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NORCADINANE SESQUITERPENE FROM THE ROOTS OF *Cinnamomum subavenium*

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Cinnamomum subavenium Miq. (Lauraceae) is a medium-sized evergreen tree, found in central to southern mainland China, Burma, Cambodia, Taiwan, Malaysia, and Indonesia [1]. In the course of screening for biologically and chemically novel agents from Formosan Lauraceous plants [2–10], *C. subavenium* Miq. was chosen for further phytochemical investigation. In previous studies, we have investigated the chemical constituents of the Formosan Lauraceous plants and have identified a novel cytotoxic monoterpenoid, subamone, five new butanolides, subamolide A–E, two new secobutanolides, secosubamolide and secosubamolide A, along with 27 known compounds from the stems and leaves of *C. subavenium* Miq. [1, 7, 10]. The MeOH extract of its roots was subjected to solvent partitioning and chromatographic separation to afford six pure substances. The chemical constituents in the roots of *C. subavenium* were separated with column chromatography.

Investigation on the MeOH extract of the leaves has led to the isolation of six compounds, two novel norcadinane-type sesquiterpenoids: oxyphyllenodiol A (**1**) [11] and oxyphyllenodiol B (**2**) [11]; one steroid: *β*-sitosterol (**3**) [12]; and three benzenoids: myristicin (**4**) [13], 3,4-methylenedioxy-5-methoxycinnamyl alcohol (**5**) [14], and myristicic acid (**6**) [15]. These compounds were obtained and characterized by comparison of their physical and spectral data (UV, IR, NMR, and MS) with values obtained in the literature [11–15]. Among them, **1** and **2** were found for the first time from this plant.

The specimen of *C. subavenium* was collected from Wulai Hsiang, Taipei County, Taiwan in May, 2005. A voucher specimen (Cinnamo. 5) was identified by Dr. Fu-Yuan Lu (Department of Forestry and Natural Resources College of Agriculture, National Chiayi University) and was deposited in the School of Medical and Heath Science, The Fooyin University, Kaohsiung County, Taiwan. The air-dried roots of *C. subavenium* (1.5 kg) were extracted with MeOH (50 L ×6) at room temperature, and a MeOH extract (77.5 g) was obtained upon concentration under reduced pressure. The MeOH extract, suspended in H_2O (1 L), was partitioned with $CHCl_3$ (2 L ×5) to give fractions soluble in $CHCl_3$ (40.7 g) and H_2O (26.5 g). The $CHCl_3$-soluble fraction (40.7 g) was chromatographed over silica gel (800 g, 70–230 mesh) using *n*-hexane–EtOAc–MeOH mixtures as eluents to produce six fractions. Fraction 1 (7.09 g) was subjected to silica gel chromatography by eluting with *n*-hexane–EtOAc (80:1), enriched with EtOAc to furnish four further fractions (1-1–1-4). Subfraction 1-3 (2.21 g) was subjected to silica gel chromatography, eluting with $CHCl_3$–MeOH (100:1), and enriched gradually with MeOH, to obtain five subfractions (1-3-1–1-3-5). Subfraction 1-3-3 (0.92 g) was further purified on a silica gel column using *n*-hexane–EtOAc mixtures to obtain myristicin (**4**) (11 mg, 0.0270%). Fraction 2 (9.33 g) was subjected to silica gel chromatography by eluting with *n*-hexane–EtOAc (50:1), enriched with EtOAc to furnish five further subfractions (2-1–2-5). Subfraction 2-1 (2.07 g) was further purified on a silica gel column using *n*-hexane–EtOAc mixtures to obtain 3,4-methylenedioxy-5-methoxycinnamyl alcohol (**5**) (20 mg, 0.0491%). Fraction 4 (4.39 g) was subjected to silica gel chromatography by eluting with *n*-hexane–EtOAc (40:1), then enriched with acetone to furnish 5 subfractions (4-1–4-5). Subfraction 4-2 (1.16 g) was further purified on a silica gel column using *n*-hexane–EtOAc mixtures to obtain myristicic acid (**6**) (14 mg, 0.0343 %). Then, subfraction 4-5 (0.83 g) was further purified on a silica gel column using *n*-hexane–EtOAc (40:1) to obtain β-sitosterol (**3**) (29 mg, 0.0713%). Fraction 5 (4.98 g) was subjected to silica gel chromatography by eluting with *n*-hexane–EtOAc (20:1), then enriched with acetone to furnish 6 subfractions (5-1–5-6). Subfraction 5-4 (1.41 g) was further purified on a silica gel column using *n*-hexane–EtOAc mixtures to obtain oxyphyllenodiol A (**1**) (15 mg, 0.0369%) and oxyphyllenodiol B (**2**) (15 mg, 0.0369%).

