Two New Phenylglycol Derivatives Isolated from *Syringa reticulata* var. *mandshurica* and Their Antifungal Activities

Qiong Ming Xu,[a] Yan Li Liu,[a] Xiao Ran Li,[a] Yu Lin Feng,[a,b] and Shi Lin Yang*,[a,b]

[a] *College of Pharmacy, Soochow University; Suzhou 215123, China: and* [b] *Jiangxi College of Traditional Chinese Medicine; Nanchang 330006, China.*

Received February 14, 2009; accepted May 22, 2009; published online May 28, 2009

Two new phenylglycol derivatives, (*S*)-(+)-2-(3,4-dihydroxy phenyl)-2-ethoxyl- ethanol and (*S*)-(+)-2-(3,4-dihydroxy phenyl)-2-acetoxy-ethanol, were isolated from the leaves of *Syringa reticulata* var. *mandshurica*, along with two known phenethylols, *p*-hydroxyl phenethanol and 3,4-dihydroxy phenethanol. The planar structures of the new compounds were established on the basis of their spectral data, and their absolute stereochemistry was established by modified Mosher's method. The two known compounds were identified by comparison of spectral data with published references. The two new compounds showed conspicuous antifungal activities by agar medium assay.

Key words *Syringa reticulata* var. *mandshurica*; phenylglycol derivative; isolation; identification; antifungal activity

Syringa reticulata var. *mandshurica* is a dwarfish arbors found in Northeast and North of China. The leaves of this plant species have been used as an antibiosis, antiinflammatory and antivirus medicine in folklore.[1,2] During the course of our investigation for antifungal agents from the chloroform extract of the leaves of *Syringa reticulata* var. *mandshurica*, two new crystalline compounds, (*S*)-(+)-2-(3,4-dihydroxy phenyl)-2-ethoxyl-ethanol (**1**) and (*S*)-(+)-2-(3,4-dihydroxy phenyl)-2-acetoxy-ethanol (**2**), together with two known compounds, *p*-hydroxyl phenethanol (**3**) and 3,4-dihydroxy phenethanol (**4**),[3] were obtained. We now report the isolation and structural elucidation of the two new compounds, as well as the evaluation of their antifungal activities.

Results and Discussion

(*S*)-(+)-2-(3,4-Dihydroxy phenyl)-2-ethoxyl-ethanol (**1**) was obtained as white needles. The molecular formula was determined to be $C_{10}H_{14}O_4$ by high resolution (HR)-electron ionization (EI)-mass spectrometry. The IR spectrum of compound **1** suggested the presence of hydroxyl group(s) (3625, 3432, 1115, 1090 cm^{-1}), and phenyl ring(s) (1601, 1580, 870 cm^{-1}). The UV spectrum gave absorption maxima at λ 205, 218 and 279 nm, indicating the presence of one or two phenolic hydroxyl group(s).

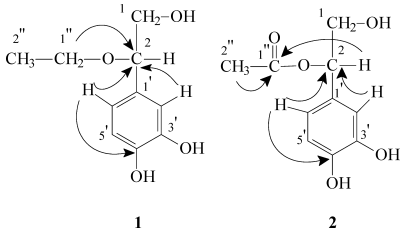
The aromatic proton signals at δ 6.75 (1H, d, J=1.8 Hz), 6.72 (1H, d, J=7.8 Hz) and 6.61 (1H, dd, J=7.8, 1.8 Hz) in the ^{1}H-NMR spectrum of compound **1** (Table 1) indicated the presence of 1,2,4-trisubstituted phenyl ring, whilst the ethoxyl moiety in the structure was indicated by the proton signals at δ 1.16 (3H, t, J=7.2 Hz) and 3.33 (2H, q, J=7.2 Hz). The ^{1}H-NMR spectrum also showed a parahydrogen proton signal at δ 4.20 (1H, dd, J=7.8, 4.2 Hz) and a carbinol proton signals at δ 3.53 (1H, dd, J=16.2, 7.8 Hz) and 3.47 (1H, dd, J=16.2, 4.2 Hz), which formed an AB_2 spin system. The three hydroxy groups appeared to be located at C-1, C-3′ and C-4′ based upon the comparison of the ^{1}H- and ^{13}C-NMR spectra between compound **1** and (*R*)-phenyl-1,2-ethanediol,[4] whilst the ethoxyl group was established at C-2 on the basis of the down field shifts of H-2 at δ 4.20. The elucidation of compound **1** was supported by the existence of the fragment ion peaks at *m*/*z* 167 ([M−CH_2OH]$^+$) in the EI-MS spectrum of compound **1**. The proposed structure of compound **1** was verified by the heteronuclear multiple bond connectivity (HMBC) experiment (Fig. 1).

