

Ethnobotany. Lecture 13

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Outline

- 1 Starch-containing plants
 - Starch plants of native use
 - Inulin plants
 - Starch plants from sedge family: starch + silicon
- 2 Legumes
 - Soya beans, soybeans, *Glycine max*
 - Beans (*Phaseolus vulgaris*)
 - Pea (*Pisum sativum*)
 - Lentils, *Lens culinaris*
 - Chickpea (*Cicer arietinum*)



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Starch-containing plants

Starch plants of native use



Quamash (*Camassia quamash*)

- Famous “Quamash”, important food source of Native Americans in the West
- Belongs to lily family, Liliaceae
- Bulbs are edible and highly nutritious



Quamash, *Camassia quamash*



Quamash roots



Potato bean, groundnut, *Apios americana*

- “Mdo” in Dakota language; belongs to legume family (Leguminosae)
- Grow across all eastern part of U.S.
- Used by Native Americans as a main starch source, tubers also contain significant amounts of proteins; beans are also edible



Potato bean, *Apios americana*



Prairie turnip, breadroot, *Psoralea esculenta*

- “Tiksi” in Dakota language
- Common plant of North Dakota
- Thick main root is edible after cooking or making flour



Breadroot, *Psoralea esculenta*



Starch-containing plants

Inulin plants



Jerusalem artichoke, *Helianthus tuberosus*

- Belongs to Compositae (sunflower) family
- Tubers are rich of inulin, fructose polymer, useful dietary fiber
- Plant was used by eastern Indian tribes and now spread to Eurasia



Jerusalem artichoke



Jerusalem artichoke tubers



Some other inulin plants

- Common chicory, or *Cichorium intybus* from the same family Compositae; this European plant became invasive in North America
- Chicory is cultivated sporadically as vegetable and as a source of chicory drink—coffee supplement; 68% of inulin in dry weight
- Dandelion, *Taraxacum officinale* is again an invasive plant; inulin-containing root is edible after cooking
- Yacon (*Smallanthus sonchifolius*) is cultivated in Andes
- Many other Compositae (e.g., thistles) also have edible roots rich of inulin



Chichory



One of thistles, *Arctium*



Starch-containing plants

Starch plants from sedge family:
starch + silicon



Water chestnut, *Eleocharis dulcis*, Cyperaceae, China

- Rich of dietary fibers, vitamins B, copper and manganese
- Cell walls contain phenolic compounds which are not damaged when boiling



Water chestnut



Chufa, *Cyperus esculentus*, Cyperaceae, Africa

- Tubers are rich of potassium, phosphorous and oils (20–36%!)
- Traditional food in Africa, also cultivated in Spain and California



Chufa

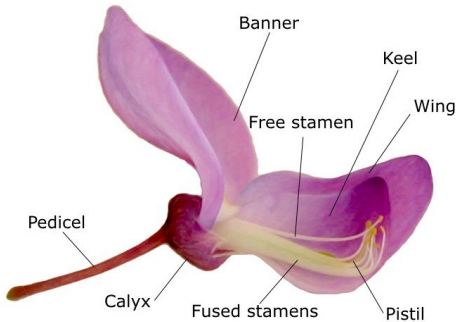
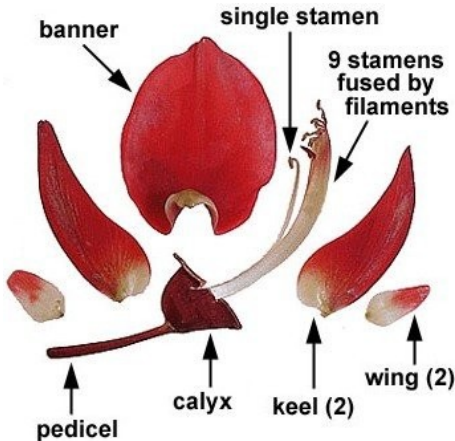


Main characteristics of legumes

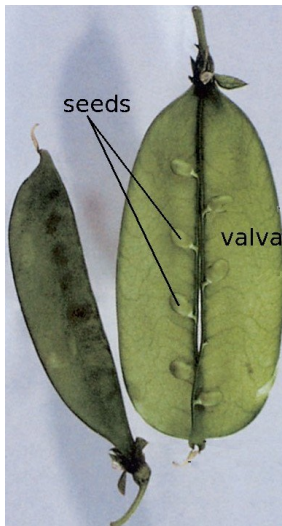
- One of the biggest plant families, more than 15,000 species
- Two most important characters: monosymmetric flowers with banner and keel; and monomeric legume fruit
- Nitrogen-fixing bacteria form root nodules (for cultivation, there are special *nitragines*)
- Consequently, all parts of legumes are rich of proteins, 2–4 times more than in cereals



