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Some Chemical Components from *Gnetum montanum* Markgr. in Vietnam

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Abstract

Gnetum montanum Markgr.(Gnetaceae), Vietnamese name as Day gam, Gam nui is a creeping and turning wood, distributed in natural forests at altitudes of 200-1200 m. It grows widely in mountain areas in Vietnam. Its stem can disinfect, eliminate rheumatism, eliminate toxins in the body, and support the treatment of inflammation, blood disorders, leprosy, or joint pain in traditional medicine. In the course of study on the chemical composition of Gnetum montanum Markgr. in Vietnam, this paper described the extraction and structure evaluation of four compounds, including lehmbachol D (1), 3,4,5-trimethoxy-stilbene-10,14-diol (2), gnetucleistol C (3) and (+)-pinoresinol (4). The stems of this plant were collected, identified, dried and extracted in different polarity solvents. These substances were isolated from the ethyl acetate of methanol extract on the basis of column chromatography combined with thin layer chromatography. Their structures were identified based on spectroscopic evaluation and comparison of corresponding authentic compounds. Compound 2 was firstly reported on the paper.

Keywords: *Gnetum*, *G.montanum*., stilbenes, stilbenediol.

1. Introduction

Over the past 90 years, more than 40 species of the Gnetaceae family have been studied [1]. The constituents of *Gnetum* genus have been previously evaluated, which revealed that they were rich in various stilbenes and oligo stilbenes stilbenoids, alkaloids, and flavonoids [2-4]. Many stilbene derivatives, represented as resveratrol, rhapontigenin, isorhapontigenin have been isolated from the genus *Gnetum*. Common stilbenoid were present in many different species of *Gnetum*. For example, resveratrol was isolated from five species of *Gnetum*. Stilbenes were the first groups extracted and structurally determined from the family Gnetaceae. Up to now, many different stillbene skeletons, which are gnetifolin A, gnetifolin C, gnetifolin D, gnetifolin E, gnetifolin F, gnetifolin P, gevastrol, isorhapotigenin, lehmbachol A, lehmbachol D, were isolated. Gnetifolins are also commonly found in the *Gnetum* and mostly found in *Gnetum montanum* Markgr. (*G.montanum*), *Gnetum puruifolium*, *Gnetum klossii*. Gnetifolin K is the most common gnetifolin. In addition, gnetumelin B, oxyresveratrol, gnetulin, and ε-viniferin have also been found in the genus. Besides, polyphenols are always present in large amounts in the genus *Gnetum*. Around the world, the stems and roots of some species of this genus are used in medicines to treat low back pain, rheumatism, limb pain, trauma, and respiratory infections. It is noteworthy that about one hundred of stilbenoid compounds have been found in fifteen species of the genus *Gnetum*. Therefore, this class of substances is considered a characteristic composition of the genus. These compounds have long been shown to have effective antioxidant, antibacterial, antihypertensive, anticancer, and anti-inflammatory properties [3, 5-6].

G.montanum was first discovered by Friedrich Markgraf in 1930. In folklore, it is used to treat rheumatism, bone pain, menstrual disorders, and snake bites. The decoction from the *G.montanum* is used to detoxify, treat fever, and malaria, or be used in combination with other herbs. The extracts from the plant have antibacterial and antioxidant activities by DPPH free radical scavenging, α-amylase and α-glucosidase inhibition in vitro. Therefore, *G.montanum* is a potential source of medicinal herbs for the study of antibiotic, antioxidant, α-amylase and α-glucosidase inhibitors, contributing to the prevention and treatment of diabetes. Phytochemical studies reported some remarkable classes of substances in this plant (Fig. 1). The basic compounds, stilbenoids and lignan, were extracted and their structures were identified such as gnetifolin A, gnetucleistol C, gneafricanin F, and (+)-pinoresinol. Among them (+)-piroresinol, gneafricanin F make up a large amount in components of the plant. The other compounds including lehmbachol A, and gnetuhainin Q, isorhapontigenin, isorhapontin, *trans*-pynosylvin, gnetifolin E, and resveratrol were isolated as well [7-8].

