Ethnobotany. Lecture 8

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Outline

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Outline

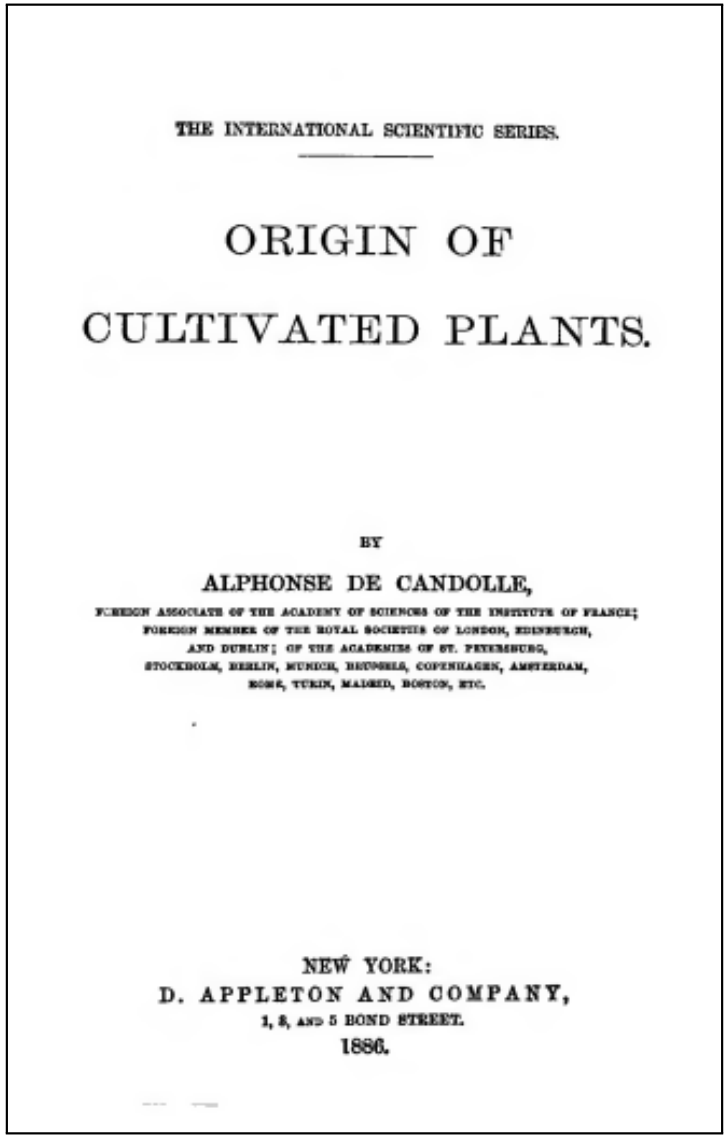
Why knowing centers of origin is important

- Tracing history of civilizations alongside with history of plan 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 thee centers of plant origin: China, West Asia/Egypt and tropical Asia

De Candolle's "Origin"



THE INTERNATIONAL SCIENTIFIC SERIES.

ORIGIN OF

CULTIVATED PLANTS.

BY

ALPHONSE DE CANDOLLE,

FOREIGN ASSOCIATE OF THE ACADEMY OF SCIENCES OF THE INSTITUTE OF FRANCE;
FOREIGN MEMBER OF THE ROYAL SOCIETIES OF LONDON, EDINBURGH,
AND DUBLIN; OF THE ACADEMIES OF ST. PETERSBURG,
STOCKHOLM, BERLIN, MUNICH, BRUSSELS, COPENHAGEN, AMSTERDAM,
ROME, TURIN, MADRID, BOSTON, ETC.

NEW YORK:
D. APPLETON AND COMPANY,
1, 3, AND 5 BOND STREET.
1886.

