

Systematic Botany. Lecture 14–16

Alexey Shipunov

Minot State University

October 2–7, 2013



Outline

Gramineae or Poaceae—Grass family

Description

Diversity of Gramineae



Gramineae or Poaceae—Grass family

Description



Gramineae, or Poaceae—grass family

- ▶ $\approx 8,000$ species distributed thorough all the world, but most genera concentrate in tropics
- ▶ Prefer dry, sunny places
- ▶ Often form tussocks—compact structures where old grass stems, rhizomes and roots are intermixed
- ▶ Grasses form grasslands—specific ecological communities widely represented on Earth. North Dakota prairies are grasslands.

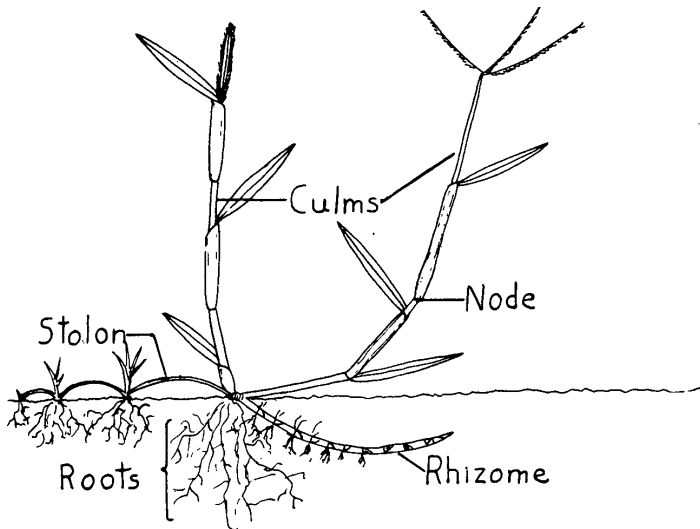


Morphology of grasses

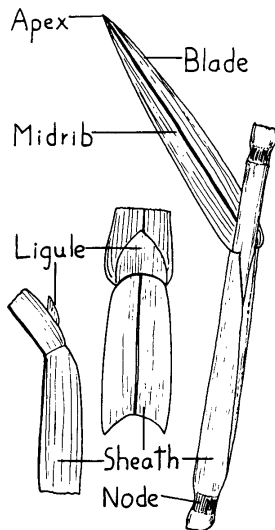
- ▶ Stems usually hollow and round
- ▶ Leaves flat, in two ranks
- ▶ Flowers reduced, wind-pollinated, usually bisexual, form complicated spikelets
- ▶ Each spikelet bear two glumes; each flower has lemma and palea scales
- ▶ Perianth is reduced to lodicules
- ▶ Stamens from 6 to 1 (most often 3), with large anthers
- ▶ Fruit is a caryopsis, it includes flower scales
- ▶ Seed has a specific embryo with coleoptile, coleorhiza and scutellum



