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Studies on the Constituents of *Viburnum* Species. XVIII.[1] Viburnols: Six New Triterpenoids from *Viburnum dilatatum* THUNB.[2]

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Six new triterpenoids, viburnols F, G, H, I, J and K, were isolated from the leaves of *Viburnum dilatatum* THUNB. (Caprifoliaceae). The structures were determined by extensive spectroscopic studies. Viburnols F, G and I are the first example of a new class of modified dammarane-type triterpenes.

Key words *Viburnum dilatatum*; Caprifoliaceae; triterpene; dammarane; viburnol

We have recently reported the isolation of five new triterpenoids, viburnols A, B, C, D and E, from the $CHCl_3$ extract of the leaves of *Viburnum dilatatum* THUNB.[1] In a previous communication,[2] we reported the isolation and structural elucidation of six new triterpenoids, viburnols F—K, obtained from the remaining fractions of the same extract. In this paper, we present a full account of the structure elucidations of viburnols F (**1**), G (**2**), H (**3**), I (**4**), J (**5**) and K (**6**).

Viburnol F (**1**) was obtained as its methyl ester **1a**, $[\alpha]_D$ +43.5° ($CHCl_3$). The molecular formula of **1a** was assigned as $C_{31}H_{50}O_7$ on the basis of the MS and ^{13}C-NMR spectral data. Its ^{1}H- and ^{13}C-NMR spectra were similar to those of viburnol E.[1] The ^{1}H- and ^{13}C-NMR spectra of **1a**, however, lacked the signals due to a methylene (C-1) and a cyclic ketone (C-2) of viburnol E and instead showed signals characteristic of two oxygenated carbons [a methine (δ_H 4.37, δ_C 82.5) and a quaternary carbon (δ_C 85.5)], a methoxycarbonyl group (δ_H 3.76, δ_C 174.9, 51.9) and two hydroxyl groups (δ_H 4.68, 4.28, each 1H, disappearing on D_2O exchange). These findings suggested that the two hydroxy groups are located at the C-1 and -2 positions, and the methoxycarbonyl group is located at the hydroxy-bearing quaternary carbon (δ_C 85.5), in the five-membered A-ring. The location of the methoxycarbonyl on C-2 was deduced from the heteronuclear multiple bond coherence (HMBC) spectrum. The quaternary carbon at δ_C 85.5 showed HMBC correlations with the methyl protons at δ 1.05 (28-CH_3) and 0.84 (29-CH_3), which are also correlated to the quaternary carbon at δ 46.7 (C-4). On the other hand, the methine carbon at δ 82.5 showed a correlation with the methyl protons at δ 1.09 (19-CH_3), which are also correlated to the quaternary carbon at δ 46.0 (C-10). Thus, the structure of ring A of **1a** was indicated. The stereochemistry of **1a** was deduced from the difference nuclear Overhauser effect (NOE) spectra. The observation of NOE enhancements between 1-H/19-CH_3 (but not between 1-OH/19-CH_3), 19-CH_3/29-CH_3, 29-CH_3/2-$COOCH_3$ and 2-$COOCH_3$/1-H indicated that they were all on the same face (β) of the molecule, while the presence of interactions between 1-OH/9-H and 2-OH/28-CH_3 revealed that these were on the same face (α), opposite to the β-face. The signal of 9-H of **1a** was shifted to a lower field ($\Delta\ \delta$ +0.46) than that of viburnol E indicating the presence of steric compression between 1α-OH and 9-H. Moreover, the carbon signal of C-9 was shifted upfield from that of viburnol E by $\Delta\ \delta$ −7.4 due to the γ-gauche effect with 1α-OH (C-19 seems not to be affected by 1-OH). All other HMBC (Fig. 1) and NOE

