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# GALIPEIN, A COUMARIN FROM *GALIPEA TRIFOLIATA*

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**Key Word Index**—*Galipea trifoliata*; Rutaceae; coumarins; ramosin; phebalosin; 7-isopentenyloxy-8-(*trans*-1′,2′-epoxy-3′-methyl-3′-butenyl)coumarin; galipein.

**Abstract**—In addition to phebalosin and ramosin, the air-dried stem and root barks of *Galipea trifoliata* contain a third previously unreported coumarin identified as 7-isopentenyloxy-8-(*trans*-1′,2′-epoxy-3′-methyl-3′-butenyl)coumarin.

## INTRODUCTION

In our continuing phytochemical studies of Rutaceae, we report here coumarins from stem and root barks of *Galipea trifoliata.*

## RESULTS AND DISCUSSTION

The petrol extracts of the root bark and of the stem bark from *Galipea trifoliata*, on chromatographic separation, each afforded, three coumarins. Two were identified as ramosin (7-isopenteryl oxy-8-isopenterylcoumarin) [1] and phebalosin 7-methoxy-8-(*trans*-1′,2′-epoxy-3′-methyl-3′-butenylcoumarin) [2]. The third (**1**), a new natural compound, was isolated as colourless prisms from acetone.

The UV spectrum of **1** in methanol exhibited maxima at 223, 246, 257, 312 (sh) and 324 nm. There was no bathochromic shift on addition with sodium hydroxide. The IR spectrum afforded strong peaks at 1740, 1710, 1605 and 1220 $cm^{-1}$. This suggested that **1** was a non-phenolic and 7-*O*-substituted coumarin [3].

In the $_1$H NMR spectrum, a pair of doublets at $\delta$6.18 and 7.62 (each 1H, *d*, $J$ = 10 Hz) was characteristic of H-3 and H-4 in the coumarin nucleus. Two *ortho*-coupled aromatic protons at $\delta$7.29 and 6.85 (each 1H, *d*, $J$ = 9 Hz) were attributed to H-5 and H-6 in the aromatic nucleus. A 7-isopentenyloxy group was revealed by two methyl singlets at $\delta$1.76 and 1.78, a doublet at $\delta$4.62 for methylene protons and a multiplet at $\delta$5.44 for an olefinic proton. An 8-isoprenoid side chain was characterized by a vinylic methyl group at $\delta$1.86 and two multiplets at $\delta$5.02 and 5.26 corresponding to the presence of $C{=}CH_2$ as in phebalosin. An AB quartet centred at $\delta$3.93 (1H, *d*, $J$ = Hz), 3.97 (1H, *d*, $J$ = 2 Hz) revealed the presence of the epoxide oxymethine protons, the vicinal coupling constant of 2 Hz indicating a *trans* configuration [4].

The UV, IR and $^1$H NMR spectra suggested that **1** was 7-isopentenyloxy-8-(*trans*-1′,2′-epoxy-3′-methyl-3′-butenyl) coumarin for which we propose the name of galipein.

## EXPERIMENTAL

*Materials.* Stem bark and root bark of *Galipea trifoliata* Aublet (voucher samples. No. 47, are deposited at the Herbarium of O.R.S.T.O.M. Center of Cayenne in French Guyana) collected near Säul (French Guyana), were sliced, then air-dried and powdered.

Centrifugal thin layer chromatographic (CTLC) separations were carried out using a Chromatotron from Harrison Research. All mps are uncorr. $^1$H NMR were measured at 90 MHz in $CDCl_3$ using TMS as int. standard. EIMS were recorded at 70 eV.

*Extraction, isolation and purification.* The air-dried powdered material were separately stirred at room temp. with petrol (68–80°). Filtration, followed by removal of petrol, gave a residue which was chromatographed on a silica gel column using hexane containing increasing amounts of EtOAC. The coumarins collected were isolated and purified by CTLC on silicagel with hexane–EtOAC as eluent (9/1 to 7/3).