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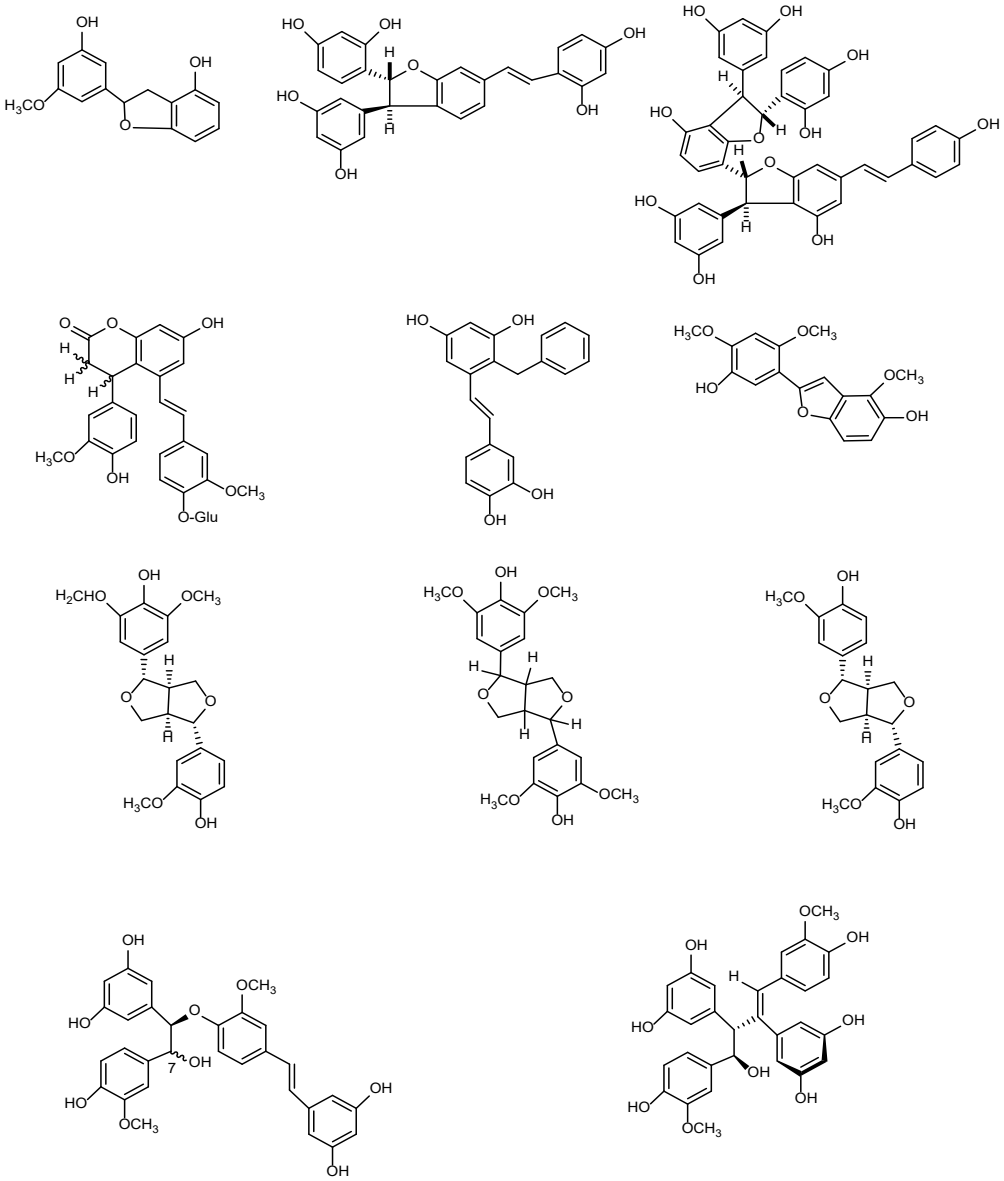


Fig. 1. Some compounds were isolated from *Gnetum montanum* Markgr.

In Vietnam *G.montanum* is named as Day gam and also known as Gam nui, Day mau or Vuong ton. This species grows in moist forests at an altitude of 500-1500 m. Some Vietnamese scientific reports in the field of natural chemical compositions were remarkable. From the extract of *G. montanum* collected in Tuyen Quang, three compounds *trans*-resveratrol, resveratroloside and isorhapontigenin-13-glucoside were extracted and identified [9] . From the EtOAc extract of *G. montanum* collected in Yen Bai, four compounds including gnetifolin A, trans-pinosylvin, *cis*-resveratrol and gnetifolin E were elucidated [10]. However, research on the chemical composition of this species is still very potential. In the continous course of chemical study of *G.montanum* three stilbene derivatives and one lignan z were isolated and characterized of from this species in Vietnam. Compound 2 as 3, 4, 5-trimethoxy-stilbene-10,14-diol is firstly recorded on the paper.

