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THREE NEW 8,9-SECO-*ENT*-KAURANE DITERPENOIDS FROM *RABDOSIA SHIKOKIANA (LABIATAE)*

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Three new *ent*-kauranoids, O-methylshikoccin (3), epoxyshikoccin (4) and O-methylepoxyshikoccin (5), have been isolated from aerial parts of the *Rabdosia* plant and their structures, including absolute configuration, have been elucidated by the spectroscopic data and the chemical transformations from shikoccin (1).

KEYWORDS ——— diterpenoid; *ent*-kaurane; seco-kaurane; *Rabdosia shikokiana*; O-methylshikoccin; epoxyshikoccin; O-methylepoxyshikoccin; structure

From the aerial parts of *Rabdosia shikokiana* (Makino) Hara *var. occidentalis* (Murata) Hara, we previously isolated two *ent*-kaurane type diterpenoids, shikoccin (1) and shikoccidin (2),[1,2] the former of which has the unique 8,9-seco-kaurane skeleton. Its antitumour activity was the subject of another article.[3]

Further investigation of the same species has resulted in the isolation of three new *ent*-kaurane ditepenes having an 8,9-seco-*ent*-kaurane skeleton, for which we propose the names, O-methylshikoccin (3), epoxyshikoccin (4) and O-methylepoxyshikoccin (5), together with the known diterpenes, isodomedin (6)[4,5] and leukamenin E (7).[6] This report deals with the structural elucidation of these new compounds.

O-Methylshikoccin (3) [$C_{23}H_{32}O_5$(M^+388); mp 268-271°C; $[\alpha]_D^{25}$ -4.5° (C=0.40, MeOH) showed the following spectral data; λmax(MeOH) 244nm (ε 7300); νmax(KBr) 1745, 1736, 1698, 1654, 1620, 1250, 1100 cm^{-1}; ^{1}H-NMR($CDCl_3$) δ 0.99 (s, tert.Me), 1.02 (s, tert.Me × 2), 2.11 (s, OAc), 3.18 (s, OMe), 3.66 (1H, br s), 4.17 (1H, dd, 13, 6 Hz), 4.74 (1H, br t, 3 Hz), 5.44 (1H, s), 6.13 (1H, s), and 7.15 (1H, d, 1.5 Hz). The ^{13}C-NMR shifts are summarized in the table.

The structure (3) for O-methylshikoccin was deduced from a comparison of these data with those of shikoccin (1). On treatment with hydrochloric or sulfuric acid-methanol, shikoccin (1) was converted into (3), which gave the confirmation for the structure of O-methylshikoccin.

Epoxyshikoccin (4) [$C_{22}H_{30}O_6$(M^+390), mp 124-126°C, $[\alpha]_D^{25}$ -6.3° (C=0.35, MeOH) showed the following physical properties : λmax(MeOH) 232.5nm (ε 6490); νmax($CHCl_3$) 3655, 3530, 1733, 1698, 1646, 1255, 1028 cm^{-1}; ^{1}H-NMR($CDCl_3$) δ 1.04 (s, tert.Me × 2), 1.08 (s, tert.Me), 2.14 (s, OAc), 3.27 (1H, br s), 3.73 (1H, s), 4.57 (1H, dd, 12, 5 Hz), 4.77 (1H, br t, 3 Hz), 5.53 (1H, d, 1 Hz), and 6.28 (1H, s); ^{13}C-NMR (see the table). These facts strongly indicate that this compound has a structure corresponding to the 8,14-epoxy derivative of shikoccin (1).

Treatment of 1 with m-chloroperbenzoic acid or Jones reagent[7] gave epoxyshikoccin which is identical with the natural product. The epoxy ring was assigned to be of α-configuration since the coupling of the protons between C-13 and C-14 was not observed. Therefore, epoxyshikoccin should be represented by formula 4.

