5. Summary

1. A spontaneous chlorophyll mutation isolated in hexaploid wheat involves intragenic change at one locus. The mutant allele is partially dominant to normal such that homozygotes are yellow and heterozygotes are light green.

2. Thin layer chromatography of leaf pigments did not reveal any qualitative differences between mutant and normal.

3. Quantitative analysis showed that chlorophylls, and to a less extent carotenoids, are reduced in the mutant.

4. As chlorophyll *b* was reduced more than chlorophyll *a* the ratio of chlorophyll *a* : *b* was increased above that of normal.

5. Quantities of chlorophylls and carotenoids vary with maturity of the leaf and with the environment.

Acknowledgments.—We are indebted to Dr Shirley W. Jeffrey, C.S.I.R.O., Division of Fisheries and Oceanography, for her advice and for details of the thin layer technique prior to publication.

One of us (R.P.) held a Reserve Bank of Australia Scholarship while carrying out this research.

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GENETICS OF SPECTACLE IN DIPLOID POTATOES

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Received 20.ii.69

1. Introduction

The spectacle character in potatoes is a failure of pigmentation in sharply delimited patches around the eyes of tubers; the shape of the patches varies from oval to transversely streak-like. Dodds and Paxman (1962) showed

that, in the cultivated diploids ($2n = 24$), spectacle is controlled by heterozygosity at the *I* locus in a tuber which carries basic pigmentation genes: *II* and *Ii* are self-coloured; Ii^{sp} is spectacle; all combinations of *i* and i^{sp} are white.

2. Results

Results are summarised in table 1. They extend the results of Dodds and Paxman and confirm their interpretation of spectacle as the heterozygote Ii^{sp} (entries 1-6 in the table). The families 62/72 and 73 (entry 7), however, show that clone C.P.C. 2749 bred as a spectacle though classified phenotypically as self-coloured and this was confirmed by family 63/85, a test-cross

Table 1

Spectacle segregations in diploid potatoes

Families*	Parental		Observed: self col'd	Observed: spectacle	Observed: white	Ratio	χ^2 [d.f.]
1. 63/3	whi × s.c.	$i^{sp}i^{sp} \times II$	0	44	0	—	—
2. 62/53, 54	*spt* × *spt* and recip.	$Ii^{sp} \times Ii^{sp}$	38	89	55	1 : 2 : 1	—
3. 63/4	*spt* × *spt*	$Ii^{sp} \times Ii^{sp}$	10	18	11	1 : 2 : 1	—
4. 64/59	*spt* × *spt*	$Ii^{sp} \times Ii^{sp}$	8	14	8	1 : 2 : 1	—
5. 64/60	*spt* × *spt*	$Ii^{sp} \times Ii^{sp}$	8	14	8	1 : 2 : 1	—
	Totals, 2-5		64	135	82	1 : 2 : 1	dev. 2·74[1] het. 1·07[3]
6. 62/68, 69	1081 × 2211 and recip.	*spt* × s.c. $Ii^{sp} \times II$	21	19	0	1 : 1 : 0	0·10[1]
7. 62/72, 73	1082 × 2749 and recip.	*spt* × ?*spt*† $Ii^{sp} \times Ii^{sp}$	12	23	4	1 : 2 : 1	4·54[2]
8. 62/74, 75 and 64/61	1082 × 1674 and recip.	*spt* × whi. $Ii^{sp} \times ii^{sp}$	18	3	41	1 : 1 : 2	13·71[2]§
9. 63/85	2211 × 2749	s.c. × ?*spt*† $II \times Ii^{sp}$	36	6	0	1 : 1 : 0	21·43[1]§
10. 64/237 etc.	63/85 backcrosses 18 families	s.c. × s.c. $II \times II$	314	0	(27)‡	—	—
11. 64/254 etc.	63/85 backcrosses 6 families	*spt* × s.c. $Ii^{sp} \times II$	84	65	0	1 : 1 : 0	dev. 2·42[1] het. 13·54[5]§

* Entries 1-5 are based on families raised in a dormancy selection experiment, of unknown ultimate parentage (Simmonds, 1964). Entries 6-11 are based on C.P.C. clones 1082, 2211 etc.

† C.P.C. 2749 phenotypically self-coloured—see text.

‡ Classified with some doubt: presumably very weak self-coloured.