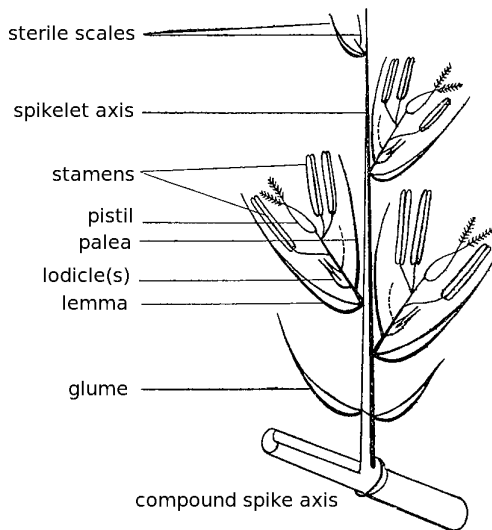
Grass branching



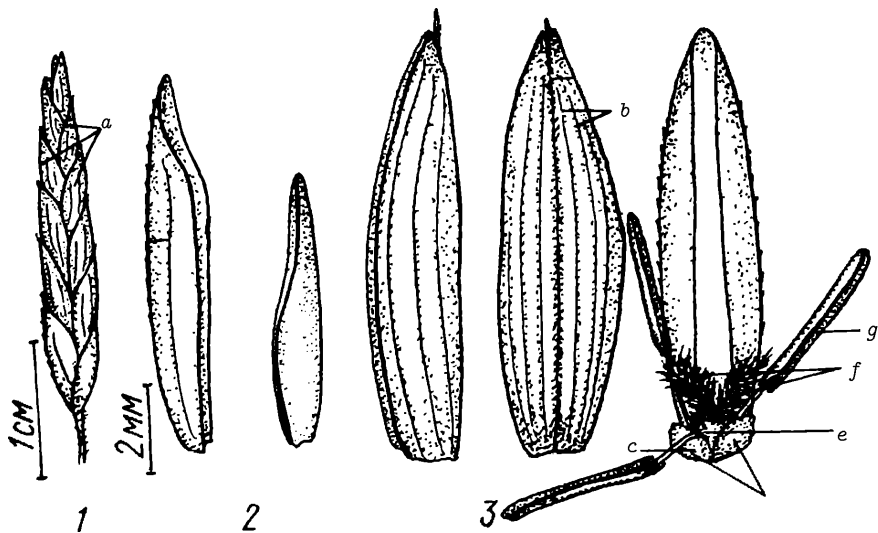
Grass leaves



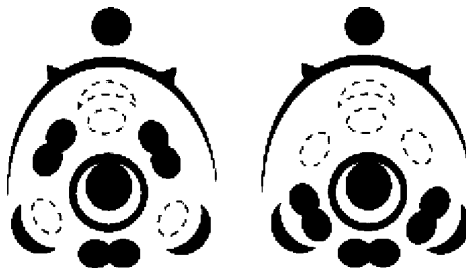
Scheme of grass spikelet



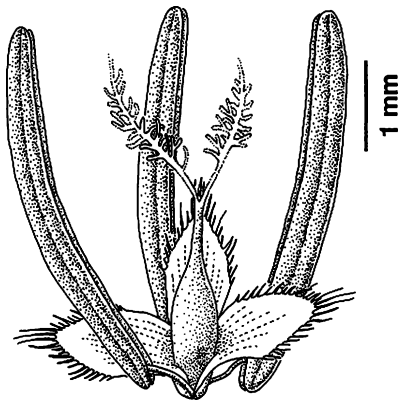
Bromegrass (*Bromus inermis*) spikelet and flower



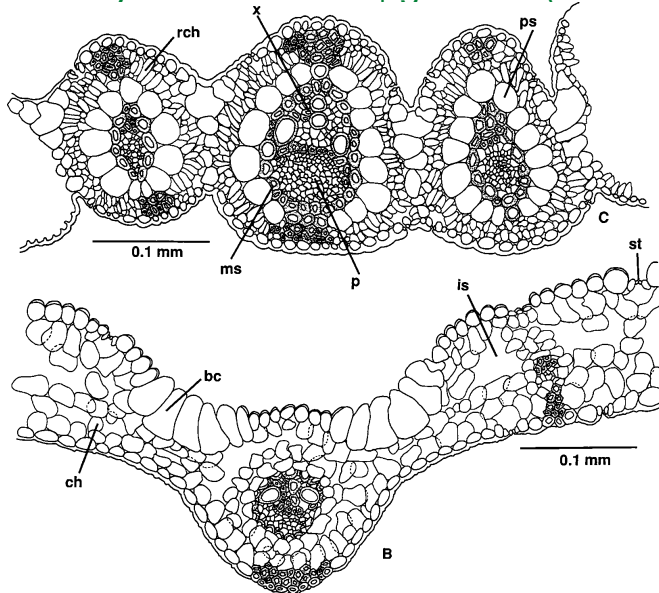
Different theories of grass flower origin



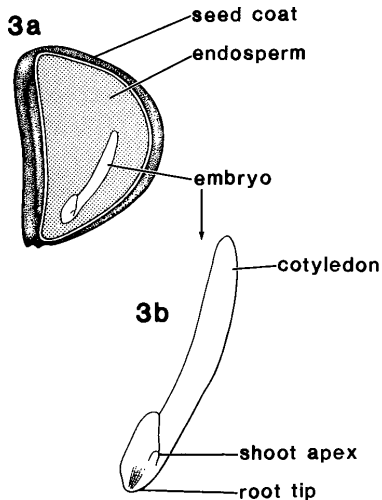
Grass flower: bamboo



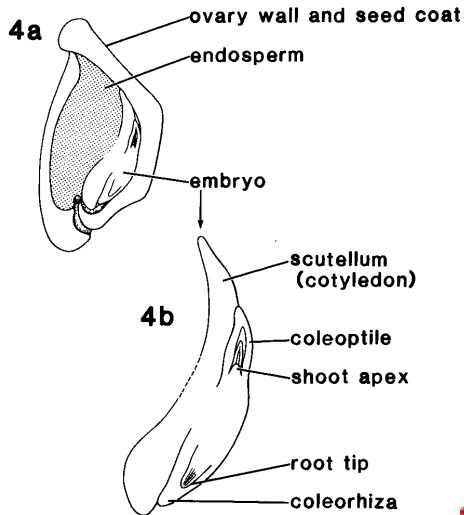
Kranz anatomy of leaves in C₄ grasses (above)



