Two New Tetranortriterpenoids from *Cipadessa cinerascens*

by **Yan-Li Ren**[a])[b]), **Qian-Rui Tang**[c]), **Ying-Tong Di**[a]), **Hong-Ping He**[a]), **Zhen Zhang**[a]), **Shun-Lin Li**[a]), **Xiao-Jiang Hao***[a])

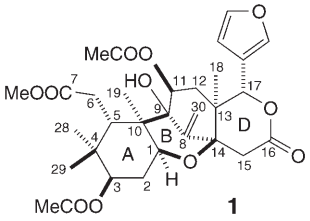
[a]) State Key Laboratory of Phytochemistry and Plant Resource in West China, Kunming Institute of Botany, Kunming 650204, Yunnan, P. R. China (fax: +86-871-5150227; e-mail: haoxj@mail.kib.ac.cn)

[b]) College of Living Creature Science and Technology, Hunan Agriculture University, Changsha 410128, Hunan, P. R. China

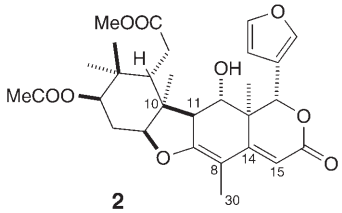
[c]) College of Horticulture and Landscape, Hunan Agricultural University, Changsha 410128, Hunan, P. R. China

Two new tetranortriterpenoids, cipadesin D (**1**) and E (**2**), were isolated from the stems of *Cipadessa cinerascens*. Their structures were elucidated by analysis of their spectroscopic data.

Introduction. – *Cipadessa cinerascens* (PELL.) HAND.-MAZZ is a shrub belonging to the Meliaceae, which has its stronghold in Southwest China [1]. Its leaves and roots are used as the folk medicine for the treatment of cold, malaria, bellyache, dysentery, rheumatoid arthritis, skin itch, and so on [2]. A large number of tetranortriterpenoids has been isolated from the plants of Meliaceae, such as swietenin [3], astrotrichilin [4], sandoricin and 6-hydroxysandoricin [5], and so forth. From the genus *Cipadessa*, only six tetranortriterpenoids [6][7] have been isolated previously. In addition, diterpenoids [8], sterols, heneicosenes [7], flavonoids and their glucosides [9], have also been reported from the genus *Cipadessa*. Herein we reported the isolation and structural elucidation of the two new tetranortriterpenoids **1** and **2** from the stems of *C. cinerascens* (PELL.) HAND.-MAZZ.



1



2

Results and Discussion. – Compound **1** was isolated as white powder, and was found to have the molecular formula $C_{31}H_{40}O_{11}$ by HR-ESI-MS (*m*/*z* 611.2462 $[M + Na]^+$. The ^{1}H- and ^{13}C-NMR data (*Tables 1* and *2*) suggested that **1** could be considered as tetranortriterpenoid [7], having the same rings *A*, *D*, and *E* as cipadesin A [6].

Table 1. *^{1}H-NMR Data* (500 MHz, $CDCl_3$) *for Compounds* **1** *and* **2**. δ in ppm, J in Hz. Arbitrary atom numbering.