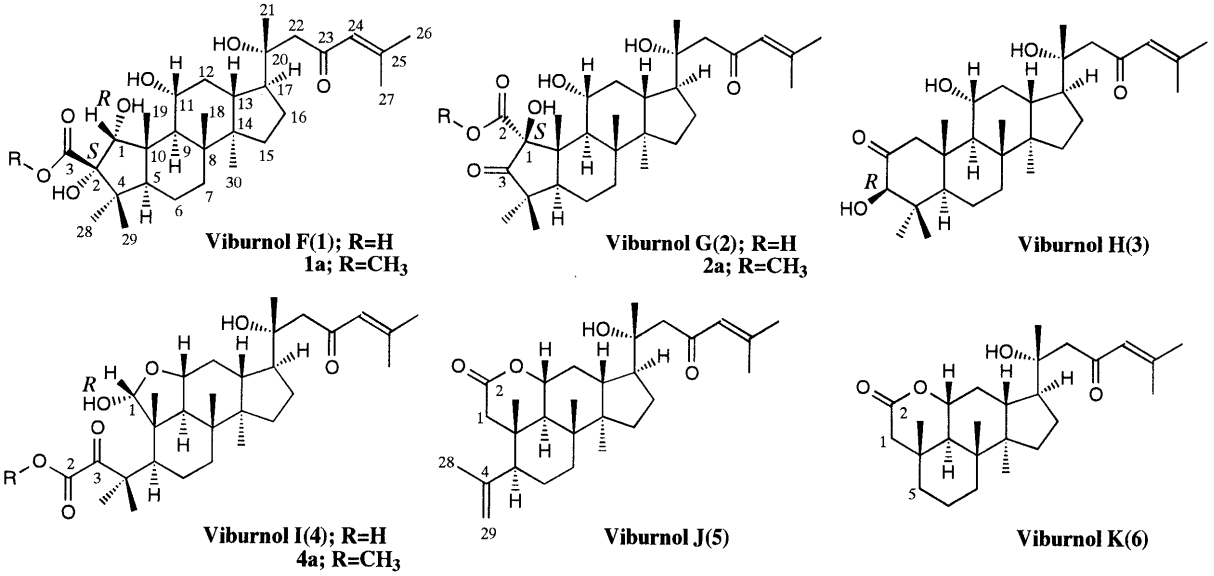

Chart 1

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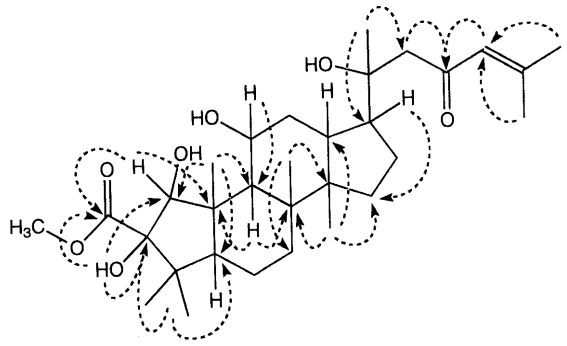

Fig. 1. HMBC Correlations of **1a**

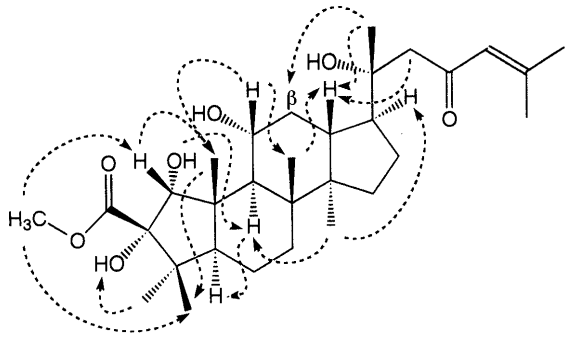

Fig. 2. NOE Enhancements of **1a**

(Fig. 2) correlations of **1a** were the same as those of viburnol E. On the basis of the above data, the structure of viburnol F (1) was established as depicted in the formula.