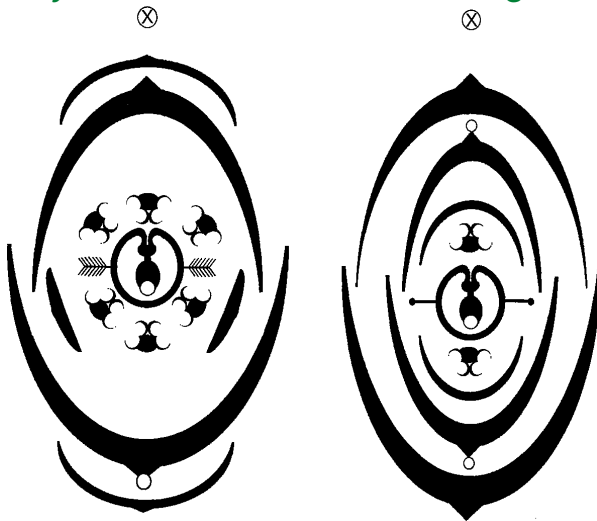
Typical Monocot Embryo (*Zephyranthes treatiae*, Amaryllidaceae)



Grass Embryo (*Zea diploperennis*)



Grasses: *Oryza* and *Anthoxanthum* diagrams



$$\uparrow P_{0-3} A_{0-3+2-3} \underline{G_{(2)}}$$



Grass inflorescences

- ▶ Compound spikes
- ▶ Panicles



Rare event: bamboo (*Schizostachyum* sp.) is flowering!



Festuca sp.

Rice (*Oryza sativa*), the most important world crop



Corn (*Zea mays*), the most productive world crop (up to 10 MT/ha)



Gramineae or Poaceae—Grass family

Diversity of Gramineae



Subfamily Anomochlooideae

- ▶ Broad leaves, no spikelets, no lodicules, 4–6 stamens. Tropical South America.
 - ▶ *Anomochloa*—anomochloa
 - ▶ *Streptochaeta*—streptochaeta



Anomochloa

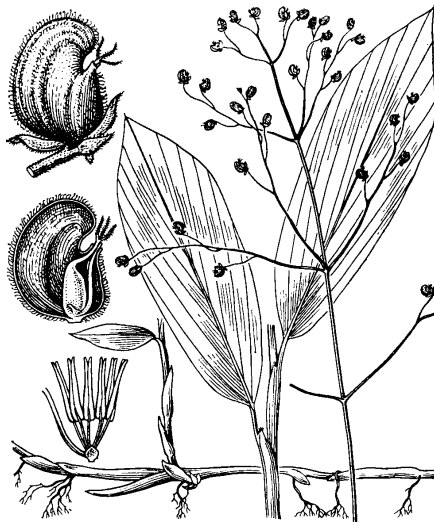


Subfamily Pharoideae

- ▶ Broad leaves with pinnate venation, spikelets one-flowered, unisexual, in panicles, 6 stamens, 3 stigmas.
 - ▶ *Pharus*—pharus, South America
 - ▶ *Leptaspis*—leptaspis, tropics of Old World



Leptaspis



Subfamily Puelioideae

- ▶ Broad leaves with parallelodromous venation, spikelets with multiple unisexual florets, 3 lodicules, 6 stamens, 3 stigmas
 - ▶ *Puelia*—puelia (Tropical Africa, poorly studied)



Puelia

Subfamily Bambusoideae

“BEP clade” starts here.

- ▶ Mostly woody plants, leaves broad or narrow, spikelets bisexual or unisexual, number of flower parts vary. $\approx 1,200$ species.
 - ▶ *Phyllostachys*—golden bamboo, often cultivated in southern U.S.
 - ▶ *Arundinaria*—hill cane, native to eastern U.S.
 - ▶ *Bambusa*—bamboo, reaches 35 m in height
 - ▶ *Melocanna*—has large berry-like caryopses



Arundinaria appalachiana



Melocanna



Subfamily Ehrhartoideae

- ▶ Herbaceous plants, ligules mostly not fringed, sometimes annuals, inflorescences are mostly panicles, 2 lodicules, 2 styles, stamens 3–6. \approx 120 species.
 - ▶ *Oryza*—rice
 - ▶ *Zizania*—wild rice
 - ▶ *Leersia*—cut grass



Leersia oryzoides

Subfamily Pooideae

Annuals or perennials, inflorescences are compound spikes, racemes or panicles, spikelets bisexual, lodicules 2, stamens 3, styles 2, embryo small (like in previous subfamilies). $\approx 3,300$ species.

