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Monoterpene Glycosides and Furan Derivative from Coleus amboinicus Lour.(โมโนเทอร์ปีนกลัยโคไซด์และอนุพันธ์ฟูรานจากเเียมหูเสือ)

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Monoterpene Glycosides and Furan Derivative from *Coleus amboinicus* Lour.

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ABSTRACT: Extraction of the aerial parts of *Coleus amboinicus* Lour. yielded two monoterpene glycosides, thymoquinol-β-D-glucopyranoside and carvacrol-β-D-glucopyranoside, and a furan derivative, 5-(hydroxymethyl)-2-furaldehyde. Identification of the compounds isolated was accomplished by spectroscopic techniques and comparison with reported data. This study is the first to report the occurrence of monoterpene glycosides in the genus *Coleus*.

Key words: *Coleus amboinicus*, Labiatae, thymoquinol-β-D-glucopyranoside, carvacrol-β-D-glucopyranoside, 5-(hydroxymethyl)-2-furaldehyde.

INTRODUCTION

Coleus amboinicus Lour. (Syn. *C. aromaticus* Benth., *C. carnosus* Hassk.; Thai name, Niam-huu-suea; Labiatae) is an aromatic subshrub often employed as a substitute for borage or thyme. The plant has been used as traditional remedy in various countries, mostly acting as a carminative to relieve indigestion, dyspepsia, gas pains and in the treatment of bronchitis. In Thailand, fresh leaf juice is employed to treat asthma(1). A large number of terpenoids have been isolated from plants in the genus *Coleus*, including forskolin (coleonol), a labdane diterpenoid which exhibits potential in the treatment of glaucoma, cardiomyopathy and asthma(2-3). Monoterpenoids (4-8), sesquiterpenoids(4-5,7), abietane-type diterpenoids (9) and triterpenoids(10) were reported as constituents of *C. amboinicus*.

We report here on the isolation and characterization of two monoterpene glycosides, thymoquinol-β-D-glucopyranoside(**1**) and carvacrol-β-D-glucopyranoside(**2**), and a furan derivative, 5-(hydroxymethyl)-2-furaldehyde(**3**), from the aerial parts of niam-huu-suea. This is the first report of these compounds from this Coleus species.

MATERIALS AND METHODS

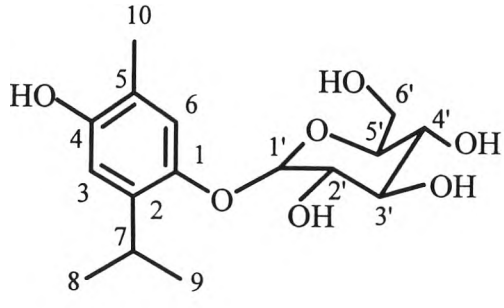
Plant material

Coleus amboinicus Lour. was cultivated at the Department of Pharmaceutical Botany, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok, Thailand. A voucher specimen of the plant is deposited in the Herbarium of the Faculty of Pharmaceutical Sciences, Chulalongkorn University.

General

UV spectra were obtained on a Milton Roy Spectronic 3000 spectrometer, using methanol as the solvent. IR spectra were recorded with a Shimadzu IR-440 spectrophotometer in KBr. EI-MS spectra were recorded at 70eV using a Fisons VG Trio 2000 quadrupole mass spectrometer. ^{1}H- and ^{13}C-NMR spectra were obtained using a

JEOL JMN-A500 (Alpha series) NMR spectrometer at 500 MHz and 125 MHz, respectively, in acetone-d6 with TMS ($\delta = 0$) as internal standard. TLC was performed on silica gel (Merck) plates. The spots were visualized by spraying with 10% H_2SO_4 and then heating at 110° for 3 min. CC was performed over Merck Silica gel 60, particle size 0.040-0.063 mm.