Viburnol G (**2**) was obtained as its methyl ester **2a**, $[\alpha]_D$ +73.8° ($CHCl_3$). The molecular formula of **2a** was assigned as $C_{31}H_{48}O_7$ on the basis of the MS and ^{13}C-NMR spectral data. From comparison of the NMR spectral data of **2a** with those of viburnol E, it was deduced that **2a** possesses an oxygenated quaternary carbon (δ_C 89.2), a methoxycarbonyl group (δ_H 3.76, δ_C 172.4, 52.9) and a hydroxyl group (δ_H 5.64, 1H, disappearing on D_2O exchange) instead of a methylene (C-1) group in viburnol E. These findings suggested that a tertiary alcohol and a methoxycarbonyl group are located at the C-1 position in the five-membered A-ring. This deduction was supported by the HMBC spectrum. The carbon at δ 89.2 showed a correlation with the methyl protons at δ 1.02 (19-CH_3), which are also correlated to the quaternary carbon at δ 49.0 (C-10). Furthermore, correlations were observed between the carbon at δ 217.3 (C-3) and the protons of 1-OH (δ 5.64), 28-CH_3 and 29-CH_3 (δ 1.07, 1.17). Thus, the structure **2a** was indicated. The hydroxyl group at C-1 was determined to be on the same side as 19-CH_3 from the NOE difference spectrum. The C-19 signal of **2a** was shifted upfield from that of viburnol E by $\Delta\delta$ −3.3 due to the γ-gauche effect of 1β-OH. All other HMBC and NOE correlations of **2a** were the same as those of viburnol E. On the basis of the above data, the structure of viburnol G (**2**) was established to be as depicted.

Viburnol H (**3**) was obtained as an amorphous powder, $[\alpha]_D$ +43.3° ($CHCl_3$). The molecular formula of **3** was assigned as $C_{30}H_{48}O_5$ on the basis of the MS and ^{13}C-NMR spectral data. The ^{1}H- and ^{13}C-NMR spectral data of **3** were closely related to those of viburnol D,[1] except that **3** had an oxygenated methine (δ 82.4) instead of the methylene group in viburnol D. Thus, **3** may be formulated as a hydroxy derivative of viburnol D at ring A. The ^{1}H-NMR spectrum of **3**, however, showed signals of a methine proton at δ 3.89 (1H, s) and a methylene proton at δ 2.25 and 3.48 (each 1H, d, J=13.0 Hz). The multiplicities of these signals indicated that the keto group is located between a hydroxymethine and a methylene group, possibly on C-2. The location of the hydroxy group on C-3 was deduced from the HMBC spectrum, that is, cross peaks were observed between the methylene protons and C-9, -10 and -19, and between the hydroxymethine proton and C-4, -28 and -29. The stereochemistry of the hydroxyl group at C-3 was determined as β on the basis of the NOE difference spectra, in which NOE enhancements were observed at 3-H and 9-H when one of the methylene protons (δ 2.25) at C-1 was irradiated. All other HMBC and NOE correlations of **3** were the same as those of viburnol D. On the basis of the above data, the structure of viburnol H (**3**) is proposed to be as depicted in the formula.

Viburnol I (**4**) was obtained as its methyl ester **4a**, $[\alpha]_D$ +20.0° ($CHCl_3$). The molecular formula of **4a** was assigned as $C_{31}H_{48}O_7$ on the basis of the MS and ^{13}C-NMR spectral data. From a comparison of the spectral data of **4a** with those of viburnol B methyl ester,[1] it was deduced that **4a** possesses a hemiacetal (δ_H 4.99, δ_C 105.2) and a carbonyl (1738 cm^{-1}, δ_C 202.8) instead of methylene (C-1) and δ-lactone carbonyl (C-2) groups in viburnol B. The planar structure of **4a** was finally deduced from the HMBC spectrum. The cross peaks between the proton at δ 4.99 and C-11 (δ 75.8), and between the 19-CH_3 (δ 1.07) and the carbon at δ 105.2, suggested the presence of a five-membered hemiacetal ring between C-1 and -11. The cross peaks between the methyl protons at δ 1.25 and 1.37 (28-CH_3, 29-CH_3) and carbon signals at δ 202.8, 50.3 (C-4) and 45.5 (C-5), respectively, suggested that the carbon signal at δ 202.8 is assignable to C-3. The remaining methoxycarbonyl moiety should, therefore be connected with this carbonyl. The presence of the α-ketomethylester moiety was supported by the electron impact (EI) mass fragment at m/z 287 [$M^+ - H_2O$ − C_6H_9O (C-20/-22 cleavage)-$C_6H_{10}O_3$ (C-4/C-5 cleavage)]. On the basis of the above data, **4a** was suggested to be an A-seco dammarane-type triterpene having a five-membered hemiacetal ring and methoxalyl group. The stereochemistry of the hemiacetal group at C-1 was determined by an NOE experiment; a significant NOE between 1-H and 19-CH_3 was observed. Moreover, the carbon signal of C-5 in **4a** was shifted upfield from that of viburnol B methyl ester by $\Delta\delta$ −9.8 due to the γ-gauche effect of 1α-OH (C-19 seems to be unaffected by the 1-OH). All other HMBC and NOE correlations of **4a** were the same as those of viburnol B methyl ester. On the basis of the above data, the structure of viburnol I (**4**) was established to be as depicted in the formula.

