

Poaceae: Characters, Distribution and Types

Topics Discussed

1. Characters of Poaceae
2. Distribution of Poaceae
3. Economic Importance
4. Affinities
5. Important Types.

Characters of Poaceae:

Mostly herbs, stem jointed, fistular, cylindrical; leaves simple, alternate, sheathing, sheath open, ligulate; inflorescence compound spike; flowers zygomorphic, hypogynous, protected by palea; perianth represented by 2 or 3 minute scales (lodicules); stamens 3, versatile; carpel one, style 2 or 3, stigmas feathery, basal placentation; fruit caryopsis; testa fused with pericarp.

A. Vegetative characters:

Habit:

Herbs, annuals or perennials or shrubs, sometimes tree like (Bambusa, Dendrocalamus).

Root:

Adventitious, fibrous, branched, fascicled or stilt (Zea mays).

Stem:

Underground rhizome in all perennial grasses, cylindrical, culm with conspicuous nodes and internodes, internodes hollow, herbaceous or woody, glabrous or glaucous, vegetative shoots are

arising from the base of aerial stem or from underground stems are called tillers.

Leaves:

Alternate, simple, distichous, exstipulate, sessile, ligulate (absent in *Echinochloa*), leaf base forming tubular sheath, sheath open, surrounding internode incompletely, ligule is present at the junction of the lamina and sheath, entire, hairy or rough, linear, parallel venation.

B. Floral characters:

Inflorescence:

Compound spike which may be sessile or stalked. Each unit of inflorescence is spikelet. The spikelets are arranged in various ways on the main axis called rachilla. A compound inflorescence may be spike of spikelets (*Triticum*), panicle of spikelets (*Avena*).

The spikelet consists of a short axis called rachilla on which 1 to many sessile or short stalked flowers are borne. The florets may be arranged in alternate or opposite manner on the central axis.

At the base of rachilla two sterile scales, called glumes, are present. The glumes are placed one above the other on opposite sides. The lower one is called first glume and the upper is called second glume. Both the glumes are boat shaped and sterile. Above the glumes a series of florets are present. Each floret has an inferior palea or lemma and above it a superior palea. The lemma frequently bears a long, stiff hair called awn.

Flower:

Bracteate and bracteolate, sessile, incomplete, hermaphrodite, or unisexual (*Zea mays*), irregular, zygomorphic, hypogynous, cyclic.

Perianth:

Represented by membranous scales called the lodicules. The lodicules are situated above and opposite the superior palea or may be absent, or many (*Ochlandra*), or 2 or 3.

Androecium:

Usually stamens 3, rarely 6 (Bambusa, Oryza) and one in various species of Anrostis, Lepturus; polyandrous, filaments long, anthers ditheous, versatile, linear, extrorse; pollen grains dry.

Gynoecium:

Monocarpellary, according to some authors carpels 3, of which 2 are abortive, ovary superior, unilocular with single ovule, basal placentation, style short or absent; stigmas two feathery or papillate and branched.

Fruit:

Caryopsis (achene with pericarp completely united or adherent with the seed coat) or rarely nut (Dendrocalamus) or berry (Bambusa).

Seed:

Endospermic and containing a single cotyledon called scutellum, which is shield shaped and pressed against the endosperm.

Floral formula:

Floral formula – $0 | 0 \text{ } \overline{\text{P}}_{0 \text{ or } 2} \text{ (Lodicules)} \text{ A}_{3 \text{ or } 6} \text{ G}_{\underline{1}}$.

Distribution of Poaceae:

The family is commonly known as grass family. It is one of the largest among the angiospermic families. It consists of 620 genera and 6,000 species. The members are cosmopolitan in distribution. The plants represent all the 3 ecological types as hydrophytes, xerophytes and mesophytes. In India it is represented by 850 species.

Economic Importance of Poaceae:

The family stands first and foremost in respect of economic importance in whole of Angiosperms. The staple food grains of the population of world is derived from *Oryza sativa* (Rice) and *Triticum aestivum* (Wheat). They are cultivated from time immemorial.

The family has been divided on economic basis as follows:

Food:

Triticum aestivum, *Oryza sativa*, *Zea mays* (Maize), *Hordeum vulgare* (Jaw), *Sorghum vulgare* (Jowar), *Avena sativa* (Oats), *Pennisetum typhoides* (Bajra) are cultivated for cereals and food grains.