The absolute configuration of compound **1** was determined by the application of modified Mosher's method. The dimethyl ether of compound **1** was prepared by the methyl ether reaction of phenolic hydroxyl group using diazomethane. The (*R*)- and (*S*)-9-anthylmethoxyacetic (AMAA) esters of the dimethyl ether of compound **1** (**1a**, **1b**, respectively) were prepared using the corresponding (*R*)- and (*S*)-9-

Table 1. ^{1}H- (600 MHz) and ^{13}C- (150 MHz) NMR Data of Compounds **1** and **2** (CD_3OD, δ ppm)

	1		**2**	
	δ_C	δ_H	δ_C	δ_H
1	68.3	3.53 dd (16.2, 7.8)[a)] 3.47 dd (16.2, 4.2)	67.8	3.58 dd (15.6, 7.2) 3.48 dd (15.6, 4.2)
2	84.5	4.20 dd (7.8, 4.2)	87.7	4.38 dd (7.2, 4.2)
1′	132.7		132.2	
2′	115.2	6.75 d (1.8)	114.8	6.73 d (1.8)
3′	146.7		146.5	
4′	146.4		146.1	
5′	116.5	6.72 d (7.8)	116.3	6.68 d (7.8)
6′	119.9	6.61 dd (7.8, 1.8)	119.6	6.56 dd (7.8, 1.8)
1″	65.4	3.33 q (7.2)	171.4	
2″	15.8	1.16 t (7.2)	21.2	2.04 s

a) Data in parentheses are *J* values (in Hz).



1 **2**

Fig. 1. Key HMBC Correlations of Compounds **1** and **2**

* To whom correspondence should be addressed. e-mail: yangshilin@suda.edu.cn

AMAA, respectively. Compounds **1a** and **1b** were analyzed by NMR and the $\Delta\delta_{R-S}$ ($\delta_{1a}-\delta_{1b}$) values were calculated. The $\Delta\delta_{R-S}$ values at H-1″ and H-2″ were negative, whilst, those at H-2′ and H-6′ were positive. This result indicated that the assignment of the *S* configuration at C-2 in compound **1** (Fig. 2).[5] Thus, the absolute stereochemistry of compound **1** was determined and was found to possess 2*S* configuration. The 2*S* configuration was confirmed by the fact that the specific optical rotation of compound **1** was +32.0, whilst the specific optical rotation of (*R*)-phenyl-1,2-ethanediol was −58.0 under the same test condition.[4]

(*S*)-(+)-2-(3,4-Dihydroxy phenyl)-2-acetoxy-ethanol (**2**) was obtained as white needles. The molecular formula was determined to be $C_{10}H_{12}O_5$ by HR-EI-mass spectrometry. The IR spectrum of compound **2** suggested the presence of hydroxyl group(s) (3620, 3400, 1100, 1085 cm^{-1}), ester carbonyl group(s) (1740, 1245, 1050 cm^{-1}) and phenyl ring(s) (1600, 1580, 870 cm^{-1}). The UV spectrum gave absorption maxima at λ 205, 218 and 279 nm, indicating the presence of one or two phenolic hydroxyl group(s).

^{1}H-NMR spectrum of compound **2** also displayed the signals of three aromatic protons of the 1,2,4-trisubstituted phenyl and the aliphatic proton signals between δ 3.40—4.40, which formed an AB_2 spin system. Among the latter signals, the double-diplont at δ 4.38 was attributed to the parahydrogen proton at C-2; another two double-diplonts at δ 3.58 and 3.48 were attributed to the carbinol protons at C-1, similar to those of compound **1**.

