

VARIATION IN THE LIMA BEAN, "PHASEOLUS LIMENSIS"

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The climbing, twining lima bean, *Phaseolus limensis*, is regarded as native of tropical America where it is extensively grown. It is also grown in California as well as in many parts of the orient and Europe.

In the book entitled "Origin of Cultivated Plants", by Gray and Trumbull (1), mention of the lima is made only casually. In another work, "Nativity of the Bean" (2), it is again mentioned only casually, nothing is given regarding its origin or history. Carter (3) reports on early American descriptions of the lima bean. The bean was known to the American natives and has been occurring in at least 3 varieties on this continent: A large seeded variety from Peru; a small seeded variety from southeast and southwest United States, Mexico and Guatemala and a variety high in Cyanide from the Caribbean coast. In a 1951 translation of the work of Vavilov (4), as well as that of Stanford (5), a brief description is given of the lima bean. Stanford does discuss its economic importance very briefly.

In 1930, Miyake, Yashitoka and Kiyoo (6) reported some work on *Phaseolus vulgaris*. They reported having demonstrated that piebald seed markings are recessive to self color. They further postulated three modifiers affecting the piebald color. "Speckled" and "Mottled" types are said to be dominant over plain color. They also found a gene for "Cream" color to be linked with one for the mottled pattern with a recombination value of 2.6%. Two complementary genes, when recessive, produce cream or white seeds.

Lamprecht (7), 1931, also working with *P. vulgaris*, reported studies in which he proposed a basic gene, (P) for color with the two recessives (pp) producing white seeds. A (c) gene with (P) produces a "mottled" effect. Another gene (J) with (P) produces "raw-silk yellow". Whether these factors apply as well to limas has not been shown. In searching the literature of recent years one finds several references to studies regarding the bean composition in the nature of biochemical studies. Nothing, however, indicates that work of the genetics of color has been pursued in *limensis*. One title on the hemagglutinating inheritance has recently been published, Schertz and Jurgelsky, 1961, discuss the ratios derived from crosses of biochemical variants. When high and low agglutinating strains were crossed, results indicated that the high acts as a simple dominant factor.

In the fall of 1960, in a planting of some ordinary lima beans - *Phaseolus limensis*, secured at a local grocery store, there were collected among the mature pods, two pods, from one plant, with seeds showing a variegated pericarp, Figure 1. The seeds were saved for planting during the following spring.

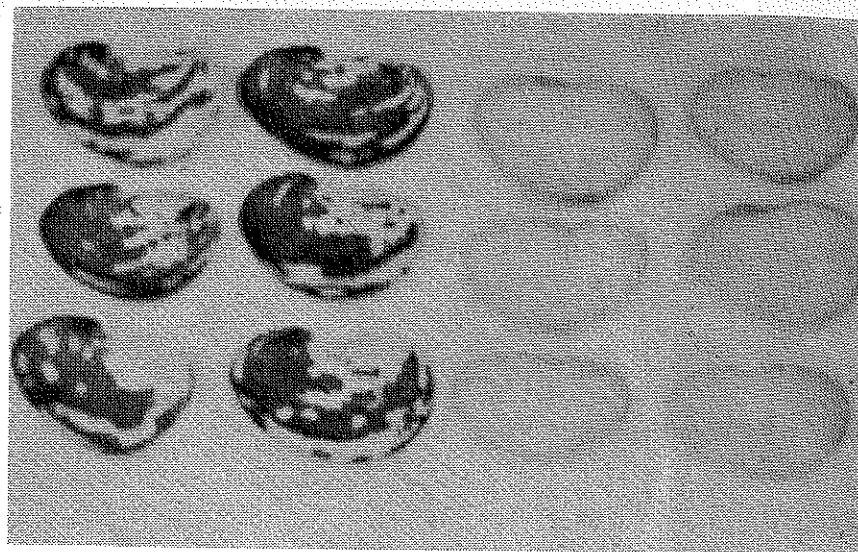


Figure 1. Lima beans showing the extent of variegation.

In 1961, the variegated seeds were planted. Due to climatic conditions only incompletely developed pods were harvested. There was no assurance that the variegated character was recovered since the seeds collected were immature and shrunken and there was only very little indication that they carried variegation.

In 1962, we had a very wet spring and again planting was delayed. Since lima beans require a long and warm growing season and since the abnormal seeds were planted toward the middle of June we did not expect much in the way of results. Plants developed from about 15 seeds. The seeds were only very moderately speckled. Out of these we again were able to harvest only 4 pods containing 11 relatively mature seeds since an early frost had killed most of the developing seeds. Again the variegated color in these seeds seemed to have appeared very late and was present only in very small dots within the pericarp.

In 1963, the 11 seeds were planted very early with continued hope of getting some mature seeds and an indication of the genetic

composition of the variants. Fortunately some mature seeds were produced although many of the late pods were still green and were frozen before maturing. The lima bean seems to continue to produce flowers and pods as long as the weather permits.

Five hundred thirty seeds were produced in 1963 that could be classified. Of these 268 were deeply variegated, 250 were "spotted" or mottled and 39 showed no coloration. In some of the "mottled" as few as only one very small pigmented spot can be noted. Perhaps those listed as having no color may be classified with the "spotted".

In order to make some genetic analyses of the color, further breeding will be necessary. It appears, however, that there may be a single factor for self color with modifiers that determine the extent and pattern of variegation and/or mottling. The "cream" or white may be due to complete suppression of pigment by at least two modifiers.

The main purpose of this report is to get the appearance of this mutated form on record.

REFERENCES

1. Gray, A. and Trumbull. Origin of Cultivated Plants.
2. Nativity of the Bean.
3. Carter, George F. An Early American. Chron. Bot. 12 (4/6) 155-160 (1948-1949).
4. Vavilov, N. I. Origin Variation, Immunity and Breeding of Cultivated Plants. Trans. by K. S. Chester. Chronica Botanica, Vol. 13: No.'s 1-6 (1951).
5. Stanford, E. E. Economic Plants. Appleton-Century Crafts. (1949).
6. Miyake, Kiichi, Yoshitaka Imai and Kiyoo Tabachi. Contributions to the Genetics of Phaseolus Vulgaris Journal Coll. Agriculture Imp. Univ. Tokyo. 11 (1) 1-20 (1930).
7. Lamprecht, Herbert. Bertrage zur Genetils von Phaseolus Vulgaris Zur Vererbung der Testafarbe Hereditas 16 (1/2): 169-211. (1931).
8. Schertz, K. E., and W. Jurgelsky. Inheritance of Anti A. hemglutinating Activity of Lima Beans.