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NOVEL C-20-OXYGENATED PROSTANOIDS, 20-ACETOXYCLAVULONES, FROM THE STOLONIFER CLAVULARIA VIRIDIS QUOY AND GAIMARD[1]

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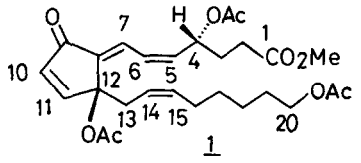
Summary: Three new marine prostanoids having an acetoxyl group at a C-20 position, 1, 2 and 3, were isolated from the Japanese Stolonifer Clavularia viridis Quoy and Gaimard. Their structures were elucidated by spectroscopic methods.

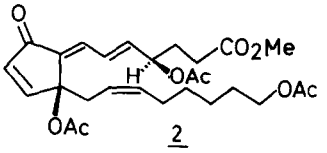
Previously we have reported on new type of prostanoids, clavulone I, II and III,[2,3] showing noticeable physiological activities, which were isolated from the Stolonifer Clavularia viridis Quoy and Gaimard. Efforts to find congeners of clavulones from the same marine animal with the interest due to their unique structural features resulted in the isolation of three novel C-20-oxygenated prostanoids. This paper describes the structure elucidation of these compounds 1, 2 and 3. These are the first example of C-20-oxygenated prostanoids which were fully characterized as isolable species, although 20-hydroxyprostaglandins are recognized in metabolites of mammalian prostanoids as detected by means of GC-MS.[4]

Silica gel chromatography (C_6H_6-AcOEt=10:1) of the AcOEt extract[2a] of Clavularia viridis Quoy and Gaimard (wet weight 5 kg) gave a fraction containing 1-3 following the fractions of clavulones. Further repeated silica gel chromatography and preparative TLC of the fraction gave 1[5] [13 mg, $C_{27}H_{36}O_9$, $[\alpha]_D$ -31.1°(c 0.09,$CHCl_3$)], 2 [215 mg, $C_{27}H_{36}O_9$, $[\alpha]_D$ +3.7°(c 0.54,$CHCl_3$)] and 3 [16 mg, $C_{27}H_{36}O_9$ $[\alpha]_D$ +26.4°(c 0.86,$CHCl_3$)], in order of decreasing polarity as pale yellow oils.

The spectral data of 1, 2 and 3 given in Notes[6-8] are extremely similar to those of clavulone I, II and III[2a], respectively, except for the following differences in NMR spectra. The terminal methyl signal at C-20 on the ω-side chain present in clavulones disappeared in the spectra of 1-3, while the signals due to CH_2OAc were newly observed: 1 ^{1}H-NMR δ_{ppm} 2.05(3H,s), 4.04(2H,t,J=6.6 Hz),



1



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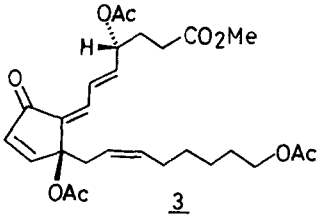

3

^{13}C-NMR δ_{ppm} 64.5(t); 2 ^{1}H-NMR 2.05(3H,s), 4.04(2H,t,J=6.9 Hz), ^{13}C-NMR 64.4(t); 3 ^{1}H-NMR 2.02(3H,s), 4.04(2H,t,J=6.9 Hz), ^{13}C-NMR 64.4(t). On the basis of these findings, the structures of 1, 2 and 3 can be represented by replacing the methyl group at C-20 in clavulone I,II and III with the acetoxymethyl group, respectively. The 4-R and 12-R configurations of these compounds were elucidated by the CD measurement. As shown in Table, the CD data of 1, 2 and 3 are well comparable to those of clavulone I,II and III,respectively, whose absolute configurations were already established.[2b] The acetoxyl group at C-20 is too far from the chiral centers to affect the Cotton effects in CD spectra.

Table CD Data of the compounds 1-3 and clavulones

	1	clavulone I	2	clavulone II	3	clavulone III
$\lambda^{EtOH}_{ext}(\Delta\varepsilon)$nm	247(+2.6) 290(-3.6)	248(+3.8) 291(-5.0)	247(+2.6) 295(-1.0)	250(+4.2) 293(-3.4)	243(+2.5) 291(-0.7)	245(+3.4) 297(-0.6)