Fodder:

Many grasses as *Cynodon dactylon*, *Panicum*, *Cymbopogon*, *Agrostis*, *Poa* are grown for fodder.

Sugar:

Saccharum officinarum (Sugarcane; H. Ganna) is cultivated for gur and sugar.

Building material:

Some species of *Bambusa* e.g. *B. tulda*, *B. vulgaris* are used for scaffolding, thatching huts etc.

Furniture:

Species of *Dendrocalamus* (H. Bent), *Arundinaria*, *Melocalamus* are used in manufacture of furniture.

Aromatic grasses:

Many grasses yield scented oils which are used in perfumery viz. *Vetiveria zizanioides* (H. Khus khus) yields vetiver oil from the roots. The roots are also woven into curtains. *Andropogon odoratus* (Ginger grass), *Cymbopogon citratus* (Lemon grass), *Cymbopogon martini* (Geranium grass), *Cymbopogon jawarancusa* etc. also yield oil.

Medicinal:

Phragmites karka, *Cymbopogon schoenanthus* etc. are medicinal.

Secale cereale is cultivated for infection of its inflorescence by *Claviceps purpurea* for production of Ergot and for extraction of ergotine. Ergotine is an excellent remedy for uterine contraction.

Paper:

It is manufactured from certain species of grasses and bamboos.

Ornamental:

Rhynchelytrum repens, Cortaderia selloana and some species of the tribe Bambusoideae are ornamentals.

Besides these a number of grasses are grown to form fine lawns, play grounds etc.

Primitive characters:

1. A few plants arboreal in habit.
2. All florets in a spikelet are fertile.
3. Glumes are persistent.
4. Lemmas are herbaceous and leafy.
5. Stigmas are three.
6. Leaves are simple and alternate.
7. Flowers are hypogynous and hermaphrodite.
8. Seeds are endospermic.

Advanced characters:

1. Plants are mostly herbaceous, annuals and perennials.
2. Leaves are exstipulate.
3. Flowers are arranged in distinct inflorescence.
4. Flowers are small, inconspicuous and zygomorphic.
5. Perianth is represented by lodicules.
6. Stamens are reduced to 3.
7. Gynoecium is monocarpellary and unilocular.
8. Basal placentation.
9. Fruit is caryopsis.

10. Seeds are small sized.

Affinities of Poaceae:

The family Poaceae (Gramineae) closely resembles the family Cyperaceae and the two families have been placed in same order Glumiflorae by Engler and Prantl, and Glumaceae by Bentham and Hooker. Hutchinson (1964), Butzin (1965) and Takhtajan (1969) placed the families into 2 separate orders, the Cyperales and Graminales on the basis of many differences viz., 1. leaf sheath, 2. jointed and unjointed stem, 3. single bract and lemma and palea, 4. seed coat etc.

Cronquist (1968) considered that the families are also related on account of some chemical data. Hegnauer (1963) has also supported the same view.

Hutchinson (1959) believes that the origin of Grasses i.e., the family Poaceae (Gramineae) took place on parallel line with Cyperaceae through Juncaceae which was derived directly from Liliforean stock.

Division of the family and chief genera:

The family is divided into 2 sub-families:

Sub-family I. Poideae:

Spikelets one to many flowered; mature spikelets break up and fall above the persistent glumes leaving them intact, if spikelets falling entire then not 2-flowered or if 2-flowered falling entire; the glumes and lemmas all membranous with wrinkled seed. Rachilla is continued above the floret. This sub-family is divided into 8 tribes.

Sub-family II. Panicoideae:

Spikelets mostly two flowered, rarely one flowered, falling entire at maturity with their stalks and glumes. In a spikelet one floret is perfect i.e. hermaphrodite, the other is sterile or male usually. Rachilla is not continued above the upper floret. This sub-family is divided into 3 tribes.

