SOROCENOLS C - F, FOUR NEW ISOPRENYLATED PHENOLS FROM THE ROOT BARK OF *SOROCEA BONPLANDII* BAILLON[1]

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Abstract — From the root bark of *Sorocea bonplandii* Baillon (Moraceae), collected in Paraguay, four new isoprenylated phenols, sorocenols C (**1**), D (**2**), E (**3**), and F (**4**) were isolated along with four known isoprenylated phenols, mulberrofuran K (**5**), kuwanon J (**6**), chalcomoracin (**7**), and kuwanol E (**8**). The structures of sorocenols C - F were shown to be **1** - **4**, respectively. These compounds are regarded as variations of Diels-Alder type adducts between chalcone derivatives and dehydroisoprenylated phenols.

Previously we reported the structure determination of two new isoprenylated phenols, sorocenols A and B, isolated from the root bark of *Sorocea bonplandii* Baillon, collected in Paraguay.[2] Further extension of studies on the components of *S. bonplandii* led to the isolation of four new isoprenylated phenols, sorocenols C (**1**), D (**2**), E (**3**), and F (**4**). This paper deals with characterization of these compounds. Sorocenol C (**1**), pale yellow plates, mp 242 - 243 °C, $[\alpha]_D^{21}$ 0°, showed positive reaction to methanolic ferric chloride, and gave the protonated molecular ion peak at *m/z* 645 in the fast-atom bombardment (FAB) mass spectrum. The ^{13}C nmr spectrum indicated the presence of thirty nine carbons (Table 1). These results suggest the molecular formula of **1** to be $C_{39}H_{32}O_9$. The uv spectrum of **1** exhibited maxima at 220, 283, 313 (sh), 333 (sh), 347, 366 nm. While the absorption pattern of the spectrum was similar to those of 2-arylbenzofuran derivatives,[3] the absorption maxima were shifted to longer wave side. Furthermore the spectrum of **1** was similar to those of albanol B (**9**)[4,5] and mulberrofuran P (**10**),[6] demonstrating that **1** is an 2-arylbenzofuran derivative such as **9** and **10**. The ^1H nmr spectrum of **1** was analysed by comparing with that of **9**, along with the aid of the 2D ^1H-^1H COSY spectrum and showed the signals of the following protons (δ in acetone-d_6): protons in a 3-hydroxy-3-methylbutyl group, δ 1.19,