Viburnol J (**5**) was obtained as an amorphous powder, $[\alpha]_D$ +45.5° ($CHCl_3$). The molecular formula of **5** was assigned as $C_{29}H_{44}O_4$ on the basis of the MS and ^{13}C-NMR spectral data. From a comparison of the NMR spectral data of **5** with those of viburnol C,[1] it was

Table 1. ^{13}C-NMR Chemical Shifts (67.8 MHz, $CDCl_3$)

C	1a	2a	3	4a	5	6
1	82.5	89.2	55.9	105.2	48.9	50.6
2	85.5	172.4	212.3	164.9	170.5	170.4
3	174.9	217.5	82.4	202.8	—	—
4	46.7	44.5	45.3	50.3	144.5	—
5	55.9	51.6	55.3	45.5	56.1	40.2
6	17.9	17.5	18.3	22.7	23.7	18.1
7	35.2	35.0	35.4	34.0	34.1	33.9
8	41.2	41.6	41.0	38.2	39.1	39.2
9	47.3	49.1	55.1	49.8	46.5	45.3
10	46.0	49.0	44.8	47.5	35.7	32.1
11	69.8	69.5	70.3	75.8	78.0	78.6
12	38.2	37.6	39.7	34.5	34.7	34.7
13	41.2	41.4	40.7	43.3	40.9	40.9
14	50.2	50.5	50.1	50.2	50.1	50.0
15	30.9	30.8	30.7	30.9	30.7	30.6
16	25.2	25.2	25.0	26.0	25.0	25.0
17	50.1	50.0	50.2	48.3	49.3	49.3
18	16.8	17.1	16.3	15.3	15.2	15.0
19	16.9	14.5	17.7	17.3	17.2	20.4
20	74.9	74.6	74.8	74.8	74.4	74.4
21	26.5	26.0	26.5	26.1	25.8	25.8
22	50.0	50.9	49.9	50.6	51.0	51.0
23	202.9	202.8	202.8	202.7	202.6	202.6
24	124.9	124.9	124.8	124.8	124.7	124.7
25	157.6	57.8	157.6	157.5	157.8	157.7
26	27.9	28.0	27.8	27.9	27.9	27.9
27	21.0	21.2	21.0	21.0	21.0	21.0
28	25.3	27.6	29.5	20.5	22.9	—
29	21.2	22.3	16.5	23.8	114.6	—
30	16.7	16.7	16.3	16.0	16.4	16.3

Assignments were confirmed by ^{1}H–^{1}H and ^{13}C–^{1}H COSY, distortionless enhancement by polarization transfer (DEPT) and HMBC methods.

deduced that **5** possesses an isopropenyl group (δ_H 4.92, 4.68, 1.75, δ_C 144.5, 114.6, 22.9) instead of a hydroxyl and two methyl (C-28, -29) groups in viburnol C. The isopropenyl group was located at C-5 from the HMBC spectrum. The carbon signal at δ 56.1 (C-5) showed correlations with the methyl protons (δ 1.75) and with the olefin protons (δ 4.92, 4.68). All other HMBC and NOE correlations of **5** were the same as those of viburnol C. On the basis of the above data, the structure of viburnol J (**5**) was established to be as depicted in the formula.

