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2″-*O*-ACETYLQUERCITRIN FROM AZALEA FLOWERS

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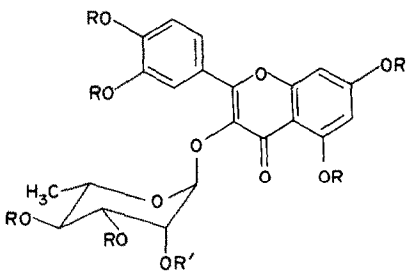
Key Word Index—*Rhododendron*; Ericaceae; Red Wing azalea; flowers; acylated flavonoid glycosides; 2″-*O*-acetylquercitrin; structural analysis.

A new flavonol glycoside, isolated earlier from flowers of Red Wing azalea [1], yielded quercetin and L-rhamnose as the only products identified on acid hydrolysis. The compound was chromatographically distinct from quercitrin (3-*O*-α-L-rhamnosylquercetin) (**1**) but had the same UV spectrum [2]. We now show by NMR analysis that the new compound is the 2″-*O*-acetyl derivative of quercitrin (**2**) yielding quercitrin on alkaline hydrolysis. Many acylated flavonoid glycosides are recorded but in only a few instances has the point of attachment of the acyl group been determined. Compound **2** is of particular interest as an inhibitor of lens aldose reductase [3].

PMR data for **1**, **2** and **3** (hepta-*O*-acetylquercitrin) are shown in Table 1. The spectra of **1** and **2** are closely similar, except that **2** gives rise to (a) a 3-proton singlet ($\delta = 2.00$ ppm) and (b) a 1-proton double doublet (6.33 ppm) that is shifted downfield from its position in the quercitrin spectrum (5.09 ppm). Clearly, the 3-proton singlet is due to the introduction of an acetyl group and the 1-proton double doublet has undergone the normal 1–1.3 ppm downfield shift caused by acetylation. Since H-1″ and H-2″ in α-rhamnose are equatorial, while H-3″, H-4″ and H-5″ are axial, $J_{1''2''}$ and $J_{2''3''}$ should be small (~1–3 Hz), while $J_{3''4''}$ and $J_{4''5''}$ should be large (~9–10 Hz). A first-order spectrum would show the H-1″ signal as a doublet with small spacing; the H-2″ signal as a double doublet or 1:2:1 triplet with small spacings; the H-3″ signal as a double doublet with large and small spacings; the H-4″ signal as a 1:2:1 triplet with large spacings and the H-5″ signal as an 8-line multiplet. The actual spectrum of **2** (Table 1) is *ca* first-order. The signal shifted downfield is a double doublet with small spacings and it is therefore assigned to H-2″. The remaining assignments are straightforward and all are confirmed by the decoupling experiments summarized in the Table. The spectrum of the rhamnose portion of hepta-*O*-acetylquercitrin (**3**) is included for comparison. The main difference between the spectra of **2** and **3** is that the H-3″ and H-4″ signals of **3** are shifted downfield, as expected.



1: R = R′ = H
2: R = H; R′ = MeCO
3: R = R′ = MeCO

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Table 1. PMR spectra of **1**, **2** and **3** in deuteriopyridine at 100 MHz*

	Temp.	H-1″	H-2″	H-3″	H-4″	H-5″	CH_3	2″-AcO
1	25°	6.27 *d* (1.5)	5.09 *dd* (1.5, 3.5)	4.67 *dd* (3.5, 9)	~4.3 *m*	~4.3 *m*	1.47 *d* (5.5)	—
	80°	Irr	*d* (3)	—	—	—	—	—
	80°	*s*	Irr	*d* (9)	—	—	—	—
2	25°	6.26 *d* (1.5)	6.33 *dd* (1.5, 3.5)	4.77 *dd* (3.5, 9)	4.13 *tr* (9)	~4.3 *m*	1.49 *d* (5.5)	2.00 *s*
	80°	—	Irr	*d* (9)	—	—	—	—
	80°	—	—	*d* (3)	Irr	—	—	—
	80°	—	—	—	—	Irr	*s*	—
3	25°	6.13 *d* (2)	6.21 *dd* (2, 3)	5.72 *dd* (3, 10)	5.45 *tr* (10)	3.77 *m* (6, 10)	1.18 *d* (6)	2.02 †*s*

* In ppm downfield from TMS; *d*—doublet, *dd*—double doublet, *tr*—triplet, *m*—multiplet, Irr—irradiated; numbers in parentheses are observed splittings. † The other rhamnose acetyl methyl signals are at 1.94 and 2.11 ppm.

