NOTES AND COMMENTS

RECOMBINATION VALUE FOR GENES *E* AND *M* IN POTATOES

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In the cultivated tetraploid potato, *Solanum tuberosum* L., white-splashed-pink periderm is determined by a basic gene *D* for tuber-skin pigmentation, a gene *E* for pink anthocyanin production in the periderm, and a gene *M* which restricts pigment production to areas around the eyes and which is closely linked to *E* (Howard, 1959). A further gene, *P*, changes pink into purple. Some of the large numbers of seedlings grown each year at this Institute have been used to determine the frequency of recombination between *E* and *M* (tables 1 and 2).

The data have been divided into seven categories: (1) a large family from virus-free King Edward (white-splashed-pink) × Cl. 650 (white tubers, purple sprouts); (2) a large family from virus-free King Edward × Maris Piper (white tubers, pink sprouts); (3) a number of small families from paracrinkle-infected King Edward × various male parents (all with white tubers); (4) a number of small families from Y30/8, V27A and V27B (clones with white-splashed-purple tubers bred from King Edward, see Howard, 1962) × Ulster Knight (white tubers); (5) various clones with white tubers as female parents × J26 (a pollen-fertile clone with white-splashed-pink tubers bred by Mr J. Clarke, the breeder of the Ulster series of varieties); (6) a cross with J26 as female parent with Ulster Knight; and (7) a number of crosses of Red King (a periclinal chimera in which L_1 is full pigment and L_2 is unchanged King Edward—see Howard, 1959) × various male parents with white tubers.

The summary of results in table 2 suggest that category 5, various female parents × J26, and category 7, Red King × various male parents, differ from the others. The results for the Red King crosses can be easily explained. It is known from work with other plants—Blakeslee, Satina and Avery (1946) for *Datura* (like potato a member of the Solanaceae) and in several other genera, references in Bergann (1962)—that occasional embryo-sac mother cells may be derived from L_1 and not, as is usual, from L_2. Thus it might be expected that the seedlings with full coloured tubers in the Red King crosses would originate both from crossovers between *E* and *M* and from occasional embryo-sac mother cells derived from L_1 which is already *E* and not *EM* (Howard, 1959).

The results for J26 suggest that there is more crossing-over between genes *E* and *M* in embryo-sac mother cells than in pollen-mother cells. Using the value of recombination of 0·57 per cent. obtained from the two large King Edward families (categories 1+2), then there is a significant deficiency of seedlings with full coloured tubers when J26 is the male parent

TABLE 1

Segregations for seedlings with white, splashed purple, splashed pink, full purple and full pink tubers

	Family No.	Female parent[1]	Male parent[1]	No. of seedlings with tubers				
				white	splashed		full	
					purple	pink	purple	pink
1	L1	K. Edward (virus-free) . .	Cl. 650	4633	1809	1744	6	10
2	L2	K. Edward (virus-free) . .	Maris Piper	2399	....	2002	...	16
3	M47	K. Edward (paracrinkle infected) .	V49/10	16	...	11	...	0
	M48	K. Edward (paracrinkle infected) .	V60/7	26	...	23	...	0
	M92	K. Edward (paracrinkle infected) .	U. Knight	63	...	52	...	1
	R22	K. Edward (paracrinkle infected) .	Cl. 650	100	53	46	0	1
			Total (3)	205	53	130	0	2
4	S112	Y30/8	U. Knight	140	60	57	0	1
	Q59	Y30/8	U. Knight	168	68	59	0	0
	Q60	Y30/8	U. Knight	40	15	10	1	0
	Q85b	Y30/8	U. Knight	145	76	64	2	1
	Q55	V27A	U. Knight	21	10	10	0	0
	Q56	V27B	U. Knight	68	37	32	0	1
	Q57	V27B	U. Knight	12	6	6	0	0
	Q58	Y30/8 (pink)	U. Knight	75	...	54	...	1
	Q85a	Y30/8 (pink)	U. Knight	70	...	54	...	1
			Total (4)	739	272	346	3	5
5	M3	R17/2	J26	220	...	225	...	0
	M53	R16/1	J26	128	...	190	...	1
	M56	R17/4	J26	188	...	134	...	0
	M59	R25/1	J26	36	...	26	...	0
	M61	W46/1	J26	148	...	95	...	0
	M69	V49/10	J26	178	...	83	...	1
	M73	T58/1	J26	271	...	170	...	0
	N9	S113/10	J26	445	...	345	...	0
	N17	Majestic	J26	353	...	289	...	1
	N38	Majestic	J26	298	...	272	...	0
	N35	T58/3	J26	696	249	234	1	0
			Total (5)	2931	249	2063	1	3
6	N37	J26	U. Knight	667	...	511	...	3
7	R23	Red King	Cl. 650	100	36	39	1	3
	Q61	Red King	Cl. 650	2140	856	918	20	26
	R25	Red King	U. Knight	93	...	63	...	4
	Q62	Red King	Seneca	191	...	177	...	5
	Q64	Red King	U. Beacon	92	...	64	...	5
	M101	Red King	Seneca	32	...	30	...	2
	S29	Red King	U. Knight	51	...	35	...	2
			Total (7)	2699	892	1326	21	47

[1] White, splashed pink tubers—K. Edward, J26 and pink Y30/8.
Periclinal chimera—Red King.
White, splashed purple tubers, Y30/8, V27A and V27B.
White tubers, purple sprouts—Cl. 650 and T58/3.
White tubers, pink sprouts—remainder of parents.

in crosses. The direct comparison of J26 as male and female parent cannot be made by the short χ^2 test because of the low numbers of seedlings with full coloured tubers. The chance of getting more than two seedlings with full coloured tubers in the cross J26 × Ulster Knight has, however, a probability of less than 0·02 if the cross-over value is 0·17 per cent. as found in the crosses with J26 as male parent. Crossing-over between *E* and *M* in pollen mother cells may therefore be less frequent than in embryo-sac mother cells.

TABLE 2

Summary of table 1 for frequencies of seedlings with splashed and full coloured tubers

	Female parent	Male parent	No. of seedlings with tubers		Per cent. full colour/total with pigment
			splashed	full colour	
1	K. Edward (virus-free) . .	Cl. 650	3553	16	0·45
2	K. Edward (virus-free) . .	Maris Piper	2002	16	0·80
3	K. Edward (paracrinkle infected) .	Various	183	2	1·09
4	Y30/8, V27A and V27B . .	U. Knight	618	8	1·28
5	Various	J26	2312	4	0·17
6	J26	U. Knight	511	3	0·58
7	Red King	Various	2218	68	2·98

(*a*) Categories 1 *v.* 2—total splashed 5555; total full colour, 32; per cent. full colour/total with pigment, 0·57. $\chi^2 = 2{\cdot}81$; $n = 1$; $0{\cdot}10 > P > 0{\cdot}05$.

(*b*) Categories 1 + 2 *v.* category 7. $\chi^2 = 111$; $n = 1$; $0{\cdot}001 > P$.

(*c*) Categories 1 + 2 *v.* category 5. $\chi^2 = 5{\cdot}91$; $n = 1$; $0{\cdot}02 > P > 0{\cdot}01$.

1. SUMMARY

1. The recombination value for genes *E* and *M* in embryo-sac mother cells is estimated to be about 0·57 per cent.

2. In the periclinal chimera Red King about 2 per cent. of embryo-sac mother cells trace back to layer L_1 at the growing point.

3. Crossing-over between *E* and *M* may be less frequent in pollen mother cells than in embryo-sac mother cells.

2. REFERENCES

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