Tribes:

Bromeae *Bromus*—brome grass

Meliceae *Melica*—melic, *Glyceria*—mannagrass

Poeae *Poa*—bluegrass, *Festuca*—fescue, *Avena*—oats, *Phleum*—timothy grass and many others

Stipeae *Stipa*—needle-and-thread, *Oryzopsis*—ricegrass

Triticeae *Triticum*—wheat, *Secale*—rye, *Hordeum*—barley, *Agropyron*—wheatgrass and many others



Bromus commutatus



Subfamily Aristidoideae

“PACCAD clade” starts here.

- ▶ Xerophytic grasses, mostly tropical and subtropical, ligules fringed, panicles, lemma with three awns, palea short, stamens 1–3, embryo small or large, C_4 (*Aristida*). \approx 350 species.
 - ▶ *Aristida*—threeawn



Aristida purpurea

Subfamily Arundinoideae

- ▶ Large perennials, sometimes almost woody, have panicles, palea not reduced, stamens 1–3, embryo mostly large, C₃-plants. \approx 35 species.
 - ▶ *Arundo*—giant reed
 - ▶ *Phragmites*—reed



Arundo



Subfamily Danthonioideae

- ▶ Large xerophytic grasses with narrow leaves, ligule hairy, lemma with single awn, C_3 -plants. ≈ 250 species.
 - ▶ *Danthonia*—oatgrass from outside of prairies
 - ▶ *Cortaderia*—pampas grass



Cortaderia



Subfamily Panicoideae

Primarily tropical grasses, ligule often consists of hairs or absent, spikelets frequently paired, embryo large, leaves with Kranz anatomy, mostly C₄-plants. $\approx 3,270$ species.

Tribes:

Paniceae *Panicum*—millet, *Setaria*—pigeongrass,
Cenchrus—sandbur

Andropogoneae *Saccharum*—sugarcane, *Sorghum*—sorghum,
Zea—corn, *Coix*—Job's tears, *Andropogon*
(*Schizachyrium*)—bluestem



Setaria



Cenchrus



Coix

Subfamily Chloridoideae

Grasses of dry climates, ligule fringed, leaves have specific bicellular microhairs, spikelets compressed, sometimes one-sided, embryo large, C₄-plants, Kranz anatomy. $\approx 1,400$ species

Tribes:

Eragrostideae *Eragrostis*—lovegrass

Zoysieae *Sporobolus*—dropseed, *Spartina*—cordgrass,
Calamovilfa—sandseed

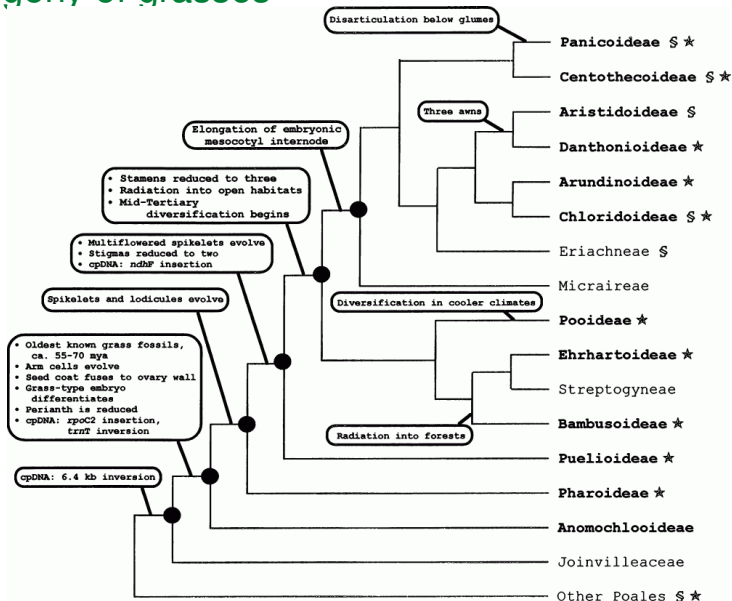
Cynodonteae *Muhlenbergia*—muhly, *Bouteloua*—grama



Muhlenbergia



Phylogeny of grasses



Summary

- ▶ Most important characters of grasses: stem anatomy, fruit and embryo



For Further Reading



A. Shipunov.

Systematic Botany [Electronic resource].

2011—onwards.

Mode of access:

http://ashipunov.info/shipunov/school/biol_448



Van Bruggen, Th.

The vascular plants of South Dakota.

1996. 3rd ed.

University of South Dakota, Vermillion, SD. P. 226–231.

