Ethnobotany. Lecture 13

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Outline

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1. Centers of cultivated plants origin

2. Sugar plants
   - Sugars

Obesity and Type II diabetes in Polynesians

The American Journal of CLINICAL NUTRITION

Obesity in Samoans and a perspective on its etiology in Polynesians.

S T McGarvey

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Abstract

For Samoans, modernization produces obesity and adiposity and concomitant increases in cardiovascular disease risk factors and outcomes. Massive adiposity and high prevalence of obesity characterizes modernizing adult Samoans. Mean body mass index (in kg/m2) at ages 25-54 y is 30-32 for males and 32-36 for females. Prevalence of overweight in female adults is 46% in traditional Western Samoans and 80% in migrants in Hawaii. Five-year longitudinal data show striking weight and fat gain, especially in younger adults and females. An evolutionary perspective on Polynesian adiposity is based on scenarios of the fates of sailors on the voyages of discovery and of settlers in the pioneer island villages. Efficient metabolisms producing rapid adipose-tissue growth could have increased survival among the first Polynesians. Rapid dietary and physical activity changes caused by modernization interacting with such population genetic predispositions may lead to the documented massive adiposity.

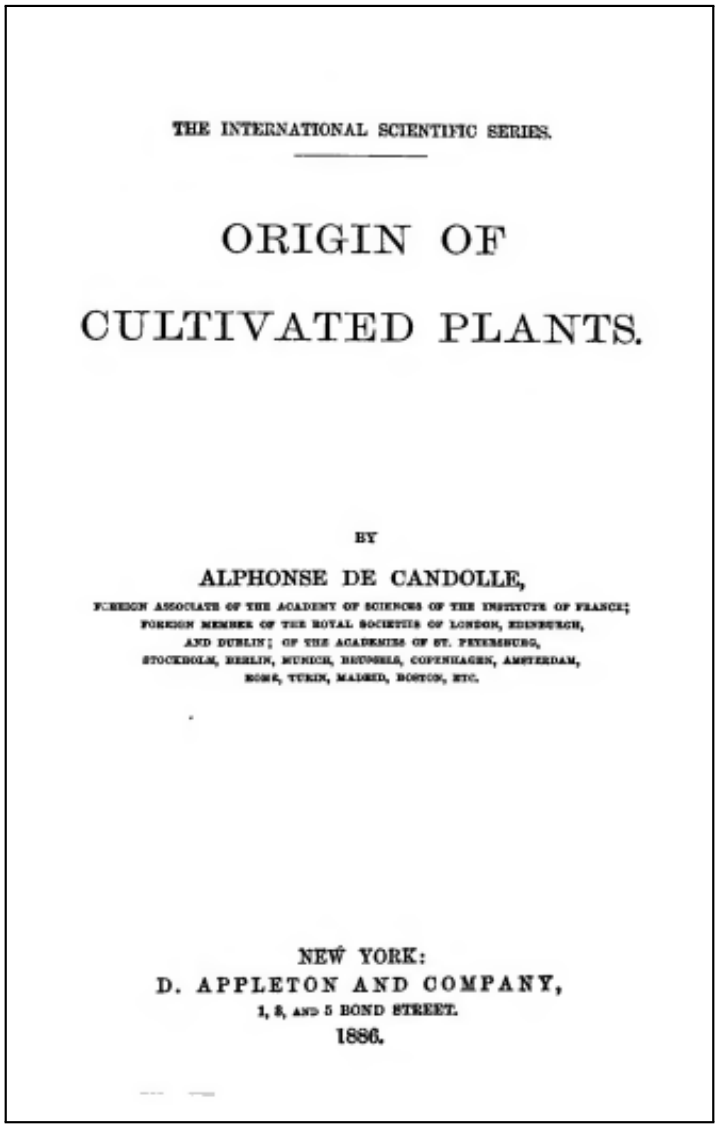
Why knowing centers of origin is important

- Allows to trace history of civilizations alongside with history of plant cultivation
- Allows for historical discoveries
- Helps to find 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)