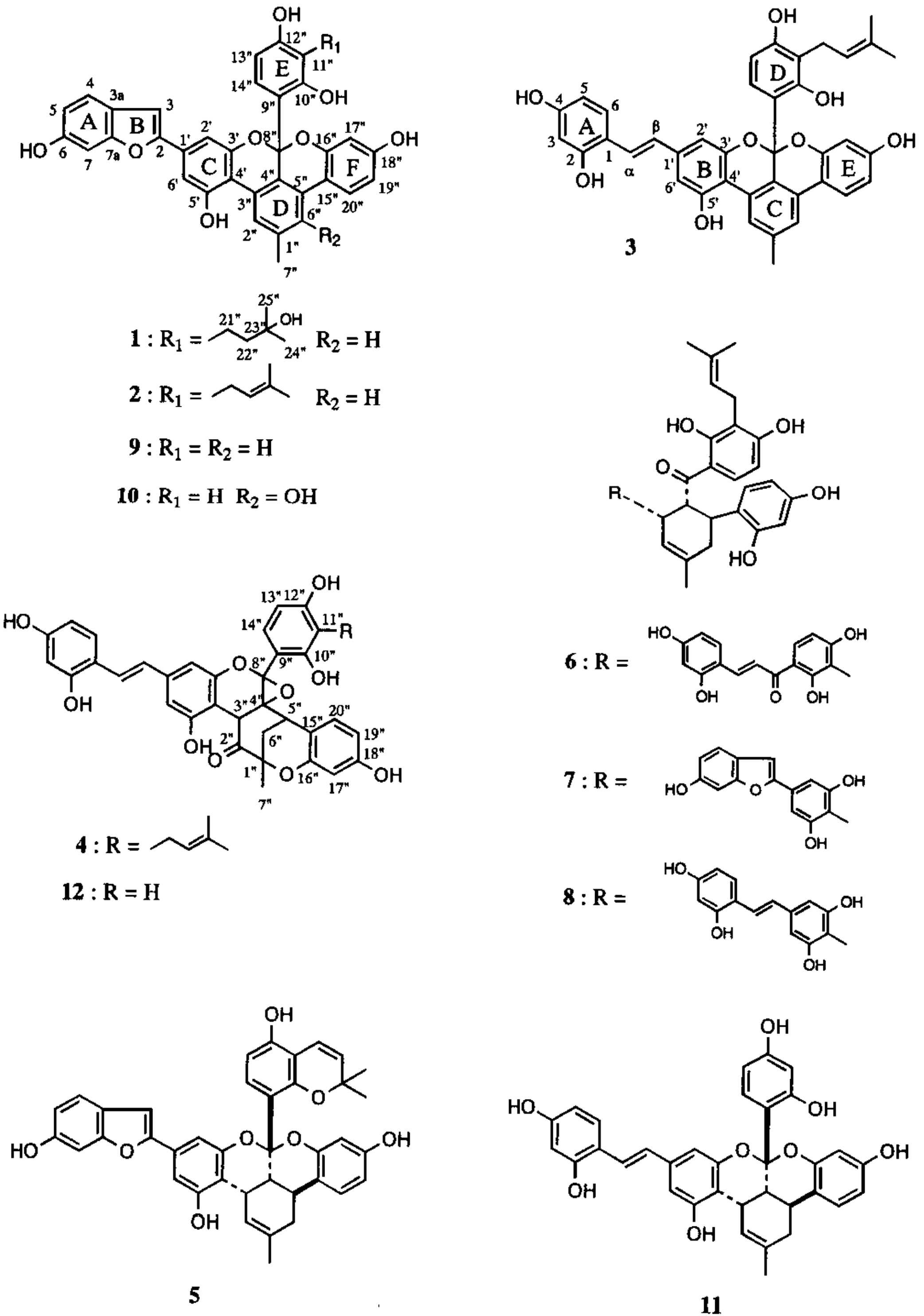
1 : R1 = (21"–25" OH side chain) R2 = H
2 : R1 = (prenyl) R2 = H
9 : R1 = R2 = H
10 : R1 = H R2 = OH
3
4 : R = (prenyl)
12 : R = H
6 : R =
7 : R =
8 : R =
5
11
A
B
C
D
E
F
OH
HO
R1
R2
R

Figure 1

Table 1 ^{13}C and ^{1}H nmr chemical shifts (ppm) of **1** and **2**

	1$^{\#1}$		**2**$^{\#1}$		**9**$^{\#2}$
C	(δ ^{13}C)	(δ ^{1}H)	(δ ^{13}C)	(δ ^{1}H)	
C-2	154.2		154.2		155.0
C-3	103.5	7.11 (d, *J* = 1)	103.5	7.12 (d, *J* = 1)	103.2
C-3a	122.4		122.4		123.0
C-4	122.3	7.42 (d, *J* = 8)	122.3	7.42 (d, *J* = 8)	122.3
C-5	113.5	6.82 (dd, *J* = 2 and 8)	113.6	6.82 (dd, *J* = 2 and 8)	113.5
C-6	157.1		157.1		157.4
C-7	98.5	6.99 (br d, *J* = 2)	98.4	6.99 (d, *J* = 2)	98.5
C-7a	157.0		157.0		157.4
C-1'	132.4		132.4		132.7
C-2'	105.9	7.12 (d, *J* = 1.5)	105.9	7.12 (d, *J* =1.5)	106.1
C-3'	153.3		153.2		153.6
C-4'	111.2		111.2		111.6
C-5'	156.9		156.9		157.1
C-6'	107.5	7.14 (d, *J* = 1.5)	107.5	7.14 (d, *J* = 1.5)	107.6
C-1"	140.6		140.7		140.8
C-2"	126.4	8.46 (br s)[a]	126.5	8.46 (br s)[a]	126.7
C-3"	129.7		129.7		130.1
C-4"	121.9		121.9		122.5
C-5"	129.2		129.2		129.8
C-6"	121.4	7.63 (br s)[a]	121.4	7.63 (br s)[a]	121.3
C-7"	22.2	2.52 (3H, br s)	22.2	2.52 (3H, br s)	22.3
C-8"	106.9		106.9		106.7
C-9"	115.1		115.0		116.0
C-10"	155.4		155.4		158.2
C-11"	118.3		116.9		105.0
C-12"	158.4		158.3		160.8
C-13"	106.2	5.94 (d, *J* = 8)	105.9	5.95 (d, *J* = 8)	106.5
C-14"	127.6	6.02 (d, *J* = 8)	127.7	6.01 (d, *J* = 8)	131.6
C-15"	115.0		115.0		115.7
C-16"	152.2		152.2		152.7
C-17"	105.3	6.58 (d, *J* = 2)	105.3	6.57 (d, *J* = 2)	105.4
C-18"	160.1		160.1		160.2
C-19"	111.7	6.59 (dd, *J* = 2 and 8)	111.7	6.59 (dd, *J* = 2 and 8)	111.6
C-20"	125.3	7.72 (d, *J* = 8)	125.4	7.72 (d, *J* = 8)	125.3
C-21"	18.8	2.73 (2H, m)	22.8	3.36 (2H, br d, *J* = 6.5)	
C-22"	43.3	1.65 (2H, m)	124.0	5.22 (m)	
C-23"	70.8		131.0		
C-24"	29.5	1.19 (3H, s)	17.9	1.75 (3H, br s)	
C-25"	29.8	1.22 (3H, s)	25.9	1.54 (3H, br s)	