Viburnol K (**6**) was obtained as an amorphous powder, $[\alpha]_D$ +25.5° ($CHCl_3$). The molecular formula of **6** was assigned as $C_{26}H_{40}O_4$ on the basis of the MS and ^{13}C-NMR spectral data. From a comparison of the NMR spectral data of **6** with those of viburnol C, it was deduced that **6** possesses a methylene (δ_C 40.2) group instead of a hydroxyl-bearing carbon (C-4), two methyls (C-28, -29) and a methine (C-5) in viburnol C. The carbon signals of C-6 and -10 in **6** were shifted upfield from those of viburnol C by $\Delta\delta$ −4.1 and −5.5, respectively, because of the loss of the β-substituent effect. These findings suggested that the methylene carbon at δ 40.2 could be assigned as C-5. All other HMBC and NOE correlations of **6** were the same as those of viburnol C. On the basis of the above data, the structure of viburnol K (**6**) was established to be as depicted in the formula. Viburnol K (**6**) is the first example of a ring A-tetranor (C-3, -4, -28 and -29)- triterpene isolated from a natural source.

The methyl esters **1a**, **2a** and **4a** may be artifacts formed from the corresponding acids **1**, **2** and **4** during the extraction and isolation processes.

Viburnols F (**1**), G (**2**), H (**3**), I (**4**), J (**5**) and K (**6**) were presumably biosynthesized from viburnol D (Fig. 3), so all the chiral centers of **1** (except C-1 and -2), **2** (except C-1), **3** (except C-3), **4** (except C-1), **5** and **6** are expected to coincide with those of viburnol D, whose absolute configuration was elucidated from the circular dichroism (CD) spectrum.[1] Based on this assumption, the full structures of viburnols F—K (**1**—**6**) are as shown in Chart 1.

Compounds **1**—**6** are new dammarane-type triterpenes, and compounds **1**, **2** and **4** are the first examples of a new class of modified dammarane-type triterpenes. Furthermore, the occurrence of compounds **1** and **2** gives important clues to the biosynthesis of the A-nor-triterpenoid, viburnol E.

It is likely that all viburnols (except viburnols D and H) are biosynthesized from the postulated intermediate (**7**; dammar-24-ene-2,3,23-trione-1α,11α,20α-triol). Bonds cleavages at ring A followed by recyclization would afford viburnols F (route A), G (route B), A (route C) and I (route D) (Fig. 3).[3]

Experimental

The instruments, materials and experimental conditions were the same as in our previous paper.[1]

Extraction and Isolation The extraction and isolation procedures were as described in our previous paper.[1] Compounds **1a** (10.0 mg), **2a** (7.0 mg), **3** (30.0 mg), **4a** (6.5 mg), **5** (10.0 mg) and **6** (9.5 mg) were isolated from frs. 3-2-4—3-2-8 by preparative HPLC.

Viburnol F Methyl Ester (**1a**): An amorphous powder, $[\alpha]_D$ +43.5° (c=0.3, $CHCl_3$). IR ($CHCl_3$) cm^{-1}: 3421, 2954, 1727, 1672, 1613. UV λ_{max} (MeOH) nm (log ε): 241.0 (3.89). EI-MS m/z: 516 $(M-H_2O)^+$. FAB-MS m/z: 535 $(M+H)^+$. HR-MS m/z: 516.3459 (M^+-H_2O, Calcd for $C_{31}H_{48}O_6$; 516.3451). ^{1}H-NMR (270 MHz, $CDCl_3$) δ: 6.07 (1H, br t, J=1.2 Hz, 24-H), 4.68 (1H, br s, 1-OH), 4.40 (1H, s, 20-OH), 4.37 (1H, s, 1-H), 4.28 (1H, s, 2-OH), 3.99 (1H, ddd, J=11.2, 10.5, 5.0 Hz, 11-H), 3.76 (3H, s, $COOCH_3$), 2.54, 2.61 (2H, d, J=16.4 Hz, 22-CH_2), 2.42 (1H, br s, 11-OH), 2.21 (1H, m, 12-H_β), 2.17 (3H, d, J=1.2 Hz, 27-CH_3), 2.14 (1H, d, J=11.2 Hz, 9-H), 1.91 (3H, d, J=1.2 Hz, 26-CH_3), 1.21 (3H, s, 21-CH_3), 1.09 (3H, s, 19-CH_3), 1.05 (3H, s, 28-CH_3), 0.97 (6H, s, 18,30-CH_3), 0.84 (3H, s, 29-CH_3). ^{13}C-NMR (67.8 MHz, $CDCl_3$): Table 1.