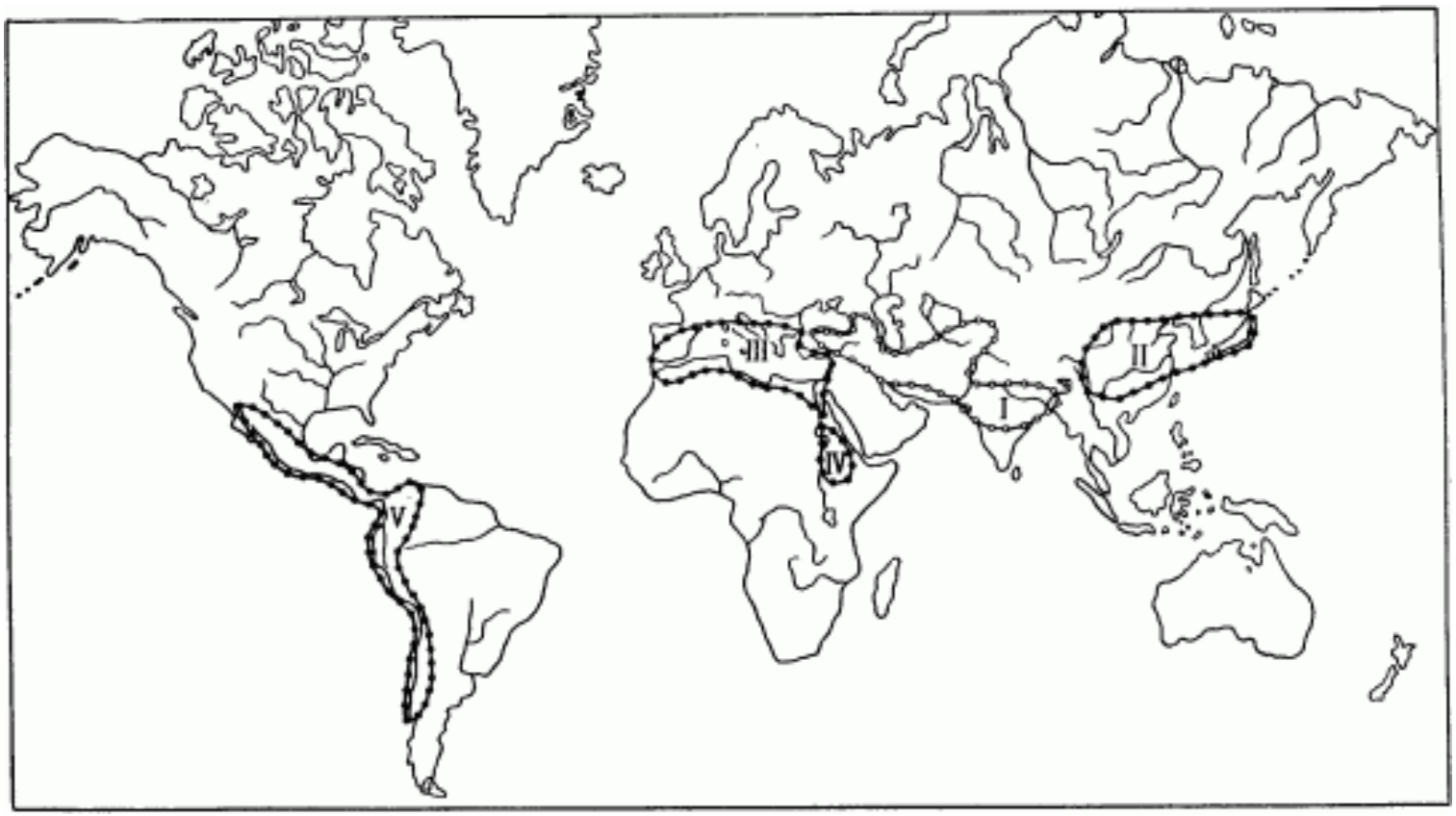
- On the 5th International Genetics Congress, he presented his new classification of centers based on field and collection research
- Differential method: studying density of distribution on a level of varietes. Places where biggest densities were intersected become “centers candidates”
- In 1930s, he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