2. Materials and Methods

2.1. Plant Materials

Stem of *G.montanum* (Fig. 2) was collected in Vinh Trung, Vinh Linh, Quang Tri province in December 2020. The plant samples were then preserved for specimen making and were obtained by Dr. Nguyen The Cuong (Institute of Ecology and Biology Resources - Vietnam Institute of Science and Technology). As a result, this plant was *G.montanum*, owned by the genus *Gnetum*, family Gnetaceae. A sample voucher (GM1) was present at the Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology.

Fig. 2. *Gnetum montanum* Markgr.

2.2. General Experimental Procedures

The method of analysis and separation of the extracted residues was thin layer and column chromatographies. The isolated compounds were identified by modern analytical methods such as 1D, 2D-NMR, and HR-MS.

Preparative HPLC was carried out using an AGILENT 1200 HPLC system. Column chromatography was performed using either silica gel (Kieselgel 60, 70-230 mesh, and 230-400 mesh, Merck), RP-18 resin (150 µm, Fuji Silysia Chemical Ltd.) as the reversed-phase or Sephadex LH-20 (Amersham Biosciences, Sweden). Thin layer chromatography (TLC) was performed using 60 F254 (0.25 mm, Merck) and RP-18 F254S (0.25 mm, Merck) silica-gel thin plates.

NMR spectra were recorded on an Agilent 600 MR NMR spectrometer (600 MHz for ^{1}H-NMR and 150 MHz for ^{13}C-NMR). Chemical shift (δ) is reported in parts per million (ppm) and abbreviations such as *s* (single), *d* (double), *t* (triplet), *q* (quadruplet), *m* (multiple), and *br.* (extensive) is used to report data. HR-MS mass spectra were recorded on an AGILENT 1200 series LC-MSD Ion Trap. The melting point was measured on a Cole-Parmer. Plant samples were extracted with methanol using Vevor Ultrasonic model JPS-100A.

2.3. Extraction and Isolation

The cleaned *G.montanum* stems were chopped, dried, and crushed. The resulted dry powder stems (12.0 kg) were extracted with methanol at room temperature (3 times × 15 L, every 1 h). The extracts were obtained, filtered, and distilled to recover the solvent under reduced pressure and to yield 600.0 g of methanol extract (GM). This residue is dissolved in water and extracted with dichloromethane and ethyl acetate, respectively. The dichloromethane and ethylacetate extracts were distilled to recover the solvent under reduced pressure to obtain the dichloromethane fraction (GM.D, 40.0 g), the ethyl acetate fraction (GM.E, 60.0 g), and water residue. The GM.E fractions were separated on a silica gel chromatographic column with a gradient elution system of D/M (100/ 0 → 0/100, v/v), four segments are obtained: GM2B, GM2C, GM2D, and GM2E. The GM2C and GM2D fractions were combined and chromatographed on a silica gel column with D/M elution system (100/0-1/1, v/v) as diluent to obtain five subunits GM4B, GM4D, GM4E, GM4F and GM4G.

The GM4B was separated on a silica-gel column with the solvent system H/A (2/1, v/v) to produce 4 parts: GM21E, GM21F, GM21H, GM21K. GM21F was further separated on a Sephadex column with the solvent system M/W (1/1, v/v) obtains 2 fractions GM26D and GM26E. From GM26E running HPLC at the rate of 47% ACN, at the retention time of 52 minutes, compound **3** with a mass of 17.7 mg was obtained. The fraction GM21H were separated on a reverse phase silica-gel column with an elution system of M/W (1/1, v/v) to obtain 2 subfractions GM24B and GM24C. GM24B was separated on HPLC at the rate of 38% ACN, at the retention time of 40 minutes to yield **4** (22.9 mg). GM24C was separated on HPLC at the rate of 38% ACN, at the retention time of 64 minutes to yield **2** (6.2 mg). The fractions GM4D and GM4E were chromatographed on a silica gel column with D/M elution system (12/1, v/v) to obtain 3 subfractions: GM13A, GM13B, GM13C. The GM13A subunit was loaded on the Sephadex column and eluted with a M/W elution system (1/1, v/v) to obtain three fractions GM20B, GM20D, and GM20C. The GM20C subunit was further separated chromatographically on an HPLC chromatograph with ACN/water elution system (35%, v/v) and at the retention time of 34 minutes to obtain compound **1** (24 mg). Column chromatographic performance was monitored by thin-layer chromatography (see Fig. 3). The separated compounds were structurally determined by 1D, 2D NMR, and MS spectroscopy methods.