The proposed structure of compound **2** was verified by the heteronuclear multiple bond connectivity (HMBC) experiment (Fig. 1).

The absolute configuration of compound **2** was also determined by the application of modified Mosher's method. The dimethyl ether of compound **2** was prepared by the methyl ether reaction of phenolic hydroxyl group using diazomethane. The (*R*)- and (*S*)-9-AMAA esters of the dimethyl ether of compound **2** (**2a**, **2b**, respectively) were prepared using the corresponding (*R*)- and (*S*)-9-AMAA, respectively. Compounds **2a** and **2b** were analyzed by NMR, and the $\Delta\delta_{R-S}$ ($\delta_{2a}-\delta_{2b}$) values were calculated. The $\Delta\delta_{R-S}$ value at H-2″ was −0.06, whilst, that at H-2′ was +0.04, and at H-6′ was +0.04, which indicated that the assignment of the *S* configuration at C-2 in compound **2** (Fig. 2).[5] Thus, the absolute stereochemistry of compound **2** was determined and was found to possess 2*S* configuration. The 2*S* configuration was confirmed by the fact that the specific optical rotation of compound **2** was +38.5, whilst the specific optical rotation of (*R*)-phenyl-1,2-ethanediol was −58.0 under the same test condition.[4]

In order to determine whether compounds **1** and **2** were naturally occurring in the leaves of *Syringa reticulata* var. *mandshurica*, the leaves were extracted with CH_3OH, and then the resultant extract was subjected to HPLC analysis. The latter experiment demonstrated the presence of compounds **1** and **2** in the CH_3OH extract of the leaves of *Syringa reticulata* var. *mandshurica*. This result indicated that compounds **1** and **2** occurred naturally, rather than as a consequence of the utilization of acetone during the separation procedure.

Biological Activities' Evaluation The inhibitory effects of compounds **1**, **2**, **3** and **4** on *Phytophthora capsici* were determined in agar. These results were shown in Fig. 3. The radial growth of *Phytophthora capsici* was inhibited by compounds **1**, **2**, **3**, and **4**. *Phytophthora capsici* growth was considerably reduced with increasing concentration of compounds **1**, **2**, **3**, and **4** and 59.1%, 72.5%, 40.8% and 44.2% inhibition of mycelia growth were respectively observed at 1 mM after 6 d of incubation.

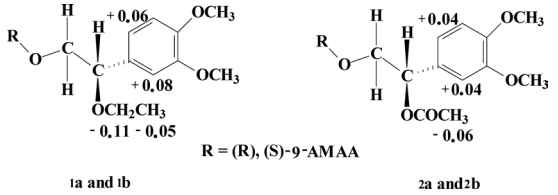


Fig. 2. The Absolute Configuration of Compounds **1** and **2** Determined by Modified Mosher's Method

1a and **1b**: the (*R*) and (*S*)-AMAA ester of the dimethyl ether of compound **1**; **2a** and **2b**: the (*R*) and (*S*)-AMAA ester of the dimethyl ether of compound **2**; $\Delta\delta_{R-S}$ values calculated from ^{1}H-NMR spectra of **1a**, **1b**, **2a**, and **2b**.

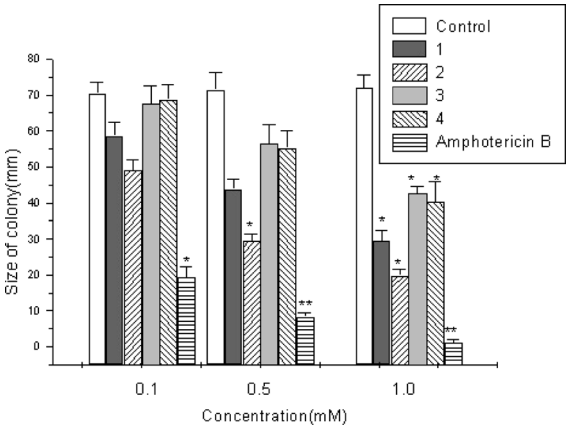


Fig. 3. Effects of **1**, **2**, **3**, and **4** on the Growth of *Phytophthora capsici* for 6 d

Compounds were inoculated onto medium and cultured for 6 d. Values are given as mean±S.E.M. of three experiments. $*p<0.05$, $**p<0.01$ *vs.* control group.

