red gram, *Vigna mungo* (black gram) *V. radiata* (green gram)

Vegetable, Fruits and Nuts

Olericulture deals with vegetables, Pomology deals with fruits and nuts which are rich and valuable sources of food. Horticulture – the branch of Agriculture relating to the cultivation of fruits (Pomology), vegetables (Olericulture) and flowers and oranamental plants (Floriculture)

Oils and oil seeds

Oil seeds are important both for consumption and for industrial purpose. In human diet, fat is supplied by oils which give the necessary energy for metabolism besides adding taste to the food. Oil is used for medicinal purpose and also for preparation of soap,. cosmetics, and lubrication. castar and coconut oil are the important industrial oil.

Sugars and Starch

The use of sugarcane for the production of jaggery has been in existence for many centuries. In Eurupe, Canada and USA sugar beet is the source of sugar. Sugar beet was not prominent in tropical countries because sugarcane give high tonnage of yield . The other sources are palmyrah, coconut and date. The tapped juice of the plants are converted into palm gur, the cheap source of sugar to the people sugars, besides being used as food sweeteners are rich source of energy.

In Indian diet, cereals supply the bulk of starch as in rice, sorghum, maize and other cereals, Starchy food is also obtained from sweet potato, tapioca, and sago palm, Starch is also an industrial product used in confectionary, textiles, stationary and cosmetic industries.

Fibres

Next to food clothing is the most important one and is obtained brown wood pulp for the manufacture of gunny bags hessions cloths, and packing material. The fibres of Jute and Mesta are of importance. Twines, cordages and ropes needed in daily flowers in carpet, mats, brushes, and for stubbing purpose such cotton is used .

Beverages

Coffee , tea, cocoa are important beverages and they have stimulating effect. Fruit juices like lemonades, orangeades, apple pineapple and mango juices constitute the soft drinks. Coffee and tea are commercial crop grown in plantation and exported. Coco is gaining important in beverages and confectionaries.

Narcotics, fumiatories and masticatories

Products from tobacco, ganja , opium which have a stimulating effect on small doses come under narcotics, Narcoties are substance which produce a stimulating or drowsy effect. They relieve pain and produce sleep. Mild stimulating preparation , adjuncts to fermentation, flavouring ingredients to

beverages, and mild poisons are also called narcotics. When substance are smoked be cause of the stimulating effect of tobacco they are called as fumitories. Substance which are chewed as the betel leaf and arecanut for the mastecatories. Tobacco comes as Narcotics, Fumitories and masticatories. The alkaloid present in the plant parts are responsible for creating the effects.

Drugs are obtained from large number of plants are called medicinal plants.

Species and containments

A variety of plant products are made use of as food adjuncts to add flavour, aroma and taste, is spices and those give aroma and flavour is condiments. Pepper, cardamom cloves, chillies, turmeric ginger, onion, and garlic. The species and condiments have essential oils which are responsible for the flavour and taste.

Rubber

The rubber plantations in tropical countries, given the species, ***Hevea brasiliensis*** a plant introduced from Brazil Latex is obtained from the plant and processed as used as rubber . Rubber is also obtained from ***Manihot glaziovii*** *Cryptostegia* and *Taraxacum.*

Forages

Feed for domestic animals is obtained from grain crops and fodder crops. Generally includes fodder and postarages; Guniea grass Napier grass, Lucerne, fodder cholam, fodder Maize etc., are harvested and fed to animals. The grasses and legumesare grown in arable land and left for grazing of animals come under pastures. The foliage of number of trees and shrubs which are edible to animals form the another source of forage.

Green manures and green leaf manures

Growing of special crops for adding organic matter and Nitrogen to the soil and ploughing them in situ is called green manuring. daincha, sunnhemp, pillipesara, kolingi, indigo and *Sesbania speciosa* the green lopping from shrubs, trees incorporated in the field as from *Ipomoea cornea,* and *Gliricidia* form the green leaf manuring. Usually green manuring plants are popilonacious type which fix nitrogen in the soil by the formation of bacterial nodules and higher

'N' content in leaves and shoots.

06. Botanical description and floral biology

Cereals

Characters of Cereals

Most of the cereals are herbaceous annuals. Stem or culm often erect, cylindrical, hollow except at nodes. Tillering habit, shallow fibrous root system. Leaves alternate, distichously with parallel venation and sheathing leaf base. Presence of ligules, lodicules.

Inflorescence is panicle or spike. Stamens usually three (in rice - six). Fruit is a caryopsis.

Rice – *Oryza sativa* L. (2n = 24)

Systematic Position:

Division : Phanerogams

Sub-Division : Angeisperms

Class : Monocotyledon

Series : Glumacea

Sub class : Glumiflorae

Family : Poaceae

Sub family : Poaideae

Tribe : Oryzeae

Origin: India or Africa

Putative parents and origin of cultivated rice

There are two divergent views regarding the origin of cultivated rice. i. **Polyphyletic:** Originated from several species.

Acording to this theory, the two forms of cultivated rice viz., Asian rice *O. sativa* and African rice, *O.glaberrima* have evolved independently in their respective regions from several species. ii. **According** to this theory both Asian rice and African rice arose from a common parent. (*O. perennis*). This view is the most accepted one because both Asian rice and African rice are similar except in glume pubesence, ligule size and colour of pericarp which is red in African rice.

Species in the genus *Oryza*

According to the latest view the genus oryza include 22 valid species. Out of these, two are cultivated diploids viz. *O. sativa* and *O. glaberrima* and rest are wild species with include both diploid and tetraploid forms. **Subspecies in cultivated *Oryza savita***

Rice has been in cultivation for long period and adapted well under diverse climatic conditions and soils. This has resulted in the evolution of three geographical races which has been given subspecies status. The three subspecies are:

i. ***O. sativa*** subsp **indica** : Tall spreading, more tillering, awnless ii. ***O. sativa*** subsp **japonia** : Short, erect, more tillering, awnless iii. ***O. sativa*** subsp **javanica** : Tallest, erect, poor tillering, awned

Marked sterility barriers occur between the subspecies. It ranges up to 80% in case of indica x japonica where as it is less in case of indica x javanica.