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 varietes. 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

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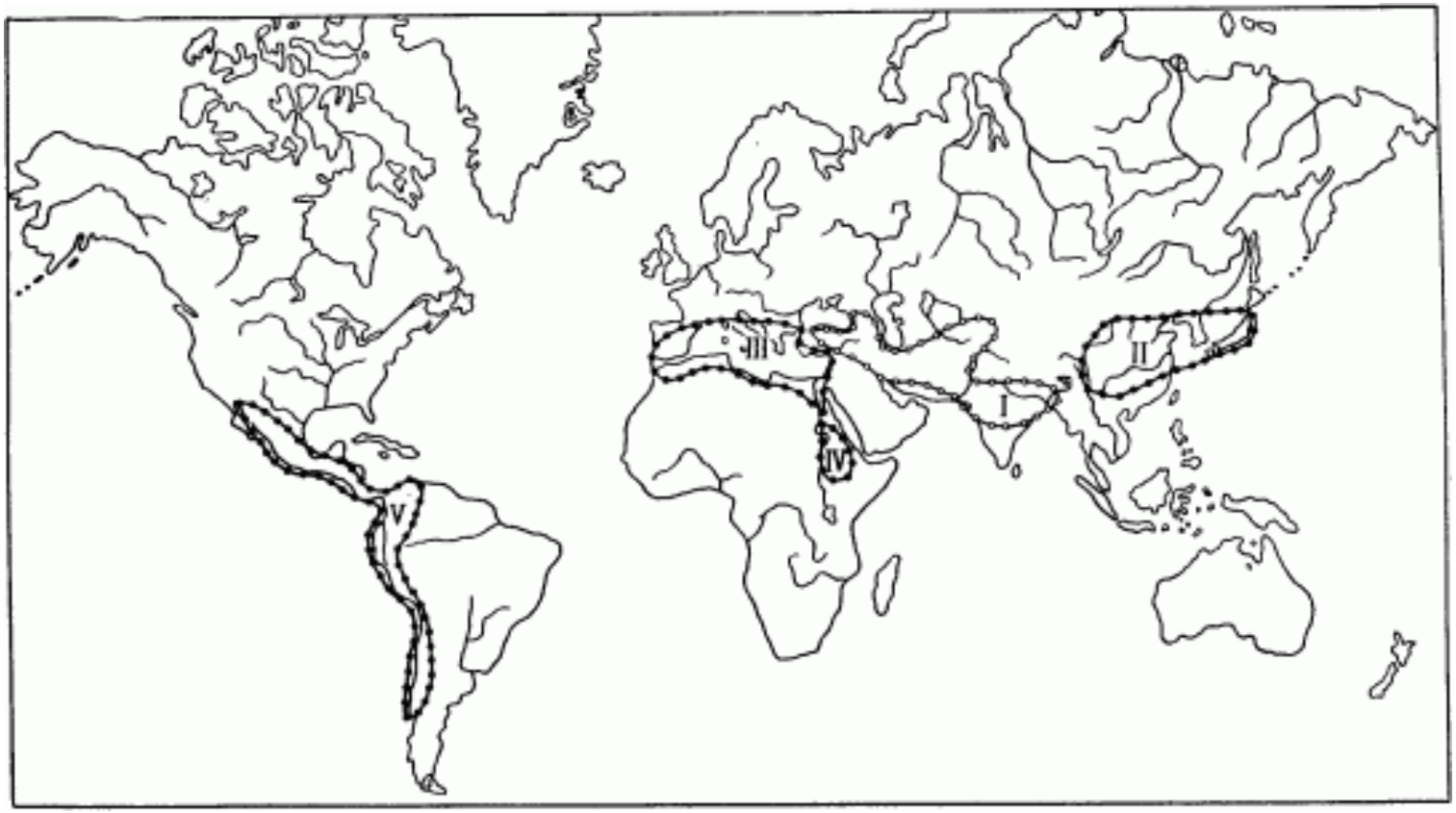
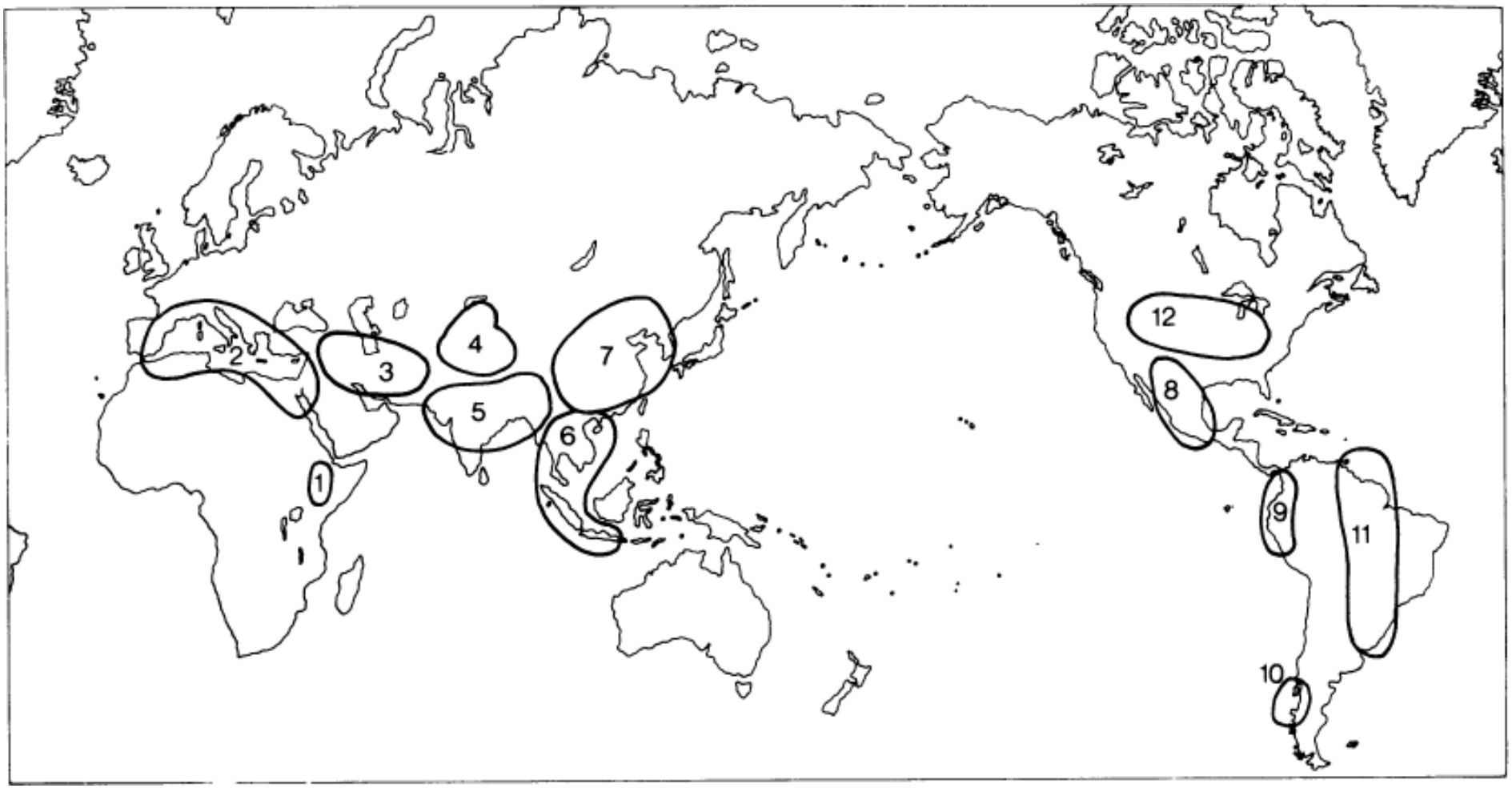
Five Vavilov's centers



