

4-methoxy-5-ethoxyacetophenone [8] (2 g) with tri-*O*-methylgalloyl chloride (2.5 g) in Py (15 ml) gave 2-(3',4',5'-trimethoxy)benzoyloxy-4-methoxy-5-ethoxyacetophenone, colourless needles from EtOAc-petrol (2.8 g), mp 177° (Found: C, 62.8; H, 6.3.  $C_{21}H_{24}O_8$  requires: C, 62.37; H, 5.98%). This ester (2.5 g) and KOH (2 g) in Py (15 ml) on heating at 40° gave 2-hydroxy-4,3',4',5'-tetramethoxy-5-ethoxydibenzoylmethane, bright yellow needles from EtOAc-petrol (1.5 g), mp 151°; green ferric reaction. (Found: C, 62.5; H, 6.0.  $C_{21}H_{24}O_8$  requires: C, 62.37; H, 5.98%). On refluxing with HOAc-NaOAc for 3 hr, the dibenzoylmethane (1 g) gave **1d**, colourless needles (0.85 g) from  $CHCl_3$ -petrol, mp 213–214° (Found: C, 64.9; H, 5.5.  $C_{21}H_{22}O_7$  requires: C, 65.27; H, 5.74%). Synthetic **1d** was different from prosogerin-D Et ether.

6,3',4',5'-Tetramethoxy-7-ethoxyflavone (**1c**). Esterification of 2-hydroxy-4-ethoxy-5-methoxyacetophenone [8] (2 g) with tri-*O*-methylgalloyl chloride (2.5 g) in Py (15 ml) gave 2-(3',4',5'-trimethoxy)benzoyloxy-4-ethoxy-5-methoxyacetophenone, colourless needles from EtOAc-petrol (2.7 g), mp 139–140° (Found: C, 62.2; H, 6.0.  $C_{21}H_{24}O_8$  requires: C, 62.37; H, 5.98%). This ester (2.5 g) and KOH (2 g) in Py (15 ml) gave 2-hydroxy-4-ethoxy-5,3',4',5'-tetramethoxydibenzoylmethane, bright yellow needles from EtOAc-petrol (1.5 g), mp

165° (Found: C, 62.1; H, 6.1.  $C_{21}H_{24}O_8$  requires: C, 62.37; H, 5.98%). Dehydrocyclization of the dibenzoylmethane (1 g) with NaOAc (1 g) in HOAc (20 ml) gave 6,3',4',5'-tetramethoxy-7-ethoxyflavone (**1c**), colourless needles (0.8 g) from  $CHCl_3$ -petrol, mp 239–240°, identical with prosogerin-D Et ether.

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## HILL ACTIVITY AND ANTHOCYANIN LEVELS IN *MANGIFERA INDICA*

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**Key Word Index**—*Mangifera indica*; Anacardiaceae; chlorophyll; anthocyanin; Hill activity.

**Abstract**—Anthocyanin composition and the rates of Hill activities were compared in the leaves of *Mangifera indica*. The important feature is the higher rate of Hill activity in anthocyanin-containing leaves as compared to the green leaves.

We have recently demonstrated that the Hill activity in anthocyanin-containing bracts of *Euphorbia pulcherrima* is higher than in the green leaves [1]. However, these studies were done in different foliage types. Therefore, it was of interest to undertake similar studies also in the plants of same foliage type varying in anthocyanin content. In *Mangifera indica*, the newly

formed twigs, bear three different fully expanded leaf types, reddish, reddish-green and green leaves varying in anthocyanin and chlorophyll contents. Comparative studies on pigment composition and rates of Hill activities of these leaf types were undertaken. Interestingly enough, the anthocyanin-containing leaves not only show Hill activity but also at rates higher than the

Table 1. Pigment composition and rates of Hill activity of different leaf types of *Mangifera indica*

Pigment and Hill activity	Stage and organ		
	Red leaf	Reddish green leaf	Green leaf
Chlorophyll a, mg/g fr. wt	0.17	0.14	1.00
Chlorophyll b, mg/g fr. wt	0.13	0.12	0.83
Total chlorophyll, mg/g fr. wt	0.30	0.26	1.83
Total anthocyanin, mg/g fr. wt	0.36	0.10	*
Hill activity, mM			
DCPIP reduced/mg chl/hr at 20° ± 2	1.98	1.58	0.65

\* Not detected in our method.

anthocyanin-free green leaves.

The comparative pigment compositions and Hill activities of the three different leaf types are given in Table 1. The table shows that the green leaves have highest chlorophyll content and in the reddish and reddish-green leaves; total chlorophyll contents are 84 and 86% lower, respectively. The chlorophyll b/a ratio remains fairly constant in all the foliage types. The reddish leaves contain maximum anthocyanin; there is 72% reduction in red-green leaves and in the green leaves anthocyanins could not be detected.

The table further shows that the highest Hill activity is found in the reddish leaves and the decline in the anthocyanin content is accompanied by a reduction of Hill activity. Thus, the Hill activities of reddish green and green leaves are only 77 and 33%, respectively of that of the reddish leaves. The noteworthy feature, therefore, is the relationship between anthocyanin level and the rate of Hill activity. In an earlier paper [1] attention was drawn to the probability of the anthocyanins having some role in photosynthesis. The present work bears out this contention.

#### EXPERIMENTAL

Fully expanded reddish, reddish green and green leaves from newly formed twigs of *Mangifera indica* cv Chausa, growing in the University Campus, were collected and subjected to chlorophyll composition, anthocyanin content and Hill activity. While sampling, care was taken to maintain uniformity in size, colour and state of the leaf types, as far as

possible. Chlorophyll a, chlorophyll b and total chlorophyll were quantitatively estimated spectrophotometrically [2, 3]. Chloroplast isolation and Hill activity measurements were done according to refs. [4, 5]. Tissue (1 g) was crushed in 5 ml 95% EtOH-1.5 N HCl (17:3). The sample was quantitatively transferred to a beaker and kept overnight at 4°. The sample was filtered and the vol. made to 25 ml, 2 ml aliquot of the extract was taken and made to 10 ml. The diluted extract was kept in dark for 2 hr and  $A_{535}$  measured. Total anthocyanin was calculated following the equation of ref [6].

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