Table 2. ^{13}C chemical shifts of **1** and **2***

	1	2
C-4	178.8	178.6
$\underline{C}H_3\underline{C}OOR$		172.4
C-1″	102.7	99.8
C-6	99.5†	99.6
C-8	94.6†	94.6
$\underline{C}H_3COOR$		20.6‡
$\underline{C}H_3$-C-5″	17.1‡	17.1‡

* Values in ppm downfield from TMS; solvent: MeOD-D_2O (3:1); noise-decoupled, 15 MHz Fourier transform spectra; 8K data points; 4 kHz spectral width. † Signal disappears on deuteration. ‡ Changes to quartet on single-frequency, off-resonance decoupling.

Corroborative evidence for the structure of **2** as 2″-*O*-acetylquercitrin is provided by ^{13}C NMR data (Table 2). The noise-decoupled spectrum of **2** contains an ester carbonyl carbon peak and an additional Me group peak, both of which are absent in the spectrum of **1**. Moreover, the large (2.9 ppm) upfield shift of the C-1″ (rhamnose) signal in **2** would be expected only if the adjacent (C-2″) OH group was acetylated [4]. The signal for C-1″ was distinguished from those of the neighboring C-6 and C-8 signals by exchanging H-6 and H-8 in **1** with deuterium [5].

When **2** is warmed in dry deuteriopyridine the acetyl group migrates to the 3″-position and eventually an equilibrium is established between the 2″- and 3″-isomers. This finding will be reported elsewhere.

EXPERIMENTAL

Isolation. Fresh azalea flowers (Rhododendron × cv Red Wing) were extracted with boiling MeOH. **2** was purified by TLC on 2-mm layers of microcrystalline cellulose as previously described [1]. It was shown by chromatography that **2** was present in the MeOH extract before purification and was not an artifact.

Base hydrolysis. **2** (3 mg) in 0.5 N NaOH (1 ml) was heated for 15 min at 100°. The soln was acidified and quercitrin extracted with EtOAc.

Deuterium exchange. **1** (200 mg) in D_2O (2 ml) containing pyr (1 ml) was heated for 2 hr at 100°. The chilled soln was acidified with conc HCl and kept 18 hr at 4°. 6,8-d_2-*quercitrin* was obtained as bright yellow crystals.

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PHENOLIC COMPOUNDS FROM THE HEARTWOOD OF *GARCINIA INDICA**

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No previous work has been reported on the heartwood pigments of *G. indica*, but D-leucine has been extracted from the leaves [1], (−) hydroxycitric acid from the fruit [2] and glycerides and fatty acids from the seeds [3]. Phenolic metabolites isolated from other Guttiferae heartwoods include xanthones [4], biflavanoids {5–7} coumarins [8] and biphenyls [9].

The heartwood of *Garcinia indica* was reduced to shavings and extracted with hot $CHCl_3$. Evaporation of the solvent from the extract gave a residue which separated into a yellow oil and a semi-solid black tar. The yellow oil was a mixture of aliphatic compounds (NMR and IR evidence) and was not investigated further. The black tar was chromatographed on silica. Elution with EtOAc–PhMe led to the isolation of 1,7-dihydroxyxanthone (euxanthone) [10] and the biflavanoids volkensiflavone [11] and morelloflavone [12, 11] which were separated by preparative TLC and identified by spectral comparison with authentic specimen, and by permethylations to give the chalcone-flavones by opening of ring I–C.

Dimethyl terephthalate was also isolated by chromatography but we assume this product is a plasticiser leeched out from the plastic bottle during transit from India.

These results support previous conclusions from work on *Garcinia* species which show that 3,8-linked biflavanoids and xanthones are present in the heartwood.

* Part 32 in the series "Extractives from Guttiferae". For Part 31 see ref. [6].