第 19 卷 第 2 期 中 国 药 物 化 学 杂 志 Vol. 19 No. 2 p. 144
2009 年 4 月 总 88 期 Chinese Journal of Medicinal Chemistry Apr. 2009 Sum 88

Article ID: 1005 - 0108(2009)02 - 0144 - 03

Clavicoronol, a new metabolite, from the mycelia culture of *Clavicorona pyxidata*

ZHENG Yong-biao[1,2], LIN Xin-jian[2], ZHENG Zhong-hui[1], LU Chun-hua[1]

(1. Key Laboratory of the Ministry of Education for Cell Biology and Tumor Cell Engineering, School of Life Sciences, Xiamen University, Xiamen 361005, China;
2. Institute of Soil and Fertilizer, Fujian Academy of Agricultural Sciences, Fuzhou 350013, China)

Abstract: Aim To explore the new bioactive metabolites from the mycelia culture of the edible mushroom *Clavicorona pyxidata*. **Methods** The constituents were isolated and purified by column chromatography, and their structures were identified by spectroscopic analyses, including 1D- and 2D-NMR data, and single-crystal X-ray diffraction. **Results** A new natural product, named clavicoronol (**1**) along with adenosine (**2**), were obtained. **Conclusion** Compound **1** is a new compound and stereochemistry of **2** was confirmed by a single-crystal X-ray diffraction.

Key words: *Clavicorona pyxidata*; clavicoronol; adenosine; single-crystal X-ray diffraction

CLC number: Q284 **Document code**: A

珊瑚菌菌体培养物的新天然产物

郑永标[1,2],林新坚[2],郑忠辉[1],鲁春华[1]

(1. 厦门大学 生命科学学院 细胞生物学与肿瘤细胞工程教育部重点实验室,福建 厦门 361005;
2. 福建省农业科学院 土壤肥料研究所,福建 福州 350013)

摘 要:**目的** 对珊瑚菌(*Clavicorona pyxidata*)菌体培养物的活性成分进行分离。**方法** 用多种色谱技术对化合物进行分离纯化,并用光谱技术和单晶 X 射线衍射技术鉴定化合物的结构。**结果** 从中分离到 2 个化合物:clavicoronol(**1**)、腺苷(**2**)。**结论** 化合物 **1** 为新化合物,并通过单晶 X 射线衍射技术确定了 **2** 的立体构型。

关键词:珊瑚菌; clavicoronol;腺苷;单晶 X 射线衍射

Clavicorona pyxidata is a wild mushroom which was widely used for curing gastric pain, dyspepsia, gout and heat-toxicity in China. Some compounds have been isolated from *Clavicorona pyxidata*, such as clavicoronic acid which was a novel inhibitor of reverse transcriptases[1]. *Clavicorona pyxidata* YB2005 was isolated from the wild fruit body in Jilin Province and identified by ITS methods. In exploring the new bioactive metabolites from this medicinal mushroom, a new metabolite, clavicoronol (**1**) along with adenosine (**2**) were obtained. Their structures were elucidated by the analysis of NMR

Received date: 2008 - 08 - 28
Foundation item: This work was financially supported by the National Natural Science Foundation of China (30500632), the National Science Fund for Distinguished Young Scholars to Y.-M. Shen (30325044)
Biography: ZHENG Yong-biao (1970 -), male (Han nationality), was born in Fujian Province, Ph. D student of School of Life Sciences, Xiamen University, and was major in natural products of microbiology; LU Chun-hua (1975 -), female (Han nationality), was born in Shandong province, associate professor, and was major in natural products of chemistry, Tel: (0592) 2184180, E-mail: ahua0966@xmu.edu.cn.

data (^{1}H, ^{13}C-NMR, DEPT, HSQC, HMBC, ^{1}H-^{1}H COSY and NOESY). The relative stereochemistry of **2** was confirmed by a single-crystal X-ray diffraction.

