6. The genetic basis of the absence of anthocyanin in the aleurone of indigenous races.

Brieger started several years ago a project of testing a large number of indigenous races for the genetic basis of "colorless aleurone," and especially for the absence of anthocyanin. Since it was found that direct crosses with genetic testers gave modified segregations, we used Brieger's method of randomizing modifiers in the analysis of Mexican races. The indigenous races, with strong modifier complexes for "colorless," were crossed with one deeply colored race (Negrito from northern Colombia, which has a strong modifier complex favoring pigment formation). The color in F_1 ears varied very much, with pronounced differences in reciprocal crosses owing to the dosage effects. The F_2 segregations gave approximately normal mendelian ratios owing to the randomization of the modifiers. The same was true for F_3 families and for the backcrosses to tester lines, but there remained frequently a pronounced dosage effect in the sense that heterozygotes, when simplex, showed the recessive phenotype.

From the 523 F_2 ears, from the F_3 ears, and the crosses with testers the following results were obtained: There are three recessive inhibitors involved. Practically all colorless races are of the constitution rr, and the frequency of the dominant gene R was less than 10%; at the C locus the frequency of the dominant C allele was about 50% as was that for the recessive inhibitor c. The dominant C^I allele very rarely occurred. The third inhibitor probably involved the A_1 locus with a frequency of 20% for recessive a1 and 80% for dominant A_1.

The F_2 families could be organized in groups, in accordance to the constitution of the Mexican races:

Group 1: races Harinoso de Ocho, Elotes Occidentales, Tuxpeño, and samples Coahuila 8, Carmen, and Capiten: One half (92) of the F_2 families gave a 9:7 ratio, and one quarter either a 3:1 or a 27:37 ratio. It can be assumed that the average constitution of these races was: rr Cc Aa, with the frequencies adjusted to those given above for the individual alleles.

Group 2: races Chapalote, Vandeño, Reventador and Cuba Amarillo: About two thirds (72) of the F_2 families gave a 9:7 ratio and the remaining one third (42) gave a 27:37 ratio. Thus the average constitution of the races was rr cc Aa.

Group 3, race Celaya: The relatively few F_2 families gave the following ratios: 7 (3:1) - 7 (9:7) - 15 (27:37) - 1 (1:3 or 3:13). Thus we must accept as the average constitution, as in group 1, the formula rr Cc Aa, with an occasional substitution of c by the dominant inhibitor.

Group 4, races Rabloncillo, Tehua, Tepecintle, Zapalote Grande, sub-race Perla and sample Guanajuato 61: There were 80 families with a 9:7 ratio, 102 with a 27:37 ratio and 20 with either a 1:3 or 3:13 ratio. The average constitution must thus have been the same as in group 2, with an occasional substitution of the recessive c inhibitor by its dominant inhibitor allele.

It could also be shown that all abnormalities observed can be attributed to dosage effects, which cause simplex heterozygotes to give the recessive (colorless) phenotype. For this purpose we first determined what should be in each case the results expected from a dosage effect, and then verified that these results were in fact observed: (a) The families segregating for the ratios 3:1 or 1:3 in all groups and 9:7 in groups 2 and 4 should give, and gave an asymmetrical distribution in the direction expected, i.e., in favor of high frequencies of colorless kernels in all but the 1:3 ratio, where the higher frequencies were in the colored kernel class. (b) The families with a 9:7 ratio in group 1 showed, besides the asymmetry in the direction of colorless kernels, also an excess of colored kernels in some ears, which were the result of dosage effect in ears which should have segregated in a 3:1 ratio but had their ratio considerably altered by dosage. (c) The ears of the 27:37 group showed a bimodal distribution, owing to the shift of ears of the 9:7 group and of the 27:37 ratio towards higher frequencies of colorless kernels.

No other exceptions were observed, and it may be stated that the frequency of contamination, and also of heterofertilization was very low.

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