

Ethnobotany. Lecture 9

Alexey Shipunov

Minot State University

January 30, 2013



Outline

1 Centers of cultivated plants origin

2 Sugar plants

- Sugars



Outline

- 1 Centers of cultivated plants origin
- 2 Sugar plants
 - Sugars



Why knowing centers of origin is important

- Tracing history of civilizations alongside with history of plant cultivation
- Historical discoveries
- New landraces and wild relatives useful for selection

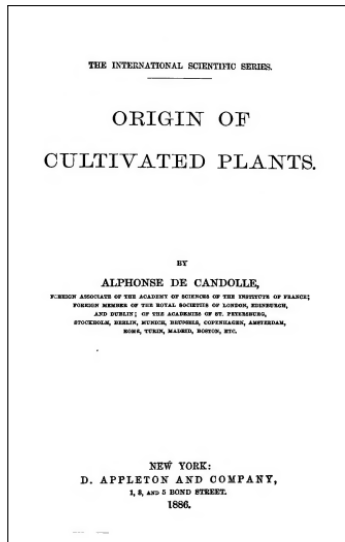


Initial hypotheses: De Candolle (1882)

- Mentioned that distribution of ancient cultivated plants was very unequal
- Found three centers of plant origin: China, West Asia/Egypt and tropical Asia



De Candolle's "Origin"



Nikolai Vavilov work (1926)

- On the 5th International Genetics Congress, he presented his new classification of centers based on field and collection research
- Differential method: studying density of distribution on a level of varieties. Places where biggest densities were intersected become “centers candidates”
- In 1930s, he establishes “ecological passports” of territories which show ecologic, economic and geographic traits



Vavilov's centers (1926)

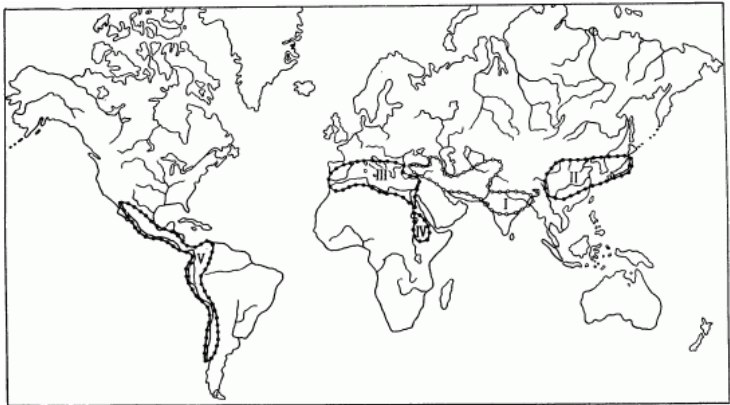
In 1926, he designated five centers of origin:

- ① India
- ② China
- ③ Mediterranean region
- ④ Ethiopia
- ⑤ South and Central America

Later, he added some (Central Asia) and split some of them



Five Vavilov's centers



More recent hypotheses

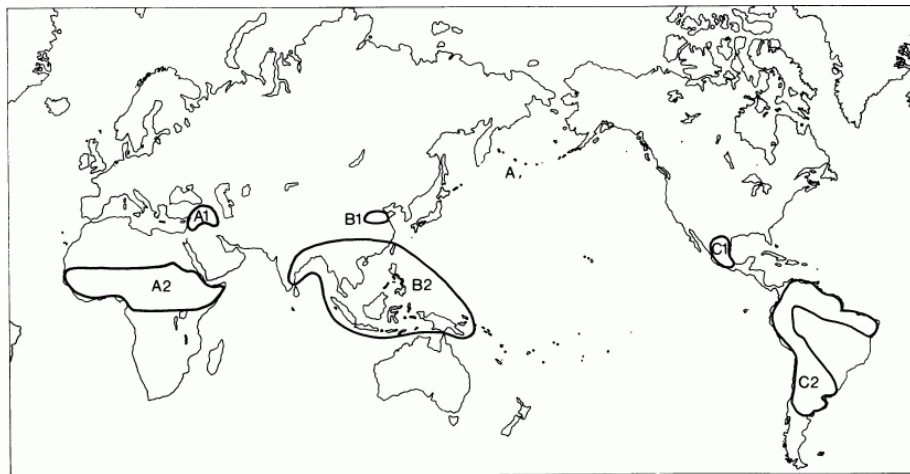
- Darlington (1952): several American centers, twelve centers in total
- Harlan (1971): “centers of agricultural beginnings”: only six
- Zhukovskij (1965–1982): 12 “megacenters” (regions). All Vavilov’s centers listed, plus several which do not produce substantial amounts of cultivated plants but still separate



