Vavilov's Centres of Origin

A centre of origin is a geographical area where a group of organisms, either domesticated or wild, first developed its distinctive properties. Centres of origin are also referred to as centres of diversity. The knowledge of crop plants is basic to genetics and plant breeding. This allows one to locate wild relatives, related species and new genes, especially dominant genes, which may provide resistance to diseases. Knowledge of the origin of crop plants is important in order to avoid genetic erosion or the loss of germplasm, due to the loss of ecotypes and landraces, loss of habitat and increased urbanisation.

Centres of origin may be of two types-

i) Primary centre of origin and ii) Secondary centre of origin.

The area where a crop has evolved from its wild species, showing maximum diversity is known as the primary centre of origin. In some areas, certain crop species show considerable diversity of forms, although they did not originate there. Such centres are called secondary centres of origin.

Nikolai Ivanovich Vavilov, a geneticist and plant breeder studied the domestication of plants in great depth. He directed his studies on the problems of cultivated plant species in terms of diversity within and between them, that could be put to practical use. Vavilov noted that the centres of origin of cultivated plants occurred mostly in mountainous regions between the tropic of Capricorn (23º) south of the equator and about 45º north of the equator, in the Old World. In the New World, crop domestication occurred between the tropics of Cancer and Capricorn approximately. In all the cases, agricultural origins and primitive diversity occurred in high and complex mountainous regions. Vavilov considered that as a rule, the primary foci of crop origins were in mountainous regions, characterised by the presence of dominant alleles. In his work entitled, "The Phytogeographical Basis for Plant Breeding" (1935), he summarised all his previous work on centres of origin and diversity. He stated that plants were not domesticated somewhere in the world at random, but there are specific regions where domestication started. A Vavilov centre is defined to be an original centre for the domestication of plants. Until today, Vavilov's centres are regions where a high diversity of a crop and its wild relatives can be found representing the natural relatives of domesticated crop plants.

The eight centres of origin / diversity of plants, as described by Vavilov, are as follows:

1. **The Chinese Centre**- This is the largest independent centre of origin, where about 138 different endemic plants were recognized. These included Italian millet, Japanese barnyard millet, soybean, sugarcane, opium, camphor, hemp, etc.
2. **The Indian Centre**- It has been further divided into two sub-centres:
    a. The Indo-Myanmar Centre, that includes about 117 plants, like rice, chickpea, mung bean, brinjal, cucumber, radish, yam, mango, orange, tamarind, sugarcane, coconut, safflower, sesame, cotton, jute, hemp, black pepper, sandalwood, bamboo, etc. and

b. The Indo- Malayan Centre, has about 55 plants like velvet bean, banana, pummelo, sugarcane, clove, nutmeg, black pepper, etc.

3. **The Inner Asiatic/ Central Asiatic Centre**- It includes about 43 plants, like common wheat, club wheat, peas, lentils, mung bean, mustard, hemp, cotton, onion, carrot, pear, almond, grape, apple, etc.
4. **Asia Minor/ Middle East Centre**- This centre includes about 83 plants like durum wheat, common wheat, oriental wheat, barley, rye, oats, alfalfa, fenugreek, figs, pomegranate, apple, pear, etc.
5. **The Mediterranean Centre**- This region includes about 84 plants including durum wheat, Polish wheat, Mediterranean oats, Egyptian clover, flax, black mustard, olive, cabbage, turnip, lettuce, asparagus, peppermint, thyme, etc.
6. **Ethiopian Centre**- This region includes about 38 plants like Abyssinian hard wheat, Polish wheat, barley, sorghum, pearl millet, flax, sesame, castor bean, garden cress, coffee, okra, etc.
7. **South Mexican and Central American Centre**- This region includes about 49 plants like maize, lima beans, gram, amaranth, pumpkin, chayote, Upland cotton, sweet potato, arrowroot, guava, pepper, papaya, cashew, cherry, tomato, etc.
8. **South American Centre**- This centre includes about 62 plants like potato, starchy maize, lima bean, common bean, tomato, gourd, cherry, pumpkin, Egyptian cotton, cocoa, guava, tobacco, strawberry, peanut, rubber tree, pineapple, Brazil nut, cashews, etc.

Limitations of Vavilov's work:

i. Vavilov considered the region with greatest genetic diversity of a species as the centre of origin of that species. But now many plants are known whose centres of diversity and places of maximum genetic diversity are different. E.g. maize and tomato.
ii. As per Vavilov, the centres of origin of cultivated plants are limited to the mountains and small hills of the tropical and subtropical regions. But recent evidence also suggests plains as the centre of origin of many cultivated plants.
iii. Today, many crops are known whose centres of origin have been found to be different from those suggested by Vavilov. Moreover, a particular crop may have more than one centre of origin. Also, the centres of origin of many species cannot be traced back due to lack of enough evidence.
iv. According to Vavilov, the primary centre of origin of a plant is marked by high frequency of dominant alleles towards the centre and recessive towards the periphery. But this view is not acceptable as per recent knowledge.