*Isopentenyloxy-8-(trans-1′,2′-epoxy-3′-methyl-3′-butenyl)-coumarin*, mp 88–90°; IR $\nu_{max}^{KBr}$ $cm^{-1}$: 1740, 1710, 1605, 1280, 1220, 1090, 780; MS *m/z* (rel. int. %): 312 $[M]^+$ (2) ($C_{19}H_{20}O_4$), 244 $[M-C_5H_8]$ (32), 230 $[M-C_5H_6O]$ (50), 215 $[244-CHO]$ (33), 175 $[244-C_4H_5O]$ (100); $^1$H NMR: $\delta$7.29 and 6.85 (each, 1H, *d*, $J$ = 9 Hz, H-5 and H-6), 7.62 and 6.18 (each, 1H, *d*, $J$ = 10 Hz, H-4 and H-3), 5.44 (1H, *m*, 7-O-$CH_2$-CH $=C(Me)_2$) 5.26 and 5.02 (each, 1H, *m*-MeC$=CH_2$), 4.62 (2H, *d*, $J$ = 7 Hz, 7-*O*-$CH_2$–), 3.97 and 3.89 (each, 1H, *d*, $J$ = 2 Hz, *trans* –HC–CH–). 1.86 (3H, *t*, MeC$=CH_2$), 1.78 and 1.76 (each, 3H, *s*, Me).

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of **6** except for a (−) signal at $\delta$5.60 due to a methoxy group.

## EXPERIMENTAL

Mps: uncorr. $^1$H NMR was run at ($CD_2Cl_2$) 100 MHZ and 400 MHz and $^{13}$C NMR spectra ($CD_2Cl_2$) at 74.2 MHz. HRMS, $^{13}$C NMR and micro-analysis were performed at the Department of Chemistry, University of British Columbia, Canada.

*Isolation and identification of phenolics.* The dried powdered seeds (500 g) of *M. dactyloides* Gaertn., from Hanguranketa, Sri Lanka, were extracted with $Me_2CO$. The concd $Me_2CO$ extract was defatted with petrol giving a viscous brown solid (165 g), which after CC on silica gel using petrol:EtOAc mixtures of increasing proportions yielded compounds **1–6**, which were purified by prep. TLC.

1-(2,6-*Dihydroxyphenyl*)*tetradecan*-1-*one* (**1**). Needles mp, 91–91.5° (petrol, lit [3] 91–92); Found: C, 74.89%; H, 9.96%; $C_{20}H_{32}O_3$ requires: C, 74.96%; H, 10.06%, UV $\lambda_{max}^{EtOH}$ nm, 223, 268, 339, $\lambda_{max}^{EtOH/OH^-}$ nm 239, 283, 390; IR $\nu_{max}^{KBr}$ 3360 (*br*), 1640 (*s*) $^1$H NMR (400 MHz, $CD_2Cl_2$) $\delta$9.37 (2H, *br s*, OH-16, 20 $D_2O$ exchangeable), 7.22 (1H, *t*, $J$=8 Hz, H-18), 6.38 (2H, *d*, $J$=8 Hz, H-17, 19), 3.12 (2H, *t*, $J$=7 Hz, H-2), 1.69 (2H, *m*, H-3), 1.27 (20H, *m*, H-4-13), 0.88 (3H, *t*, $J$=7 Hz, H-14); HRMS, *m/z* (rel. int.%) 320.2356 ($C_{20}H_{32}O_3$, 10), 302.2246 ($C_{20}H_{30}O_0$, 17), 189.0920 ($C_{12}H_{13}O_2$, 17), 165.0553 ($C_9H_9O_3$, 26), 152.0473 ($C_8H_8O_3$, 31), 137.0247 ($C_7H_5O_3$, 100) $^{13}$C NMR assignments are given in Table 1.

*Malabaricone A* (**2**). Crystals (petrol) mp, 80–82° (lit. [4] 81–82°).

*Malabaricone D* (**3**). Pale yellow crystals (toluene) mp, 89–91° (lit [4] 90–91°).