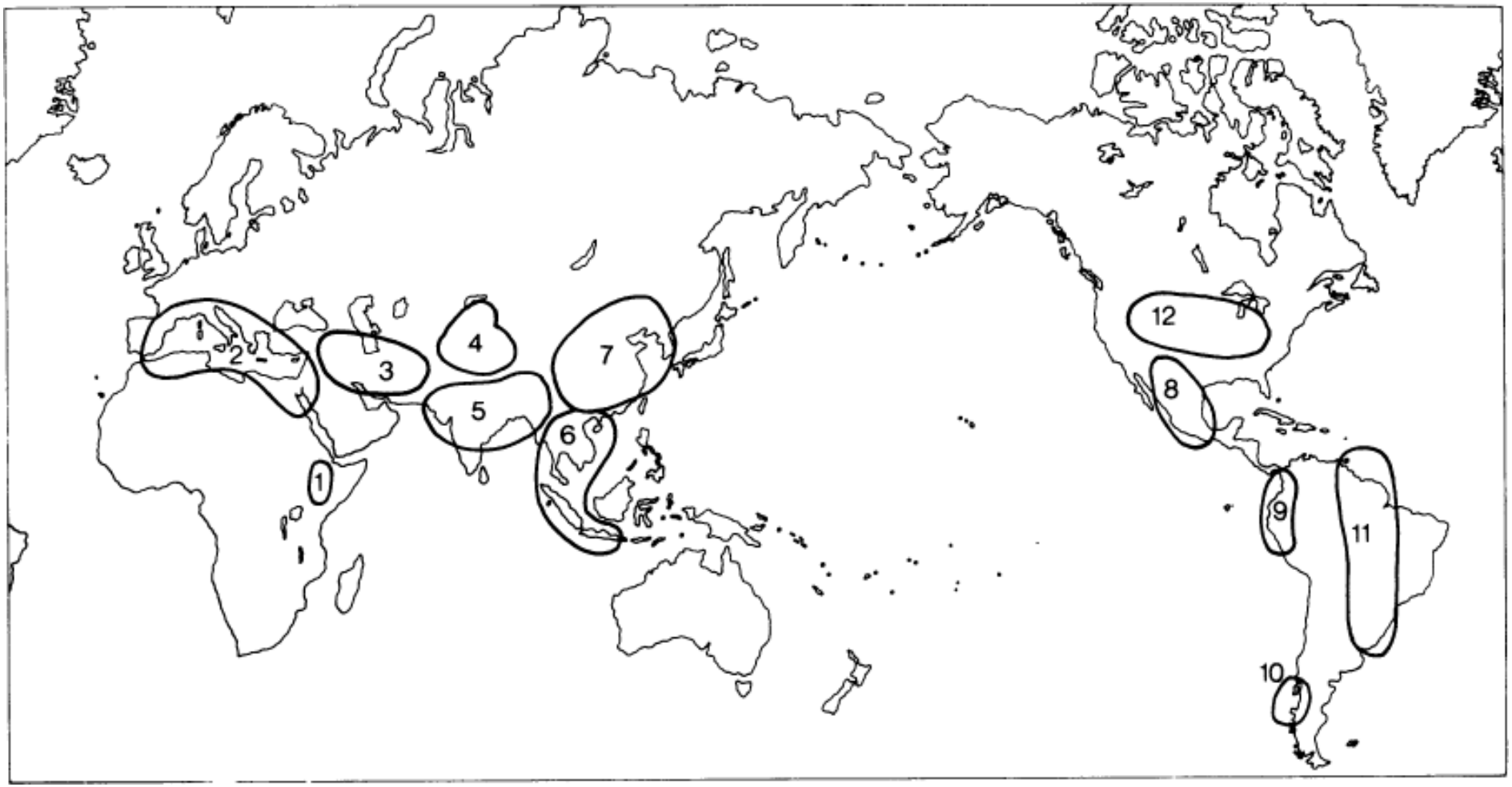
Five Vavilov's centers



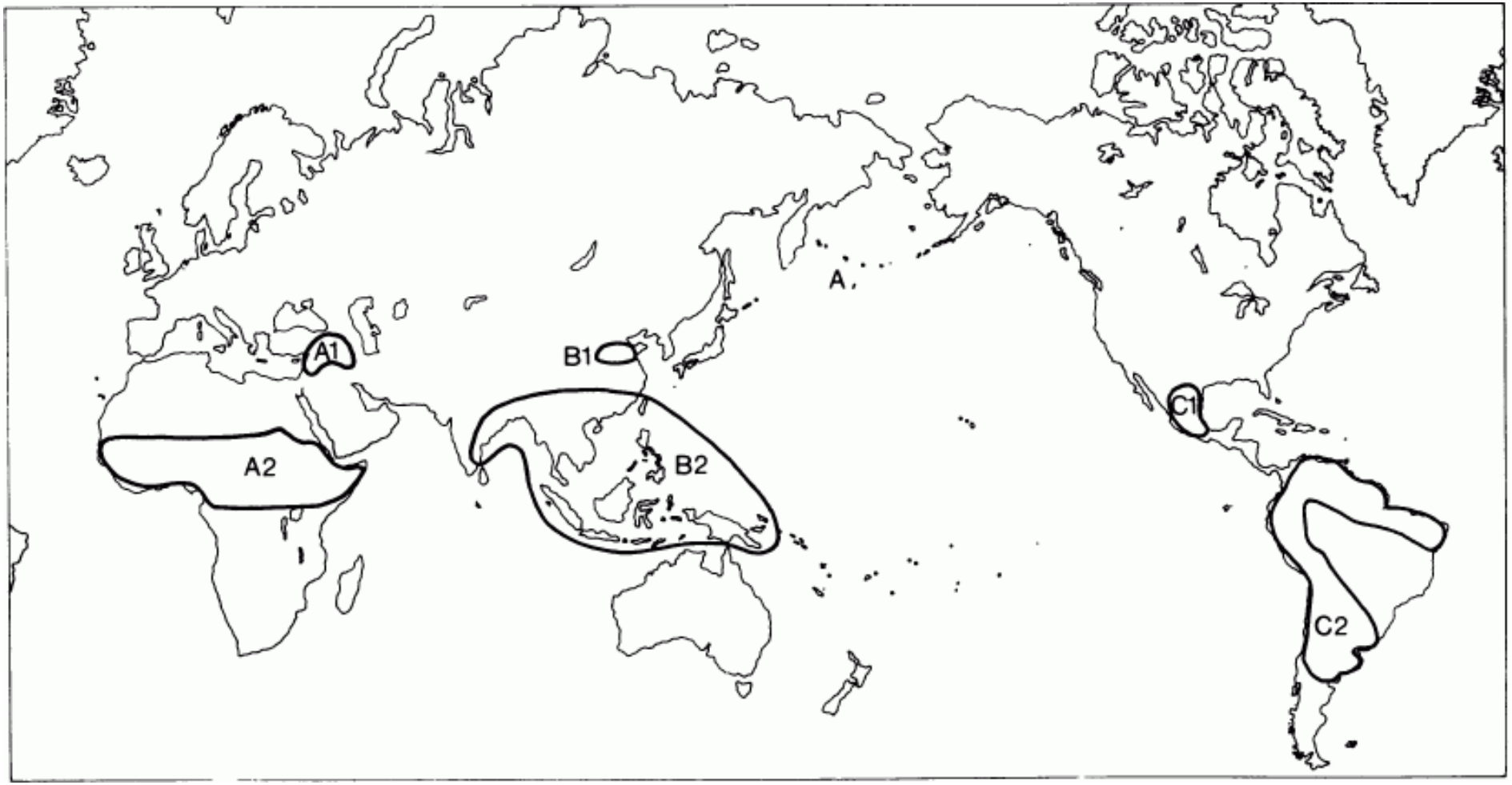