Wheat – *Triticum sp*. (X = 7)

Wheat is the most important cereal in the world, giving about one-third of the total production, followed closely by rice. In temperate regions it is the major source of food. The chief use of wheat is the flour for making bread.

Systematic position:

Division : Phanerogams

Sub-Division : Angeosperms

Class : Monocotyledon

Series : Glumacea

Sub class : Glumiflorae

Family : poaceae

Tribe : Triticeae

Subfamily : Pooideae

Chromosome number:

Diploid : 2n =14, **Tetraploid :** 2n = 28, **Hexaploid :** 2n = 42

Place of Origin:

Diploid: Asia minor, **Tetraploid :** Abyssinia, North Africa, **Hexaploid :** Central Asia

Classification:

Ploidy level	Species	Common name	Genome
Diploid (2n=14) 2 species	*T.boeticum*	Wild einkorn	AA
	(T.aegilopoides)	Einkorn	AA
	T.monococum		
Tetraploid (2n=28) 7 species	*T.dicoccoides*	Wild Emmer	AA BB
	T.dicoccum	Emmer	AA BB
	T.durum	Macaroni wheat	AABB
	T.persicum	Persian wheat	AABB
	T.turgidum	Rivet wheat	AABB
	T.polonicum	Polish wheat	
	T.timopheevi		
Hexaploid (2n= 42) 5 species	*T.aestivum*	Common or bread wheat Club wheat	AABBDD
	T.compactum		AABBDD
	T.sphaerococcum		AABBDD
	T.spelta		AABBDD
	T.macha	Dwarf wheat	AABBDD
		Spelt wheat	
		Macha wheat	

Fourteen species of wheat are present according to Vavilov

1.*T.boeoticum* 2.*T.monococcum*

3.*T.dicoccoides* 4.*T.dicoccum*

5.*T.durum* 6.*T.persicum*

7.*T.turgidum* 8.*T.polonicum*

9.*T.timopheevi* 10.*T.aestivum*

11.*T.sphaerococcum* 12.*T.compactum*,

13.*T.spelta* 14.*T.macha.*

Origin of diploid wheat:

(Wild einkorn) *T.boeticum (T.aegilopoides*)

Natural mutation and selection

T.monoccocum

Cultivated diploid

AA (2n = 14)

T. boeoticum is probably the ancestor for all the cultivated wheats

Origin of Tetraploid wheats: Origin of hexaploid wheats (Fig.2):

T.boeoticum x Aegilops spelltoides *T.dicoccum x Aegilops squarrosa*

AABB DD

AA BB 2n = 28 2n = 14

2n = 14 2n 14 F

1

ABD(2n = 21)

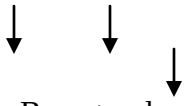
T.dicoccoides 2n = 28 *T.aestivum*

Wild emmer AABB AABBDD (2n = 42)

F Sterile (2n=14) (AB) Sterile

1

Natural mutation and Doubling Natural doubling



By natural selection (Cultivated)

T.dicoccum (Emmer wheat)
AABB (2n=28) Cultivated

Structure of Wheat Grain

Fruit is a dry, one seeded indehisent fruit known as caryopsis. The grain may be either hard or soft in texture with a creamy white, amber, red or purple colour depending upon variety. The dorsal (back side) convex surface of kernal is smooth except at the base where the fruit coat is wrinkled indicating the position of embryo the ventral surface (front side) is flat and charactersed by a deep furrow or groove.

The following 4 structures are recognized in wheat grain

i.Grain coat, ii. Nucellar epidermis, iii. Endosperm and iv. Embryo.