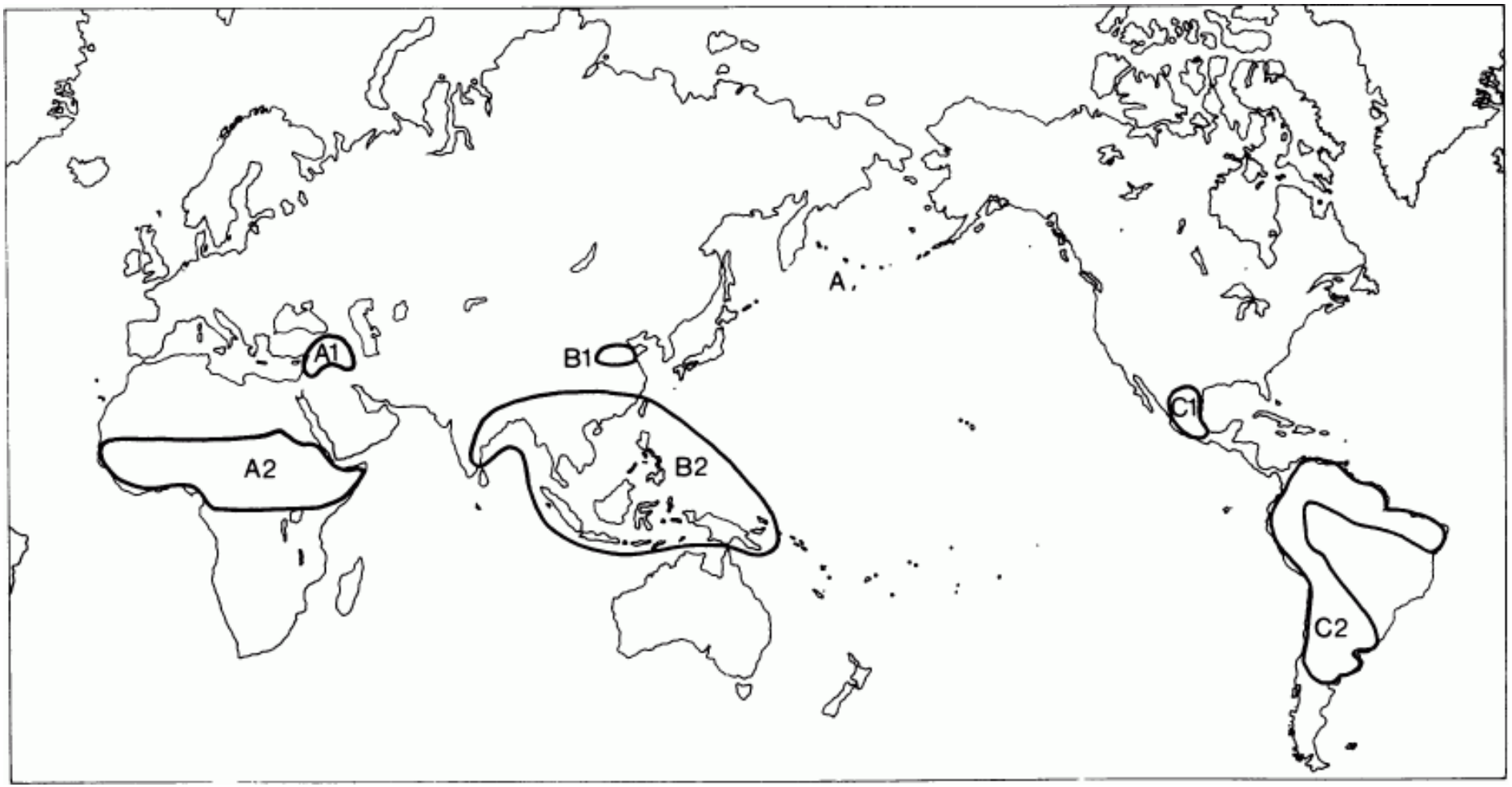
More recent hypotheses

- 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



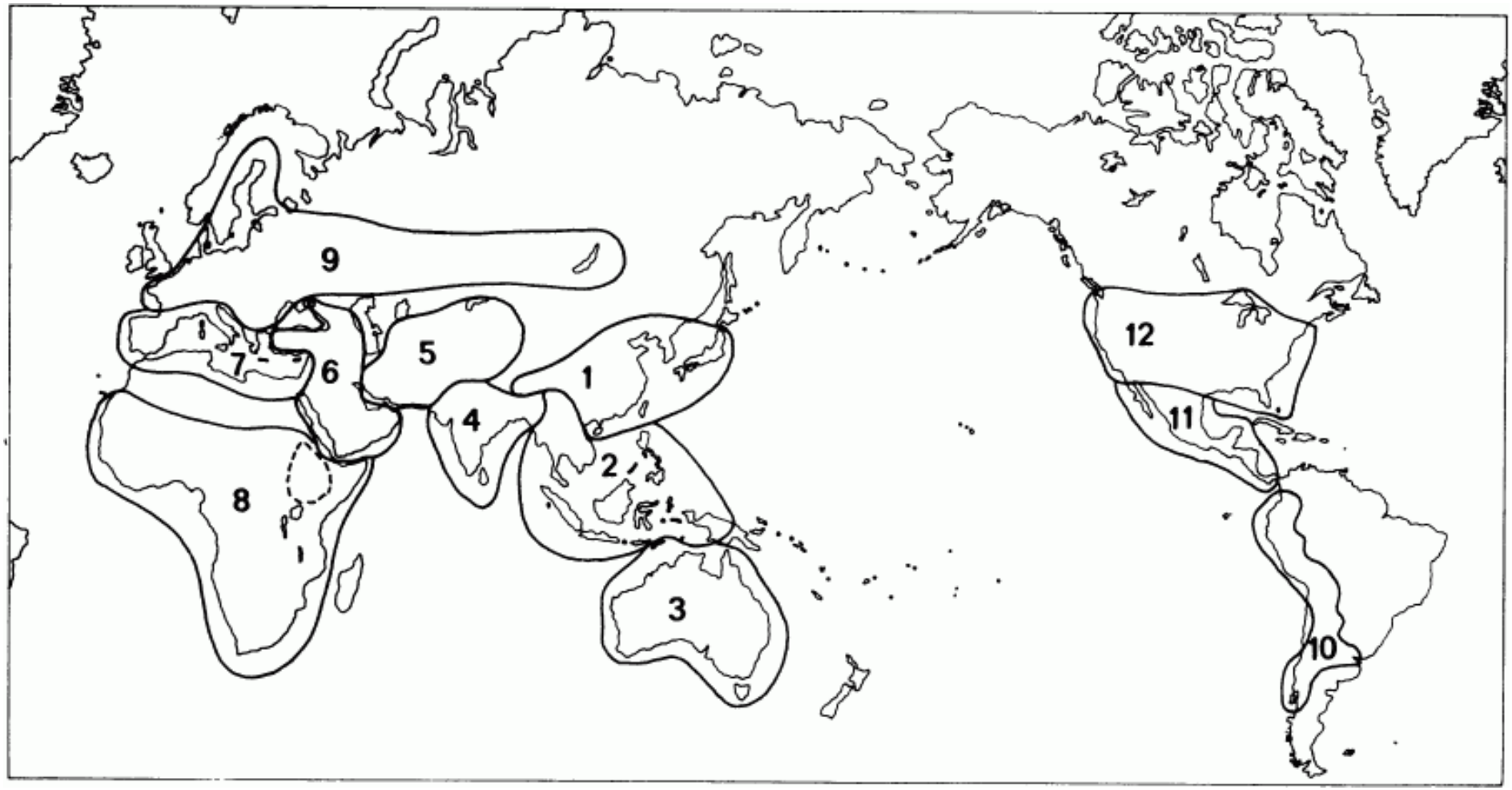
Harlan's centers of agricultural beginnings



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 susceprible 