Lehmbachol D (1): White amorphous powder; HR-ESI-MS: m/z 467.1699 $[M+H]^+$, calcd. for $[C_{26}H_{27}O_8]$: 467.1700.

^{1}H-NMR (600 MHz, CD_3OD), *δ* (ppm): 7.06 (1H, *dd*, *J* = 8.4, 1.8 Hz, H-6′), 6.99 (1H, d, *J* = 1.8 Hz, H-2′), 6.83 (1H, *d*, *J* = 8.4 Hz, H-5′), 6.35 (2H, *brs*, H-2″, H-6″), 6.27 (1H, *d*, *J* = 1.8 Hz, H-4), 6.22 (1H, *d*, *J* = 1.8 Hz, H-6), 4.71 (1H, *d*, *J* = 4.8 Hz, H-1), 4.50 (1H, *dd*, *J* = 8.4 Hz, H-11), 4.16 (1H, *d*, *J* = 1.2 Hz, H-9), 3.88 (3H, *s*, 3′-OMe), 3.80 (2H, *m*, H-2, H-10), 3.75 (6H, *s*, 3″,5″-OMe), 3.57 (1H, *dd*, *J* = 8.4 Hz, H-11).

^{13}C-NMR (150 MHz, CD_3OD), *δ* (ppm): 160.1 (C-5), 156.3 (C-7), 149.2 (C-3′), 149.1 (2C, C-3″, C-5″), 148.6 (C-3), 147.3 (C-4′), 138 (C-1), 135.1 (C-1′), 134.7 (C-4″), 123 (C-8), 120.3 (C-6′), 116.2 (C-5′), 111 (C-2′), 105.5 (2C, C-2″, C-6″), 103.3 (C-4), 102.9 (C-6), 89.4 (C-1), 75 (C-11), 59.9 (C-2), 56.7 (2C, 3″, 5″-OMe), 56.6 (C-10), 56.4 (3′-OMe), 52.1 (C-9).

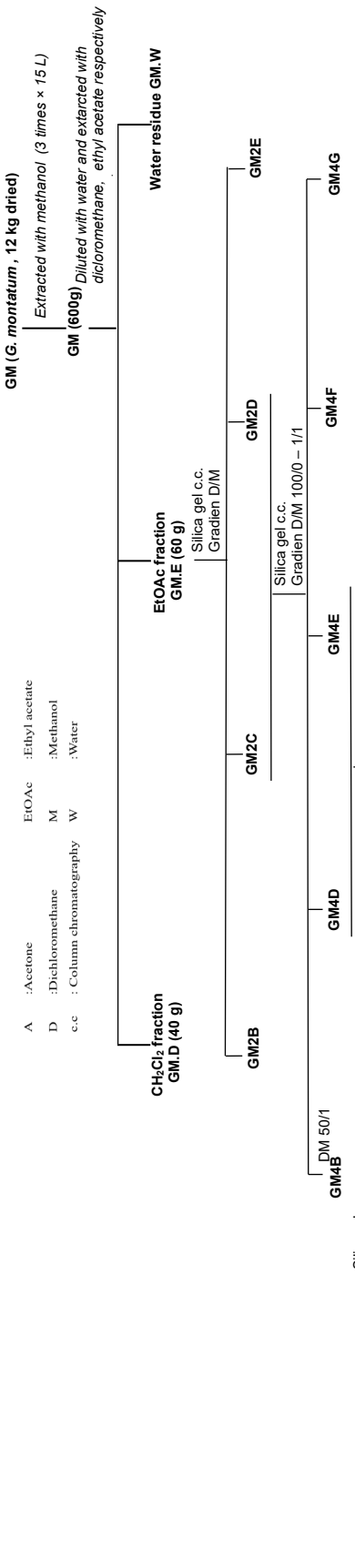


Fig. 3. Diagram of isolation of compounds **1-4** from *Gnetum montanum* Markgr.