Solvent #1 : acetone-*d*$_6$ #2 : CD_3OD *J* in Hz

[a] These protons showed long-range coupling with the methyl protons at C-7"

1.22 (each 3H, s), 1.65, 2.73 (each 2H, m), two sets of ABX type aromatic protons, δ 6.82 (1H, dd, *J* = 2 and 8 Hz), 6.99 (1H, d, *J* = 2 Hz), 7.42 (1H, d, *J* = 8 Hz), 6.58 (1H, d, *J* = 2 Hz), 6.59 (1H, dd, *J* = 2 and 8 Hz), 7.72 (1H, d, *J* = 8 Hz), *o*-coupled aromatic protons, δ 5.94 (1H, d, *J* = 8 Hz), 6.02 (1H, d, *J*

= 8 Hz), two sets of *m*-coupled aromatic protons, δ 7.12, 7.14 (each 1H, d, J = 1.5 Hz), 7.63 (1H, br s), 8.46 (1H, br s), one olefinic proton, δ 7.11 (1H, d, J = 1 Hz), methyl group on an aromatic ring, δ 2.52 (3H, br s). In the ^{1}H nmr spectrum of **1**, the coupling patterns and the chemical shifts of all the proton signals except those of the 3-hydroxy-3-methylbutyl group and the protons on the E ring were similar to those of the relevant protons of **9**.[4,6] These results suggest that **1** seems to be 11"-substituted albanol B. This assumption was supported by the ^{13}C nmr spectrum of **1**. The spectrum of **1** was analysed by comparing with that of **9**, along with the aid of the 2D ^{13}C-^{1}H COSY spectrum (Table 1). In the spectrum, the chemical shifts of all the carbon atoms except the carbons at C-11" and C-14" positions were approximately similar to those of the relevant carbons of **9**. From the above results, the structure of sorocenol C is characterized as **1**.

Sorocenol D (**2**), pale yellow amorphous powder, $[\alpha]_D^{18}$ 0°, showed positive reaction to methanolic ferric chloride, and gave the protonated molecular ion peak at *m/z* 627 in the FAB mass spectrum. The ^{13}C nmr spectrum of **2** showed the presence of thirty nine carbons (Table 1). These results suggest the molecular formula to be $C_{39}H_{30}O_8$. The uv spectrum of **2** was similar to that of **1**. The ^{1}H nmr spectrum of **2** was analysed by comparing with that of **1**, along with the aid of the 2D ^{1}H-^{1}H COSY spectrum, and showed the signals of the following protons: protons in a 3,3-dimethylallyl group, δ 1.54, 1.75 (each 3H, br s), 3.36 (2H, br d, J = 6.5 Hz), 5.22 (1H, m), two sets of ABX type aromatic protons, δ 6.82 (1H, dd, J = 2 and 8 Hz), 6.99 (1H, d, J = 2 Hz), 7.42 (1H, d, J = 8 Hz), 6.57 (1H, d, J = 2 Hz), 6.59 (1H, dd, J = 2 and 8 Hz), 7.72 (1H, d, J = 8 Hz), *o*-coupled aromatic protons, δ 5.95, 6.01 (each 1H, d, J = 8 Hz), two sets of *m*-coupled aromatic protons, δ 7.12, 7.14 (each 1H, d, J = 1.5 Hz), 7.63, 8.46 (each 1H, br s), one olefinic proton, δ 7.12 (1H, d, J = 1 Hz), methyl group on an aromatic ring, δ 2.52 (3H, br s). In the spectrum, the coupling patterns and the chemical shifts of all the proton signals except those of the 3,3-dimethylallyl group were good agreement with those of the relevant protons of **1** (Table 1). In the ^{13}C nmr spectrum of **2**, the chemical shifts of all the carbon atoms except those of the 3,3-dimethylallyl group and the carbon at C-11" position were good agreement with those of the relevant carbon atoms of **1** (Table 1). From the above results, the structure of sorocenol D is characterized as **2**.