More recent hypotheses

- 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



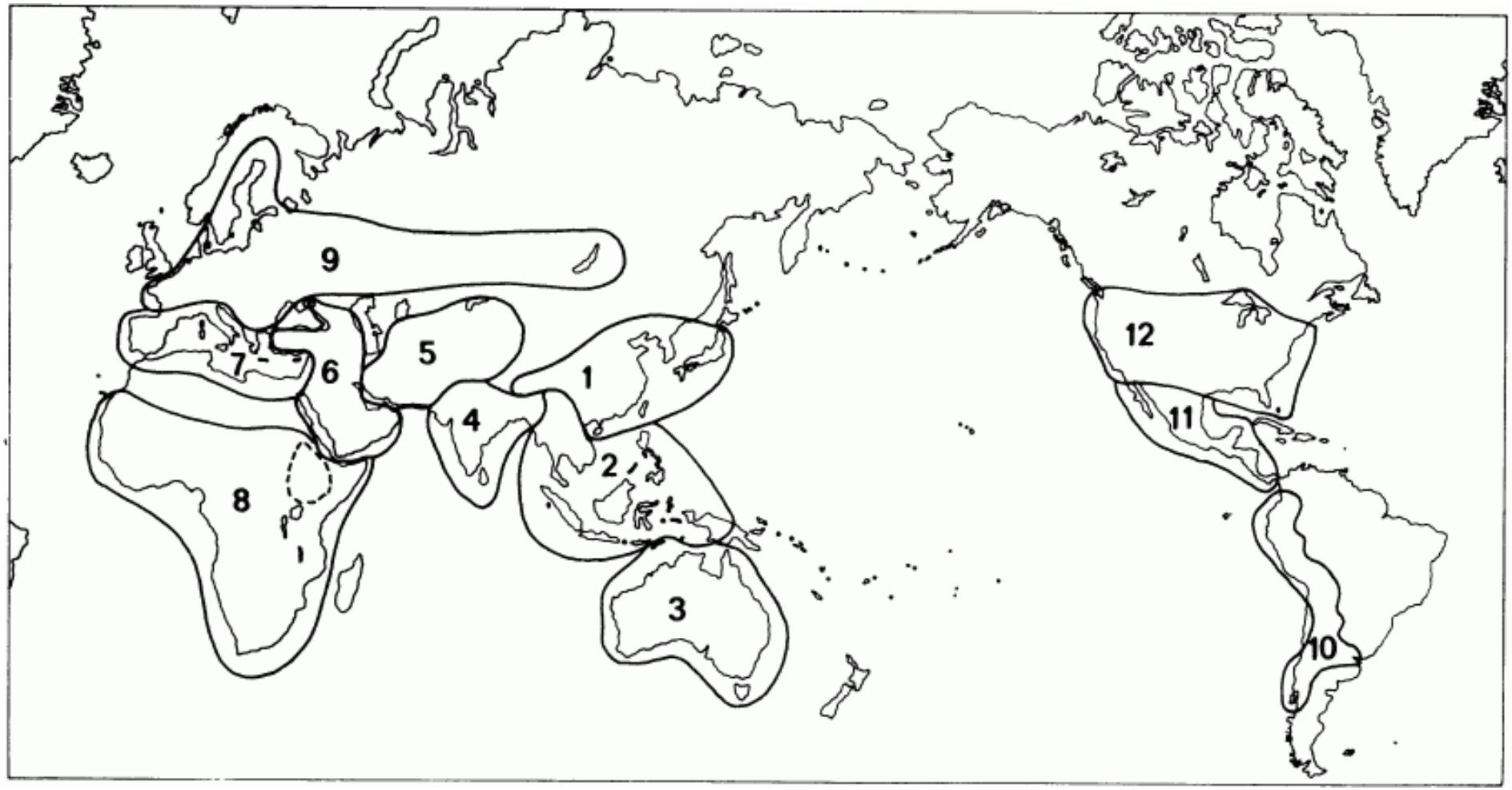
Harlan's centers of agricultural beginnings