O-Methylepoxyshikoccin (5) [$C_{23}H_{32}O_6$(M^+404), mp 142-144°C, $[\alpha]_D^{25}$ +24.2° (C=0.60, MeOH) showed the following spectral data : λmax (MeOH) 233nm (ε 5113); νmax ($CHCl_3$) 1730, 1704, 1648, 1255, 1108cm^{-1}; ^{1}H-NMR ($CDCl_3$) δ 0.97 (s, tert.Me), 1.00 (s, tert.Me), 1.08 (s, tert.Me), 2.07 (s, OAc), 3.18 (s, OMe), 3.34 (1H, br s), 3.63 (1H, s), 4.11(1H, dd, 12, 5 Hz), 4.74 (1H, br t, 3 Hz), 5.48 (1H, d, 1 Hz), 6.27 (1H, s). The structure of this compound was easily derived from these data coupled with the ^{13}C-NMR spectrum. Treatment of O-methylshikoccin (3) with m-chloroperbenzoic acid afforded O-methylepoxyshikoccin (5), which gave direct evidence for the structure of O-methylepoxyshikoccin.

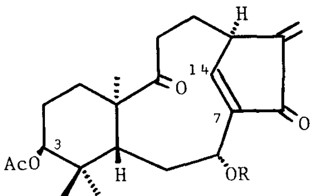
Recently, two diterpenes having the 8,9-secoo-ent-kaurane skeleton were isolated from closely related plant species.[8]

Table. ^{13}C-NMR Spectra[a] of (1), (3), (4), and (5)

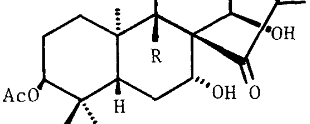
C-Atom	(1)	(3)	(4)	(5)
1	30.9[b]	30.8[b]	31.5[b]	31.2[b]
2	25.8[b]	25.8[b]	25.1[b]	25.0[b]
3	76.9	76.8	76.9	77.3
4	38.0	38.0	38.3	37.3
5	37.1	36.7	35.6	35.4
6	27.2[b]	27.3[b]	27.0[b]	27.1[b]
7	64.3	73.5	61.8	72.0
8	148.5	146.2	64.5	64.0
9	214.5	213.7	213.3	213.5
10	53.0	52.9	52.7	52.8
11	35.8	33.4	32.1	31.5
12	22.0[b]	22.0[b]	21.9[b]	21.9[b]
13	42.3	42.3	39.9	38.6
14	158.9	158.8	60.2	59.9
15	194.5	194.8	195.6	197.0
16	145.9	145.7	145.0	145.8
17	116.3	115.8	121.9	121.9
18	28.2	28.3	28.0	28.3
19	20.9	20.8	20.8	21.0
20	16.8	16.8	16.6	16.6
$\underline{C}H_3CO_2$-	22.0	22.0	21.6	21.7
$CH_3\underline{C}O_2$-	170.4	169.9	169.9	170.0
CH_3O-	-	56.4	-	59.1

a) Measured in CDCl3, values in δ scale relative to internal TMS.

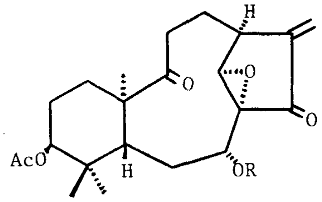
b) Tentatatively assigned.



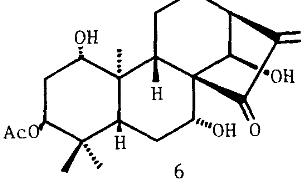
1, R=H
3, R=Me



2, R=OH
7, R=H



4, R=H
5, R=Me



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REFERENCES AND NOTES

1) E. Fujita, N. Ito, I. Uchida, K. Fuji, T. Taga and K. Osaki, *J. Chem. Soc., Chem. Commun.*, 1979, 806.
2) T. Taga, K. Osaki, N. Ito and E. Fujita, *Acta Crystallogr.*, in contributing (1982).
3) Y. Nagao, N. Ito, T. Kohno, H. Kuroda, and E. Fijita, *Chem. Pharm. Bull.* 30, 727 (1982).
4) I. Kubo, I. Miura, K. Nakanishi, T, Kamikawa and T. Isobe, *J. Chem. Soc., Chem. Commun.*, 1977, 555.
5) Isodomedin was identified as its triacetate.
6) Y. Takeda, T. Fujita and A. Ueno, *Chemistry Letters*, 1981, 1229.
7) P. Sandaraman and W. Herz, *J. Org. Chem.*, 42, 813 (1977).
8) T. Fujita, Y. Takeda, T. Shingu, M. Kido and Z. Taira, *J. Chem. Soc., Chem. Commun.*, 1982, 162.

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