

# Fruit Color Inheritance in a Cross of a Dark-Colored Accession with a Light-Colored Accession in *Cucurbita pepo*

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Thirteen loci, some of them multiple-allelic, have been identified as affecting fruit exterior color in *Cucurbita pepo* L. (2). Three major loci are *D* (Dark stem), *l-1* (light coloration-1), and *l-2* (light coloration-2) (5). These three loci were identified in a cross of 'Fordhook Zucchini' (*C. pepo* subsp. *pepo* Zucchini Group), which has intense-colored fruits and dark stems, with 'Vegetable Spaghetti' (*C. pepo* subsp. *pepo* Vegetable Marrow Group), which has light-colored fruits and light stems. 'Fordhook Zucchini' possesses genotype *D/D L-1/L-1 L-2/L-2* whilst 'Vegetable Spaghetti' possesses genotype *d/d l-1/l-1 l-2/l-2*.

The complementary dominant *L-1* and *L-2* alleles cause the fruit to be intense, dark-colored from anthesis through maturity. When either or both is homozygous recessive, the fruits are lightly colored. During the first week past anthesis, it is difficult to distinguish *L-1/- l-2/l-2*, *l-1/l-1 L-2/-*, and *l-1/l-1 l-2/l-2* genotypes phenotypically. Afterwards, each genotype develops a characteristic pattern that allows it to be distinguished clearly from the others. These have been designated 'Light type 1', 'Light type 2', and 'Plain light', respectively (1,5).

The *D* gene has almost no effect on the fruits during the first week after anthesis. The dominant *D* allele causes the fruits to darken during the second and third weeks after anthesis, with recessive *d/d* having no effect. The darkening caused by the dominant allele occurs independently of the allelic state of the *l-1* and *l-2* genes and masks their effect, that is, *D* is epistatic to *l-1* and *l-2* (5).

A fourth locus is *pl* (plain light). This gene is of relatively minor effect, determining whether or not the 'Light type 1' phenotype is expressed (1). Plants of genotype *d/d L-1/- l-2/l-2 Pl/-* exhibit the 'Light type 1' fruit phenotype whilst those of genotype *d/d L-1/- l-2/l-2 pl/pl* exhibit the 'Plain light' fruit phenotype.

'True French' (*C. pepo* subsp. *pepo* Zucchini Group) has intense exterior fruit color throughout development but has light stems. An inbred of 'True French' was crossed with an inbred of 'Beirut' (*C. pepo* subsp. *pepo* Vegetable Marrow Group) in order to determine the allelic state of 'True French' in regard to these four genes. 'Beirut' has 'Plain light' fruit color phenotype; its genotype is *d/d l-1<sup>ist</sup>/l-1<sup>ist</sup> l-2/l-2 pl/pl* (3), that is, it carries the *l-1<sup>ist</sup>* allele for irregular striping, but striping is not expressed because both, *l-2* and *pl* are homozygous recessive (1). The source of the original seed stock of 'True French' was as described previously (4). Seeds of the original seed stock of 'Beirut' were kindly provided by Hazera' Seeds (Berurim, Israel). Seeds of parental, filial and backcross generations were sown in the field at Newe Ya'ar. Most of the data are from the spring-summer and summer-fall seasons of 2002, with supplemental data from previous spring-summer seasons.

None of the parental-, filial-, and backcross-generation plants of either cross had dark stems. Therefore, 'True French' does indeed possess genotype *d/d*.

All *F*<sub>1</sub> plants and all plants of the backcross to 'True French' bore intense-colored fruits. This was true when the fruits were young as well as when they attained intermediate age (Table 1). Thus, intense coloration is dominant to light coloration. The young fruits segregated to intense-colored and light-colored in accordance with a 9:7 ratio in the *F*<sub>2</sub> and a 1:3 ratio in the backcross ( $\chi^2=0.053$ ,  $P=0.81$  and  $\chi^2=0.476$ ,  $P=0.48$ , respectively), as expected for two complementary dominant genes conferring intense coloration of young fruits. Therefore, 'True French' possesses genotype *L-1/L-1 L-2/L-2*.

Both the *F*<sub>2</sub> and the backcross to 'Beirut' segregated to three phenotypes of intermediate-age fruits. The fruits that had been of intense color when young remained so. The light-colored fruits developed into one of two light-colored phenotypes—'Light type 2'

Table 1. Intermediate-age fruit color in the cross of ‘True French’ and ‘Beirut’ (*d/d l-1/l-1 l-2/l-2*).

Generation & Description	Number of plants					Expected ratio	$\chi^2$	<i>P</i>
	Total	Dark	Light type 1	Light type 2*	Plain light			
P <sub>1</sub> , True French	48	48	0	0	0	—	—	—
P <sub>2</sub> , Beirut	42	0	0	0	42	—	—	—
F <sub>1</sub> , P <sub>1</sub> × P <sub>2</sub>	10	10	0	0	0	—	—	—
F <sub>1</sub> , P <sub>2</sub> × P <sub>1</sub>	48	48	0	0	0	—	—	—
F <sub>2</sub> , (P <sub>1</sub> × P <sub>2</sub> ) ⊗	101	61	0	21	19	9:3:4	2.130	0.35
F <sub>2</sub> , (P <sub>2</sub> × P <sub>1</sub> ) ⊗	101	51	0	23	27	9:3:4	1.588	0.45
F <sub>2</sub> , Total	202	112	0	44	46	9:3:4	1.415	0.48
BC <sub>1</sub> , P <sub>1</sub> × F <sub>1</sub>	33	33	0	0	0	—	—	—
BC <sub>1</sub> , P <sub>2</sub> × F <sub>1</sub>	280	75	0	70	135	1:1:2	0.536	0.76

\*includes ‘Light type 2’ and irregular-striped (3) individuals

(with or without irregular stripes) (3) and ‘Plain light’—by intermediate age; no ‘Light type 1’ individuals were observed. The three fruit-color phenotypes segregated in accordance with a 9:3:4 ratio in the F<sub>2</sub> and a 1:1:2 ratio in the backcross (Table 1). The lack of individuals of ‘Light type 1’ phenotype indicates that ‘True French’ possesses genotype *pl/pl*. For the four loci, the genotype of ‘True French’ is therefore *d/d L-1/L-1 L-2/L-2 pl/pl*.

**Acknowledgement:** Contribution No. 111/2003 from the Institute of Field & Garden Crops, Agricultural Research Organization, Bet Dagan, Israel.

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