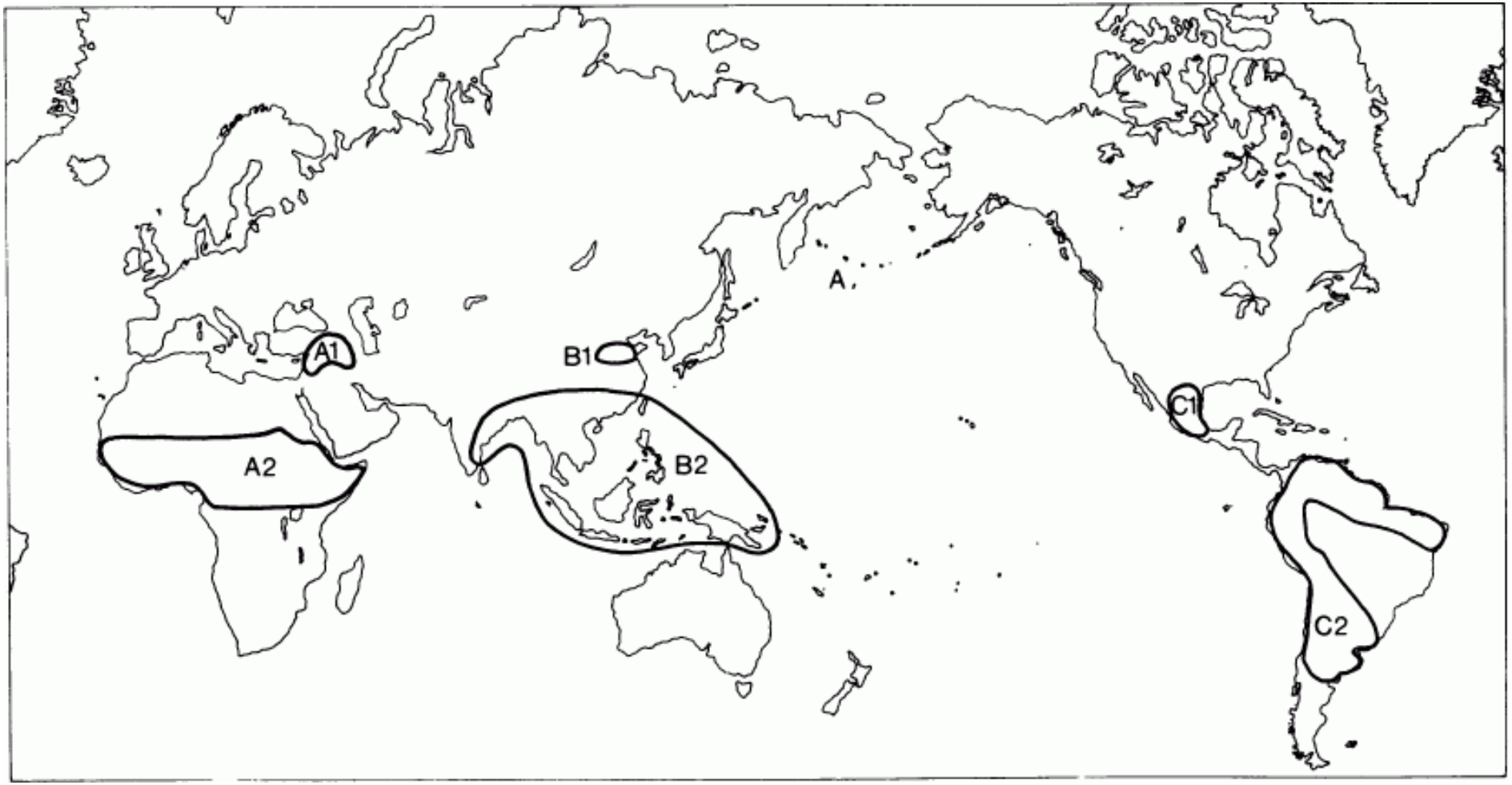
Centers of origin from Zhukovskij

- 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)



We will follow Harlan (1971)



West Asian center (A1)

- Xerophytes, 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

Sugar plants

Sugars

Sugars and their role

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

Sugars and civilizations (speculation!)

- 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.

Summary

- According to Harlan (1971), there are 6 centers (regions) of initial plant cultivation
- Sugar is highly used but controversial source of energy

For Further Reading

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