Experimental

General Experimental Procedures Melting points were determined using a Fisher-Johns melting point apparatus, and are uncorrected. Optical rotations were obtained on a Perkin-Elmer model 241 polarimeter. UV spectra were measured on a Shimadzu UV2401 spectrometer. IR spectra were taken on a Perkin-Elmer 983 G spectrometer. ^{1}H-, ^{13}C-NMR and 2D NMR spectra were recorded on a Varian Inova 600 spectrometer in CD_3OD using tetramethylsilane (TMS) as internal standard. HR-EI-MS were determined on a Micromass Zabspec spectrometer. HR-ESI-MS spectra were determined on a Q-TOF2 spectrometer. Preparative high performance liquid chromatography (HPLC) was carried out on a column of Phenyl (250×9.4 mm i.d., Agilent Zorbax SB-Phenyl, Palo Alto, U.S.A.) with a Waters 2996 detector, the flow rate was 2 ml/min and the wave length for detection was 220 nm. Medium pressure liquid chromatography (MPLC) was carried out on a column of silica gel H (460×26 mm i.d., Buchi Borosilikat 4.6, Flawil, Swiss). Silica gel for column chromatography was obtained from Qingdao Marine Chemical Factory, Qingdao, China. Precoated plates of silica gel GF_{254} were used for TLC, and detected under UV. (*R*)-9-Anthylmethoxyacetic acid and (*S*)-9-anthylmethoxyacetic acid were prepared by the method of previously reported paper.[6] Diazomethane was prepared by the decomposition of *N*-nitroso-*N*-methyl-*p*-luenesulfonamide (Sinopharm Chemical Reagent Co., Ltd.). 4-Dimethylaminopyridine (DMAP) and *N*,*N*′-cicyclohexylcarbodiimide (DCC) were purchased from Sinopharm Chemical Reagent Co., Ltd.

Plant Material The leaves of *Syringa reticulata* var. *mandshurica* were collected in Heilongjiang Province of China in October 2005, and identified

by Professor Jian-Wen Wang of our college. A voucher sample is deposited in the Herbarium of the College of Pharmacy, Soochow University.

Extraction and Isolation The dried plant material (5 kg) was percolated with 150 l MeOH. The solvent was subsequently dried under reduced pressure to give the residue, which was partitioned between $CHCl_3$ and H_2O. The $CHCl_3$-soluble fraction was further portioned between petroleum ether and 90% MeOH (v/v). The 90% MeOH fraction (125 g) was further subjected to silica gel column chromatography (80—100 mesh, 450×80 mm) and eluted with petroleum ether–EtOAc gradients to afford 20 fractions (F1—F20). Further purification of F12 through MPLC, using petroleum ether–EtOAc (70 : 30) as eluent, yielded *p*-hydroxyl phenethanol (**3**) (150 mg). Further purification of F14 using sephadex LH-20 column chromatography, eluted by $CHCl_3$–MeOH (1 : 1), yielded 3,4-dihydroxy phenethanol (**4**) (320 mg). (*S*)-(+)-2-(3,4-Dihydroxy phenyl)-2-ethoxyl-ethanol (**1**) (18 mg) and (*S*)-(+)-2-(3,4-dihydroxy phenyl)-2-acetoxy-ethanol (**2**) (14 mg) were obtained from F16 through RP-HPLC using MeOH–H_2O (75 : 25) as eluents.

(*S*)-(+)-2-(3,4-Dihydroxy phenyl)-2-ethoxyl-ethanol (**1**): White needles, mp 36—37 °C (CH_3OH). $[\alpha]_D^{25}$ +32.0 (c=0.005, $CHCl_3$). UV λ_{max} (CH_3OH) nm: 205, 218, 279. IR (KBr) ν_{max} cm^{-1}: 3625, 3432, 1601, 1580, 1115, 1090, 870. ^{1}H- and ^{13}C-NMR (CD_3OD) spectral data see Table 1. HR-EI-MS *m*/*z*: 198.0902 ($[M]^+$, 12), 167.0710 (100.0), 139.0746 (47.0), 111.0804 (17.0), 93.0702 (28.5).