1-(2,6-*Dihydroxyphenyl*)-9-(4-*hydroxy*-3-*methoxyphenyl*) *nonan*-1-*one* (**4**). White needles (toluene) mp 109–111°; found: C, 71.03%; H, 7.48%, $C_{22}H_{28}O_5$ requires: C, 70.95%; H, 7.58%; UV $\lambda_{max}^{EtOH}$ nm 340, 272, 269, 220 $\lambda_{max}^{EtOH/OH^-}$ nm 386, 283, 238; IR $\nu_{max}^{KBr}$ cm$^{-1}$ 3450 (*s*), 3340 (*br*), 1635 (*s*), $^1$H NMR ($CD_2Cl_2$ run at 400 MHz) $\delta$9.50 (2H, *s*, OH-17, 21, $D_2O$ exchangeable), 7.20 (1H, *t*, $J$=8 Hz, H-19), 6.98 (1H, *d*, $J$=8 Hz, H-15), 6.73 (1H, *d*, $J$=2 Hz, H-11), 6.65 (1H, *dd*, $J$=2 and 8 Hz, H-14), 6.37 (2H, *d*, $J$=8 Hz, H-20, 18), 5.60 (1H, *s*, $D_2O$ exchangeable, OH-13), 3.80 (3H, *s*, H-22), 3.00 (2H, *t*, $J$=7 Hz, H-2), 2.44 (2H, *t*, $J$=7 Hz, H-9), 1.64 (4H, *m*, H-3, 8), 1.32 (8H, *m*, H-4-7); HRMS *m/z* (rel. int.%) 372.1947 ($C_{22}H_{28}O_5$, 52), 262.1568 ($C_{16}H_{22}O_3$, 21), 234.1618 ($C_{15}H_{22}O_2$, 15), 165.0548 ($C_9H_9O_3$, 22), 137.0605 ($C_8H_9O_2$, 100), 137.0244 ($C_7H_5O_3$, 79); $^{13}$C NMR assignments are given in Table 2.

Table 1. $^{13}$C NMR assignment (attached proton test) of compound **1**

| Carbon no. | $\delta$(ppm) | Intensity |
|---|---|---|
| 1 | 207.79 | 6 |
| 2 | 44.82 | 32 |
| 3 | 24.41 | 48 |
| 4–11 | 29.66 | 90 |
| | 29.55 | 75 |
| | 29.40 | 52 |
| | 29.37 | 48 |
| 12 | 31.93 | 17 |
| 13 | 22.70 | 23 |
| 14 | 14.13 | −14 |
| 15 | 110.03 | v. weak |
| 16, 20 | 161.03 | 15 |
| 17, 19 | 108.52 | −100 |
| 18 | 135.57 | −52 |

Table 2. $^{13}$C NMR assignment (attached proton test) of compound **4**

| Carbon no. | $\delta$(ppm) | Intensity |
|---|---|---|
| 1 | 207.95 | 6 |
| 2 | 44.71 | 41 |
| 3 | 24.37 | 46 |
| 4 | 29.12 | 47 |
| 5, 6 | 29.02 | 69 |
| 7 | 28.75 | 45 |
| 8 | 31.25 | 45 |
| 9 | 35.08 | 61 |
| 10 | 136.35 | 12 |
| 11 | 110.58 | −48 |
| 12 | 145.05 | 8 |
| 13 | 144.52 | 5 |
| 14 | 114.57 | −41 |
| 15 | 119.93 | −39 |
| 16 | 110.05 | 6 |
| 17, 21 | 161.18 | 15 |
| 18, 20 | 108.42 | −101 |
| 19 | 135.62 | −50 |
| 22 | 56.01 | −19 |

*Oxidation of* **4**. Compound **4** (75 mg) was heated in HOAc (0.3 ml) with one drop of concd $H_2SO_4$ at 60° for 15 min. Acetylated **4** (30 mg) in $Me_2CO$ was stirred with a soln of $KMnO_4$ (0.2 g) in $H_2O$ (0.5 ml) and $Me_2CO$ (2 ml), decolourized with $NaHSO_3$ in dil. $H_2SO_4$ and extracted with $Et_2O$. Prep. TLC of the extract on silica gel with the upper layer of toluene–HOAc–$H_2O$ (2:3:1) [5] gave acetylvanillic acid which was characterized by mmp and co-TLC with an authentic sample.

*Malabaricone B* (**5**). Pale yellow crystals (toluene) mp 100–102° (lit. [4] 102°).

*Malabaricone C* (**6**). Yellow crystals (toluene) mp 122–124° (lit. [4] 123–124°).

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