Sorocenol E (**3**), pale yellow needles, mp 217 - 220 °C, $[\alpha]_D^{21}$ 0°, showed positive reaction to methanolic ferric chloride, and gave the protonated molecular ion peak at *m/z* 647 in the FAB mass spectrum, and the molecular formula was supported to be $C_{39}H_{34}O_9$ by the presence of thirty nine carbons in the ^{13}C nmr spectrum (Table 2). While the uv spectrum was similar to that of kuwanol A (**11**),[7] the absorption maxima

Table 2 ^{13}C and ^{1}H nmr chemical shifts (ppm) of **3**

	3		**11**	
C	(δ ^{13}C)	(δ ^{1}H)	(δ ^{13}C)	(δ ^{1}H)
C-1	117.0		117.1	
C-2	157.1		157.0	
C-3	103.6	6.45 (d, J = 2)	103.2	6.43 (d, J = 2.4)
C-4	159.4		159.3	
C-5	108.6	6.39 (dd, J = 2 and 8)	108.0	6.38 (dd, J = 2.4 and 8.4)
C-6	128.5	7.42 (d, J = 8)	127.8	7.39 (d, J = 8.4)
C-α	125.8	7.39 (d, J = 16)	125.1	7.32 (d, J = 16.5)
C-β	124.9	6.89 (d, J = 16)	124.0	6.88 (d, J = 16.5)
C-1'	141.1		138.8	
C-2'	107.6	6.81 (br s)	106.4	6.64 (d, J = 1.5)
C-3'	152.9		153.4	
C-4'	109.9		111.4	
C-5'	156.6		157.2	
C-6'	109.9	6.81 (br s)	106.7	6.62 (d, J = 1.5)
C-1"	140.5		132.7	
C-2"	126.2	8.43 (br s)[a]	122.7	
C-3"	129.6		37.2	
C-4"	121.7		28.4	
C-5"	129.6		35.0	
C-6"	120.9	7.59 (br s)[a]	36.1	
C-7"	22.2	2.50 (3H, br s)	23.8	
C-8"	106.8		102.1	
C-9"	115.2		116.7	
C-10"	155.4		156.9	
C-11"	118.1		103.5	
C-12"	158.3		158.4	
C-13"	106.1	5.94 (d, J = 8)	106.7	
C-14"	127.6	6.01 (d, J = 8)	129.7	
C-15"	115.2		116.6	
C-16"	152.2		152.5	
C-17"	105.2	6.56 (d, J = 2)	104.2	
C-18"	159.9		156.9	
C-19"	111.6	6.58 (dd, J = 2 and 8)	109.3	
C-20"	125.3	7.70 (d, J = 8)	127.2	
C-21"	18.8	2.73 (2H, m)		
C-22"	43.3	1.68 (2H, m)		
C-23"	71.0			
C-24"	29.6	1.22 (3H, s)		
C-25"	29.6	1.23 (3H, s)		

Solvent acetone-*d6*

[a] These protons showed long-range coupling with the methyl protons at C-7"

