Phytochemistry, 1976, Vol. 15, p. 838 Pergamon Press. Printed in England.

A NEW FLAVONE 6-GLUCOSIDE FROM *CITHAREXYLUM SUBSERRATUM*

SUBRAMANIAN MATHURAM, KOZIPARAMBIL K. PURUSHOTHAMAN and AYYAPPATH SARADA
Captain Srinivasa Murti Research Institute, Madras 600020, India
and
JOSEPH D. CONNOLLY
Department of Chemistry, University of Glasgow, Glasgow, G12 8QQ, Scotland

Key Word Index—*Citharexylum subserratum*; Verbenaceae; 5,4'-dihydroxy-7,3'-dimethoxyflavone 6-glucoside.

From the acetone extract of the leaves of *Citharexylum subserratum* (Verbenaceae) [1] we have isolated a new flavone glucoside which has been assigned the above structure on the following evidence.

The glucoside, $C_{23}H_{24}O_{12}$, mp 256°, readily yielded a hexaacetate, mp 136°. Acid or enzymatic hydrolysis afforded glucose and an aglucone, $C_{17}H_{14}O_7$, mp 248–50° which underwent methylation to a pentamethoxyflavone, mp 178°, the mass spectrum of which has a strong M-15 peak and retro-Diels–Alder fragments at *m/e* 162, 195 and 167, indicating trimethoxy substitution in ring A and a dimethoxyphenyl ring B[2]. This is supported by the NMR spectrum [δ 6.56 (*s*, H-3), 6.78 (*s*, H-8), 6.94 (*d*, *J* 8 Hz, H-5'), 7.48 (*dd*, *J* 8, 2 Hz, H-6'), 7.3 (*d*, *J* 2 Hz, H-2')]. The appreciable upfield shifts (0.61, 0.53 and 0.47 ppm) of 3 methoxyl groups in benzene solution confirmed the structure 5,6,7,3',4',-pentamethoxyflavone and distinguished it from the alternative 5,6,8,3',4'-isomer [3] which has the same mp.

The aglucone formed a triacetate mp 224° whose mp, UV and NMR spectrum are identical with those reported [4] for 5,6,4'-triacetoxy-7,3'-dimethoxyflavone. In agreement with this structure the triacetate shows large upfield benzene induced shifts for the two methoxyl groups (0.64, 0.77 ppm) and two acetoxymethyl groups (0.46, 0.5 ppm) and only a marginal shift for the third acetoxymethyl group (0.15 ppm) as would be expected for a 5-acetate. The presence of the vicinal hydroxyl substituents at 5 and 6 was confirmed by the bathochromic shift of 18 nm in band II in the UV spectrum of the original aglucone on addition of NaOAc–H_3BO_3 [5]. Thus the aglucone is 7,3'-dimethoxy-5,6,4'-trihydroxyflavone. Since there is no shift in the position of band I in the UV spectrum of aglucone relative to the glucoside (see Experimental) the sugar residue must be attached to positions 5 or 6 in ring A. The $AlCl_3$ induced shift of the UV spectrum of the glucoside [λ_{max} 344, 272 nm changing to λ_{max} 370, 302 *sh*, 286 nm] is indicative [5] of the presence of a hydroxyl group at position 5. In addition, one of the two phenolic acetoxymethyl signals (δ 2.32, 2.44) of the glucoside hexaacetate is deshielded by the carbonyl group and hence is attached to 5. This evidence supports the structure 5,4'-dihydroxy-7,3'-dimethoxyflavone 6-glucoside for the new compound. This glucoside is a further addition to the small group of known flavone 6-glucosides [5,6], the first reported member of this series being pedaliin [7].

EXPERIMENTAL

All mp's are uncorrected. NMR spectra were recorded in $CDCl_3$ with TMS as internal standard.