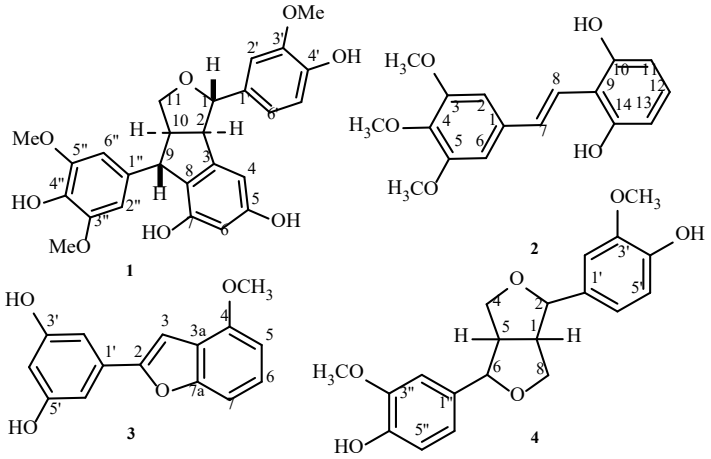


Fig. 4. The chemical structures of compounds **1-4**

Table 2. ^{13}C-NMR spectral data for compounds **1** and **2** and reference compounds

C	**1**			**2**	
	$^{\#}\delta_C$[a,b]	δ_C[a,b]	C	$^{\alpha}\delta_C$[a,b]	δ_C[a,b]
1	90.3	89.4	1	135.2	137.3
2	60.8	59.9	2	103.4	104.4
3	149.4	148.6	3	153.6	154.6
4	104.2	103.3	4	137.7	138.2
5	161.0	160.1	5	153.6	154.6
6	103.8	102.9	6	103.4	104.4
7	157.2	156.3	7	131.2	132.0
8	123.9	123.0	8	120.0	121.4
9	53.0	52.1	9	112.2	113.3
10	57.5	56.6	10	156.7	158.0
11	75.9	75.0	11	107.2	108.0
1'	136.0	135.1	12	127.8	128.9
2′	111.9	111.0	13	107.2	108.0
3′	150.0	149.2	14	156.7	158.0
4′	148.1	147.3	3-OCH_3	55.5	56.6
5′	117.0	116.2	4-OCH_3	59.7	61.2
6′	121.1	120.3	5-OCH_3	55.5	56.6
1"	138.9	138.0			
2", 6"	106.5	105.5			
3", 5"	150.0	149.1			
4"	135.6	134.7			
3′-OMe	57.4	56.4			
3", 5"-OMe	57.6	56.7			

Recorded in [a] CD_3OD, [b] 150MHz, [#] δ_C of lehmbachol D measured in CD_3OD [11]
[α] δ_C of compound 1 in Chinese patent number CN 110041166: Dracaena cochinchinensis extract with bacteriostatic function as well as preparation and application thereof [12]

3,4,5-Trimethoxy-stilbene-10,14-diol (2): White amorphous powder; HR-ESI-MS: m/z 303.1230 $[M+H]^+$, calcd. for $[C_{17}H_{19}O_5]$: 303.1227.

^{1}H-NMR (600 MHz, CD_3OD), δ (ppm): 7.6 (1H, *d*, *J* = 16.2, H-7), 7.4 (1H, *d*, *J* = 16.2 Hz, H-8), 6.86 (1H, *t*, *J* = 7.8 Hz, H-12), 6.82 (2H, *s*, br, H-2, H-6), 6.37 (2H, *d*, *J* = 7.8 Hz, H-11, H-13), 3.9 (6H, *s*, 3-OMe, 5-OMe), 3.79 (3H, *s*, 4-OMe).

^{13}C-NMR (150 MHz, CD_3OD), δ (ppm): 158.0 (2C, C-10, C-14), 154.6 (2C, C-3, C-5), 138.2 (C-4), 137.3 (C-1), 132.0 (C-7), 128.9 (C-12), 121.4 (C-8), 113.3 (C-9), 108.0 (2C, C-11, C-13), 104.4 (2C, C-2, C-6), 61.2 (4-OMe), 56.6 (2C, 3-OCH_3, 5-OMe).

Gnetucleistol C (3): Amorphous powder; HR-ESI-MS: m/z 257.0807 $[M+H]^+$, calcd. for $[C_{15}H_{13}O_4]$: 257.0808.

^{1}H-NMR (600MHz, CD_3OD, δ (ppm): 7.21 (1H, *dd*, *J* = 7.8 Hz, H-6), 7.11 (1H, *d*, *J* = 7.8 Hz, H-7), 7.07 (1H, *s*, H-3), 6.83 (2H, *d*, *J* = 1.8 Hz), 6.72 (1H, *d*, *J* = 1.8 Hz), 6.31 (1H, *t*, *J* = 1.8Hz, H-4′), 3.95 (3H, *s*, 4-OMe).