were shifted to longer wave side. The ^{1}H nmr spectrum of **3** was analysed by comparing with those of **9** and **11**, along with the aid of the 2D ^{13}C-^{1}H COSY spectrum (Table 2). The spectrum showed the signals of the following protons: protons in a 3-hydroxy-3-methylbutyl group, δ 1.22, 1.23 (each 3H, s), 1.68, 2.73 (each 2H, m), two sets of ABX type armatic protons, δ 6.39 (1H, dd, J = 2 and 8 Hz), 6.45 (1H, d, J = 2 Hz), 7.42 (1H, d, J = 8 Hz), 6.56 (1H, d, J = 2 Hz), 6.58 (1H, dd, J = 2 and 8 Hz), 7.70 (1H, d, J = 8 Hz), *o*-coupled aromatic protons, δ 5.94, 6.01 (each 1H, d, J = 8 Hz), *m*-coupled aromatic protons, δ 7.59, 8.43 (each 1H, br s), two aromatic protons, δ 6.81 (2H, s), two *trans*-olefinic protons, δ 6.89, 7.39 (each 1H, d, J = 16 Hz), methyl group on an aromatic ring, δ 2.50 (3H, br s). In the spectrum of **3**, the chemical shifts and coupling patterns of all the proton signals of the stilbene moiety in **3** were approximately agreement with those of the relevant proton signals of **11** (Table 2). These results suggest that **3** was a 4'-substituted 2,4,3',5'-tetrahydroxystilbene derivative. The ^{13}C nmr spectrum of **3** was analysed by comparison with those of **9** and **11**, along with the aid of 2D COLOC spectrum of **3** (Table 2). The ^{13}C nmr spectrum of **3** supported that the C ring is an aromatic ring and the C-11" position is substituted with the isoprenoid moiety (Table 2). The chemical shifts of all the carbon atoms of the stilbene moiety in **3**, except those of C-1', C-4' and C-6', were similar to those of the relevant carbons of **11**. Furthermore the chemical shifts of all the carbon atoms in the C, D, and E rings, except those of C-11" and C-14 " positions, were approximately similar to those of the relevant carbons of **9** (Table 1 and 2). From the above results, the structure of sorocenol E is characterized as **3**.

Sorocenol F (**4**), amorphous powder, $[\alpha]_D^{24}$ +20°, showed positive reaction to methanolic ferric chloride, and gave the protonated molecular ion peak at *m/z* 663 in the FAB mass spectrum, and the molecular formula was supported to be $C_{39}H_{34}O_{10}$ by the presence of thirty nine carbons in the ^{13}C nmr spectrum (Table 3). The uv spectrum of **4** was similar to those of oxyresveratrol[8] and kuwanon Z (**12**),[9] and suggested that **4** is one of the 4'-substituted 2,4,3',5'-tetrahydroxystilbene derivative. The ^{1}H nmr spectrum of **4** was analysed by comparing with that of **12**, along with the aid of the 2D ^{1}H-^{1}H COSY spectrum (Table 3). The spectrum showed the signals of the following protons: protons in a 3,3-dimethylallyl group, δ 1.56, 1.69 (each 3H, br s), 3.01 (1H, br dd, J = 6 and 14 Hz), 3.10 (1H, br dd, J = 8 and 14 Hz), 4.81 (1H, m), a methyl group, δ 1.73 (3H, s), a set of methylene protons, δ 1.87, 2.83 (each 1H, dd, J = 3 and 14 Hz), two methine protons, δ 2.75 (1H, br t, J = 3 Hz), 3.47 (1H, s), two sets of ABX type aromatic protons, δ 6.36 (1H, dd, J = 2 and 8 Hz), 6.41 (1H, d, J = 2 Hz), 7.36 (1H, d, J = 8 Hz), 6.34 (1H, dd, J = 2 and 8 Hz), 6.35 (1H, d, J = 2 Hz), 6.65 (1H, d, J = 8 Hz), *o*-coupled aromatic protons, δ 6.58, 7.26 (each 1H, d, J = 8 Hz), *m*-coupled aromatic protons, δ 6.25, 6.60 (each 1H, d, J = 1 Hz), *trans*-olefinic protons, δ 6.85, 7.27 (each 1H, d, J = 16 Hz). In the spectrum of **4**, the chemical shifts and coupling patterns of all the proton signals except those of 3,3-dimethylallyl group and

