Lathyranolic Acid A, First Secolathyrane Diterpene in Nature from *Euphorbia lathyris*

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S₁₉. EIMS spectrum of *Euphorbia* factor L₁₁ (**2**).

S₂₀. ESI-MS spectrum of *Euphorbia* factor L₁₁ (**2**).

S₂₁. ¹H-¹H COSY spectrum of *Euphorbia* factor L₁₁ (**2**) in CDCl₃.

S₂₂. HMQC spectrum of *Euphorbia* factor L₁₁ (**2**) in CDCl₃.

S₂₃. Expanded HMQC spectrum (δ_H 1.00-3.00 vs δ_C 12.0-53.0) of *Euphorbia* factor L₁₁ (**2**) in CDCl₃.

S₂₄. HMBC spectrum of *Euphorbia* factor L₁₁ (**2**) in CDCl₃.

S₂₅. NOESY spectrum of *Euphorbia* factor L₁₁ (**2**) in CDCl₃.

S₂₆. Expanded NOESY spectrum (δ_H 4.18-8.22) of *Euphorbia* factor L₁₁ (**2**) in CDCl₃.

S₂₇. IR (KBr disc) spectrum of *Euphorbia* factor L₁₁ (**2**).

S₂₈. UV and CD spectra of *Euphorbia* factor L₁₁ (**2**) in MeOH (1mg/mL).

Experimental Section

General Methods: Melting points were measured with a SGW X-4 apparatus (Shanghai Precision & Scientific Instrument Co., Ltd.) and were uncorrected. Optical rotation was determined on a Perkin-Elmer 341 polarimeter. UV was measured on Shimadzu UV-210A. UV and CD spectra were measured on a JASCO J-810 instrument. IR spectra were recorded on a Perkin-Elmer 577 spectrometer. NMR spectra were measured on a Bruker AM-400 spectrometer with TMS as internal standard. EIMS (70 eV) and ESIMS were carried out on a Finnigan MAT 95 mass spectrometer, and an Esquire3000plus LC-MS instrument, respectively. All solvents used were of analytical grade (Shanghai Chemical Plant). Silica gel (200-300 mesh), silica gel H, C18 reversed phase silica gel (250 mesh, Merck) and MCI gel (CHP20P, 75-150 μ , Mitsubishi Chemical Industries Ltd.) were used for column chromatography. Pre-coated silica gel GF254 plates (Qingdao Haiyang Chemical Plant, Qingdao, People's Republic of China) were used for TLC. YMC-Pack ODS-A column (250 $\times$ 10 mm) was used for preparative HPLC (monitor wavelength: 254 nm).

Plant Material: The seeds of *Euphorbia lathyris* L. were purchased from the Shanghai Pharmaceutical Corporation Limited and identified by Dr. Ying Xiang of Shanghai Institute of Materia Medica.

Chemical Transformation of *Euphorbia* Factor L₁₁ (2) to Lathyranolic Acid A (1): Each of the transformed products was identified by ¹H NMR, EIMS and optical rotation, and also by comparison with the authentic sample (co-TLC).

Periodate Oxidation: To a solution of **2** (24.5 mg, 0.0408 mmol) in 67 % aqueous THF (8 mL), 0.5 mol/L H₂SO₄ (2 mL) and NaIO₄ (33.5 mg, 0.157 mmol) were added. The reaction solution was stirred at room temperature for 48 hours, and was quenched by adding glycerol (2 mL) to destroy the excess periodate. The resulting mixture was diluted with H₂O (10 mL) and then extracted with EtOAc (10 mL $\times$ 3). The crude product was separated by preparative TLC (CHCl₃-MeOH, 80:1) to give a major compound, and was finally purified by preparative HPLC (flow rate, 3 mL/min; 75% MeOH in H₂O) to afford **1** (7.1 mg, 0.0144 mmol, 35% yield; t_R = 7.9 min) (For the nonreacted **2**, t_R = 25.5 min).

Baeyer-Villiger Oxidation: To a stirred mixture of **2** (7.5 mg, 0.0125 mmol) and NaHCO₃ (4.5 mg, 0.0536 mmol) in CH₂Cl₂ (4 mL) at 0 °C, 2.5 mg of *m*-CPBA (70% 0.0101 mmol) was added. After 8 hours reaction, 1.0 mg of NaHSO₃ (0.0096 mmol) was added to quench the reaction (to exhaust the excess *m*-CPBA). The reaction mixture was diluted with H₂O (5 mL) and then extracted with CH₂Cl₂ (5 mL $\times$ 3) to obtain the product, which was purified by preparative TLC (CHCl₃-MeOH, 80:1) and then preparative HPLC (flow rate, 3 mL/min; 75% MeOH in H₂O) to yield **1** (1.5 mg, 0.00304 mmol, 24% yield).