Darlington's centers



Harlan's centers of agricultural beginnings

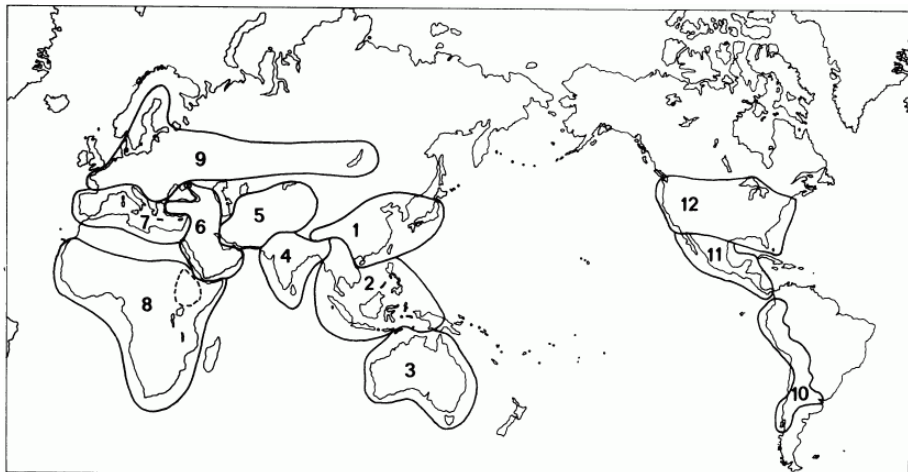


Centers of origin from Zhukovskij

- China
- Indochina—Indonesia
- Australia—New Zealand
- India
- Central Asia
- West Asia
- Mediterranean
- Africa
- Europe—Siberia
- Central America
- Bolivia—Peru—Chile
- North America



Zhukovskij's regions (centers)



West Asian center (A1)

- Plants relatively small, stiff stems and leaves, drought-tolerant
- Some wheats, two-rowed barley, oats, lentils
- Ancient Egypt and Mesopotamia



Indian center (B2)

- Xerophytes*, small leaves, rapid development and filling-out of seeds, small seeds, extremely susceptible to European fungal and bacterial diseases
- Some wheats, six-rowed barley, finger millet, chickpea
- Ancient Indus Valley Civilization



African/Ethiopian center (A2)

- Adapted to poor soils, starting to grow in the beginning or in the end of rain season
- Fonio, tef, sorghum, pearl millet
- Ancient African civilizations: Aksum, Yoruba, Benin



China center (B1)

- Mesophytes and even hydrophytes, short development, small and medium-sized seeds, relatively big leaves
- Rice, soybeans
- Ancient Chinese kingdoms



Central American center (C1)

- Xerophytes and mesophytes, slow growing, big seeds, drought- and hot-tolerant
- Corn, common bean, sweet potatoes
- Ancient Aztec and Mayan empires



South American center (C2)

- Mesophytes, many are tolerant to low temperatures, big leaves, developed underground parts
- Cassava, potatoes, oca etc.
- Ancient Andean civilization



Sugar plants

Sugars



Sugars and their role

- Mono- and polysaccharides
- Glucose, fructose, sucrose, cellobiose
- Starch (amylose + amylopectin) and glycogen



Sugars and civilizations (speculative hypothesis!)

- High level of glucose uptake by nervous cells
- Increasing use of sugars in human history
- “Unsuccessful” civilizations which did not find a reliable source of sugars



Ethanol

- Immediate product of yeast fermentation of glucose
- Pre-adaptation to alcohol from frugivores
- Bind to GABA (gamma-aminobutyric acid) receptors
- Converted into acetaldehyde (toxic!) by alcohol dehydrogenase and then into acetic acid by acetaldehyde dehydrogenase*
- Asian flush and alcoholism are related to the genetic diversity of alcohol dehydrogenases



Downsides of sugars

- Obesity, because sugars are easily convert into fats
- Diabetes, because insulin cannot deal with large quantities of sugars
- Dental diseases, especially dental caries (caused by lactobacteria taking sugars for their growth)
- Multiple sweeteners have been developed to avoid side-effects of sugars: heterocyclic saccharine (in “Sweet’N Low”), amino acid derivative aspartame (in “Equal”), chlorine hexose sucralose (in “Splenda”, “Altern”). All are controversial.



Stevia rebaudiana, the natural sweetener

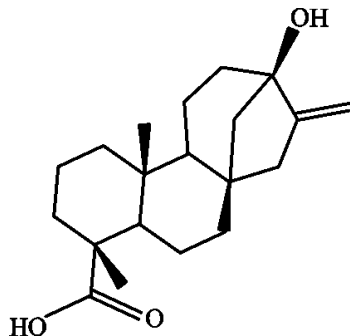
- Belongs to aster family, Compositae
- Originated in South America
- Leaves contain the group of sweet glycosides, derivatives of steviol
- Despite of multiple controversies (not approved in EU, banned in Norway and Singapore) used by Coca-Cola and PepsiCo in their “zero calories” drinks



Stevia flowers



Steviol



Summary

- Twelve centers (region) of initial cultivation exist
- Sugar is highly used but controversial source of energy



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.

Mode of access:

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

Pages 23–27.