Viburnol G Methyl Ester (**2a**): An amorphous powder, $[\alpha]_D$ +73.8° (c=0.4, $CHCl_3$). IR ($CHCl_3$) cm^{-1}: 3451, 2957, 1755, 1719, 1672, 1613. UV λ_{max} (MeOH) nm (log ε): 240.0 (3.93). EI-MS m/z: 514 $(M-H_2O)^+$. FAB-MS m/z: 533 $(M+H)^+$. HR-MS m/z: 514.3303 (M^+-H_2O, Calcd for $C_{31}H_{46}O_6$; 514.3295). ^{1}H-NMR (270 MHz, $CDCl_3$) δ: 6.05 (1H, br t, J=1.2 Hz, 24-H), 5.64 (1H, s, 1-OH), 4.37 (1H, s, 20-OH), 3.82 (1H, m, 11-H), 3.76 (3H, s, $COOCH_3$), 3.34 (1H, d, J=8.9 Hz, 11-OH), 2.57 (2H, s, 22-CH_2), 2.32 (1H, m, 12-H_β), 2.17 (3H, d, J=1.2 Hz, 27-CH_3), 2.06 (1H, d, J=10.9 Hz, 9-H), 1.92 (3H, d, J=1.2 Hz, 26-CH_3), 1.20 (3H, s, 21-CH_3), 1.17 (3H, s, 29-CH_3), 1.07 (3H, s, 28-CH_3), 1.02 (6H, s, 18,19-CH_3), 0.94 (3H, s, 30-CH_3). ^{13}C-NMR (67.8 MHz, $CDCl_3$): Table 1.

Viburnol H (**3**): An amorphous powder, $[\alpha]_D$ +43.3° (c=0.7, $CHCl_3$). IR ($CHCl_3$) cm^{-1}: 3475, 3019, 2974, 1704, 1674, 1614. UV λ_{max} (MeOH) nm (log ε): 240.0 (3.79). EI-MS m/z: 470 $(M-H_2O)^+$. FAB-MS m/z: 489 $(M+H)^+$. HR-MS m/z: 470.3366 (M^+-H_2O, Calcd for $C_{30}H_{46}O_4$; 470.3396). ^{1}H-NMR (270 MHz, $CDCl_3$) δ: 6.06 (1H, br t, J=1.3 Hz, 24-H), 4.36 (1H, br s, 20-OH), 3.98 (1H, ddd, J=10.6, 10.4, 5.3 Hz, 11-H), 3.89 (1H, s, 3-H), 3.48 (1H, d, J=13.0 Hz, 1-H_β), 2.56 (2H, s, 22-CH_2), 2.25 (1H, d, J=13.0 Hz, 1-H_α), 2.22 (1H, m, 12-H_β), 2.17 (3H, d, J=1.3 Hz, 27-CH_3), 1.92 (3H, d, J=1.3 Hz, 26-CH_3), 1.70 (1H, d, J=10.6 Hz, 9-H), 1.21 (3H, s, 21-CH_3), 1.19 (3H, s, 28-CH_3), 0.99 (3H, s, 19-CH_3), 0.96 (6H, s, 18,30-CH_3), 0.70 (3H, s, 29-CH_3). ^{13}C-NMR (67.8 MHz, $CDCl_3$): Table 1.