	1	**2**
H–C(1)	3.30 (*d*, $J = 3.6$)	4.25 (*s*)
CH_2(2)	1.91–1.88, 2.16–2.12 (2*m*)	2.14 (*dd*, $J = 6.6, 3.3$), 2.47–2.39 (*m*)
H–C(3)	4.74 (*s*)	4.62 (*s*)
H–C(5)	2.81 (*d*, $J = 9.5$)	2.31 (*d*, $J = 9.3$)
CH_2(6)	3.05 (*d*, $J = 17.5$, H_α), 2.44 (*dd*, $J = 17.5, 10.0$, H_β)	3.10 (*d*, $J = 16.9$, H_α), 2.39 (*d*, $J = 9.5$, H_β)
H–C(11)	5.78 (br. *s*)	2.66 (*d*, $J = 9.5$)
CH_2(12)	2.59 (*dd*, $J = 15.0, 3.5$, H_α), 1.71 (*d*, $J = 15.0$, H_β)	4.36 (*d*, $J = 10.1$)
CH_2(15) or H–C(15)	2.93 (*d*, $J = 18.0$, H_α), 2.64 (*d*, $J = 18.0$, H_β)	5.60 (*s*)
H–C(17)	5.69 (*s*)	5.26 (*s*)
Me(18)	0.88 (*s*)	1.30 (*s*)
Me(19)	0.86 (*s*)	1.24 (*s*)
H–C(2′) (fur)	7.40 (*s*)	7.50 (*d*, $J = 7.2$)
H–C(4′) (fur)	6.37 (br. *s*)	6.55 (*s*)
H–C(5′) (fur)	7.40 (*d*, $J = 2.0$)	7.55 (*s*)
Me(28)	1.00 (*s*)	1.05 (*s*)
Me(29)	0.84 (*s*)	0.82 (*s*)
CH_2(30) or Me(30)	5.47 (*s*, H_α), 5.19 (*s*, H_β)	1.80 (*s*)
MeCOO–C(11)	2.08 (*s*)	–
MeCOO–C(3)	1.97 (*s*)	2.08 (*s*)
MeO	3.72 (*s*)	3.76 (*s*)

Table 2. *^{13}C-NMR Data* (125 MHz, $CDCl_3$) *of Compounds* **1** *and* **2**. δ in ppm. Arbitrary atom numbering.

	1	**2**		**1**	**2**
C(1)	74.0 (*d*)	86.8 (*d*)	C(17)	79.4 (*d*)	79.2 (*d*)
C(2)	27.8 (*t*)	25.2 (*t*)	C(18)	15.5 (*q*)	11.7 (*q*)
C(3)	76.0 (*d*)	76.9 (*d*)	C(19)	17.1 (*q*)	21.4 (*q*)
C(4)	38.1 (*s*)	38.0 (*s*)	C(3′) (fur)	120.8 (*s*)	123.0 (*s*)
C(5)	36.3 (*d*)	36.4 (*d*)	C(2′) (fur)	140.1 (*d*)	142.0 (*d*)
C(6)	31.5 (*t*)	32.1 (*t*)	C(4′) (fur)	109.5 (*d*)	110.2 (*d*)
C(7)	174.5 (*s*)	176.3 (*s*)	C(5′) (fur)	143.1 (*d*)	145.0 (*d*)
C(8)	145.7 (*s*)	101.5 (*s*)	C(28)	21.8 (*q*)	21.8 (*q*)
C(9)	78.2 (*s*)	162.6 (*s*)	C(29)	27.0 (*q*)	26.5 (*q*)
C(10)	50.0 (*s*)	46.4 (*s*)	C(30)	112.4 (*t*)	10.0 (*q*)
C(11)	75.3 (*d*)	56.7 (*d*)	Me*C*OO–C(11)	169.3 (*s*)	–
C(12)	34.4 (*t*)	70.0 (*d*)	*Me*COO–C(11)	21.5 (*q*)	–
C(13)	40.3 (*s*)	44.8 (*s*)	Me*C*OO–C(3)	170.0 (*s*)	171.7 (*s*)
C(14)	80.7 (*s*)	165.2 (*s*)	*Me*COO–C(3)	21.2 (*q*)	21.1 (*q*)
C(15)	34.1 (*t*)	104.0 (*d*)	MeO	52.0 (*q*)	52.3 (*q*)
C(16)	169.6 (*s*)	167.9 (*s*)			

Analysis of the ^{1}H,^{1}H-COSY, HMQC (*Fig. 1*), and NOESY (*Fig. 2*) data established the structure of cipadesin D (**1**). IR Absorptions at 1740 and 1631 cm^{-1} and ^{13}C-NMR signals at δ 174.5, 170.0, 169.6, and 169.3 indicated that **1** had a lactone and three ester carbonyl groups, and its ^{1}H- and ^{13}C-NMR showed the

