Asian Journal of Chemistry; Vol. 27, No. 10 (2015), 3913-3914

ASIAN JOURNAL OF CHEMISTRY

http://dx.doi.org/10.14233/ajchem.2015.18659

NOTE

A New Isocoumarin from Bark of *Lindera caudatat*

YUEDE WANG, KUN ZHOU, BING-KUN JI, WEI DONG, YINKE LI, MIN ZHOU, YANQING YE, QIUFEN HU and XUEMEI GAO*

Key Laboratory of Chemistry in Ethnic Medicinal Resources, State Ethnic Affairs Commission & Ministry of Education, Yunnan Minzu University, Kunming 650031, P.R. China

*Corresponding author: E-mail: huqiufena@aliyun.com

Received: 29 August 2014; *Accepted*: 7 May 2015; *Published online*: 22 June 2015; AJC-17372

A new isocoumarin, caudacoumarin D (**1**) was isolated from the bark of *Lindera caudata*. Its structure was elucidated by spectroscopic methods, including extensive 1D NMR and 2D NMR techniques. The antitobacco mosaic virus (anti-TMV) activity of **1** was evaluated. The results revealed that caudacoumarin D (**1**) showed anti-TMV activity with inhibition rate of 17.2 %.

Keywords: Isocoumarin, Caudacoumarin D, *Lindera caudate,* Anti-tobacco mosaic virus activity.

The plants of Lindera family (Lauraceae) are mainly distributed in tropical, subtropical to temperate regions of Asia and the midwest of United States[1]. This genus plants were traditionally used to treat stomach, urinary system diseases and rheumatic pain in Chinese folk[2,3]. *Lindera caudata* (Nees) Hook.f. is an evergreen plant found in central and south of China which have been used to hemostatic, analgesic and antipyretic Chinese remedy in Chinese folk[4]. However, the studies of the chemical constituents of this plant had not been reported in literatures.

Isocoumarin is an important class of natural products widely occurring in plant kingdom and is known to exhibit a wide range of pharmacological activities, including antibacterial and anti-fungal[5-7], cytotoxicity[8,9], antivirus[10,11], antioxidant[12], anti-inflammatory[13], *etc*. With the aim of multipurpose utilization of medicinal plants and identification of bioactive natural products, the phytochemical investigation on the bark of *L. caudata* was carried out. As a result, a new isocoumarin, caudacoumarin D (**1**) was isolated from this plant.

UV spectra were obtained using a Shimadzu UV-2401A spectrophotometer. ECD spectra were measured on a JASCO J-810 spectropolarimeter. IR spectra were obtained in KBr disc on a Bio-Rad Wininfmred spectrophotometer. ESI-MS were measured on a VG Auto Spec-3000 MS spectrometer. ^{1}H, ^{13}C and 2D NMR spectra were recorded on Bruker 500 instrument with TMS as internal standard. Column chromatography was performed on silica gel (200-300 mesh), or on silica gel H (10~40 μm, Qingdao Marine Chemical Inc., China). Second separate was used an Agilent 1100 HPLC equipped with ZORBAX-C_{18} (21.2 mm × 250 mm, 7.0 μm) column and DAD detector.

The barks of *Lindera caudata* (Nees) Hook.f. was collected in Dehong Prefecture, Yunnan Province, P.R. China, in September 2012. The identification of the plant material was verified by Prof. Y.J. Chen (Yunnan Minzu University). A voucher specimen (YNNI-2012-99) has been deposited in our laboratory.

Extraction and isolation: The barks of *L. caudata* (2.8 kg) were extracted four times with 70 % acetone (4 × 5 L) at room temperature and filtered. The crude extract (63.5 g) was applied to silica gel (200-300 mesh) column chromatography, eluting with a $CHCl_3$-$(CH_3)_2CO$ gradient system (20:1, 9:1, 8:2, 7:3, 6:4, 5:5), to give six fractions A-F. The further separation of fraction B (9:1, 8.62 g) by silica gel column chromatography, eluted with petroleum ether-EtOAc (9:1, 8:2, 7:3, 6:4, 1:1), yielded mixtures B1-B5. Fraction B2 (8:2, 5.84 g) was subjected to preparative HPLC (65 % MeOH, flow rate 12 mL/min) to give compound **1** (15.6 mg).