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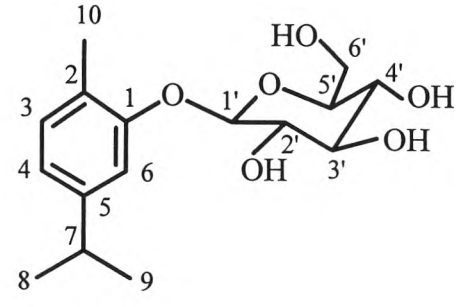

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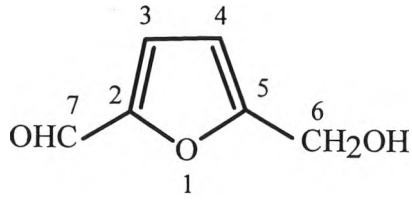

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Extraction and isolation

The dried aerial parts (3.5 kg) were chopped into small pieces and then macerated three times in MeOH. The combined MeOH extract was concentrated under reduced pressure and partitioned between hexane and H_2O. The aqueous fraction was then successively partitioned with $CHCl_3$ and EtOAc. The EtOAc fraction, after evaporation of solvent under reduced pressure, afforded 34.4 g of the dried extract. A portion (20.0 g) of this extract was subjected to CC with $CHCl_3$-MeOH (7:1) as the solvent system and 30-ml fractions were collected. Combined fractions 28-36 were rechromatographed over silica gel columns eluting with $CHCl_3$-MeOH (50:1) and $CHCl_3$-MeOH-H_2O (50:1:1), respectively, to give **3** (49 mg). Combined fractions 51-100 were rechromatographed using the solvent systems of CHCl3-MeOH (5:1) and $CHCl_3$-acetone (2:1), respectively, to yield **2** (190 mg). Finally, chromatography of combined fractions 101-140 over a series of silica gel columns with $CHCl_3$-MeOH (10:3), $CHCl_3$-MeOH (10:1) and $CHCl_3$-acetone (1:2), respectively, as eluents yielded **1** (540 mg).

Thymoquinol-β-D-glucopyranoside (**1**) Pale yellow solid. UV λ_{max} (MeOH) nm (log ε): 286 (2.84), 216 (3.23); IR υ_{max} (KBr) cm^{-1} : 3390 (OH), 2960, 1700, 1510, 1420, 1360, 1200, 1080; EI-MS *m/z* (rel. int.) : $[M]^+$ 328 (1), 167 (10), 166 (100), 151 (53), 91 (6) ; ^{1}H-NMR (acetone-d_6, 500 MHz) : δ 6.92 (1H, *s*, H-6), 6.68 (1H, *s*, H-3), 4.75 (1H, *d, J* = 7.3 Hz, H-1'), 3.88 (1H, *dd, J* = 10.9, 1.9 Hz, H-6'a), 3.73 (1H, *dd, J* = 10.9, 4.9 Hz, H-6'b), 3.53 (1H, *m,* H-5'), 3.50 (1H, *m,* H-4'), 3.49 (1H, *m,* H-3'), 3.47 (1H, *septet, J* = 7.0 Hz, H-7), 3.42 (1H, *m,* H-2'), 2.13 (3H, *s,* Me-10), 1.13 (6H, *d, J* = 7.0 Hz, Me-8, Me-9) ; ^{13}C-NMR (acetone-d_6, 125 MHz) : (151.5 (*s,* C-4), 148.9 (*s,* C-1), 137.6 (*s,* C-2), 122.5 (*s,* C-5), 120.2 (*d,* C-6), 112.9 (*d,* C-3), 104.0 (*d,* C-1'), 78.1 (*d,* C-5'), 77.4 (*d,* C-3'), 74.9 (*d,* C-2'), 71.4 (*d,* C-4'), 62.7 (*t,* C-6'), 26.5 (*d,* C-7), 23.5 (*q,* C-9), 23.4 (*q,* C-8), 16.0 (*q,* C-10).

Carvacrol-(-D-glucopyranoside (2) Pale yellow solid. UV λ_{max} (MeOH) nm (log ε) : 276 (2.82), 269 (2.86), 216 (3.30); IR υ_{max} (KBr) cm^{-1} : 3390 (OH), 2960, 1710, 1510, 1420, 1250, 1080; EI-MS *m/z* (rel. int.) : 167 (1), 166 (9), 151 (15), 150 (100), 135 (65), 133 (5), 105 (7), 91 (15); ^{1}H-NMR (acetone-d^6, 500 MHz) : δ 7.02 (1H, *d, J* = 7.5 Hz, H-3), 7.02 (1H, *d, J* = 1.8 Hz, H-6), 6.78 (1H, *dd, J* = 7.5, 1.8 Hz, H-4), 4.93 (1H, *d, J* = 7.6 Hz, H-1'), 3.89 (1H, *dd, J* = 11.5, 1.8 Hz, H-6'a), 3.72 (1H, *dd, J* = 11.5, 4.9 Hz, H-6'b), 3.54 (1H, *dd, J* = 7.6, 1.8 Hz, H-5'), 3.54 (1H, *m,* H-3'), 3.50 (1H, *m,* H-2'), 3.49 (1H, *m,* H-4'), 2.84 (1H, *septet, J* = 6.7 Hz, H-7), 2.20 (3H, *s,* Me-10), 1.20 (6H, *d, J* = 6.7 Hz, Me-8, Me-9) ; ^{13}C-NMR (acetone-d_6, 125 MHz) : δ 156.7 (*s,* C-1), 148.5 (*s,* C-5), 131.0 (*d,* C-3), 125.2 (*s,* C-2), 120.5 (*d,* C-4), 114.0 (*d,* C-6), 102.1 (*d,* C-1'), 78.1 (*d,* C-5'), 77.5 (*d,* C-3'), 74.7 (*d,* C-2'), 71.4 (*d,* C-4'), 62.6 (*t,* C-6'), 34.5 (*d,* C-7), 24.3 (*q,* C-9), 24.2 (*q,* C-8), 16.0 (*q,* C-10).