Important Types of Poaceae:

1. *Triticum aestivum* (Fig. 118.1):

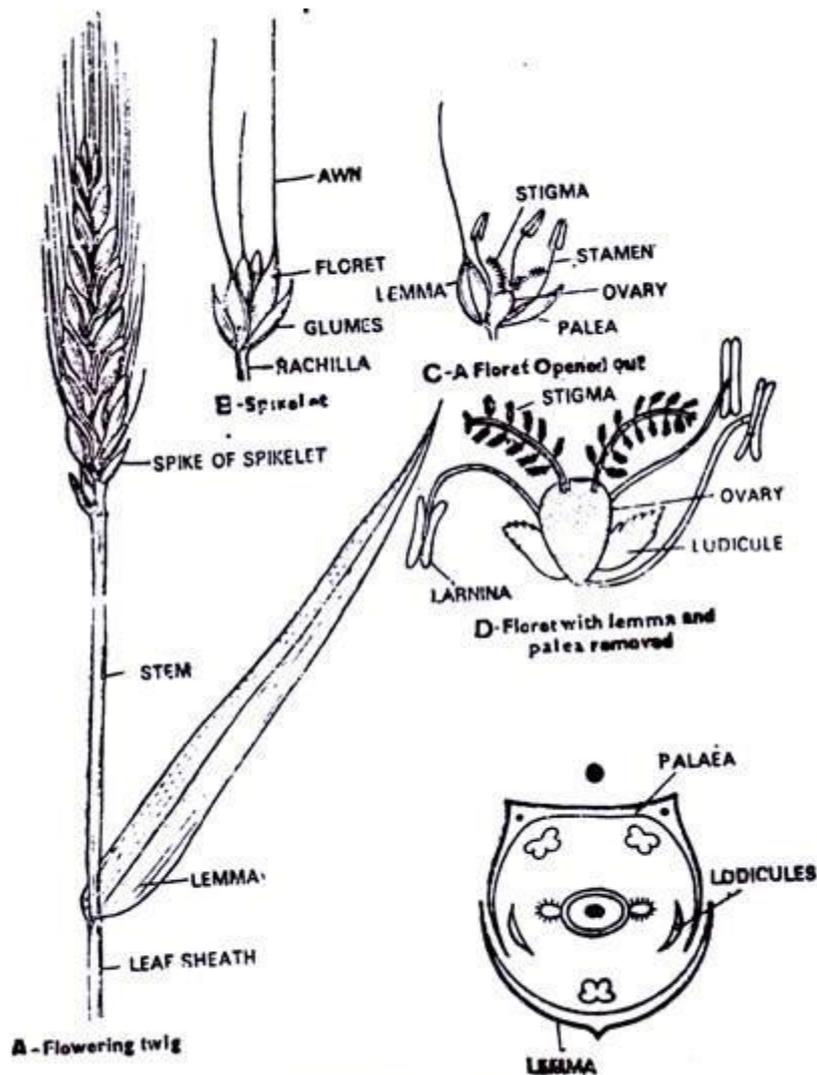


Fig. 118.1. *Triticum aestivum*.

Habit:

A cultivated annual crop plant.

Root:

Adventitious.

Stem:

Herbaceous, erect, cylindrical, fistular, with distinct nodes and internodes, unbranched, glabrous, a number of tillers.

Leaf:

Simple, alternate, green, exstipulate, entire margin, acute apex, sheathing leaf base, at the junction of leaf-sheath and leaf-blade membranous ligule present, parallel venation.

Inflorescence:

Spike of spikelets.

Flower:

Bracteate, sessile, hermaphrodite, zygomorphic, incomplete, hypogynous, flower lies between superior and inferior palea.

Perianth:

2 membranous scales – the lodicules.

Androecium:

Stamens 3, polyandrous, filament long, anthers dorsifixed when young and versatile when mature.

Gynoecium:

Monocarpellary, theoretically tricarpellary, ovary superior, unilocular, single ovule, basal placentation, style short; stigma 2, feathery.

Floral formula:

$o|o \ \delta \ P_2 \text{ (lodicules)} \ A_3 \ G_1$

2. Zea mays:

Habit:

An annual cultivated crop plant.

