

TESTA ANTHOCYANINS IN PISUM

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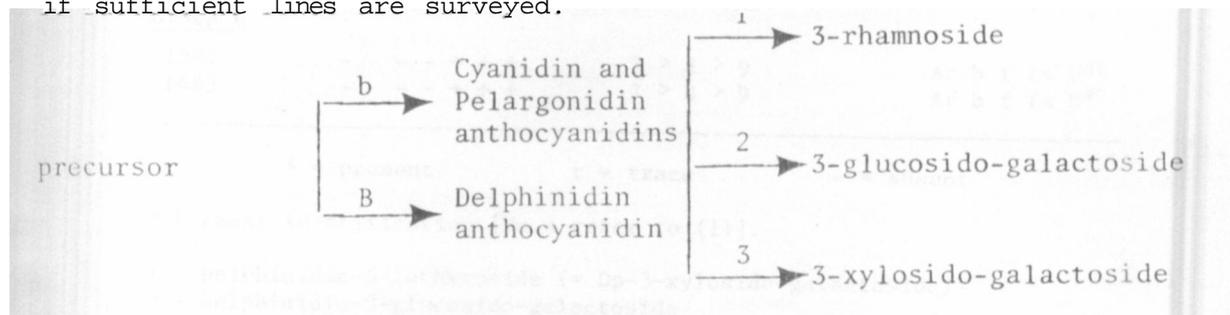
An earlier study of testa pigmentation in the Weibullsholm pea collection (1) showed the occurrence of possibly nine anthocyanins. Although only two pigments were fully identified at this time it was clear that the *b* locus determined a qualitative difference in pigmentation: *b* plants were characterized by the presence of delphinidin derivatives and *B* plants by the absence of delphinidin and the presence of cyanidin derivatives. The results also indicated a quantitative relationship between certain genes and anthocyanin production. No anthocyanins were detected in the absence of gene *A*.

Six of the nine pigments have now been identified. Pigments 3 and 7 [numbered as in (1)] proved to be identical. The status of pigments 4 and 5 is unclear, but they are probably artifacts which arise sporadically during the extraction process.

Testas of lines shown to be rich in specific anthocyanins or particular mixtures of pigments were extracted in quantity, and the anthocyanins isolated and purified using procedures described by Jarman and Crowden (2). Structural determinations were then made on the rigorously purified pigments using the standard procedures outlined by Harborne (3).

The identity of the pigments and their distribution in lines used for this work are given in Table 1. Whereas various gene combinations involving *F*, *Fs*, *U⁺*, and *U* were seen to promote high anthocyanin production (1), these genes appear to bear no relationship to the distribution of pigments among the different lines. Six distinct groupings emerge based on pigment variation. Five groups (all *B*) contain delphinidin anthocyanins (supplemented by occasional trace amounts of cyanidin). Differentiation between these groups is based on glycoside variation. The sixth group (*b*) contains cyanidin and pelargonidin anthocyanins, and relates directly to group 5 in terms of glycosidation pattern.

These data suggest that at least three loci are involved in the glycosidation biochemistry of anthocyanins in *Pisum* seed coats, corresponding to the steps numbered 1, 2, and 3 in the likely biochemical reaction sequence shown in the diagram. The data are not inconsistent with the supposition that *Ar* controls step 3 (formation of lathyroside). However, with such meager data the apparent relationship could easily be fortuitous and the true nature of the genetic control must await the accumulation of breeding data. On the basis of the present results we might expect to find *b* plants with Cyanidin-3-rhamnoside and probably nine groups in both *B* and *b* plants if sufficient lines are surveyed.



(1) Crowden, R. K. 1978. PNL 10:5-8.

(2) Jarman, S. J. and Crowden, R. K. 1973. *Phytochemistry* 12:171-173.

(3) Harborne, J. B. 1966. *Comparative Biochemistry of Flavonoids*. Academic Press, New York.

TABLE 1. Variation in testa pigmentation amongst 23 Weibullsholm pea lines.

Line No.	Pigment*									Pigment Proportion	Genotype
	6	1	2	3	7	8	9				
Group 1											
1327	+	-	-	-	-	-	-	-	-		ar B f fs u
1391	+	-	-	-	-	-	-	-	-		ar B f fs u
Group 2											
1384	+	+	-	-	-	-	-	-	-	1 > 6	Ar B f fs U st
Group 3											
1445	+	+	+	t	-	-	-	-	-	1 > 2 > 6 > 3	Ar B f fs U
1570	+	+	+	-	-	-	-	-	-	1 > 2 > 6	Ar B f fs U
1155	+	+	+	+	-	-	-	-	-	1 > 2 > 3 = 6	Ar B F Fs u
1181	+	+	+	t	-	-	-	-	-	1 > 2 > 6 > 3	Ar B F Fs u
1952	+	+	+	t	-	-	-	-	-	1 > 2 = 3 > 6	Ar B f fs U
Group 4											
5	-	+	-	-	-	-	-	-	-		Ar B F Fs u
971	-	+	-	-	-	-	-	-	-		Ar B F Fs u
1352	-	+	-	t	-	-	-	-	-		Ar B f Fs U st
1955	-	+	-	-	-	-	-	-	-		Ar B f Fs u
Group 5											
378	-	+	+	-	-	-	-	-	-	1 > 2	Ar B f Fs ^{ex} u
805	-	+	+	t	-	-	-	-	-	1 > 2 > 3	Ar B F Fs u
806	-	+	+	-	-	-	-	-	-	1 > 2	Ar B F Fs u
808	-	+	+	-	-	-	-	-	-	1 > 2	Ar B f fs U
1164	-	+	+	-	-	-	-	-	-	1 > 2	Ar B f fs U st
1477	t	+	+	t	-	-	-	-	-	1 > 2 > 3 > 6	Ar B f fs U st
1491	t	+	+	-	-	-	-	-	-	1 >> 2 > 6	Ar B F fs U
1909	-	+	+	-	-	-	-	-	-	1 > 2	Ar B f Fs u
2003	t	+	+	+	-	-	-	-	-	1 > 2 > 3 >> 6	Ar B f fs U
Group 6											
1394	-	-	-	-	+	+	+			7 > 8 > 9	Ar b f fs U st
1483	-	-	-	-	+	+	+			7 > 8 > 9	Ar b f fs U st

+ = present t = trace - = absent

* Pigment Identification [No.s refer to (1)].

1 = Delphinidin-3-lathyroside (= Dp-3-xylosido-galactoside)

2 = Delphinidin-3-glucosido-galactoside

6 = Delphinidin-3-rhamnoside

7 = 3 = Cyanidin-3-lathyroside

8 = Cyanidin-3-glucosido-galactoside

9 = Pelargonidin-3-lathyroside