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

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 rebauldiana, 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

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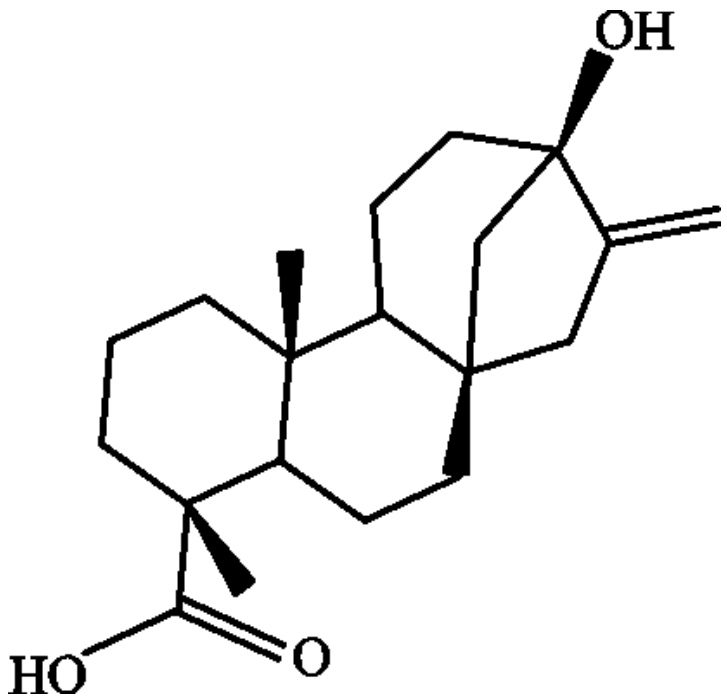
Stevia flowers

