ANOTHER CASE OF RECESSIVE INHERITANCE OF YELLOW COTYLEDON COLOR

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Seventy-two years ago 0. E. White reported a case of recessive inheritance of yellow cotyledon color (4). The variety 'Goldkonig' was a common parent in all the crosses that produced this unusual pattern of" inheritance; crosses in which Goldkonig was not a parent gave the typical ratio of 3 yellow to 1 green. To explain his findings, White postulated the interaction of three loci: Y G and I. (the latter is the still-accepted locus residing in chromosome 1). White's scheme did not go unchallenged, however. Wellensiek, for one, noted that because White proposed the universal presence of Y, the very existence of Y could not be demonstrated (3). A few years later E. Nilsson (2) reinvestigated the matter in depth and interpreted his own and White's results as an interac¬ tion of just two loci, I and O. The chlorophyll defect conferred by recessive o affects both the whole plant and the cotyledon, and the combination i o results in cotyledons that appear yellow rather than green, i.e. o is epistatic to i. Consequently, White's symbol Y was declared invalid and his symbol G was regarded as a synonym of O (l).

In 1977 I scored several field-grown F2 populations from crosses made for the purpose of studying flower color variation. The parents of these crosses were inbred lines derived from earlier crosses, the cotyledon color of the female and male being green and yellow, respectively. Seeds borne on F1 plants (i.e. F2 seed) were both yellow and green, with yellow predominating. Although flower color was of prime interest, the progenies were classified for several characters, including cotyledon color. Most of the F2 plants that segregated for cotyledon color showed the usual ratio of yellow to green, but in some plants there were more green seeds than yellow. Table 1A presents the number of yellow and green seeds observed in several of these exceptional F2 plants.

The distinction between yellow and green was very clear in most cases, but because the plants were grown in the field there was the possibility that the yellow seeds in the mixture of green and yellow resulted from bleaching or from some other cause. Another possible complication was the fact that the F2 populations exhibited partial sterility, only about a fourth of the total being fully fertile. Still, the seed yield of most plants was good.

Table 1. Distribution for cotyledon color in certain F_2 plants derived from an I x i cross and the progeny test results of selected F_2 seeds.

A. Number of seeds with green and yellow cotyledons in each of five different F_2 plants grown in the field.

F_2 plant number	Green	Yellow
B277-492-(27)	50	25
B277-495-(2)	39	13
B277-495-(20)	31	12
B277-501-(3)	95	15
B277-513-(9)	25	8

B. F3 progeny test results from growing ten green and five yellow seeds from each of the first four F_2 plants listed in A above.

Number of seeds with green or yellow cotyledons in 10 F3 plants derived from 10 F2 seeds with green cotyledons				Number of seeds with green or yellow cotyledons in 5 F3 plants derived from 5 F2 seeds with yellow cotyledons			
F, plant number	Green	Yellow	Total	F? plant number	Green	Yellow	Total
C377-198-(l)	21	0	21	C377-198-(ll)	10	3	13
(2)	22	0	22	(12)	17	6	2 3
(3)	17	0	17	(13)	20	7	27
(4)	22	0	22	(14)	13	3	16
(5)	26	0	26	(15)	19	3	22
(6)	33	0	33				
(7)	27	0	27				
(8)	20	0	20				
(9)	19	0	19				
(10)	21	0	21				
C377-199-(l)	17	0	17	C377-199-(ll)	20	2	22
(2)	27	0	27	(12)	16	4	20
(3)	28	0	28	(13)	3	22	25
(4)	22	0	22	(H)	19	6	25
(5)	21	0	21	(15)	24	8	32
(6)	21	0	21				
(7)	22	0	22				
(8)	36	0	36				
(9)	21	0	21				
(10)	32	0	32				
C377-200-(l)	21	0	21	C377-200-(ll)	18	1	19
(2)	16	0	16	(12)	18	2	20
(3)	18	0	18	(13)	19	1	20
(4)	13	0	13	(14)	17	9	26
(5)	26	0	26	(15)	18	1	19
(6)	24	0	24				
(7)	17	0	17				
(8)	19	0	19				
(9)	19	0	19				
(10)	19	0	19				
C377-201-(l)	28	0	28	C377-201-(ll)	8	13	21
(2)	21	0	21	(12)	12	5	17
(3)	19	0	19	(13)	16	5	21
(4)	29	0	29	(14)	14	3	17
(5)	22	0	22	(15)	16	5	21
(6)	22	0	22				
(7) .	23	0	23				
(8)	24	0	24				
(9)	26	0	26				
(10)	32	0	32				

Table IB presents the progeny test results from four F2 segregants exhibiting anomalous yellow/green ratios. In each case ten green and five yellow seeds were progeny tested in the greenhouse in the fall of 1977. The F3's showed little, if any, evidence of sterility and the yield per plant was typical and satisfactory for greenhouse plants grown under high density and was sufficient to determine their underlying genotype. Bleaching is not a problem under glasshouse conditions. Without exception, the ten green seeds progeny tested from each of four F2 plants bred true for green. It was the yellow seeds that segregated, but in general they produced more green than yellow seeds thus repeating the unusual segregation ratio resembling 3:1 or 13:3. However, in a few instances the distributions appear to be non-Mendelian. Although the data presented suggest that the green segregants do not segregate further, a few F3 segregants were advanced to the F4 and one such F3 with green cotyledons gave rise to an F4 with 12 green and 1 yellow. The yellow seed was not progeny tested.

The F3 progeny tests leave little doubt that the unusual green/yellow distribution In F2 was real and not due to seed bleaching. On the other hand, the distribution patterns in F2 and F3 do not appear to be attributable to a phenomenon like that found in Goldkonig, since, if that were the case, the yellow seeds would not expected to segregate further.

The observations presented here may represent a novel case of recessive yellow, one that might he worth pursuing further. To do justice to the study, however, a detailed and possibly lengthy investigation would be required. Whether the partial sterility or poor seed set found in the F2 populations is relevant to the outcome, whether gamete elimination, genotypic instability, or some other factor may account for the observations remains to be determined. Remnant seeds of the progeny tested fa's and the progeny tested F3's themselves are still available should someone wish to investigate the matter further.

1. Blixt, S. 1977. PNL Supplement 9:2-59.
2. Nilsson, K. 1929. Hereditas 12: 17-32.
3. Wellensiek, S. I. I925. Genetic monograph on Pisum. Bibliographia Genetica 2:343-476.
4. White, 0. E. 1916. Amer. Naturalist 50:530-547.

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