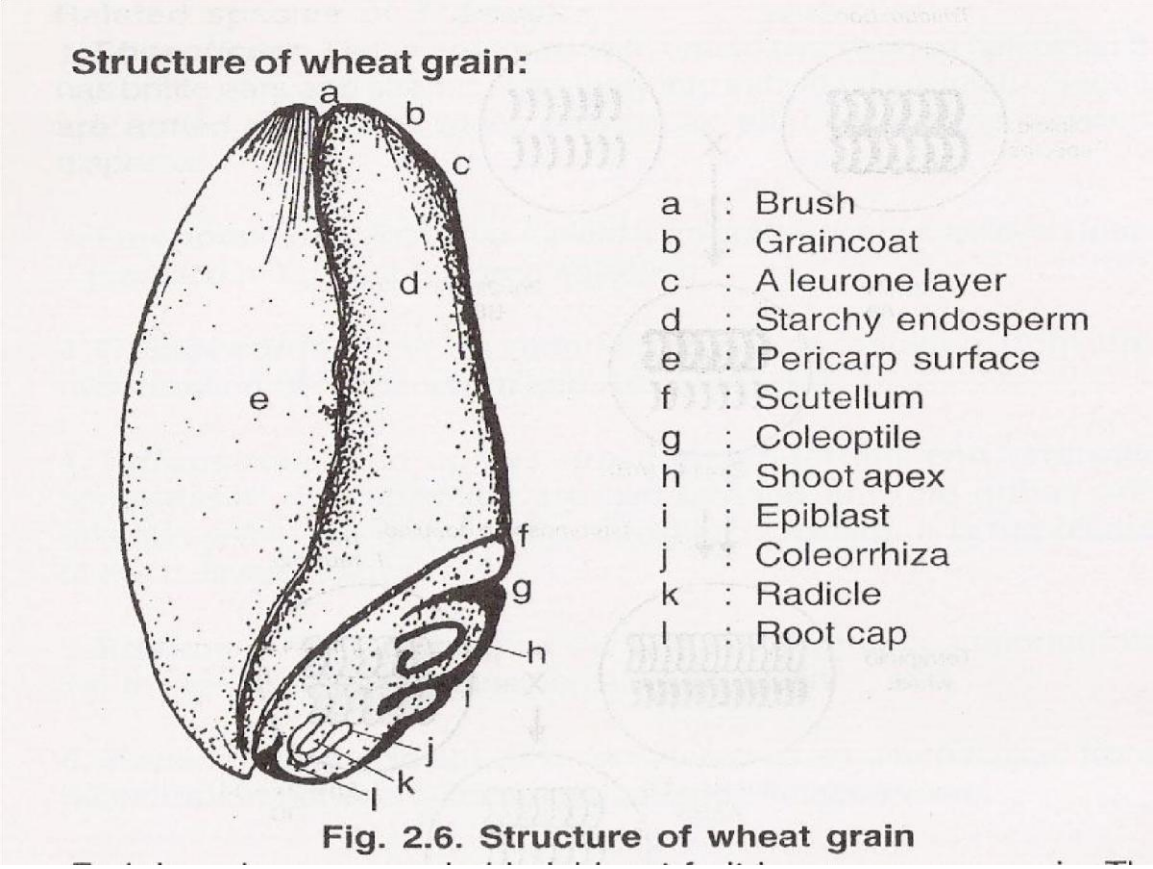


Fig. 2.6. Structure of wheat grain

Lecture 07

Maize - Zea mays (2n - 20)

Maize is the most important cereal in the world after wheat and rice; it was also most widely distributed. The genus Zea is considered to be monotypic previously. Recently Teosinte the related genera of Zea has been included as Zea mexicana.

Centre of origin : Southern Mexico.

Systematic Position

Division : Phanerogams

Sub - Division : Anageosperms

Class : Monocotyledon

Series : Glumacea

Sub class : Glumiflorae

Family : Poaceae

Sub family : Poaideae

Tribe : Maydeae

Zea Mexicana - The Probable Three Species involved in The evolution ancester of Maize of Cultivated Maize

Tripsacum dactyloides (2n= 36, 72) Gama grass:

A perennial grass which is used as fodder. Distributed in tropical and subtropical North America.

Origin and putative parent:

There are three different views about the origin of maize.

1. It originated from Teosinte (Euchlaena mexicana) (Zea maxicana) by direct selection, mutation or hybridization with other grasses.
2. Another theory is that maize originated from a wild pod corn.
3. Another theory is that teosinte, tripsacum and maize, all descended from a common ancestor by divergent evolution but the ancestor would have been lost.

Sorghum -Sorghum bicolor (L) Moench (2n = 20)

Sorghum is the fourth important world cereal, following wheat, rice and maize. It is the staple food in the drier parts of tropical Africa, India and China. The threshed grain is ground into a wholemeal flour, and used for making thin porridge or a thick paste or dough by boiling in water.

Systematic Position:

Division : Phanerogams

Sub - Division : Anageosperms

Class : Monocotyledon

Series : Glumacea

Sub class : Glumiflorae

Family : Poaceae

Sub family : Poaideae

Tribe :

Andropoganae **Sub**

tribe : Sorgasturm

Origin:

Africa in the primary centre. India is the secondary centre of origin.

***Sorghum bicolor* (2n = 20)**

Origin: Africa

Progenitor of sorghum

1. S.arundinaceum 2. S.verticilliflorum 3. S.sudanense 4. S.aethiopicum. The cultivated sorghum *Sorghum bicolor* is divided in to five basic races based the coverage of glume on the grain (Fig 1).

Hybrid races:

This consists of all combinations of the basic races.

1.Guniea	bicolor (GB)	6.Guinea kaffir (GK)
2.Caudatum	bicolor (CB)	7.Guinea durra (GD)
3.Kaffir	bicolor (KB)	8.Kaffir caudatum (KC)
4.Durra	bicolor (DB)	9.Kaffir durra (KD)
5.Guinea	caudatum (GC)	10.Durra caudatum (DC)

Pearlmillet - *Pennisetum glaucum* L. (2n = 14)

Pearl millet is the staple food in the drier parts of Tropical Africa and in India, where it is the fourth most important cereal after rice, sorghum and wheat. The grains are also fed to poultry

and other livestock. The green plants provide a useful fodder and it is sometimes grown for this purpose. It also plays a major role in fodder improvement by crossing with Napier grass.

Systematic Position :

Division : Phanerogams

Sub – Division: Anageosperms

Class : Monocotyledon

Series : Glumacea

Sub class : Glumiflorae

Family : Poaceae

Tribe : Paniceae

Origin: Africa

Distribution : Africa, India, Pakistan, Bangladesh,

Origin and putative parents

Stapf included 32 species is Penicillaria. Of these 32 species found in Africa, six annuals are considered wild and probable ancestors of the cultivated one. Pearl millet is a product of **multiple domestication.** They are

1. *Pennisetum perottettii*
2. *P. molllissimum*
3. *P. violaceum*
4. *P. versicolor*
5. *P. adonense*
6. *P. gymnothrix*

The cultivated species of *Pennisetum* is believed to have originated thro' hybridization with in these six species.

Characteristics features of Bajra :

1. Spikelet subtended by involucre of bristles.
2. Lodicules are absent (flower opening does not occur, only androecium and gynoecium protrude out).
3. Pennicillate anthers (anther tip cilliated - charecteristic of the genus Pennisetum)

4. Fused style with bifid stigma.

5. Protogynous nature.

Ragi - Eleusine coracana Gaertn. (2n = 36)

Finger millet is an important staple food in parts of East and Central Africa, India, particularly in Karnataka. It is used for malting and brewing.