References and Notes

1. This paper constitutes Part X of "Studies on Marine Natural Products."
2. a) H.Kikuchi, Y.Tsukitani, K.Iguchi and Y.Yamada, Tetrahedron Lett., 23, 5171(1982); b) idem, ibid, 24, 1549(1983).
3. Kitagawa et al. independently reported on claviridenone-b, -c and -d from the same marine origin. Direct comparisons of the spectral data of clavulones with those of claviridenones revealed that clavulone I,II and III are identical with claviridenone-d,-c and -b,respectively; M.Kobayashi,T.Yasuzawa,M.Yoshihara,H.Akutsu,Y.Kyogoku and I.Kitagawa,ibid,23, 5331(1982).
4. K.Gréen and B.Samuelsson, Eur.J.Biochem., 62, 527(1976); W.S.Powell and S.Solomon, J.Biol. Chem., 253, 4609(1978).
5. All new compounds gave satisfactory high resolution mass measurement.
6. 1: UV(EtOH) 230(10,900),288(13,700)nm. IR(film) 1735,1705,1640,1235 cm^{-1}. ^{1}H-NMR(270 MHz, CDCl3) δ_{ppm}(J in Hz) 2.03(3H,s,OAc),2.05(6H,s,OAc),2.38(2H,t,J=7.5,H-2),2.66(1H,dd,J=8, 14.5,H-13),3.00(1H,dd,J=7,14.5,H-13),3.70(3H,s,OMe),4.04(2H,t,J=6.6,H-20),5.22(1H,m,H-14), 5.47(1H,m,H-15),5.79(1H,m,H-4),5.84(1H,t,J=10.2,H-5),6.42(1H,d,J=6.3,H-10),6.58(1H,dd,J= 10.2,12.5,H-6),7.27(1H,d,J=12.5,H-7),7.47(1H,d,J=6.3,H-11). ^{13}C-NMR(67.8 MHz,CDCl3) δ_{ppm} 21.0(q,2C),21.3(q),25.6(t),27.3(t),28.5(t),29.0(t),29.8(t,2C),35.8(t),51.8(q),64.5(t),69.4 (d),85.1(s),121.5(d),124.2(d),124.6(d),134.5(d),135.2(d),137.4(s),138.9(d),157.8(d),169.1 (s),169.9(s),171.2(s),172.9(s).193.1(s).
7. 2: UV(EtOH) 230(14,200),292(18,700)nm. IR(film) 1730,1700,1640,1235 cm^{-1}. ^{1}H-NMR(270 MHz, CDCl3) δ_{ppm}(J in Hz) 2.05(3H,s,OAc),2.07(3H,s,OAc),2.08(3H,s,OAc),2.38(2H,t,J=7.3,H-2), 2.69(1H,dd,J=7.6,16,H-13),2.87(1H,dd,J=7.3,16,H-13),3.68(3H,s,OMe),4.04(2H,t,J=6.9,H-20), 5.20(1H,m,H-14),5.41(1H,q,J=7,H-4),5.51(1H,dt,J=11,7.3,H-15),6.03(1H,dd,J=7,14.8,H-5),6.41 (1H,d,J=6.9,H-10),6.74(1H,dd,J=12.2,14.8,H-6),6.86(1H,d,J=12.2,H-7),7.47(1H,d,J=5.9,H-11). 13C-NMR(67.8 MHz,CDCl3) δ_{ppm} 21.0(q,2C),21.2(q),25.6(t),27.3(t),28.5(t),29.2(t,2C),29.5(t), 36.0(t),51.8(q),64.4(t),72.8(d),85.0(s),121.5(d),126.8(d),129.3(d),134.5(d),135.0(d),136.8 (s), 141.3(d),158.1(d),169.5(s),169.9(s),171.2(s),172.9(s),193.3(s).
8. 3: UV(EtOH) 230(12,400),295(12,100)nm. IR(film) 1730,1695,1640,1235 cm^{-1}. ^{1}H-NMR(270 MHz, CDCl3) δ_{ppm}(J in Hz) 2.02(3H,s,OAc),2.05(3H,s,OAc),2.10(3H,s,OAc),2.39(2H,t,J=7.6,H-2), 2.62(1H,dd,J=7.6,14.2,H-13),2.87(1H,dd,J=7.3,14.2,H-13),3.68(3H,s,OMe),4.04(2H,t,J=6.9, H-20),5.21(1H,m,H-14),5.44(1H,q,J=5.9,H-4),5.51(1H,m,H-15),6.03(1H,dd,J=5.9,15.5,H-5),6.36 (1H,d,J=6.3,H-10),6.52(1H,d,J=11.2,H-7),7.50(1H,d,J=6.3,H-11),7.74(1H,dd,J=11.2,15.5,H-6). 13C-NMR(67.8 MHz,CDCl3) δ_{ppm} 21.0(q,2C),21.7(q),25.6(t),27.3(t),28.5(t),29.0(t),29.2(t), 29.8(t),35.6(t),51.7(q),64.4(t),72.5(d),85.2(s),121.8(d),126.4(d),133.5(d),134.2(d),135.6 (s),136.9(d),141.1(d),156.0(d),169.9(s),170.1(s),171.2(s),173.1(s),194.0(s).

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