^{13}C-NMR (150 MHz, CD_3OD), δ (ppm): 160 (2C, C-3′, C-5′), 157.2 (C-2), 156 (C-7a), 154.9 (C-4), 133.4 (C-1′), 126.2 (C-6), 120.6 (C-3a), 105 (C-7), 104.5 (C-5), 104.3 (2C, C-2′, C-6′), 103.9 (C-4′), 99.6 (C-3), 56.1 (4-OMe).

(+)-Pinoresinol (4): Amorphous powder; HR-ESI-MS: m/z 337.1332 $[M-H]^-$, calcd. for $[C_{20}H_{21}O_6]$: 337.1344.

^{1}H-NMR (600 MHz, CD_3OD, δ (ppm): 6.96 (1H, *d*, *J* = 2Hz, H-2), 6.84 (1H, *dd*, *J* = 8.0, 2.0 Hz, H-6), 6.82 (1H, *d*, *J* = 8.0 Hz, H-5), 4.72 (1H, *d*, *J* = 4.8 Hz, H-7), 4.24 (1H, *dd*, *J* = 9.0, 7.0 Hz, H-9), 3.86 (1H, *s*, O-Me), 3.85 (1H, *dd*, *J* = 9.0, 4.0Hz), 3.14 (1H, *m*, H-8).

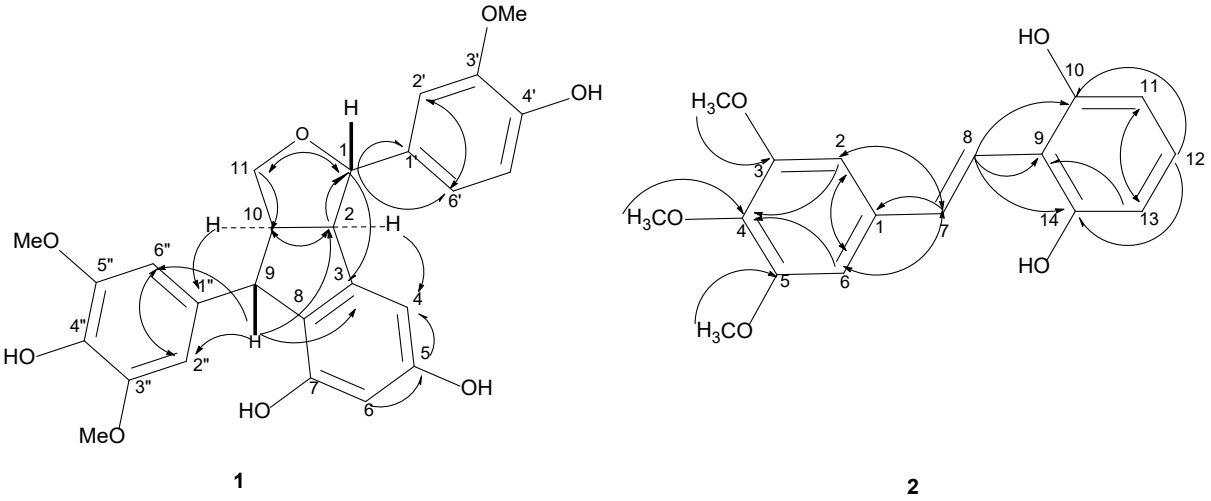
^{13}C-NMR (150 MHz, CD_3OD), δ (ppm): 149.1 (1C, C-3), 147.3 (1C, C-4), 133.8 (1C, C-1), 120.1 (1C, C-6), 116.1 (1C, C-5), 111 (1C, C-2), 87.5 (1C, C-7), 72.6 (1C, C-9), 56.5 (1C, O-Me), 55.3 (1C, C-8).

3. Results and Discussions

The chemical structures of the isolated compounds were determined based on modern spectroscopic methods such as one- and two-dimensional nuclear magnetic resonance and mass spectroscopy.