Caudacoumarin D (1): $C_{17}H_{20}O_5$, Obtained as a pale yellow gum; UV (MeOH) λ_{max} (log ε) 210 (4.02), 272 (3.68), 298 (3.50), 338 (3.69) nm; IR (KBr, ν_{max}, cm^{-1}): 3425, 3067, 2932, 2868, 1739, 1660, 1613, 1560, 1473, 1384, 1217, 1135, 1083, 861, 750; ESIMS *m/z* (positive ion mode) 327 $[M+Na]^+$; HRESIMS (positive ion mode) *m/z* 327.1202 $[M+Na]^+$ (calcd. $C_{17}H_{20}NaO_5$ for 327.1208).

A 70 % aq. acetone extract prepared from the bark of *L. caudata* was subjected repeatedly to column chromatography on silica gel, Sephadex LH-20, RP-18 and preparative HPLC

to afford compound (**1**). The structure of **1** was shown in Fig. 1 and the ^{1}H NMR and ^{13}C NMR data of **1** were listed in Table-1.

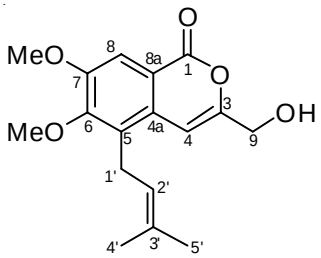

Fig. 1. Structure of compound **1**

TABLE-1
^{1}H AND ^{13}C NMR DATA FOR COMPOUND **1**
(IN $CDCl_3$, 100 AND 400 MHz)

No.	δ_C	δ_H (m, *J*, Hz)	No.	δ_C	δ_H (m, *J*, Hz)
1	161.8 s		9	62.5 t	4.34 s
3	155.5 s		1′	27.4 t	3.49 (d) 7.2
4	106.3 d	6.47 s	2′	122.3 d	5.22 (t) 7.2
4a	129.2 s		3′	133.8 s	6.83 (d) 8.5
5	132.9 s		4′	17.8 q	1.57 s
6	155.6 s		5′	25.9 q	1.76 s
7	149.2 s		6-OMe	61.2 q	3.82 s
8	113.7 d	7.46 s	7-OMe	56.3 q	3.80 s
8a	121.3 s		–	–	–

Compound **1** was obtained as pale yellow gum. The molecular formula was determined to be $C_{17}H_{20}O_5$ by high resolution-electrospray ionization-mass spectra (HR-ESIMS), *m/z* 327.1202 $[M+Na]^+$ (calcd 327.1208 for $C_{17}H_{20}NaO_5$). The IR spectrum showed absorption bands for hydroxy (3425), unsaturated lactone (1739, 1660) and aromatic rings (1613, 1560 and 1473). The ^{1}H NMR signals revealed the presence of a 1,2,3,4,5-penta substituted benzene moiety (δ_H 7.46 s), a prenyl group [δ_H 3.49 d (7.2) 2H, 5.22 t (7.2) 1H, 1.57 s 3H and 1.76 s 3H], a olefine proton (δ_H 6.47 s), a oxidated methylene proton (4.34 s 2H) and two methoxy protons (δ_H 3.80 s and 3.82 s). Its ^{13}C NMR showed the presence of a 1,2,3,4,5-penta substituted benzene moiety (δ_C 129.2 s, 132.9 s, 155.6 s, 149.2 s, 113.7 d and 121.3 s), a prenyl group (δ_C 27.4 t, 122.3 d, 133.8 s, 17.8 q, 25.9 q), an ester carbonyl (δ_C 161.85), a pair of olefenic carbon signals (δ_C 155.5 s, 106.3 d), a oxidated methylene carbon (δ_C 62.5 t) and two methoxy carbons quaternary carbon quaternary carbon(δ_C 61.2 q and 56.3 q). These data indicted that **1** should be a 3-hydroxy-methyl-isocoumarin[14,15]. This deduction was also supported by the HMBC correlations (Fig. 2) of H-9 (δ_H 4.34) with C-3 (δ_C 155.5) and C-4 (δ_C 106.3), of H-4 (δ_H 6.47) with C-3 (δ_C 155.5), C-9 (δ_C 62.5), C-4a (δ_C 129.2), C-5 (δ_C 132.9) and C-8a (δ_C 121.3). Moreover, the HMBC correlations of two methoxy protons (δ_H 3.82 and 3.80) with C-6 (δ_C 155.6) and C-7 (δ_C 149.2) suggested the position of two methoxy groups at C-6 and C-7 respectively. The prenyl group located at C-5 was supported by the HMBC correlations of H-12 (δ_H 3.49) with C-4a (δ_C 129.2), C-5 (δ_C 132.9) and C-6 (δ_C 155.6) and of H-22 (δ_H 5.22) with C-5 (δ_C 132.9). The structure of compound **1** is therefore determined and gives the trivail name of caudacoumarin D.