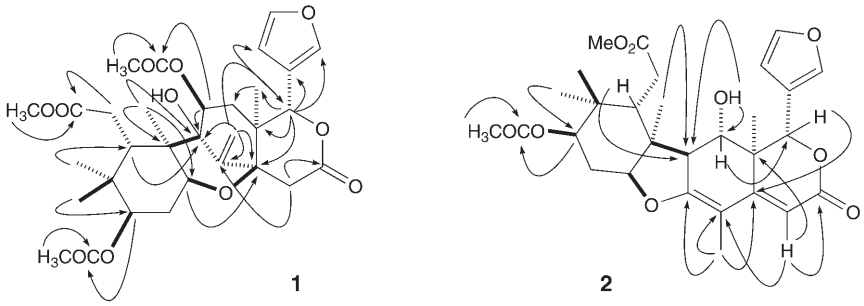


Fig. 1. *Important HMBC* (→) *correlations of* **1** *and* **2**

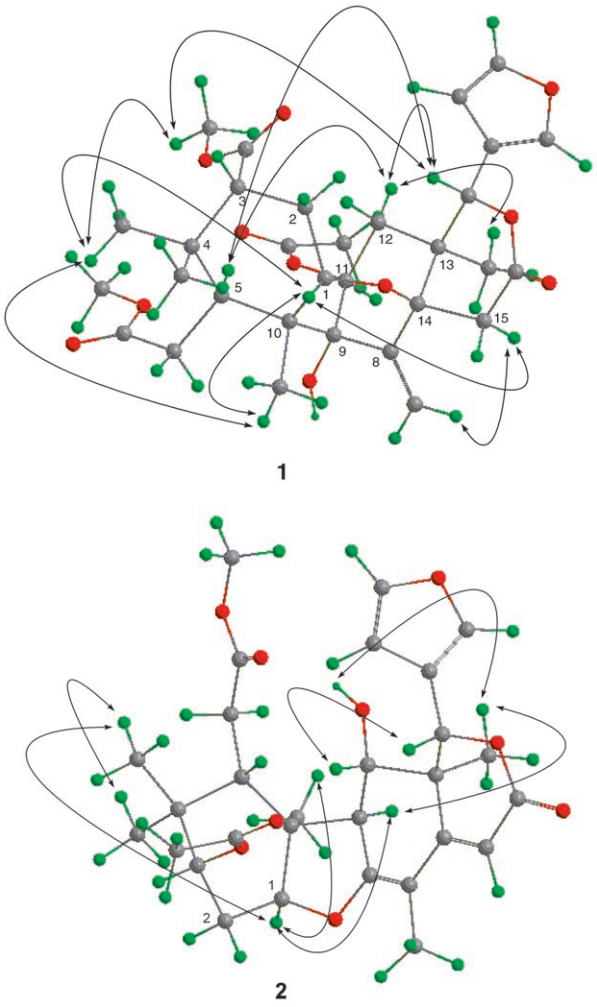


Fig. 2. *Important ROESY* (↔) *correlations of* **1** *and* **2**

presence of an MeO group (δ(H) 3.72; δ(C) 52.0) and two acetyloxy groups (δ(H) 1.97, 2.08; δ(C) 170.0, 169.3). Moreover, **1** also contained a 3-substituted furan ring (δ(H) 7.40, 7.40, 6.37; δ(C) 143.1, 140.1, 120.8, 109.5) and four quaternary Me groups (δ(H) 1.00, 0.88, 0.86, 0.84; δ(C) 21.8, 15.5, 17.1, 27.0). The differences with respect to cipadesin A [6] concerned data of rings *B* and *C*, which were confirmed by 2D-NMR (^{1}H,^{1}H-COSY, HMQC, and HMBC). HMBC Correlations (*Fig. 1*) Me(18)/C(12), C(13), and C(14), CH_2(30)/C(8), C(9), and C(14), H–C(11)/C(9), H–C(17)/C(13), C(14), and C(12), and CH_2(15)/C(8) showed the presence of a six-membered ring *C* with an exocyclic CH_2= group at C(8), which was correlated to ring D by C(13) and C(14). Moreover, the cross-peaks H–C(5)/C(10) and C(9), Me(19)/C(9) and C(10), and H–C(1)/C(14) showed that ring *A* is connected to ring C *via* C(10)–C(9) and C(1)–O–C(14), thus forming a six-membered ring *B* (–C(1)–C(10)–C(9)–C(8)–C(14)–O–), as in sandoricin [5]. In the NOESY plot of **1** (*Fig. 2*), the correlations *Me*COO–C(11)/H–C(17), H–C(17)/H$_\beta$–C(12), and H$_\beta$–C(12)/H–C(5) showed that MeCOO–C(11), H–C(17), H$_\beta$–C(12), and H–C(5) were situated above the plane and were in β-configuration. Moreover, the NOESY correlations Me(19)/H–C(1), Me(18)/H$_\alpha$–C(12) H$_a$–C(30)/H$_\alpha$–C(15), H$_\beta$–C(15)/H–C(1) showed that CH_2(30), Me(18), H–C(1), and C(8) were situated below the plane and were in α-configuration. Therefore, the relative configuration of **1** was established.