Table 3 ^{13}C and ^{1}H nmr chemical shifts (ppm) of **4**

	4		**12**	
C	(δ ^{13}C)	(δ ^{1}H)	(δ ^{13}C)	(δ ^{1}H)
C-1	116.1		116.7	
C-2	156.9		156.1	
C-3	103.6	6.41 (d, J = 2)	103.2	6.42 (d, J = 2)
C-4	159.1		160.2	
C-5	108.4	6.36 (dd, J = 2 and 8)	107.9	6.36 (dd, J = 2 and 8)
C-6	128.2	7.36 (d, J = 8)	127.7	7.36 (d, J = 8)
C-α	126.5	7.27 (d, J = 16)	125.8	7.26 (d, J = 16)
C-β	124.1	6.85 (d, J = 16)	123.6	6.83 (d, J = 16)
C-1'	141.2		140.5	
C-2'	107.5	6.25 (d, J = 1)	107.0	6.24 (d, J = 1)
C-3'	155.0		154.3	
C-4'	110.3		109.7	
C-5'	159.1		158.3	
C-6'	100.2	6.60 (d, J = 1)	99.6	6.57 (d, J = 1)
C-1"	75.8		75.3	
C-2"	196.8		195.2	
C-3"	49.2	3.47 (s)	49.0	3.46 (s)
C-4"	92.5		92.3	
C-5"	38.3	2.75 (br t, J = 3)	37.9	2.79 (dd, J = 3 and 4)
C-6"	31.2	1.87 (dd, J = 3 and 14) 2.83 (dd, J = 3 and 14)	31.0	1.87 (dd, J = 4 and 14) 2.84 (dd, J = 3 and 14)
C-7"	22.6	1.73 (3H, s)	22.4	1.72 (3H, s)
C-8"	109.9		109.2	
C-9"	114.8		114.4	
C-10"	163.4		166.0	
C-11"	117.3		98.2	6.16 (d, J = 2)
C-12"	171.1		172.2	
C-13"	111.6	6.58 (d, J = 8)	111.3	6.54 (dd, J = 2 and 8)
C-14"	123.3	7.26 (d, J = 8)	125.8	7.36 (d, J = 8)
C-15"	112.0		111.6	
C-16"	155.9		155.1	
C-17"	103.2	6.35 (d, J = 2)	102.7	6.35 (d, J = 2)
C-18"	159.1		158.1	
C-19"	107.7	6.34 (dd, J = 2 and 8)	107.2	6.34 (dd, J = 2 and 8)
C-20"	134.3	6.65 (d, J = 8)	133.6	6.65 (d, J = 8)
C-21"	22.1	3.01 (br dd, J = 6 and 14) 3.10 (br dd, J = 8 and 14)		
C-22"	122.5	4.81 (m)		
C-23"	131.7			
C-24"	17.9	1.69 (3H, br s)		
C-25"	26.0	1.56 (3H, br s)		

Solvent acetone-d_6

ortho-coupled aromatic protons were good agreement with those of the relevant protons of **12** (Table 3). The ^{13}C nmr spectrum of **4** was analysed by comparison with that of **12**, along with the aid of the 2D ^{13}C-^{1}H COSY spectrum. The chemical shifts of all the carbon atoms except that of C-11" were similar to those

