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ANTHOCYANINS OF SOME LEGUMINOSAE FLOWERS AND THEIR EFFECT ON COLOUR VARIATION

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Key Word Index—*Bauhinia variegata*; *Cassia nodosa*; *Delonix regia*; Leguminosae; anthocyanins; flavonoids; colour variation.

The flowers of *Bauhinia variegata* are pale violet in colour, while those of *Cassia nodosa* are pale pink. While flower colour is constant in these two plants, flowers of *Delonix regia* range in colour from yellowish–orange to dark red. The lighter coloured flowers appear early in May, while the darker coloured flowers appear about two weeks later; the latter also have a longer life.

In the present study, the 3-monoglucosides and 3-diglucosides of cyanidin, malvidin and peonidin were variously identified in these 3 plants (Table 1). These pigments are common to the Leguminosae [1]. While it has been reported that the petals of *Cassia marginata* contain pelargonidin with an isoprene substituent [2], in the present study, only cyanidin-3-glucoside was detected in *C. nodosa* petals.

Besides the anthocyanins of *Delonix regia*, other flavonoids present were identified, namely quercetin-3-arabinoside, quercetin-3-glucoside, quercetin-3-rutinoside, naringenin-5-glucoside and chalcononaringenin-2′-glucoside. Naringenin-5-glucoside is most probably an artifact, since it always appeared in trace amounts when isosalipurposide (chalcononaringenin-2′-glucoside) was rechromatographed.

A chromatographic survey of the flowers of *D. regia* indicated that about 70% of the population are of the dark red colour, 30% a lighter shade (reddish–orange) and only 2–3% are typical yellowish–orange. From sampling a typical flower of both yellowish–orange and dark red colours, it was clear that relative amounts of isosalipurposide and anthocyanins play the key role in colour variation. On a dry weight basis, the anthocyanins were quantitatively estimated at 524 nm, and the results indicated that the dark red flowers contain five times the amount of anthocyanins present in the yellowish–orange flowers.

The carotenoids of *D. regia* have been previously identified [3]. In the present study, the carotenoids of both yellowish–orange and red flowers were extracted, and 2-D TLC showed no qualitative difference. A quantitative study, however, indicated that the carotenoids of the yellowish–orange flowers were 5–6 fold the concentration of those present in the red flowers (λ_{max} measured over the range of 420–460 nm).

The pH of the sap solution of the yellowish–orange flowers was 3.9, and that of the red flowers 3.8. At such a pH, co-pigmentation between the anthocyanins and other flavonoids must be responsible for the red colour developed [4–8]. In the yellowish–orange flowers, only small amounts of anthocyanins are present in comparison to isosalipurposide so that their role in the colour effect is minimal, even when co-pigmented.

It is concluded that the red colour in *Delonix regia* flowers is most probably due to co-pigmentation between anthocyanins and other flavonoids. The colour of the yellowish–orange flowers is mostly attributed to an increase in the isosalipurposide concentration, along with an increase in the background of the yellowish cytoplasmic carotenoids.

EXPERIMENTAL

Materials. The flowers of *Bauhinia variegata* L. and *Cassia nodosa* Buch. Ham. were collected from the Orman Botanical Gardens. *Delonix regia* Raf. flowers were collected in the vicinity of Cairo and its suburbs. Voucher specimens are deposited at the Herbarium, Botany Department, Cairo University.

Extraction and identification of pigments. Standard procedures were used [9–11].

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Table 1. Anthocyanins of legume flowers

Pigment	Presence/absence in *Bauhinia variegata*	*Cassia nodosa*	*Delonix regia*
Cyanidin-3-glucoside	+	+	+
Cyanidin-3-gentiobioside	−	−	+
Malvidin-3-glucoside	+	−	−
Malvidin-3-diglucoside	+	−	−
Peonidin-3-glucoside	+	−	−
Peonidin-3-diglucoside	+	−	−

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DIFERULIC ACID AS A POSSIBLE CROSSLINK IN HEMICELLULOSES FROM WHEAT GERM

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Key Word Index—*Triticum aestivum*; Gramineae; wheat endosperm; hemicelluloses; pentosans; diferulic acid.

Abstract—Bound diferulic acid has been identified in small amounts in the water-insoluble pentosans of wheat endosperm. Evidence is presented suggesting that diferulic acid crosslinks adjacent polysaccharide molecules and reduces their solubility.

INTRODUCTION

White wheat flour (*Triticum aestivum*) contains thin cell walls of endosperm which consist predominantly of pentosans (arabinoxylans) the greater part of which are water-insoluble[1]. Smaller quantities of hexosans (β-glucan and glucomannans) [1, 2] and a soluble arabinogalactan-peptide have also been identified [3, 4]. The soluble [5] and insoluble [6] arabinoxylans contain small amounts of ferulic acid bound by ester linkages to the pentosans. Both arabinoxylans are similar in composition; the reasons for the insolubility of the larger part of these pentosans are not known [2, 6]. It has been suggested that ferulic acid residues are dimerized by oxidative phenolic coupling to form diferulic crosslinks which would insolubilize the pentosans [6, 7]. To test this hypothesis the insoluble wheat flour pentosans were investigated for the possible presence of bound diferulic acid.

RESULTS AND DISCUSSION

The water-insoluble pentosans were isolated with a yield of 4.3% from the ground endosperm of wheat by water extraction, wet sieving and enzymatic degradation of starch. The preparation contained about 60% polysaccharides (2/3 arabinoxylans and 1/3 β-glucans); the remainder consisted of protein and lipid material and