Systematic Position:

Division : Phanerogams

Sub - Division: Anageosperms

Class : Monocotyledon

Series : Glumacea

Sub class : Glumiflorae

Family : Poaceae

Tribe : Eragrostideae

Place of origin: India

Characters of Eleusine:

Infloresence is contracted into a number of digitate spikes of spikelet. Spikelet consists of more than two florets subtended by two glumes.

Lecture 08

Small Millets

The grains of small millets are small in size, hence they are called small millets. The characters of small millets are hardy, drought, resistant, with little care it grows and gives some yield, can be grown in sub marginal lands also as a rainfed crop, mostly grown by hill tribes.

Fox Tail Millet - *Setaria italica* (2n:18)

Family: Poaceae

Foxtail millet is the most important millet in India especially in Tamil Nadu, Karnataka and parts of Maharastra. It is next in importance to Sorghum and finger millet.

Botany

Annual grass; seminal roots three followed by numerous thin adventitious roots, culms erect, slender, internodes hollow, tillering; leaf sheath longer than internodes, ligulate; leaf blade linear; tip acuminate; mid rib prominent. Inflorescence spike like panicle, carrying 6-12 two flowered sub sessile spikelets each subtended by 1-3 bristles; stamens three; ovary with two long styles ending in plumose stigma; fruit caryopsis tightly enclosed by lemma and palea.

Center of origin: East Asia

Wild relatives

Setaria italica was probably derived from *S. viridis* a common weed in the old world. It seems that *S. italica* and *Panicum miliaceum* were among the first crops to be domesticated in central eastern Asia. They were widely spread throughout Asia and Eastern Europe in pre historic times.

Little Millet - *Panicum sumatranse (P. miliare)* (2n: 36)

Family: Poaceae

Botany

An annual tufted grass with slender culms, soft leaves, inflorescence a panicle with erect hairy branches; spikelets in pairs with two glumes; floret with two lemmas, two lodicules, three stamens and ovary with plumose stigma; fruit a caryopsis.

Centre of origin: W. Africa

Distribution : India, Sri Lanka, parts of China.

Barn Yard Millet- *Echinochola frumentosa* (2n: 36 and 54)

Family: Poaceae

Botany

A robust tufted annual grass; seminal roots followed by adventitious roots; stem smooth, glabrous, producing tillers; internodes hollow; leaf blade linear, lanceolate; tip acute; margin finely toothed. Inflorescence a panicle; spikelet two flowered, awnless, pedicellate, subtended by bristles, two glumes; lower floret sterile with lemma and palea; upper floret hermaphrodite, five nerved lemma and five nerved palea, two lodicules, three stamens, two distinct style with plumose stigma. Fruit a caryopsis enclosed in white shining hardened lemma and palea.

Center of origin: E.Asia

Barnyard millet originated either from *E. colona* or *E. crusgalli* and possesses characters intermediate between the two.

Proso Millet - *Panicum milliaceum* (2n: 36 & 72)

Family: Poaceae

Center of origin: Central Asia

Distribution : India, Africa, Erope, USA. China, Japan.

Botany

A shallow rooted erect annual grass, free tillering, internodes hollow, cylindrical; leaf lamina linear lanceolate. Inflorescence a slender panicle; spikelet with two florets with two glumes; lower floret sterile; upper floret fertile with lemma, palea, two lodicules, three stamens and two styles with plumose stigmas; fruit a caryopsis enclosed by persistent lemma and palea.

kodo millet - *Paspalum scrobiculatum* (2n: 40)

Family: Poaceae

Center of origin: India

Botany

An annual tufted grass; leaves in two ranks, stiff, erect. Inflorescence a panicle; 2-8 spikelets in flattened rachis; spikelets usually in two rows; each spikelet has two florets; lower floret sterile, upper bisexual with lemma, palea, two lodicules, three stamens and plumose stigma; grain enclosed in hard horny persistent husk which is difficult to remove.

Lecture 09

Pulses

Fabaceae

(Subfamily – Papilionaceae, caesalpinaceae, mimosceae.)

Distinguishing characters

Often climbers, bisexual flowers, generally Zygomorphic, sepals 5 with odd sepal anterior, generally more or less united. 5 petals and papilionaceous, stamens mostly 10, mono or diadelphous, carpel one with ventral suture posterior. Fruit mostly a legume.

Habit: Mostly herbs, shrubs or climbers wild as well as cultivated

Root: Taproot, which are branched and bear nodules containing nitrogen-fixing bacteria.

Stem: Erect herbaceous or woody, climbing by means of tendril.

Leaf: Leaves may be simple or compound. Mostly alternate with leafy stipules. The leaves may be modified into tendrils.

Inflorescence: Usually racemose but may be Carymbose raceme.

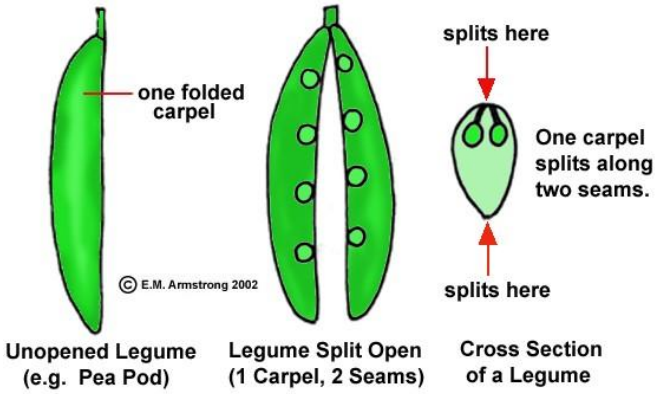
Flower: Bracteate, bisexual, complete, Zygomorphic, irregular papilionaceous, and hypogynous.

