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Origins of Cultivated Plants

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Origins of Cultivated Plants
Ref. Chap. I of Hayes, Immer & Smith

1. Early beliefs:

Cultivated plants were gifts of the Gods.

But those people did not have many of today's important plants so their Gods were not so benevolent! They thought cultivation directly improved plants.

2. The early researchers:

2.1 Decandolle - 1855 and 1882 publications

Traced some species to wild ancestors

Influenced by Linnaeus

Species were relatively unrelated if non-crossable he believed

No knowledge of genetics, cytology, crossing barriers, evolution, etc!

2.2 Darwin - 1868 pub. "Variation of Animals and Plants Under Domestication."

Knew nothing about laws of inheritance.

2.3 Mendel - 1 important paper, 1865 "Investigations of Plant Hybrids."

Thought plants became adapted to changing conditions through the action of the environment (wild or cultivated) upon variable populations the result of natural crossing between varieties and/or species.

Reference: Vol. 13 of Chronica Botanica (Botanical Stories) pub. in Waltham, Mass., 1949. "The Origin, Variation, Immunity, and Breeding of Cultivated Plants." N. I. Vavilov. Trans. by K. Starr Chester.

2.4 Vavilov, Nikolai Ivanovitch

Russia's most distinguished geneticist.

Born 1887, died 1942.

Studied with Bateson in England (Biffen 1st)

Studied geo. dist., origin, and characteristics of cultivated plants in many places.

1920 - 1935 very active in biology.

Clashed with a clever scientist demagogue who was an able physiologist (Lyaenko)

but knew nothing about genetics.

Established the value of vast plant collections for breeding work.

Demonstrated "the law of homologous series in variation" - holds that parallel variations existed in all categories of related plants.

Example - black seeded cereals

dis. res.

oppressed branches

poplar, oak, maple, linden

Centers of origin of cultivated plants

8 centers were apparent

3. Vavilov's centers of origin.

3.1 Chinese - the earliest and largest; consisted of mountains and adjacent

lowlands of central and western China.
136 species excluding ornamentals.

3.2 Indian center of origin inc. Burma and Assam. 117 species thought to have originated here.

3.3 Indo-Malayan (Indo China and Malay Archipeligo) 55 species

3.4 Central Asia

NW India, Afganistan, part of Russia
42 species

3.5 Near-eastern center

Iran and NW areas
83 species

3.6 Mediterranean

84 species

3.7 Abyssinian center

38 species

3.8 Central America and South Mexico

49 species

3.9 South America

Peru, Ecuador, Bolivia
45 species

3.10 Chiloe (Island west of South America belonging to Chile)

4 species

3.11 Brazil - Paraguay

13 species

3.12 West African

1 specie that I know of

These centers are separated by deserts, mountain ranges, or bodies of water. Of the 640 most important cultivated plants in the world, 500 belong to the old world. Of these, 400 originated in Southern Asia.

3.12.1 Based upon personal investigations and trips and upon knowledge of the work of others.

.2 Centers of origin

3.12.2.1 Chinese

Earliest and largest

Millets

Soybeans

Barley, awnless and hulless

Oats, naked

Radish

Sugarcane

Oranges

Lettuce

Cucumbers

(No. 1 in Thailand)

- | | | |
|----------|--|--|
| | Buckwheat
Plums, prunes, Apricots | Squash
*Peaches |
| 3.12.2.2 | Hindustan (Burma and Assam)
*Rice
Cowpea

Tangerine | Egg Plant
*Some cotton
species
Citron |
| 3.12.2.3 | Central Asiatic which includes Punjab, Kishmir
Afghanistan and northward.
*Common wheat
English peas
*G. herbaceum
Cantaloupes Carrots Spinach
Garlic Pears Almonds
Apples Chick peas | Lentils Sesame
Flac Hemp |
| 3.12.2.4 | Near Eastern consisting of Iran, Asia Minor (most
Turkey and some adjacent land)
Einkorn (and 8 other species)
2-row barley
Rye
Common oats
Red oats
Alfalfa
Vetch | Fig Cherry
English Walnut
Filberts chestnuts
Hazel nuts
Apples |
| 3.12.2.5 | Mediterranean
Durum, emmer, and spelt
wheats

Some oats and barley species
Hops
etc
Flax | Ranks with China
as source of vegeta-
bles.

beets onion chives
leek lettuce |
| 3.12.2.6 | Abyssinian
Common 6-rwo barley
Durum wheat
Grain sorghum
Coffee | lentils
chick pea
castor bean
Okra
6-row barley
more diverse here
than anywhere
else. |
| 3.12.2.7 | South Mexican and Central America
*Corn
Beans, Lima and others
Sweet potato
*Upland cotton, <u>G. hirsutum</u> | Cacao
Papaya
Avacado
Squash |

3.12.2.8 South America
 Irish potatoes peanuts
 Lupines Hevea (rubber)
G. barbadense Pineapple
 *Tomato Cashew
 Quinine
 *Tobacco

3.12.2.9 North America
 Sunflower, Blueberries, Cranberries, Currents,
 Gooseberries.

3.12.3 Evolution by cultivation (Darlington and Janaki Annual)
 pp. 18 - 23

- A. Tillage conditions
- B. Sowing conditions
- C. Harvesting conditions
 - 1. Replacement of a crop by its own weeds
 - 2. Secondary uses follow primary use
- D. Conditions of fertilization
 - 1. Inbreeding replaces outbreeding
 - 2. Outbreeding replaces inbreeding
- E. Secondary changes

The Law of
 Comparable Series of Variants in
 Rather Closely Related Species
 (or The Law of Homologous Series)

1. Discovered by Vavilov and co-workers
 Published in 1922.
 Same thing was commented on by Darwin about 1870.
 Same thing was commented on by Walsh, 1863.

2. Example:
 Oat species all have: same seed color types
 hairy vs. glabrous glumes
 spring and winter types

Cotton Species:
 fiber colors - white, brown, green
 hairs, present or absent
 seed color
 leaf form

Diciduous trees:
 Appressed branching
 Poplars Maple
 Oak Linden

Wheat and rye have same kind of variants

Related genera also show parallel variation

Hulled and hulless oats, wheat, barley, corn, millet

Suggests monophyletic origin of plants.

This information helps the plant breeder by assuring him that if he searches he may find a needed variant if it has been observed in species related to the one he wishes to improve.

The definite regularity in plant life and animal life is what one would expect from the nature of the evolutionary process.