(*S*)-(+)-2-(3,4-Dihydroxy phenyl)-2-acetoxy-ethanol (**2**): White needles, mp 41—42 °C (CH_3OH). $[\alpha]_D^{25}$ +38.5 (c=0.005, $CHCl_3$). UV λ_{max} (CH_3OH) nm: 205, 218, 279. IR (KBr) cm^{-1}: 3620, 3400, 1740, 1600, 1580, 1245, 1100, 1085, 1050, 870. ^{1}H- and ^{13}C-NMR (CD_3OD) spectral data see Table 1. HR-EI-MS *m*/*z*: 212.0679 ($[M]^+$, 10), 181.0510 (100.0), 169.0507 (85.5), 153.0560 (19.0), 141.0548 (19.0), 109.0290 (10.5), 103.0382 (18.0).

p-Hydroxyl Phenethanol (**3**): White needles, mp 92—93 °C (CH_3OH). UV λ_{max} (CH_3OH) nm: 224, 279. IR (KBr) cm^{-1}: 3450, 3080, 1880, 1610, 1580, 1450, 1240, 1055, 810. ^{1}H-NMR (CD_3OD) δ: 2.70 (2H, t, J=7.0 Hz), 3.61 (2H, t, J=7.0 Hz), 6.75 (2H, d, J=8.5 Hz), 7.02 (2H, d, J=8.5 Hz). EI-MS *m*/*z*: 138 ($[M]^+$, 82), 120 (5), 108 (45), 107 (100), 91 (10), 77 (85), 65 (11), 51 (24).

3,4-Dihydroxy Phenethanol (**4**): White needles, mp 70—71 °C (CH_3OH). UV λ_{max} (CH_3OH) nm: 210, 220, 284. IR (KBr) cm^{-1}: 3420, 3080, 1610, 1535, 850, 810. ^{1}H-NMR (CD_3OD) δ: 2.52 (2H, t, J=7.0 Hz), 3.55 (2H, t, J=7.0 Hz), 6.78 (1H, d, J=1.5 Hz), 6.72 (1H, d, J=7.5 Hz), 6.60 (1H, dd, J=7.5, 1.5 Hz). EI-MS *m*/*z*: 154 ($[M]^+$, 80), 137 (100), 110 (24), 109 (28), 92 (16), 63 (11), 55 (9), 51 (8).

Preparation of the Dimethyl Ether of Compounds 1 and 2 To a solution of diazomethane in ether (2.0 ml), was added compound **1** (10.0 mg), and the mixture was allowed to stand in dark place for 3 d at room temperature. The reaction was quenched by the addition of 1.0 ml of acetic acid, then, 2.0 ml of water was added, and the mixture was subsequently extracted with CH_2Cl_2 (3×1.0 ml). The CH_2Cl_2-soluble layers were combined, dried over anhydrous $MgSO_4$, and evaporated. The residue was subjected to short silica gel column chromatography, and eluted with *n*-hexane–EtOAc (8 : 2) to afford the dimethyl ether of compound **1** (8.0 mg).[7] The dimethyl ether of compound **2** (7.6 mg) was prepared by the same procedure. ^{1}H- and ^{13}C-NMR (CD_3OD) spectral data of the two compounds were seen in Table 2.

