

Ethnobotany. Lecture 5

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Outline

1 Announcements

2 C₄ grasses

- Zea mays, corn
- Sorghum
- Pearl millet, Pennisetum
- Finger millet, dagusa, Eleusine
- Common, or proso millet, Panicum

3 Non-grass grains—pseudocereals

- Buckwheat, Fagopyrum esculentum
- Quinoa (Chenopodium) and other pseudocereals



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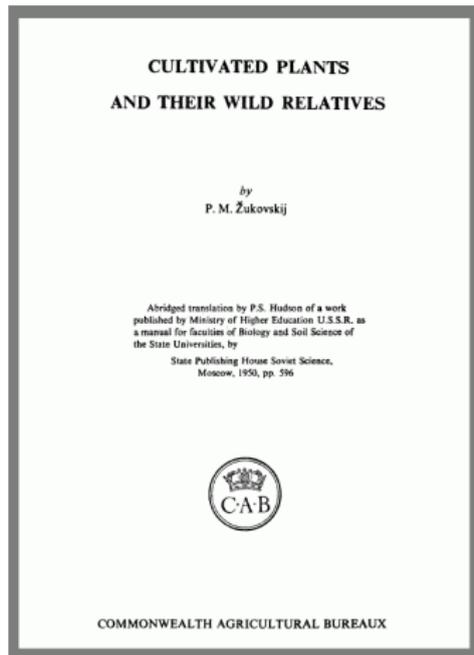


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Reference book is now on-line



[http://ashipunov.info/shipunov/school/biol_310/
zukovskij1962_cultivated_plants.pdf](http://ashipunov.info/shipunov/school/biol_310/zukovskij1962_cultivated_plants.pdf)



C₄ grasses

Zea mays, corn



Zea mays, corn

- The most important world grain (after wheat and rice)
- Mostly tropical, subtropical and warm temperate culture
- U.S. is a main corn producer (almost 50% of world production)
- Has a high yield: up to 8 tons/hectare
- Grains are rich of proteins (up to 20%) and oil (4–8%)
- Using for bread-like products, for making starch, sugar, as a forage plant, for making different secondary production (coal, ethanol, paper)



Zea mays morphology and taxonomy

- Unique grass, the sole member of genus *Zea*
- High (up to 6 m) annual with relatively small root system
- Has a highly modified inflorescences: terminal male are panicles whereas axillare female inflorescences have inflated axis and densely packed flowers
- Female flowers have extremely long styles (sometimes ≈ 1 m)
- Cross-pollinated
- Caryopsis big, round-shaped, with soft or glossy endosperm



Zea mays diversity

- Four most common varieties:
- var. *microsperma*: small grains and cobs, endosperm has two layers and used for popcorn
- var. *amylacea*: grains are rich in starch
- var. *dentiformis*: 70% of cultivated corn
- var. *saccharata*: rich in sugars, used for canned corn



Zea mays agriculture

- Optimal temperatures are 25–30° C
- Needs a constant water supply and rich (especially with nitrogen and phosphorous) soil
- Most effective with crop rotation
- Likes short days, vegetation period up to 200 days

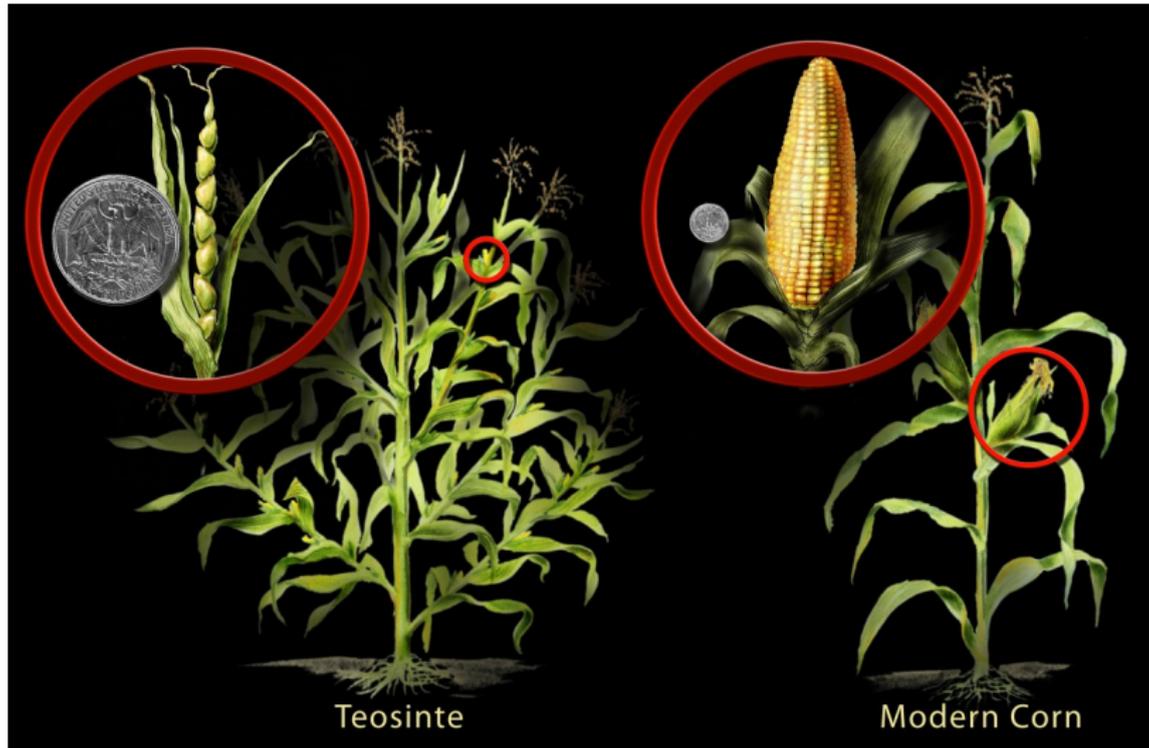


Zea mays origin

- No close relatives exist (!)
- Two related genera are *Teosinte* (teosinte) and *Tripsacum* (gama grass) which could cross with corn
- Most probably, wild ancestor became extinct \approx 5,000 years ago