Calyx: Five sepals, gamosepalous, odd sepal anterior with valvate aestivation inferior.

Corolla: 5 petals, polypetalous unequal with a descending imbricate aestivation papilionaceous, the outermost (posterior) petal is largest and forms the broad free standard (vexillum). The lateral pair of the side petals, which are also free and generally long clawed, forms the wings, while the anterior pair are closely appressed and often more or less coherent and forms the keel (carina) in which essential organs are closed.

Androecium: 10 stamens, diadelphous 9+1 Anthers 2 celled dehiscence by longitudinal, inferior.

Gynoecium: Monocarpellary, superior, unilocular with marginal placentation. Style flattened and hairy with a simple stigma.



Fruit: A legume (It develops from a monocarpellary superior ovary with marginal placentation. It dehisces along both the sutures)

Seeds: Usually non-endospermic

1. **Legume or Pod**: Composed of one carpel.

Note: Some legumes are indehiscent and do not split open.

Red Gram - *Cajanus cajan* (2n=22)

There are two types of redgram varieties.1) *Cajanus cajan* var, bicolor (Arhar). It is cultivated extensively in N. India. The Plants are woody tall and perennial in habit, large pod, bold grain. 2) *C. cajan* var, flavus. (Tur).It is cultivated in peninsular India.(S. India)

Annual crop, medium tall to dwarf type, Medium grain and pod. **Fruit** is a **pod,** which is variable in shape size, constriction color texture, and pubescence. Pods, which have deep constriction, are known as beaded while others are flattish. Seeds may be rounded or lens shaped and varying in color, size and shapes.

Bengal gram - *Cicer arietinum* (2n= 16)

In India it is one of the important pulse crop grown throughout the country. It is grown as a cold weather crop both in north and south India. It is drought resistant. There are two races Desi smaller grain and Kabuli bigger grain.

Fruit turgid pod normally containing one or two seeds which vary in size and shape and color. The seed coat may be smooth or puckered and wrinkled or roughly granulate. Cotyledons thick and yellowish.

Green gram *Vigna radiata* (2n = 22)

Green gram is indigenous to India and has been in cultivation since prehistoric times. Erect or semi erect herbaceous annual with slight tendency for twining in the upper branches. Leaves trifoliate with long petioles, stipules with basal appendage, stipules minute and leaflets

entire ovate, flowers 10 – 20 crowded in axillary racemes on long pedicels, keel spirally coiled, stamens diadelphous (9+1) ovary with long bearded style. Pod longer than in black gram with short hairs.

Seeds globular with many five and wavy ridges on the surfaces, hilum flat cotyledonus yellowish.

Pod seed as food for human being, green and dry plant as fodder.

Black gram *Vigna mungo* (2n = 24)

Black gram is cultivated in many tropical and subtropical countries in several parts of Asia Africa and C&S America. It is a twining herb, annual plant, densely hairy, stem slightly ridged, leaves alternate, stipulate, petiolate, Pinnately trifolate. Inflorescence axillary raceme with flowers congested at the top of the peduncle. Flowers 5-6. Shortly pedicelled bisexual, hypogynous, Zygomorphic, Complete. Sepals 5 gamosepalous, imbricate corolla papilionaceous, petals five, polypetalous keel in the form of spiral beak. Androecium diadelphous (9+1) filament alternately long and short. Gynoecium superior ovary, monocarpellary unilocular marginal placentation. Fruit – Legume densely hairy seeds, generally black.

Soybean - *Glycine max* (2n=40)

Soybean is one of the most important legume food of the people of far eastern countries like China and Japan and are chiefly used as a pulse. The seeds are rich in protein and are of high biological value. It is also rich in fat and vitamins, being good source of calcium and phosphorus. It has oil content upto 20 % and protein 40 %.

Cowpea *Vigna unguiculata* (2n=22)

It is grown in warm parts of the world. Tender leaves are used as greens from the vegetable type cowpea. Sprouted seed as vegetables. Grain as pulses. Whole plant as green fodder. Cow pea and maize green fodder mixture is excellent for cattle.*Vigna unguiculata* sub species *unguiculata* grain cowpea

Vigna unguiculata sub species *sinensis* grain cowpea

V. unguiculata sub species *sesquipedalis* yard long bean- vegetable cowpea

Dolichos group of pulses

The dolichos are twining herbs with stipullate, trifoliate leaves. Flowers are racemose or axillary, calyx tube short, corolla is much exerted petals equal in length keel is obtuse not spiral, stamens are diadelphous. Ovary nearly sessile. The pod is flat linear or oblong.

Lab-Lab*: Lablab purpureus* 2n=22, 24 (var. typicus)

Garden or pandal avarai is perennial, but cultivated as annual. The pods are long tapering. It was no oil glands and no smell. Entire pod is edible.*Lablab purpureus* var lignosus (Field bean, Mochai) it is a semi bushy type. Podes relatively shorter, oblong, and fibrous seeds. Plant give a mochai odour

Gingelly - *Sesame indicum* (2n= 26) Pedaliaceae.

Botany of Pedaliaceae.

They are Annual or perennial, leaves opposite or upper alternate, simple, exstipulate, flowers hermaphrodite, Zygomorphic, calyx 5 cleft, corolla gamopetalus 5 lobed, 2 lipped, stamens 4, anthers convenient in pairs, 2 celled, disc hypogynous, ovary superior,1 celled with 2 intensive parietal placentas, the cell again often divided by superior septa, fruit a capsule or nut. Seeds without endosperm, embryo. Straight with flattened cotyledons

Distinguishing characters

Stem quadrangular in shape, Basal leaf opposite, upper leaf alternate. Presence of extra floral nectary gland as peduncle base. Corolla bell shaped, biliped and five lobed. Androecium-epipetalous didynamous stamens. Ovary bicarpellary, by presence of false septa appear as four loculed. Seed color varies from pure white to various shades of brown and gray to black. Seed coat may be rough or smooth.