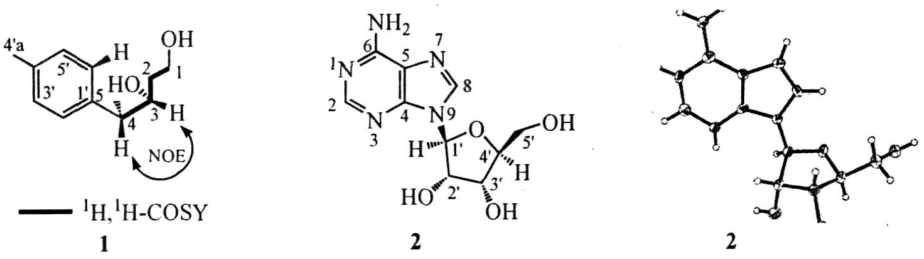

Figure 1　The structures of 1 and 2

Clavicoronol (**1**) was obtained as a colorless oil, $[\alpha]_D^{20}$ +4.56 °(c 0.29, $CHCl_3$). The molecular formula was determined as $C_{12}H_{18}O_2$ according to the HR ESI-Q-TOF MS which showed the obvious quasi molecular ion at m/z: 217.0933 $[M + Na]^+$. IR absorption implied the presences of hydroxyl (3353 cm^{-1}), methyl (2924 cm^{-1}) and aromatic (1593 cm^{-1}) groups. ^{1}H-NMR spectra of **1** (Table 1) showed the presence of four aromatic protons [at δ 7.09 (d, 2H, J = 7.8 Hz); δ 7.17 (d, 2H, J = 7.8 Hz)] and indicated the 1, 4-bisubstitutions of aromatic moiety. The presence of aromatic moiety was further supported by the ^{13}C-NMR resonances assigned to six aromatic carbons (Table 1). HMBC correlation from the methyl protons at δ 2.28 (H-4′a) to C-3′, C-4′ and C-5′ indicated the linkage of the methyl at C-4′. The cross peaks between H-5 and H-4, H-4 and H-3, H-3 and H-2b, and H-1 and H-2a (2b) can be observed in the ^{1}H-^{1}H-COSY spectrum and allowed to establish the fragment of CH_3 (5)-CH (4)-CH (3)-CH_2 (2)-CH_2 (**1**) (Figure 1). The key HMBC correlations from H-5 to C-4, C-3 and C-1′, and H-4 to C-2, C-3, C-1′ and C-2′ (6′), and H-1 to C-3 confirmed the connections of the fragment and allowed the linkage of the fragment with C-1′. The hydroxyl group were determined at C-1 and C-3 according to the downshift of the carbons at δ 61.0 and 74.9, respectively. The relative stereochemistry of **1** was determined by the NOE correlations between H-4 and H-3.

Adenosine (**2**) was an elucidated by analysis of NMR data (^{1}H, ^{13}C NMR, HSQC, HMBC) (Table 2). Compound **2** was an enantiomer of α-adenosine whose NMR data (^{1}H, ^{13}C) was reported by Ciuffreda[2] and coworks. The stereochemistry of **2** was established by single-crystal X-ray diffraction (CCDC number: 685692) (Figure 1). It was reported that some edible fungi contained the high level of nucleosides and nucleobases[3]. Adenosine, one of nucleoside, possessed many kinds of bioactivities and have been used in clinic.

Compounds **1** - **2** showed no antibacterial (Escherichia coli, Bacillus Subtilis and Staphylococcus aureus) and anti-yeast (Candida albicaus) activities at the concentration 100 μg·mL^{-1} using a similar MIC method and exhibited low cytotoxicities against HeLa cells by MTT assay.

Table 1　^{1}H-NMR and ^{13}C-NMR data for clavicoronol (1) in $(CD_3)_2CO$

Position	δ_H (600 MHz)	δ_C (150 MHz)	HMBC (600 MHz)
1	3.70 (d, 1H, *J* = 5.4 Hz)	61.0 (t)	C-3
2a	1.64 (m, 1H)	37.3 (t)	C-1, C-3
2b	1.48 (m, 1H)		
3	3.91 (m, 1H)	74.9 (d)	
4	2.78 (m, 1H)	46.4 (d)	C-2, C-3, C-5, C-1′, C-2′(6′)
5	1.27 (d, 3H, *J* = 7.2 Hz)	17.7 (q)	C-3, C-4, C-1′
1′		142.1 (s)	
2′	7.09 (d, 1H, *J* = 7.8 Hz)	129.4 (d)	C-4, C-4′, C-3′
3′	7.17 (d, 1H, *J* = 7.8 Hz)	129.2 (d)	C-4′, C-4′a, C-2′

(to be continued)

Continued Table 1

Position	δ_H (600 MHz)	δ_C (150 MHz)	HMBC (600 MHz)
4′		135.9 (s)	
4′a	2.28 (s, 3H)	21.0 (q)	C-4′, C-3′(5′)
5′	7.17 (d, 1H, J = 7.8 Hz)	129.2 (d)	C-4′, C-4′a, C-6′
6′	7.09 (d, 1H, J = 7.8 Hz)	129.4 (d)	C-4, C-4′, C-5′
OH	3.64 (overlap, 1H)		
OH	3.64 (overlap, 1H)		

Table 2 ^{1}H-NMR and ^{13}C-NMR data for adenosine(2) in DMSO-d_6

Position	δ_H (600 MHz)	δ_C (150 MHz)	HMBC (600 MHz)
2	8.13 (s, 1H)	152.4 (d)	C-4, C-6
4		149.0 (s)	
5		119.3 (s)	
6		156.1 (s)	
8	8.34 (s, 1H)	139.9 (d)	C-4, C-5, C-1′
1′	5.88 (d, 1H, J = 6.1 Hz)	87.9 (d)	C-4, C-8, C-2′
2′	4.61 (d, 1H, J = 6.1 Hz)	73.4 (d)	C-1′, C-4′
3′	4.14 (d, 1H, J = 1.9 Hz)	70.6 (d)	C-1′, C-5
4′	3.96 (d, 1H, J = 1.9 Hz)	85.9 (d)	C-3′
5′a	3.68 (m, 1H)	61.6 (t)	C-3′, C-4′
5′b	3.56 (m, 1H)		
NH_2	7.36 (s, 2H)		C-6
2′OH	5.47 (overlap, 1H)		C-1′, C-2′, C-3′
3′OH	5.21 (d, 1H, J = 3.9 Hz)		C-2′, C-3′, C-4′
5′OH	5.46 (overlap, 1H)		C-4′, C-5′

Reference:

[1] ERKEL G, ANKE T, GIMENEZ A, et al. Antibiotics from basidiomycetes. XLI. Clavicoronic acid, a novel inhibitor of reverse transcriptases from Clavicorona pyxidata (Pers. ex Fr.) Doty [J]. J Antibiot, 1992, 45 (1): 29 - 37.

[2] CIUFFREDA P, CASATI S, MANZOCCHI A. Spectral assignments and reference data complete ^{1}H and ^{13}C NMR spectral assignment of a- and b-adenosine, 2′-deoxyadenosine and their acetate derivatives [J]. Mag Res Chem, 2007, 45 (9): 781 - 784.

[3] YUAN J P, ZHAO S Y, WANG J H, et al. Distribution of nucleosides and nucleobases in edible fungi [J]. J Agr Food Chem, 2008, 56 (3): 809 - 814.