§ Significant at 5 per cent. level or beyond. In the last line, heterogeneity due to three families, two tending to excess self-coloured, one to excess spectacle.

to C.P.C.2211, a clone known to be *II*. In this family there was a marked deficiency of spectacles, suggesting that some of the self-coloured progeny were perhaps also genotypically spectacled. This was not so however, as shown by backcrosses to C.P.C. 2211 (entries 10 and 11): spectacle progeny bred as spectacles (though with some disturbed ratios) and self-coloured progeny bred as such. The latter produced some anomalous white and

blotchy segregates but no convincing spectacles. The clone C.P.C. 2749 no longer exists so it is not possible to check its phenotype or perform further breeding tests. Whatever the cause of the discrepancy between its appearance and breeding behaviour, its progeny behave more or less normally.

Although C.P.C. 2749 is the only proven example of a non-spectacle clone that breeds as a spectacle, the collected data suggest that the behaviour may be quite frequent (table 2). Thus, after eliminating 2749 and its progeny, 14 families are recorded in Dodds and Paxman (1962) and in the present work and they collectively show significant and rather consistent deficiencies of spectacles. Of the 14 families 13 are deficient but only two significantly so when considered individually. If the deviations are supposed to be due wholly to misclassification, then it appears (last line of table 2) that some 8-25 per cent. of genetically spectacled individuals may not express the character. The allele i^{sp} therefore generally gives heterozygous expression in combination with *I* but is sometimes recessive to it, this variability reflecting presumably variability of the genetic background.

TABLE 2

Deficiency of spectacles in diploid potatoes

	Expectation of *Spt*	
	50%	25%
Families	9	5
Spt per cent., observed	46·2	18·9
Ratio, *spt* : not	320 : 372	83 : 357
χ^2 dev., *p*	3·91[1], 5%	8·84[1], 1%
χ^2 het., *p*	2·62[8], 95%	8·99[4], 5-10%
Spt misclassified per cent.	7·5	24·6

The material was watched for signs of the somatic segregation behaviour of spectacle known in the tetraploid potatoes (Simmonds, 1965). In particular there was obvious reason to suspect that C.P.C. 2749 might have been a " suppressed spectacle ". This cannot be directly tested but the vegetative constancy and breeding behaviour of its progeny make it very unlikely. All the many potatoes examined in these studies were phenotypically constant within plants and between vegetative generations. There is therefore yet no evidence that spectacles in diploid potatoes are other than constant in somatic expression. This supports Howard's (1967) conclusion that variability of spectacle expression depends upon the presence of the gene *M*, so far known only in the tetraploid potatoes. In the diploids, patterns that resemble the effect of *M* occur but are rare and yet uninvestigated.

Formally, the results agree with the idea that spectacle is determined by the heterozygote, Ii^{sp}, acting on a pigmented (*R* or *P*) background. The allele *I* is concerned with pigment production in the absence of light, whereas i^{sp} inhibits pigmentation around axillary meristems whether in light (stems) or in dark (tubers). Thus a different physiological basis of activity is implied and this in turn implies the action of a different locus. On this basis *I* might be expected to be a compound locus such that, for example: $I = Isp$, $i^{sp} = iSp$ and $i = isp$. The double dominant *ISp* has not been detected but the spectacle character is uncommon (Dodds and Paxman, 1962), few zygotes

have been tested and no systematic search for recombinants has been made. On this interpretation, *Sp* might turn out to belong either to *B* or *F* since Dodds and Long (1956) showed that *BIF* were closely linked in that order. The *B* and *F* loci are both concerned with pigment distribution and it has been shown that there is a *BI* position effect (Dodds, 1955).

3. Summary

1. The spectacle pattern is a white patch round each eye of an otherwise pigmented potato tuber. Genetically it is the heterozygote Ii^{sp}, *II* being self-coloured and $i^{sp}i^{sp}$ white.

2. One self-coloured heterozygote has been detected and a rather consistent deficiency of spectacles in several families suggest that they may be fairly frequent (in the range 8-25 per cent. of heterozygotes).

3. Speculatively, it seems likely that i^{sp} is compound.

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A CHROMOSOMAL CHIMERA IN A PLANT OF *LILIUM CALLOSUM* WITH A COMPLEX TRANSLOCATION*

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Received 10.iii.69

1. Introduction

A chromosomal mutation in a somatic cell of a higher plant produces a cell-lineage of altered chromosomes, resulting in a chromosomal chimera (*c.f.* Swanson, 1957). Making use of chromosomal chimeras induced by X-ray, Brumfield (1943) determined the number of initial cells of the terminal meristem of roots to be three in *Crepis capillaris* and in *Vicia faba*. Davidson (1961) induced chromosomal chimeras in the meristem of regenerating roots of *Vicia faba* following X-irradiation and colchicine treatment, and estimated that the primordium of the root meristem was composed of 40-50 cells. In

* Contributions from the Department of Biology, Faculty of Science, Kyushu University, No. 171.