The compound **1** was isolated from the fraction of ethyl acetate extract of *G.montanum* as an amorphous powder. The ^{1}H-NMR spectrum of **1** showed the signal of ABX aromatic protons at δ_H 7.06 (1H, *dd*, *J* = 8.4, 1.8 Hz, H-6′), 6.99 (1H, *d*, *J* = 1.8 Hz, H-2′), 6.83 (1H, *d*, *J* = 8.4 Hz, H-5′), one substituted benzene ring with one set of ortho coupled protons at δ_H 6.35 (2H, brs, H-2″, H-6″). One 1,3,5,6-tetrsubstituted aromatic ring at δ_H 6.27 (1H, *d*, *J* = 1.8 Hz, H-4), 6.22 (1H, *d*, *J* = 1.8 Hz, H-6), one methoxy signal at 3.88 (3H, *s*, 3′-OMe) and the symmetry methoxy signal at 3.75 (6H, *s*, 3″,5″-OMe). Besides, there was the signals of one oximethin proton 4.71 (1H, *d*, *J* = 4.8 Hz, H-1) and one oximethylene signal at 4.50 (1H, *dd*, *J* = 8.4 Hz, H-11) and 3.57 (1H, *dd*, *J* = 8.4 Hz, H-11), three methin at 4.16 (1H, *d*, *J* = 1.2 Hz, H-9 and 3.80 (2H, *m*, H-2, H-10). The combination of ^{1}H-NMR and ^{13}C-NMR spectra of **1** allowed to determine the signals of an 1,3,4,5-substituted rings at δ_C 138 (C, C-1"), δ_C 105.5 (2 CH, C-2", C-6"), δ_C 149.1 (2C, C-3", C-5"), δ_C 134.7 (C, C-4") and of an 1,3,5,6-substituted rings at δ_C 148.6 (C, C-3), δ_C 103.3 (CH, C-4), δ_C 160.1 (C, C-5), δ_C 102.9 (CH, C-6), δ_C 156.3 (CH, C-7), δ_C 123 (C, C-8); signal of the remaining benzene ring at δ_C 135.1 (C, C-1′), δ_C 111 (CH, C-2′), δ_C 149.2 (C, C-3′), δ_C 147.3 (C , C-4′), δ_C 116.2 (CH , C-5′), δ_C 120.3 (CH , C-6′). In addition, the spectrum of furan ring was depicted at δ_C 89.4 (CH, C-1), δ_C 59.9 (CH, C-2), δ_C 56.6 (CH, C-10), δ_C 75.0 (CH_2, C-11) and the remaining carbon of cyclopentane rings at δ_C 52.1 (CH, C-9).

Moreover, the structure of **1** was confirmed clearly on a basis of two-dimensional spectra HSQC and HMBC. In the HMBC spectra it was verified that C-1′ (δ_C 135.1) connect directly to C-1 (δ_C 89.4) through the interaction between H-1 (δ_H 4.71) and C-1′ (δ_C 135.1), similarly the interaction between H-9 (δ_H 4.16) and C-1" (δ_C 138.0) also confirmed the direct bond of C-9 and C-1". The proton signals of H-9 (δ_H 4.16) to C-8 (δ_C 123.0) and H-2 (δ_H 3.80) to C-3 (δ_C 148.6) were detected to propose the existence of cyclopentane by δ_C 59.9 (CH, C-2), δ_C 148.6 (C, C-3), δ_C 123 (C, C-8), δ_C 52.1 (CH, C-9), δ_C 56.6 (CH, C-10). Likewise, the interchange between H-11 (δ_H 3.57) and C-10 (δ_C 56.6), H-2 (δ_H 3.80) and C-1 (δ_C 89.4) and the long-range correlations of H-1 (δ_H 4.71) and C-11 (δ_C 75), H-11(δ_H 4.5, δ_H 3.57) and C-1 (δ_C 89.4), hence a furan ring was suggested. The HSQC interactions approved the carbon and proton positions based on the crossed peaks between H-6' (δ_H 7.06) and C-6' (δ_C 120.3), H-2′ (δ_H 6.99) and C-2′ (δ_C 111), H-5' (δ_H 6.83) and C-5' (δ_C 116.27), H-2″, H-6″ (δ_H 6.35) and C-2″, C-6″ (δ_C 105.5), H-1 (δ_H 4.71) and C-1 (δ_C 89.4), the H-11 (δ_H 4.50, 3.57) and C-11 (δ_C 75.0). All of NMR data of **1** were consistent with the corresponding data of lehmbaochol D (Table 1). Moreover the HR-MS mass spectrometry showed an ion peak m/z 467.1699 $[M+H]^+$, which suggested the molecular formula of $C_{26}H_{26}O_8$. From the above spectral data and comparison with reference, compound **1** was identified as lehmbaochol D, a compound isolated from *Salacia lehmbachii* species [11].