5-(Hydroxymethyl)-2-furaldehyde (**3**) Dark brown oil. UV λ_{max} (MeOH) nm (log ε) : 279 (2.34), 224 (2.05); IR υ_{max} (KBr) cm^{-1} : 3380 (OH), 2930, 2850, 1710, 1670 (C=O), 1520, 1190, 1020 ; EI-MS *m/z* (rel. int.) : $[M]^+$ 126 (6), 125 (9), 124 (100), 123 (68), 109 (6), 105 (10), 97 (9), 96 (10), $[M\text{-}CH_2OH]_+$ 95 (44), 84 (18), 68 (3); ^{1}H-NMR (acetone-d_6, 500 MHz) : δ 9.59 (1H, *s,* H-7), 7.37 (1H, *d, J* = 3.6 Hz, H-3), 6.58 (1H, *d, J* = 3.6 Hz, H-4), 4.65 (2H, *s,* H_2-6) ; ^{13}C-NMR (acetone-d_6, 125 MHz) : δ 178.2 (*d,* C-7), 163.0 (*s,* C-5), 153.5 (*s,* C-2), 123.9 (*d,* C-3), 110.3 (*d,* C-4), 57.5 (*t,* C-6).

RESULTS AND DISCUSSION

Three compounds (**1-3**) were isolated from the EtOAc fraction of the aerial parts of *C. amboinicus*. The 1D- and 2D-NMR spectra of **1** and **2** identified these two compounds as aryl-terpenoids with isopropyl, methyl and hydroxyl substituents, of which **2** possessed one less hydroxyl group. A β-glucopyranosyl unit could be observed as connecting to the aglycone portion of both compounds. Comparison with previously reported data identified **1** as thymoquinol-(-D-glucopyranoside (1,4-dihydroxy-2-isopropyl-5-methylphenyl-1-O-β-D-glucopyranoside). The monoterpene glycoside 1 was initially reported as a minor component of the mixture of phenolic glycosides from *Geum japonicum* (Rosaceae) (11) and, later, was isolated from the fresh fronds of *Pteridium aquilinum* var. caudatum (Pteridaceae) (12). Similarly, compound 2 was identified as carvacrol-β-D-glucopyranoside (1-hydroxy-5-isopropyl-2-methylphenyl-1-O-β-D-glucopyranoside), previously found in *Thymus vulgaris,* another plant of the family Labiatae (13). Carvacrol has been reported as a constituent of *C. amboinicus* (4-5, 7-8). However, this study is the first to report the occurrence of monoterpene glycosides in a member of the genus *Coleus.*

Compound 3 is a small molecule consisting of only 6 carbon atoms. Its MS ($[M]^+$ peak at *m/z* 126, a mass fragment at m/z 95) and IR data (absorption bands at 3380, 2930, 2850 and 1670 cm^{-1}) suggested the presence of both hydroxymethyl and aldehyde moieties in the molecule. Analysis of its NMR spectra established 3 as 5-(hydroxymethyl)-2-furaldehyde, a compound widely used in organic synthesis. It was recently isolated from bulbs of *Gladiolus* spp. as a natural inhibitor of chlorophyll biosynthesis that could be used as herbicide with low toxicity to animals and man (14).