Root:

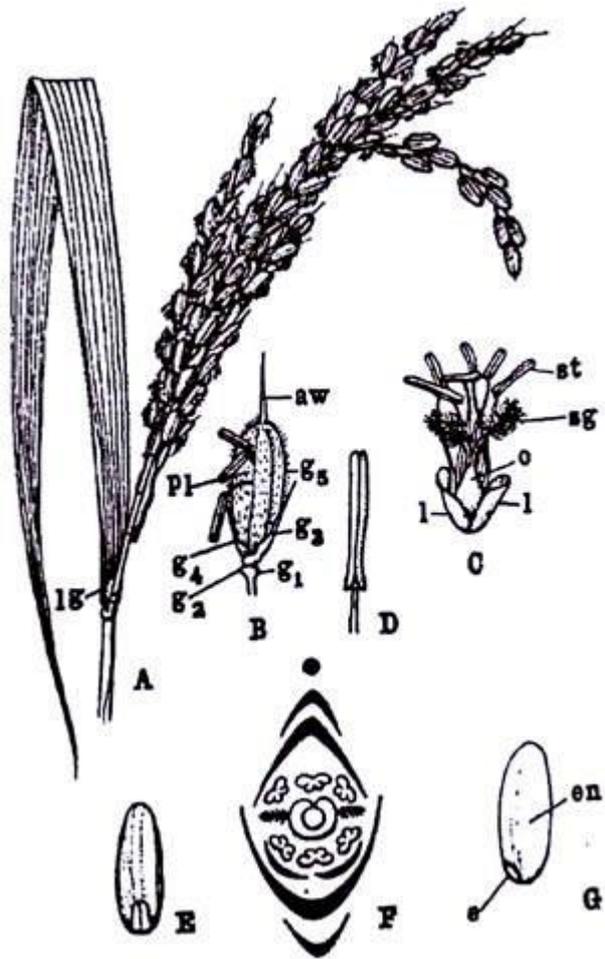
Adventitious stilt roots.

Stem:

Erect, cylindrical, herbaceous, solid, distinct nodes and internodes, smooth, green.

Leaf:

Alternate, simple, long ligule present, linear, entire margin, green, multicostate parallel venation, sheathing leaf base.



Inflorescence:

Plant monoecious, diclinous; two kinds of flowers in different inflorescences; male in staminate and female in pistillate inflorescence respectively.

Male flower:

Each spikelet has two flowers-one pedicellate other sessile; each has a pair of bracts the inferior and superior palea, zygomorphic.

Perianth:

Represented by 2 scales – the lodicules.

Androecium:

Stamen 3, linear, versatile, extrorse.

Gynoecium:

Rudimentary or absent.

Female flower:

Each spikelet is two flowered and subtended by two glumes – the sterile and fertile. Each flower is enclosed by inferior and superior palea. zygomorphic.

Perianth:

Represented by 2 lodicules.

Androecium:

Absent.

Gynoecium:

Monocarpellary, unilocular, (theoretically tricarpellary) superior, single ovule, basal placentation; style filiform, long; silky, stigma hairy.

Floral formulae – Male flower : $o|o \ \sigma \ P_2 \text{(lodicules)} \ A_3 \ G_0$

Female flower : $o|o \ \rho \ P_2 \text{(lodicules)} \ A_0 \ G_1$

3. Oryza sativa (Fig. 118.2):

Habit:

A cultivated herb for food.

Root:

Adventitious, fibrous roots.

Stem:

Herbaceous, erect, cylindrical, fistular, nodes and internodes are present, green.

Leaf:

Long, narrow, with a sheathing base, ligulate, membranous, linear to lanceolate, entire, parallel venation.

Inflorescence:

Panicle of spikelets, Spikelet – one loosely arranged on the branches of the panicle. At the base of the each spikelet there are two small, membranous, persistent bracts called the empty Glumes; above them lies the single flower which is enveloped in two larger bracts.

The lower one (in the axil of which the flower develop) is the flowering glume, which may or may not have at its apex a narrow

elongated outgrowth called the awn; the upper one inserted at little above the flowering glume is called Palea.

Flower:

Bracteate (Lemma or inferior palea) pedicellate, complete, hermaphrodite, zygomorphic, small hypogynous.

Perianth:

Represented by 2 scales called lodicules, fleshy and small.

Androecium:

Stamens six, polyandrous, anthers linear, versatile, introrse.

Gynoecium:

Monocarpellary, ovary superior, unilocular with only one ovule. Style 2, short; stigma 2 feathery and lateral.

Fruit:

A caryopsis completely enclosed by the flowering glume and palea.

Floral formula:

Br. Brl o|o ♂ P₂ A₆ G₁.