Compound **2**, named cipadesin E, was isolated as a colorless crystal ($CHCl_3$/MeOH) and had the molecular formula $C_{29}H_{36}O_9$, as deduced by HR-ESI-MS (*m*/*z* 551.2426 [M + Na]$^+$). Its structure was established by spectroscopic means (see *Tables 1* and *2* and *Figs. 1* and *2*) and by comparison with cipadesin C [6].

A lactone and two ester carbonyl groups were recognized from the IR absorption of **2** at 1729 cm^{-1} and the ^{13}C-NMR signals at δ 176.3, 171.7, and 167.9. The ^{1}H- and ^{13}C-NMR data of **2** showed close similarity to those of cipadesin C [6], which implied that **2** was also a tetranortriterpenoid, except for the absence of an acetyloxy group and an oxygenated methane, as well as the presence of an additional CH_2 group (δ(H) 2.14, *dd*, *J* = 6.6, 3.3 Hz, H$_\alpha$–C(2); 2.47–2.39, *m*, H$_\beta$–C(2)). The ^{13}C-NMR signals of C(1), C(2), and C(3) were obviously shifted to high field, which suggested that this CH_2 group was CH_2(2). This assumption and the remaining structure were supported by HMBC and NOESY experiments (*Figs. 1* and *2*).

We thank Prof. *De-Ding Tao*, Kunming Institute of Botany, Chinese Academy of Sciences, for the identification of plant materials. The authors are also grateful to members of the Analytical Group of the State Key Laboratory of Phytochemistry and Plant Resources in West China, Kunming Institute of Botany, for measurements of all spectra.

Experimental Part

General. Solvents were distilled before use. Thin-layer (TLC) and column chromatography (CC): silica gel GF_{254} and *H*, resp. (*Qingdao Haiyang Chemical Co.*). Optical rotations: *Horiba SEAP-300* spectropolarimeter. IR Spectra: *577* spectrometer; in cm^{-1}. 1D- and 2D NMR Spectra: *Bruker AM-500* spectrometer; δ in ppm, *J* in Hz. EI- and HR-ESI-MS: *VG Auto Spec 3000*; in *m*/*z*.

Plant Material. The stems of *Cipadessa cinerascens* were collected in Xishuangbanna, Yunnan Province, P. R. China, in June 2006. The plant was identified by Prof. *De-Ding Tao*, Kunming Institute of Botany, CAS.

Extraction and Isolation. The air-dried stems (15 kg) of *Cipadessa cinerascens* were ground and then extracted by 10 l each of refluxing 95% EtOH for 5, 3, and 1 h, respectively. After evaporation of the solvent, the residue was subjected to CC (silica gel, Me_2CO/petroleum ether of increasing polarity): *Fr. 1–5*. *Fr. 3* (25 g) was resubjected to CC (silica gel, petroleum ether/AcOEt) 7:3 to afford a powder product, which was repeatedly subjected to HPLC (silica gel, H_2O/MeCN 3:2) and prep. TLC (petroleum ether/AcOEt 3:2): cipadesin D (**1**; 23 mg). Subsequent CC (petroleum ether/AcOEt 7:3) gave a solid, which was recrystallized from petroleum ether/Me_2CO: cipadesin E (**2**, 30 mg).