REFERENCES

1. Panthong, D. Kanjanapothi, and W.C. Taylor. Ethnobotanical review of medicinal plants from Thai traditional books, part 1 : plants with antiinflamatory, anti-asthmatic and antihypertensive properties. *J. Ethnopharmacol.* 18 : 213-228 (1986).
2. Tandon, M.M. Dhar, S. Ramakumar, and K. Venkatesan. Structure of coleonol, a biologically active diterpene from *Coleus forskohlii. Indian J. Chem. Ser. B* 15 : 880-888 (1977).
3. Valdes III, S.G. Mislankar, and A.G. Paul. *Coleus barbatus (C. forskohlii)* (lamiaceae) and the potential new drug forskolin (coleonol). *Econ. Bot.* 41 : 474-483 (1987).
4. Malik, R. Ahmad, S.A. Khan, and M.K. Bhatty. Studies on the essential oil of the Coleus aromaticus plant. *Pak. J. Sci. Ind. Res.* 28 : 10-12 (1985).
5. Bos, H. Hendriks, and F.H.L. Van Os. The composition of the essential oil in the leaves of *Coleus aromaticus* Bentham and their importance as a component. *Pharm. Weekbl. (sci. ed.)* 5 : 129-130 (1983).
6. Haque. Analysis of volatile constituents of Pakistani *Coleus aromaticus* plant oil by capillary gas chromatography / mass spectrometry. *J. Chem. Soc. Pak.* 10 : 369-371 (1988).

7. Baslas, and P. Kumar. Chemical examination of essential oil of *Coleus aromaticus* Benth. *J. Indian Chem. Soc.* 58 : 103-104 (1981).

8. Morton. Country borage (*Coleus amboinicus* Lour.) : a potent flavoring and medicinal plant. *J. Herbs Spices Med. Plants* 1 : 77-90 (1992).

9. Yoshizaki, P. Ruedi, and C.H. Eugster. Diterpenoid leaf-gland pigments : 11-coleons and royleanones from *Coleus carnosus* Hassk. *Helv. Chim. Acta* 62 : 2754-2762 (1979).

10. Brieskorn, and W. Riedel. Triterpene acids from *Coleus amboinicus*. *Arch. Pharm. (Weinheim)* 310 : 910-915 (1977).

11. Shigenaga, I. Kouno, and N. Kawano. Triterpenoids and glycosides from *Geum japonicum*. *Phytochemistry* 24 : 115-118 (1985).

12. Castillo, A.L. Wilkins, D.R. Lauren, D.E. McNaughton, and B.L. Smith. Structure elucidation of 1,4-dihydroxy-2-*iso*-propyl-5-methylphenyl-1-O-β-D-glucopyranoside, a constituent of *Pteridium aquilinum* var. *caudatum*. *J. Nat. Prod.* 58 : 1889-1891 (1995).

13. Skopp, and H. Horster. Sugar bound regular monoterpenes, part I. Thymol- and carvacrolglycosides in *Thymus vulgaris*. *Planta Med.* 29 : 208-215 (1976).

14. Wubert, U. Oster, and W. Rudiger. Interaction of 5-hydroxymethyl-furfural with hydroxymethylbilane synthase. *Phytochemistry* 46 : 45-50 (1997).

Thai J. Pharm. Sci., 1998, Vol. 22, No. 2 pp. 67-71

โมโนเทอร์ปีนกลัยโคไซด์และอนุพันธ์ฟูรานจากเนียมหูเสือ

รุทธ์ สุทธิศรี และ รติพรรณ เหลืองสุวรรณ

บทคัดย่อ : จากการสกัดต้นส่วนเหนือดินของเนียมหูเสือ (*Coleus amboinicus* Lour.) ได้สารกลุ่มโมโนเทอร์ปีน กลัยโคไซด์ 2 ชนิด คือ thymoquinol-β-D-glucopyranoside กับ carvacrol-β-D-glucopyranoside และสารอนุพันธ์ฟิวแรน 1 ชนิด คือ 5-(hydroxymethyl)-2-furaldehyde การพิสูจน์เอกลักษณ์ของสารที่สกัดได้ทำโดยใช้เทคนิคทางสเปกโทรสโกปีและการเปรียบเทียบกับข้อมูลที่ได้มีรายงานไว้ การศึกษานี้เป็นการรายงานครั้งแรกถึงการมีสารกลุ่มโมโนเทอร์ปีน กลัยโคไซด์อยู่ในพืชสกุล *Coleus*

กุญแจคำ : เนียมหูเสือ, Labiatae, thymoquinol-β-D-glucopyranoside, 5-(hydroxymethyl)-2-furaldehyde