Preparation of Compounds 1a and 1b DMAP (4.0 mg) was added all at once to a solution of 4.0 mg of the dimethyl ether of compound **1**, 5.0 mg of (*R*)-9-AMAA, and 6.0 mg of DCC in 1.0 ml of methylene chloride. After 24 h, the dicyclohexylurea was removed by filtration, the filter cake was washed three times with 1.0 ml hexane, and the combined filtrates were washed with 2×0.5 ml cold 1 N aqueous hydrochloric acid, 2×0.5 ml saturated sodium bicarbonate, and 2×0.5 ml saturated brine. The organic phase was then dried over anhydrous $MgSO_4$ and filtered and evaporated. The residue was subjected to preparative HPLC, and eluted with acetonitrile–H_2O (80 : 20), to yield the (*R*)-9-AMAA ester, **1a** (1.5 mg).[8] The (*S*)-9-AMAA ester, **1b** (1.7 mg) was prepared by the same procedure from the dimethyl ether of compound **1** (4.0 mg) with (*S*)-9-AMAA. ^{1}H-NMR ($CDCl_3$) of compound **1a**: 3.35 (3H, s), 3.80 (3H, s), 3.84 (3H, s), 6.22 (1H, s), 7.41 (2H, dd, J=6.6, 7.8 Hz), 7.49 (2H, dd, J=6.6, 7.8 Hz), 7.96 (2H, d, J=8.4 Hz), 8.40 (1H, s), 8.53 (2H, d, J=8.4 Hz), the rest see Table 3. HR-ESI-MS *m*/*z*: 475.2129 ($[M+H]^+$). ^{1}H-NMR ($CDCl_3$) of compound **1b**: 3.35 (3H, s), 3.82 (3H, s), 3.85 (3H, s), 6.21 (1H, s), 7.40 (2H, dd, J=6.6, 7.8 Hz), 7.48 (2H, dd, J=6.6, 7.8 Hz), 7.94 (2H, d, J=9.0 Hz), 8.40 (1H, s), 8.52 (2H, d, J=9.0 Hz), the rest was shown in Table 3. HR-ESI-MS *m*/*z*: 475.2125 ($[M+H]^+$).

Preparation of Compounds 2a and 2b The above-mentioned procedure was used to prepare (*R*)- and (*S*)-9-AMAA ester of (*S*)-(+)-2-(3,4-dimethoxy phenyl)-2-acetoxy-ethanol, **2a** (1.2 mg) and **2b** (1.3 mg). ^{1}H-NMR ($CDCl_3$) of compound **2a**: 3.32 (3H, s), 3.82 (3H, s), 3.84 (3H, s), 6.20 (1H, s), 7.38 (2H, dd, J=6.6, 7.8 Hz), 7.48 (2H, dd, J=6.6, 7.8 Hz), 7.94 (2H, d, J=8.4 Hz), 8.38 (1H, s), 8.53 (2H, d, J=8.4 Hz), the rest see Table 3. HR-ESI-MS *m*/*z*: 489.1918 ($[M+H]^+$). ^{1}H-NMR ($CDCl_3$) of compound **2b**: 3.33 (3H, s), 3.81 (3H, s), 3.85 (3H, s), 6.21 (1H, s), 7.41 (2H, dd, J=6.6, 7.8 Hz), 7.50 (2H, dd, J=6.6, 7.8 Hz), 7.95 (2H, d, J=9.0 Hz), 8.40 (1H, s), 8.54 (2H, d, J=9.0 Hz), the rest was shown in Table 3. HR-ESI-MS

Table 2. ^{1}H- (600 MHz) and ^{13}C- (150 MHz) NMR Data of the Dimethyl Ether of Compounds **1** and **2** (CD_3OD, δ ppm)

	Dimethyl ether of **1**		Dimethyl ether of **2**	
	δ_C	δ_H	δ_C	δ_H
1	68.5	3.55 dd (16.2, 7.8)[a]	68.8	3.60 dd (15.6, 7.2)
		3.48 dd (16.2, 4.2)		3.51 dd (15.6, 4.2)
2	84.8	4.22 dd (7.8, 4.2)	88.5	4.40 dd (7.2, 4.2)
1′	132.8		132.6	
2′	115.5	6.78 d (1.8)	115.6	6.76 d (1.8)
3′	148.5		148.9	
4′	147.8		148.2	
5′	117.1	6.74 d (7.8)	117.3	6.70 d (7.8)
6′	120.4	6.64 dd (7.8, 1.8)	120.8	6.58 dd (7.8, 1.8)
1″	65.5	3.35 q (7.2)	171.6	
2″	16.0	1.18 t (7.2)	21.5	2.05 s
OCH_3	57.5	4.82 s	57.6	4.85 s
	56.6	4.75 s	56.8	4.76 s

a) Data in parentheses are *J* values (in Hz).