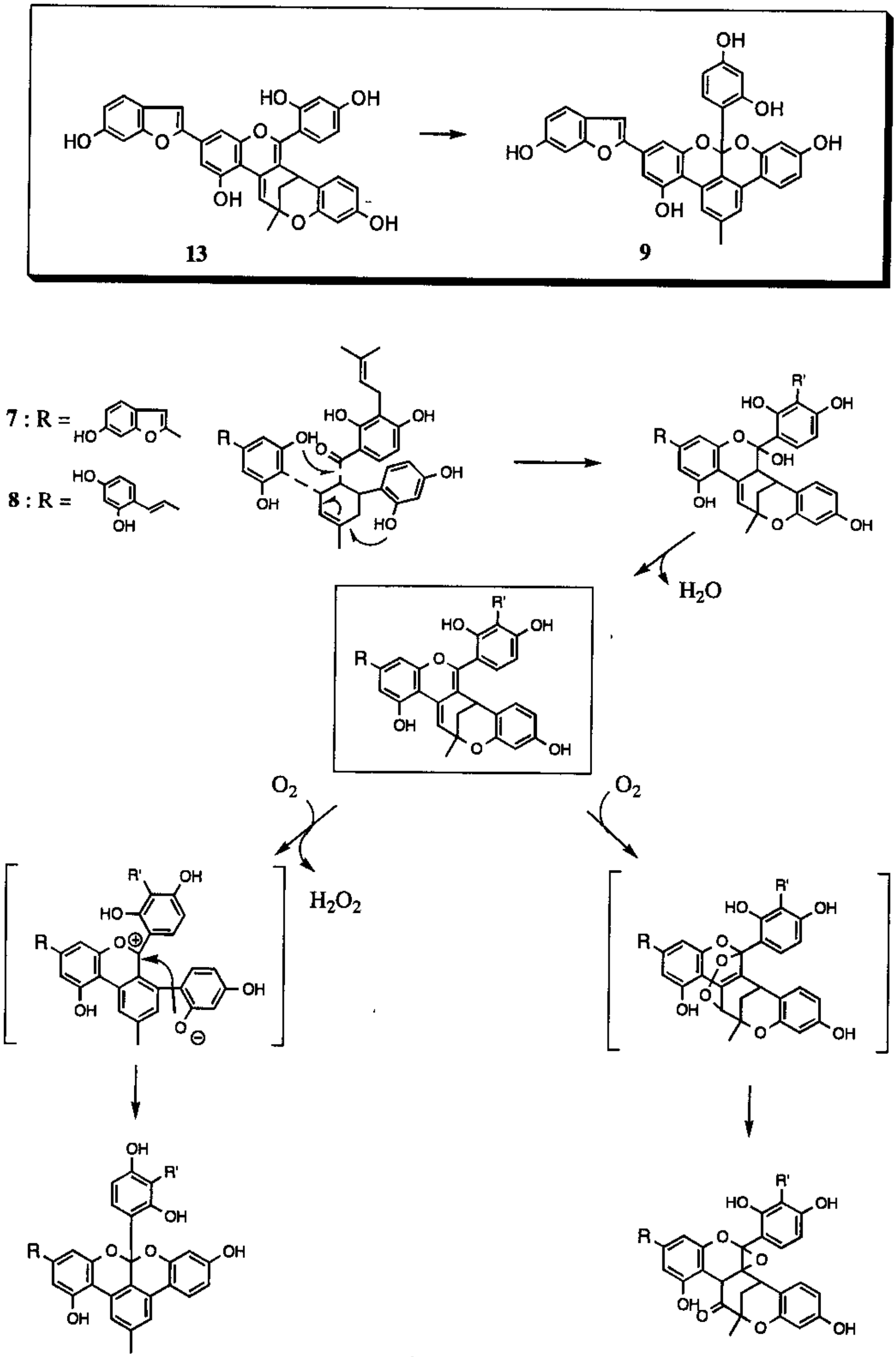

Figure 2

of the relevant carbons of **12** (Table 3). From these results, the 3,3-dimethylallyl group locates at the C-11" position of kuwanon Z (**12**) and the structure of sorocenol F is characterized as **4**.

While sorocenols C (**1**), D (**2**), and E (**3**) have the assymmetric centers, these compounds showed no optical rotations. On the other hand, Hano *et al.* reported that albanol B (**9**) was confirmed to be an artifact derived from mulberrofuran I (**13**) by autooxidation[5] and compound (**13**) would be a derivative induced from the Diels-Alder type adduct through the hemiketal intermediate.[10] Considering these reports as well as the isolation of chalcomoracin (**7**)[11] and kuwanol E (**8**)[12] from the same material, sorocenols C (**1**), D (**2**), and E (**3**) seem to be artifacts derived from the mulberrofuran I type intermediate and sorocenol F (**4**) seems to be derivative induced from the intermediate as described in Figure 2.

EXPERIMENTAL

Abbreviations: s = singlet, d = doublet, dd = double doublet, t = triplet, m = multiplet, br = broad, sh = shoulder. The general procedures followed and the instruments used in our previous paper.[2]

Isolation of Sorocenols C (1), D (2), E (3), and F (4)