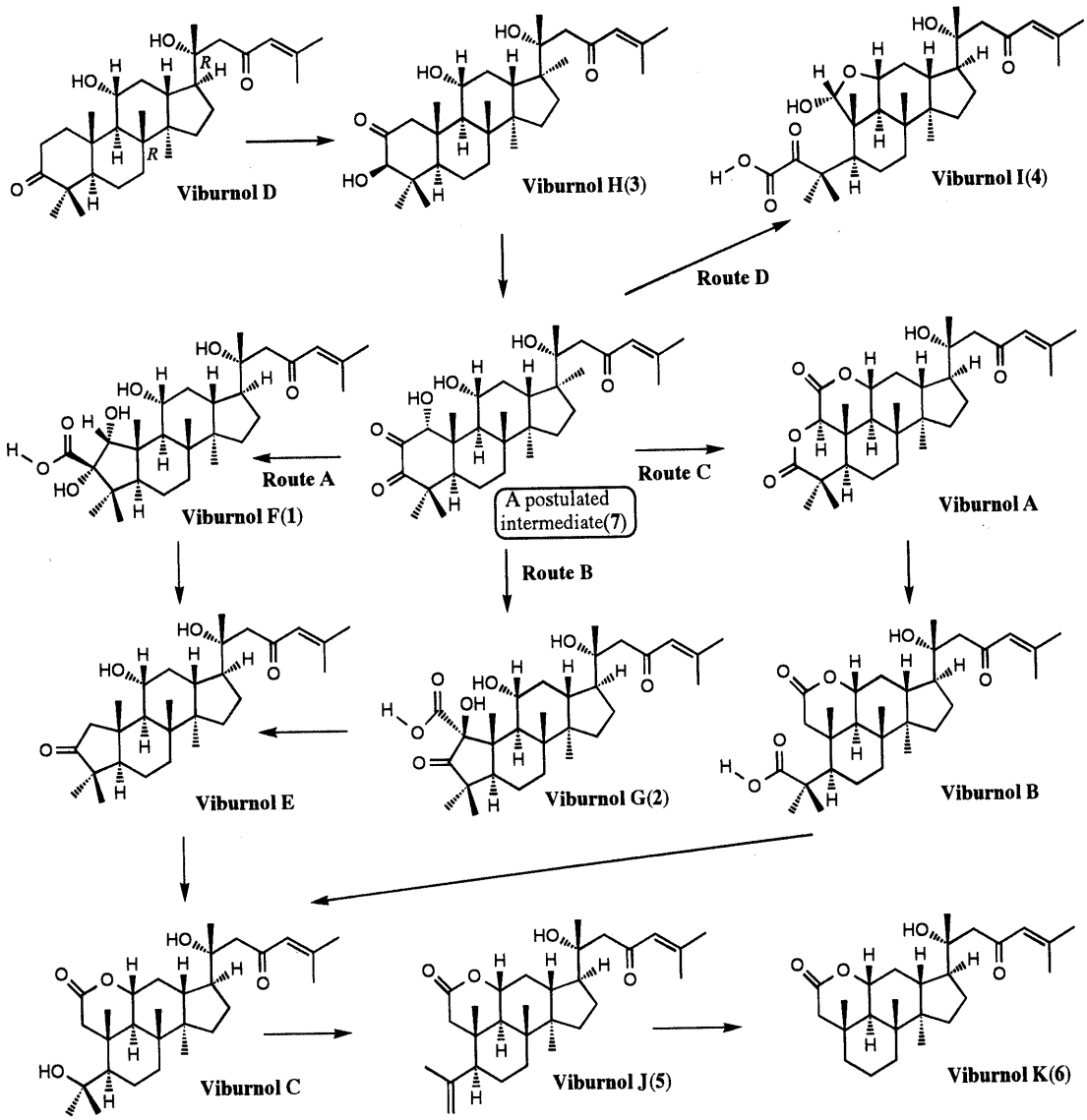

Fig. 3. Possible Biosynthetic Pathways of Viburnols

Viburnol I Methyl Ester (**4a**): An amorphous powder, $[\alpha]_D$ +20.0° (c=0.3, $CHCl_3$). IR ($CHCl_3$) cm^{-1}: 3452, 2958, 2928, 1738, 1713, 1673, 1612. UV λ_{max} (MeOH) nm (log ε): 241.0 (3.94). EI-MS m/z: 514 $(M-H_2O)^+$. FAB-MS m/z: 533 $(M+H)^+$. HR-MS m/z: 514.3322 (M^+-H_2O, Calcd for $C_{31}H_{46}O_6$; 514.3295), m/z: 417.2674 ($M^+-H_2O-C_6H_9O$, Calcd for $C_{25}H_{37}O_5$; 417.2641), m/z: 287.1970 ($M^+-H_2O-C_6H_9O-C_6H_{10}O_3$, Calcd for $C_{19}H_{27}O_2$; 287.2011). ^{1}H-NMR (270 MHz, $CDCl_3$) δ: 6.04 (1H, br t, J=1.0 Hz, 24-H), 4.99 (1H, d, J=2.5 Hz, 1-H), 4.33 (1H, s, 20-OH), 3.84 (3H, s, $COOCH_3$), 3.73 (1H, ddd, J=11.9, 11.0, 5.0 Hz, 11-H), 2.61, 2.53 (2H, d, J=16.5 Hz, 22-CH_2), 2.36 (1H, m, 12-H_β), 2.34 (1H, d, J=2.5 Hz, 1-OH), 2.16 (3H, d, J=1.0 Hz, 27-CH_3), 2.10 (1H, d, J=11.9 Hz, 9-H), 1.91 (3H, d, J=1.0 Hz, 26-CH_3), 1.37 (3H, s, 29-CH_3), 1.25 (3H, s, 28-CH_3), 1.19 (3H, s, 21-CH_3), 1.07 (3H, s, 19-CH_3), 0.97 (3H, s, 18-CH_3), 0.96 (3H, s, 30-CH_3). ^{13}C-NMR (67.8 MHz, $CDCl_3$): Table 1.

