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FLORAL ANTHOCYANINS OF SOME MALESIAN *HIBISCUS* SPECIES

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Key Word Index—*Hibiscus*; *Abelmoschus*; *Thespesia populnea*; Malvaceae; chemosystematics; anthocyanins; cyanidin glycosides.

Abstract—In 14 Malesian species of *Hibiscus* (*sensu lato*) the most common floral anthocyanin was cyanidin 3-sambubioside. Cyanidin 3-glucoside was found in large woody species and the 3-sophoroside only in section Lilibiscus. Contrary to previous reports, flavonols and anthocyanins of *Hibiscus mutabilis* were of the same glycosidic type.

RESULTS AND DISCUSSION

Hibiscus species are numerous in warm regions and provide a number of important food, fibre-bearing and decorative plants. Constituents of some species have been studied, but not their systematic distribution.

Results are reported here for floral anthocyanins (identified by the usual methods) for 11 *Hibiscus* species and 4 in closely allied genera. Flower pigments are of possible interest for two reasons. Firstly, in flowers of almost all sections of *Hibiscus* and the allied genera *Gossypium*, *Thespesia*, *Abutilon* and *Abelmoschus* there is a colour pattern of remarkably frequent occurrence. The main part of the corolla is white, ivory or yellow (the latter colour usually due to 6- or 8-hydroxylated flavonols) and anthocyanin occurs in the base of the petals forming a deep red "eye". From descriptions of flower morphology in Malesian species [1] this colour pattern appears to be associated with a relatively long staminal column and may be of biological significance. Secondly, there are several species that show rapid colour changes through production of anthocyanin in the fully open flower, and this raises questions concerning anthocyanin biosynthesis.

The most spectacular example of flower colour change is in *Hibiscus mutabilis*. Usual cultivated forms have no red eye although there is a small basal spot pigmented with cyanidin aglycone [2]. Flowers open overnight, are pure white in the morning, pink at noon and red at dusk. The rapidity of this change suggests the possibility of direct reduction of flavonol glycoside (found in the white flower) to anthocyanin, but this is not in accord with our present understanding of biosynthetic pathways in the flavonoids. Moreover, the compounds present have been reported to be quercetin 7-glucoside and quercetin 3-diglucoside in the white flower, and cyanidin 3,5-diglucoside in the red flower [3]. Subsequently the presence of quercetin 3-galactoside, 3-glucoside, 3-rutinoside and 4′-glucoside in flowers throughout the colour change has been reported [4]. Direct conversion of flavonol to anthocyanin appears improbable because of the wide difference in glycosidic type, and the earlier report has been cited as supporting evidence that this transformation does not occur in plants [5]. However, the author has not been able to find any of the above diglycosides in flowers of *H. mutabilis* from several sources around Malaysia. The main pigments of white and red flowers were quercetin 3-sambubioside and cyanidin 3-sambubioside respectively. Ishikura [7] also found the latter compound to be the predominant anthocyanin of *H. mutabilis* and it is evidently (see Table 1) the typical *Hibiscus* flower pigment. Because of the identical glycosidic residues there thus remains a formal possibility that direct conversion of flavonol glycoside to anthocyanin could occur in *H. mutabilis*. It is unlikely that this possibility is eliminated by an apparently static flavonol concentration [4] as the fraction that need be converted to give the observed colour is rather small, as is readily demonstrated by Mg–HCl reduction of the crude ethanolic extract of the white flower.

Systematic aspects of the results are evident from Table 1. Cyanidin 3-sophoroside was previously reported from *H. rosa-sinensis* [6] and this was the only anthocyanin found in the various cultivated forms (presumably not derived from interspecific hybridisation) available in Malaysia. Otherwise it occurred only in *H. schizopetalus*, also of section Lilibiscus.

Cyanidin 3-glucoside was found as the predominant anthocyanin only in the four species of sections Azanza and Bombycidendron. These are large trees with stipulate leaves, so that occurrence of simple monoglycoside appears to correlate with primitive vegetative characters. Results for the other large-tree *Hibiscus* species in the region would be of interest.

Thespesia populnea although showing a strong superficial resemblance to *H. tiliaceous* in habit and ecology, is here further distinguished by the floral anthocyanin. Cyanidin 3-rutinoside has been previously reported in the Malvaceae, in *Abutilon insigne* [10].

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Table 1. Floral anthocyanins of some of Malvaceae, tribe Hibisceae

Species	Compounds*	Habit	Source or voucher†
Abelmoschus esculentus (L.) Moench	Cy 3-sambubioside	herb	UA
A. manihot (L.) Medicus	Cy 3-sambubioside; Cy 3-glucoside	herb	16309
A. moschatus Medicus	Cy 3-sambubioside; Cy 3-glucoside	sub-shrub	1004
Hibiscus section *Azanza*			
H. archboldianus Borss.	Cy 3-glucoside; Cy 3-sambubioside	big tree	Lae
H. macrophyllus Roxb.	Cy 3-glucoside	big tree	6859
H. tiliaceous L.	Cy 3-glucoside	big tree	1192
Hibiscus section *Bombycidendron*			
H. grewiifolius Hassk.	Cy 3-glucoside; Cy 3-sambubioside	tree	001564
Hibiscus section *Furcaria*			
H. cannabinus L.	Dp 3-sambubioside; Dp 3-glucoside	shrub	Rakhimkhanov *et al.* [8]
H. sabdariffa L.	Dp and Cy 3-sambubioside Dp and Cy 3-glucoside	herb	Du and Francis [9]
H. surattensis L.	Cy 3-sambubioside	herb	14292
Hibiscus section *Lilibiscus*			
H. rosa-sinensis L.	Cy 3-sophoroside	shrub	16131
H. schizopetalus (Mast.) Hook.f.	Cy 3-sophoroside	shrub	SBG
Hibiscus section *Trionum*			
H. mutabilis L.	Cy 3-sambubioside	shrub	16158
	Cy 3-sambubioside; Cy 3-glucoside		Ishikura [7]
H. brackenridgei	Cy, Dp 3-sambubioside	herb	UM
Thespesia populnea (L.) Sol.	Cy 3-rutinoside	tree	UM

* In order of abundance. † Numbers are for specimens in Herbarium of University of Malaya, Kuala Lumpur. Sources of living plants were as follows: UM, Botany Garden of University of Malaya; UA, University of Agriculture, Serdang, Malaysia; SBG, Singapore Botanic Garden; Lae Botanic Garden, Lae, Papua New Guinea.

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