¹H NMR spectrum of lathyranoic acid A (1) in CDCl₃

¹³C NMR spectrum of lathyranic acid A (1) in CDCl₃

DEPT spectrum of lathyranolic acid A (1) in CDCl₃

EIMS spectrum of lathyranic acid A (1)

ESI-MS spectrum of lathyranoic acid A (1)

Display Report

Analysis Info

Analysis Name 046-3301.D
 Method Copy of SOPMSNP.M
 Sample Name yjm-ELL-19
 Comment 7□

Acquisition Date 03/23/04 18:36:57
 Operator Administrator
 Instrument esquire3000plus

Acquisition Parameter

Ion Source Type	ESI	Ion Polarity	Negative	Alternating Ion Polarity	on
Mass Range Mode	Std/Normal	Scan Begin	100 m/z	Scan End	1750 m/z
Capillary Exit	-160.0 Volt	Skim 1	-40.0 Volt	Trap Drive	78.0
Accumulation Time	2787 凝	Averages	3 Spectra	Auto MS/MS	off

¹H-¹H COSY spectrum of lathyranoic acid A (1) in CDCl₃ELL-19 CDCl₃ COSY

Solvent: CDCl₃
 Ambient temperature
 Mercury-400BB "SINM400"
 Relax. delay 1.000 sec
 Acq. time 0.160 sec
 Width 3205.1 Hz
 2D Width 3205.1 Hz
 4 repetitions
 512 increments
 OBSERVE H1 400.1571914 MHz
 DATA PROCESSING
 Sg. sine bell 0.080 sec
 F1 DATA PROCESSING
 Sg. sine bell 0.080 sec
 FT size 1024 x 1024
 Total time 46 min, 27 sec

HMQC spectrum of lathyranic acid A (**1**) in CDCl₃

Expanded HMQC spectrum (δ_{H} 1.00-3.00 vs δ_{C} 10.7-44.7) of lathyranic acid A (**1**) in

CDCl₃

HMBC spectrum of lathyranic acid A (**1**) in CDCl₃

NOESY spectrum of lathyranic acid A (**1**) in CDCl₃

IR (KBr disc) spectrum of lathyranolic acid A (**1**) in CDCl₃

¹H NMR spectrum of transformed lathyranic acid A (1) in CDCl₃ELL-11-NI CDCl₃ 1H Jan 10 2005

¹H NMR spectrum of *Euphorbia* factor L₁₁ (**2**) in CDCl₃

¹³C NMR spectrum of *Euphorbia* factor L₁₁ (**2**) in CDCl₃

Expanded ¹³C NMR spectrum (δ 128.0-133.6) of *Euphorbia* factor L₁₁ (**2**) in CDCl₃

DEPT spectrum of *Euphorbia* factor L₁₁ (2) in CDCl₃

ELL-11 C0CL3 BB+DEPT-13504-01-05

EIMS spectrum of *Euphorbia* factor L₁₁ (2)

ESI-MS spectrum of *Euphorbia* factor L₁₁ (2)

Display Report

Analysis Info

Analysis Name 013-0801.D
 Method Copy of SOPMSNP.M
 Sample Name yjm-ELL-11
 Comment el□

Acquisition Date 02/26/04 12:50:15
 Operator Administrator
 Instrument esquire3000plus

Euphorbia factor L₁₁ (2)

Acquisition Parameter

Ion Source Type	ESI	Ion Polarity	Negative	Alternating Ion Polarity	on
Mass Range Mode	Std/Normal	Scan Begin	100 m/z	Scan End	1750 m/z
Capillary Exit	-160.0 Volt	Skim 1	-40.0 Volt	Trap Drive	78.0
Accumulation Time	340 纒	Averages	3 Spectra	Auto MS/MS	off

¹H-¹H COSY spectrum of *Euphorbia* factor L₁₁ (2) in CDCl₃

HMQC spectrum of *Euphorbia* factor L₁₁ (**2**) in CDCl₃

Expanded HMQC spectrum (δ_{H} 1.00-3.00 vs δ_{C} 12.0-53.0) of *Euphorbia* factor L₁₁ (**2**) in CDCl₃.

HMBC spectrum of *Euphorbia* factor L₁₁ (**2**) in CDCl₃

NOESY spectrum of *Euphorbia* factor L₁₁ (**2**) in CDCl₃

Expanded NOESY spectrum (δ_{H} 4.18-8.22) of *Euphorbia* factor L₁₁ (2) in CDCl₃

IR (KBr disc) spectrum of *Euphorbia* factor L₁₁ (2)

UV and CD spectra of *Euphorbia* factor L₁₁ (**2**) in MeOH (1mg/mL)