Two new diterpenoids from *Isodon eriocalyx*

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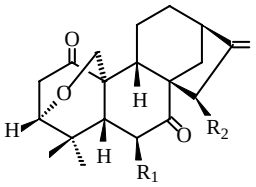
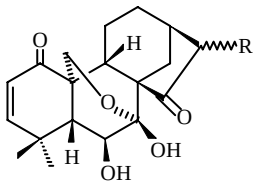
Abstract: Two new diterpenoids, maoecrystal U and epi-maoecrystal P were isolated from the leaves of *Isodon eriocalyx*. Their structures were determined as 6β-acetoxy-15β-hydroxy-3α, 20epoxy-*ent*-kaur-16-ene-1, 7-dione **1** and 16 (s)-methoxymethyl-6β, 7β-dihydroxy-7α, 20-epoxy-*ent*-kaur-2, 3-ethenylene-1, 15-dione **2** respectively, by spectroscopic methods.

Key words: *Isodon eriocalyx*; *ent*-kaurenoids; maoecrystal U; epi-maoecrystal P.

Isodon eriocalyx (Dunn) Hara (Labiatae). It has been used as folk medicine to treat sore throat, inflammation as well as reducing blood pressure[1]. Previous studies on this genus have revealed, a number of diterpenoids possess various bioactivities such as anti-tumor and anti-bacterial[2, 3] activities. In order to find more biologically active substances, we have carefully investigated the chemical constituents of *I. eriocalyx* collected in Zhongdian county of Yunnan province and isolated two new diterpenoids. This paper deals with the elucidation of their structures.



1 R_1=OAc R_2=OH
3 R_1=OH R_2=OAc



2 R=α-CH_2OCH_3
4 R=β-CH_2OCH_3

Maoecrystal U **1**, colorless crystals (from acetone), mp 250-252.5°C, $[\alpha]_D^{18}$ -112.9 (c 0.62, $CHCl_3$), was established to have a molecular formula of $C_{22}H_{28}O_6$ by EI mass ($[M]^+$ *m/z* 388) and ^{13}CNMR which is same with maoecrystal A **3**[4]. The ^{1}H and ^{13}CNMR spectra of **1** were very similar to those of maoecrystal A **3**. So we assumed that **1** has the same skeleton as that of maoecrystal, 3α, 20-epoxy-16-ene-*ent*-kaur-1, 7-dione. Inspection of the ^{1}H-^{1}HCOSY and HMBC spetra of **1**, 6-H correlaties with an acetoxy, and 15-H correlaties with C-9, C-7, C-16 and C-17. Those facts indicated that the acetoxy and hydroxy should be assigned to C-6 and C-15 position respectively. In NOESY spectrum of **1**, the correlations between 6α-H with 19-CH3 and 15α-H with 14β-H suggested the 6-OAc and 15-OH were β-orientation. Thus unambiguous of all carbons were completed and listed in **Table 1**.

Tabale 1. ^{13}CNMR data of compounds (1-4) (100.6 Mhz, δ in ppm)

NO.	**1** ($CDCl_3$)	**3** (C_5D_5N)	**2** ($CDCl_3$)	**4** (C_5D_5N)
1	207.6 (s)	210.2 (s)	196.8 (s)	197.3 (s)
2	41.6 (t)	42.1 (t)	127.1 (d)	127.4 (d)
3	76.8 (d)	77.3 (d)	161.1 (d)	160.6 (d)
4	37.5 (s)	38.1 (s)	35.8 (s)	36.2 (s)
5	47.9 (d)	51.5 (d)	57.0 (d)	59.3 (d)
6	73.5 (d)	71.9 (d)	73.0 (d)	73.6 (d)
7	205.3 (s)	208.8 (s)	95.2 (s)	96.3 (s)
8	57.0 (s)	56.5 (s)	60.2 (s)	61.1 (s)
9	33.5 (d)	35.0 (d)	48.1 (d)	48.1 (d)
10	51.1 (s)	51.8 (s)	46.4 (s)	46.3 (s)
11	20.4 (t)	20.8 (t)	19.1 (t)	19.3 (t)
12	32.7 (t)	32.8 (t)	29.5 (t)	20.0 (t)
13	38.8 (d)	40.2 (d)	30.0 (d)	29.7 (d)
14	34.6 (t)	35.9 (t)	25.2 (t)	28.1 (t)
15	74.6 (d)	74.8 (d)	221.1 (s)	222.5 (s)
16	152.6 (s)	151.6 (s)	58.4 (d)	56.6 (d)
17	107.1 (t)	108.3 (t)	71.7 (t)	69.0 (t)
18	29.0 (q)	29.5 (q)	29.9 (q)	30.3 (q)
19	22.9 (q)	23.1 (q)	24.6 (q)	34.2 (q)
20	62.0 (t)	62.4 (t)	65.5 (t)	65.6 (t)
OAc	169.6, 20.6	170.3, 21.0		

Epi-macoecrystal P **2**, colorless needles (from acetone), mp 222-224.5°C, $[\alpha]_D^{25}$ -14.2 (c 0.62, $CHCl_3$), was established to have a molecular formula of $C_{21}H_{28}O_6$ by FABMS ($[M+1]^+$ *m/z* 377) and ^{13}CNMR. The ^{1}H and ^{13}CNMR spectra of **2** were very similar to those of maoecrystal P **4**[5] except the signals of C-12 and C-14 (see **Table 1**). Because they have the same formula and situation groups by inspecting the IR, UV, ^{1}H and ^{13}CNMR spectra. So, **2** has the same skeleton as that of maoecrystal P possing 6β, 7β-dihydroxy-7α, 20-epoxy-*ent*-kaurene except for the orientation of 16-methoxymethyl. The β-orientation of 16-methoxymethyl of maoecrystal P was deduced from the upfield shift of C-12 (δ 20.2 ppm) due to the γ-steric compression effect between 16β-methoxymethyl group and 12β-H. So we suggested that the 16-methoxymethyl group of **2** is α-orientation which deduced from the upfield shift of C-14 (δ 25.2 ppm) because of the γ-steric compression effect between 16α-methoxymethyl group and 14β-H. The NOESY spectra also suggested that the 16-methoxymethyl is α-orientation because of the correlation between 16βH with 12β-H.

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