Viburnol J (**5**) An amorphous powder, $[\alpha]_D$ +45.5° (c=0.2, $CHCl_3$). IR ($CHCl_3$) cm^{-1}: 3456, 2965, 1718, 1673, 1611. UV λ_{max} (MeOH) nm (log ε): 241.0 (3.93). EI-MS m/z: 438 $(M-H_2O)^+$. FAB-MS m/z: 457 $(M+H)^+$. HR-MS m/z: 438.3112 (M^+-H_2O, Calcd for $C_{29}H_{42}O_3$; 438.3134). ^{1}H-NMR (270 MHz, $CDCl_3$) δ: 6.05 (1H, br s, 24-H), 4.92 (1H, t, J=1.7 Hz, 29-H_b), 4.68 (1H, br s, 29-H_a), 4.42 (1H, ddd, J=11.6, 11.4, 5.0 Hz, 11-H), 4.38 (1H, s, 20-OH), 2.57 (2H, s, 22-CH_2), 2.54 (1H, d, J=16.0 Hz, 1-H_β), 2.39 (1H, ddd, J=12.0, 5.0, 3.0 Hz, 12-H_β), 2.17 (3H, s, 27-CH_3), 2.16 (1H, d, J=16.0 Hz, 1-H_α), 1.92 (3H, d, J=1.3 Hz, 26-CH_3), 1.79 (1H, d, J=11.6 Hz, 9-H), 1.75 (3H, br s, 28-CH_3), 1.21 (3H, s, 21-CH_3), 1.06 (6H, s, 18, 19-CH_3), 0.97 (3H, s, 30-CH_3). ^{13}C-NMR (67.8 MHz, $CDCl_3$): Table 1.

Viburnol K (**6**) An amorphous powder, $[\alpha]_D$ +25.5° (c=0.4, $CHCl_3$). IR ($CHCl_3$) cm^{-1}: 3452, 2943, 1718, 1674, 1614. UV λ_{max} (MeOH) nm (log ε): 241.0 (3.80). EI-MS m/z: 398 $(M-H_2O)^+$. FAB-MS m/z: 417 $(M+H)^+$. HR-MS m/z: 398.2831 (M^+-H_2O, Calcd for $C_{26}H_{38}O_3$; 398.2821). ^{1}H-NMR (270 MHz, $CDCl_3$) δ: 6.04 (1H, br t, J=1.0 Hz, 24-H), 4.39 (1H, ddd, J=11.9, 10.6, 5.0 Hz, 11-H), 4.37 (1H, s, 20-OH), 2.56 (2H, s, 22-CH_2), 2.38 (1H, m, 12-H_β), 2.34 (1H, d, J=17.2 Hz, 1-H_β), 2.17 (3H, d, J=1.0 Hz, 27-CH_3), 2.16 (1H, d, J=17.2 Hz, 1-H_α), 1.92 (3H, d, J=1.0 Hz, 26-CH_3), 1.78 (1H, d, J=11.9 Hz, 9-H), 1.21 (3H, s, 21-CH_3), 1.12 (3H, s, 19-CH_3), 1.04 (3H, s, 18-CH_3), 0.95 (3H, s, 30-CH_3). ^{13}C-NMR (67.8 MHz, $CDCl_3$): Table 1.

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References and Notes

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