Cipadesin D (=*(4*R*,4a*S*,6*S*,7*S*,7a*R*,8*S*,10*R*,11a*S*,12a*R*)-6,10-Bis(acetyloxy)-4-(furan-3-yl)dodecahydro-7-hydroxy-4a,7a,9,9-tetramethyl-13-methylene-2-oxo-4*H*,12a*H*-pyrano[4,3-*b*][1]benzoxocin-8-acetic Acid Methyl Ester*; **1**): White powder. $[\alpha]_D^{23} = -82.6$ ($c = 0.66$, $CHCl_3$). IR (KBr): 3441, 1740, 1631, 1374, 1246. ^{1}H- and ^{13}C-NMR: *Tables 1* and *2*. ESI-MS: 611 ($[M + Na]^+$). HR-ESI-MS: 611.2462 ($[M + Na]^+$, $C_{31}H_{40}NaO_{11}^+$; calc. 611.2468).

Cipadesin E (=*(1*R*,6a*S*,8*R*,10*S*,10a*S*,10b*S*,11*S*,11a*S*)-8-(Acetyloxy)-1-(furan-3-yl)-3,6a,7,8,9,10,10a,10b,11,11a-decahydro-11-hydroxy-5,9,9,10a,11a-pentamethyl-3-oxo-1*H*-benzofuro[2,3-*g*]-2-benzopyran-10-acetic Acid Methyl Ester*; **2**). Colorless crystal. UV ($CHCl_3$/MeOH): 321, 238, 205. $[\alpha]_D^{23} = -206.11$ ($c = 0.3$, $CHCl_3$/MeOH). IR (KBr): 3395, 1729, 1645, 1367, 1052. ^{1}H- and ^{13}C-NMR: *Tables 1* and *2*. ESI-MS: 529 (8, $[M+H]^+$). HR-ESI-MS: 529.2426 ($[M + H]^+$, $C_{29}H_{37}O_9^+$; calc. 529.2437).

REFERENCES

[1] 'Flora Reipublicae Popularis Sinicae', Science Press Beijing, 1997, Vol. 43, p. 58.
[2] Editorial Board of China Herbal, State Administration of Traditional Chinese Medicine, 'China. China Herbal', Shanghai Scientific and Technical Publishers, 1999, Vol. 32, p. 3861.
[3] M. M. G. Saad, T. Iwagawa, M. Doe, M. Nakatani, *Tetrahedron* **2003**, *59*, 8027.
[4] D. A. Mulholland, J. J. Nair, D. A. H. Taylor, *Phytochemistry* **1996**, *42*, 1239.
[5] R. G. Powell, K. L. Mikolajczak, B. W. Zikowski, E. K. Mantus, D. Cherry, J. Clardy, *J. Nat. Prod.* **1991**, *54*, 241.
[6] X. H. Yuan, B. G. Li, M. Zhou, H. Y. Qi, G. L. Zhang, *Org. Lett*. **2005**, *7*, 5051.
[7] X. D. Luo, S. H. Wu, Y. B. Ma, D. G. Wu, *Phytochemistry* **2000**, *55*, 867.
[8] S. R. Rojatkar, B. A. Nagasampagi, *Phytochemistry* **1994**, *37*, 505; S. R. Rojatkar, Y. G. Chiplunkar, B. A. Nagasampagi, *Phytochemistry* **1994**, *37*, 1213.
[9] L. Liang, C. C. Zhong, Z. Y. Xiao, *Zhongcaoyao* **1990**, *21*, 2; L. Liang, C. C. Zhong, Z. Y. Xiao, *Zhongcaoyao* **1991**, *22*, 6; L. Liang, C. C. Zhong, Z. Y. Xiao, *Zhongcaoyao* **1994**, *25*, 236.

Received January 3, 2007