The dried root bark of *Sorocea bonplandii* (550 g) was extracted with *n*-hexane, benzene, and acetone, successively.[2] Evaporation of *n*-hexane, benzene, and acetone solutions to dryness yielded 9.3 g, 3.3 g, and 20.3 g of the residue, respectively.[2] The benzene extract (3.3 g)[2] was chromatographed over silica gel (250 g) with *n*-hexane containing increasing amount of ethyl acetate as an eluent.[2] The fraction (0.1 g) eluted with *n*-hexane - ethyl acetate (3 : 7) was rechromatographed over silica gel (10 g) with benzene - ethyl acetate as an eluent. The fraction eluted with benzene - ethyl acetate (83 : 17) was fractionated by preparative hplc [solvent, *n*-hexane - ethyl acetate (3 : 2), column, Senshu Pak SSC-Silica 4251-N, 1 cmϕ x 25 cm, detector, uv 280 nm] to give sorocenol D (**2**, 1.4 mg) and mulberrofuran K (**5**, 1.6 mg).[13] The acetone extract (20.3 g) was chromatographed over silica gel (250 g) with *n*-hexane containing increasing amount of ethyl acetate as an eluent.[2] The fraction (1.3 g) eluted with *n*-hexane - ethyl acetate (1 : 1) was rechromatographed over silica gel (50 g) with benzene containing increasing amount of acetone. The fraction (0.25 g) eluted with benzene - acetone (85 : 15) was fractionated by preparative tlc [benzene - acetone (2 : 1)] followed by preparative hplc [chloroform - ethyl acetate (2 : 5), ethyl ether only, above described conditions] to give sorocenol C (**1**, 15 mg), sorocenol E (**3**, 3 mg), kuwanon J (**6**, 5 mg)[14] and chalcomoracin (**7**, 2 mg).[11] The fraction (0.32 g) eluted with benzene - acetone (8 : 2) was fractionated by preparative tlc [benzene - acetone (1 : 1), chloroform - ethyl acetate (1 : 2), *n*-hexane - acetone (2 : 3)] followed by preparative hplc [*n*-hexane - ethyl acetate (1 : 3)] to give sorocenol E (**3**, 60 mg) and kuwanol E (**8**, 20 mg).[12] The fraction (0.35 g) eluted with benzene - acetone (7 : 3) was fractionated by preparative tlc [benzene - ethyl acetate (1 : 2)] followed by preparative hplc [chloroform - ethyl acetate (1 : 2)] to give kuwanol E (**8**, 10 mg),[12] sorocenol E (**3**, 15 mg) and sorocenol F (**4**, 183 mg). The known compounds (**5**, **6**, **7**, and **8**) were identified by comparing with the spectral data of authentic samples.

Sorocenol C (1)

Compound (**1**) was crystallized from methanol to give pale yellow plates, mp 242 - 243 °C. $FeCl_3$ test: positive (brown).

$[\alpha]_D^{21}$ 0° (MeOH). Uv λ_{max}^{MeOH} nm (log ε): 222 (sh 4.58), 283 (4.04), 313 (sh 4.21), 333 (sh 4.40), 347 (4.42), 366 (4.47). Ir ν_{max}^{KBr} cm^{-1}: 3350 (br), 1600, 1500, 1405, 1360, 1200, 1142, 1110, 1035. FAB-ms: *m/z* 645 (MH$^+$), 451, 221, 205, 149.

Sorocenol D (2)

Compound (2) was obtained as pale yellow amorphous powder. FeCl$_3$ test: positive (brown). $[\alpha]_D^{18}$ 0° (MeOH). Uv λ_{max}^{MeOH} nm (log ε): 221 (sh 4.62), 283 (4.06), 312 (sh 4.20), 330 (sh 4.37), 347 (4.51), 365 (4.46). Ir ν_{max}^{KBr} cm^{-1}: 3300 (br), 1620, 1530, 1500, 1200. FAB-ms: *m/z* 627 (MH$^+$), 626 (M$^+$), 449, 391, 282, 185.

Sorocenol E (3)

Compound (3) was crystallized from methanol to give pale yellow needles, mp 217 - 220 °C (decomp.). FeCl$_3$ test: positive (brown). $[\alpha]_D^{21}$ 0° (MeOH). Uv λ_{max}^{MeOH} nm (log ε): 221 (sh 4.68), 282 (4.18), 313 (4.33), 360 (4.54). Ir ν_{max}^{KBr} cm^{-1}: 3300 (br), 1600, 1560, 1410, 1150, 1020. FAB-ms: *m/z* 647 (MH$^+$), 629, 573, 451, 427, 391, 369, 309, 263, 217.

Sorocenol F (4)

Compound (4) was obtained as pale yellow amorphous powder. FeCl$_3$ test: positive (brown). $[\alpha]_D^{24}$ +20° (c = 0.025, MeOH). Uv λ_{max}^{MeOH} nm (log ε): 240 (sh 4.27), 288 (4.34), 304 (4.07), 328 (4.34). Ir ν_{max}^{KBr} cm^{-1}: 3300 (br), 1620, 1505, 1380. FAB-ms: *m/z* 663 (MH$^+$), 645, 467, 391, 282, 263, 256, 205, 161.

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Received, 24th July, 1995