Table 3. ^{1}H-NMR Data of the Matrix of Compounds **1a**, **1b**, **2a** and **2b** (600 MHz, $CDCl_3$, δ ppm)

	δ_H		δ_H	
	1a	**1b**	**2a**	**2b**
1	3.58 dd (15.6, 7.2)[a]	3.59 m	3.56 dd (15.6, 7.2)	3.60 dd (15.6, 7.2)
	3.63 dd (15.6, 4.2)	3.62 m	3.65 dd (15.6, 4.2)	3.60 dd (15.6, 4.2)
2	4.25 dd (7.2, 4.2)	4.30 dd (7.8, 4.2)	4.44 dd (7.2, 4.2)	4.48 dd (7.2, 4.2)
1′				
2′	6.78 d (1.8)	6.72 d (1.8)	6.76 d (1.8)	6.70 d (1.8)
3′				
4′				
5′	6.73 d (7.8)	6.70 d (7.8)	6.69 d (7.8)	6.66 d (7.8)
6′	6.66 dd (7.8, 1.8)	6.58 dd (7.8, 1.8)	6.60 dd (7.8, 1.8)	6.54 dd (7.8, 1.8)
1″	3.25 q (7.2)	3.36 q (7.2)		
2″	1.13 t (7.2)	1.18 t (7.2)	1.18 s	2.06 s

a) Data in parentheses are *J* values (in Hz).

m/*z*: 489.1911 ([M+H]$^+$).

Antifungal Assay Antifungal assay was performed by the agar medium assay.[9] An isolate of *Phytophthora capsici* was furnished by Institute of Dermatoloty, Chinese Academy of Medical Sciences. The isolate was propagated as a mycelial culture on 1% agar medium containing 10% V8 juice and maintained in the dark at 20 °C. Six-day-old cultures were used as the source of inoculum. The mycelia grew in radial fashion outward from the inoculum disk. The diameter of the mycelial mass was measured daily after inoculation. Compounds **1**, **2**, **3**, and **4** were first dissolved in dimethylsulfoxide (DMSO) to produce 50 mM stock solutions, which were then added to V8 medium to give the appropriate final concentrations. Media containing only DMSO was used as control. Control plates were inoculated following the same procedure. Plates were incubated at 25 °C for 6 d and the colony diameter was recorded each day. Culture was initiated by placing a 6-mm disk of inoculum in the center of the medium in a 150-mm Petridish.

Acknowledgement This paper was funded by the National Sciences Foundation of China (No. 30873362) and Pre-research Project of Soochow University. We want to express our thanks to Mrs. Li-Ping Shi in Shanghai Institute of Organic Chemistry; Chinese Academy of Sciences for the determination of NMR data.

References

1) Petkov V., Manolov P., *Comp. Med. East West*, **6**, 123—130 (1978).
2) Tranter H. S., Tasson S. C., Nychaas G. J., *J. Appl. Bacterriol.*, **74**, 253—259 (1993).
3) Wang D. D., Liu S. Q., Chen Y. J., Wu L. J., Sun J. Y., Zhu T. R., *Acta Pharm. Sin.*, **17**, 951—954 (1982).
4) Kuang Y. Q., Zhang S. Y., Sun X. L., Wei L. L., *J. Fourth Mil. Med. Univ.*, **23**, 865—867 (2002).
5) Latypov S. K., Ferreiro M. J., Quiüoá E., Riguera R., *J. Am. Chem. Soc.*, **120**, 4741—4751 (1998).
6) Pham V. C., Jossang A., Sévenet T., Nguyen V. H., Bodo B., *Tetrahedron*, **63**, 11244—11249 (2007).
7) Li J. Z., Liu W. H., Li F. G., Wang J. J., Suo Y. R., Liu Y. J., *Chin. J. Org. Chem.*, **27**, 1594—1599 (2007).
8) Trost B. M., Belletirs J. L., Godleski S., Medougal P. G., Balkovec J. M., *J. Org. Chem.*, **1986**, 2370—2374 (1986).
9) Billerbeck V. G., Roques C. G., Bessière J. M., Fonvieille J. L., Dargent R., *Can. J. Microbiol.*, **47**, 9—17 (2001).