Lecture 10. Oil Seeds

Castor *Ricinus communis* (2n=20) Euphorbiaceae

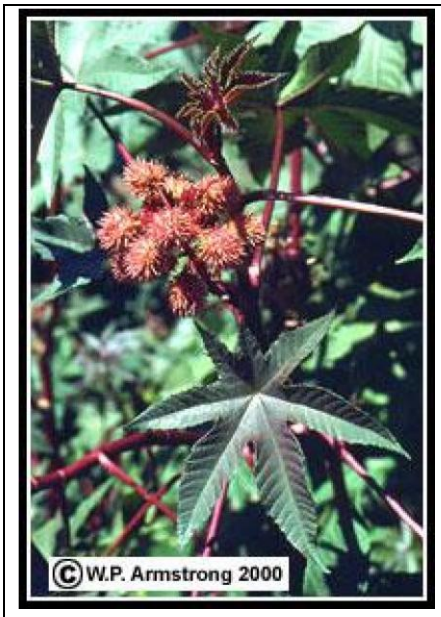
Botany

Habit varies, mostly herbs but shrubs and trees are also common. Leaves simple or compound stipulate, latex commonly present, inflorescence in its ultimate arrangements is cymose , flowers small, regular, unisexual, perianth usually calycine , rarely petaloid sometimes altogether wanting, male flower –stamens a many as double as many as perianth

leaves or numerous of flower or sometimes only one , the male flowers sometimes rudiment of the ovary , female flower ovary generally three celled, ovules one or two in each chamber, styles and stigmas as many as the cells, fruit (rigma) generally a capsule splitting into three coccid that separate from a persistent central column

Distinguishing characters.

Presence of bloom –Ashy coating on the leaves and stem of the plant. Monoecious condition-unisexual flowers, male at the bottom and female at the top. Androecium – polyadelphous condition, filaments branched. The hilum almost concealed under the carancle. Presence of thin leaf like cotyledon. Toxic alkaloids like ricin (blood coagulant) ricinin and allergen are present.



Fruits(Regma)

Fruits (Regma)

It develops from tricarpellary syncarpous superior trilocular ovary and splilts into many parts called cocci. Four distinct size groups of fruits namely 1)very small fruits are found in ornamental types and in some of the wild perennial types. 2) Small and 3) medium types are preferred for cultivation since they fairly high oil content varying from 45 to 57 %. 4) Big seeds have generally low oil content of less than 40%. Very small seeds are preferred for medicinal purposes.

On the fruit the epicarp may be either smooth or warty or spiny. Attractively colored types of horticultural value with colored inflorescences and fruits have been evolved. The seeds color ranges from white to gray deep chocolate, purple and red. Mottling is also much varying.

The seed has no dormancy.

Sunflower - *Helianthus annus* (2n= 34) Asteraceae

Botany

Plants are usually herbs, leaves exstipulate ,flowers aggregated into heads, an involucre of bracts surrounds the head or capitulum , calyx reduced to bristles or modified into papas, corolla (5) valvate in all disc florets, but in marginal ray florets which may sterile or lack stamens and acts as an attraction for insects , inner hermaphrodite bisexual flowers . Stamens epipetalous with syngenesious anthers forming a ring through which the style passes. Stigmas 2. Ovary inferior, one chambered with one anatropous ovule, fruit-achene (A small hard dry indenescent one seeded fruit. The wall of single seed is free from the hard pericarp or wall of the fruit)

Safflower *Carthamus tinctorius (*2n = 24) Asteraceae

Safflower is an important oilseed crop in India. It is slowly becoming of increasing importance as an oil crop for the drier parts of tropics and subtropic. In India it is cultivated for both oil and reddish dye called safflower dye (cathamin) from florets. At the time of full bloom flowers collected and corolla alones removed and dried. Yellow dye is obtained by washing and dissolving it is water. There are two coloring matters. 1. Yellow pigment soluble in water and red color soluble in alkalis. The seed /fruit is **achene**

Rape and Mustard *Brassica* sp. (2n=16, 18, 20, 22, 36)

Botany of cruciferae.

Annual, biennial or perennial herbs, a watery sap present, plants emit a sulphorous odour. Stem covered by unicellular stellate hairs. Flowers arranged in typical racemes, usually ebractate, sepals in two alternating dimerous whorls , petals 4, clawed diagonally placed stamens tetra dynamous carpels 2, ovary two chambered, the development of a false septum,ovules numerous on two parietal placentas. Fruit a **Siliqua** (It develops from bicarpellary syncarpous gynoecium with parietal placentation and a false septum. It is a long narrow multiseeded fruit which dehisces from below upwards by both sutures. **Siliqula.** It is a broad flat and shortened form of siliqua.)

The group rape and mustard includes the oil yielding species of Brassica. The commercial Indian rape seed and mustard are often mixture of rape seed, mustard and colza in varying proportion. The seeds go by different name in different parts of the country. Generally both colza (sarson) and rape (toria) are called together rape seed. Rai is mustard. Cultivated Brassica can be broadly divided into two distinct types.

1. Vegetable type - cabbage,(*Brassica oleraceae* - var capitata.) cauliflower (*Brassica oleraceae* varbotrytis). Turnip (*Brassica oleraceae* var rapa)

2. Oil seed type.**1) Rape seed** *Brassica compestris* and 2**) Mustard** *Brassica nigra*.

Rape seed

a) *Brassica compestris* (2n= 20)

Indian rape seed is self sterile in natures. Important oilseed crop of N.India. There are three cultivated types.