Steviol

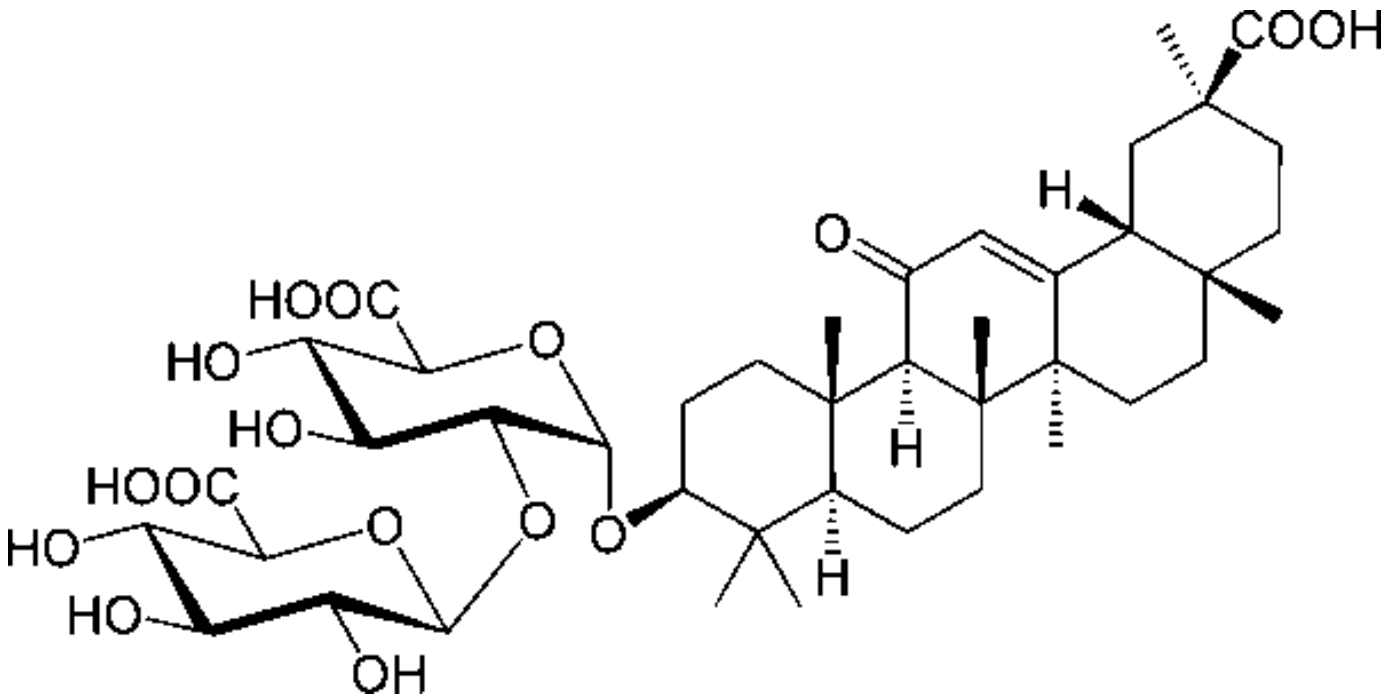


Our native natural sweeteners

- North Dakotan wild licorice (*Glycyrrhiza lepidota*) belongs to legume family, Leguminosae
- Contains natural sweetener glycyrrhizin
- Side-effects are hypertension and lowering of testosterone level in males

American licorice, *Glycyrrhiza lepidota*

Glycyrrhizin



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

A. Candolle, de.
Origin of cultivated plants [Electronic resource]. D. Appleton and Co, 1886.
Mode of access: http://www.archive.org/details/cu31924002051211.

N. I. Vavilov.
Centers of origin of cultivated plants [Electronic resource]. Cambridge University Press, 1992.
Mode of access: http://ashipunov.info/shipunov/school/biol_310/vavilov1992_centers.djvu.

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