Corn and teosinte



Teosinte



Tripsacum



Zea mays history

- First remains from Mexico dated 3,400 years BC
- Most probably domestication started in Mexico and Central America independently
- All varieties already exist in pre-Colombian era, corn became widely cultivated from Canada to southern South America
- In 1492, Columbus wrote first notes about corn cultivation
- From XVI century, cultivation started in Africa, then in Europe and finally in Asia



C₄ grasses

Sorghum



Sorghum, sorghum

- More than 30 species, many of them are cultivated
- Ancient culture (3,000 BC), started in Africa
- Now cultivated mostly in Asia and Africa, preferably in most dry and hot places
- Yield is around 3 tons/hectare



Sorghum morphology and agriculture

- Tall (up to 1.5 m) grasses
- Inflorescences are dense panicles
- Small grains
- Requires high temperatures and short days
- Drought-tolerant, allows most kinds of soils
- Long growth period: 200 or more days
- Came to Asia \approx 2,000 years ago, but cultivated in Europe and U.S. only for last 100 years



Sorghum diversity

- *Sorghum bicolor*—grain sorghum, Africa
- *Sorghum durra*—white sorghum, India
- *Sorghum chinensis*—red sorghum, or gao liang, China



Sorghum



Gao liang



C₄ grasses

Pearl millet, Pennisetum



Pearl millet, *Pennisetum*

- One cultivated African species, *Pennisetum glaucum*
- Forage and cereal culture, mostly in Africa and Asia
- Tall plant with compact cylindrical panicle
- Undemanding culture, requires only warm temperatures and short days



Pearl millet



C₄ grasses

Finger millet, dagusa, Eleusine



Finger millet, dagusa, *Eleusine coracana*

- Indian ancient crop (now cultivated also in Africa), sole species of genus
- Used as cereal
- Yield is comparable with wheat (2 ton/hectare)
- Requires aerated, humid soils and short days
- Resistant to fungal and bacterial diseases



Finger millet



C₄ grasses

Common, or proso millet, Panicum



Common, or proso millet, *Panicum miliaceum*

- Initially, ancient Chinese culture (2,500 BC)
- Grains are rich of proteins (14%)
- Requires short days but also has short cultivation time therefore cultivated up to 56° latitude
- Now cultivated mostly in East Europe, in U.S. only as a birdseed



Proso millet



Non-grass grains—pseudocereals

Buckwheat, *Fagopyrum esculentum*



Buckwheat, *Fagopyrum esculentum*

- Pseudocereals are not grasses but are using in similar ways, e.g., for flour, as “true” cereals, sometimes even for breads
- Buckwheat (*Fagopyrum esculentum* from Polygonaceae family) is one of the most important and old (6,000 BC) pseudocereal
- Yield is relatively low (\approx 1 ton/hectare)
- In addition to grain production, one of the best nectar producers



Buckwheat features

- Hardy plant (mountain origin!), but requires rich and relatively wet soils
- Two forms of flowers, with long and short styles: **heterostyly**. Therefore, strict cross-pollinator. Main pollinators are bees: minimum two hives per hectare required.
- Grains are rich of proteins and microelements (especially iron)



Buckwheat, *Fagopyrum esculentum*



Buckweed pollination and fruits



Buckwheat history

- Domesticated probably in Nepal (where is still used as nut) and spread across most of Eurasia
- Cultivated in Europe (especially Russia and France), China, Canada and northern U.S. (e.g., North Dakota)



Non-grass grains—pseudocereals

Quinoa (Chenopodium) and other
pseudocereals



Quinoa (*Chenopodium quinoa*)

- Belong to Amaranthaceae family (close to buckwheat family)
- Originated in Andean region, used from 2,000 BC and was plant of main importance (more than corn, secondary only to potato) in Inca civilization
- Adapted to high altitudes, easily cultivated above 4,000 meters
- Yield is \approx 2 ton/hectare
- Contain balanced sets of useful amino acids and microelements; could be used as a sole food even for long journeys
- Unfortunately, seeds contain weakly toxic and bitter *saponin* which should be removed before cooking (usually by soaking in water)



Quinoa, *Chenopodium quinoa*



Quinoa grains



Other important pseudocereals

- Amaranth (*Amaranthus* spp. from *Amaranthaceae*): cultivated mostly in Europe and America, originated from Central America. Grains are highly diverse in microelements and proteins
- Chia (*Salvia hispanica* from *Labiatae*): domesticated in Mexico, used by Aztecs. Grains are rich of diverse lipids. From 2008, recommended as “novel food” in EU.
- Whattleseed (*Acacia* spp. from *Leguminosae*): original grains of Australian Aborigines.



Anaranth, *Amaranthus* sp.



Chia, *Salvia hispanica*



Whattleseed, *Acacia* spp.



Australian millstone



Summary

- Widely cultivated C_4 grasses are mostly ancient American (corn) or African (sorghum) cultures
- **Pseudocereals** are non-grass grains, plants from families other than Gramineae but used for same purposes



For Further Reading



A. Shipunov.

Ethnobotany [Electronic resource].

2011—onwards.

Mode of access:

http://ashipunov.info/shipunov/school/biol_310



P. M. Zhukovskij.

Cultivated plants and their wild relatives [Electronic resource].

Commonwealth Agricultural Bureaux, 1962. Abridged translation from Russian.

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