Brassica compestris var. **brown sarson**

Brassica compestris var.**Yellow sarson**

Brassica compestris var. **toria**

b) *Brassica napus* 2n=38 European rape seed. Self fertile grown in Europe

Mustard

a) *B. nigra* (2n=16) Black or true mustard. Banarasi rai contains 28% of fixed oil used as medicine . Oil is pungent due to presence of glucoside sinigrin mostly used as contiments.

b) *B. alla* 2n=24. White mustard or ujli sarson. Young seedlings used as salads. Seeds yellowish in color contains 30% oil.

c) ***B. juncea*** 2n=36 Indian mustard.(Brown sarson).Popularly known as rai contains 35% oil. Leaves are used as herbal medicines. Most pungent among cultivated oil seeds. It contains glucoside sinigrin.

The oil producing species of Brasicca are all cross fertilized.

Key characters

Leaves two types 1) stem leaves bigger, lance shaped and serrated. Flower leaf small smooth margin. Androecium tetradynamous . Fruit sliqua. The oil content of the seed varies from 30-45% depending on the variety.

Fibers

The fibers are obtained from the sclerenchymatous cells found in the plant body and these fiber cells occur either in groups or bundles. Chemically the fiber cell consists chiefly of cellulose with lignin or semi cellulose or any other substances. The commercial term fiber includes generally all thin and slender substances, which can be spun or made use of as fine stuffing material. Fiber cells are non-living structures, when mature and serve as a purely mechanical function, i.e. they impart strength and rigidity to the plant body.

Lecture 11

Cotton *Gossypium* sp. (2n=26, 52) Malvaceae

Cotton is the most ancient crop of the tropical and subtropical. It is one of the most important items of export in the developing countries. Cotton fiber is unchallenged natural textile fiber even today. The genus gossypium consists of diploid and tetraploid cultivated cotton. **Old world cotton or Desi cotton or diploid cotton** 2n=26 are ***G. herbaceum*** (uppam cotton) and ***G. arboreum*** (Karunkanni cotton)

New world cotton or American cotton or Tetraploid cotton 2n=52 are ***G. hirsutum***.(Combodia or upland cotton) and ***G. barbadense***. (Sea Island cotton)

Cotton fiber is epidermal prolongation of seed coat cells. The longer out growth make **lint** and the shorter one make **fuzz.** In diploid cotton and upland cotton both lint and fuzz are

present where as Sea island cotton **(*G. barbadense*)** only lint are present and such seeds are called **naked seed**.

Structure of fiber

There are five different parts in a mature fiber. 1) The integument or outer layer is also called cuticle or waxy layer **.**2) Outer cellulose layer which is largely the original cell wall. 3) Layers of secondary deposits. This is nearly pure cellulose. Numerous concentric layers in this portion is recorded. 4) Walls of the lumen, a spiral structure surrounding the central cavity of the fiber and more dense than any other part of the fiber. 5) Substance in lumen is structure less and of a nitrogenous nature.

Jute - ***Corchorus capsularis, C. olitorius***.(2n=14) Tiliaceae.

Jute is a leading crop among all bast fiber. (Stem fiber) plants. It is a typical plant of humid tropics and subtropics. Jute is chiefly raised for the sake of its fiber, which develops in the external part of the stem (in the bark). Individual fibrils are from 5 to 40 mm long. The surface of the jute fiber is smooth and brown in color. Commercial jute fiber is obtained from two species *viz. Corchorus capsularis* (white or bitter jute) and *C. olitorius* (Tossa jute). Mainly grown in W.

Bengal, Bangladesh.

Fiber extraction.

The ideal phase of harvest is when the plants are in small pods. Harvested plants are bundled and staked for the withering of leaves. After 2 to 4 days the leaves shed and the bundles are then steeped in water.

Steeping

It is a process of immersing the bundles in water. After 2 to 4 days the tissues and cells rupture. This facilitates the entry of micro organism into stem.

Retting

It is a process by which harvested stems are steeped in water so that the fiber in the stem get loosened and separated from the woody stalk due to the removal of protein, gums and other mucilaginous substances by the micro organisms. Fiber yield is 6% of the fresh stem weight.

Fiber Quality

Jute fiber is fine and silky but less stronger then many other fiber.

Mesta *Hibiscus cannabinus* (2n = 36) Malvaceae

Mesta fiber is a valuable fiber probably next to jute. This crop is successfully grown throughout tropics and subtropics. Bast fiber is obtained from the stem similar to jute.

Sun hemp. *Crotalaria juncea*. 2n=16 Fabaceae

Sunnhemp is another source of bast fiber, grown in tropical countries. It is also grown as fodder and green manure. The fibers are stronger than jute but lighter in color and more enduring than jute. They are long strands of fiber of about 4 to 5 feet in length and yellow to green in color. Fiber is obtained by retting.

Sugars

(Sugar cane *Saccharum officinarum* (2n=80) Poaceae.)

Sugar cane is a perennial gigantic grassy plant of Poaceae family. It is extensively grown in India, Cuba, Hawaii W.Indies.

There are 5 species of sugarcane of which three are cultivated and two are wild species.

1. ***Saccharum officinarum*.** Noble cane (2n=80). Large barreled, low fiber, high sugar content, susceptible to diseases and pests.
2. ***S. barberi.*** Indian cane (2n=82-124) Intermediate between noble and wild canes. Small barrel, internodes spindle shaped, high fiber content, resistant to diseases.
3. ***S. sinense.*** Chinese cane (2n=118) Vigorous thin grassy form resistant to drought, pest and diseases. Fair amount of sucrose content.
4. ***S. spontaneum.*** Wild cane (2n=40-128). Vigorous than grassy form. Virtually no sucrose, resistant to drought, pest and diseases.
5. ***S. Robustum.*** Wild cane (2n=60-194) Thick stock low sugar content, disease resistant.