Isolation. Shade dried *Citharexylum subserratum* (leaves) collected after flowering commenced (4 kg, coarse powder) was successively exhaustively extracted with hexane, $CHCl_3$ and Me_2CO by cold percolation. The Me_2CO extract was concentrated to about 500 ml. and left aside overnight. The solid which separated was filtered and crystallised from EtOH, to give the glucoside mp 256°. The mother liquor was evaporated to dryness *in vacuo*, treated with H_2O and extracted with Et_2O, EtOAc and *n*-BuOH. The *n*-BuOH extract was taken to dryness, the residue redissolved in Me_2CO and left in an ice chest overnight. The separated solid was crystallised from EtOH to give more glucoside (1.6 g). (Found: C, 55.80; H, 5.0 $C_{23}H_{24}O_{12}$ requires C, 56.10; H, 4.9). UV λ_{max}^{EtOH} 344 (ϵ, 22300), 272 (ϵ, 15800); with NaOAc 385 (23000), 351 (ϵ, 24000), 269 (ϵ, 20000); with NaOAc + B_2O_3 354 (ϵ, 24000), 272 (ϵ, 21000); with $AlCl_3$ 370 (ϵ, 24000), 286 (ϵ, 19000), 302 *sh* (ϵ, 18000) nm. Acetylation with Ac_2O/pyridine gave the hexaacetate ex MeOH, mp 136°. (Found: C, 54.7; H, 4.9 $C_{35}H_{36}O_{18}$ requires C, 55.1; H, 5.0%). NMR: δ 1.99, 2.0, 2.02, 2.08 (3H, *s*, each, glucose acetates), δ 2.33 (3H, 4'-OAc), 2.44 (3H, 5-OAc), δ 3.91, 3.95 (3' and 7-OMe), δ 6.52 (1H, *s*, 3-H), δ 6.75 (1H, *s*, 8-H), δ7.35 (3H, *m*, 2'-H, 5'-H, 6'-H).

Hydrolysis. To the glucoside (800 mg) in EtOH (20 ml) was added HCl (1:1, 7 ml) and the solution refluxed on a water bath for 12 hr. The product was obtained as a gum, which was crystallised from Me_2CO to yield 7,3'-dimethoxy 5,6,4'-trihydroxyflavone (240 mg), mp 248–50°, (lit[4]251–255°). (Found: C, 61.8; H, 4.40 $C_{17}H_{14}O_7$ requires C, 61.8; H, 4.3%). UV: λ_{max}^{EtOH} 344 (ϵ, 32500), 284 (ϵ, 30500); with NaOAc 400 (ϵ, 28000), 344 (ϵ, 33000), 287 (ϵ, 31000); with NaOAc + B_2O_3 339 (ϵ, 31000), 302 (ϵ, 32000); with $AlCl_3$ 369 (ϵ, 29000), 296 (ϵ, 28000), 308 *sh* (ϵ, 20000) nm. Enzymic hydrolysis with β-glucosidase gave the same aglucone and glucose, which was identified by PC. The corresponding triacetate, 5,6,4'-triacetoxy-7,3'-dimethoxyflavone, had mp 224° (lit. [4] 217–219°). (Found: C, 60.7; H, 4.5 $C_{23}H_{20}O_{10}$ requires C, 60.5; H, 4.4%). Treatment with Me_2SO_4 K_2CO_3 Me_2CO gave 5,6,7,3',4'-pentamethoxyflavone, mp 178° (lit. [2] 178°). (Found: C, 64.5; H, 5.6 $C_{20}H_{20}O_7$ requires C, 64.5; H, 5.4%). NMR δ 3.91, 3.93, 3.95 (3H each) 3.98 (6H) (5 × OMe).

Acknowledgements—Indian authors thank the Central Council for Research in Indian Medicine and Homoeopathy, Government of India, for financial support and Miss P. Brindha for identification of the plant.

REFERENCES

1. Cooke, T. (1958) *The Flora of the Presidency of Bombay* Vol. II. 518 (Botanical Survey of India, Sri Gouranga Press Private Ltd., Calcutta).
2. Rama Rao, A. V. and Venkataraman, K. (1968) *Indian J. Chem.* **6,** 677.
3. Jain, A. C. and Seshadri, T. R. (1962) *J. Ind. Chem. Soc.* **39,** 515.
4. Fukui, K., Nakayama, M. and Matsui, T. (1969) *J. Chem. Soc. Japan* **90,** 1270.
5. *The Flavonoids* (1975) edited by Harborne, J. B., Mabry, T. J. and Mabry, H., Chapman & Hall, London.
6. Okuda, T., Yoshida, T. and Ono, I. (1975) *Phytochemistry* **14,** 1654.
7. Krishnaswamy, N. R., Seshadri, T. R. and Tahir, P. J. (1968) *Indian J. Chem.* **6,** 676.