Monosymmetric flower of legumes



Legume: the fruit of Leguminosae



Root nodules



Legumes

Soya beans, soybeans, Glycine max



Soya beans, *Glycine max*

- The most cultivated legume
- Seeds contain 42% of proteins including essential amino acids lysine, methionine and tryptophan; plus 20% of non-saturated oils
- Nearly universal culture: used as food, as technical culture, as oil culture and for the forage



Soya flowers



Soya features

- Cultivated mostly to the south from 50° latitude
- Nitrogen assimilation is slow at the beginning of season and reach the pike when plants start to flower
- Yield is \approx 2 ton/hectare
- Main producer is United States, than Brazil



Soya agriculture

- Requires warm, wet and shiny climates; tolerates small frosts
- Easily grow on different soils but needs crop rotation
- Relatively fast growing: 120–150 days
- The biggest problem is harvesting: early harvesting leads to decaying of seeds whereas late harvesting results in legume cracking



Soya beans



Soya history

- Prehistoric crop in East Asia
- Introduced in Europe and North America about the end of XVIII century
- In U.S., considered as technical and did not used for food until late 1920s



Legumes

Beans (*Phaseolus vulgaris*)



Beans (*Phaseolus vulgaris*)

- The second most cultivated legume
- “Beans” is the name of multiple cultivated legumes (more than 10 genera), but in strict sense, there are common beans, *Phaseolus vulgaris* and similar species
- Seeds are rich of carbohydrates and proteins
- Green legumes are also used as vegetables



Beans features

- Herbaceous annual vines with deep roots
- High diversity of cultivars
- Beans should be cooked for at least 10 min at 100° C to destroy weakly poisonous *phytohaemagglutinins*



Beans



Diversity of common beans



- Navy beans (*Phaseolus vulgaris*, multiple cultivars)
- Lima beans (*Phaseolus lunatus*)
- kidney beans (*Phaseolus vulgaris* cv. 'Red Kidney')
- Pinto beans (*Phaseolus vulgaris* cv. 'Pinto')
and many others...



Beans agriculture

- Extremely heat tolerant, requires average watering
- Does not grow well in colder climates
- Require short days; soil type is not critical
- Often cultivated inside mixed crops (with corn, rice, safflower)



Beans history

- Native culture of Central America and Mexico; important plant for Aztec civilization
- Spread around the world in XIX century
- Top producers now are Brazil and India



Legumes

Pea (*Pisum sativum*)



Pea (*Pisum sativum*)

- Old culture of Old World, one of most hardy legumes
- Food and forage plant
- Seeds are high of carbohydrates (14%, and 1/3 of them are sugars) and proteins (5%)



Pea flowers



Pea features

- Annual herb which is able to climb up to 2 m with tendrils
- Comparing with other legumes, has an extremely short vegetation period, from 65 days (!)
- The northern line of cultivation is 68° latitude
- Long-day culture, also requires wet soils



Pea history

- Domesticated prehistorically in West Asia; wild landraces of same species are still exist
- Spread to both Western Europe and Eastern Asia (common culture in Japan)
- Self-pollinated, and became a famous model plant of first genetic experiments made by Gregor Mendel



Legumes

Lentils, *Lens culinaris*



Lentils (*Lens culinaris*)

- One of the oldest cultivated plants, has been part of human diet since Neolithic times
- Rich of proteins (26%) and especially carbohydrates (60%)



Lentil



Lentils features

- Annual herbaceous vine up to 1 m high
- Less hardy than pea, requires warm season, vegetation period is often more than 100 days
- Long-day plant, drought tolerant (this is rare among cultivated legumes)
- Has relatively low yield (0.8 ton/hectare)



Lentils history

- Was domesticated in West Asia even before first civilizations appear
- Mentioned in Old Testament since it was a common food for Palestinian nations
- The word “lens” originated from Latin name of lentils
- Biggest producers are now Canada and India



Red and brown lentils



Legumes

Chickpea (*Cicer arietinum*)



Chickpea (*Cicer arietinum*)

- One of primary Indian food plants
- Composition and yield is similar to lentils ($\approx 23\%$ proteins and 64% carbohydrates, 0.8 ton/hectare)
- Has big seeds, requiring more boiling time than other legumes (up to 2 hours)
- Green parts are not edible as forage



Chickpea



Chickpea features

- Drought tolerant and therefore cultivated in arid climates
- Does not require specific soils
- Prefer long-days: does not go far into tropics; biggest producers are India, Pakistan and Turkey



Chana masala: Indian cousine



Some other legumes

- Pigeon pea (*Cajanus cajan*) perennial legume, originated in India
- Hyacinth bean (*Lablab purpureus*) has the African origin, it is frequently grown also as ornamental



Summary

- **Starch-containing plants** are accumulating starch or inulin in their underground parts
- Legumes are rich of proteins including essential amino-acids
- They mostly require humid climates and do not need specific soils
- Crop rotation is needed for most of legume cultures



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.

Mode of access:

http://ashipunov.info/shipunov/school/biol_310/zhukovskij1962_cultivated_plants.djvu.