The above 5 species are important for the improvement of sugar cane. They all inter cross freely.

Inflorescense is panicle. It is also called **Arrow.**

Nobilization

Back crossing of F1 with ***S. officinarum*** (noble cane)

Forage Crops

The term **forages** is used broadly to mean all the plant constituents that are eaten by herbivores, including that are grazed (**pastures**) and those that are cut and fed such as **fodder**. Crop residues such as straw and the foliage of trees and shrubs also fall within this broad definition.

Fodders- Plants, which are, cultivated as forages crops and they are cut and fed to animals in stalls.

Pastures- grasses and legumes are grown in pasture lands where the animals are led to graze. **Forages** can broadly be classified into three groups. *viz.* **grasses, legumes and non legumes.**

Grasses. Annual grass – Maize, sorghum, and cumbu.

Perennial grass.—B.N. and N.B, hybrids.

Legumes Annual Cowpea, cluster bean.

Perennial Lucerne, Sirato, Desmanthus

Non legumes. – Fodder beet, Fodder radish.

Grasses

Napier grass - *Pennisetum purpureum*

It is a tall perennial grass forming very thick clumps, tillering is heavy. It comes up well in both under tropical and temperate regions. It comes well in any soil condition and also responds to sewage irrigation 6-8 harvests can be taken in a year. The grass withstands drought for short spell and regenerate with rains. **Pearl millet** Napier (Bajara - Napier)

They are very vigorous in their growth and adopted for varying climatic and soil conditions. They give heavy yield higher than Napier. They are more nutritious, palatable, succulent, juicy and less fibrous. They tiller profusely have luxuriant growth and responds to higher level of nitrogen.

Guinea grass- *Panicum maximum*

It is the most popular grass with heavy tillering, forming big clumps with long internodes, slender and glabrous. It comes up well in tropical condition with moist climates. Under cultivation it can be grown in any soil. It requires sufficient moisture but cannot withstand water logging. It responds to sewage irrigation. It can be harvested once in 25 to 30 days interval.

The crop can be allowed in the field for several years. Dry matter content is 15- 20% Protein 68% free from all toxic principles.

Buffel grass- *Cenchrus ciliaris*

It is an important perennial pasture grass and grows well in a great variety of soil and climate. It is a perennial grass with underground rhizomes. They are hardy and drought resistant and have quick regeneration capacity. It gives the highest forage yield among the grasses grown under rainfed condition. Aerial branches tufted, leaf sheath compressed with hairs raceme of spikes sessile spikelets, no lodicules.

Johnson grass- *S. halapense*

It is native of Africa. It was taken by colonel Johnson and hence named after him. In South India it occurs both in 2n = 20 & 40 forms. Because of rhizomatous condition it will spread easily. Co. 27 fodder cholam (Co 11 x *S. halapense)*

Legume Fodder

Lucerne / Alfalfa *(Medicago sativa)*

It is also called as **queen of fodder or green gold**. Lucerne is grown for pastuer, hay, dehydrated meal and for medicinal purpose. It is an important leguminaceous fodder grown as a perennial crop in drier regions and as an annual crop in hot humid regions. It is heat and drought resistant.

Cow pea-*Vigna unguiculata*

It is the most important leguminous fodder crop during summer and rainy seasons mainly due to its quick growing habit, high yielding ability and high protein content.

Desmodium- D. tortuosum / intortum is commonly known as green leaf desmodium, is a larges trailing and climbing, perennial rooting at nods and having a deep tap root. It can be harvested 23 times . Shade tolerant green manure cum fodder produces profuse seeds.

Protein 22%. It is a tropical legume. It grows well in acid soils.

Stylosanthus guianensis

It is a summer growing perennial pasture fodder legumes. *S.hamata* found to thrive in alkaline soils. *S.fruiticosa* is from India. It is an herb and small shrub. It thrives in light soils due to its deep rooting system.

Tree fodder

Subabul- *Leucaena leucocephala*.

Among the browsing leguminous trees it lops the best. It provides economic nutritious and highly palatable forage to livestock and poultry. It has an amino acid mimosin. Excess feeding leads to fall of hairs, thyroids gland swelling and stunted growth. Pods can be fed to cattle. Protein 29%.

Glyricidia sepium

It is a medium tall tree grown in tea coffee and coca plantation for shade. It is pruned for green manure purpose.

Agathi / sithagathi- *Sesbania gandiflora* and *S. sesban*.

It is a fast growing and leaves are rich in protein and very much relished by all types of livestock.

Erythin- *Erythnina indica*

Indian coral leaf is a nirogen fixing cumfodder green manure tree suited even to high acid soil.

Green manure and green leaf manure

Green manure is generally a leguminous crop raised in a field and incorporated in situ.
E.g. Sunnhemp, daincha.

Green leaf manure

It is a practice of cutting and applying them to the fields and ploughing them e.g. Neem, calotropis, glyricidia.

Sunnhemp. *Crotalaria juncea.* Erect herbaceous shrub. Cylindrical stem silky appearance pods oblong inflated and hairy.

Sesbania speciosa. It was introduced from South Africa. It is a quick growing and attains 3-4m in about 4 months. The crop stands drought and to some extent salinity. The stem is pithy but if allowed To grow for more than 4 or 5 months it becomes woody.

***Daincha.* (** *Sesbania aculeata)*It is aquick growing succulent crop which adpts itself to varying conditions of soil amd clinmates. It can be grown even under adverse drought, water logging condition and salinity.

Tephrosia pururea noctiflora. It is a perennial undershrub, growing wild in sandy or gravellywaste places. It ia also grown as and annual crop for green manure

Neem. *Azadirachta indica*. Evergreen tree with plenty of foliage. Loppings once or twice a year.

Pungam. *Pongamia glabra*. A leguminous ever green tree. Lopping is done once or twice a year.