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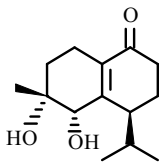

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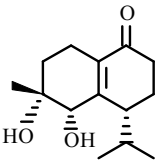
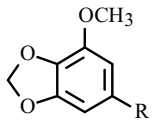


2



4 - 6

4: R = CH_2-CH=CH_2
5: R = CH=CH-CH_2OH
6: R = COOH

Oxyphyllenodiol A (1) as in [11], colorless oil. UV (λ_{max}, nm): 245. IR (ν_{max}, cm^{-1}): 3450, 1670. ^{1}H NMR (500 MHz, $CDCl_3$, δ, ppm, J/Hz): 0.93 (3H, d, J = 7.0, H-12), 1.06 (3H, d, J = 7.0, H-13), 1.22 (3H, s, H-15), 1.67 (1H, ddd, J = 6.5, 8.5, 14.8, H-2β), 1.80 (1H, ddd, J = 5.2, 6.5, 14.9, H-2α), 1.97 (2H, m, H-7), 2.21 (1H, m, H-11), 2.24 (1H, ddd, J = 6.5, 8.5, 15.8, H-1α), 2.32 (1H, ddd, J = 6.1, 6.1, 17.5, H-8α), 2.50 (1H, ddd, J = 5.2, 6.5, 16.0, H-1β), 2.52 (1H, ddd, J = 6.6, 8.8, 17.5, H-8β), 2.65 (1H, m, H-6), 4.18 (1H, br.s, H-4), EI-MS *m/z* 238 $[M]^+$.

Oxyphyllenodiol B (2) as in [11], colorless oil. UV (λ_{max}, nm): 245. IR (ν_{max}, cm^{-1}): 3445, 1660. ^{1}H NMR (500 MHz, $CDCl_3$, δ, ppm, J/Hz): 0.73 (3H, d, J = 7.0, H-12), 0.87 (3H, d, J = 7.0, H-13), 1.28 (3H, s, H-15), 1.58 (1H, ddd, J = 6.4, 11.1, 17.8, H-2β), 1.85 (1H, ddd, J = 6.2, 7.1, 17.8, H-2α), 1.94 (1H, m, H-7α), 2.00 (1H, m, H-7β), 2.25 (1H, dq, J = 5.6, 7.1, H-11), 2.34 (1H, m, H-8α), 2.36 (2H, m, H-1), 2.53 (1H, ddd, J = 4.0, 8.9, 17.2, H-8β), 2.63 (1H, m, H-6), 3.98 (1H, br.s, H-4), EI-MS *m/z* 238 $[M]^+$.

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REFERENCES

1. R. J. Lin, W. L. Lo, Y. D. Wang, and C. Y. Chen, *Nat. Prod. Res.*, **22**, 1055 (2008).
2. T. J. Hsieh, S. F. Hsieh, and C. Y. Chen, *Chem. Nat. Comp*., **46**, 99 (2010).
3. C. Y. Chen, H. M. Wang, S. H. Chung, W. L. Lo, W. L. Yang, and S. C. Yang, *Chem. Nat. Comp.*, **46**, 474 (2010).
4. I. J. Lin, W. L. Lo, Y. C. Chia, L. Y. Huang, T. M. Cham, W. S. Tseng, Y. T. Yeh, H. C. Yeh, Y. D. Wang, and C. Y. Chen, *Nat. Prod. Res.*, **24**, 775 (2010).
5. M. J. Cheng, W. L. Lo, W. S. Tseng, H. C. Yeh, and C. Y. Chen, *Nat. Prod. Res.*, **24**, 732 (2010).
6. C. Y. Chen, W. L. Yang, and Y. R. Hsui, *Nat. Prod. Res.*, **24**, 423 (2010).
7. S. Y. Kuo, T. J. Hsieh, Y. D. Wang, W. L. Lo, Y. R. Hsui, and C. Y. Chen, *Chem. Pharm. Bull*., **56**, 97 (2008).
8. C. Y. Chen, Y. L. Hsu, Y. C. Tsai, and P. L. Kuo, *Food Chem. Toxicol.*, **46**, 2476 (2008).
9. T. Z. Liu, J. T. Cheng, S. J. Yiin, C. Y. Chen, C. H. Chen, M. J. Wu, and C. L. Chern, *Food Chem. Toxicol.*, **46**, 321 (2008).
10. C. Y. Chen, C. H. Chen, C. H. Wong, Y. W. Liu, Y. S. Lin, Y. D. Wang, and Y. R. Hsui, *J. Nat. Prod.*, **70**, 103 (2007).
11. O. Muraoka, M. Fujimoto, G. Tanade, M. Kubo, T. Minematsu, H. Matsuda, T. Morikawa, I. Toguchida, and M. Yoshikawa, *Bioorg. Med. Chem*. *Lett*., **11**, 2217 (2001).
12. W. S. Sheen, I. L. Tsai, C. M. Teng, and I. S. Chen, *Phytochemistry*, **36**, 213 (1994).
13. R. B. Lauffer and L. J. Que, *J. Am. Chem. Soc.,* **25**, 7324 (1982).
14. U. Thron, R. Martin, and J. Reichling, *J. Biosci.*, **44**, 7 (1989).
15. S. B. Malik, P. Sharma, and T. R. Seshadri, *Indian J. Chem.,* **15**, 536 (1977).