1 **2**

Fig. 5. The key HMBC correlations of compounds **1** and **2**

Table 3. ^{13}C-NMR spectral data for compounds **3-4** and reference compounds

3			**4**		
C	**&δ_C[a,b]**	**δ_C[a,b]**	**C**	**Ωδ_C[a,b]**	**δ_C[c,b]**
1	-	-	1	54.2	55.3
2	155.9	157.2	2	85.9	87.5
3	98.9	99.6	4	71.7	72.6
3a	125.5	120.6	5	54.2	55.3
4	153.8	154.9	6	85.9	55.3
5	103.8	104.5	8	71.7	72.6
6	125.5	126.2	1', 1"	132.9	133.8
7	104.2	105.0	2', 2"	108.7	111.0
7a	155.1	156.0	3', 3"	146.7	149.1
1'	132.2	133.4	4', 4"	145.3	147.3
2', 6'	103.4	104.3	5', 5"	114.3	116.1
3', 5'	159.4	160.0	6', 6"	118.9	120.1
4'	103.5	103.9	OCH_3	56.0	56.5
4-OMe	55.3	56.1			

Recorded in [a] CD_3OD, [c] MeOD, [b]150MHz, [&]δ_C of gnetucleistol C measured in CD_3OD [13], [Ω]δ_C of (+)-pinoresinol measured in CD_3OD [14]

The compound **2** was isolated from the ethylacetate extract of *G.montanum* in the form of white amorphous powder. The ^{1}H-NMR spectrum (600 MHz, CD_3OD), δ_H (ppm) of compound 2 appeared 1doublet signal at 6.86 (1H, t, J = 7.8 Hz, H-12) and 1 doublet signal of 2 protons at 6.37 (2H, *d*, J = 7.8 Hz, H-11, H-13). Which represented the symestry substituted aromatic ring. Two protons 6.82 (2H, *s*, br, H-2, H-6) revealed the appearance of 3,4,5- substituted aromatic ring and two H positions are symmetric. Signal of 7.6 (1H, d, J = 16.2, H-7), 7.4 (1H, *d*, J = 16.2 Hz, H-8) were typical for the signal of the methine group outside the ring.These evidences suggested that **2** has a stilbene skeleton, a tipical one of the genus *Gnetum*. Besides, there were the signals of methoxy protons at 3.9 (3H, *s*, 3-OMe, 5-OMe), 3.79 (3H, *s*, 4-OMe). The ^{13}C-NMR spectroscopic data of **2** showed signals of 21 carbon atoms suggesting the presence of two aromatic rings, a double bond outside the rings. In addition, the interaction on the two dimensional HMBC spectrum allowed the confirmation of the position of groups in the molecule. The correlation from H-7 (δ_H 7.6) to C-1 (δ_C 137), C-2 (δ_C 104), C-6 (δ_C 104.4), and from H-8 (δ_H 7.4) to C-9 (δ_C 113.3), C-10 (δ_C 158.0), C-14 (δ_C 158.0) confirmed position of the double bond at C-7 and C-8. The crossed peaks from 4-OCH_3 (δ_H 3.79) to C-4 (δ_C 138.2), 3-OCH_3 (δ_H 3.9) to C-3 (δ_C 56.6), 5-OCH_3 (δ_H 3.9) to C-5 (δ_C 56.6) confirmed the positions of -OCH_3 at C-3, C-4, C-5. All of the NMR data of **2** were similar to those of compound **1** in the Chinese patent number CN 110041166: *Dracaena cochinchinensis* extract with bacteriostatic function as well as preparation and application thereof. Additionally, the HR-MS mass spectra appeared an ion peak m/z 303.1230 $[M+H]^+$ corresponding to the molecular formula of $C_{17}H_{18}O_5$. Hence, the structure of **2** was established based on the spectra interpretation and the comparison of NMR data with the spectra in the patent. Up to now, this compound was published only on the Chinese patent number CN 110041166 [12]. It was named as 3,4,5-trimethoxy-stilbene-10,14-diol.

Structures of compound **3-4** was elucidated successfully based on the NMR, Mass spectras combined with the comparations with the spectroscopy datas of desired compounds (Table 3).

4. Conclusion

This research was completed in the frame work of phytochemical study of *G.montanum*. Four compounds were isolated based on column chromatographies. Their structures were identified on a basis of mordern spectroscopy methods such as 1D, 2D-NMR, HR-MS. These components of *G.montanum* in Vietnam are belong to main clasification of *G.montanum* components. Compound **2** as 3,4,5-trimethoxy-stilbene-10,14-diol is firstly recorded on the paper. This study contributed to clarify the chemical composition of *G.montanum* species grown in Vietnam and scientific information to the treasure of natural compounds in Vietnam.

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