

### Tests of seemingly colored derivatives of r-cu

What appear to be fully colored kernels are observed in plants segregating for r-cu. From a cross of the type r-cu/r-r, Fcu/+ x r-g/r-g fully colored kernels were collected and the plants tested with a W22 r-g/r-g stock. Twelve ears were obtained, all of which showed the presence of r-cu as revealed by its variable expression (MGNL 48:66-68). Furthermore, five of the ears segregated variegated kernels, indicating the presence of Fcu. No mottled kernels were observed in reciprocal crosses, a characteristic of r-cu.

Tests of 29 other apparently colored derivatives from crosses with another r tester (r/r, wx/wx) showed that the behavior of r-cu was unchanged, producing a continuous range of phenotypes from near colorless to dark dilutes and again what seem to be fully colored derivatives.

These apparent full-color derivatives arising in r-cu crosses are, therefore, a phenotypic extreme of the widely ranging expressiveness of r-cu.

Jaime Gonella and Peter A. Peterson

### The nature of En-induced germinal derivatives of mutable alleles in maize: Characterization of colored, pale and colorless derivatives of a2-m

Controlling element systems in maize such as Ac-Ds and En-I initiate mutation events at diverse loci. The resultant phenotypic changes include widely diverse levels of genic expression from completely null (non-functional) to fully functional alleles. These are induced by the initial insertion of regulatory elements such as Ac or En (or Spm) at the designated locus or their respective controlling element Ds or I. Within the En controlling-element system there are a large number of independently induced mutable alleles at the A, A2 and C loci, each originating from the dominant fully functional allele. Some of these alleles, in turn, give rise to several phenotypically diverse derivatives. A wide assortment of such derivatives with varied phenotypic expression (from null to full colored aleurone) arose at several mutable a2 loci under the control of En system. The present study reports the characterization of colored, pale and colorless derivatives of four different a2 mutable alleles: a2-m78018, a2-m68144, a2-m68140 and a2-m11511.

Isolation of derivatives: The colored derivatives of a2-m78018 (coarse type mutability) were originally isolated from the following testcross of a mutable allele: a2-m(coarse) Bt/a2-m(pale) Bt x a2 bt/a2 bt. In a typical set of nine testcrosses, the frequencies varied from 1 to 9% of total Bt kernels. Plants grown from these were crossed by a2-m(r) Bt/a2-m(r) Bt, an En tester, to identify the En content. All the colored derivatives were found to contain one or more En, indicating that these are non-responsive types (nr). All these derivatives are maintained in a uniform genetic background: W22-Colored converted, homozygous for all anthocyanin controlling genes, C, C2, R, A, A2, Bz, Bz2 and pr (hereafter identified as W22-Col).

Pale derivatives of a2-m68144 (pattern type: very fine, clear dots with medium high frequency) were originally isolated from the following type of testcrosses: a2-m(v.v.f.cl.m.hi) Bt/a2 bt x a2 bt/a2 bt. Several plants were grown from these pale kernels and recurrently crossed for two generations to W22-Col. Pale kernels were finally selected from the selfed ears, W22-Col/pale (X). The isolation and characterization of pales of a2-m11511 were described previously (Peterson, Genetics, 1966; Fowler and Peterson, Genetics, 1974). Quantitative determination of anthocyanin content: Replicate samples of kernels of the desired genotype were collected from segregating ears and their relative anthocyanin content was determined by quantitative analysis (Table 1).

Several possible conclusions can be drawn from the statistical analysis of the data: 1) significant differences exist between colored derivatives in terms of the anthocyanin content of the aleurone; 2) there can be significant differences between colored derivatives arising from the same source, indicating that the original allele does not represent a predetermined potential; 3) colored derivatives

Table 1. Quantitative determination of anthocyanin pigments from colored, pale and colorless derivatives of different a2 mutable alleles.

Pedigree	Phenotype	Mean O.D.	% control	Origin
B 2561/sib	Colored	0.588	100.00	W22-Col (control)
4 4409-4/2335	Colored	0.375	67.24	<u>a2-m78018</u>
4 4409-1/2335	Colored	0.493	84.40	<u>a2-m78018</u>
4 4409-1/2335	Colorless	0.005	0.85	<u>a2-m78018</u>
4 4415-1/2340	Colored	0.373	63.79	<u>a2-m78018</u>
4 4415-1/2340	Colorless	0.005	0.85	<u>a2-m78018</u>
4 4474-4/2347	Colored	0.478	82.75	<u>a2-m78018</u>
4 4417-4/2347	Colorless	0.005	0.85	<u>a2-m78018</u>
308-78-7A (x)	Pale	0.0715	12.00	<u>a2-m68144</u>
4 3048 (x)	Pale	0.0445	6.80	<u>a2-m68140</u>
4 3048 (x)	Colored	0.435	74.13	<u>a2-m68140</u>
4 3036 (x)	Pale	0.0265	5.17	<u>a2-m68140</u>
4 3049 (x)	Colored	0.403	68.96	<u>a2-m68140</u>
8 3825 (x)	Pale	0.075	11.20	<u>a2-m11511</u>

arising from one source allele can be significantly different from the derivatives of other alleles, indicating that the processes involved in the origin of such derivatives may not be identical; 4) every colored derivative included in this study is significantly different from pale, colorless and colored control; thus, it can be concluded that all these colored derivatives represent a differential impairment of anthocyanin synthesis in the aleurone of kernels.

Similarly the pales, which are distinctly different from the colored and colorless types, also show significant differences in anthocyanin content. Also, significant differences exist between pales originating from the same source as well as pales originating from different sources. All the tested pales are significantly different from colorless and colored types. Again, these intermediate allelic types represent a higher degree of impairment of anthocyanin production, since these accumulate relatively low quantities of anthocyanins in the aleurone tissue (as little as 6 to 13% of control). Absolutely no anthocyanin pigments were present in the aleurone of colorless derivatives.

Qualitative analysis: Qualitative differences among the colored, pale and colorless types have been investigated by thin layer chromatography and spectroscopic techniques. The results suggest that there are no qualitative differences in terms of anthocyanin pigments between colored, pale and colored control. All of them accumulate the same anthocyanin pigments, namely cyanidin-3-glucoside and pelargonidin-3-glucoside in appropriate proportions depending on Pr and pr constitution.

Arjula R. Reddy and Peter A. Peterson

#### Pattern differentiation of mutable c alleles; a second factor conditioning pattern type

In the En controlling-element system, there are a large number of independently originated mutable c alleles with widely varied spotting patterns of aleurone, ranging from coarse to very finely spotted type. Some of these mutable alleles, for example, c-m55301, c-m55398, c-m55453 and c-m55351, express two distinct patterns: (a) coarse and (b) fine type in testcrosses (c-m Sh Wx/c sh wx x c sh wx/c sh wx).

Each of the pattern types was tested. When the plants grown from the coarse kernels of the above cross were testcrossed (c-m sh wx/c sh wx x c sh wx/c sh wx) only coarse types appeared in the progeny (Table I). In tests of fine type kernels (c-m Sh Wx/c sh wx x c sh wx/c sh wx) both coarse and fine kernels were