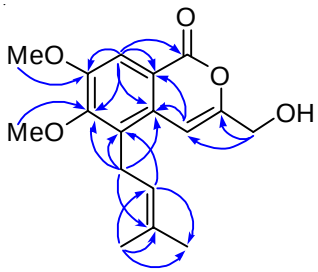

Fig. 2. Key HMBC (↷) correlations of compound **1**

Since some isocoumarins are known to exhibit potential antivirus activities[10,11], compound **1** was tested for its anti-TMV activities. The anti-TMV activities were tested using the half-leaf method[15,16]. Ningnanmycin (a commercial product for plant disease in China), was used as a positive control. The results revealed that compound **1** showed anti-TMV activity with inhibition rate of 17.2 %, respectively.

ACKNOWLEDGEMENTS

This research was supported by the National Natural Science Foundation of China (No. 21302164), the Excellent Scientific and Technological Team of Yunnan High School (2010CI08), the National Undergraduates Innovating Experimentation Project (2011HX18) and start-up funds of Yunnan University of Nationalities.

REFERENCES

1. Z.Y. Wu and D.Y. Hong, The Plants of Lauraceae, Flora of China, vol 31.
2. C.F. Zhang and Z.T. Wang, *J. Shenyang Pharm. Univ.*, **17**, 230 (2000).
3. T. Shen, X.M. Chen, B. Harder, M. Long, X.N. Wang, H.X. Lou, G.T. Wondark, D.M. Ren and D.D. Zhang, *Planta Med.*, **80**, 426 (2014).
4. S.M. Hu, Zhonghua Bencao, Shanghai Science & Technology, Shanghai, vol. III, pp. 65-68 (1996).
5. M. Figueroa, H. Raja, J.O. Falkinham III, A.F. Adcock, D.J. Kroll, M.C. Wani, C.J. Pearce and N.H. Oberlies, *J. Nat. Prod.*, **76**, 1007 (2013).
6. R.X. Li, S.X. Chen, S.B. Niu, L.D. Guo, J. Yin and Y.S. Che, *Fitoterapia*, **96**, 88 (2014).
7. J. Qi, C.L. Shao, Z.Y. Li, L.S. Gan, X.M. Fu, W.T. Bian, H.Y. Zhao and C.Y. Wang, *J. Nat. Prod.*, **76**, 571 (2013).
8. H.L. Jiang, X.H. Luo, X.Z. Wang, J.L. Yang, X.J. Yao, P. Crews, F.A. Valeriote and Q.X. Wu, *Fitoterapia*, **83**, 1275 (2012).
9. S.L. Luo, X.J. Huang, Y. Wang, R.W. Jiang, L. Wang, L.L. Bai, Q.-L. Peng, C.-L. Song, D.-M. Zhang and W.-C. Ye, *Fitoterapia*, **95**, 115 (2014).
10. J. Arunpanichlert, V. Rukachaisirikul, Y. Sukpondma, S. Phongpaichit, S. Tewtrakul, N. Rungjindamai and J. Sakayaroj, *Chem. Pharm. Bull. (Tokyo)*, **58**, 1033 (2010).
11. S.-Z. Shang, W.-X. Xu, L. Li, J.-G. Tang, W. Zhao, P. Lei, M.-M. Miao, H.-D. Sun, J.-X. Pu, Y.-K. Chen and G.-Y. Yang, *Phytochem. Lett.*, **11**, 53 (2015).
12. K. Tianpanich, S. Prachya, S. Wiyakrutta, C. Mahidol, S. Ruchirawat and P. Kittakoop, *J. Nat. Prod.*, **74**, 79 (2011).
13. L.C. Di Stasi, D. Camuesco, A. Nieto, W. Vilegas, A. Zarzuelo and J. Galvez, *Planta Med.*, **70**, 315 (2004).
14. Y. Takenaka, N. Morimoto, N. Hamada and T. Tanahashi, *Phytochemistry*, **72**, 1431 (2011).
15. L.B. Zhang, J. Ji, C. Lei, H.Y. Wang, Q.S. Zhao and A.J. Hou, *J. Nat. Prod.*, **75**, 699 (2012).
16. Q.F. Hu, B. Zhou, J.M. Huang, X.M. Gao, L.D. Shu, G.Y. Yang and C.T. Che, *J. Nat. Prod.*, **76**, 292 (2013).